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July 5, 2022

File: W2020L8-0003

Rasel Hossain,
Senior Manager
Crown-Indigenous Relations and Northern Affairs Canada – Contaminants and Remediation Division
P.O. Box 1500 4923-52nd St
Yellowknife, Northwest Territories, X1A 2R3

Sent by email

Dear Rasel,

Re: AEMP Design Plan, Version 1.0 – Not Approved – Rayrock Remediation Project – Miscellaneous – Former Rayrock Mine, NT

The Wek'èezhii Land and Water Board (Board) met on June 27, 2022 and considered the Aquatic Effects Monitoring Program (AEMP) Design Plan, Version 1.0,¹ submitted by Crown-Indigenous Relations and Northern Affairs Canada – Contaminants and Remediation Division (CIRNAC-CARD) on February 16, 2022 as required by Water Licence (Licence) W2020L8-0003.²

The Board has not approved the AEMP Design Plan, Version 1.0 for the reasons detailed in the Board's Reasons for Decision (attached).

As per Part B, Condition 11, REVISE AND SUBMIT in the Licence, the Board requires that CIRNAC-CARD revise the AEMP Design Plan and submit Version 1.1 to the Board, for approval, no later than **January 31, 2023**. The revision must address the items listed in the Reasons for Decision and must be prepared in accordance with the Land and Water Boards' *Document Submission Standards*³ and the MVLWB/GNWT

¹ See WLWB Online Registry www.wlwb.ca/ for [Rayrock - AEMP - Design Plan - V 1.0 - Feb 16 22](#).

² See WLWB Online Registry for [CIRNAC-CARD - Rayrock - Issuance Letter and Water License - Nov 18 21](#).

³ See WLWB Policies and Guidelines webpage for MVLWB [Document Submission Standards](#).

*Guidelines for Aquatic Effects Monitoring Programs.*⁴ Once submitted, the revised AEMP Design Plan will undergo the Board's standard public review process before being considered by the Board.

As detailed in the attached Reasons for Decision, the Board has included requirements for additional baseline sampling to be conducted in 2022 and prior to submission of Version 1.1 of the AEMP Design Plan. Also as detailed in the attached Reasons for Decision, the Board has included requirements for engagement to take place prior to submission of Version 1.1 of the AEMP Design Plan.

Please direct questions or concerns regarding this letter to Ryan Fequet in writing.

Yours sincerely,



Mason Mantla
Chair, Wek'èezhii Land and Water Board

BCC'd to: Rayrock Distribution List
 Ron Breadmore, CIRNAC-CARD
 Andrew Richardson, CIRNAC-CARD
 Bridget Rusk, CIRNAC-CARD
 Tim Morton – Inspector, CIRNAC

Attached: Reasons for Decision

⁴ See WLWB Policies and Guidelines webpage for [MVLWB/GNWT Guidelines for Aquatic Effects Monitoring Programs](#).



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Reasons for Decision

Licensee: Crown-Indigenous Relations and Northern Affairs Canada – Contaminants and Remediation Division (CIRNAC-CARD)	
Location: Kwetj̄ᓃàà (former Rayrock mine and exploration sites), NT	File: W2020L8-0003
Subject: Rayrock AEMP Design Plan Version 1.0	

Decision from the Wek'èezhìi Land and Water Board Meeting of June 27, 2022

1.0 Decision

On June 27, 2022, the Wek'èezhìi Land and Water Board (WLWB or the Board) considered Crown-Indigenous Relations and Northern Affairs Canada – Contaminants and Remediation Division's (CIRNAC-CARD) Aquatic Effects Monitoring Program (AEMP) Design Plan Version 1.0 (the Plan).¹ The Plan is required by Licence W2020L8-0003, Part F, Condition 2 of the Licence, and was requested by the Board on September 30, 2021.² In consideration of the submission and reviewer comments and proponent responses, the Board has made the following decisions:

1. To not approve Version 1.0 of the AEMP Design Plan;
2. To require CIRNAC-CARD to submit Version 1.1 of the AEMP Design Plan. Version 1.1 is to include Design Plan Revisions 1 through 63, and is to be submitted no later than January 31, 2023;
3. To require CIRNAC-CARD to conduct Engagement as outlined in Engagement Requirements 1 through 5; and
4. To require CIRNAC-CARD to conduct additional baseline sampling as outlined in Baseline Sampling Requirements 1 through 9.

¹ See WLWB Online Registry at www.wlwb.ca for [Rayrock - AEMP - Design Plan - V 1.0 - Feb 16 22](#).

² See WLWB Online Registry for [Rayrock - Licence and Permit - Reasons for Decision - Sep 30 21](#).

2.0 Background

Water Licence W2020L8-0003 and Land Use Permit W2020X0005 were issued on November 18, 2021 and authorize CIRNAC-CARD to conduct remediation activities at the former Rayrock Uranium Mine, former Sun Rose Advanced Exploration Site, and affiliated sites. The AEMP is required by Part F, Condition 2 of the Licence. The purpose of an AEMP is to monitor for project-related effects in the aquatic environment and the requirements for an AEMP are outlined in the AEMP Design Plan. Kwetj̄j̄j̄j̄j̄j̄ (the former Rayrock Mine site) is the only area included in the proposed AEMP as the remediation activities here may impact waterbodies. Remediation activities include the draining, treating, and discharge of Mill Lake water into Sherman Lake, in addition to repair work at two Tailings Containment Areas (TCAs) near the Alpha Lake section of the Sherman Lake Waterbody and Gamma and Beta Lakes.

CIRNAC-CARD submitted Version 1.0 of its AEMP Design Plan (the Plan) on December 18, 2020, for information purposes and discussion with Parties during the Technical Session held for the Licence and Permit Applications on January 26-28, 2021.³ This AEMP did not undergo public review and was therefore not approved when the Licence was issued on November 18, 2021. The Licence required submission of the Plan within 90 days of the effective date of the Licence.⁴

CIRNAC-CARD submitted an updated Version 1.0 of its AEMP Design Plan on February 16, 2022. The Plan outlines CIRNAC-CARD's proposed monitoring activities for the aquatic environment of Kwetj̄j̄j̄j̄j̄j̄. These monitoring activities include four components:

- Aquatic Environment Monitoring
- Water and Sediment Chemistry Monitoring
- Benthic Assessments
- Fish Assessments

Each component is proposed to be monitored before, during, and after remediation to determine if remediation activities are impacting the aquatic receiving environment.

The Plan was circulated to the Rayrock Distribution List for public review via the Online Review System (ORS) on March 8, 2022. Comments and recommendations were due April 14, 2022, with responses from CIRNAC-CARD due April 28, 2022. The Board received comments from the following Parties:

- Environment and Climate Change Canada (ECCC);
- Government of the Northwest Territories – Environment and Natural Resources (Environmental Assessment and Monitoring) (GNWT-ENR-EAM);
- Tłj̄chq̄ Government; and
- Wek'èzhìi Renewable Resources Board (WRRB).

³ See WLWB Online Registry for [Rayrock - AEMP - Design Plan - V 1.0 - Dec 18 20](#) and [Rayrock - AEMP - Design Plan - V 1.0 - Appendix A - Dec 18 20](#).

⁴ See WLWB Policies and Guidelines (<https://wlb.ca/resources/policies-and-guidelines>) for [MVLWB/GNWT Guidelines for Aquatic Effects Monitoring Programs](#) (2019).

Board staff also asked questions during the public review. On April 19, 2022, CIRNAC-CARD requested an extension to the response deadline until May 13, 2022 due to staff availability. The response deadline extension was granted, and responses were received by this deadline. Reviewer recommendations and proponent responses are available on the WLWB ORS.⁵

3.0 Reasons for Decision

As discussed throughout this Reasons for Decision, many issues were raised during the public review of this Plan, which the Board has decided should be addressed in a revised version. The Board has thus decided not to approve Version 1.0 of the AEMP Design Plan and requires submission of Version 1.1 to include the Design Revisions outlined in this Reasons for Decision. As Version 1.1 is to include collection of additional baseline data in 2022, as well as engagement prior to revising some aspects of the Plan, the Board anticipates that this revised version will require several months to prepare. It is important to note, however, that a revised version must be submitted with sufficient time for it to be considered by the Board before remediation activities commence. For these reasons, the Board requires that Version 1.1 be submitted as soon as possible, and no later than January 31, 2023.

- ***Decision #1: The Board has decided not to approve Version 1.0 of the AEMP Design Plan.***
- ***Decision #2: CIRNAC-CARD is to submit Version 1.1 of the AEMP Design Plan. Version 1.1 is to include Design Plan Revisions 1 through 63 and is to be submitted no later than January 31, 2023.***

As mentioned above and discussed throughout this Reasons for Decision, the Board has included several requirements for engagement to inform Version 1.1. These requirements have been included to help ensure that CIRNAC-CARD receives the feedback necessary to help resolve certain issues and improve the Plan.

- ***Decision #3: CIRNAC-CARD is to conduct Engagement as outlined in Engagement Requirements 1 through 5.***

Also as mentioned above and discussed throughout this Reasons for Decision, the Board's assessment of the Plan and the outcome of the public review revealed the need for additional baseline monitoring to be conducted in 2022.

- ***Decision #5: CIRNAC-CARD is to conduct additional baseline sampling as outlined in Baseline Sampling Requirements 1 through 9.***

3.1 General Organization of the Plan

As an overarching comment, the Board found the AEMP Design prepared by CIRNAC-CARD difficult to read and to follow. The document lacked a coherent structure and information was difficult to find. The

⁵ See WLWB Online Review System (<https://new.onlinereviewsystem.ca/>) for [Rayrock - Aquatic Effects Monitoring Program Design Plan V 1.0](#).

document also had several inconsistencies. This became particularly apparent in the Board’s analysis of reviewer comments and proponent responses. Some examples include:

- Background information (i.e., historical data) and baseline information (i.e., 2021 data) is presented in the same section and sometimes all collated into the same tables. This led to confusion about what data is being proposed for use in the AEMP analyses moving forward (see Section 3.2.2 of this Reasons for Decision).
- Details on methods are scattered throughout the Plan. They can be found in Sections 3, 5, and/or 6 of the Plan, depending on the component. In some cases, the reader must refer to the Background Section (i.e., Section 3.0 of the Plan) to understand what variables may be monitored as part of the AEMP. The Board is of the view that a reader should be able to easily find this information in the Plan.
- Description of the Action Levels are presented first in Section 7.0 of the Plan, followed by the Response Framework in Section 8.0. Action Levels are part of the Response Framework, and these sections should be presented as one cohesive section.
- Table 1-1 is intended to be a summary of the whole AEMP program yet includes a number of inconsistencies and incorrect references (including incorrect water bodies and incorrect sampling quantity/type, depth info).
- ***Design Plan Revision #1: Version 1.1 of the AEMP Design Plan is to be significantly revised to improve the organization and flow, with a focus on eliminating inconsistencies and ensuring that all relevant information is located in the appropriate sections.***

3.2 Issues that Affect All or Several Components

This Reasons for Decision is generally organized by component (e.g., Water Chemistry, Sediment Chemistry, Benthic Assessment) with some other topics discussed later in the document. There are two overarching topics that affect all or several components. These are discussed here instead of repeated several times throughout the Reasons for Decision.

3.2.1 Reference Lakes

Based on the AEMP Summary Table (i.e., Table 1-1) and background information provided in Section 3 of the Plan, the Rayrock Project appears to include four Reference Lakes: New Control Lake, Alternate Reference Lake, Lake B, and Kwetsòtìa.

New Control Lake

It is unclear if New Control Lake is intended to be retained as a Reference Lake in the AEMP. It is included in Table 1-1 but several locations in the Plan discuss that it has limited applicability and may or will be replaced with Alternative Reference Lake.⁶ The choice of reference lake needs to be clear and approved

⁶ For examples, see WLWB Online Registry for [Rayrock - AEMP - Design Plan - V 1.0 - Feb 16 22](#), pages 60, 124, and 127.

as part of the Design. This is important to ensure that the appropriate baseline is available and to ensure that it is clear which lake will be used in statistical comparisons moving forward.

- ***Design Plan Revision #2: Version 1.1 of the AEMP Design Plan is to clarify which reference lakes will be used for which components moving forward. This should be accurately reflected in Table 1-1.***

Kwetsòtia

Kwetsòtia is a small lake located east of Mill Lake. It is connected to Mill Lake during periods of high water levels and has a permanent discharge to Sherman Lake. Section 5.0 of the Plan proposes the use of Kwetsòtia as a reference location for the smaller impacted lakes included in the AEMP (i.e., Beta and Gamma Lakes). Reference lakes are meant to represent unimpacted nearby lakes that have similar characteristics as impacted lakes so that changes in regional conditions can be considered when evaluating changes in impacted lakes over time. During the public review, the Tłıchq Government raised concern with the appropriateness of Kwetsòtia as a Reference location.

The Tłıchq Government commented that the sediment results from 2021 do not seem to support the position that this lake has not been significantly impacted because 2021 concentrations are elevated compared to background concentrations (TG comments 9 and 13). The Tłıchq Government also questioned the assumption that high flow events would have less impact on Kwetsòtia (TG comment 24). The Tłıchq Government stated that it does not agree that Kwetsòtia is the best choice for reference for Gamma and Beta lakes (TG comment 9). The Tłıchq Government recommended that a different water body be used as the reference site for the tailings water bodies and that CIRNAC-CARD revise language in the Plan to make it clear that Kwetsòtia may have been impacted by previous site activities (TG comment 13).

