

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

Water Quality Division

Montana Pollutant Discharge Elimination System (MPDES)

2025 Major Modification Fact Sheet

Permittee:	Sibanye-Stillwater, dba, Stillwater Mining Company
Permit Number:	MT0026808
Receiving Water:	East Boulder River and Alluvial Ground Water
Facility Name:	Stillwater Mining Company - East Boulder Mine
County:	Sweet Grass
Facility Contact:	Ashley Chancellor, Environmental Affairs Manager East Boulder Mine PO Box 1227 Big Timber, MT 59011
Facility Type:	Privately-Owned Treatment Works, Minor
Number of Outfalls	Three (for fee determination only)

I. Permit Status

Stillwater Mining Company's (SMC) East Boulder Mine (EBM) Montana Pollutant Discharge Elimination System (MPDES) permit MT0026808 was issued on August 1, 2023, and became effective on September 1, 2023. The permit was not appealed and expires on August 31, 2028. On October 2, 2023, the Montana Department of Environmental Quality (DEQ) issued a minor modification that corrected typographical errors in the permit.

On May 12, 2025, SMC submitted a major modification request electronically and mailed a hardcopy with the modification fee, which was received by DEQ on May 15, 2025. On August 5, 2025, SMC submitted a supplement to their request for major modification. On August 14, 2025, DEQ made a minor modification of SMC's MPDES permit to extend the Total Nitrogen (TN) first Interim Limit End date in Table 2 and the due dates in the Compliance Schedule Plan in Part I.E.1. (Nutrients) and 2. (Total Recoverable Copper), by 120 days.

Note: On October 3, 2025, EPA approved Montana's repeal of the numeric nutrient standards in Department Circular-12A (DEQ-12A). Therefore, the numeric water quality criteria that the permit's current TN effluent limits are based upon are no longer

applicable for purposes of the Federal Clean Water Act (DEQ-12A was repealed by the Montana Legislature in May 2025).

II. Permit Modification Request

SMC has requested to extend the compliance schedule dates for TN, based on a number of factors, including the fact that TN water quality standards, upon which the current permit is based, have been changed. The specific modifications requested are:

- Extend the 32 lb TN/day first interim limit ending date from August 31, 2025, to August 31, 2028 (Permit Table 2), or until narrative standards for nutrients are approved by the U.S. Environmental Protection Agency (EPA) and implemented by DEQ in MT0026808;
- Extend the 15.1 lb TN/day second interim limit ending date from August 31, 2027, to August 31, 2030 (Permit Table 2). This would also change the 10.8 lb TN/day limit's effective starting date from September 1, 2027, to September 1, 2030 (Permit Table 3); and
- Extend the date for submitting the Compliance Plan in Section I.E.1. from September 1, 2025 to September 1, 2027.

The permit modification was also initiated because SMC concluded the nitrogen compliance schedule is unachievable with the schedule provided.

To support this request, SMC submitted a Wastewater Treatment Plant (WTP) optimization review dated April 25, 2025, a Hydrometrics technical memorandum titled, "Future Total Nitrogen Load Evaluation for the East Boulder Mine," and a Hydrometrics technical memorandum titled, "Review of Impacts to East Boulder River Due to Historic Total Nitrogen Loads to Outfall 002" as appendices to their initial modification request on May 12th. Further appendices were submitted with the supplemental modification request on August 5th including effluent and receiving water quality data, and a Rhithron Report entitled, "A Biological Assessment of Sites on the East Boulder River, Sweetgrass County, Montana: Macroinvertebrates, Periphyton, Chlorophyll a, and Periphyton Ash-free Dry Mass 2024," (Rhithron 2024). DEQ requested all raw data reported in Rhithron (2024) on August 6, 2025, which were provided by SMC on August 13, 2025, with clarifying information provided in response to an August 13, 2025, request on August 20, 2025.

III. Basis for Permit Modification

MPDES permits may be modified during their term if any of the causes at Administrative Rules of Montana (ARM) 17.30.1361(2) are applicable. SMC requested the modifications to MT0026808 based on three such causes. Under the rule and Part VI, Section O of the permit, DEQ may also determine, as it has done here, that reopening and modifying the MPDES permit is appropriate and necessary based on a change in water quality standards.

These causes to modify a permit are discussed in more detail below, including, as applicable, excerpts from SMC's modification request.

- 1) *"A permit condition may be modified "when the department receives new information that was not available at the time of permit issuance." ARM 17.30.1361(2)(b). SMC's Request for Modification is supported by new information that was not available at the time the Permit was issued; specifically, SMC offers additional effluent characterization data and a refined*

understanding of potential discharge flow. This new data demonstrates that flows from SMC's water treatment plant at the East Boulder Mine have increased significantly since issuance of the Permit in 2023 and are likely to remain high or increase further during the Permit term. The increased effluent flow and associated increase in TN load constitute new data/information that would have justified the application of different interim TN conditions at permit issuance."

SMC asserts that the two enclosures provided with the request, a WTP optimization review and a future load analysis, would have assisted DEQ in developing timelines for the TN compliance schedule had they been available at the time of permit issuance.

In the WTP optimization review, SMC argues that current water treatment system is optimized and not able to achieve interim or final TN limits under current operational scenarios. The 2024 technical memorandum provides treatment removal efficiency and increasing WTP loading data as support of this claim.

As a result, SMC argues that the maximum sum of TN from Outfalls 002 & 003 is greater than the first interim TN limit of 15.1 lbs/day TN. However, the maximum TN load provided in Table 3 of their technical memo is theoretical, combining data from January 2023 and new information for Outfall 003 resulting in an estimated Sum of 16.4 lbs/day. The 13.1 lbs/day maximum discharge rate was during the previous permit term, and, as such, does not constitute new information as it was available upon issuance of the permit on August 1, 2023. Table 1 compares the highest average monthly discharge rate for TN, pre- and post-renewal (September 1, 2023).

Table 1: Comparison of Highest Average Monthly TN Loads (lbs/day) from EBM before and after MPDES Renewal

	Outfall 002	Outfall 003	SUM
Pre-renewal	13.1 (Jan 2023)	2 (engineering)	15.1
Post-renewal	10.1 (April 2025)	3.4 (March 2024)	13.5

Based on this, DEQ does not believe that it's accurate to say that the EBM is not able to achieve the interim TN limit of 15.1 lbs/day.

Similarly, SMC argues that future load analysis indicates that the facility will be unable to achieve interim effluent limits under future operational scenarios and that this constitutes new information not available at the time of issuance that would have justified different permit conditions. SMC's basis for this claim is that annual average inflow to the WTP from mine workings is increasing (from 140 gallons per minute (gpm) in 2008 to 325 gpm in 2020). SMC states that future groundwater inflow will increase further (to between 374 and 575 gpm in 2043) such that mass loading of TN may increase despite maintained WTP TN removal efficiency. However, this analysis is of historic mine inflows, production rates, and cumulative production and indicates lower flow than the estimated maximum groundwater inflow of 737 gpm included in the 2000-issued permit. Pre-issuance trends in groundwater inflow does not constitute new information, it is a new analysis of old, pre-September 2023, information.

Further, DEQ disagrees that this information would have justified different permit terms at the time of issuance. The EBM is considered a new source subject to no degradation nonsignificance review, SMC agreed to permit limits based on numeric DEQ-12A standards, and it was assessed a final effluent limitation based on the application of nonsignificance criteria. DEQ granted a compliance schedule and established interim effluent limitations based on WTP performance in its current configuration (i.e. post-2021 upgrades) to comport with the legal requirement that compliance schedules ensure compliance with the final effluent limitation “as soon as possible” (ARM 17.30.1350(1)(a)). The one piece of new information supplied was on the performance of the onsite septic system, which is performing considerably worse than the estimations on which the facility-wide compliance schedule was based. Had this information been available to DEQ in 2023, this information likely would have justified a modest increase in the first interim load-based limit (to ~16.2 lbs/day).

However, given the request to reassess the TN limit under the narrative criteria, and the recognized need to implement the narrative criteria following a change in state and federal law, final effluent limits must now be derived from the narrative criteria. Considering the unique circumstances present here, this also requires a reconsideration of the need for any compliance schedule or interim limits. Based upon DEQ’s derivation of final effluent limitations for TN, as well as the information provided by SMC, DEQ does not find that a compliance schedule is justified. As a result, interim TN limits are not appropriate.

Compliance schedules are used to provide time to meet permit limits or other requirements based on current or demonstrated conditions. A compliance schedule may not be extended because a facility plans to have greater wastewater inputs in the future. SMC’s projections for increased wastewater flow have not yet occurred and do not interfere with its present compliance with effluent limits.

2) *“A permit condition may be modified “when the department determines good cause exists for modification of a compliance schedule” as a result of “events over which the permittee has little or no control and for which there is no reasonably available remedy.” ARM 17.30.1361(2)(d). As described in SMC’s initial May 12th Request for Modification, the Permit’s compliance schedule terms for TN are unachievable. To address this issue, SMC was planning to seek an individual variance — a pathway that was characterized as available to SMC at Permit issuance in 2023.*

However, following permit issuance, EPA indicated that a Feasibility Allowance would also be required in addition to an Individual Variance. In light of that fact, there was not time to secure both permitting steps in advance of the first interim TN milestone and SMC maintains that there is no reasonably available alternative option for water management.”

SMC’s basis for cause to modify under ARM 17.30.1361(2)(d) is that: the compliance plan was based on the understanding that an individual variance was a potential process that could be used if compliance wasn’t achievable, SMC had no control over changing guidance from EPA on the availability of a variance, and SMC has no reasonably available remedy to meet interim or final effluent limits under current or future water management, again citing the WTP optimization review and future load analysis.

The 2023 Fact Sheet included an individual variance as a potential compliance option that could be used if it was found that compliance with the final effluent limitation was not achievable. The reference in the Fact Sheet did not concern interim limits. The individual variance was an option for the very stringent final effluent limits based on nondegradation that were not scheduled to take effect for 10 years. While it is true that EPA's change in guidance around the availability of an individual variance prior to obtaining an authorization to degrade/feasibility allowance was outside of the scope of SMC's control, this circumstance is not related to interim effluent limits, and, regardless, SMC's final effluent limits and the consideration of any compliance schedule must now be based upon final effluent limits derived from the narrative criteria.

- 3) *“A permit condition may be modified “when the standards or requirements on which the Permit was based have been changed.” ARM 17.30.1361(2)(c). This provision is relevant to SMC’s permit modification request given the potential implementation of narrative nutrient standards (including TN) stemming from the recent passage of House Bill 664 and MDEQ’s subsequent submission dated May 6, 2025 to EPA Region 8 initiating EPA’s water quality standards review under Section 303(c) of the Clean Water Act.”*

As noted elsewhere in this Fact Sheet, EPA acted on Montana's submitted water quality standards change on October 3, 2025, and approved Montana's decision to repeal DEQ-12A. DEQ proposes to reopen and modify the permit and has reassessed the final TN water quality-based effluent limit (WQBEL) under the narrative nutrient criterion at 17.30.637(1)(e), including the applicable nonsignificance criterion at ARM 17.30.715(1)(h). The rationale for this change, as well as the elimination of the previous compliance schedule for TN, is further explained throughout this Fact Sheet. With the exception of the modification of the final TN effluent limitation, addition of the Nutrient Bioassessment Special Condition, and removal the TN compliance, no other permit limitations, requirements, or conditions are proposed to be modified. All unmodified aspects of the existing permit will remain in effect for the duration of the permit.

Further, a permit condition may be modified under the “reopener” conditions in a permit when the condition is established under ARM 17.30.1344(2). ARM 17.30.1361(2)(g). Pursuant to Part VI, Section O of the permit, the permit may be modified and reopened if water quality standards in the receiving water have changed. As discussed above, the applicable water quality standard for TN has changed and a modification is appropriate.

IV. Facility Information

The Facility has permit coverage for three outfalls: Outfall 001, which has never been constructed but is permitted to be a future direct discharge of treated mine wastewater to the East Boulder River through a diffuser; Outfall 002, which is the infiltration of treated mine wastewater that mixes with groundwater before reaching the river; and Outfall 003, which is a septic system discharge upgradient of Outfall 002. Outfalls 002 and 003 discharge first to groundwater, then into surface water in a diffuse manner along 10,420 feet of stream length.

V. Water Quality-Based Effluent Limitations (Total Nitrogen)

A. Applicable Water Quality Criteria

This modification implements the narrative criterion at ARM 17.30.637(1)(e):

1. *State surface waters must be free from substances attributable to municipal, industrial, agricultural practices or other discharges that will:
(e) create conditions which produce undesirable aquatic life.*

The East Boulder Mine is considered a new source for the purposes of nondegradation as defined at ARM 17.30.702 (2023 Fact Sheet) such that water quality criteria are modified by the nonsignificance criteria at ARM 17.30.715, as applicable. The East Boulder River where the mine discharges is not listed as impaired for parameters associated with the propagation of undesirable aquatic life associated with excess nutrients and, as such, is considered a high-quality water with respect to ARM 17.30.637(1)(e). The applicable nonsignificance criterion for the narrative nutrient criteria is at ARM 17.30.715(1)(h):

- (1) *The following criteria will be used to determine whether certain activities or classes of activities will result in nonsignificant changes in existing water quality due to their low potential to affect human health or the environment. These criteria consider the quantity and strength of the pollutant, the length of time the changes will occur, and the character of the pollutant. Except as provided in (2), changes in existing surface or ground water quality resulting from the activities that meet all the criteria listed below are nonsignificant, and are not required to undergo review under 75-5-303, MCA:
(h) changes in the quality of water for any parameter for which there are only narrative water quality standards if the changes will not have a measurable effect on any existing or anticipated use or cause measurable changes in aquatic life or ecological integrity.*

Further, the nonsignificance criterion at ARM 17.30.715(2) also apply:

- (2) *Notwithstanding compliance with the criteria of (1), the department may determine that the change in water quality resulting from an activity which meets the criteria in (1) is degradation based upon the following: (a) cumulative impacts or synergistic effects; (b) secondary byproducts of decomposition or chemical transformation; (c) substantive information derived from public input; (d) changes in flow; (e) changes in the loading of parameters; (f) new information regarding the effects of a parameter; or (g) any other information deemed relevant by the department and that relates to the criteria in (1).*

B. Basis for TN WQBELs

Background

Total nitrogen (TN) was originally identified as a pollutant of concern in the 2000-issued MPDES permit because nitrogen-containing blasting agents are used at the EBM with additional contributions of nitrogen from the onsite sanitary septic system drain field. A facility-wide nitrogen limit was assessed in the 2000-issued MPDES permit based on the narrative criterion at ARM 17.30.637. Because the facility was considered a new source for purposes of nondegradation (ARM 17.30.702), this criterion was modified by the narrative nonsignificance criteria, currently found at ARM 17.30.715(1)(h). Based on the 1992 Final Environmental Impact statement for the EBM, which, “concluded that an increase in the instream nitrogen concentration to 1.0 mg/L at the 7Q10 would not cause undesirable or harmful algal growth,” the 2000 permit limit was set at the mass-based effluent limitation of 10,950 lbs/year (or 30 lbs/day) of N as the sum of total N discharged

from Outfall 001 and total inorganic nitrogen (TIN) discharged at Outfall 002, with an additional 2 lbs/day from Outfall 003. This mass-based effluent limitation was based on the assumption of a maximum biological treatment rate of 737 gpm at 3.6 mg/L TIN. An exception was included in this permit which allowed for the discharge of additional N during periods of summer high flow. Outfall 001 has yet to be constructed in 2025.

In 2014, base numeric nutrient standards for wadeable streams were adopted by the Board of Environmental Review in Department Circular DEQ-12A along with procedures for granting individual nutrient variances as described in Circular DEQ-12B. SMC applied for and received an individual nutrient variance which allowed for the discharge of up to 15 mg/L of TN at a discharge rate of 0.72 mgd (500 gpm), for a monthly average limit of 90 lbs/day. However, during the permit renewal process, DEQ determined that the 32 lbs/day facility-wide effluent limitation imposed in the 2000 permit was more stringent and was therefore maintained in the 2015 permit as a TN limit (based on anti-backsliding requirements). Because compliance with the previous effluent limitation was in terms of TIN for discharges from Outfall 002, Discharge Monitoring Report (DMR) data from pre-2015 are not directly comparable with DMR data from 2015 to present.

As described in the 2023 Fact Sheet (Appendix 4), between the 2015 and 2023 permit renewals, several changes occurred in the regulatory landscape with respect to nutrients in Montana such that SMC-EBM was no longer eligible for a variance following EPA's 2017 disapproval of the use of Montana's general variance for industrial dischargers. Further, the Montana Legislature passed Senate Bill 358 in the 2021 legislative session, which repealed the nutrient variance statute at § 75-5-313, MCA, and the implementation rule at ARM 17.30.660, and directed DEQ to eliminate DEQ-12A and replace the base numeric nutrient standards with a narrative nutrient approach in consultation with the Nutrient Workgroup (NWG). Because the NWG consultation process was ongoing at the time of the 2023 permit renewal, SMC agreed to the implementation of the base numeric nutrient standards, including permit implementation of the related numeric-based nonsignificance limits.

The 2023-issued permit assessed a final effluent limitation for TN based on the applicable DEQ-12A criterion of 0.30 mg/L TN, as modified by the nonsignificance criteria for harmful parameters at ARM 17.30.715(1)(f) which states that if the ambient quality of the receiving water is less than 40% of the applicable numeric criterion that the ambient concentration may be increased by up to 10% of the standard. As a result, the TN concentration calculated to meet nonsignificance criteria was 0.10 mg/L TN (after mixing).

House Bill 664, 2025 Mont. Laws ch.338, was passed into state law in May 2025. The bill revised Montana's nutrient standards approach by repealing the numeric nutrient criteria in DEQ-12A, repealing the changes to statute that were added via Senate Bill 358 in 2023, and eliminating the NWG (among other things). As a result, DEQ may only utilize the narrative criterion at ARM 17.30.637(1)(e) when assessing potential nutrient impacts to state surface waters formerly covered by DEQ-12A, provided no other site-specific nutrient criteria are in effect for a specific surface water. Passage of House Bill 664 also prompted DEQ to submit a water quality standards change to EPA on May 6, 2025. EPA acted on Montana's submitted water quality standards change on October 3, 2025, and approved Montana's decision to repeal DEQ-12A. As a result, DEQ-12A is no

longer effective for purposes of the Federal Clean Water Act. In its modification request, made pursuant to ARM 17.30.1361, SMC requested a reevaluation of its TN effluent limits under the narrative standard. Such reevaluation is warranted under both SMC's request and under the reopener provisions in SMC's MPDES permit. *See* Part IV, Section O, Permit No. MT0026808.

Interpretation of Narrative Nutrient Criteria (for TN)

To interpret the narrative prohibition as modified by the nonsignificance criterion, DEQ used the narrative nutrient translation process described in Appendix A of this Fact Sheet and documented in Appendix B. In brief, this approach uses all available data on nutrient concentrations and biological response variables (benthic algae, macroinvertebrates (i.e., aquatic insects), dissolved oxygen delta, diatoms, etc.), comparing conditions up- and downstream of the discharge to assess a) whether the discharge has reasonable potential to cause or contribute to an excursion from the narrative nutrient criterion and b) identify the discharge concentration protective of the narrative nutrient criterion, as modified by nonsignificance criteria where applicable. This determination is based on the protection of beneficial uses in the receiving water, both in the immediate surface receiving water and downstream, associated with the propagation of undesirable aquatic life.

Where the nonsignificance criterion is applicable, as in the case of EBM, the applicable protections are more stringent such that no measurable effects on any existing or anticipated use nor measurable change in aquatic life or ecological integrity are permissible. ARM 17.30.715(1)(h). Measurable effects are interpreted by DEQ as the quantifiable effect size for a given methodological approach, based on scientific literature or analysis of variability in long-term datasets from reference streams monitored by DEQ (see Suplee et al. 2005). Effect size is best understood as the numeric expression of the practical, real-world significance of a difference between two groups, rather than the statistical significance.

Bioassessment Monitoring Stations

Biological indicator data were submitted by SMC for a total of six surface water monitoring stations in East Boulder River sampled from 1998 to 2004: EBR-001, EBR-002, EBR-003, EBR-004, EBR-004a, and EBR-005 as described in Appendix B. The locations of these monitoring stations are shown in Figure 1. Station EBR-004 was moved downstream by ~ 800 feet in response to groundwater monitoring data and is referred to as station EBR-004a after relocation, which occurred in 2013. In this document, combined data from EBR-004 and EBR-004a will be referred to as EBR-004(a). Station EBR-003 is adjacent to the facility, but upstream of where discharges from Outfall 002 enter the East Boulder River and therefore did not suitably fit the definition of an upstream control site nor a downstream impact site.

Stations EBR-001 and EBR-002 are upstream of the facility. EBR-004(a) and EBR-005 are downstream of the Facility, but within the Department-approved mixing zone, EBR-005 being the downstream-most point where discharge reaches the river. Stations EBR-002 and EBR-004(a) have the most complete datasets spanning this time period, which is inclusive of the onset of discharge as authorized by the 2000-issued MPDES permit. For purposes of assessment of effluent limitations for TN under the narrative nutrient criteria, DEQ evaluated stations EBR-001 and EBR-002 as upstream controls, and EBR-004(a) and EBR-005 as "downstream" sites to conduct a comparative evaluation of measurable impacts to aquatic life.

Receiving Water Characterization

The ultimate receiving water (East Boulder River) is a perennial, wadeable stream in the Middle Rockies Ecoregion (Omernik & Griffith 2014) for which the applicable nutrient growing season is July 1-September 30, annually. The East Boulder River is not a spring creek nor is there a lake downstream of the discharge. The critical condition flow of the receiving water (14Q5) is 6.79 million gallons per day (mgd), or 10.5 cubic feet per second (cfs). The receiving waterbody, for several miles upstream and downstream of the mixing zone, is moderately shaded (1992 FEIS). The dominant substrate types are boulders and cobble (1992 FEIS).

