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May 5, 2025

File: W2020L8-0003

Dawn Keim,
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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 Dawn,

Re: AEMP Response Framework Update - Rayrock Remediation Project - Miscellaneous - Former Rayrock Mine, NT

The Wek'èezhìi Land and Water Board met on April 23, 2025, and considered the Aquatic Effects Monitoring Program (AEMP) Response Framework update submitted by Crown-Indigenous Relations and Northern Affairs Canada – Contaminants and Remediation Division (CIRNAC-CARD) on January 30, 2025.¹ The AEMP Response Framework update was initially required by the Board in the Reasons for Decision on the AEMP Design Plan, Version 1.1² (see Section 2 of the Attached Reasons for Decision for further details).

As explained in the attached Reasons for Decision, the Board has decided to approve the AEMP Response Framework with revisions. As a reminder, CIRNAC-CARD is required to submit Version 1.2 of the AEMP Design Plan to include the approved Response Framework as directed by the Board in the Reasons for Decision for Version 1.1 (Decision #2). The revisions outlined in Recommendation #1 and discussed in this Reasons for Decision should be included in Version 1.2 of the AEMP Design Plan.

Please direct questions or concerns regarding this letter to [Anneli Jokela](#) in writing.

¹ See WLWB Online Registry for [Rayrock – AEMP Response Framework Update – Jan 30 25](#).

² See WLWB for [Rayrock – AEMP Design Plan – Version 1.1 – Reasons for Decision – May 22 24](#).

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Mason Mantla', written in a cursive style.

Mason Mantla
Chair, Wek'èezhìi Land and Water Board

Bcc'd to: Rayrock Distribution List
Attached: Reasons for Decision



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Reasons for Decision

Reference/File Number:	W2020L8-0003 (Type "A" Water Licence)
Licensee:	Crown-Indigenous Relations and Northern Affairs Canada Contaminants and Remediation Division (CIRNAC-CARD)
Subject:	Aquatic Effects Monitoring Program (AEMP) Response Framework Update

Decision from the Wek'èezhìi Land and Water Board Meeting of April 23, 2025

1.0 Decision

On April 23, 2025, 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) Response Framework Update as required by Board direction from the Reasons for Decision for Version 1.1 of the Plan.¹ In consideration of the submission, previous Board direction, reviewer comments, and proponent responses, the Board has made the following decisions:

1. Approve the AEMP Response Framework update with revisions (i.e., Revisions 1 and 2);
2. Require CIRNAC-CARD to submit the updated version of the AEMP Design Plan (Version 1.2) including the revisions outlined in Decision #1 within 60 days of receiving this Decision;
3. Require CIRNAC-CARD to provide additional supporting information for the proposed approach for deriving the site-specific significance threshold values for radionuclides in water as part of the 2024 AEMP Annual Report;
4. As part of the AEMP Annual Reports, the Board requires CIRNAC-CARD to include a review of the High Action Level (HAL) for any water quality parameter that triggers the Low Action Level (LAL) and verify that the proposed (HAL) triggers remain appropriate. If a LAL was triggered during the

¹ See WLWB for [Rayrock – AEMP Design Plan – Version 1.1 – Reasons for Decision – May 22 24](#).

2024 monitoring season, the Board requires this review be provided with the 2024 AEMP Annual Report (see Decision #5 for further direction); and

5. In consideration that the Board is requiring additional information to be included in the 2024 AEMP Annual Report (i.e., requirements 3 and 4) and recognizing that the deadline for the submission of the 2024 AEMP Annual Report is approaching on May 31, 2025, the Board decided to extend the deadline for submission of the 2024 AEMP Annual Report to no later than June 30, 2025.

2.0 Background

The Kwetı̄ᓂàà (Rayrock) Remediation Project involves the clean up of the former Rayrock mine and other uranium exploration sites in the surrounding area of the Tı̄chq Region. The Rayrock site was impacted by historical mining activities that occurred between the 1950s and 1970s. Since 1984, information has been collected regarding the risks to humans and the environment, which was used to complete a Human Health and Ecological Risk Assessment (HHERA; CanNorth 2018).² Remediation activities include the draining, treating, and discharging of Mill Lake water into Sherman Lake, as well as repair work at two Tailings Containment Areas (TCAs) near the Alpha Lake section of the Sherman Lake Waterbody and Gamma and Beta Lakes. The AEMP Design Plan is a requirement under Part F, Condition 2 of CIRNAC-CARD's Water Licence W2020L8-0003 (the Licence) and is designed to detect potential changes in Sherman Lake from the discharge of Mill Lake treated water, as well as any changes to other receiving waterbodies (i.e., Gamma and Beta Lakes) caused by the project during remediation. The Licence also requires that the AEMP Design Plan be in accordance with the LWB/GNWT *Guidelines for Aquatic Effects Monitoring Programs* (AEMP Guidelines³).