In response, CIRNAC-CARD explained that Kwetsòtia is similar in size and depth to Gamma and Beta, is in the same geographical area, and has similar geochemical characteristics. CIRNAC-CARD also stated that the presumed northern flow route to Kwetsòtia has never been observed with flow and while photos show a potential pathway for flow, the volume that would pass through this alignment would be minimal compared to the flow through the primary creek to Sherman Lake. While CIRNAC-CARD acknowledged that anomalous radionuclide concentrations were detected in 2021, it does not agree that one anomalous result should discount this location. CIRNAC-CARD explained that radionuclide concentrations in sediments were highest in 2021 in many of the sediment samples at Rayrock (i.e., not just at Kwetsòtia) and that since there was little site activity in 2021, there is no reason to believe that a site source caused a radionuclide concentration increase. CIRNAC-CARD also explained that investigations by one of its consultants found only very low to non-reportable concentrations of uranium along the alignment to Kwetsòtia, suggesting that it is very unlikely that Kwetsòtia has been impacted by flow from Mill Lake.

Overall, CIRNAC-CARD stated that the 2021 results alone do not represent proof of impact and did not provide any indication of whether it would revise the statement in the Plan as recommended by the Tłıchq Government. In terms of an alternative location, CIRNAC-CARD stated that the applicability of other

downstream sites would need to be investigated and would be harder and less safe to access. CIRNAC-CARD thus concluded that Kwetsõtia is the most representative background location that could be proposed.

Similar to its comments related to sediment chemistry, the Tłıchq Government commented that Kwetsõtia may not be the best choice to represent an unimpacted lake because uranium was elevated in benthic invertebrate tissue compared to samples collected from Sherman Lake K and New Control Lake (TG comment 40). CIRNAC-CARD explained that this was one of a few examples where it was higher; CIRNAC-CARD noted that Kwetsõtia is lower for several metals, but the magnitude is not always worth noting. While CIRNAC-CARD stated that higher uranium in Kwetsõtia is worth noting, as are select metals in Sherman Lake, Kwetsõtia, and New Control Lake, they stated that the results from 2021 in Kwetsõtia were somewhat unexpected and that it will be interesting to see additional data comparing each location to data from previous years. It is unclear if this means that additional years of data may indicate that Kwetsõtia is no longer a suitable reference location. At this time, it is unclear if another reference lake would be available and whether elevated concentrations in some parameters is sufficient to exclude Kwetsõtia as a reference location, especially given that reference locations are being selected based on measuring impacts as a result of the remediation work, not necessarily as a result of historical impacts. However, should another reference location be needed in the future, the Board is of the opinion that work to identify one should begin as soon as possible.

- ***Design Plan Revision #3: CIRNAC-CARD is to update Version 1.1 of the AEMP Design Plan with the following:***
 - ***(a) an explanation of the 2021 results for sediment and benthos in Kwetsõtia that addresses elevated concentrations of variables identified by the Tłıchq Government; and***
 - ***(b) detailed rationale for why Kwetsõtia remains a good reference site option given the results from 2021.***

- ***Baseline Sampling Requirement #1: CIRNAC-CARD is to investigate options for a reference location in 2022 that could be used as an alternative to Kwetsõtia. Baseline data for all relevant components should be collected from this location in 2022.***

Lake B

Lake B is located south of Sherman Lake, Lake A, and Beta and Gamma Lakes. All waterbodies at Kwetłı̀aà (Rayrock) drain to Lake B, which then drains approximately 7 km through more than 19 small ponds and lakes before discharging to the Marian River. Lake B was requested to be included in the AEMP by the Tłıchq Government as a location that monitors all water and sediment flowing from the Kwetłı̀aà (Rayrock) site and is included as a reference location in the water and sediment component of the AEMP, as well as a downstream exposure area as part of the benthic assessment component of the AEMP.

The Tłıchq Government commented that sediments in Lake B show some low-level impacts relative to Alternate Control Lake and recommended that a discussion of Lake B results with comparisons to

background conditions be included in the Plan and that text be revised (TG comments 14 and 26). CIRNAC-CARD's response to TG comment 26 refers to its response provided for Kwetsõtia and does not directly address Lake B. CIRNAC-CARD's response to TG comment 14 provides some added explanation that helps to address the Tłıchq Government's recommendations.

- ***Design Plan Revision #4: Version 1.1 of the AEMP Design Plan is to be updated to include an explanation of the 2021 results for sediment in Lake B, which includes a comparison to background conditions.***

3.2.2 Statistical Approach

Section 4.0 of the Plan provides a general description of the method proposed for analysing the data as part of the AEMP. CIRNAC-CARD states that:

The primary method of analysing the data for statistically significant change is considering Critical Effect Size (CES). Differences are considered significant when the CES is exceeded. Differences over time (or to baseline conditions) and between reference and exposure areas are considered significant when the CES, defined in Section 5 for each component, is exceeded.

Section 5.0 of the Plan does not define the Critical Effect Size (CES) for each component. According to Sections 4, 5, and 6 of the Plan, the Board understands the Plan to be proposing the following CES:

- For water and sediment chemistry concentrations: a statistically significant change is defined as an increase of more than 25% from baseline (for parameters with concentrations greater than ten times the method detection limit (MDL) given by the laboratory).
- For benthic invertebrate endpoints: an exceedance of ± 2 standard deviations of the reference area will be considered a significant result.
- For fish health endpoints: a statistically significant change is defined as a change of more than 25% from baseline.
- For metal concentrations in fish tissue: a statistically significant change is defined as an increase of greater than 25% from baseline averages, in fish of comparable size and weight, or between exposure and reference areas.

During the public review, several comments were received regarding the statistical approach and plan for evaluation of AEMP data. In general, these comments highlighted a lack of clarity in the approach, as well as inconsistencies in statements throughout the Plan and between the Plan and responses by CIRNAC-CARD. The lack of clarity in the proposed statistical approach has made it challenging for the Board to evaluate the adequacy of the baseline data, particularly for benthic invertebrate endpoints. For example, in responses to comments, CIRNAC-CARD has repeatedly said that comparisons would be made for each location across time (i.e., comparing a location's future results to its baseline results) rather than comparisons to a reference location. However, several areas of the Plan (for benthos and fish) suggest that comparisons of impacted locations to reference locations will be made. These issues are addressed in detail in the paragraphs below.

CES Values – Which Metrics are Planned for Comparison?

The Tłıchq Government commented that CES values are not explicitly defined in the AEMP for media or areas and that it is not clear which values would form the baseline for the CES approach (e.g., would a maximum historical value be the basis of the CES? Or would it be the mean value ± 2 SD?; TG comment 1). The Tłıchq Government recommended that the Plan clearly present the CES values to be used in the analyses (TG comment 1). CIRNAC-CARD responded that this is explained in Sections 4 and 5 of the Plan and stated that the process does not provide defined values. CIRNAC-CARD explained that for this AEMP, CES is intended as a magnitude of change that could be considered indicative of an issue. It does not appear that the TG was asking how the CES will be used. In the Board's view, it is clear that it is meant to identify potential changes. What is unclear is what the metrics that are going to be evaluated are. Is it the mean, median, 95th percentile? GNWT-ENR had a similar comment for water and sediment chemistry, stating that it is not clear whether the change will be evaluated against the upper limit of the background (e.g., the 95th percentile) or the mean background concentration (GNWT-ENR comment 10). CIRNAC-CARD responded that the change is not evaluated against background or reference but is evaluated against data to date. The Plan says that the analyses will be looking for an increase from baseline, in other words, a comparison of monitoring data for a site compared to the baseline data for that same site. What is not clear is what metric will be compared over time (i.e., will the AEMP be comparing the monitoring data mean to the baseline mean? Or will the AEMP be comparing the monitoring data median to the baseline median?). The Tłıchq Government addressed this issue again in comment 55, stating that the 'baseline' conditions/concentrations corresponding to CES is not clear. The Tłıchq Government recommended that baseline values should be stated where practical (TG comment 55). In this instance, CIRNAC-CARD responded that this would be the average pre-remediation values. It is not entirely clear what data would be included in the calculation of pre-remediation values – this is discussed more in the next subsection of this Reasons for Decision.

For benthic invertebrates, the Tłıchq Government commented that it is not clear how the CES approach is going to be applied and recommended that for clarity, the measurements that would be considered a CES exceedance should be presented in the AEMP (TG comment 56). CIRNAC-CARD's response provided no new information than what is already available and just reiterated the endpoints that will be assessed and stated that differences will be considered significant when the CES is exceeded.

For fish health metrics, GNWT-ENR commented on the lack of clarity regarding how CES will be developed, specifically for length and age distribution (GNWT-ENR comment 11). GNWT-ENR recommended that the text be revised to clarify which endpoints will be evaluated using the statistical significance and CES approach and that a summary table be provided for all measurement endpoints that shows the method for assessing change, the alpha for any statistical tests, and the CES (GNWT-ENR comment 11). CIRNAC-CARD responded that they would do this in each AEMP Report, but the Board is of the opinion that this should be part of the Plan, as the Plan is meant to outline the analyses that will be done and reported on via the AEMP Annual Report. The Plan should provide clear expectations as to what should be expected in the AEMP Annual Report.

Since the baseline dataset will be finalized following the final baseline sampling year (i.e., 2022), the Board is of the opinion that the baseline metrics to be used in the statistical analyses can be calculated and presented in the next version of the Plan. Not only will this provide clarity on the metrics that are being proposed for use (e.g., mean, median, and/or 95th percentile), but if the CES value to exceed is calculated and provided, it will be easier for parties to see that the metrics to be compared are consistently being carried forward. For example, if it was decided that the metric to be considered for water chemistry is the mean and the baseline mean concentration of arsenic at Sherman Lake B were 0.57 µg/L, then according to CIRNAC-CARD's description in the Plan, a difference would be considered significant if the mean concentration of arsenic samples at Sherman Lake B at a later date were greater than 0.71 µg/L (i.e., 0.57 µg/L + 25%).

- ***Design Plan Revision #5: Version 1.1 of the AEMP Design Plan is to be revised to include a more detailed explanation of the statistical analyses to be conducted. This should be clearly outlined for each component of the AEMP, in what is currently Section 6.0 of the Plan.***
- ***Design Plan Revision #6: In addressing Design Plan Revision 5, Version 1.1 of the AEMP Design Plan is to be revised to include tables with the baseline values that will be used in the statistical comparisons, including the CES values that will be used to determine the upper and/or lower limits of change.***

Baseline Values – What Data is Being Used to Inform Baseline Conditions

Section 3.0 of the Plan provides what appears to be all the available historical data for proposed AEMP sites, in addition to the data collected as part of the baseline program in 2021. For some components, data is presented by year, for other components, data is presented by site. Several comments were received regarding lack of clarity around what data would be used to inform the baseline conditions to be used in the statistical analyses.

As discussed above, the Tł̓ch̓q̓ Government commented that the 'baseline' conditions/concentrations corresponding to CES is not clear and recommended that the baseline values be stated where practical (TG comment 55). CIRNAC-CARD responded that this would be the average pre-remediation values but it is not clear what data would be included in the calculation of pre-remediation values. Would this be data from 2021 only, or data from all years presented in Section 3.0 of the Plan? Board staff asked questions about this during the public review (WLWB staff comments 4 and 7) and CIRNAC-CARD responded that: "Data analysis to assess for potential change will use the data from 2021 and 2022 to establish conditions before remediation, with other data also used in accordance with the limitations described in Section 3" and "...use of previous data will have to consider time of year and location differences for the fish that were collected". These responses did not help clarify how other data, outside of 2021 and 2022 would be used. Would this be used as supporting information when trying to explain results, or would some of that data be used in the calculation of baseline means? Many comments received during the public review and discussed throughout this Reasons for Decision have highlighted potential issues/limitations of the historical data (e.g., no depth information for benthos samples; see TG comment 31). It is important that

there is a clear understanding of how the historical data may be used so that reviewers can provide feedback now on the proposed analyses and adequacy of baseline.

The Tłıchq Government had a question about how duplicate water quality samples were being presented in Section 3.0 of the Plan and included in calculations of background means (TG comment 16). CIRNAC-CARD's response indicates that in its analyses, duplicates will be handled differently than in the presented tables and provided a description of how it intends to do that. This description is not provided within the Plan. This comment further supports the need for a clear definition of what is being included in the "baseline" measurement/statistic to be used in the statistical analyses.

- ***Design Plan Revision #7: In addressing Design Plan Revisions 5 and 6, CIRNAC-CARD is to clarify and explain the baseline conditions to be used for each component in Version 1.1 of the AEMP Design Plan.***

The Tłıchq Government commented that no source information was provided for CES and recommended that it be included (TG comment 54). CIRNAC-CARD responded that it was not clear what information the Tłıchq Government wanted. The Board agrees that it is not clear what information the Tłıchq Government wanted but note that it would have been helpful if CIRNAC-CARD had reached out to the Tłıchq Government to clarify this prior to providing its responses.