No reach-specific TN or TP criteria have been developed for the receiving water body. The East Boulder River where the mine discharges is not listed as impaired for nutrients or excessive algal growth, though downstream reaches have been listed as impaired for chlorophyll-a since the mid-1990s (2023 Fact Sheet). Continuous dissolved oxygen (DO) has not been monitored within several miles upstream and downstream of the discharge. There have been no known exceedances of DO standards in Circular DEQ-7 and the average DO delta during the nutrient growing season is unknown. Michael Suplee, PhD (of DEQ) served as the consulting Water Quality Standards Scientist for this narrative nutrient evaluation.

In addition to the data discussed in the following sections, the Permittee also submitted diatom bioassessment data, reporting percent relative abundances of sediment increaser taxa. These data were not considered in this analysis as they are not considered nutrient biological response variables.

Ambient Nutrient Concentrations

The updated applicable ecoregional range for the Middle Rockies Ecoregion for TN is 0.139-0.980 mg/L and for TP is 0.02-0.06 mg/L (Appendix A). These ranges encompass the range of harm-to-beneficial-use nutrient concentration thresholds that have been identified in the scientific literature or by studies carried out by DEQ. The ranges are applicable during the summer growing season (July to September each year) when impacts from excess nutrients are manifested in Montana's rivers and streams. The growing season concentrations of TN and TP (2015-2017) are shown in Figure 2, with shading demonstrating the ecoregional range values. For TN, ambient concentrations in the East Boulder River are at the low end of the ecoregional range (Figure 2a). For TP, ambient concentrations are below the ecoregional range (Figure 2b). In both cases, ambient nutrient concentrations are comparable to pre-mining conditions (TN mean = 0.20 mg/l; TP mean = 0.02; Beak 1982 as reported in 1992 FEIS). The median N:P (molar) ranges from 37 at EBR-001 to 133 at EBR-005 (Figure 3), indicating that the receiving water is highly P limited, consistent with the conclusion drawn in the 1992 FEIS. The increasing N:P from upstream of the EBM discharge to downstream suggests that the discharge may be exacerbating P limitation of primary production through N enrichment.

Benthic Algae Bioassessment

Benthic algae have been quantified up- and downstream of the groundwater discharge, as chlorophyll-a (chl-a) and as ash free dry mass (AFDM) using methods considered appropriate by DEQ. Chlorophyll-a concentrations were measured using EPA method 446.0 (Arar 1997; Rhithron 2024). Ash free dry mass was measured by desiccating periphyton samples at 106°C for 4 hours, weighing, combusting at 500°C for 2 hours and reweighing (Rodgers et al 1979; Rhithron 2024).

Across monitoring stations, annual mean ($\pm$ standard deviation) chl-a was lowest at EBR-001 ($4.14 \pm 4.65 \text{ mg m}^{-2}$) and highest at EBR-004a ($37.6 \pm 140 \text{ mg/l}$), declining to $4.89 \pm 8.16 \text{ mg m}^{-2}$ at EBR-005 (Figure 4). These median chl-a densities are low and similar to DEQ's Mountain stream reference sites which average $12 \pm 9.8 \text{ mg chl-a m}^{-2}$ (Schulte and Craine 2023). Two annual mean values exceeded the harm-to-use recreation threshold of 150 mg m^{-2} (per Suplee et al. 2009) at EBR-002, in 2005 and 2019; site EBR-002 is upstream of the discharge and the 2019 observation is consistent with elevated algal growth observed in another Montana river that year (DEQ 2024a).

To identify measurable changes in undesirable aquatic life, annual median chl-a densities from downstream of the discharge were subtracted from their corresponding annual medians from upstream of the discharge, using both EBR-004(a) and EBR-005 as downstream sites paired with upstream EBR-002. It has been observed that, over a range of chl-a values from 40 to 1,280 mg chl-a m^{-2} , there needs to be about a $50 \text{ mg chl-a m}^{-2}$ increase for the change to be visually observed in streams (Suplee et al. 2009). However, the low-density chl-a values observed in the East Boulder River are more akin to values seen in DEQ's Mountain reference sites which averaged (over the past 20 years) $12 \text{ mg chl-a m}^{-2} \pm 1$ standard deviation of $9.8 \text{ mg chl-a m}^{-2}$ (Schulte and Craine 2023). An effect size (aka measurable effect) in this scenario would be equivalent to at least 2 standard deviations, or about $20 \text{ mg chl-a m}^{-2}$; this approach equates to using a p-value of about 0.05 in a statistical test (like a t-test) to compare two datasets.

In most cases, chl-a concentrations were similar to or lower at downstream sites than at upstream sites (Figure 5), consistent with the increase in P limitation from up to downstream of the discharge. Chl-a values exhibit a high degree of variability such that these differences do not constitute a consistent, measurable change in undesirable aquatic life but warrant ongoing monitoring.

Ash free dry mass (AFDM) data were only available between 2021-2024, increasing from $1.60 \pm 1.34 \text{ g AFDM m}^{-2}$ to $6.25 \pm 2.02 \text{ g AFDM m}^{-2}$ from EBR-001 to EBR-003 (upstream of discharge) and then decreasing to $5.34 \pm 7.31 \text{ g AFDM m}^{-2}$ at EBR-004a and $4.20 \pm 2.82 \text{ g m}^{-2}$ at EBR-005 over this time period (Figure 6). These mean AFDM densities are very low, similar to DEQ's Mountain stream reference sites which averaged $5.8 \text{ g AFDM m}^{-2} \pm 1$ standard deviation of $9.9 \text{ g AFDM m}^{-2}$; Schulte and Craine (2023). Using the same approach as for chl-a to derive a measurable change, one would need to see about 20 g AFDM m^{-2} change to signify a measurable difference. There were no observed exceedances of the harm to use threshold of 35 g AFDM m^{-2} . AFDM was generally slightly higher downstream at EBR-004a and EBR-005 than upstream at EBR-002 and EBR-001, but not at a measurable level. In 2023, AFDM was lower at EBR-005 than at EBR-002 and EBR-001, driven by higher upstream AFDM in that year. Given this, these differences do not constitute a measurable change in undesirable aquatic life but warrant ongoing monitoring.

Benthic macroinvertebrate bioassessment

Benthic macroinvertebrate communities have been quantified at the monitoring stations since 2000, late in the growing season (late August-early September) using the travelling kick method (Rhithron 2024). While DEQ discontinued the use of the travelling kick method for monitoring and assessment purposes in 2005, this method produces samples indistinguishable from the MAC-R-500 method currently in use by DEQ (Jessup et al. 2005; Suplee 2023) and is considered valid for the purposes of this evaluation and, given the long-term dataset, DEQ encourages its continued use to optimize comparability with historic data. Benthic macroinvertebrate metric data were reported as

Observed/Expected (O/E) using the method described in DEQ (2012), Hilsenhoff Biotic Index (HBI) using the method described in DEQ (2012), and the Montana Valley and Foothill Prairies (MVFP) metric per Bollman (1998). DEQ only considered O/E and HBI, as the MVFP was developed for the Montana Valley and Foothill Prairies ecoregion (Bollman 1998) and is therefore not applicable to high mountain streams (such as sites EBR-001 through 005) located outside of the MVFP ecoregional area.

DEQ identified thresholds for measurable change in O/E and HBI benthic macroinvertebrate metrics. For O/E, the measurable change threshold was set at 0.159 (15.9% change) based on the repeat sample variance for this metric using the travelling kick method reported in Stribling et al. (2008). The applicable harm-to-use threshold for O/E is ≤ 0.9 (DEQ 2012). That is, an evaluated site would be considered impacted if it did not have at least 90% taxon concordance with regional reference sites. For HBI, the measurable change threshold was calculated by analyzing the variability in DEQ's western MT reference stream sites over the past 20 years, for which an average site has (over that time period) a standard deviation of 0.5 HBI units. Thus, for there to be a measurable difference between two sites there should be at least 2 standard deviations difference between means, which (based on the reference sites' variances) is equal to 1.0 HBI unit. The applicable harm to use (impairment) threshold for HBI in the Mountains is 3.52 (Schulte and Craine 2023).

Median HBI values at all monitoring stations were below the impairment threshold of 3.52, with some values, both up and downstream of the discharge, exceeding (Figure 7). Because higher HBI values indicate impaired macroinvertebrate communities, the change between up and downstream was represented as downstream minus upstream to allow for easier comparability with O/E (for which lower values indicate a less healthy macroinvertebrate community and higher values indicate a healthier macroinvertebrate community). In two instances, there were measurable changes in HBI between down and upstream Stations: once in 2002 between EBR-005 and EBR-002 and again in 2008 (Figure 8).

Median annual O/E values were consistently below the impairment of beneficial use threshold of 0.9 at EBR-003, EBR-004, and EBR-005 while EBR-001, EBR-002 and EBR-004a were generally around the impairment threshold value (Figure 9). From 2000 to 2009, O/E metric scores upstream of the discharge were measurably higher (i.e., >0.159 difference) than those downstream of the discharge for the vast majority of the years (Figure 10). From 2009 to present there were two instances of measurable differences between up and downstream of the Facility: between EBR-004 and EBR-002 in 2018, and between EBR-005 and EBR-002 in 2022. The observed measurable change between up and downstream stations in 2018 follows two high TN-loading years (2016-2017), consistent with impacts to macroinvertebrate communities after a ~ 1 year transit time between ground and surface water (Hydrometrics 2017).

In consideration of the relevant nonsignificance criterion at ARM 17.30.715(2), DEQ considered potential cumulative impacts or synergistic effects, secondary byproducts of decomposition or chemical transformation, and changes in the loading of parameters. EBM is located in the headwaters of the East Boulder River and there are no other point source discharges in the vicinity of the Facility. However, there are non-point source discharges of TN from EBM's waste rock storage area and Tailings Storage Facility (TSF). These contributions were accounted for in our assessment

of the facility's reasonable potential to cause or *contribute* to an exceedance of the narrative criterion by using monitoring stations EBR-001 and EBR-002 as representative of upstream conditions. EBR-003 is located upstream of EBM's discharge from Outfall 002 but downstream of non-point TN discharges. To address cumulative impacts of non-point and point sources, DEQ did not use monitoring station EBR-003 as an upstream sampling location. Further, the 2023-issued permit included a reasonable potential analysis for secondary byproducts of TN ammonia and nitrate + nitrite, assessing effluent limitations for both parameters (2023 Fact Sheet). As described below, the facility will be capped at current performance on a mass loading basis, ensuring no change in the loading of TN. Based on this analysis, DEQ considers this change in water quality nonsignificant.

In conclusion, there is evidence that SMC's discharge at EBM from 2000-2017 had a measurable impact on aquatic communities but that this impact has not been present from 2018 to present. This pattern is consistent with the history of upgrades to and optimization of the WTP. When EBM initiated discharge through the infiltration basin in 2000, the WTP consisted of a six fixed-bed denitrification cell system. Since this time, the EBM WTP has undergone extensive upgrades, improving TN removal from effluent. In 2007/2008, SMC converted one of the six cells in the original denitrification cell system to a heated mixed bed bioreactor (MBBR) followed by a second in 2012. Between 2018-2022, three additional cells were converted from fixed beds to rock cells. In 2021, SMC added a thickener to help with the clarification step and installed two 10-micron disc filters to treat any wastewater that would be discharged. In addition, optimization and source reduction efforts have been on-going since 2016.

VI. Final Effluent Limitations

Effluent Limitations

Taken together, evidence of measurable impacts to aquatic communities prior to 2018 and recent upgrades indicate that past (pre-2018) TN loading to the East Boulder River had a measurable impact on aquatic communities, but current facility TN loading does not result in measurable changes to aquatic life or ecological integrity. On this basis, the final WQBEL for TN is calculated by evaluating the facility's TN loading from 2018 to present and capping the facility at this level of discharge by calculating the mean monthly average mass loading from 2018-present for outfalls 002 and 003, multiplying this value by the long-term average (LTA) multiplier at the 95% confidence interval (Table 2; EPA TSD). This results in a facility-wide effluent limitation of 16.0 lbs/day TN.

Table 2. Calculation of TN WQBEL based on facility performance from 2018-present (Monthly Average)

Statistic	Units	Outfall 002	Outfall 003	SUM
Average	lbs/day	7.91	2.52	10.4
Std Dev	lbs/day	5.49	0.5	
cv		0.69	0.2	
LTA Multiplier		1.65	1.17	
Monthly Avg Limit ⁽¹⁾	lbs/day	13.0	3.0	16.0

(1) To calculate 'cap at current,' DEQ uses the EPA's 1991 TSD method and determines the long-term average (LTA) multiplier in conformance with Table 5-1 (chronic).

Because the final effluent limitation is based on Facility performance, a compliance schedule is not warranted.

VII. SPECIAL CONDITIONS

The availability of biological indicator data is essential for the continued evaluation of reasonable potential to cause or contribute to an excursion from the narrative prohibition at ARM 17.30.637(1)(e) and for the assessment of effluent limitations for nutrients. Therefore, ambient monitoring is proposed as a requirement of the permit, as follows:

SMC shall, at minimum, conduct annual:

- benthic macroinvertebrate and benthic algal assessments, according to the methods described in Rhithron 2024;
- ambient TN and TP sampling; and
- Aquatic flora visual assessments using a DEQ-approved form by trained staff. The assessment includes visual observations for Didymo in a standard assessment quadrant (10m long by stream wetted-width wide).

The biological assessments shall be conducted, at a minimum, at East Boulder River monitoring locations EBR-001, -002, -004a, and -005 annually between July 1-September 30th. SMC shall provide results to DEQ via an annual report submitted by May 31st each year. SMC shall include any proposed changes to the annual assessment protocols with, or before, the annual report submittal. No changes in any protocol will be made unless agreed to by DEQ, in writing.

VIII. PUBLIC PARTICIPATION

In accordance with ARM 17.30.1372, DEQ issued Public Notice No. MT-25-05, dated October 8, 2025. The public notice states that a tentative decision has been made to modify an MPDES permit for Stillwater East Boulder Mine, and that a draft permit, fact sheet and environmental assessment (EA) have been prepared. Public comments are invited any time prior to 11:59 PM November 7, 2025. Comments may be directed to:

DEQ - Water Protection Bureau
PO Box 200901
Helena, MT 59620
or DEQWPBPublicNotices@mt.gov

All comments received or postmarked prior to the close of the public comment period will be considered in the formulation of the final modified permit. DEQ will respond to all substantive comments and issue a final decision within sixty days of the close of the public comment period, or as soon as possible thereafter.

All persons, including applicants, who believe any condition of the modification is inappropriate, or that DEQ's tentative decision to deny an application, terminate a permit, or prepare a draft permit is inappropriate, shall raise all reasonably ascertainable issues and submit all reasonably available arguments supporting their position by the close of the public comment period (including any public

hearing) under ARM 17.30.1372.

C. Notification of Interested Parties

Copies of the public notice were mailed to the Permittee, state and federal agencies and interested persons who have expressed in interest in being notified of permit actions. A copy of the distribution list is available in the administrative record for this permit. In addition to mailing the public notice, a copy of the notice and applicable draft permit, fact sheet and EA were posted on DEQ website for 30 days.

Any person interested in being placed on the mailing list for information regarding this MPDES Permit should contact DEQ, reference this Facility, and provide a name, address, and phone number.

D. Public Hearing Written Comments

During the public comment period provided by the notice, DEQ will accept requests for a public hearing. A request for a public hearing must be in writing and must state the nature of the issue proposed to be raised in the hearing (ARM 17.30.1374).

E. Permit Appeal

After the close of the public comment period DEQ will issue a final permit decision. A final permit decision means a final decision to issue, deny, modify, revoke and reissue, or, terminate a permit. A permit decision is effective 30 days after the date of issuance unless a later date is specified in the decision, a stay is granted pursuant to ARM 17.30.1379, or the applicant files an appeal pursuant to 75-5-403, MCA.

The Applicant may file an appeal within 30 days of DEQ's action to the following address:

Secretary, Board of Environmental Review
Department of Environmental Quality
1520 East Sixth Avenue
PO Box 200901
Helena, Montana 59620-0901

F. Additional Information

Requests for additional information or questions regarding this permit should be directed to the Water Protection Bureau at (406) 444-5546.

IX. FIGURES

Figure 1. Facility Map showing the location of all monitoring stations.

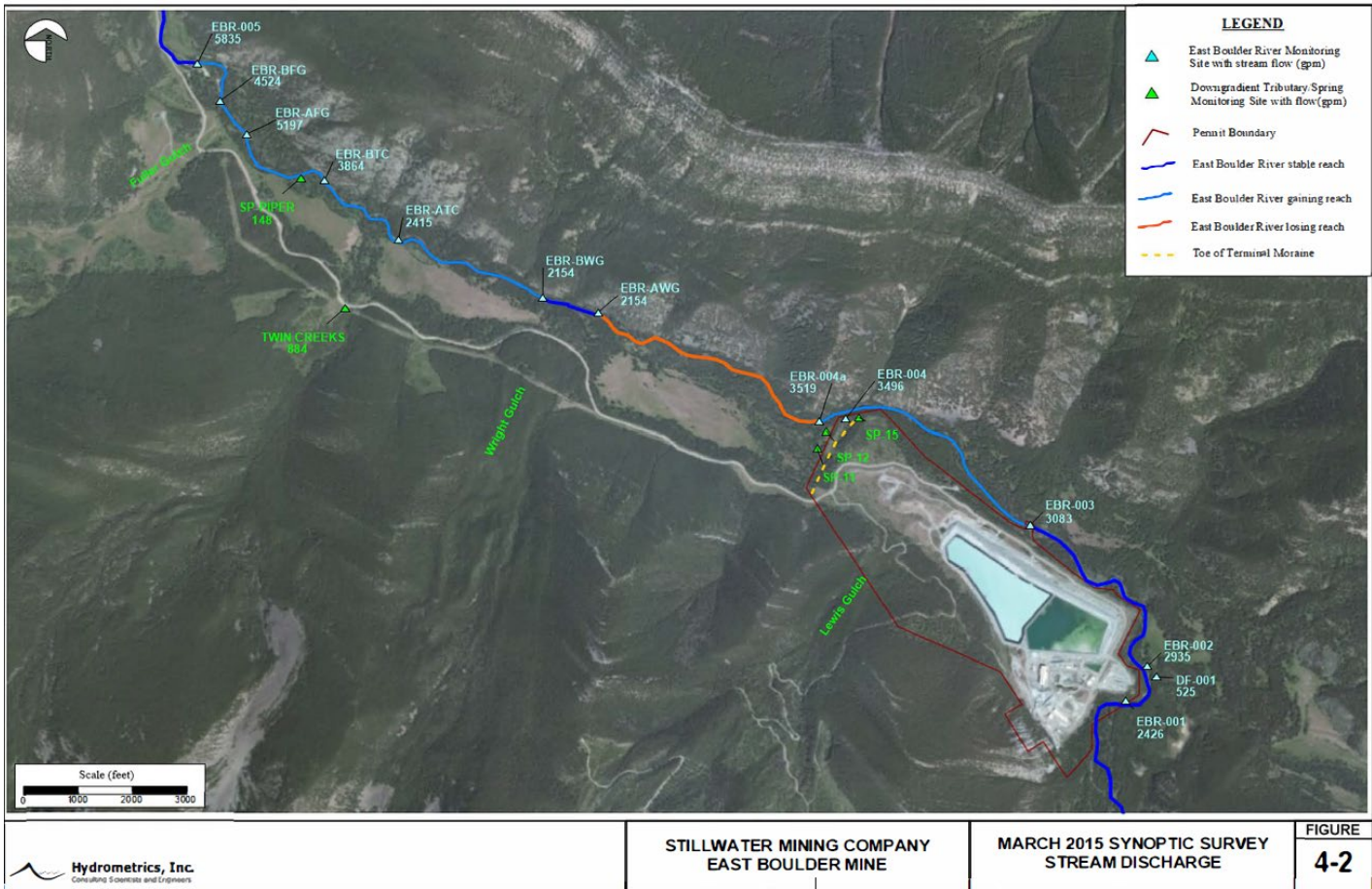


Figure 2. Ambient total nitrogen (a) and total phosphorus (b) concentrations at monitoring stations EBR-001, EBR-002, EBR-003, EBR-004a, and EBR-005 during the 2015-2018 nutrient growing seasons (July 1- Sept 30, annually). Shading indicates ecoregional range values for the Middle Rockies ecoregion.