CIRNAC-CARD's proposed monitoring activities for the aquatic environment of the Kwetı̄ᓂàà (Rayrock) Remediation Project include the following monitoring components:

- aquatic environment
- water and sediment chemistry
- benthic invertebrate assessments
- fish assessments

On July 5, 2022, the Board did not approve Version 1.0 of the Design Plan and directed CIRNAC-CARD to submit Version 1.1.⁴ The AEMP Design Plan Version 1.1 was to include 63 revisions; CIRNAC-CARD was also required to collect additional baseline data and to conduct engagement prior to revisiting some aspects of the AEMP Design Plan. After several conformity follow-ups with Board staff, CIRNAC-CARD provided a final updated submission of the AEMP Design Plan Version 1.1 on March 1, 2024. The AEMP

² See WLWB Online Registry for [Rayrock - IR Response from CIRNAC-CARD - Rayrock HHERA - Nov 20 20](#).

³ See WLWB Online Registry for [LWB/GNWT Guidelines for Aquatic Effects Monitoring Programs \(2019\)](#).

⁴ See WLWB Online Registry for [AEMP Design Plan V1.0 - Reasons for Decision - Jul 5 22](#).

Design Plan Version 1.1 and the 2022 Annual Report, dated May 31, 2023, were circulated for public review on March 5, 2024. The AEMP Annual Report provided additional baseline information that was referenced in the AEMP Design Plan, so it was included for consideration during the review process. On May 15, 2024, the Board decided to approve Version 1.1 of the AEMP Design Plan with the exception of the Response Framework (Section 12 of the AEMP Design Plan Version 1.1).⁵ This partial approval of the AEMP Design Plan allowed the Project to stay on schedule and enabled the initial implementation of the AEMP monitoring while addressing the recommended revisions to the Response Framework, which would undergo a focused public review.

As required by the Board in the Reasons for Decision on the AEMP Design Plan, Version 1.1, CIRNAC-CARD submitted an updated AEMP Response Framework on July 2, 2024.⁶ The updated AEMP Response Framework was circulated for public review on July 4, 2024. In addition, notifications of AEMP High Action Level (HAL) exceedances for water quality and an AEMP Response Plan addressing these HAL exceedances were also included as part of the public review.⁷

After reviewing comments and proponent responses, Board staff determined that additional information was necessary to help inform the Board's decision on the updated AEMP Response Framework. As such, on November 4, 2024, an Information Request (IR) was issued to CIRNAC-CARD requiring them to provide (a) information that defines a Significance Threshold for water quality and (b) information to clarify the appropriateness of the proposed Action Levels for water quality.⁸ The IR acknowledged that CIRNAC-CARD had provided Low, Moderate, and High Action Levels, which Board staff recognized aligned with the AEMP Guidelines.⁹ However, the IR also indicated that CIRNAC-CARD could propose revised Action Levels for the water quality component in response to the IR but would be required to provide the information to clarify the appropriateness of the proposed revisions relative to the Significance Thresholds as follows:

...[i]f CIRNAC-CARD is of the view that three Action Levels are not appropriate, the Board's Reason for Decision for the AEMP Design Plan Version 1.0 indicated that "[t]he 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."¹⁰

⁵ See WLWB Online Registry for [Rayrock – AEMP Design Plan V.1.1 and 2022 AEMP Annual Report– Reasons for Decision - May 15 24](#).

⁶ See WLWB Online Registry for [Rayrock - AEMP Response Framework Update - Jul 2 24](#).

⁷ See WLWB Online Review System (new.onlinereviewsystem.ca) for [Rayrock AEMP Response Framework update and Water Quality Response Plan](#).

⁸ See WLWB Online Registry for [Rayrock – AEMP Response Framework Update – Information Request – Nov 4 24](#).

⁹ See LWBs Policies and Guidelines (www.wlwb.ca) for [MVLWB/GNWT Guidelines for Aquatic Effects Monitoring Programs](#).