- ***Engagement Requirement #1: CIRNAC-CARD is to reach out to the Tłıchq Government to obtain clarity on the recommendation provided in Tłıchq Government comment 54.***
- ***Design Plan Revision #8: Version 1.1 of the AEMP Design Plan is to be revised to include the source information as clarified by the Tłıchq Government.***

Statistical Analyses for Benthos

Section 3 of the Design provides a summary of all the information to date on benthic invertebrates around the Rayrock site. Several comments regarding this information were received from the Tłıchq Government and were aimed at better understanding the potential impacts to benthic invertebrates in tailings impacted water bodies (TG comments 8, 27, 28, 30, 32, 35, and 37). For example, Tłıchq Government comments 27 and 28 noted differences in benthos metrics between Gamma Lake (an impacted lake) and New Control Lake (a reference lake), which may suggest that Gamma Lake is not an impacted one. In these cases, the Tłıchq Government generally recommended that further study be required to determine the impact to benthos in the tailings impacted water bodies. In general, CIRNAC-CARD responded that the focus of the AEMP is to look at differences over time within a lake and not to make comparisons of metrics across lakes. If the goal is to compare within lakes over time, then it is the Board's opinion that these comments are not specific to the purpose of the AEMP Design and are more related to understanding historical impacts that have occurred in impacted water bodies. The Tłıchq Government did not explain why a better understanding of historical impacts is needed to inform the Design. The Board notes that there is a difference between quantifying the degree of historical impact versus monitoring impacts that may be caused by the remediation project.

The Board notes, however, that the goal for the benthic assessment is not always clear. For example, pages 116 and 126 of the AEMP say: “For benthic invertebrate endpoints, an exceedance of ± 2 standard deviations of the reference area will be considered a significant result.” This text suggests that benthic invertebrate endpoints for impacted lakes will be compared to endpoints from associated reference lakes to identify changes. In response to a question by Board staff regarding which reference area would be used as a comparison for the Alpha Lake section of Sherman Lake (WLWB staff comment 12), CIRNAC-CARD responded that Kwetsõtia would be used as a reference for benthic assessments. This response also suggests that benthic invertebrate endpoints for impacted lakes will be compared to endpoints from associated reference lakes to identify changes. It is thus not clear if CIRNAC-CARD intends to compare benthic invertebrate endpoints for each impacted lake to the impacted lake’s baseline conditions (within lake) or to an associated reference lake (across lake).

The type of statistical comparison being made (i.e., within or across lakes) is an important point to clarify because it influences the assessment of the adequacy of baseline data and the choice of reference location. As discussed above in Section 3.2.1 of this Reasons for Decision, the Tłı̨ch̨ Government has raised concerns with the use of Kwetsõtia as a reference location for benthic invertebrates. In addition, Section 3.6.2 of this Reasons for Decision discusses issues with replication in the baseline data set, which could have implications for the AEMP’s ability to make meaningful comparisons across lakes.

- ***Design Plan Revision #9: Version 1.1 of the AEMP Design Plan is to be revised to clarify the statistical approach and wording of CES to reflect whether comparisons for benthos are intended to be made within or across lakes. If comparisons of impacted lakes to reference lakes are intended, CIRNAC-CARD is to provide additional information to demonstrate that the sampling plan and associated baseline data will be adequately able to detect changes.***

Statistical Analyses for Fish

In reviewing the issue related to the benthos analyses described above, it was noted that a similar issue appears to be present for the fish analyses. For example, pages 116 and 147 of the AEMP say:

An increase in any metal concentration in the fish tissues of greater than 25% from pre-remediation (baseline) averages, in fish of comparable size and weight, or between exposure and reference areas, would trigger the Low Action Levels for response.

This text seems to suggest that CIRNAC-CARD has not yet determined if comparisons will be made within or across lakes. As stated above, the type of statistical comparison being made (i.e., within or across lakes) is an important point to clarify because it influences the assessment of the adequacy of baseline data and the choice of reference location. As discussed throughout Section 3.7 of this Reasons for Decision, issues related to reference location, target species, and associated baseline data have been raised.

- ***Design Plan Revision #10: Version 1.1 of the AEMP Design Plan is to be revised to clarify the statistical approach and wording of CES to reflect whether comparisons for fish are intended to be made within or across lakes. If comparisons of impacted lakes to reference lakes are***

intended, CIRNAC-CARD is to provide additional information to demonstrate that the sampling plan and associated baseline data will be adequately able to detect changes.

Response to CES Calculations

The Tłıchq Government commented that the discussion of CES in Section 4.0 of the Plan talks about how CES calculations for water and sediment chemistry are limited to values greater than 10-times the method detection limit (MDL; TG comment 57). The Tłıchq Government stated that this seems to leave a gap where a parameter that measures <MDL can increase by up to an order of magnitude and would not be identified as a significant change (TG comment 57). The Tłıchq Government stated that this does not seem like a conservative approach and recommended that CES calculations should be performed on all contaminants of concern, and that when results are less than 5-times the MDL, a qualifier could be attached to the CES calculation (TG comment 57). CIRNAC-CARD responded that use of 10-times the MDL to quantify comparisons is a standard method throughout the environmental industry that recognizes the limitations of the analytical laboratories. CIRNAC-CARD would like to maintain these to ensure that they are not having to frequently explain differences that may be due to natural variation. It is not clear if the Tłıchq Government is just interested in seeing these results or if they think that calculations with variables that have concentrations less than 5-times the MDL should be considered for assessment under the Response Framework (i.e., used in Action Level evaluations). It seems there is a compromise by which analyses could be conducted but not necessarily subject to Action Level evaluation.

- ***Design Plan Revision #11: CIRNAC-CARD is to consider how it could include the Tłıchq Government's recommendation to include additional analyses for variables with concentrations that are less than 10-times the Method Detection Limit and update Version 1.1 of the AEMP Design Plan accordingly.***
- ***Engagement Requirement #2: In addressing Design Plan Revision 11, CIRNAC-CARD is to engage with the Tłıchq Government.***

The Tłıchq Government also commented that the discussion of CES in Section 4.0 of the Plan states that “A change of greater than 25% from baseline in an undesirable direction in any monitoring event will trigger increased attention on the next event” and that it is unclear what ‘increased attention’ means (TG comment 58). CIRNAC-CARD responded that this description should be changed to “will be flagged for attention on future sampling events.” CIRNAC-CARD’s proposed update still does not help to explain what will happen should a change of greater than 25% from baseline be detected. Does this mean that more or different monitoring and/or analyses will take place? The Board notes that this level of change appears to coincide with the Low Action Level for water and sediment chemistry in the Response Framework. The Board is of the opinion that referencing the Response Framework and providing more details there about what would happen would be the best way to address this comment and make things clearer.

- ***Design Plan Revision #12: CIRNAC-CARD is to link the discussion of responses to significant changes in Section 4.0 to the Response Framework in Version 1.1 of the AEMP Design Plan.***

3.3 Water Quality

3.3.1 Sampling and Testing Locations

Surveillance Network Program (SNP) versus AEMP

Water chemistry is proposed to be sampled at a total of 16 stations. These 16 stations include the 13 SNP stations included in the Water Licence and three additional stations. Throughout the Plan, CIRNAC-CARD frequently refers to the 'SNP portion of the AEMP'. While it is reasonable to have some overlap between SNP stations and AEMP stations, these two monitoring programs serve different purposes. As explained in the *MVLWB\GNWT Guidelines for Aquatic Effects Monitoring Programs (AEMP Guidelines)*,⁷ SNP monitoring is done at key locations on the project site, often to ensure compliance with specific water licence conditions (e.g., end-of-pipe discharge) and the requirements for SNP monitoring are outlined in the Water Licence. The AEMP monitors for project-related effects in the aquatic environment and the requirements for the AEMP are outlined in the AEMP Design Plan. SNP monitoring usually occurs on or very near the project site and generally provides information on the quantity and quality of water used or waste generated and discharged to the environment. In contrast, monitoring conducted under an AEMP occurs in the wider environment that has the potential to receive waste from a project either directly or indirectly. AEMPs are meant to monitor project-related effects on the aquatic ecosystem including, for example, effects to water quality and/or quantity, aquatic habitats, and aquatic life. The way in which the SNP stations are used in the AEMP seems to have caused some confusion and appears to be creating limitations on what CIRNAC-CARD believes it must include/not include as part of the AEMP. Some examples are discussed in the paragraphs below.

In response to comments regarding the inclusion of fluoride as a monitored variable (GNWT-ENR comment 2; ECCC comment 4), CIRNAC-CARD stated that fluoride is monitored as part of the AEMP but that it would not be requesting an amendment to add fluoride to the Licence. As discussed in Section 3.1.2 of this Reasons for Decision, fluoride was not included as a variable in the AEMP. Also, no amendment to the Licence would be necessary to monitor additional variables as part of the AEMP. This response seems to be linked to CIRNAC-CARD's assumption that the AEMP needs to match the requirements of the Licence and that the variables to be monitored are those included in the SNP. AEMPs do not necessarily have to mirror Licence requirements and often monitor variables in addition to those required by a licence SNP.

Monitoring locations are provided in several places throughout the Plan and generally refer to the 'SNP portion of the AEMP' or the 'AEMP'. Readers should have one clear table in the Design Plan that outlines all the locations of the AEMP stations. While the Board acknowledges that this is provided in the Summary Table (i.e., Table 1-1 at the beginning of the document), this should be clearly provided in Section 5.2 of the Plan where the Water Chemistry component is explained. The locations should also be characterized with their purpose as they relate specifically to the AEMP and its objectives. Table 5-1 provides the SNP stations and their objective, but not all SNP objectives seem to apply in the context of the AEMP. For example, the objective for SNP Station 1663-7 (Water Discharge) is to verify the efficacy of the Mill Lake

⁷ See www.wlwb.ca for [MVLWB/GNWT Guidelines for Aquatic Effects Monitoring Programs](#) (2019), under the Resources – Policies and Guidelines menu

water treatment process and represents the point of compliance for Effluent Quality Criteria (EQC) in the Licence. This station informs on the quality of water entering the Receiving Environment – it is not a measure of the water quality in the Receiving Environment. According to the Response Framework, Action Levels will be evaluated at all stations. The proposed Low Action Level for water chemistry is exceeded when:

- (1) An increase in any metal concentration in the water of greater than 25% from pre-remediation (baseline) averages for that location; and
- (2) causes the concentration to exceed guidelines or criteria.

It is not clear what baseline data this station would be compared to for the evaluation. In addition, the water quality at SNP Station 1663-7 is not authorized to exceed the criteria.

The Licence requires that monthly acute toxicity testing be conducted at SNP Station 1663-7. CIRNAC-CARD appears to have carried this requirement into the AEMP; however, it is not clear how the acute toxicity testing results fit into the analyses described in later sections of the Design. Because it is included in the Design, GNWT-ENR sought clarification on where the acute toxicity testing would take place because Section 5.2 of the Plan implies that toxicity testing would be occurring on-site (GNWT-ENR comment 13). CIRNAC-CARD's response clarified where the sample is being taken from but not where the toxicity testing itself will be done. It is the Board's understanding that toxicity testing requires laboratory cultures and a setting in which to conduct toxicity tests over a period of 48 hours.⁸ Thus, it remains unclear where the testing itself (i.e., lab analyses) will be taking place. Should SNP Station 1663-7 remain in the Design in the next version of the Plan, CIRNAC-CARD should provide additional details on the location of the on-site toxicity testing.

As another example, SNP Station 1663-5 (Sherman Lake C) is meant to test water for use in the camp and states that the location may change at the discretion of the remediation contractor. The AEMP is not concerned with the quality of water to be used in the camp. It is unclear if CIRNAC-CARD intends to take advantage of this sampling site to also obtain information about the water quality in the Receiving Environment. If so, it is not clear what potential project effects are being monitored at this location. Consistency in sampling location is also important for the AEMP and this would not be possible if the location were to change at the discretion of the contractor.

The Tłı̨chq̓ Government had a comment about the location of SNP Station 1663-13 (i.e., the Mill Creek Outlet Station; TG comment 6). They commented that it is not clear from the description whether the sample is collected from within the creek or from within Sherman Lake. The Tłı̨chq̓ Government recommended that it be collected from Mill Creek immediately upstream of Sherman Lake and the location be revised to clearly describe where the sample is collected. CIRNAC-CARD responded that this location has not been explicitly determined because sampling here is not set to start until post-remediation; however, supports sampling within the Creek once this station is activated. CIRNAC-CARD

⁸ See Government of Canada (<https://www.canada.ca/en.html>) for [Biological test method: acute lethality of effluents to daphnia magna](#) (2000).

also said it could provide a location now, recognizing that some samples would not be able to be taken because it will be dry. In the Licence, the rationale for this SNP station is to test the water quality leaving Mill Creek before entry into Sherman Lake; this is monitoring an input to Sherman Lake and thus it is not clear how this station fits in with the objectives of the AEMP to look for changes in the Receiving Environment as a result of remediation. It appears to more appropriately be an SNP station that may be a supporting source of information for the AEMP. At this time, it is not clear to the Board that this location needs to be included as part of the AEMP. Furthermore, if CIRNAC-CARD would like it to be included now and wishes for this site to match the Licence, it will need to submit a Request to Update the SNP with the next version of the AEMP Design Plan.

- ***Design Plan Revision #13: CIRNAC-CARD is to include one comprehensive table of water chemistry sampling stations in Version 1.1 of the AEMP Design Plan. This table is to include rationale for each station that is related specifically to the AEMP. In preparing the table, CIRNAC-CARD should consider whether all SNP stations belong in the AEMP.***
- ***Design Plan Revision #14: In revising the list of water quality AEMP stations, if CIRNAC-CARD proposes to retain SNP Station 1663-7, CIRNAC-CARD is to provide more details about where the on-site toxicity testing will take place and update the Plan to explain how the results will be used in the context of the AEMP.***

3.3.2 Monitored Variables

Section 5.2 of the Plan provides the list of variables that will be measured for all the water quality samples. These include *in situ* field measurements (e.g., pH and temperature), major ions, nutrients, solids, total metals, and total radionuclides.