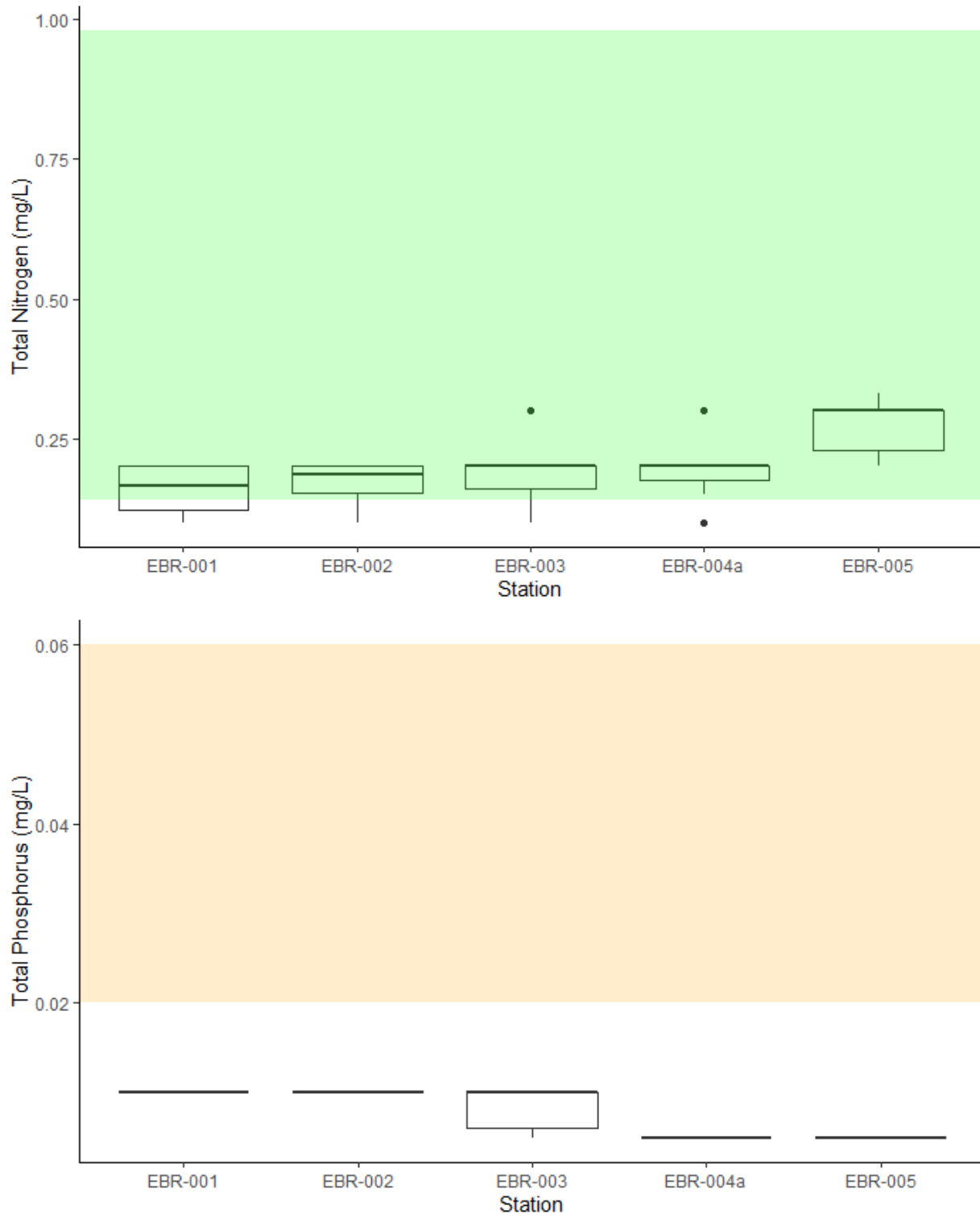


Figure 3. Median molar total nitrogen (TN) to total phosphorus (TP) ratio at East Boulder River monitoring stations during the 2015-2018 nutrient growing seasons (July 1-Sept 30). Station EBR-004 was replaced with EBR-004a in 2013, so EBR-004 is not shown. Black line represents Redfield N:P ratio of 16:1, values above the line indicate P limitation and below the line indicate N limitation.

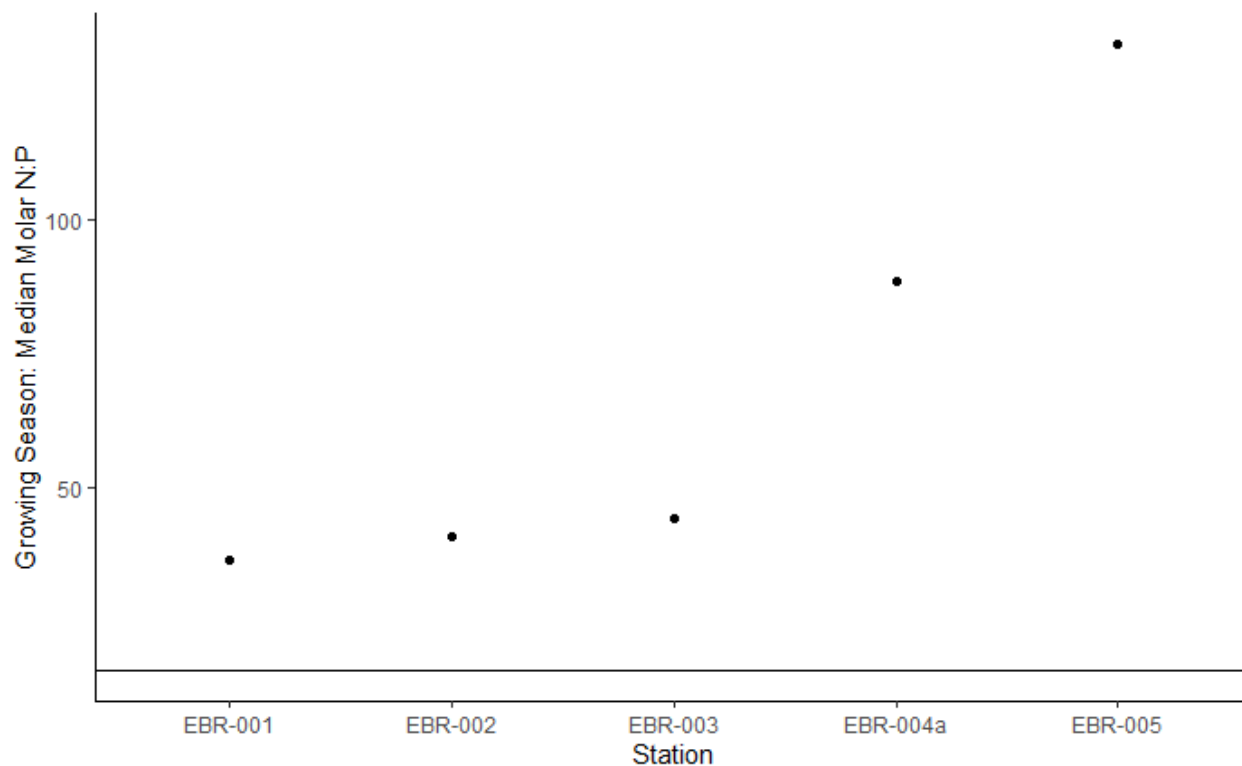


Figure 4. Mean annual chlorophyll-a densities at each EBR monitoring station (1999-2024). The red line denotes the harm recreational beneficial use threshold of $150 \text{ mg chl-a m}^{-2}$ (values above this line indicate impairment).

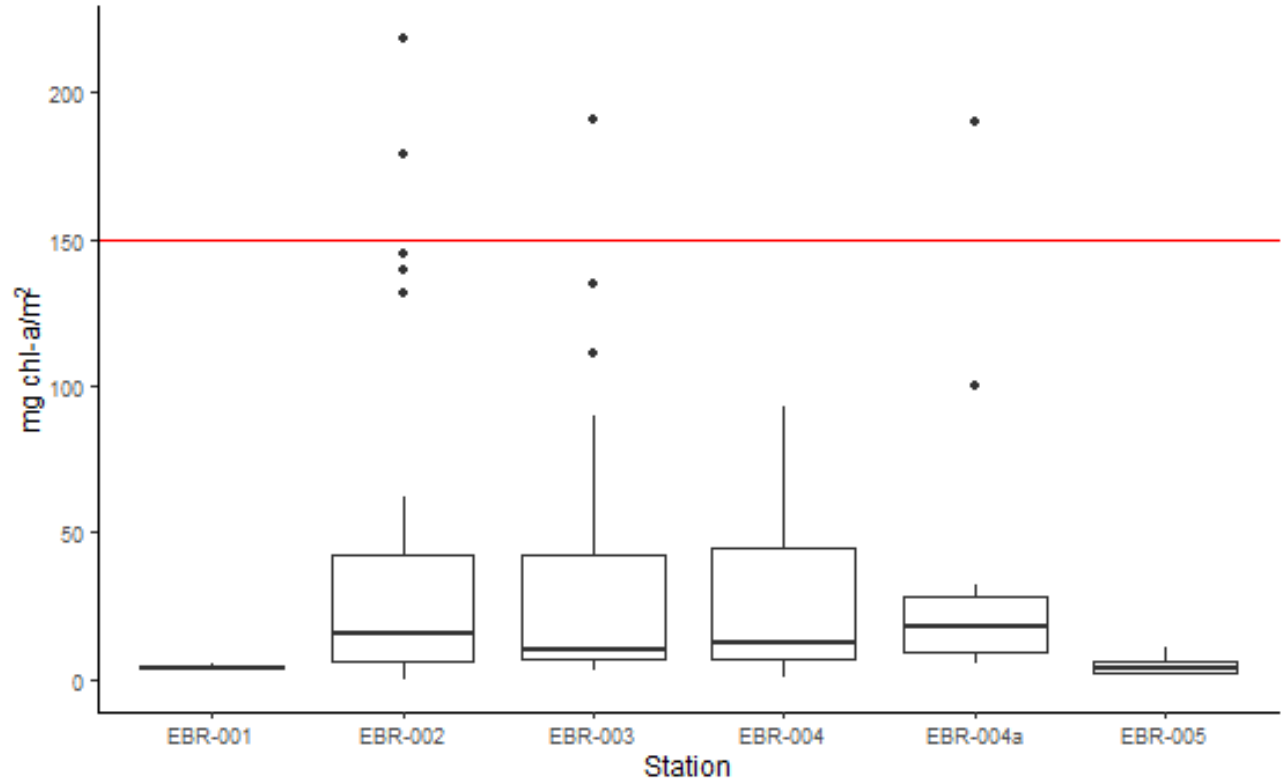
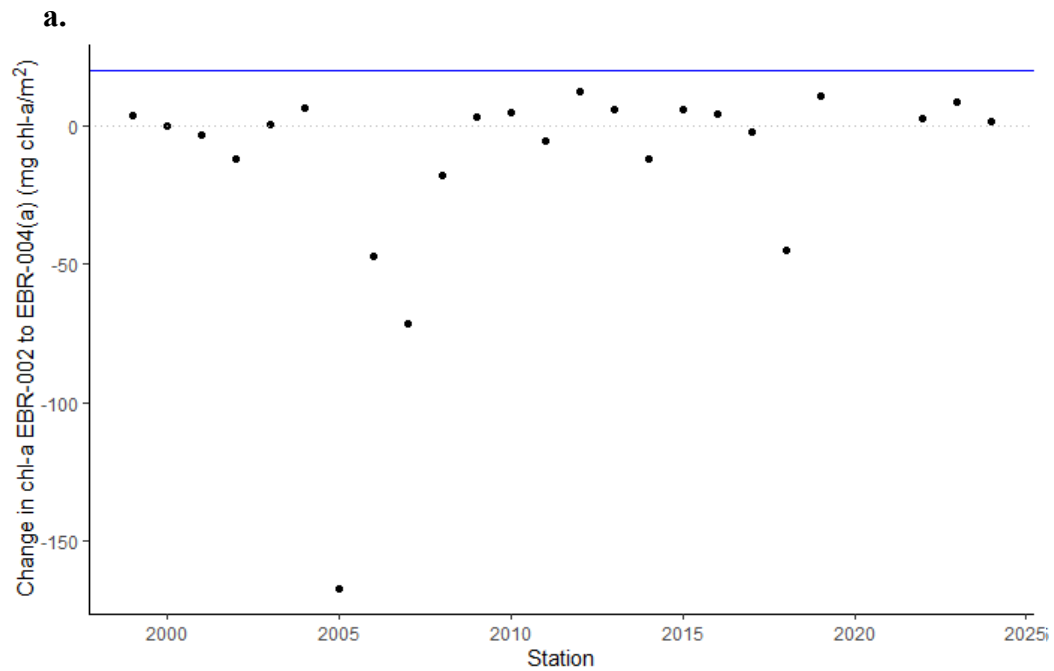


Figure 5. The difference between downstream and upstream chlorophyll-a concentrations annually between EBR-002 and EBR-004(a) (5a.) and EBR-002 and EBR-005 (5b.). The blue line indicates the measurable change threshold of 20 mg chl-a m⁻².



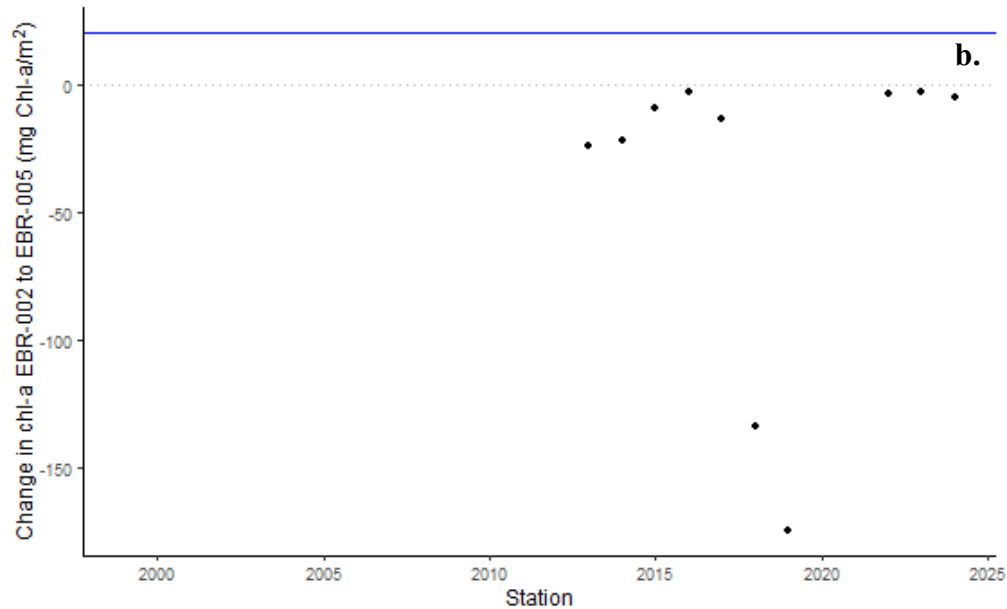


Figure 6. Mean annual ash free dry mass (AFDM) concentrations at each EBR monitoring station (2021-2024). The red line indicates the harm to recreational beneficial use threshold of 35 g AFDM m⁻² (values above this line indicate impairment).

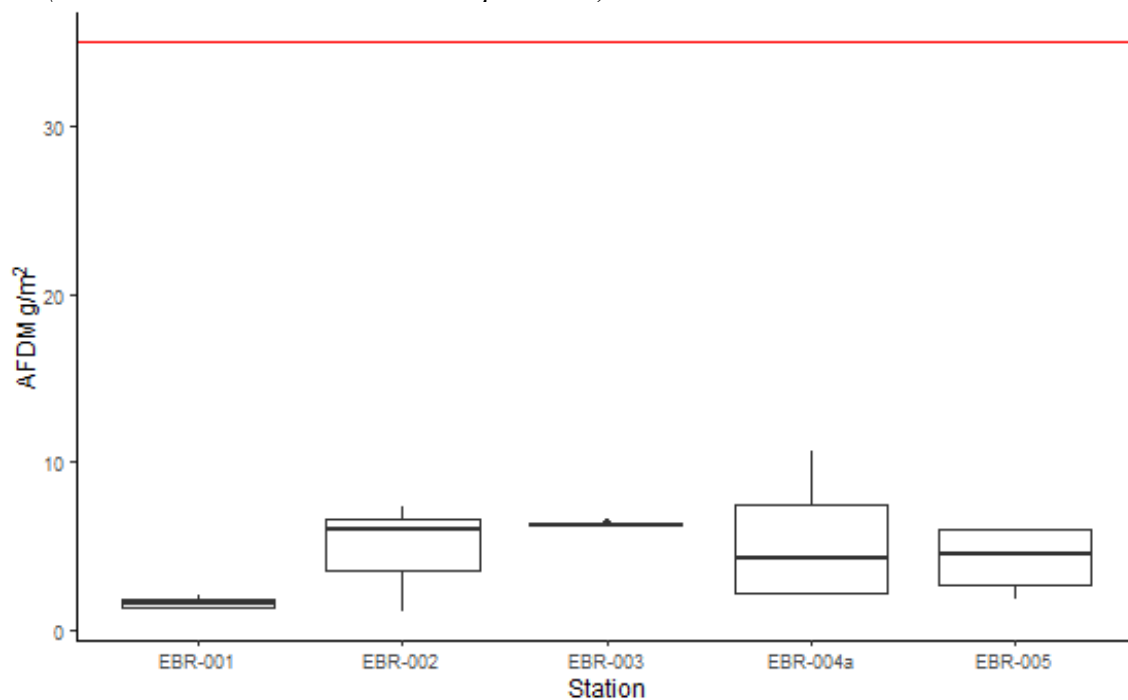


Figure 7. Annual median Hilsenhoff Biotic Index (HBI) at each EBR monitoring station (1999-2024). The red line indicates the harm to aquatic life beneficial use threshold of 3.52 (values above this level indicate impairment). EBR-004a data are only from 2022 and 2024.

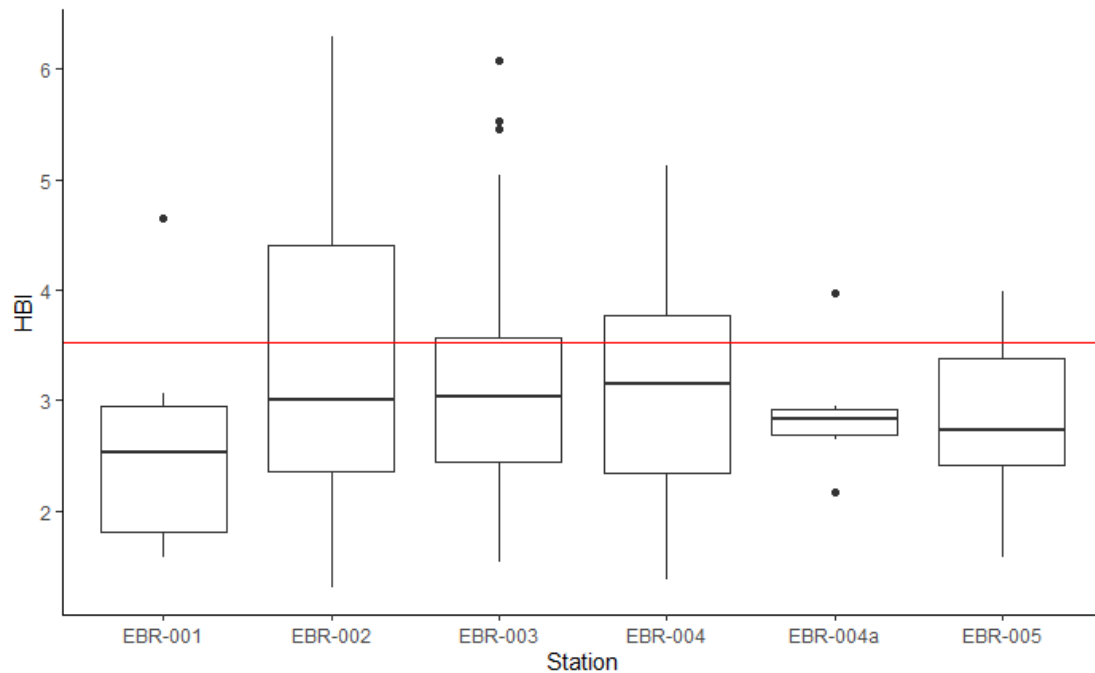
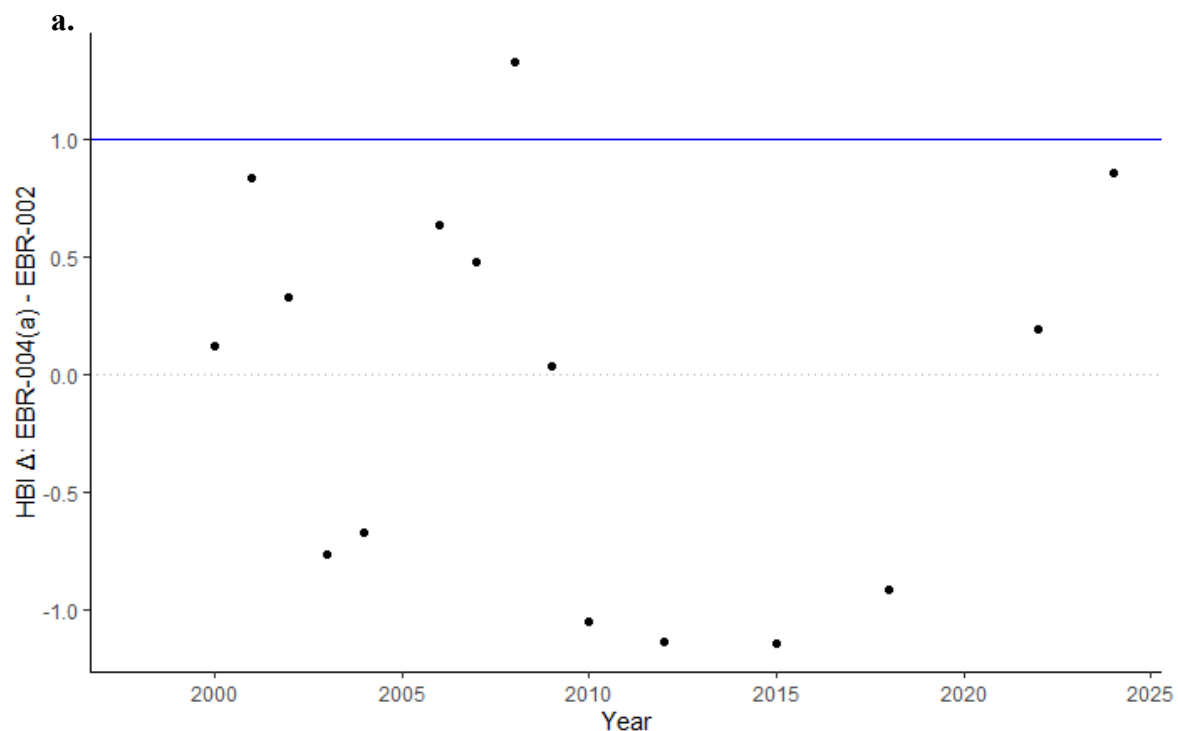


Figure 8. The difference between upstream and downstream Hilsenhoff Biotic Index (HBI) values annually between EBR-004(a) and EBR-002 (8a.) and EBR-005 and EBR-002 (8b.). The blue line indicates the measurable change threshold of 1 HBI unit.