GNWT-ENR (comment 6) recommended that the AEMP include a summary of available water quality data for Mill Lake to help determine contaminants of potential concern (COPCs) – presumably to help assess which variables should be monitored as part of the AEMP. CIRNAC-CARD responded that EQC for the Licence were developed in consideration of the water quality in Mill Lake and that no further information on Mill Lake is needed as it will no longer exist after remediation work is complete. Based on information provided in the footnote to Table 1-1, in addition to a general suite of metals, nutrients, and ions, the list of variables to be monitored as part of the AEMP includes most variables with EQC and most variables identified as being a COPC in the HHERA.⁹ Variables missing from Table 1-1 include the following variables with EQC: fluoride and total petroleum hydrocarbons; and the following variables identified as being a COPC in the HHERA: fluoride, beryllium, lithium, polonium-210, thorium-230, and uranium-238. As discussed in sections below, fluoride, polonium-210, thorium-230, and uranium-238 have all been recommended for inclusion based on comments from reviewers.

⁹ See WLWB Online Registry for [Rayrock - IR Response from CIRNAC-CARD - Rayrock HHERA - Nov 20 20](#).

Major Ions

GNWT-ENR (comment 2) and ECCC (comment 2) both indicated the need to update the list of major ions to include fluoride. CIRNAC-CARD responded that it is monitored as part of the AEMP; however, it isn't included anywhere in the Plan.

- ***Design Plan Revision #15: Table 1-1 and Section 5.2 of Version 1.1 of the AEMP Design Plan is to be revised to include monitoring for fluoride.***

Nutrients

GNWT-ENR (comment 12) recommended the inclusion of ammonia and orthophosphate as nutrients to be monitored as part of the AEMP. CIRNAC-CARD responded that the AEMP includes monitoring of total ammonia and total phosphorus (TP), and noted that TP includes orthophosphate, which CIRNAC-CARD believes to be sufficient at this time. The Board has confirmed that the Plan includes total ammonia and TP. The Board agrees that monitoring for TP is likely sufficient at this time and notes that monitoring orthophosphate could be considered as a potential response to a TP Action Level Exceedance. This is further discussed in Section 3.8.3 of this Reasons for Decision.

Metals

GNWT-ENR recommended that the dissolved fraction be monitored in addition to totals because the dissolved fraction better reflects bioavailability of metals (GNWT-ENR comment 3). Alternatively, GNWT-ENR recommended CIRNAC-CARD provide rationale for only including the total fraction. CIRNAC-CARD indicated that because the goal is to monitor for increases over the course of the Project and that the HHERA determined that current concentrations do not pose a risk, CIRNAC-CARD is of the opinion that monitoring the dissolved fraction does not contribute to its understanding of site conditions. While not stated by CIRNAC-CARD in its response, the Board understands from Section 4.0 of the Plan (i.e., Problem Formulation) that the Project is expected to have no net effect on conditions in the Receiving Environment which is likely why CIRNAC-CARD believes the HHERA conclusions suggest that monitoring for total metals is sufficient at this time. Given that there are no predicted increases at this time, the Board agrees that this is likely sufficient; however, notes that monitoring the dissolved fraction could be considered as a potential response to an Action Level Exceedance. This is further discussed in Section 3.8.3 of this Reasons for Decision.

Radionuclides

The Tłı̨chǫ Government (comment 7) recommended that water be monitored for polonium-210 and thorium-230, in addition to lead-210 and radium-226, because these are both elevated in sediments of Mill Lake. CIRNAC-CARD responded that Table 1-1 provides the Licence requirements and that the 2021 radionuclides listed in Section 3.3 of the Plan for water and sediment samples will be analyzed for the AEMP. As discussed in Section 3.1.1 of this Reasons for Decision, the Licence does not specify what parameters are to be monitored by the AEMP and the AEMP does not need to be limited to the variables required by the Licence. In addition, Section 3.3 of the Plan provides a summary of existing baseline data for the Project. While it appears that water quality samples in 2021 included the following suite of radionuclides: lead-210, polonium-210, radium-226, thorium-228, thorium-230, thorium-232, uranium-

234, uranium-235, uranium-238, there is not one table in Section 3.3 of the Plan that clearly outlines all the parameters monitored for baseline in 2021, and the Tłı̨chǰ Government (comment 15) pointed out differences in what radionuclides were monitored across sampling dates in 2021. Overall, Section 3.3 of the Plan is not clear on what is intended for monitoring as part of the AEMP moving forward. Meanwhile, Section 5.2 of the Plan only indicates that the AEMP will include at a minimum lead-210 and radium-226. The parameters to be monitored should be clearly outlined in the AEMP Design section (i.e., Section 5.2 for water chemistry); readers should not have to infer this based on what was done historically.

- ***Design Plan Revision #16: Table 1-1 and Section 5.2 of Version 1.1 of the AEMP Design Plan is to be revised to include the full list of radionuclides to be monitored in water samples as part of the AEMP, including the two recommended by the Tłı̨chǰ Government (i.e., polonium-210 and thorium-230).***

3.3.3 Sampling Methods

The methods describe that water quality samples will be taken within 10 cm of the water surface. The Tłı̨chǰ Government commented that concentrations may vary throughout the water column and recommended that CIRNAC-CARD justify why only the topmost 10 cm surface water is to be sampled (TG comment 84). CIRNAC-CARD responded that sampling locations should be as consistent as possible so they will be taking the samples at the same location in the water column to maintain this consistency; however, indicated that sampling at different depths would be a potential response if action levels are triggered. The Board agrees that sampling consistency is important but notes that the Response Framework does not include sampling at depth as a response action. This is further discussed in Section 3.8.3 of this Reasons for Decision.

The Tłı̨chǰ Government recommended inclusion of chronic toxicity testing on the treatment plant discharge (TG comment 5). The recommendation did not provide rationale for why this is necessary. CIRNAC-CARD responded that the AEMP is intended to show that the remediation is not changing the aquatic environment and that results indicating change would be investigated. CIRNAC-CARD also indicated some concern with the sensitivity of chronic toxicity testing and the associated implications of a potentially failed test. CIRNAC-CARD suggested that results of the benthic community monitoring would inform on chronic effects. As discussed in the Board's Reasons for Decision for the Issuance of the Licence,¹⁰ the Board did not include requirements for chronic toxicity testing as part of the Licence, including within the SNP. In its Reasons for Decision, the Board noted "...that there is a requirement for an AEMP..., which is expected to include monitoring of effects to aquatic species and allow for adaptive management to avoid long-term chronic effects." Given the EQC for the project are intended to lead to no change in Sherman Lake and the Board decided not to include chronic toxicity testing in the Licence, the need for chronic toxicity testing as part of the AEMP at this time is unclear. Should water quality monitoring in the Receiving Environment indicate that increases are occurring, chronic toxicity testing could be explored as a potential response action to a Low Action Level Exceedance. This is further discussed in Section 3.8.3 of this Reasons for Decision.

¹⁰ See WLWB Online Registry for [Rayrock - Licence and Permit - Reasons for Decision - Sep 30 21](#).

3.3.4 Sampling Frequency

Table 3-1 of the Plan provides a description of the Project's SNP stations, including the proposed end points for monitoring. Table 3-2 also provides a description of proposed end points for AEMP stations. Several stations indicate the following endpoints for testing: "Testing to end when TDS and metal concentrations remain consistent two consecutive years after remediation" or "Testing to end after three consecutive years of consistent results with at least two years being after remediation". Several comments and recommendations regarding this were received during the public review. Specifically, reviewers requested clarity on the meaning of "consistent" (ECCC comment 8; TG comment 81), clarity on the location for which the consistency of results would be evaluated (GNWT-ENR comment 7), and justification for why two years is enough to represent a consistent trend (TG comment 80). CIRNAC-CARD clarified that sampling evaluation would be for each station individually and committed to revising the proposed end point to be "no changes after a minimum of five years post-remediation". CIRNAC-CARD also indicated that "consistency" would be assessed through the statistical analyses described in the Plan.

Board staff asked if these endpoints referred to monitoring via the AEMP or for compliance under the Licence (i.e., the SNP). CIRNAC-CARD clarified that the endpoints identified for the SNP stations in Table 3-1 are meant to refer to the monitoring associated with the AEMP and the compliance monitoring under the Water Licence.

Endpoints for AEMP sampling sites are not typically pre-determined. Changes to the AEMP Design are expected to be proposed in the AEMP Design Plan and considered through the AEMP Re-evaluation Report (see Part F, Conditions 3 and 4 of the Licence). This allows all reviewers to have a comprehensive look at the AEMP's results and provide recommendations on need for future monitoring. Furthermore, endpoints for SNP sampling as part of the Licence have not been pre-determined. Changes to SNP monitoring require a request to the Board to consider an update to the SNP.

- ***Design Plan Revision #17: Version 1.1 of the AEMP Design Plan is to be revised to remove the sampling endpoints from Table 3-1 and Table 3-2.***

3.3.5 Discharge Objectives

The Tłı̨chq Government commented on CIRNAC-CARD's commitment to treat Mill Lake water to achieve discharge concentrations that meet the EQCs in the Water Licence and state that this is a bit different than what the Tłı̨chq Government understood (TG comment 60). The Tłı̨chq Government's understanding was that it would be treated so that water would meet or better the Canadian Council of Ministers of the Environment (CCME) Guidelines for the protection of freshwater aquatic life (CCME Guidelines), and that for parameters that have no guideline, these concentrations would meet or better the water quality of Sherman Lake in an area free from site impacts. The Tłı̨chq Government also commented that they did not fully agree with the EQCs listed in the Licence as they did not include all the radionuclides of concern. The Tłı̨chq Government thus recommended that it wants to see discharge objectives (i.e., Site Specific Remediation Objectives) set for radionuclides of concern at site (i.e., lead-210, radium, polonium, and thorium). The Board already decided not to include radionuclides in the Licence as EQC. The Board also notes that EQCs were set so that water would meet or better the CCME Guidelines, and for parameters

that have no guideline, these concentrations would meet or better the water quality of Sherman Lake in an area free from site impacts. Because the AEMP is about monitoring for project-related effects in the aquatic environment, the Board is of the opinion that the AEMP is not the place to have Site Specific Remediation Objectives (SSROs). SSROs would likely be better addressed via the Remediation Action Plan (RAP). The AEMP does include the monitoring of radionuclides, which could inform SSROs.

3.4 Sediment Quality

3.4.1 Monitored Variables

Section 5.2 of the Plan provides the list of variables that will be measured for all the sediment quality samples. These include physical variables (e.g., moisture and particle size), extractable nutrients, total metals, and radionuclides.

Metals

ECCC commented that for the analysis of metals in sediment samples, it is not specified whether it will be for total metals or extractable metals (ECCC comment 10). ECCC commented that the methodology should be comparable to previous analyses and recommended that the analytical methods be clarified. CIRNAC-CARD responded that the analytical method must produce concentrations that permit comparison to CCME Sediment Quality Guidelines and that it understands this would mean total metals. To address this comment, CIRNAC-CARD should provide the details in the Plan and ensure that the analytical methods used in 2021 are the same for all future AEMP work, including additional baseline data to be collected in 2022 (see Section 3.4.2 of this Reasons for Decision).

- ***Design Plan Revision #18: Version 1.1 of the AEMP Design Plan is to be revised to provide details of the analytical methods being used for analysis of metals in sediment samples.***

Radionuclides

As for water quality, the Tłıchq Government recommended that sediment be monitored for polonium-210 and thorium-230, in addition to lead-210 and radium-226, because these are both elevated in sediments of Mill Lake (TG comment 7). ECCC recommended that at minimum, sediments be sampled for lead-210, polonium-210, and radium-226 (ECCC comment 12). Also similar to water quality, the Tłıchq Government (comment 17) pointed out differences in what radionuclides were monitored across sampling dates in 2021. These topics were discussed in the water quality section of this Reasons for Decision (i.e., see Section 3.3.2) and a similar revision is being required here for the same reasons.

- ***Design Plan Revision #19: Table 1-1 and Section 5.2 of Version 1.1 of the AEMP Design Plan is to be revised to include the full list of radionuclides to be monitored in sediment samples as part of the AEMP, including those recommended by the Tłıchq Government and ECCC (i.e., lead-210, polonium-210, radium-226, and thorium-230).***

3.4.2 Sampling Methods

Replication

Section 6.2 of the Plan describes that sediment samples will be collected using a sediment grab sampler (an Ekman or a Petite Ponar) and that each sample will be a composite of triplicate grab samples taken within 5 m of each other. In contrast, the AEMP Summary Table (i.e., Table 1-1) at the beginning of the document indicated that sediment sampling will include one discrete sample of the sediment surface. Based on responses received during the public review, and discussed in paragraphs below, the methods in Section 6.2 appear to be the ones that were used for 2021 and are proposed for future sediment sampling as part of the AEMP.