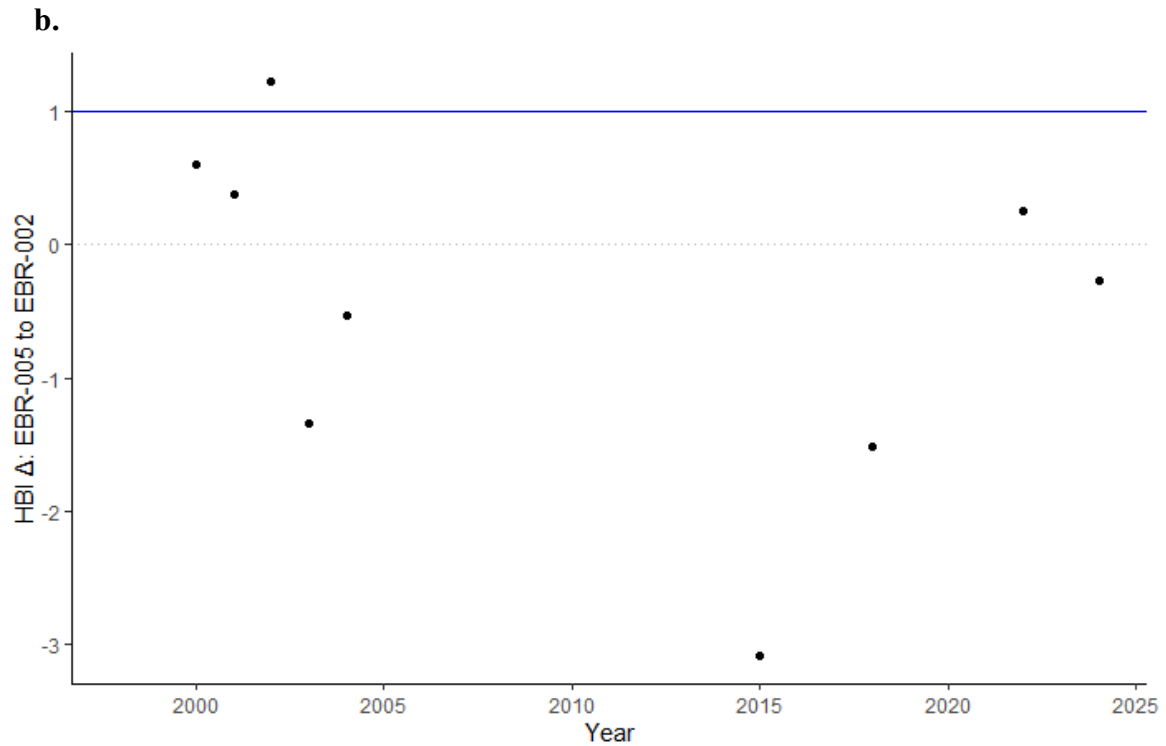


Figure 9. Annual median observed/expected (O/E) benthic macroinvertebrates at each EBR monitoring station (1998-2024). The red line indicates the harm to aquatic life beneficial use threshold of 0.9 (values below this level are consistent with impairment). EBR-004a data are only from 2022 and 2024.

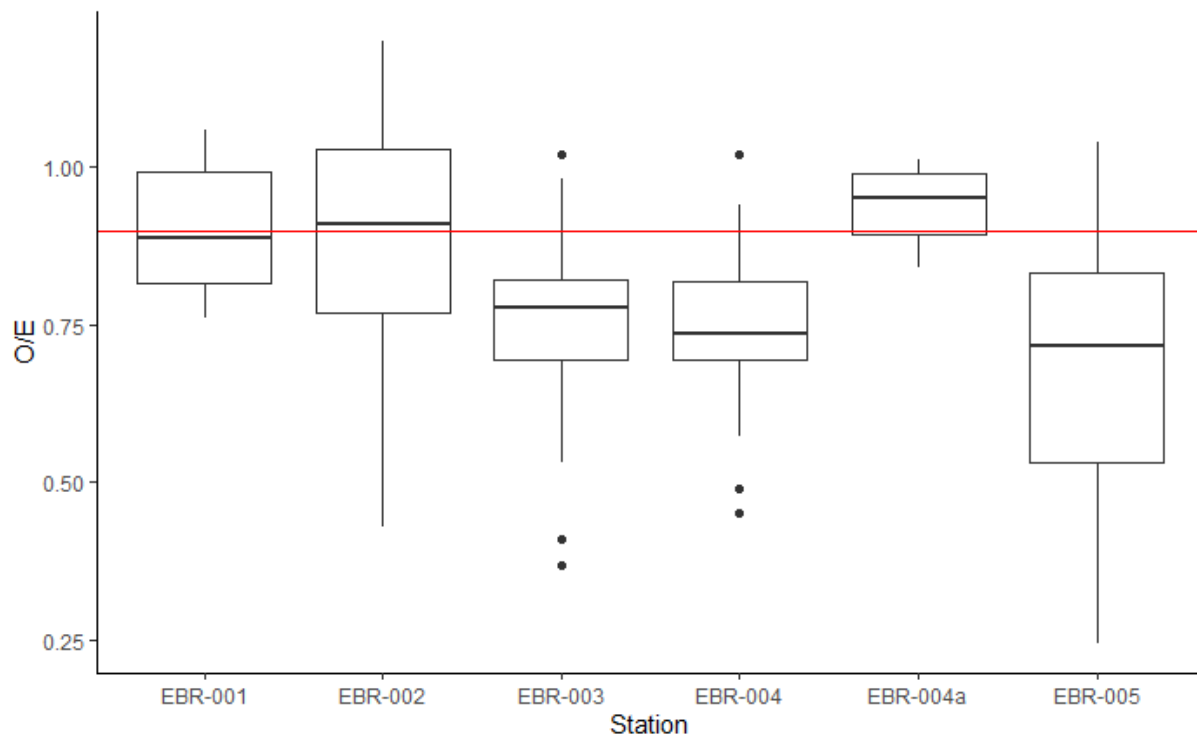
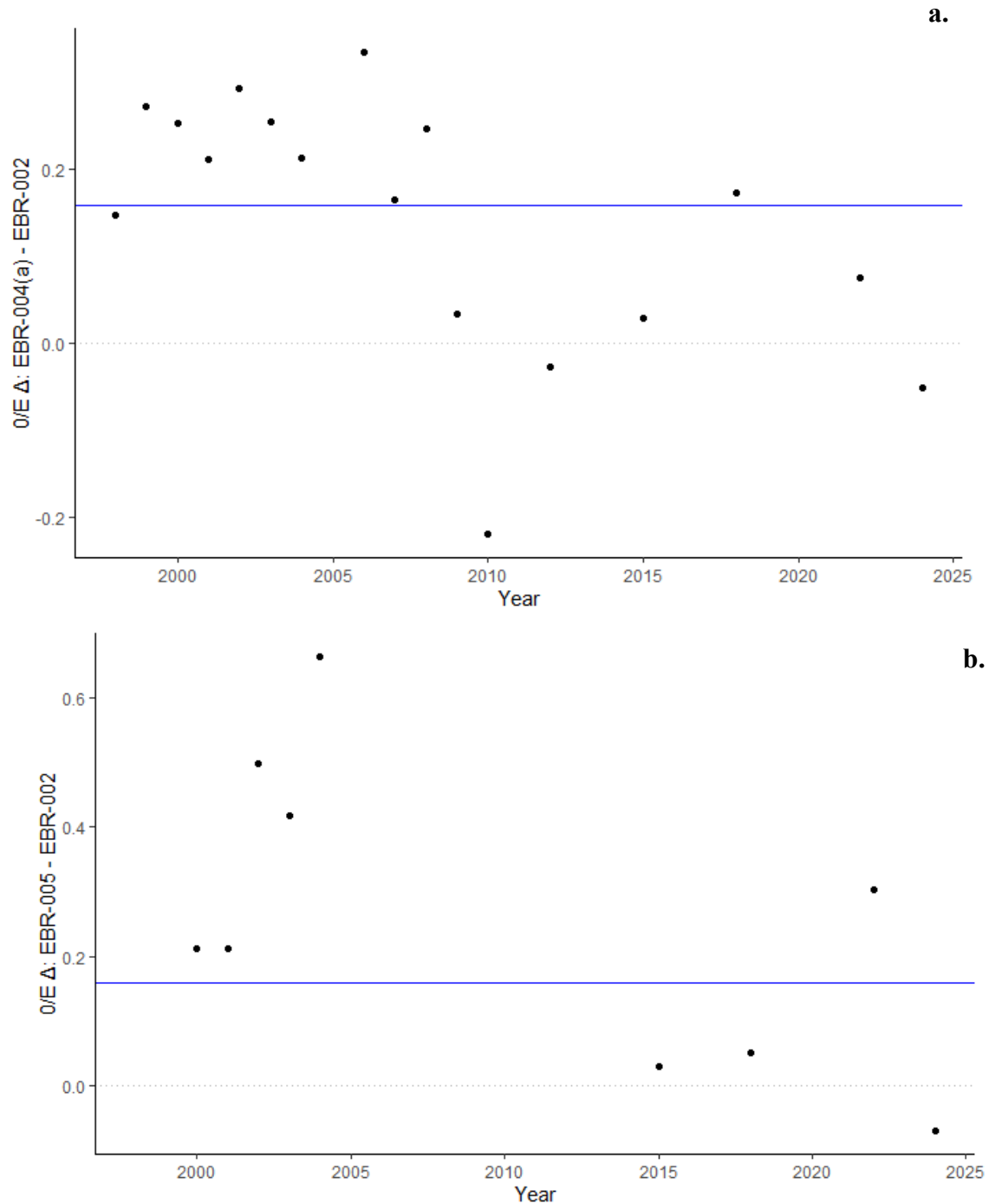


Figure 10. The difference between downstream and upstream observed/expected (O/E) benthic macroinvertebrate values annually between EBR-004(a) and EBR-002 (10a.) and EBR-005 and EBR-002 (10b.). The blue line indicates the measurable change threshold of 0.159 O/E unit.



X. REFERENCES

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XI. APPENDIX A

Narrative Nutrient Standards: Checklist of Considerations for Developing Permit Limits

This checklist and guide provides a series of factors for MPDES Permit Writers (and others) to consider when developing total nitrogen (TN) and total phosphorus (TP) permit limits under the narrative nutrient standard at ARM 17.30.637(1)(e). This approach considers best-available scientific knowledge on Montana rivers and streams at the regional scale, as well as site-specific conditions and scientific information for the waterbody in question. Receiving waterbody characteristics influence the way TN and TP affect primary productivity and biomass, dissolved oxygen and pH patterns, and aquatic life metrics. The process outlined here is intended to account for these effects at the site-specific level.

1. **Consultation with Receiving Waterbody staff experts.** DEQ's Water Quality Division has experts on specific waterbodies and the latest monitoring and research activities occurring on them. Many of these staff are in the Water Quality Planning Bureau.
 - a. **Have you investigated if there is a DEQ staff with expertise on the Receiving Waterbody?** _____
 - b. **Who is that person (or persons)?** _____
2. **Site-specific characteristics of the Receiving Waterbody.** The following is a list of Receiving Waterbody characteristics which should be completed to the degree possible. The list comprises waterbody characteristics that can influence the way TN and TP affect primary productivity and biomass, dissolved oxygen and pH patterns, and aquatic life biometrics, all of which can inform DEQ about the waterbody's beneficial use support.

- a. Is the waterbody a ditch, a wadeable stream, a medium river, or a large river (Flynn and Suplee, 2010)? _____
- b. Is the waterbody currently on the 303(d) list for nutrients, benthic chlorophyll *a* or ash free dry weight, dissolved oxygen, or pH? _____
 - i. Listed parameters: _____
- c. What is the summertime (growing season) flow pattern of the Receiving Waterbody? Ephemeral _____ Intermittent _____ Perennial _____
- d. Is the Receiving Waterbody a spring creek (see Decker-Hess, 1989)? _____
- e. Is there a lake downstream of the discharge that is likely to be affected by the facility's discharge? _____
- f. What is the 7Q10 or 14Q5 flow of the Receiving Waterbody?
 - i. Flow Stat _____
 - ii. Flow _____ (CFS)
- g. Is the Receiving Waterbody, for several miles upstream of the facility and then downstream of the discharge mixing zone, heavily shaded by riparian canopy or is it largely open to sunlight?

- h. What is the dominant substrate (i.e., D₅₀) of the Receiving Waterbody upstream of the facility and downstream of the discharge mixing zone?

- i. Has continuous dissolved oxygen (DO) been monitored within several miles upstream of the facility and downstream of the permitted discharge mixing zone?
 - i. If yes, have there been exceedances of DEQ-7 DO standards? _____
 - ii. Which ones and where? _____
 - iii. What is the average DO delta (daily maximum minus daily minimum) of the dataset during summer for the upstream and downstream locations?

- j. Has attached benthic algae been quantified (as chlorophyll *a*, ash free dry weight, or visually assessed) in the Receiving Waterbody upstream of the facility and downstream of the discharge mixing zone? _____
 - i. What are the reach average values? _____
 - ii. How do they compare to the undesirable recreational thresholds in Suplee et al. (2009) and/or other DEQ resources? _____

- k. **Are vascular aquatic plants (macrophytes) common in the Receiving Waterbody upstream of the facility and downstream of the discharge mixing zone?** _____
 - i. **What percent cover of the channel do they occupy in the upstream vs. downstream locations?** _____
 - l. **Have benthic aquatic insects (benthic macroinvertebrates) been sampled within several miles upstream of the facility and also below the discharge mixing zone?** _____
 - i. **If yes, what is the average Beck's Biotic Index 3 score for each reach?** _____
 - ii. **The average Hilsenhoff Biotic Index score?** _____
 - iii. **Other macroinvertebrate scores?** _____
 - m. **Have diatom metrics been computed for the Receiving Waterbody within several miles upstream of the facility and downstream of the discharge mixing zone?** _____
 - i. **If yes, what are the metric scores for each reach?** _____
 - n. **Are there any other unusual, notable characteristics of the Receiving Waterbody that need to be documented?** _____
 - i. **What are they?** _____
3. **Ecoregional Ranges.** The following table provides ranges of TN, TP concentrations which have been demonstrated to be protective of aquatic life and recreation beneficial uses at the ecoregional scale.
- a. **The site in question is in which level III (or level IV) ecoregion?** _____
 - b. **The ecoregional range is: TP** _____ **TN** _____
 - c. **The applicable time period (growing season) is:** _____

Region	Ecoregion (Level III)	Ecoregion (Level IV)	Range		Applicable Time Period	
			Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Start of Growing Season	End of Growing Season
Western	Northern Rockies (15)	all	20 - 40	139 - 750	July 1	Sept. 30
Western	Canadian Rockies (41)	all	20 - 60		July 1	Sept. 30
Western	Idaho Batholith (16)	all			July 1	Sept. 30
Western	Middle Rockies (17)	all except 17i		139 - 980	July 1	Sept. 30
Western	Middle Rockies (17)	Absaroka-Gallatin Volcanic Mountains (17i)	43 - 106 ^b	Use values from the lower end of the Middle Rockies (17) ecoregion range	July 1	Sept. 30
Transitional	Northwestern Glaciated Plains (42)	Sweetgrass Upland (42l), Milk River Pothole Upland (42n), Rocky Mountain Front Foothill Potholes (42q), and Foothill Grassland (42r)	20 - 206 ^c	199 - 775 ^d	July 1	Sept. 30
Transitional	Northwestern Great Plains (43)	Non-calcareous Foothill Grassland (43s), Shields-Smith Valleys (43t), Limy Foothill Grassland (43u), Pryor-Bighorn Foothills (43v), and Unglaciated Montana High Plains (43o) ^a	20 - 41 ^e	199 - 1125 ^f	July 1	Sept. 30
Eastern	Northwestern Glaciated Plains (42)	all except those listed above for 42	70 - 150	540 - 1830	June 16	Sept. 30
Eastern	Northwestern Great Plains (43) and Wyoming Basin (18)	all except for those listed above for 43, and 43c below			July 1	Sept. 30
Eastern	Northwestern Great Plains (43)	River Breaks (43c)	None recommended	None recommended	None recommended	None recommended

^aFor the Unglaciated High Plains ecoregion (43o), range applies to the polygon located just south of Great Falls, MT.

^bBased on the 10th and 90th percentiles of the natural background concentrations for this level IV ecoregion.

^cLower end based on streams' origins in the Canadian Rockies; upper end on 90th percentile of natural background for these ecoregions.

^dLower end based on macroinvertebrate response; upper end on region-specific Chla computation (see page 3-24 of document in endnote 3).

^eLower end based on similarity to Middle Rockies, upper end on Elk Creek reference site.

^fLower end based on macroinvertebrate response; upper end on region-specific Chla computation (see page 3-37 of document in endnote 3).

4. Reach-specific TN and/or TP criteria. Site specific criteria have been developed for several wadeable streams and some large river segments. See site specific derivations in Suplee and Watson (2013) and criteria recommendations for the lower Yellowstone River in Suplee et al. (2015). **Have criteria already been developed for the Receiving Waterbody?** _____

a. **If yes, what are the values?** _____

5. Summarize Findings. Please summarize the basic findings about the waterbody here.

6. Hold Nutrient Permit Limits Panel Meeting. Meeting comprises permit writer and staff with expertise on the waterbody/watershed in question from WPB and WQPB. The committee should:

a. Examine waterbody's longitudinal physical, chemical, and biological patterns (as data are available)

- b. Give consideration to the possibility of inducing more P limitation (where a POTW point source is involved) and allowing, at least in the near term, discharge at current N concentrations (or more stringent but achievable N concentrations).
- c. Recommend best nutrient permit limits to move forward with for the permit or other actions. The limits may be revisited at the next 5-year permit cycle as more data are collected under the Special Conditions in the permit.

7. Implement identified limits in the permit.

References

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XII. APPENDIX B

MT0026808 SMC EBM NARRATIVE TN CHECKLIST

Alanna Shaw

```
knitr::opts_chunk$set(echo = TRUE, warning = FALSE)
```

```
pacman::p_load(rmarkdown, tidyverse, ggplot2, ggpubr, ggtext, rstatix, datarium, performance, see, boot)
```

APPLICABLE WATER QUALITY CRITERIA:

ARM 17.30.637:

1. State surface waters must be free from substances attributable to municipal, industrial, agricultural practices or other discharges that will:
 - a. settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines;
 - b. create floating debris, scum, a visible oil film (or be present in concentrations at or in excess of 10 milligrams per liter), or globules of grease or other floating materials;
 - c. produce odors, colors, or other conditions as to which create a nuisance or render undesirable tastes to fish flesh or make fish inedible;
 - d. create concentrations or combinations of materials which are toxic or harmful to human, animal, plant, or aquatic life; and
 - e. **create conditions which produce undesirable aquatic life.**

SMC-EBM is classified as a new source (2023 Fact Sheet), therefore the above criterion is modified by the below nonsignificance criteria:

17.30.715(1)(h):

changes in the quality of water for any parameter for which there are only narrative water quality standards if the changes will not have a measurable effect on any existing or anticipated use or cause measurable changes in aquatic life or ecological integrity.

Narrative Nutrient Standards: Checklist of Considerations for Developing Permit Limits

This checklist and guide provides a series of factors for MPDES Permit Writers (and others) to consider when developing total nitrogen (TN) and total phosphorus (TP) permit limits under the narrative nutrient standard at ARM 17.30.637(1)(e). This approach considers best-available scientific knowledge on Montana rivers and streams at the regional scale, as well as site-specific conditions and scientific information for the waterbody in question. Receiving waterbody characteristics influence the way TN and TP affect primary productivity and biomass, dissolved oxygen and pH patterns, and aquatic life metrics. The process outlined here is intended to account for these effects at the site-specific level.

1. CONSULTATION:

Who is the DEQ staff person with expertise on the receiving waterbody?

Michael Suplee, Ph.D. (SMS WQP/B)

2. SITE-SPECIFIC CHARACTERISTICS OF THE RECEIVING WATERBODY

a. Is the waterbody a ditch, a wadeable stream, a medium river, or a large river?

wadeable stream

b. Is the waterbody currently on the 303(d) list for nutrients, benthic chlorophyll a or ash free dry weight, dissolved oxygen, or pH?

MT43B004_143- East Boulder River Headwaters to National Forest Boundary) is the immediate surface water receiving water and is not on the 303(d) list for nutrients, benthic chlorophyll a or ash free dry weight, dissolved oxygen, or pH.

Downstream segments of the EBR are on the 303(d) list for nutrient-related parameters:

- MT43B004_142 (National Forest boundary to Elk Creek) is listed as impaired for chlorophyll-a
- MT43B004_141 (Elk Creek to mouth (Boulder River)) listed as impaired for chlorophyll-a
- MT43B004_132 Boulder River, downstream of where the East Boulder River flows into the Boulder River is listed as impaired for total nitrogen.

c. What is the growing season hydrologic condition of the receiving waterbody?

perennial

d. Is the receiving waterbody a Spring Creek (see Decker-Hess, 1989)?

No

e. Is there a lake downstream of the discharge that is near enough that the facility's discharge is likely to have effects?

No

f. What is the critical condition flow of the receiving water?

7Q10: 3.23 mgd (5.0 cfs) (2023 Fact Sheet)

14Q5: 6.79 mgd (10.5 cfs) (2023 Fact Sheet)

g. Is the receiving waterbody, for several miles upstream of the facility and then downstream of the discharge (or mixing zone, where applicable), heavily shaded by riparian canopy or is it largely open to sunlight?

upstream: largely open to sunlight (1992 FEIS; field photographs)

downstream: largely open to sunlight (1992 FEIS; field photographs)

h. What is the dominant substrate (D_{50}) of the receiving waterbody upstream of the facility and downstream of the discharge (or mixing zone, where applicable)?

upstream: gravel/cobble (1992 FEIS; field photographs)

downstream: gravel/cobble (1992 FEIS; field photographs)

i. Has continuous dissolved oxygen (DO) been monitored within several miles upstream of the facility and downstream of the discharge (or mixing zone, where applicable)?

upstream: no

downstream: no

Have there been exceedances of DEQ-7 DO standards?

upstream: unknown

downstream: unknown

Which ones and where?

upstream: unknown

downstream: unknown

What is the average DO delta during summer?

upstream: unknown

downstream: unknown

j. Has attached benthic algae been quantified (as chlorophyll *a*, ash free dry weight, or visually assessed) in the Receiving Waterbody upstream of the facility and downstream of the discharge mixing zone?

Yes, as chlorophyll-*a* and AFDW (AFDM).

What are the reach average values?

indicated below chlorophyll-*a* and AFDW headers

How do they compare to the undesirable recreational thresholds in Suplee et al. (2009) and/or other DEQ resources?

chlorophyll *a*:

- undesirable rec threshold: 150 mg chl-*a* m^{-2} (indicated in figures by red horizontal line)
 - ~5 exceedances of the undesirable rec threshold (both up and downstream of discharge)
- measurable change: 20 mg chl-*a* m^{-2} (indicated in figures by blue horizontal line)
 - no identified measurable changes between EBR-002 and EBR-004(a) or EBR-005
- reach average values:
 - upstream:

- EBR-002: 39.0 ± 108 mg chl-a m^{-2} (1999-2024)
- downstream:
 - EBR-004: 22.5 ± 28.5 mg chl-a m^{-2} (1999-2015)
 - EBR-004a: 37.6 ± 140 mg chl-a m^{-2} (2013-2024)

```
chl.a <- read_csv("Tab 12 Chlor 4I.csv")
```

```
## Rows: 643 Columns: 3
## — Column specification —————
## Delimiter: ","
## chr (1): Station
## dbl (2): MeanChl_mgm2, Year
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

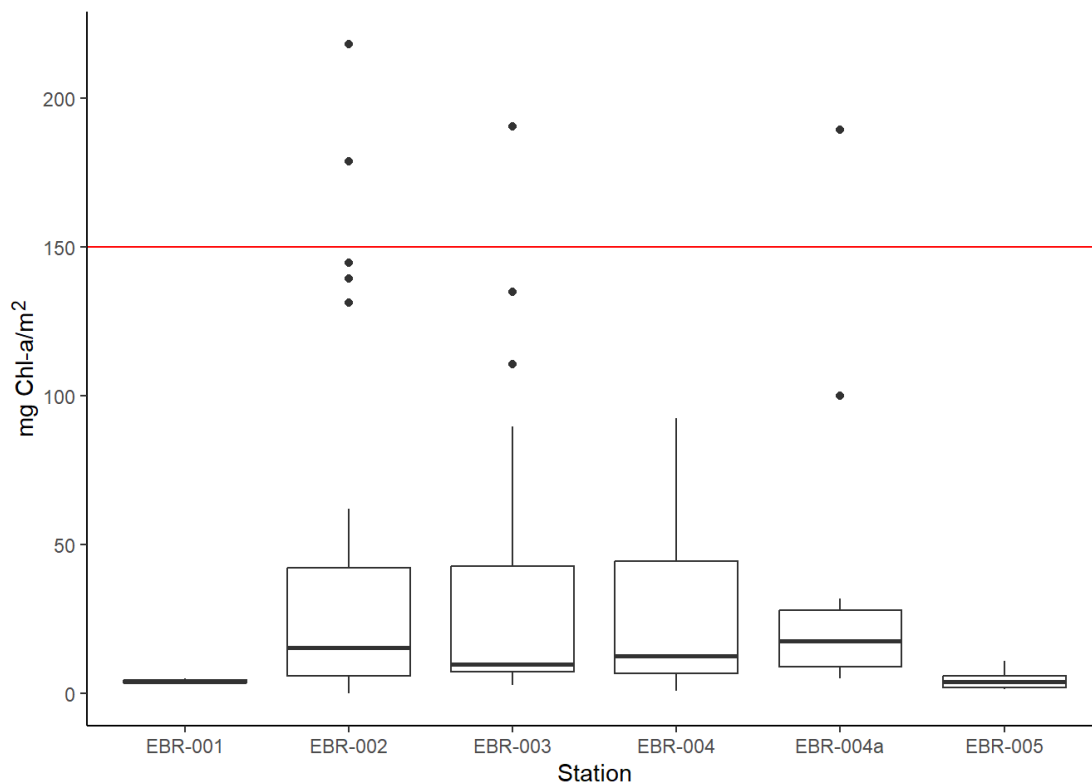
```
chl.a_sum <- chl.a %>%
  group_by(Station, Year) %>%
  summarize(ann_mean_chl = mean(MeanChl_mgm2, na.rm = TRUE)) #median selected as MOCT due to skewedness
```

```
## `summarise()` has grouped output by 'Station'. You can override using the
## `.groups` argument.
```

```
chl.a_sitesum <- chl.a %>%
  group_by(Station) %>%
  summarize(ann_mean_chl = mean(MeanChl_mgm2, na.rm = TRUE),
            ann_sd_chl = sd(MeanChl_mgm2, na.rm = TRUE)) #median selected as MOCT due to skewedness

chl.a_sum.plot <- ggplot(chl.a_sum) +
  aes(x = Station, y = ann_mean_chl) +
  geom_boxplot() +
  labs(x = "Station", y = "mg Chl-a/m<sup>2</sup>") +
  geom_hline(yintercept = 150, color = "red") + #red line indicates harm to recreational use threshold of 1
50 mg Chl-a m-2
  theme_classic() +
  theme(axis.title.y = element_markdown())
```

```
chl.a_sum.plot
```



```
knitr::kable(chl.a_sitesum, digits = 3, col.names = c("Station", "Mean chl-a (mg/l)", "SD chl-a (mg/l)"))
```

Station	Mean chl-a (mg/l)	SD chl-a (mg/l)
EBR-001	4.144	4.650
EBR-002	38.978	108.276
EBR-003	34.422	111.636
EBR-004	22.548	28.533
EBR-004a	37.644	140.159
EBR-005	4.894	8.163

```
chl.a_001 <- chl.a %>%
  filter(Station == "EBR-001") %>%
  group_by(Year) %>%
  summarize(ann_mean_chl.001 =
    mean(MeanChl_mgm2, na.rm = TRUE))

chl.a_002 <- chl.a %>%
  filter(Station == "EBR-002") %>%
  group_by(Year) %>%
  summarize(ann_mean_chl.002 =
    mean(MeanChl_mgm2, na.rm = TRUE))

chl.a_004 <- chl.a %>%
  filter(Station == "EBR-004" | Station == "EBR-004a") %>%
  group_by(Year) %>%
  summarize(ann_mean_chl.004 =
    mean(MeanChl_mgm2, na.rm = TRUE))

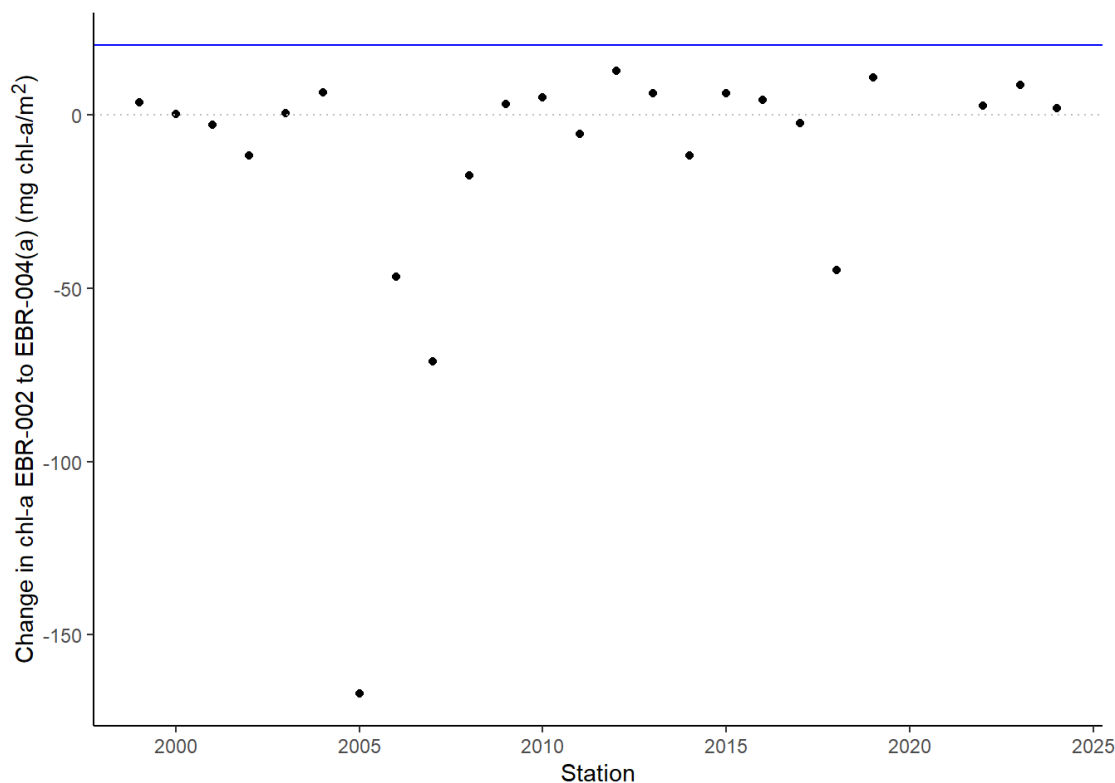
chl.a_005 <- chl.a %>%
  filter(Station == "EBR-005") %>%
  group_by(Year) %>%
  summarize(ann_mean_chl.005 =
    mean(MeanChl_mgm2, na.rm = TRUE))
```

```
chl.a_delta <- chl.a_004 %>%
  full_join(chl.a_002, by = join_by(Year), keep = FALSE) %>%
  full_join(chl.a_001, by = join_by(Year), keep = FALSE) %>%
  full_join(chl.a_005, by = join_by(Year), keep = FALSE) %>%
  mutate(ann_mean_chl.4_1_delta = ann_mean_chl.004 - ann_mean_chl.001) %>%
  mutate(ann_mean_chl.4_2_delta = ann_mean_chl.004 - ann_mean_chl.002) %>%
  mutate(ann_mean_chl.5_1_delta = ann_mean_chl.005 - ann_mean_chl.001) %>%
  mutate(ann_mean_chl.5_2_delta = ann_mean_chl.005 - ann_mean_chl.002)
```

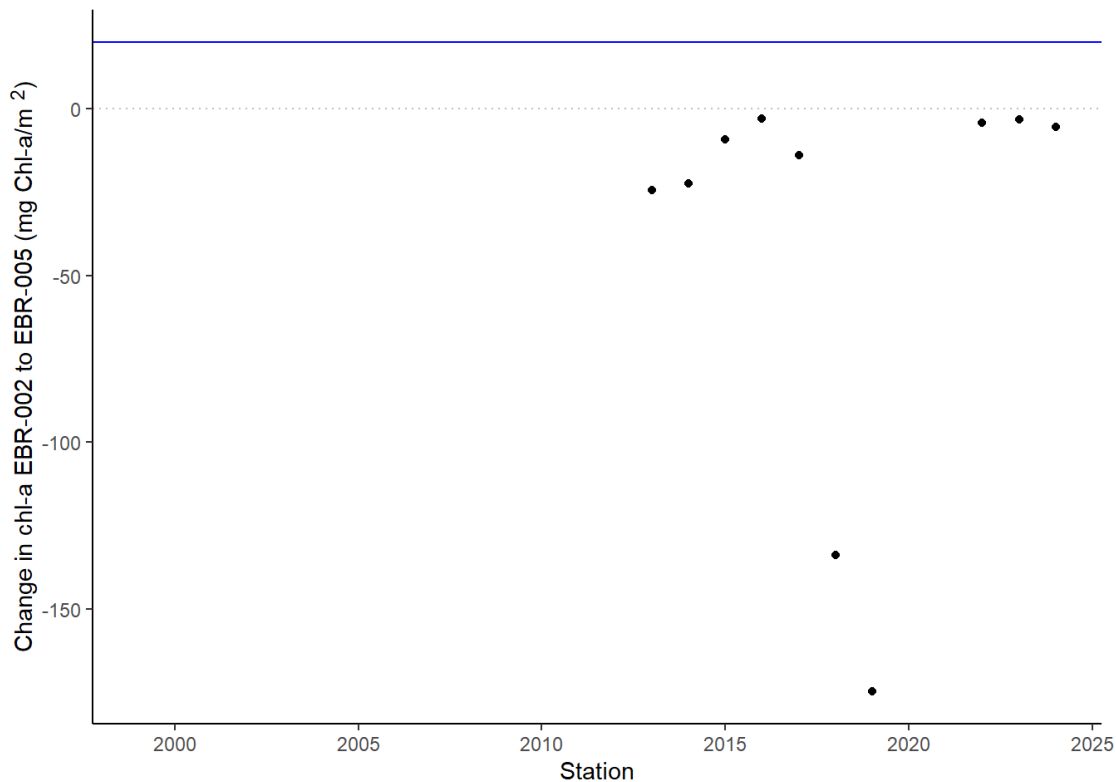
```
chl.a.4.2.plot <- ggplot(chl.a_delta) +
  aes(x = Year, y = ann_mean_chl.4_2_delta) +
  geom_point() +
  labs(x = "Station", y = expression("Change in chl-a EBR-002 to EBR-004(a) (mg chl-a/m<sup>2</sup>)")) +
  geom_hline(yintercept = 0, linetype = "dotted", color = "grey") +
  geom_hline(yintercept = 20, linetype = "solid", color = "blue") +
  theme_classic() +
  theme(axis.title.y = element_markdown())

chl.a.5.2.plot <- ggplot(chl.a_delta) +
  aes(x = Year, y = ann_mean_chl.5_2_delta) +
  geom_point() +
  labs(x = "Station", y = "Change in chl-a EBR-002 to EBR-005 (mg Chl-a/m <sup>2</sup>)") +
  geom_hline(yintercept = 0, linetype = "dotted", color = "grey") +
  geom_hline(yintercept = 20, linetype = "solid", color = "blue") +
  theme_classic() +
  theme(axis.title.y = element_markdown())
```

chl.a.4.2.plot



chl.a.5.2.plot



AFDW:

- undesirable rec threshold: 35 g/m² (indicated in figures by red horizontal line)
- measurable change: 20 g/m²
- reach average values:
 - upstream:
 - EBR-001: 1.61 ± 1.34 (2015-2024)
 - EBR-002: 4.79 ± 5.24 mg chl-a m⁻² (2015-2024)
 - downstream:
 - EBR-004: 22.5 ± 28.5 mg chl-a m⁻² (1999-2015)
 - EBR-004a: 37.6 ± 140 mg chl-a m⁻² (2013-2024)

```
AFDM <- read_csv("Tab 13 AFDW 4I.csv") %>%
  convert_as_factor(Station, Year)
```

```
## Rows: 54 Columns: 3
## — Column specification —————
## Delimiter: ","
## chr (1): Station
## dbl (2): AFDM_gm2, Year
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
AFDM_sitesum <- AFDM %>%
  group_by(Station) %>%
  summarize(ann_mean_AFDW = mean(AFDW_gm2, na.rm = TRUE),
            ann_sd_AFDW = sd(AFDW_gm2, na.rm = TRUE))

AFDM_year <- AFDM %>%
  group_by(Station, Year) %>%
  summarize(ann_mean_AFDW = mean(AFDW_gm2, na.rm = TRUE),
            ann_sd_AFDW = sd(AFDW_gm2, na.rm = TRUE))
```



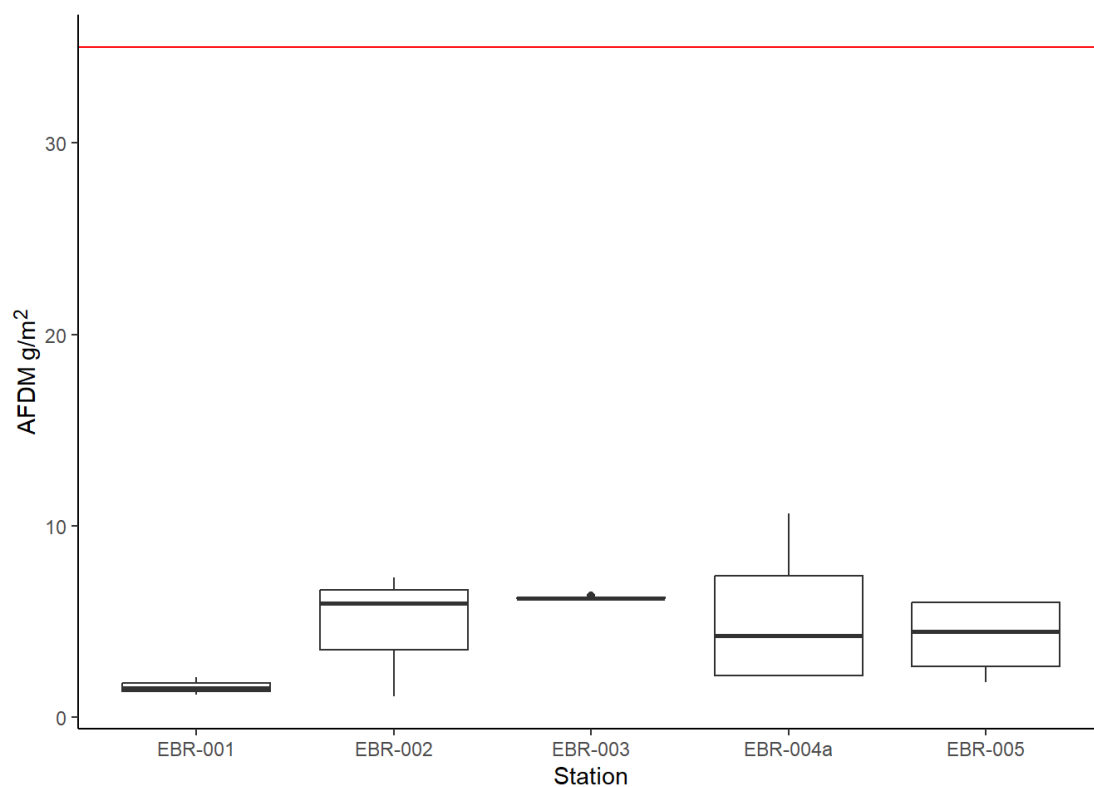
```
## `summarise()` has grouped output by 'Station'. You can override using the
## `.groups` argument.
```

```
knitr::kable(AFDM_sitesum, digits = 3, col.names = c("Station", "Mean AFDM (g/m2)", "SD AFDM (g/m2)"))
```

Station	Mean AFDM (g/m ²)	SD AFDM (g/m ²)
EBR-001	1.606	1.337
EBR-002	4.792	5.239
EBR-003	6.251	2.020
EBR-004a	5.339	7.613
EBR-005	4.198	2.821

```
AFDM.all <- ggplot(AFDM_year) +
  aes(x = Station, y = ann_mean_AFDM, group = Station) +
  geom_boxplot() +
  labs(x = "Station", y = "AFDM g/m<sup>2</sup>") +
  geom_hline(yintercept = 35, color = "red") + #red line indicates harm to recreational use threshold of 35
  mg m-2 AFDM
  theme_classic() +
  theme(axis.title.y = element_markdown())
```

AFDM.all



```

AFDM_001 <- AFDM %>%
  filter(Station == "EBR-001") %>%
  group_by(Year) %>%
  summarize(ann_mean_AFDM.001 =
    mean(AFDM_gm2, na.rm = TRUE))

AFDM_002 <- AFDM %>%
  filter(Station == "EBR-002") %>%
  group_by(Year) %>%
  summarize(ann_mean_AFDM.002 =
    mean(AFDM_gm2, na.rm = TRUE))

AFDM_003 <- AFDM %>%
  filter(Station == "EBR-003") %>%
  group_by(Year) %>%
  summarize(ann_mean_AFDM.003 =
    mean(AFDM_gm2, na.rm = TRUE))

AFDM_004a <- AFDM %>%
  filter(Station == "EBR-004a") %>%
  group_by(Year) %>%
  summarize(ann_mean_AFDM.004a =
    mean(AFDM_gm2, na.rm = TRUE))

AFDM_005 <- AFDM %>%
  filter(Station == "EBR-005") %>%
  group_by(Year) %>%
  summarize(ann_mean_AFDM.005 =
    mean(AFDM_gm2, na.rm = TRUE))

```