ECCC commented that Environment Effects Monitoring (EEM) guidance recommends a minimum number of five replicate samples within a sampling station because of the need for statistical power and to deal with heterogeneity in the substrate (ECCC comment 6). ECCC recommended that CIRNAC-CARD provide rationale for its use of three subsamples per station. In its response, CIRNAC-CARD references its response to ECCC comment 5 but ECCC comment 5 is about benthic invertebrate sampling methods and the guidance from EEM on this is different. This response also appears to indicate a potential misunderstanding on CIRNAC-CARD's part about the difference between replicates and subsamples. Section 7.2.8 of the EEM guidance is clear that if replicate samples are recommended, the collection of a minimum number of five separate samples within a station should be collected. Instead, CIRNAC-CARD is taking a single composite sample of three grab samples. This does not appear to be the standard methods recommended by EEM and could influence the ability to adequately characterize variation at the site and make comparisons over time more challenging.

This issue appears to be further supported by the significant difference between the sediment results at two different nearby sites in Sherman Lake (as discussed in TG comment 23). In response to the Tłıchq Government's comment on this, CIRNAC-CARD states that concentrations at the site are highly variable and that the sediment is not homogeneous – CIRNAC-CARD specifically states the following things to consider: only two samples have been obtained from each station and concentrations varied in samples from the same location. CIRNAC-CARD also stated that “trying to investigate or explain the differences in concentrations is not a priority for future site work and is not necessary for the AEMP”. While the AEMP may not be designed to explain why there are differences among samples from the same location, it is monitoring for changes in baseline conditions at each location, and if found, one goal would be to understand if it is related to the remediation work. If sediment samples from the same location are indeed highly variable, greater replication would be required to improve the estimate of the sediment variables at each location.

Overall, it is the Board's opinion that the sampling methods are not adequate and that it would be best to treat each sample separately – for a minimum of three replicates. If composites for each sample are required to achieve sufficient volume, this means that a total of nine grabs would be needed per location (i.e., three samples each made up of three subsamples). Ideally, five replicate samples as per EEM guidance would be taken; however, the Board has no information from CIRNAC-CARD on the feasibility of this. The Board requires CIRNAC-CARD to collect at least three replicate sediment samples per station in 2022 to improve baseline and to strongly consider increasing to up to five as per ECCC's recommendation.

- **Baseline Sampling Requirement #2: CIRNAC-CARD is to collect additional sediment baseline samples in 2022 to align with EEM guidance on replication. A minimum of three separate replicates per location must be taken.**
- **Design Plan Revision #20: CIRNAC-CARD is to provide updated baseline results for sediment in Version 1.1 of the AEMP Design Plan.**
- **Design Plan Revision #21: Version 1.1 of the AEMP Design Plan is to be revised to reflect updated replication for sediment sampling. Table 1-1 should also be revised to correctly reflect methods outlined within the Plan.**

Homogenization

ECCC recommended that the methods used to homogenize sediment subsamples prior to placement into lab containers be provided (ECCC comment 6). CIRNAC-CARD provided details of the methods in its response and the Board is of the opinion that these should be included in the Plan. However, based on the required revisions above, it is unclear if subsampling will still occur within replicate samples. Regardless, the Board is of the opinion that whatever material being used for the replicate be homogenized prior to placing into lab containers.

- **Design Plan Revision #22: Version 1.1 of the AEMP Design Plan is to be revised to include details on how sediment samples are homogenized prior to placement into lab containers. This method update should take into consideration the updated sediment sampling methods required by Baseline Sampling Requirement #2 and Design Plan Revision #21.**

3.4.3 Sampling Frequency

GNWT-ENR asked a question about the end points for monitoring sediment at SNP Stations (GNWT-ENR comment 8). This is related to the following statements that were included in Table 3-1 of the Plan: “Testing to end when TDS and metal concentrations remain consistent two consecutive years after remediation” or “Testing to end after three consecutive years of consistent results with at least two years being after remediation”. GNWT-ENR was seeking clarity on the location and list of variables that this would apply to and recommended that it should not apply only to metals. CIRNAC-CARD responded that the analysis is limited to metals because these are the primary focus of concern documented and discussed in the HHERA. CIRNAC-CARD’s response also referred to its response to GNWT-ENR comment 7, which the Board interprets to mean that the sampling evaluation would be for each station individually and that CIRNAC-CARD is committing to changing the proposed end point to be no changes after a minimum of five years post-remediation. With respect to including end points, this same issue is discussed in the water quality section of this Reasons for Decision and the same revision is being required here for the same reasons (i.e., see Design Plan Revision #5). With respect to only including metals, CIRNAC-CARD does not have to limit the assessment to metals because of the conclusions of the HHERA. The AEMP will be monitoring for other variables and as discussed in Section 3.3.4 of this Reasons for Decision, changes to the AEMP Design and updates to the SNP require Board approval. Requests to change these should be accompanied with rationale and will undergo public review. Thus, it is in CIRNAC-CARD’s best interest to

consider what other parties may want to understand about changes in sediment quality variables over time prior to requesting a reduction in monitoring.

3.4.4 Use of Guidelines

The Tłıchq Government noted that the CCME Probably Effects Level (PEL) and the Thompson Sever Effect Level (SEL) guidelines are used and referenced throughout the document but not described anywhere (TG comment 3). The Tłıchq Government recommended that they be described in the AEMP (TG comment 3). CIRNAC-CARD's response focussed on how these guidelines should or should not be used; however, the Tłıchq Government appears to simply be asking that a description of the guidelines used and referenced in data tables throughout the AEMP be provided. The Board is of the opinion that this is a reasonable request.

- ***Design Plan Revision #23: Version 1.1 of the AEMP Design Plan is to be revised to include a description of all sediment guidelines used and referenced in data tables throughout the Plan.***

3.5 Plankton

The AEMP Design for Rayrock does not include a plankton component (phytoplankton or zooplankton). GNWT-ENR commented that based on the potential exposure pathways (i.e., via direct contact with water), evaluation of potential impacts on phytoplankton and zooplankton should be an important component of the AEMP (GNWT-ENR comment 4). GNWT-ENR recommended that plankton metrics be included in the AEMP Design for Sherman Lake or that CIRNAC-CARD provide rationale for why these components are not included, considering the exposure pathway (GNWT-ENR comment 4). CIRNAC-CARD responded that the AEMP was based on requirements of the Licence. CIRNAC-CARD stated that overall, it is a weight-of-evidence approach and that plankton were not included; rather, the power of the higher trophic elements (i.e., fish) is the focus of this AEMP.

AEMP components are not necessarily based on requirements of the Licence; as discussed above, AEMPs are meant to look for effects in the Receiving Environment. Given the exposure route is via water, effects on plankton may be detected sooner than in higher trophic levels such as fish. Also, if effects to fish health are observed, understanding changes in plankton could be an important part of understanding effects detected in fish. The Board is not convinced with the rationale provided by CIRNAC-CARD for not including plankton in the AEMP. While inclusion in the AEMP every year may not be necessary, it may be important at some point, and if no baseline data is available, there will be no opportunity to understand potential changes in the plankton community following remediation. GNWT-ENR commented that there would be opportunity to collect baseline samples in 2022 (GNWT-ENR comment 9). The Board is of the opinion that at minimum, baseline phytoplankton and zooplankton samples should be collected for Sherman Lake and corresponding reference lakes in 2022. This baseline data should be included in the next version of the AEMP. The next version of the AEMP Design Plan should include plans for future plankton monitoring or more detailed rationale for why plankton should not be included as part of the annual monitoring and Response Framework at this time.

- **Baseline Sampling Requirement #3: CIRNAC-CARD is to collect phytoplankton and zooplankton baseline samples in 2022 for Sherman Lake and relevant reference lakes.**
- **Design Plan Revision #24: CIRNAC-CARD is to provide baseline results for phytoplankton and zooplankton in Version 1.1 of the AEMP Design Plan.**
- **Design Plan Revision #25: Version 1.1 of the AEMP Design Plan is to be revised to include either (a) plans for future plankton monitoring with inclusion of plankton in the Response Framework or (b) more detailed rationale for why plankton should not be included as part of the annual monitoring at this time.**

3.6 Benthic Invertebrates (Benthos)

3.6.1 Sampling Locations

As per Table 5-2 in the Plan, benthos sampling will take place in Exposure Areas, Down-stream Areas, and Reference Areas. Board staff commented that the Reference Areas to be used for comparison to Exposure Areas is not clear (WLWB staff comment 13). Board staff asked CIRNAC-CARD to confirm whether the two Down-stream Areas (i.e., Lake A and Lake B) have Reference Areas that they will be compared against. CIRNAC-CARD responded that Reference Areas are intended to demonstrate regional effects on benthic populations. Small water bodies will be compared to Kwetsõtia B, while large water bodies will be primarily compared to Alternative Reference Lake A. Based on this response, it is the Board's understanding that the Down-stream Areas represent large water bodies, would be considered potentially affected areas, and will be compared to Alternative Reference Lake A. Other components (i.e., the aquatic environment shoreline survey and fish assessment) do not include the Down-stream Areas, as such, clearer descriptions of the purpose and use of the Down-stream areas in the benthos assessment would be helpful. It is also unclear how Lake B is being considered a potentially affected lake for the benthos assessment when it is considered a Reference Lake for the water and sediment component of the program.

- **Design Plan Revision #26: Version 1.1 of the AEMP Design Plan is to be revised to include descriptions of the purpose and use of the Down-stream Areas in the benthos assessment, with clarification on whether Lake B is meant to be a reference location or a potentially impacted location.**

3.6.2 Sampling Methods

Taxonomic Analysis - Replication

As described in Section 6.3 of the Plan, benthos sampling for taxonomic analysis (i.e., density, taxonomic composition, and diversity) will involve collection of one composite sample of three subsamples taken within 5 m of each other using an Ekman grab or a Petite Ponar.

ECCC commented that as per EEM guidance, the recommended benthic sampling protocol is five stations with a minimum of three subsamples per station, taken from the dominant habitat type (ECCC comment

5). ECCC commented that the single sample per station (made up of three field subsamples) may not have been sufficient to characterize the benthic communities, given inherent variability associated with substrate and communities. ECCC stated that expanding the number of stations may be appropriate for the larger lakes and recommended that CIRNAC-CARD provide a rationale for using only one station per lake (ECCC comment 5).

In response, CIRNAC-CARD stated they were unable to find EEM guidance showing five subsamples for a composite; however, this was not what ECCC's comment was referencing. ECCC commented that EEM guidance recommends five samples per station, each made up of three subsamples. In other words, the replication per station is not sufficient based on EEM guidance. CIRNAC-CARD also stated that multiple stations are used for the Sherman Lake waterbody, which is the only potentially impacted lake that is large enough for more than one station, and that reference lakes do not need multiple locations for a design plan looking for changes over time at each location.

It is the Board's understanding that the recommendation for multiple replicates per station is to ensure appropriate characterization of the benthos community given the variability associated with substrates and benthic invertebrate communities. CIRNAC-CARD's response has not addressed how its sampling design addresses this concern. CIRNAC-CARD's response seems to indicate that stations within Sherman Lake are replicate stations of each other, but the AEMP Design suggests that the stations in Sherman Lake have been selected to monitor different potential impacts and it is not clear if they will be analyzed together (as true replicates) or separately (as different impacted locations) in the Before-After-Control-Impact (BACI) analysis.

Beyond indicating some limitation in the number of stations for smaller lakes, CIRNAC-CARD has not provided any details on limitations to increasing the sampling effort for benthos to align more closely with the EEM recommendations. EEM guidance recommends that replicate stations be 10x10 m in size and separated by at least 20 m. Based on the lake information provided in Section 3.2 of the Plan, the smallest lake is Beta Lake with an approximate area of 1800 m². Based on a quick calculation, this area should be large enough to have at least three stations – possibly four – depending on the shape of the contour and the substrate variability.

Based on all the above information, the Board requires increased replication for the benthos component. The exact amount of replication is difficult to determine because it is unclear if Sherman Lake sites are being used as replicates in the analysis or not. As a compromise, the Board requires at least three stations per site, and encourages CIRNAC-CARD to include five where possible. This could be less for Sherman Lake if CIRNAC-CARD can demonstrate that the stations in Sherman Lake are appropriately being used as replicates. To address this replication issue, additional baseline sampling will need to take place in 2022.

The need for better baseline as a starting point is also supported by CIRNAC-CARD's response to Tłıchq Government's comment 38, which noted relatively large differences in density of benthos in 2017 versus 2021. In response to this comment, CIRNAC-CARD stated that it is better to observe for changes at a set location using a rigorous and repetitive process.

- ***Baseline Sampling Requirement #4: CIRNAC-CARD is to collect additional benthos baseline samples in 2022 to align with EEM guidance on replication. A minimum of three separate***

replicates per location should be taken. This could be less for Sherman Lake if CIRNAC-CARD can demonstrate that the stations in Sherman Lake are appropriately being used as replicates.

- ***Design Plan Revision #27: CIRNAC-CARD is to provide updated baseline results for benthos in Version 1.1 of the AEMP Design Plan.***
- ***Design Plan Revision #28: Version 1.1 of the AEMP Design Plan is to be revised to reflect updated replication for benthos sampling. Table 1-1 should also be revised to correctly reflect methods outlined within the Plan.***

Tissue Collection Methods

As described in Section 6.3 of the Plan, benthic invertebrates are collected for tissue analysis of metal and radionuclides using a kick and sweep method with a D-net. The Tłıchq Government commented on the absence of samples collected for this analysis from Gamma Lake, Beta Lake, and Alpha Bay in 2021 (TG comment 39). The Tłıchq Government recommended that tissue samples be collected at all waterbodies in 2022 and that alternative methods be considered to ensure successful collection of samples from all sites (TG comment 39). The Tłıchq Government also recommended that benthic tissue samples be analyzed for radionuclides (TG comment 39). CIRNAC-CARD responded that additional sampling effort will be conducted in 2022 to collect benthic invertebrates for tissue analysis and that it will consider the use of alternative methods if necessary. CIRNAC-CARD also stated that benthic samples would be analyzed for radionuclides if sample volume is sufficient. The Board is of the opinion that best efforts should be made to collect sufficient volume for radionuclide analysis. The methods used to improve benthos sampling for tissue analysis should be described in the Plan so that the methods used are consistent moving forward.

- ***Baseline Sampling Requirement #5: CIRNAC-CARD is to collect additional baseline benthos tissue samples in 2022 to ensure that all lakes have baseline data. Best efforts should be made to collect sufficient volume for radionuclide analysis.***
- ***Design Plan Revision #29: CIRNAC-CARD is to provide updated baseline results for benthos tissue samples in Version 1.1 of the AEMP Design Plan.***
- ***Design Plan Revision #30: Version 1.1 of the AEMP Design Plan is to be revised to expand on the methods used to improve benthos sampling for tissue analysis.***

3.6.3 Taxonomic Methods

In Section 3 of the Plan, Table 3-30 outlines the species identified in the 2021 samples. ECCC commented that the table includes several species that are epibenthic or planktonic (*Hyalella*, *Gammarus*, *Daphnia*, *Epischura*) or terrestrial (*Pseudoscorpionida*) rather than benthic (ECCC comment 9) and stated that it is unclear how non-benthic invertebrates were treated in the summary statistics and metals analyses. ECCC recommended that CIRNAC-CARD clarify how non-benthic invertebrates were handled in the sample data (ECCC comment 9). CIRNAC-CARD responded that *Hyalla* were included within benthic indices because

they are primarily sediment surface dwellers. CIRNAC-CARD also responded that *Daphnia* numbers in Kwetsq̄tia were incorrectly tabulated in the indices and would have skewed the results. CIRNAC-CARD committed to clarifying the methodology to exclude them and update the AEMP benthic indices. The Board notes that this does not address all the potential non-benthos species included in ECCC's comment, so when this gets clarified in the next version, CIRNAC-CARD should make sure to address all species that may not be considered exclusively benthic.

- ***Design Plan Revision #31: Version 1.1 of the AEMP Design Plan is to be revised to clarify the methodology used for excluding species from benthos indices. This should address all species that may not be considered exclusively benthic.***
- ***Design Plan Revision #32: Version 1.1 of the AEMP Design Plan is to be revised to update the baseline benthos indices based on methods described in Design Plan Revision #31.***

One of the indices used in the benthic assessment is taxonomic richness. This represents the total number of taxonomic categories found in the sample. GNWT-ENR commented that clarity should be added around the taxonomic level (e.g., species, genus, family) used in the richness calculation (GNWT-ENR comment 16). CIRNAC-CARD responded that the recommended level of taxonomic identification is family for freshwater systems – as indicated in Section 6.3.1 of the Plan. The Board notes that other parts of the Plan discussed identification to genus. This should be corrected throughout the Plan for consistency.

- ***Design Plan Revision #33: Version 1.1 of the AEMP Design Plan is to be revised throughout to clarify that taxonomic identification for benthic invertebrates will be to the family level.***

3.7 Fish

3.7.1 Sampling Locations

The fish sampling program for Rayrock includes several sites in Sherman Lake and several sites in two different reference lakes (i.e., New Control Lake and Alternate Reference Lake). Section 3 of the Design Plan provides data for the two reference lakes and both reference lakes are included in the AEMP Summary Table (i.e., Table 1-1). Section 6.4 of the Plan states:

In 2021, both New Control Lake and Alternative Reference Lake were used for reference, but yields were poor from New Control Lake and were good from Alternative Reference Lake. Only Alternative Reference Lake will be used as reference for future assessments.

The plan to only continue fish assessments in Alternative Reference Lake was also confirmed in response to comment 65 from the Tłjchq̄ Government.

- ***Design Plan Revision #34: Table 1-1 in Version 1.1 of the AEMP Design Plan is to be revised to remove New Control Lake as a site used for the fish assessment.***

3.7.2 Sampling Frequency

As described in Section 5.4, Table 5-3 of the Plan, fish sampling is proposed to take place every three years, once during each program phase. In response to comments 44 and 48 from the Tłjchq Government and WLWB staff comment 9, CIRNAC-CARD indicated that it will now be conducting an annual sampling program for Slimy Sculpin.

- ***Design Plan Revision #35: Version 1.1 of the AEMP Design Plan is to be revised to include the annual sampling frequency for Slimy Sculpin.***

3.7.3 Sampling Parameters

Target Species

The target species to be used in the fish assessment is not clear in the Plan. Section 5.4 of the Plan discusses the different potential and preferred target species for large-and small-bodied fish but also discusses variation in CIRNAC-CARD's ability to catch them. For example, Section 5.4 states:

Northern pike are the large-bodied species that has consistently been captured during sampling events in Sherman Lake; however, lake whitefish should also be targeted as they are important target species for both recreational and Indigenous users.

It is unclear if this means that both Northern Pike and Lake Whitefish will be target species or if the target species will differ across lakes. Baseline data from 2021 shows that most lakes did not end up with 20 of either potential target species, which also raises the question about whether CIRNAC-CARD is considering pooling data from the different fish species. Pooling data from Northern Pike and Lake Whitefish would arguably not be appropriate given that Northern Pike is predominantly carnivorous while Lake Whitefish are planktivore/benthivores.

Similar ambiguities are present for small-bodied fish in the Plan. Section 5.4 states:

A species like slimy sculpin or ninespine stickleback, that may be more directly exposed to contaminated water and sediment, would be an ideal sentinel species for effects monitoring, so additional effort was expended during the 2021 pre-remediation sampling program to target a small-bodied species of fish, in Sherman Lake, for analysis. The species that is captured in the highest abundances in the sampling locations will be used as the small-bodied target species.

The Plan does not proceed to clearly state which species it will be and if it will be the same for all lakes. In fact, Table 5-3 states that large-bodied fish will be Northern Pike or Lake Whitefish and that small-bodied fish will be Slimy Sculpin, Spottail Shiner, or Ninespine Stickleback (emphasis added by the Board).

The Tłjchq Government commented on CIRNAC-CARD's statement in the Plan about selecting the species with the highest abundance to be the target species and said that this approach may be the easiest but does not give the best data for impact assessment (TG comment 61). The Tłjchq Government commented

that it would be better to select a target species that has a diet and range of travel that would provide the most accurate indication of impact for a localized area (TG comment 61). The Tłı̨ch̨ Government stated that Slimy Sculpin would be the ideal target and that a different sampling approach would have resulted in greater success (TG comment 61). The Tłı̨ch̨ Government recommended that it would like to see Slimy Sculpin used as target species, with additional effort made to capture it instead of Ninespine Stickleback (TG comment 61). CIRNAC-CARD responded that it will begin an annual sampling effort for Slimy Sculpin in 2022 with more effort expended. However, in response to Tłı̨ch̨ Government comment 49 about an observation in one Ninespine Stickleback, CIRNAC-CARD suggested that fishing effort in 2022 would help identify if this was representative of a broader population response. It is unclear to the Board why 2022 would help resolve this observation since it is stated everywhere else that the goal of the 2022 sampling program is to capture Slimy Sculpin.

While CIRNAC-CARD has committed to additional baseline sampling in 2022 for Slimy Sculpin, no commitment for additional large-bodied fish sampling has been made. The Board recognizes that large-bodied fish are only proposed to be sampled once in each phase of the Project and that the assessment requires sacrifice of 40 fish per waterbody; however, it is unclear to the Board how the current baseline data is sufficient given that 20 individuals of any one potential large-bodied fish species has not been captured in Alternate Reference Lake; whereas in Sherman Lake, 21 Northern Pike were caught but only two Lake Whitefish were captured. It seems that there is opportunity to address gaps in the baseline data seeing as the numbers of target fish were not achieved and choice of target species seems undecided.

The target species for both small- and large-bodied fish needs to be clearly identified and selected in the Plan now so that it is clear which species will be used for comparisons in the future. This selection is also necessary to help determine if there is adequate baseline data for the target species. Additional baseline data should be collected in 2022 to address any gaps and the methods used to improve fish sampling should be described in the Plan so that the methods used are consistent moving forward.

- ***Design Plan Revision #36: Version 1.1 of the AEMP Design Plan is to be revised to clearly identify the target small-bodied and large-bodied fish to be used in the AEMP.***
- ***Baseline Sampling Requirement #6: CIRNAC-CARD is to collect additional baseline small- and large-bodied fish samples in 2022 to ensure that all lakes have adequate baseline data. Best efforts should be made to collect 20 individuals of the target species for each lake.***
- ***Design Plan Revision #37: CIRNAC-CARD is to provide updated baseline results for fish in Version 1.1 of the AEMP Design Plan.***
- ***Design Plan Revision #38: Version 1.1 of the AEMP Design Plan is to be revised to include more details on methods used to capture the required baseline fish.***

Tissue Analysis

Sections 5 and 6 of the Plan present details on the methods and analysis for fish tissue samples. There is no clear table in these sections outlining the suite of metals and radionuclides to be analyzed. This lack of clarity is compounded because not all parameters reported in Section 3 of the Plan seem to be carried

over into Sections 5 and 6, so it is not clear what baseline data will be considered in the future. The Tłıchq Government had a comment about the radionuclides that were sampled and recommended that the radionuclide analysis/reporting suite for fish tissue should be clearly stated so that future sampling programs are consistent (TG comment 51).

- ***Design Plan Revision #39: Version 1.1 of the AEMP Design Plan is to be revised to include tables outlining what metals and radionuclides will be analyzed in fish tissue as part of the AEMP.***

The Tłıchq Government commented that the 2021 radionuclide analysis in fish tissue was limited to muscle tissue and recommended that it would be better to analyse liver, kidney, or bone tissues when looking for radionuclide impacts (TG comment 50). ECCC recommended that the program include analysis of lead-201, polonium-210, and radium-226 in bone tissue as part of the AEMP for fish tissue analysis (ECCC comment 13). In response, CIRNAC-CARD stated that they agreed and that they would include bone tissue collection as part of the AEMP. While it is great that CIRNAC-CARD is agreeable to including this moving forward, it is not clear how the results would be evaluated as part of the AEMP since no baseline data for radionuclides in these tissues is available. The Board is thus of the opinion that baseline data for bone tissue should be collected in 2022, or CIRNAC-CARD should be able to explain how this data could be used in the future in the absence of baseline data.

The Tłıchq Government also noted that in 2021, no small-bodied fish were submitted for metal and radionuclide analysis and recommended that they should be (TG comment 48). CIRNAC-CARD responded that they would be adding annual Slimy Sculpin collection to the program and would be collecting the relevant baseline in 2022.

- ***Baseline Sampling Requirement #7: CIRNAC-CARD is to collect baseline bone tissue data for small-and large-bodied fish in 2022.***
- ***Design Plan Revision #40: CIRNAC-CARD is to provide updated baseline results for small- and large-bodied fish bone tissue in Version 1.1 of the AEMP Design Plan.***
- ***Design Plan Revision #41: Version 1.1 of the AEMP Design Plan is to be revised to include bone tissue sampling for small- and large-bodied fish. If no baseline sampling for large-bodied fish takes place in 2022, CIRNAC-CARD should clearly explain how it will use bone tissue data for large-bodied fish moving forward in the absence of baseline data.***

Catch Per Unit Effort (CPUE)

One of the variables to be included in the fish assessment is catch per unit effort (CPUE). During the public review, the Tłıchq Government commented on a statement from CIRNAC-CARD regarding its goal to ensure equal proportions of the same species of fish will be pursued at sampling stations and noted that for CPUE to be relevant, it is a comparison of the relative abundance to other sampling events in the same location at the same time of year. The Tłıchq Government asked CIRNAC-CARD to explain how equal proportions of fish species will be collected at both lakes and how past CPUEs would be relevant (TG comment 65). CIRNAC-CARD's response did not address the questions but acknowledged that the statement sounded at odds with comparisons of CPUE between years. The Board also notes that it is not

entirely clear how CPUE will be evaluated moving forward. While it is referenced in Sections 5 and 6 of the Plan, it is not included in the table outlining the fish survey measurements for the AEMP assessment (i.e., Table 6-2).

- ***Design Plan Revision #42: Version 1.1 of the AEMP Design Plan is to be revised to:***
 - ***(a) indicate how CPUE data is being used in the fish assessment for the AEMP, and***
 - ***(b) how CPUE data over time will remain relevant if sampling methods are changing.***

von Bertalanffy Growth Parameters

Section 3.5 of the Design provides von Bertalanffy Growth Parameters (vBGPs) for Northern Pike and Lake Whitefish from 2021. The Tłıchq Government noted that the three parameters were not defined and there was no discussion of what they represented (TG comment 47). The Tłıchq Government asked CIRNAC-CARD to explain the purpose of the vBGPs and the associated findings. CIRNAC-CARD provided a response and committed to defining this in the next version. CIRNAC-CARD also suggested that future datasets could improve the analysis.