```

AFDM_delta <- AFDM_005 %>%
  full_join(AFDM_002, by = join_by(Year), keep = FALSE) %>%
  full_join(AFDM_001, by = join_by(Year), keep = FALSE) %>%
  full_join(AFDM_004a, by = join_by(Year), keep = FALSE) %>%
  full_join(AFDM_003, by = join_by(Year), keep = FALSE) %>%
  mutate(ann_mean_AFDM.4a_2_delta = ann_mean_AFDM.004a - ann_mean_AFDM.002) %>%
  mutate(ann_mean_AFDM.4a_1_delta = ann_mean_AFDM.004a - ann_mean_AFDM.001) %>%
  mutate(ann_mean_AFDM.5_2_delta = ann_mean_AFDM.005 - ann_mean_AFDM.002) %>%
  mutate(ann_mean_AFDM.5_1_delta = ann_mean_AFDM.005 - ann_mean_AFDM.001)

```

visual: NA

J. Are vascular aquatic plants (macrophytes) common in the receiving waterbody?

upstream: NO (% cover)

downstream: NO (% cover)

K. Have benthic macroinvertebrates been sampled within several miles upstream/downstream of the discharge?

Beck's Biotic Index 3: NA

Hilsenhoff Biotic Index:

- harm to use threshold: 3.52

- several instances of exceedances of this threshold (up and downstream of discharge), most exceedances at EBR-002 (upstream)
- measurable change threshold: 1

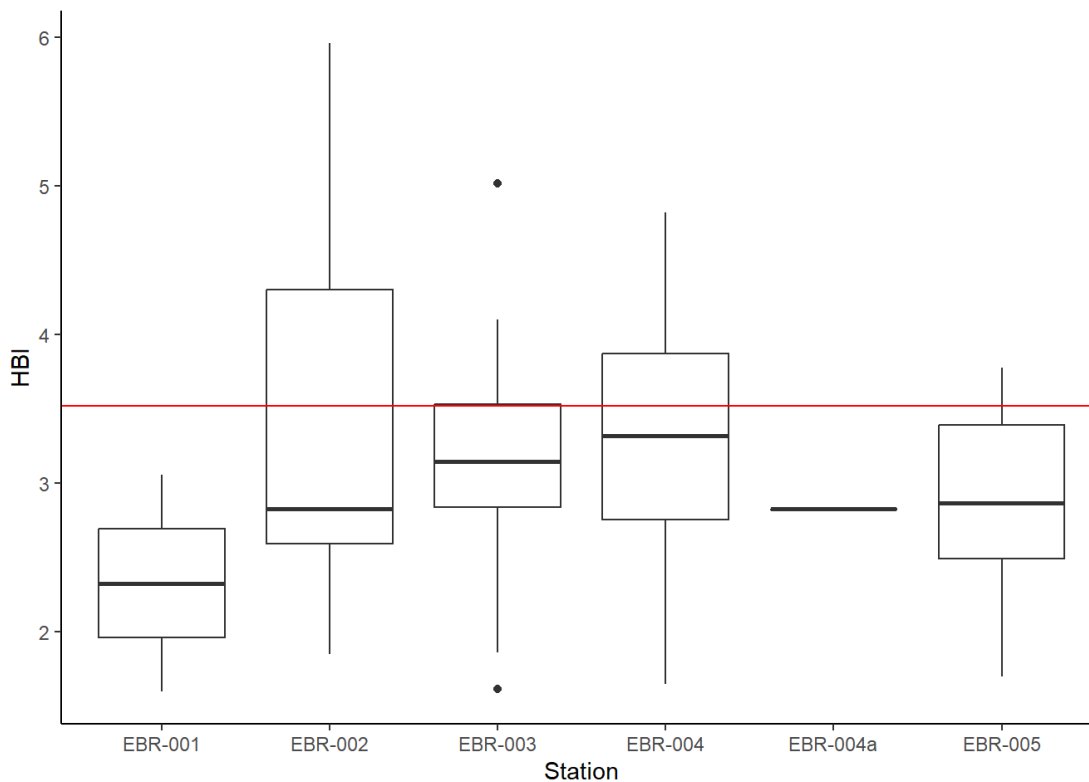
```
HBI <- read.csv("Tab 6 MDEQ HBI 4K.csv")
```

```
HBI_year <- HBI %>%
  group_by(Station, Year) %>%
  summarize(ann_med_HBI = median(MDEQ_HBI, na.rm = TRUE),
            ann_sd_HBI = sd(MDEQ_HBI, na.rm = TRUE))
```

```
## `summarise()` has grouped output by 'Station'. You can override using the
## `.groups` argument.
```

```
HBI.all <- ggplot(HBI_year) +
  aes(x = Station, y = ann_med_HBI, group = Station) +
  geom_boxplot() +
  labs(x = "Station", y = "HBI") +
  geom_hline(yintercept = 3.52, color = "red") + #harm to use threshold
  theme_classic()
```

```
HBI.all
```



```

HBI_001 <- HBI %>%
  filter(Station == "EBR-001") %>%
  group_by(Year) %>%
  summarize(ann_med_HBI.001 = median(MDEQ_HBI, na.rm = TRUE),
            ann_IQR_HBI.001 = IQR(MDEQ_HBI, na.rm = TRUE))

HBI_002 <- HBI %>%
  filter(Station == "EBR-002") %>%
  group_by(Year) %>%
  summarize(ann_med_HBI.002 = median(MDEQ_HBI, na.rm = TRUE),
            ann_IQR_HBI.002 = IQR(MDEQ_HBI, na.rm = TRUE))

HBI_003 <- HBI %>%
  filter(Station == "EBR-003") %>%
  group_by(Year) %>%
  summarize(ann_med_HBI.003 = median(MDEQ_HBI, na.rm = TRUE),
            ann_IQR_HBI.003 = IQR(MDEQ_HBI, na.rm = TRUE))

HBI_004 <- HBI %>%
  filter(Station == "EBR-004" | Station == "EBR-004a") %>%
  group_by(Year) %>%
  summarize(ann_med_HBI.004 = median(MDEQ_HBI, na.rm = TRUE),
            ann_IQR_HBI.004 = IQR(MDEQ_HBI, na.rm = TRUE))

HBI_005 <- HBI %>%
  filter(Station == "EBR-005") %>%
  group_by(Year) %>%
  summarize(ann_med_HBI.005 = median(MDEQ_HBI, na.rm = TRUE),
            ann_IQR_HBI.005 = IQR(MDEQ_HBI, na.rm = TRUE))

```

```

HBI_delta <- HBI_005 %>%
  full_join(HBI_002, by = join_by(Year), keep = FALSE) %>%
  full_join(HBI_001, by = join_by(Year), keep = FALSE) %>%
  full_join(HBI_004, by = join_by(Year), keep = FALSE) %>%
  full_join(HBI_003, by = join_by(Year), keep = FALSE) %>%
  mutate(ann_med_HBI.4_1_delta = ann_med_HBI.004 - ann_med_HBI.001) %>%
  mutate(ann_med_HBI.4_1_measurabledelta = if_else(ann_med_HBI.4_1_delta >= 1, "Yes", "No")) %>%
  mutate(ann_med_HBI.4_2_delta = ann_med_HBI.004 - ann_med_HBI.002) %>%
  mutate(ann_med_HBI.4_2_measurabledelta = if_else(ann_med_HBI.4_2_delta >= 1, "Yes", "No")) %>%
  mutate(ann_med_HBI.5_2_delta = ann_med_HBI.005 - ann_med_HBI.002) %>%
  mutate(ann_med_HBI.5_2_measurabledelta = if_else(ann_med_HBI.5_2_delta >= 1, "Yes", "No")) %>%
  mutate(ann_med_HBI.5_1_delta = ann_med_HBI.005 - ann_med_HBI.001) %>%
  mutate(ann_med_HBI.5_1_measurabledelta = if_else(ann_med_HBI.5_1_delta >= 1, "Yes", "No"))

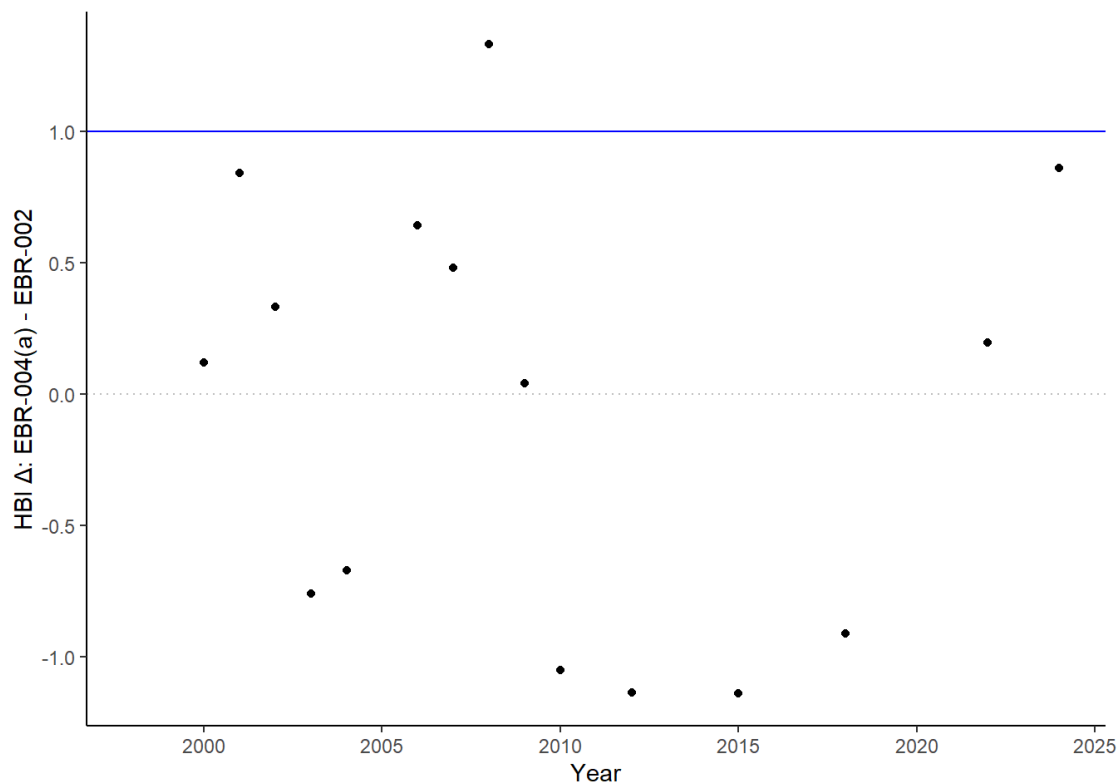
```

```

HBI.4.2.plot <- ggplot(HBI_delta) +
  aes(x = Year, y = ann_med_HBI.4_2_delta) +
  geom_point() +
  labs(x = "Year", y = "HBI Δ: EBR-004(a) - EBR-002") +
  geom_hline(yintercept = 1, color = "blue") +
  geom_hline(yintercept = 0, linetype = "dotted", color = "grey") +
  theme_classic()

```

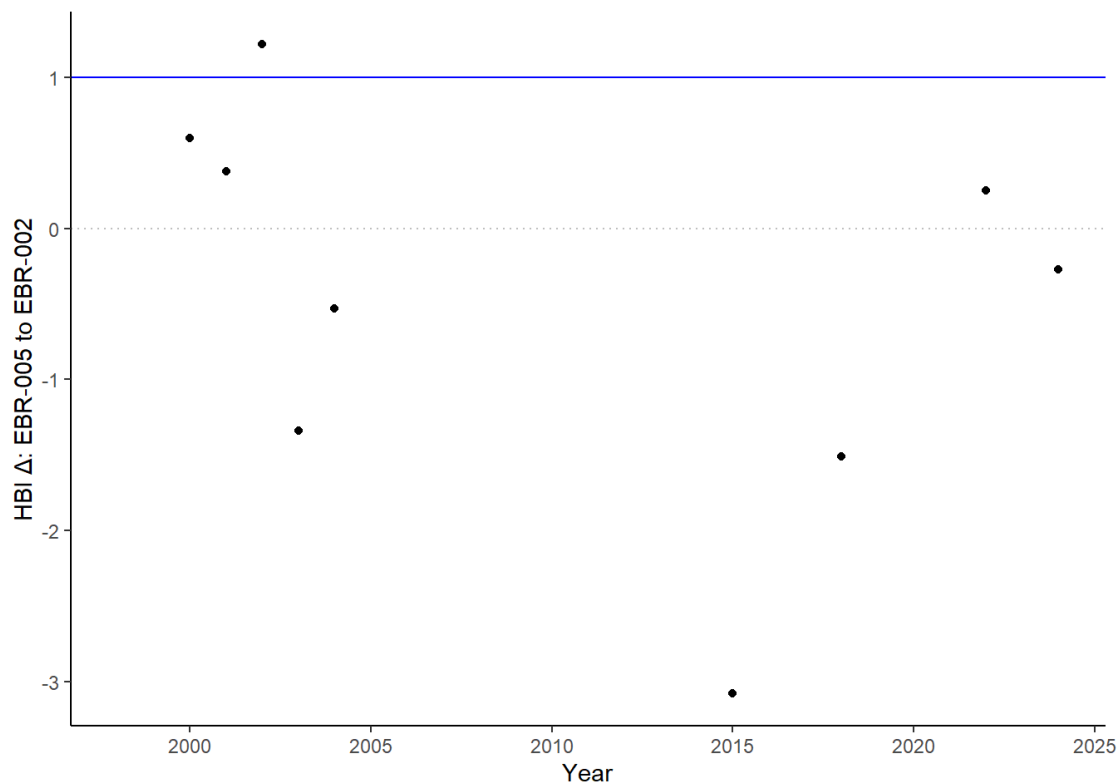
```
HBI.4.2.plot
```



Observed measurable change between EBR-004(a) and EBR-002 in 2008.

```
HBI.5.2.plot <- ggplot(HBI_delta) +
  aes(x = Year, y = ann_med_HBI.5_2_delta) +
  geom_point() +
  labs(x = "Year", y = "HBI Δ: EBR-005 to EBR-002") +
  geom_hline(yintercept = 1, color = "blue") +
  geom_hline(yintercept = 0, linetype = "dotted", color = "grey") +
  theme_classic()
```

HBI.5.2.plot



Observed measurable change between EBR-005 and EBR-002 in 2002.

Observed/Expected

- harm to use threshold : ≤ 0.9
- measurable change: 0.159

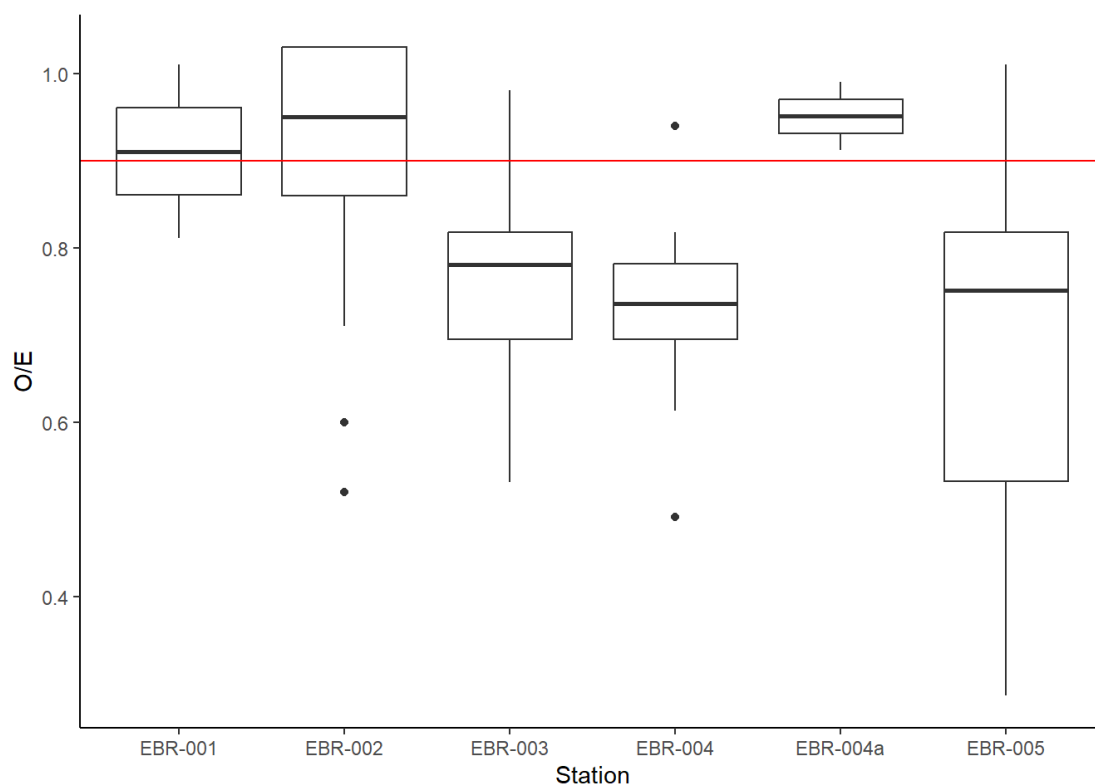
```
OE <- read.csv("Tab 5 OE 4K.csv")
```

```
OE_year <- OE %>%
  group_by(Station, Year) %>%
  summarize(ann_med_OE = median(OE2, na.rm = TRUE),
            ann_IQR_OE = IQR(OE2, na.rm = TRUE))
```

```
## `summarise()` has grouped output by 'Station'. You can override using the
## `.groups` argument.
```

```
OE.all <- ggplot(OE_year) +
  aes(x = Station, y = ann_med_OE, group = Station) +
  geom_boxplot() +
  labs(x = "Station", y = "O/E") +
  geom_hline(yintercept = .9, color = "red") + #harm to use threshold
  theme_classic()
```

```
OE.all
```



O/E scores indicates some level of impairment of aquatic community beneficial uses, with EBR-003, EBR-004 and EBR-005 being worse than EBR-001 and EBR-002. The period of record is limited for EBR-004a.

```
OE_001 <- OE %>%
  filter(Station == "EBR-001") %>%
  group_by(Year) %>%
  summarize(ann_med_OE.001 = median(OE2, na.rm = TRUE),
            ann_IQR_OE.001 = IQR(OE2, na.rm = TRUE))

OE_002 <- OE %>%
  filter(Station == "EBR-002") %>%
  group_by(Year) %>%
  summarize(ann_med_OE.002 = median(OE2, na.rm = TRUE),
            ann_IQR_OE.002 = IQR(OE2, na.rm = TRUE))

OE_003 <- OE %>%
  filter(Station == "EBR-003") %>%
  group_by(Year) %>%
  summarize(ann_med_OE.003 = median(OE2, na.rm = TRUE),
            ann_IQR_OE.003 = IQR(OE2, na.rm = TRUE))

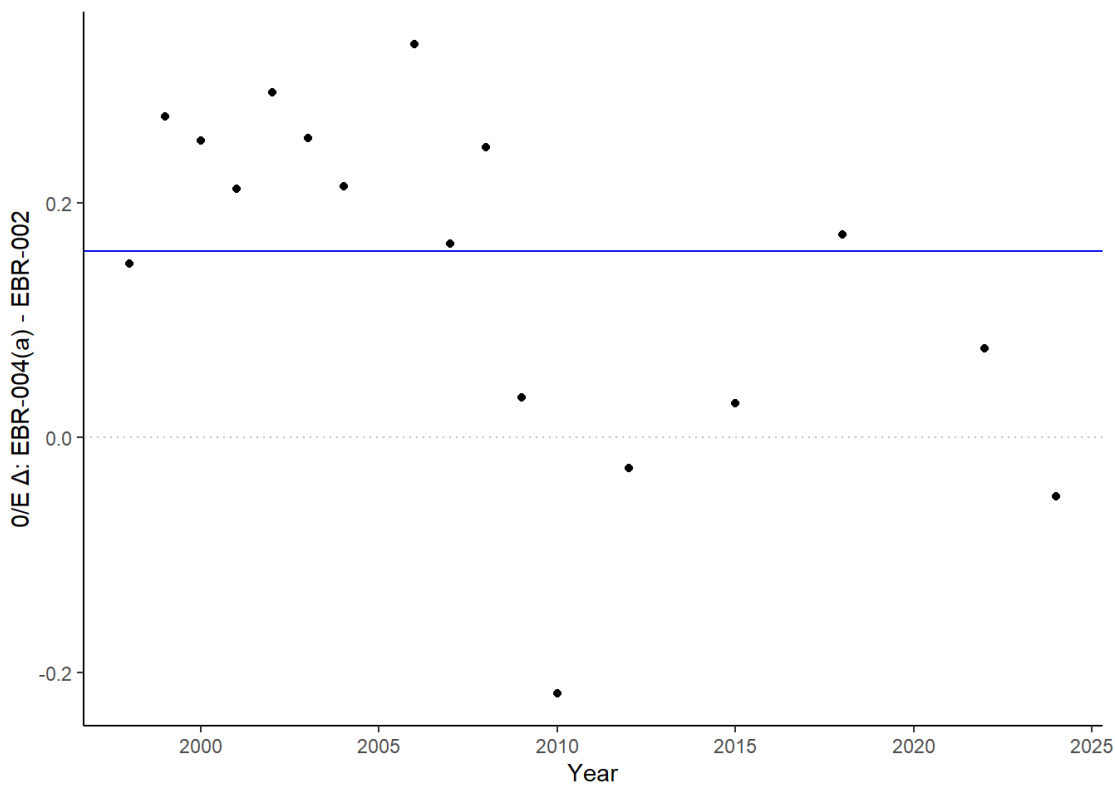
OE_004 <- OE %>%
  filter(Station == "EBR-004" | Station == "EBR-004a") %>%
  group_by(Year) %>%
  summarize(ann_med_OE.004 = median(OE2, na.rm = TRUE),
            ann_IQR_OE.004 = IQR(OE2, na.rm = TRUE))

OE_005 <- OE %>%
  filter(Station == "EBR-005") %>%
  group_by(Year) %>%
  summarize(ann_med_OE.005 = median(OE2, na.rm = TRUE),
            ann_IQR_OE.005 = IQR(OE2, na.rm = TRUE))
```

```
OE_UP_DWN_delta <- OE_004 %>%
  full_join(OE_002, by = join_by(Year), keep = FALSE) %>%
  full_join(OE_005, by = join_by(Year), keep = FALSE) %>%
  mutate(Year_X = Year) %>%
  mutate(OE.4_2_delta = ann_med_OE.002 - ann_med_OE.004) %>%
  mutate(OE.4_2_mdelta = if_else(OE.4_2_delta >= 0.159, "Yes", "No")) %>%
  mutate(OE.5_2_delta = ann_med_OE.002 - ann_med_OE.005) %>%
  mutate(OE.5_2_mdelta = if_else(OE.5_2_delta >= 0.159, "Yes", "No"))
```

```
OE.4.2.plot <- ggplot(OE_UP_DWN_delta, aes(x = Year, y = OE.4_2_delta)) +
  geom_point() +
  labs(x = "Year", y = "O/E Δ: EBR-004(a) - EBR-002") +
  geom_hline(yintercept = 0.159, color = "blue") +
  geom_hline(yintercept = 0, linetype = "dotted", color = "grey") +
  theme_classic()
```

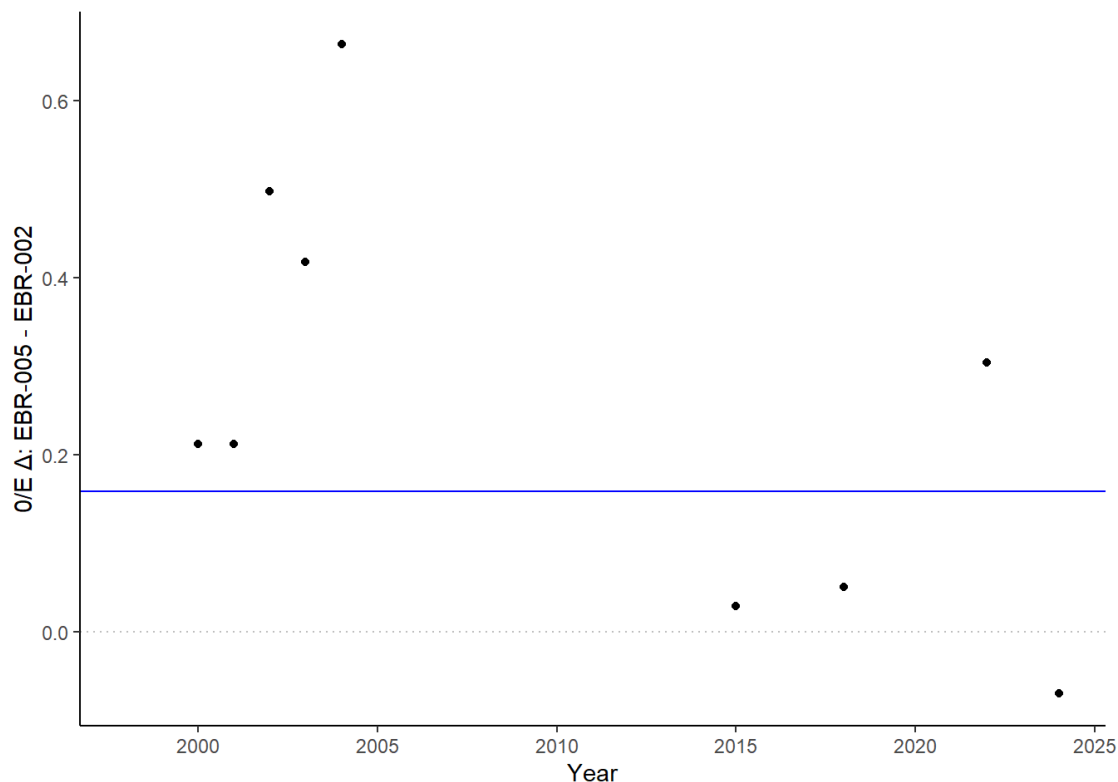
OE.4.2.plot



Measurable change in O/E between Stations EBR-004(a) and EBR-002 from 2000-2008 and again in 2018.

```
OE.5.2.plot <- ggplot(OE_UP_DWN_delta, aes(x = Year, y = OE.5_2_delta)) +
  geom_point() +
  geom_hline(yintercept = 0.159, color = "blue") +
  labs(x = "Year", y = "O/E Δ: EBR-005 - EBR-002") +
  geom_hline(yintercept = 0, linetype = "dotted", color = "grey") +
  theme_classic()
```

OE.5.2.plot



Measurable change in O/E between stations EBR-005 and EBR-002 between 2000-2004 and again in 2022.

MVFP: not appropriate for mountain stream

L. Have diatom metrics been computed for the receiving waterbody within several miles upstream/downstream of the discharge?

Yes, but sediment increasers (not nutrient specific).

M. Are there any other unusual, notable characteristics of the receiving waterbody that need to be documented?

See background for monitoring station information.

3. ECOREGIONAL RANGES:

The following table provides ranges of TN, TP concentrations which have been demonstrated to be protective of aquatic life and recreation beneficial uses at the ecoregional scale.

Region	Ecoregion (Level III)	Ecoregion (Level IV)	Range		Applicable Time Period	
			Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Start of Growing Season	End of Growing Season
Western	Northern Rockies (15)	all	20 - 40	139 - 750	July 1	Sept. 30
Western	Canadian Rockies (41)	all	20 - 60		July 1	Sept. 30
Western	Idaho Batholith (16)	all			July 1	Sept. 30
Western	Middle Rockies (17)	all except 17i		139 - 980	July 1	Sept. 30
Western	Middle Rockies (17)	Absaroka-Gallatin Volcanic Mountains (17i)	43 - 106 ^b	Use values from the lower end of the Middle Rockies (17) ecoregion range	July 1	Sept. 30
Transitional	Northwestern Glaciated Plains (42)	Sweetgrass Upland (42l), Milk River Pothole Upland (42n), Rocky Mountain Front Foothill Potholes (42q), and Foothill Grassland (42r)	20 - 206 ^c	199 - 775 ^d	July 1	Sept. 30
Transitional	Northwestern Great Plains (43)	Non-calcareous Foothill Grassland (43s), Shields-Smith Valleys (43t), Limy Foothill Grassland (43u), Pryor-Bighorn Foothills (43v), and Unglaciated Montana High Plains (43o) ^a	20 - 41 ^e	199 - 1125 ^f	July 1	Sept. 30
Eastern	Northwestern Glaciated Plains (42)	all except those listed above for 42	70 - 150	540 - 1830	June 16	Sept. 30
Eastern	Northwestern Great Plains (43) and Wyoming Basin (18)	all except for those listed above for 43, and 43c below			July 1	Sept. 30
Eastern	Northwestern Great Plains (43)	River Breaks (43c)	None recommended	None recommended	None recommended	None recommended

^aFor the Unglaciated High Plains ecoregion (43o), range applies to the polygon located just south of Great Falls, MT.

^bBased on the 10th and 90th percentiles of the natural background concentrations for this level IV ecoregion.

^cLower end based on streams' origins in the Canadian Rockies; upper end on 90th percentile of natural background for these ecoregions.

^dLower end based on macroinvertebrate response; upper end on region-specific Chla computation (see page 3-24 of document in endnote 3).

^eLower end based on similarity to Middle Rockies, upper end on Elk Creek reference site.

^fLower end based on macroinvertebrate response; upper end on region-specific Chla computation (see page 3-37 of document in endnote 3).

a. The site in question is in which level III (or level IV) ecoregion?

Middle Rockies (17g)

b. The ecoregional range is:

TP: 20-60 µg/L (0.02-0.06 mg/L)

TN: 139-980 µg/L (0.139-0.980 mg/L)

c. The growing season is:

July 1-Sept 30

In River Nutrient Dataset (2015-2018):

```
TNTP_EBR <- read.csv("EBR_inriver_nutrients.csv")
```

```
TNTP_EBR <- TNTP_EBR %>%
  filter(Station != "EBR-004")
```

```

TP_EBR_gs <- TNTP_EBR %>%
  mutate(parsed_date = mdy(Sample_Date)) %>%
  mutate(Sample_Month = month(parsed_date)) %>%
  mutate(Year = year(parsed_date)) %>%
  filter(Sample_Month == 7 | Sample_Month == 8 | Sample_Month == 9) #subset for growing season months:
  July, August, & September

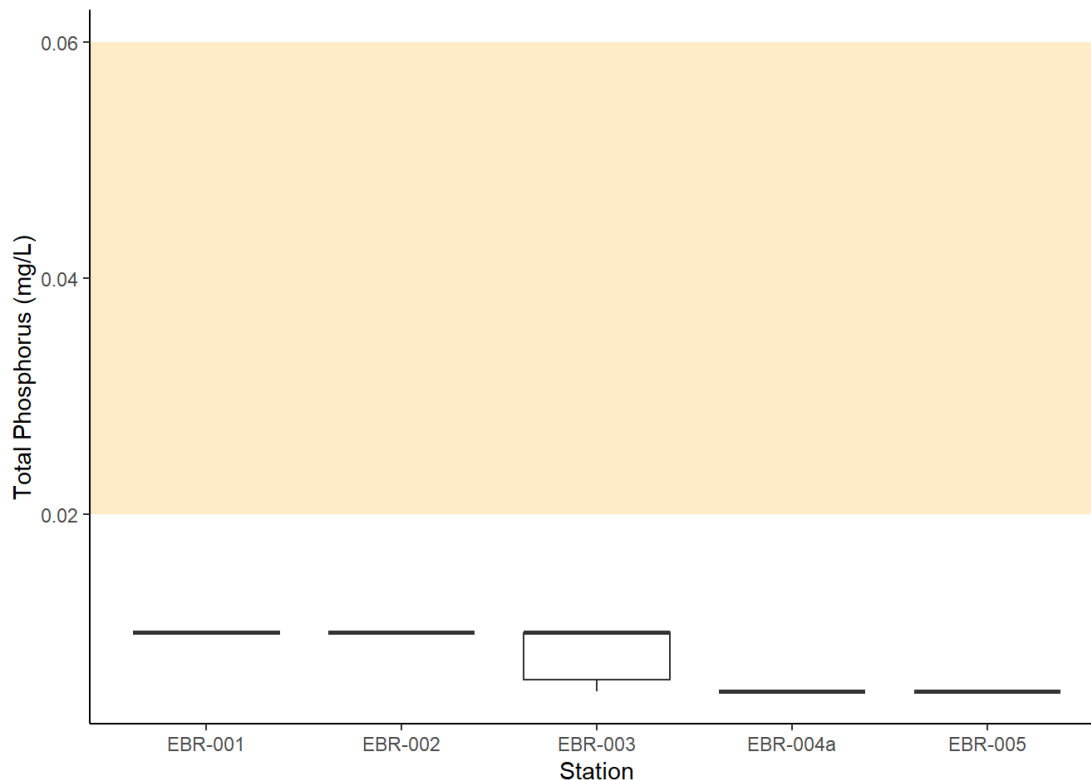
TP_EBR_gs_sum <- TNTP_EBR %>%
  mutate(parsed_date = mdy(Sample_Date)) %>%
  mutate(Sample_Month = month(parsed_date)) %>%
  mutate(Year = year(parsed_date)) %>%
  filter(Sample_Month == 7 | Sample_Month == 8 | Sample_Month == 9) %>%
  group_by(Station) %>%
  summarize(ann_med_gs_TP = median(TP_mgl, na.rm = TRUE),
            ann_IQR_gs_TP = IQR(TP_mgl, na.rm = TRUE)) %>%
  mutate(ann_med_gs_TP.mm = ann_med_gs_TP/(1000*30.97)) %>% # conversion to molar mass #conversion to
molar mass
  mutate(ann_IQR_gs_TP.mm = ann_IQR_gs_TP/(1000*30.97)) # conversion to molar mass

TP.plot <- ggplot(TP_EBR_gs) +
  aes(x = Station, y = TP_mgl, group = Station) +
  geom_boxplot() +
  labs(x = "Station", y = "Total Phosphorus (mg/L)") +
  annotate("rect",
         xmin = -Inf, xmax = Inf,
         ymin = 0.02, ymax = 0.06,
         fill = "orange", alpha = 0.2) +
  theme_classic()

TP_EBR_gs_sum_table <- TP_EBR_gs_sum[,1:3 ]

```

TP.plot



```
knitr::kable(TP_EBR_gs_sum_table, digits = 3, col.names = c("Station", "Mean [TP] (mg/L)", "IQR [TP] (mg/L)"))
```

Station	Mean [TP] (mg/L)	IQR [TP] (mg/L)
EBR-001	0.010	0.000
EBR-002	0.010	0.000
EBR-003	0.010	0.004
EBR-004a	0.005	0.000
EBR-005	0.005	0.000

```

TN_EBR <- TNTP_EBR %>%
  mutate(parsed_date = mdy(Sample_Date)) %>%
  mutate(Month = month(parsed_date)) %>%
  mutate(Year = year(parsed_date))

TN_EBR_gs <- TNTP_EBR %>%
  mutate(parsed_date = mdy(Sample_Date)) %>%
  mutate(Sample_Month = month(parsed_date)) %>%
  mutate(Year = year(parsed_date)) %>%
  filter(Sample_Month == 7 | Sample_Month == 8 | Sample_Month == 9)

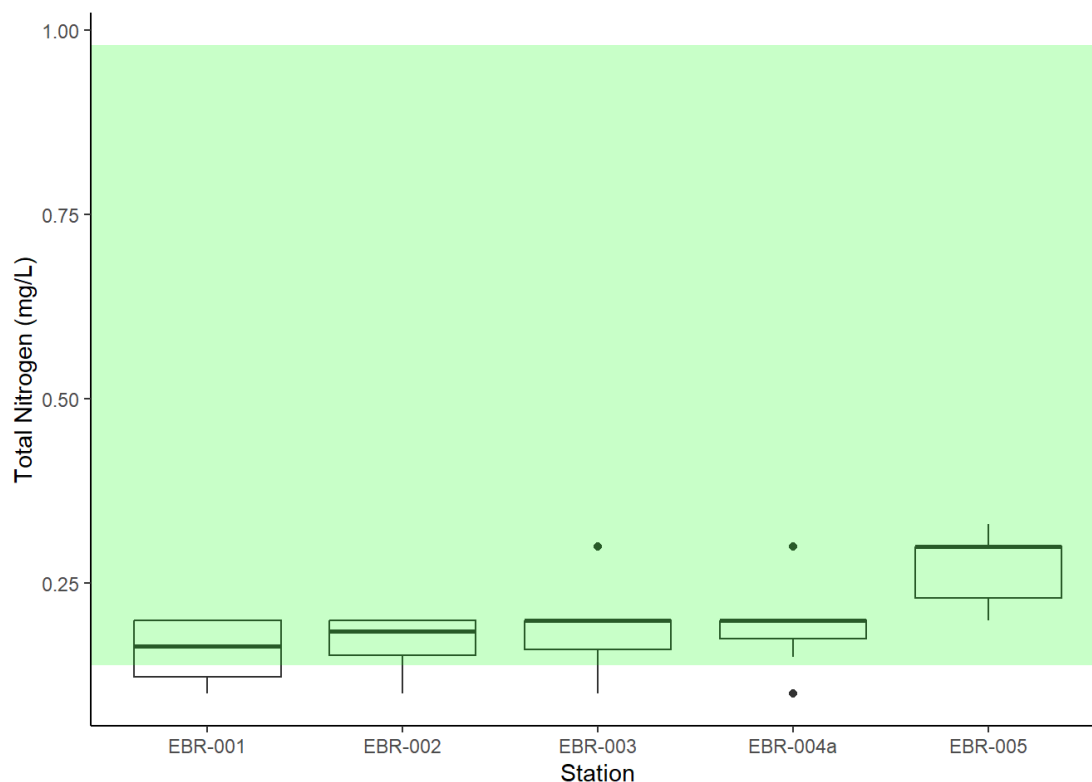
TN_EBR_gs_sum <- TNTP_EBR %>%
  mutate(parsed_date = mdy(Sample_Date)) %>%
  mutate(Sample_Month = month(parsed_date)) %>%
  mutate(Year = year(parsed_date)) %>%
  filter(Sample_Month == 7 | Sample_Month == 8 | Sample_Month == 9) %>%
  group_by(Station) %>%
  summarize(ann_med_gs_TN = median(TN_mgl, na.rm = TRUE),
            ann_IQR_gs_TN = IQR(TN_mgl, na.rm = TRUE)) %>%
  mutate(ann_med_gs_TN.mm = ann_med_gs_TN/(1000*14.01)) %>% #conversion to molar mass
  mutate(ann_IQR_gs_TN.mm = ann_IQR_gs_TN/(1000*14.01)) # conversion to molar mass

TN.plot <- ggplot(TN_EBR_gs) +
  aes(x = Station, y = TN_mgl, group = Station) +
  geom_boxplot() +
  labs(x = "Station", y = "Total Nitrogen (mg/L)") +
  annotate("rect",
          xmin = -Inf, xmax = Inf,
          ymin = 0.139, ymax = 0.980,
          fill = "green", alpha = 0.2) +
  theme_classic()

TN_EBR_gs_sum_table <- TN_EBR_gs_sum[,1:3]

```

```
TN.plot
```



```
knitr::kable(TN_EBR_gs_sum_table, digits = 3, col.names = c("Station", "Median [TN] (mg/L)", "IQR [TN] (mg/l)"))
```

Station	Median [TN] (mg/L)	IQR [TN] (mg/l)
EBR-001	0.165	0.078
EBR-002	0.185	0.048
EBR-003	0.200	0.040
EBR-004a	0.200	0.025
EBR-005	0.300	0.070

N:P during growing season

```
TN_TP_EBR_SUM <- TN_EBR_gs_sum %>%
  inner_join(TP_EBR_gs_sum, by = "Station") %>%
  mutate(NtoP = ann_med_gs_TN.mm/ann_med_gs_TP.mm)

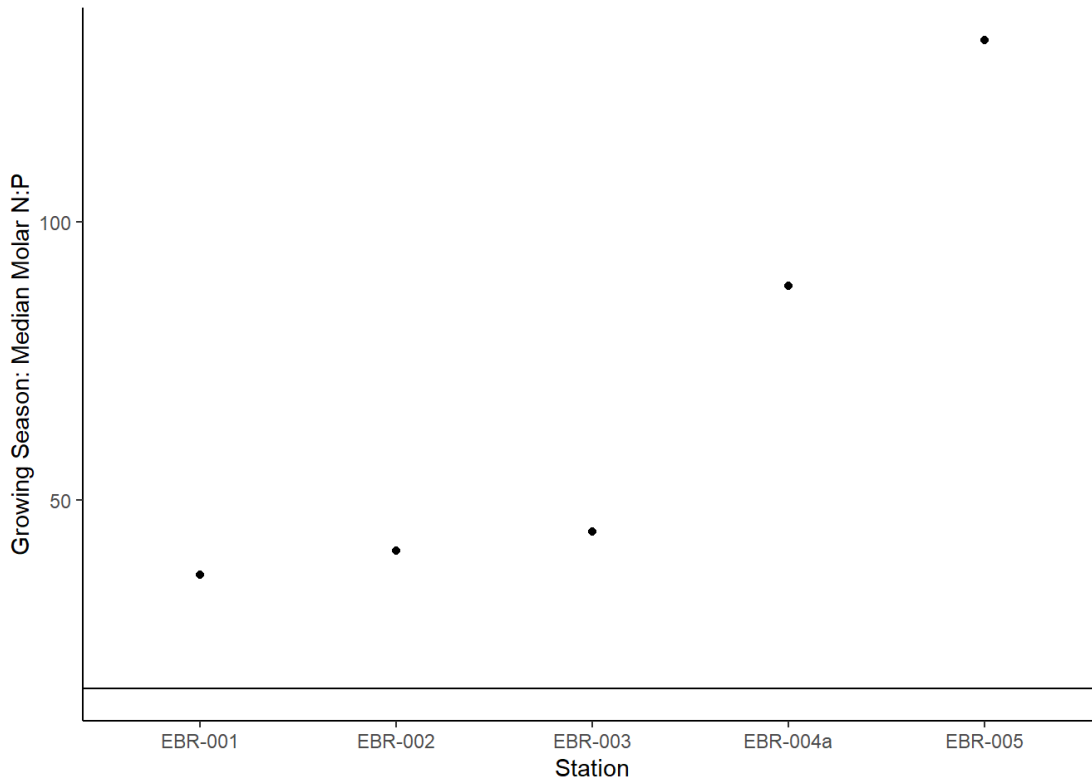
NP.plot <- ggplot(TN_TP_EBR_SUM) +
  aes(x = Station, y = NtoP) +
  geom_point() +
  labs(x = "Station", y = "Growing Season: Median Molar N:P") +
  geom_hline(yintercept = 16, color = "black") + #line indicates Redfield N:P ratio of 16:1 (values above 1
  ine indicate P limitation, below indicate N limitation)
  theme_classic()
```