In reviewing comment 47 from the Tłıchq Government regarding von Bertalanffy Growth Parameters (vBGPs), the Board noted that it is also unclear how vBGPs will be part of future assessments because they are not included in Sections 5 or 6 of the Plan. This should be clarified and highlights once again the importance of making sure that Sections 5 and 6 of the Plan are clear on expectations of the AEMP moving forward.

- ***Design Plan Revision #43: Version 1.1 of the AEMP Design Plan is to be revised to:***
 - ***(a) define the vBGPs,***
 - ***(b) explain their purpose and the associated findings, and***
 - ***(c) clarify if and how they will be used in the fish assessment for the AEMP.***

3.7.4 Sampling Methods

Small-bodied Fish

As described in Section 3 of the Plan, CIRNAC-CARD encountered difficulties capturing small-bodied fish in 2021.

The Tłıchq Government commented on the sampling methods used to catch small-bodied fish. Specifically, the Tłıchq Government commented that a minnow seine would not typically be used for this species and recommended that a different method be used if the intention is to capture Slimy Sculpin (TG comment 44). CIRNAC-CARD responded that additional sampling for Slimy Sculpin will take place in 2022 with more time and planning to incorporate appropriate methods. This is discussed more above in Section 3.7.3 of this Reasons for Decision (see Design Plan Revision #38).

The Tłıchq Government commented that it was not clear what bait was used with the minnow traps used for small-bodied fish and recommended that the AEMP identify the type of bait and minnow trap that was used (TG comment 64). CIRNAC-CARD provided some clarifications in its response and the Board is of the opinion that this should be included and explained in the next version of the Design Plan.

- ***Design Plan Revision #44: Version 1.1 of the AEMP Design Plan is to be revised to provide details on the type of minnow traps and bait used in the small-bodied fish surveys.***

The Tłıchǵ Government commented on the electrofishing methods used and recommended that CIRNAC-CARD consider a boat-based electrofishing method (TG comment 66). CIRNAC-CARD responded that the main limitations to its program had been weather and that it does not expect to encounter the same issues in the future because they will plan more time for the survey; however, CIRNAC-CARD said it will consider the suggestion in its planning. The Board notes that CIRNAC-CARD should be mindful about the influence of the methods used on the baseline data and ensure that it can continue to employ the same methods moving forward.

Large-bodied Fish

The Tłıchǵ Government had a comment about the small size of fish reported in the baseline section of the report (i.e., the fish captured in 2021 and in Section 3 of the Plan) and that this seemed odd given that a range of gill net mesh sizes were used (TG comment 63). The Tłıchǵ Government thought that these results might be indicative of a stunted population and recommended further study. In response, CIRNAC-CARD stated the result was hard to explain and that the deployment of nets will need to be considered in the next monitoring phase. The response was not clear on how this would be considered and thus it is unclear if any changes to the types and sizes of gill nets will be made. If changes to the sampling methods are made in the future, this could impact the ability to make comparisons to the baseline data.

- ***Design Plan Revision #45: Version 1.1 of the AEMP Design Plan is to be revised now if any changes are being made or considered with respect to the methods used for catching large-bodied fish.***
- ***Baseline Sampling Requirement #8: If changes to the methods used for catching large-bodied fish are being considered, CIRNAC-CARD should ensure that this will be comparable to the existing baseline data. If data will not be comparable, appropriate 2022 baseline data must be collected using the updated methods.***

3.8 Response Framework

A Response Framework has become a required component of AEMP Design Plans. As described in the AEMP Guidelines, the goal of the Response Framework is “to provide a systematic approach to responding to the results of an AEMP.” As part of the Response Framework, AEMP results are compared to predefined Action Levels for monitored variables (e.g., water chemistry, sediment chemistry, biological parameters). If an Action Level is exceeded, the Licence requires that certain actions take place (see Part F, Conditions 6 and 7 of the Licence).

Several comments were received about the proposed Response Framework during the public review, all generally addressing elements that were lacking and/or that deviated from the guidelines without sufficient rationale. These are discussed in the subsections below.

3.8.1 Significance Threshold

Defining the Significance Threshold is an important starting point for developing the Response Framework as it helps determine where to set proposed Action Levels. As described in the AEMP Guidelines:

Action Levels must be set such that adaptive management actions can be taken in a timely way to ensure that significant adverse impacts to the receiving environment never occur. A critical requirement, therefore, of the Response Framework, is defining, quantitatively or qualitatively, what is meant by “significant adverse impacts” for each project. The term “significance threshold” is used to describe the threshold where an environmental change or effect would be considered significantly adverse and therefore unacceptable. The definition of significance threshold is meant to relate predictions and determinations made during the screening or environmental assessment of a project to the administration of the resulting water licence.

No Significance Threshold is defined in the Plan. GNWT-ENR recommended that one be defined for the ecological components under evaluation so that clear Action Levels can be developed (GNWT-ENR comment 1). GNWT-ENR commented that Action Levels should reflect progressive responses to avoid exceeding the significance thresholds (GNWT-ENR comment 1). Because no Significance Threshold is defined, GNWT-ENR states that it is unclear whether the proposed Action Levels in Section 7.0 are appropriate and sufficiently sensitive. Board staff also asked for rationale for why a Significance Threshold was not included (WLWB staff comment 17).

CIRNAC-CARD responded that the AEMP monitoring is being undertaken to ensure that the receiving environment is not substantially changed from the existing conditions before the start of remediation. CIRNAC-CARD also stated that the HHERA concluded that aquatic habitats (except for Mill Lake) are not a risk to receptors. Because Significant Thresholds are defined as “a limit of environmental change which, if reached, would likely result in significant adverse impacts”, CIRNAC-CARD states that such a threshold is orders of magnitude above the Action Levels defined in Section 7.0. The Board understands CIRNAC-CARD’s response to be explaining that the project is not anticipating changes to the receiving environment, thus having a Significance Threshold as high as that defined in the AEMP Guidelines is not valuable. However, the AEMP Guidelines state that the “...definition of what constitutes a significant adverse impact is context-specific and may vary from project to project” and in some cases, “changes to water quality outside the range of natural variability may be considered a significantly adverse impact.”

The purpose of Actions Levels are to help avoid reaching a level of impact that is unacceptable for the project. Just because they are not predicted to be reached, it does not mean that that they should not be defined so that reaching them can be avoided. Identifying changes early is an important point of an adaptive management framework.

- ***Design Plan Revision #46: Version 1.1 of the AEMP Design Plan is to include a proposed Significance Threshold as part of the Response Framework.***

3.8.2 Action Levels

The AEMP Guidelines outline three tiers of Action Levels (ALs) that need to be set in a Response Framework: Low, Moderate, and High. The Response Framework proposed by CIRNAC-CARD includes two ALs (i.e., Low and High) for the following components: Hydrology, Water Chemistry, and Sediment Chemistry; and only one AL (i.e., Low) for the following components: Shoreline Survey, Benthic Community Survey, Benthic Tissue, Fish Community, and Fish Tissue.

GNWT-ENR commented that it was not clear why CIRNAC-CARD proposed something that deviates from the AEMP Guidelines and recommended that they set three tiers of ALs (GWT-ENR comment 22). Board staff also asked for rationale for not including three tiers of ALs and asked CIRNAC-CARD to elaborate why some components only had a Low AL defined (WLWB staff comment 14). In response to the overall deviation from the AEMP Guidelines, CIRNAC-CARD acknowledged that the AEMP Guidelines state that three levels are needed, but that the Rayrock Remediation Program is only three years in duration and has strict targets. In response to the development of only a Low AL for some components, CIRNAC-CARD responded that Section 7 of the Plan provided additional rationale for the Action Levels and the reason why some High ALs are not designated. Section 7 of the Plan states that because benthos and fish are monitored through a Before-After-Control-Impact (BACI) design, the higher ALs are not needed because the remediation work would be complete before triggers could be confirmed. No rationale is provided in the Plan for the absence of a High AL for the Shoreline Survey. Overall, CIRNAC-CARD states that a three-tiered system with fully defined ALs is not reasonable for a remediation project with a 2-to-3-year operation; however, CIRNAC-CARD stated that if three are needed then additional levels will be proposed.

The Board notes that project timelines cannot be known with certainty – there are often unforeseen circumstances that can influence project timelines. Regardless, the AL tiers are related to the magnitude of change, not the duration of the project. Given that the High AL involves ceasing operations, there might be a useful intermediate step. For components assessed using a BACI design, it is not clear what other options are available for defining ALs, but the Board notes that CIRNAC-CARD's rationale for not developing High ALs for these components assume that all potential impacts will stop once remediation activities are done and that only one monitoring phase will happen during each of the remediation and post-remediation phases.

With respect to the ALs for Water and Sediment, GNWT-ENR had comments about these needing to be reconsidered because they were set too high if the Significance Threshold is meant to be no change to the receiving environment (GNWT-ENR comments 18 and 19). CIRNAC-CARD responded that an AEMP must recognize the limits of environmental sampling and analysis. CIRNAC-CARD also noted that they have not suggested a significance threshold of no change to the baseline conditions; rather, no change is an objective of the Project. CIRNAC-CARD is concerned that an unreasonable effort will be required to continually monitor and justify natural environmental variability during and after project work if stricter ALs are required. The Board understands the GNWT-ENR to be saying that if no change from baseline is expected, then water and sediment quality should not be allowed to exceed 25% from baseline; meanwhile, CIRNAC-CARD is concerned about overly triggering the Low AL. Overall, the Board is of the

opinion that it is difficult to assess the conservativeness of the AL if there is no shared understanding of the Significance Threshold.

While the Board recognizes that this project is unique in terms of it having an anticipated short duration of activity and the goal is to improve the overall state of the area, the proposed ALs do not align with the purpose of a Response Framework and require further development. As discussed above, it would also be easier to consider how best to establish the ALs if there was a defined Significance Threshold. The Board thinks that having less than three action levels may be appropriate for this Project, but this discussion with parties should take place in the context of Significance Thresholds and with the goal of responding quickly to changes that are trending in an undesirable direction. Because the ALs are not needed right away (i.e., before the additional baseline sampling to be conducted in 2022), the Board is of the opinion that there is time for more discussion with parties on the Response Framework.

- ***Engagement Requirement #3: CIRNAC-CARD is to engage with GNWT-ENR and the Tłıchǫ Government on the definition of the Significance Threshold and development of Action Levels.***
- ***Design Plan Revision #47: Version 1.1 of the AEMP Design Plan is to be revised to reflect the outcome of the discussions from Engagement Requirement #3.***

The High AL for hydrology is triggered if the hydrologist determines that the rise in water levels is due to the drainage pathway not being able to handle the addition of Mill Lake water or if water levels increase to 0.75 m above freshet levels. GNWT-ENR commented that without some information on the range of natural variability in water levels of Sherman Lake, there is no context for assessing whether 0.75 m is an appropriate High AL (GNWT-ENR comment 17). GNWT-ENR recommended that the range of natural variability in water levels for Sherman Lake be provided and the use of 0.75 m as a High AL be rationalized (GNWT-ENR comment 17). CIRNAC-CARD responded that, as detailed in Section 3.2 of the Plan, water elevations could not be measured in 2020 and 2021 because of equipment issues. CIRNAC-CARD explained that the High AL trigger of 0.75 m was based on estimates of elevations that indicated drainage issues from water elevation measurement taken at the Colomac Project. CIRNAC-CARD concluded by stating that since this value cannot be rationalized based on site measured data, and since flooding of the Sherman Lake waterbody is such a low risk, the High AL level for hydrology will be removed. In the Board's opinion, it is unclear if removing this trigger is necessary because it would seem more conservative to retain one. The Board also notes that monitoring in 2022 is an option and data from this coming season could be used to help define an appropriate trigger.

- ***Baseline Sampling Requirement #9: CIRNAC-CARD is to collect 2022 baseline hydrology data.***
- ***Design Plan Revision #48: Updated baseline results for hydrology are to be provided in Version 1.1 of the AEMP Design Plan.***
- ***Engagement Requirement #4: CIRNAC-CARD is to discuss hydrology trigger options for the High AL while engaging on revising the ALs.***

- ***Design Plan Revision #49: Version 1.1 of the AEMP Design Plan is to be revised to reflect the outcome of the discussions from Engagement Requirement #4.***

The Low AL trigger for the metal and radionuclide benthic assessment is an increase in any metal concentration in benthic tissues of greater than ± 2 standard deviations (SD) from the pre-remediation (baseline) averages for metal concentrations whose values are greater than ten times the method detection limit (MDL) in the pre-remediation sampling. Board staff asked for rationale for use of ten times the MDL (WLWB staff comment 16). CIRNAC-CARD responded that the use of 10 times the MDL is a standard method throughout the industry that realizes and accepts the limitations of the analytical laboratories. The Board is of the opinion that the rationale for ALs should be included in the Plan so that all parties can have this information for consideration.

- ***Design Plan Revision #50: Version 1.1 of the AEMP Design Plan is to include rationale for the selection of all Action Levels.***

GNWT-ENR commented that chronic toxicity tests (for water or sediment) may be useful tools for adding to the weight-of-evidence for understanding causal links in benthic results (GNWT-ENR comment 20). It is not clear if this comment was meant to be a recommendation for a Response Action or if separate tests are to be included as part of the ALs given that these are not currently part of the monitoring program.