```
TN_TP_EBR_SUM.table <- TN_TP_EBR_SUM[,c("Station", "NtoP")]
knitr::kable(TN_TP_EBR_SUM.table, digits = 3, col.names = c("Station", "N:P"))
```

Station	N:P
EBR-001	36.474
EBR-002	40.895
EBR-003	44.211
EBR-004a	88.423
EBR-005	132.634

#annual median TN:TP by site ($\pm$ IQR)

NP.plot



4. REACH SPECIFIC CRITERIA:

Have criteria already been developed for the receiving waterbody? If so, what are the values?

No, NA.

5. SUMMARIZE FINDINGS

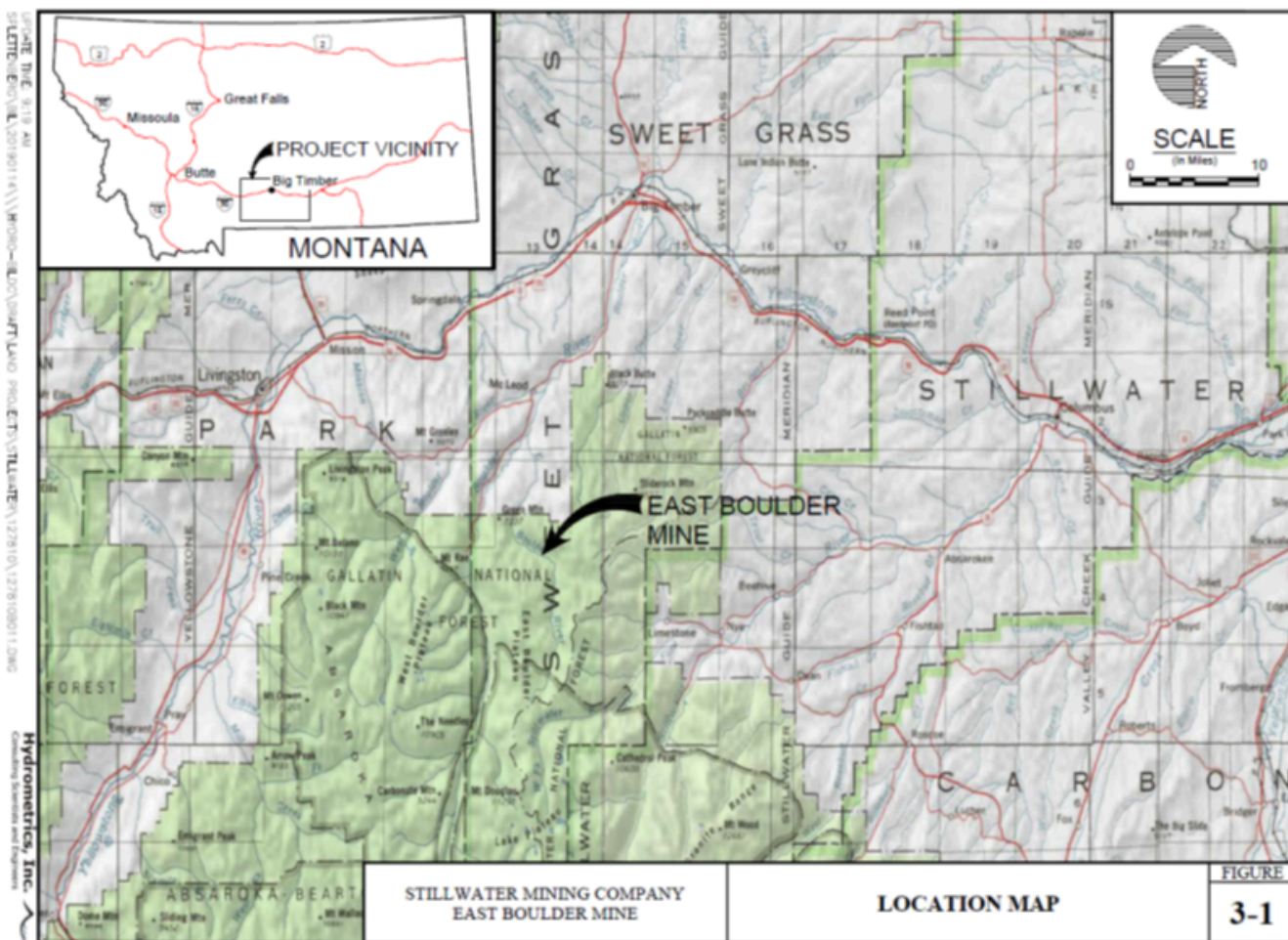
SEE 2025 MAJOR MODIFICATION FACT SHEET

6. HOLD NUTRIENT LIMITS PANEL MEETING

Meeting Held: September 15, 2025

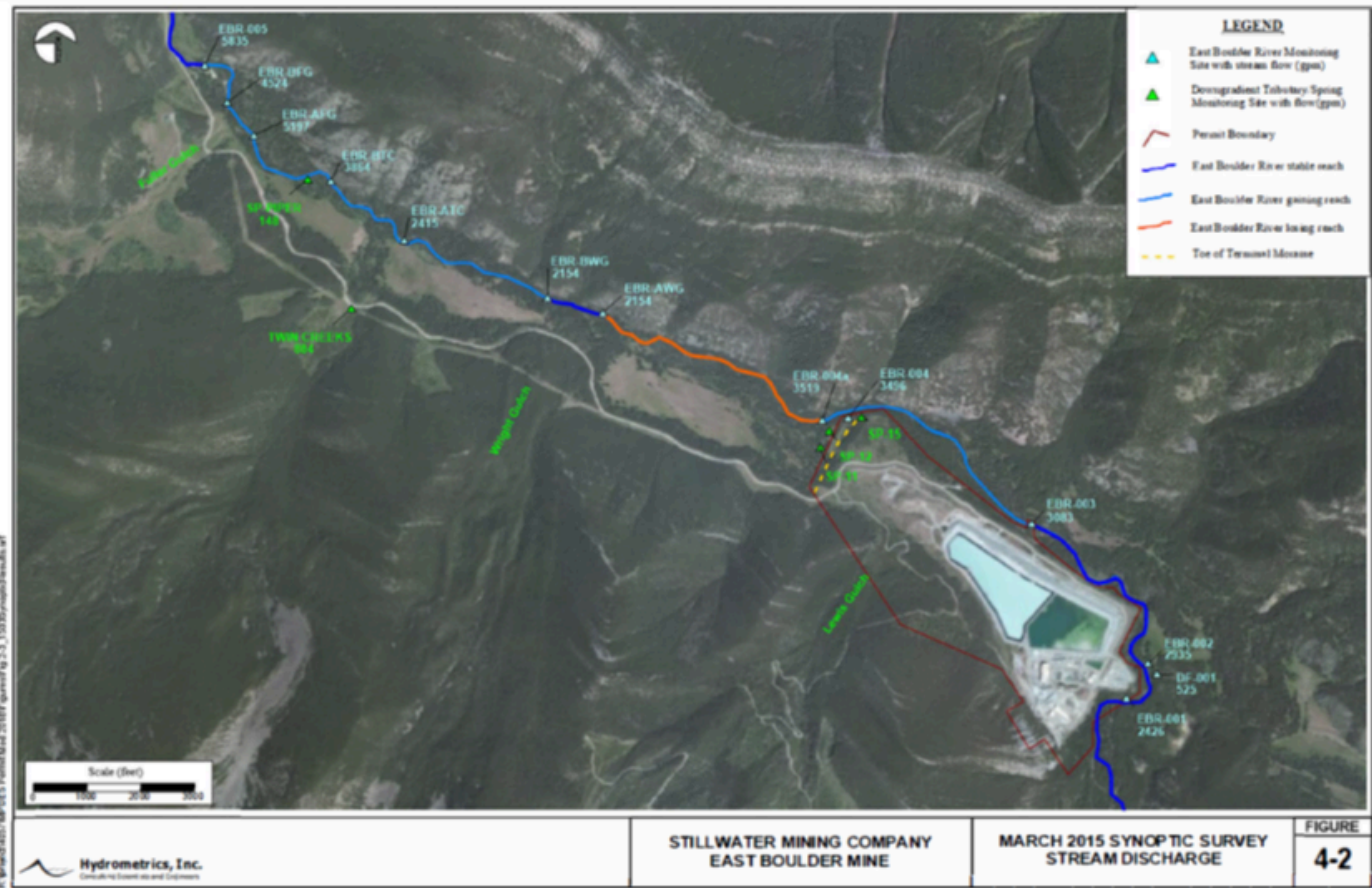
BACKGROUND:

Facility Location:

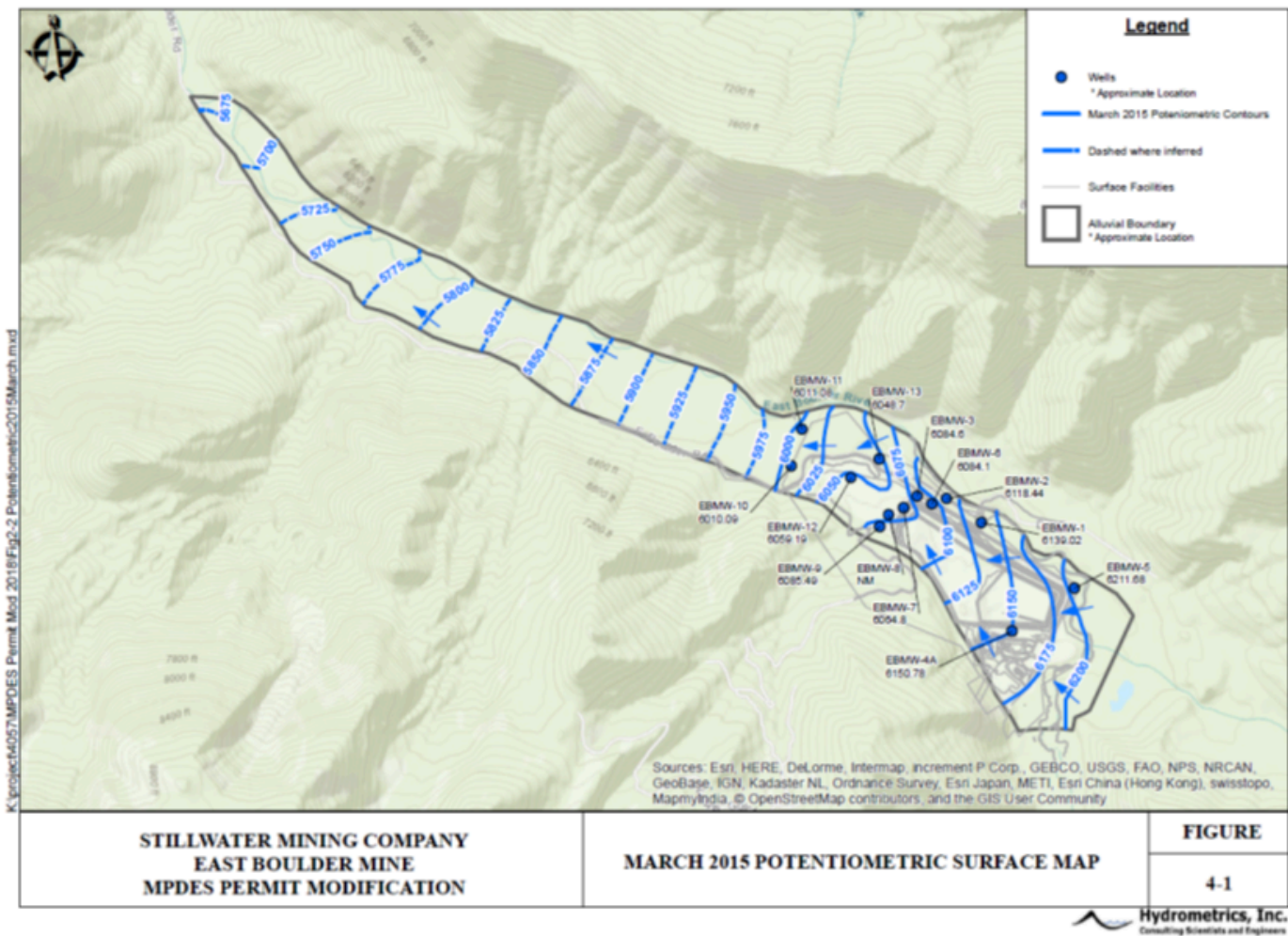


Discharge & Monitoring Sites (w/ Synoptic Survey Stream

Discharge):



2015 Potentiometric Map



SAMPLING SITES (STATIONS):

EBR-001



Site EBR-001. Looking downstream.

EBR-001 DWN (Rhithron 2025 Appendix G)



Site EBR-001. Looking upstream.

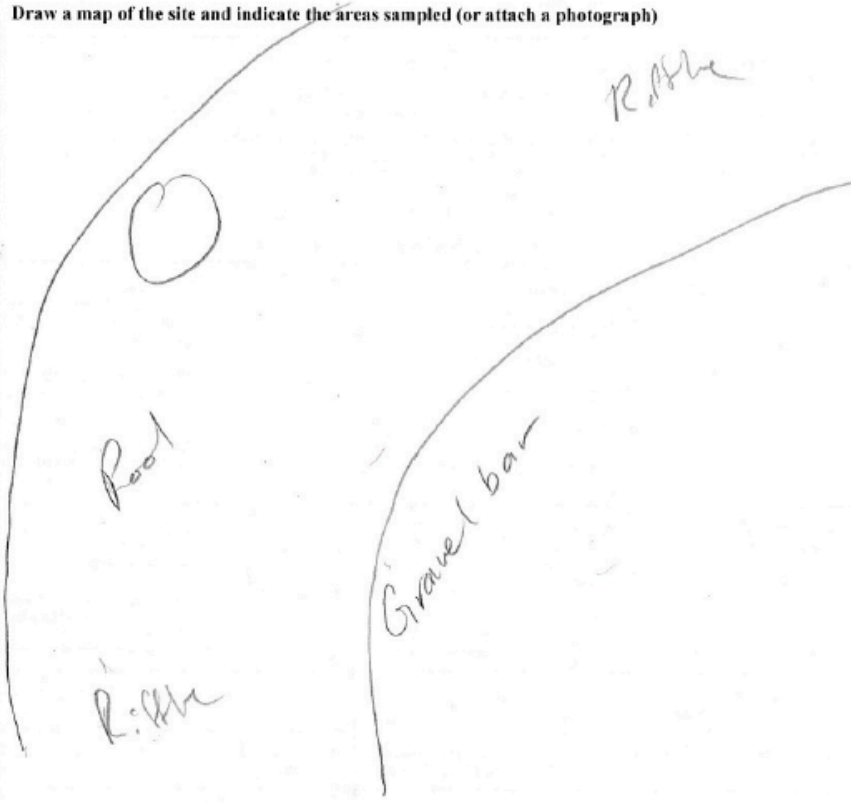
EBR-001 UP (Rhithron 2025 Appendix G)

EBR-001: Habitat Assessment

- epifaunal substrate/available cover: optimal (20/20)
- embedddness: optimal (20/20)
- velocity/depth regime: optimal (19/20)
- sediment deposition: optimal (20/20)
- channel flow status: optimal (20/20)

**PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(FRONT)**

STREAM NAME <u>EBR-002</u>	LOCATION	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

WEATHER CONDITIONS	Now ☐ storm (heavy rain) ☐ rain (steady rain) ☐ showers (intermittent) ☐ %cloud cover _____ ☐ clear/sunny	Past 24 hours ☐ ☐ ☐ % _____	Has there been a heavy rain in the last 7 days? ☐ Yes ☐ No Air Temperature _____ °C Other _____
	SITE LOCATION/MAP Draw a map of the site and indicate the areas sampled (or attach a photograph) R. Ash 		
STREAM CHARACTERIZATION	Stream Subsystem ☒ Perennial ☐ Intermittent ☐ Tidal		
	Stream Type ☐ Coldwater ☐ Warmwater Stream Origin ☐ Glacial ☐ Spring-fed ☒ Non-glacial montane ☐ Mixture of origins ☐ Swamp and bog ☐ Other _____ Catchment Area _____ km ²		

(Rhithron 2025 Appendix F)

EBR-002: Habitat Assessment

- epifaunal substrate/available cover: optimal (20/20)
- embeddedness: optimal (20/20)
- velocity/depth regime: optimal (19/20)

- sediment deposition: optimal (18/20)
- channel flow status: optimal (18/20)

EBR-003



Site EBR-003. Looking downstream.

EBR-003 DWN I (Rhithron 2025 Appendix G)



Site EBR-003. Looking downstream.

EBR-003 DWN II (Rhithron 2025 Appendix G)



Site EBR-003. Looking upstream.

EBR-003 UP (Rhithron 2025 Appendix G)

EBR-003: Habitat Assessment

- epifaunal substrate/available cover: optimal (19/20)
- embeddness: optimal (19/20)
- velocity/depth regime: optimal (20/20)
- sediment deposition: optimal (19/20)
- channel flow status: optimal (20/20)

EBR-004a



Site EBR-004a. Looking downstream.

EBR-004a DWN I (Rhithron 2025 Appendix G)



Site EBR-004a. Looking downstream.

EBR-004a DWN II (Rhithron 2025 Appendix G)



Site EBR-004a. Instream wood, looking downstream.

EBR-004a DWN III (Rhithron 2025 Appendix G)



Site EBR-004a. Looking upstream.

EBR-004a UP I (Rhithron 2025 Appendix G)



Site EBR-004a. Looking upstream.

EBR-004a UP II (Rhithron 2025 Appendix G)

EBR-004a: Habitat Assessment

- epifaunal substrate/available cover: optimal (20/20)
- embeddedness: optimal (20/20)
- velocity/depth regime: optimal (18/20)
- sediment deposition: optimal (20/20)
- channel flow status: optimal (19/20)

EBR-005



Site EBR-005. Looking downstream.

EBR-005 DWN (Rhithron 2025 Appendix G)



Site EBR-005. Looking upstream.

EBR-005 UP (Rhithron 2025 Appendix G)

EBR-005: Habitat Assessment

- epifaunal substrate/available cover: optimal (19/20)
- embeddedness: optimal (19/20)
- velocity/depth regime: optimal (18/20)
- sediment deposition: suboptimal (15/20)
- channel flow status: optimal (19/20)

SAMPLING SCHEDULE:

Table 2. History of macroinvertebrate and periphyton sampling for biological assessment, and periphyton sampling for chlorophyll *a* determination at sites in the East Boulder River drainage associated with facilities of the Sibanye-Stillwater Mining Company. An “m” indicates that a site was sampled for invertebrates in the indicated year. A “p” indicates that periphyton was sampled for biological assessment. Periphyton was sampled for chlorophyll *a* determination, (indicated by a “c”), and ash-free dry mass(indicated by an “a”).

Year	EBR-001	EBR-002	EBR-003	EBR-004a	EBR-005
1998	m*	m	m	m	
1999		m/c	m/c	m/c	
2000		m/c	m/c	m/c	
2001		m/c	m/c	m/c	
2002		m/c	m/c	m/c	
2003		m/c	m/c	m/c	
2004		m/c	m/c	m/c	
2005		c	c	c	
2006		m/c	m/c	m/c	
2007		m/c	m/c	m/c	
2008		m/c	m/c	m/c	
2009		m/p/c	m/p/c	m/p/c	
2010		m/c	m/c	m/c	
2011		c	c	c	
2012		m/p/c	m/p/c	m/p/c	
2013		c	c	c	c
2014		c	c	c	c
2015		m/p/c	m/p/c	m/p/c	m/p/c
2016		c	c	c	c
2017		c	c	c	c
2018		m/p/c	m/p/c	m/p/c	m/p/c
2019		c	c	c	c
2020			m/p/c	m/p/c	m/p/c
2021			c/a	c/a	c/a
2022	m/p/c/a	m/p/c/a	m/p/c/a	m/p/c/a	m/p/c/a
2023	c/a	c/a	c/a	c/a	c/a
2024	m/p/c/a	m/p/c/a	m/p/c/a	m/p/c/a	m/p/c/a

TN DISCHARGE HISTORY:

```

TN_MASS_ <- TN_MASS %>%
  mutate(mdy = mdy(Monitoring_Period_End_Date)) %>%
  mutate(Year = year(mdy)) %>%
  mutate(DMR_Value = as.numeric(DMR_Value)) %>%
  mutate(Month = month(mdy)) %>%
  mutate(Month = as.numeric(Month)) %>%
  mutate(DX_YR = case_when(Month >= 9 ~ Year + 1,
                           TRUE ~ Year))

#DX_YR used to account for difference in calendar year and growing season (inappropriate to discuss impacts of October,
#November, December discharge on bioassessment data collected in preceeding September)

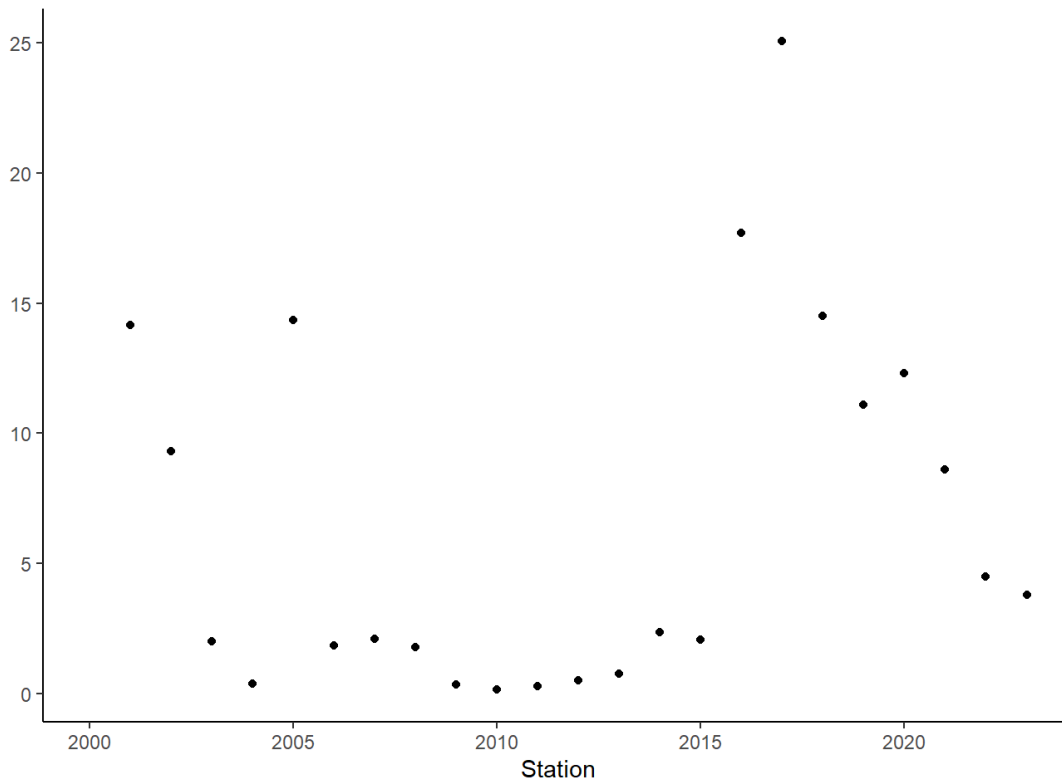
TN_MASS_SUM <- TN_MASS_ %>%
  group_by(DX_YR) %>%
  summarize(TN_ann_med = median(DMR_Value, na.rm = TRUE),
            TN_ann_IQR = IQR(DMR_Value, na.rm = TRUE)) %>%
  mutate(TN_ann_lag = lag(TN_ann_med, 0))%>%
  mutate(Year = DX_YR)

#hist(TN_MASS_$DMR_Value) #data are very positively skewed

TN_MASSplot <- ggplot(TN_MASS_SUM) +
  aes(x = DX_YR, y = TN_ann_med, group = DX_YR) +
  geom_point() +
  labs(x = "Station", y = "") +
  theme_classic()

TN_MASSplot #data are not skewed due to real inter-station differences

```



TN_MASS_SUM

```
## # A tibble: 24 × 5
##   DX_YR TN_ann_med TN_ann_IQR TN_ann_lag Year
##   <dbl>   <dbl>   <dbl>   <dbl> <dbl>
## 1  2000      NA      NA      NA  2000
## 2  2001    14.2    11.3    14.2  2001
## 3  2002     9.3     5.2     9.3  2002
## 4  2003     2      5.5     2    2003
## 5  2004     0.4     8      0.4  2004
## 6  2005    14.4     8.3    14.4  2005
## 7  2006     1.85    1.58    1.85  2006
## 8  2007     2.1     2.8     2.1  2007
## 9  2008     1.8     2.95    1.8  2008
## 10 2009     0.37    1.89    0.37  2009
## # i 14 more rows
```

Data pre-2015 do not capture all TN discharged (limits were in mixed TIN/TN terms), such that they are very likely underestimates of actual mass loading during this time. Because post-upgrade performance is consistent with no measurable change in aquatic life, we will assess the final effluent limitation on the basis of current performance from 2018-present. Limit must be assessed in mass terms in accordance with ARM 17.30.1345(8).