- ***Engagement Requirement #5: CIRNAC-CARD is to discuss the potential role for chronic toxicity tests with GNWT-ENR when discussing revisions to the Response Framework.***
- ***Design Plan Revision #51: Version 1.1 of the AEMP Design Plan is to be revised to reflect the outcome of the discussions from Engagement Requirement #5.***

The proposed response actions for exceedance of a High AL includes notifying the WLWB and the Inspector within 48 hours. In response to GNWT-ENR comment 23, CIRNAC-CARD committed to revising the Response Framework to state that High AL triggers will have a 24-hour window of time for notifying the WLWB and Inspector.

- ***Design Plan Revision #52: Version 1.1 of the AEMP Design Plan is to be revised to reflect the commitment made regarding a 24-hour window for reporting a High Action Level.***

3.8.3 Response Actions

Table 8-1 in the Plan provides proposed response actions should the proposed Low or High ALs be exceeded. The Board recognizes changes to this table will likely be required based on discussions with parties, which means that response actions may also need to be revised. This section outlines some required revisions, for when CIRNAC-CARD revises the Response Framework.

In response to comment 84 from the Tłıchq Government about sampling throughout the water column (because CIRNAC-CARD is sampling from within the top 10 cm), CIRNAC-CARD stated that sampling at different depths in the water column would be justified if concentration changes were expected, and this represents a potential response if action levels are triggered. The Board notes that the Response Framework does not include sampling at depth as a response action for water chemistry AL exceedances.

- ***Design Plan Revision #53: Version 1.1 of the AEMP Design Plan is to be revised to include sampling at depth as a response action for water chemistry AL exceedances.***

As discussed in Section 3.3.2 of this Reasons for Decision, the Board indicated that inclusion of dissolved metals in water quality samples could be considered as a potential response to an AL exceedance. This should be considered by CIRNAC-CARD when revising the Response Framework.

As discussed in Section 3.3.2 of this Reasons for Decision, the Board agreed that monitoring for TP in water quality samples was likely sufficient at this time; however, noted that monitoring orthophosphate could be considered as a potential response to a TP AL exceedance. The Board is of the opinion that this be considered by CIRNAC-CARD when revising the Response Framework.

As discussed in Section 3.3.2 of this Reasons for Decision, the Board indicated that chronic toxicity testing could be explored as a potential response action to a Low AL exceedance for water chemistry variables. The Board is of the opinion that this be considered by CIRNAC-CARD when revising the Response Framework.

- ***Design Plan Revision #54: CIRNAC-CARD is to consider the following when revising the Response Framework for Version 1.1 of the AEMP Design Plan:***
 - ***Inclusion of dissolved metals sampling in water quality samples as a potential response to an AL exceedance for water chemistry;***
 - ***Inclusion of orthophosphate monitoring in water quality samples as a potential response to an AL exceedance for TP; and***
 - ***Inclusion of chronic toxicity testing as a potential response action to an AL exceedance for water chemistry.***

3.9 Conformity to AEMP Guidelines

Part F, Condition 1 of the Licence requires that the AEMP be in accordance with the AEMP Guidelines. In addition to comments about the Response Framework discussed in Section 3.8 of this Reasons for Decision, Board staff asked a few other questions related to deviations from the AEMP Guidelines.

AEMPs are meant to be designed and implemented to meet the objectives listed in Section 2.1.3 of the AEMP Guidelines. No 'Objectives' section was included in the Plan and the objectives from the AEMP Guidelines were not referenced or discussed anywhere in the Plan. Board staff asked CIRNAC-CARD for rationale for excluding objectives (WLWB staff comment 1). Board staff also asked CIRNAC-CARD to outline the objectives of its AEMP and to provide rationale should they differ from those in the AEMP Guidelines (WLWB staff comment 1). CIRNAC-CARD responded that they would add the ones listed in the AEMP Guidelines. The Board appreciates that CIRNAC-CARD has agreed to add the objectives from the AEMP Guidelines, however, this addition will need to be further expanded on to explain how the AEMP Design meets these objectives. It is possible that they are not all relevant and/or that CIRNAC-CARD has additional ones that could be considered.

- ***Design Plan Revision #55: Version 1.1 of the AEMP Design Plan is to be revised to include the AEMP Objectives, along with a discussion of how the AEMP Design meets the objectives.***

The AEMP Guidelines indicate that “proponents must outline their approach to engagement and how they have or will integrate the information gained through engagement into AEMP planning, development, implementation, and reporting.” Board staff asked CIRNAC-CARD to elaborate on the engagement that has been conducted with respect to the AEMP and how this engagement informed the Design (WLWB staff comment 2). CIRNAC-CARD responded that it would add a paragraph which will provide a description of the engagement specifically for the AEMP.

- ***Design Plan Revision #56: Version 1.1 of the AEMP Design Plan is to be revised to include more information on engagement. This information must include and explanation of how the engagement informed the Design.***

As part of the ‘Description of the Environment’, the AEMP Guidelines require that this section include a description of the past, current, and future traditional uses of the area. Board staff asked CIRNAC-CARD why a description of future traditional uses was not included in the AEMP (WLWB staff comment 3). In response, CIRNAC-CARD committed to including a sentence stating that “Remediation of Rayrock is intended to permit unrestricted access for the Tłıchq when work is complete”. CIRNAC-CARD also stated that which traditional uses the Tłıchq wish to conduct at Rayrock is at their discretion. The Board is of the opinion that this proposed update does not fully address the requirement. While it is understood that future uses will be at the discretion of the Tłıchq, discussions with the Tłıchq would provide information on potential future uses. The Board is of the opinion that this requirement needs to be further developed in the next version of the Plan.

- ***Design Plan Revision #57: Version 1.1 of the AEMP Design Plan is to be revised to include more information on the potential future traditional uses of the Rayrock area.***

The AEMP Guidelines require a section on reporting that is to describe how the proponent will meet the reporting requirements that relate to the AEMP. In this section, proponents are expected to describe the purpose, timing, and format/content of the AEMP Annual Report, the AEMP Re-evaluation Report, notification of AL exceedances, and AEMP Response Plans. While not raised during the public review, the Board notes this section repeats the Licence conditions and provides no additional information about what to expect in the Re-evaluation Report and/or how CIRNAC-CARD plans on laying out/presenting the Annual Reports. It would also be helpful if this section outlined CIRNAC-CARD’s anticipated timing for submission of the first Re-evaluation Report and updated AEMP Design Plan.

- ***Design Plan Revision #58: Version 1.1 of the AEMP Design Plan is to be revised to include more information on the AEMP Reporting plans and expectations.***

3.10 Revisions to Reflect Commitments and/or Recommended Editorial Updates

In response to recommendations received during the public review, CIRNAC-CARD committed to editing various sections of the Plan, including figures, tables, and text.

Parties commented on the quality and information provided in figures and tables throughout the Plan. In response to comments from ECCC, GNWT-ENR, and the Tłıchq Government (ECCC comments 4, 7, and 12; GNWT-ENR comment 21; TG comments 4, 18, 29, 42, 73, 74, 78, 79, 82), CIRNAC-CARD agreed to update

the Plan with higher resolution figures (i.e., Figures 2-1, 3-2, 3-13, 3-14, and 3-15), and to make updates to the information presented in various tables and figures (i.e., Tables 3-4, 3-29, 3-40, 3-41, and 8.1; Figures 1-1 and 3-5).

The Tłıchq Government requested that Mill Lake be included in Figure 3-1 (TG comment 78). CIRNAC-CARD responded that this figure shows the drainage route from Lake B to the Marian River along with Sherman, Beta, Gamma, Unnamed Lake, and Lake A and that it was not clear why Mill Lake would not have been included. The Board believes it would be helpful to include Mill Lake in this Figure.

- ***Design Plan Revision #59: Version 1.1 of the AEMP Design Plan is to be revised to include updated figures and tables as per ECCC comments 4,7, and 12; GNWT-ENR comment 21; and TG comments 4, 18, 29, 42, 73, 74, 78, 79, and 82.***

In response to comments from the Tłıchq Government regarding information in Table 1-1 (TG comments 4, 71, and 72), CIRNAC-CARD provided clarifications on where information could be found in the AEMP but did not agree to updating the information provided in Table 1-1. Given the difficulty in viewing the monitoring locations in figures throughout the Plan, and that Table 1-1 provides a summary for readers to understand the AEMP Design Plan, the Board believes that updating this Table with the Tłıchq Government's recommendations would be helpful. If not all information can be provided within the table, the appropriate section references should at least be included. As discussed in Section 3.1 of this Reasons for Decision, revisions to Table 1-1 are also required to address inconsistencies with information throughout the Plan.

- ***Design Plan Revision #60: Version 1.1 of the AEMP Design Plan is to be revised to include an updated Table 1-1 that reflects Tłıchq Government recommendations 4, 71 and 72 and corrects inconsistencies with information throughout the Plan.***

In response to reviewer comments, CIRNAC-CARD agreed to editing typographical errors and committed to providing updates or changes to text and details in the Plan. These are captured in response to the following comments: ECCC comments 11 and 13; GNWT-ENR comments 5 and 15, TG comments 2, 10, 11, 22, 36, 52, 69, and 70, and WLWB staff comments 10,15, and 18.

- ***Design Plan Revision #61: Version 1.1 of the AEMP Design Plan is to be revised to include proposed edits and commitments made in response to ECCC comments 11 and 13; GNWT-ENR comments 5 and 15; TG comments 2, 10, 11, 22, 36, 52, 69, and 70; and WLWB staff comments 10, 15, and 18.***

In review of the Plain Language Summary, the Tłıchq Government commented that the use of 'metals' in the statement 'The soils around the former mill contains metals and oil' was not clear and suggested that the text say that 'The soil around the former mill are contaminated by toxic substances such as trace/heavy metals and oil hydrocarbons' (TG comment 67). CIRNAC-CARD responded that this wording would be incorrect and could be misunderstood; they explained that this was meant to say that 'the soil contains low-level metal concentrations and scrap metal'. The Board is of the opinion that the text be

updated to state ‘The soil around the former mill contains low-level metal concentrations, scrap metal, and oil.’

- **Design Plan Revision #62: *Version 1.1 of the AEMP Design Plan is to be revised to include the edit described in the paragraph above in response to TG comment 67.***

In the section summarizing the HHERA (i.e., Section 3.1 of the Plan), the document states that “The COPCs identified for the risk assessment for the aquatic environment were copper, fluoride, iron, lithium, and uranium in water; and copper, nickel, uranium, and zinc in sediment, in addition to the uranium-238 series radionuclides.” The Tłıchq Government commented that there are both uranium-238 and uranium-235 series radionuclides in the media and recommended that this be corrected (TG comment 76). CIRNAC-CARD responded that this is wording provided in the HHERA, so they would not want to change it. The Board notes that this is not quoted text, so it is unclear why this can’t be updated if it is not correct. At minimum, a footnote could be included to provide clarification.

- **Design Plan Revision #63: *Version 1.1 of the AEMP Design Plan is to be revised to address TG comment 76.***

3.11 Comments Related to Remediation Work

The Tłıchq Government had a comment regarding SNP stations 1663-12 and 1663-13 (TG comment 12). The locations of these stations were to be determined later – post-remediation – and the Licence explains the purpose of these stations as follows:

- SNP Station 1663-12: to test water quality leaving former Mill Lake before entry to Mill Creek;
 - SNP Station 1663-13: to test water quality leaving Mill Creek before entry into Sherman Lake.
- Tłıchq Government commented that these two locations should be sampled prior to remediation.

The Tłıchq Government stated that water should be monitored here to measure improvement following remediation (TG comment 12). Because Mill Lake will be completely remediated, CIRNAC-CARD responded that pre-remediation data will be of little value. The Board agrees that based on the proposed Project, these comparison points do not belong in the AEMP. The purpose of these SNP Stations seems to be to inform potential changes in Sherman Lake; the AEMP is not planning on monitoring changes to this creek location. The purpose of the AEMP is not to monitor for improvements owing to remediation but to monitor for effects to the receiving environment as a result of the remediation activities. Thus, the Board is not requiring inclusion of sampling prior to remediation work at these locations as part of the AEMP. However, CIRNAC-CARD may want to consider collecting the data recommended by the Tłıchq Government to help inform the success of closure in later submissions.

The Tłıchq Government recommended that consideration should be given to establishing Site Specific Remediation Objectives (SSROs) for appropriate media and areas of concern at site (TG comment 53). CIRNAC-CARD responded that they would support the development of SSROs if needed but that a delay of several months would be required to calculate the objectives based on an updated data set. As discussed in Section 3.3.5 of this Reasons for Decision, it is not clear to the Board that development of

SSROs are necessary in the context of the AEMP as these would seem more related to the Remedial Action Plan (RAP). Thus, the Board is not requiring the inclusion of SSROs as part of the AEMP.

3.12 Comments Addressed

A number of comments were not addressed in this Reasons for Decision because responses were deemed by the Board to have addressed the clarification and/or question or were identified as not requiring a response (e.g., comments from reviewers that provide a list of citations or a letter to support their other comments). The comments include the following:

- ECCC comments 1 and 2;
- GNWT-ENR comments 10, 14, 24, and 25;
- TG comments 19, 20, 21, 33, 34, 41, 43, 45, 46, 59, 62, 68, 75, 77, and 83;
- WRRB comment 1; and
- WLWB staff comments 5, 6, and 8.

Signed the 5th day of July 2022, on behalf of the Wek'èezhìi Land and Water Board



Mason Mantla
Chair, Wek'èezhìi Land and Water Board



Witness