¹⁰ See WLWB Online Registry for [Rayrock – AEMP Response Framework Update – Information Request – Nov 4 24](#).

On November 25, 2024, CIRNAC-CARD requested and was granted an extension to respond to the IR.¹¹ On January 30, 2025, CIRNAC-CARD submitted the IR response, which included a revised Response Framework with proposed revisions to all Action Levels for all AEMP components, not just water quality. Due to the differences from the Response Framework previously circulated for public review on July 4, 2024, this new submission required another comprehensive public review. Given that some of the submission updates may have addressed comments or issues raised by parties during the previous review, in the Online Review System (ORS) Item for Review (IFR), reviewers were asked to bring forward any comments that were still applicable to the updated Response Framework under this current review; therefore, only comments specific to this second public review were considered .

The response to the IR with the updated AEMP Response Framework were distributed for public review on February 14, 2025, inviting reviewers to provide comments and recommendations using the ORS. Comments and recommendations were received by the deadline of March 17, 2025, from Environment and Climate Change Canada (ECCC) and Government of Northwest Territories – Environment and Climate Change (GNWT-ECC); Board staff also submitted questions. Fisheries and Oceans Canada and the CIRNAC Inspector indicated they had no comments or recommendations for the submission. CIRNAC-CARD provided responses to reviewer comments by the deadline of March 24, 2025. The review summary is available on the ORS.¹²

3.0 Reasons for Decisions

The Board reviewed the updated AEMP Response Framework for conformity to previous Board direction provided in the May 22, 2024, Reasons for Decision and for alignment with requirements outlined in the AEMP Guidelines.¹³ The Board also reviewed all reviewer comments and proponent responses submitted during the public review period. Based on the review, the Board believes that certain aspects of the Response Framework need to be revisited, as further discussed in this Reasons for Decision. However, the Board recognizes the characteristics of the Project, which include a relatively small volume of discharge over a relatively short timeframe (i.e., a total of three years, with discharge currently in its second year) and the conservative nature of the Effluent Quality Criteria (EQC) for the Project. The Board is of the opinion that having an approved Response Framework in place as the Project enters its second year of treated effluent discharge will provide a systematic approach to addressing changes observed through the AEMP and will help evaluate potential trends towards the significance thresholds, even though some additional work on the Response Framework is required. The Board acknowledges that the proposed Low Action Levels (LALs), if exceeded, will trigger management responses to ensure that project-related environmental effects remain within acceptable limits while providing an opportunity to reassess the adequacy and efficiency of this approach through adaptive management and the AEMP Annual Report.

¹¹ See WLWB Online Registry for [Rayrock – AEMP Response Framework Update- Information Request Extension – Nov 25 24](#).

¹² See WLWB Online Review System (new.onlinereviewssystem.ca) for [Rayrock AEMP Response Framework Update and Response to Intervention Request](#).

¹³ See LWBs Policies and Guidelines (www.wlwb.ca) for [MVLWB/GNWT Guidelines for Aquatic Effects Monitoring Programs](#).

Therefore, the Board has decided to approve the updated Response Framework with revisions. Revisions 1 and 2 are discussed in Sections 3.4 and 3.6 of this Reasons for Decision. The Board also requested additional information to be provided with the 2024 AEMP Annual Report (see Decisions #2 and 3) to address the aspects that, in Board's view, need to be revisited.

- ***Decision #1: Approve the AEMP Response Framework update with revisions (i.e., Revisions 1 and 2).***

As a reminder, CIRNAC-CARD is required to submit Version 1.2 of the AEMP Design Plan to include the approved Response Framework and other revisions as directed by the Board in the Reasons for Decision for Version 1.1 (Decision #2).¹⁴ The revisions required in Decision #1 and discussed in Sections 3.4 and 3.6 of this Reasons for Decision should also be included in Version 1.2 of the AEMP Design Plan.

- ***Decision #2: Require CIRNAC-CARD to submit the updated version of the AEMP Design Plan (Version 1.2) to include the revisions outlined in Decision #1 within 60 days of receiving this Decision.***

3.1 Site-Specific Significance Thresholds

Defining the Significance Threshold is a critical starting point for developing the Response Framework as it determines “the threshold where an environmental change or effect would be considered significantly adverse and therefore unacceptable”.¹⁵ Establishing the Significance Threshold then enables setting proposed Action Levels in a manner “such that adaptive management actions can be taken in a timely way to ensure that significant adverse impacts to the receiving environment never occur”.¹⁶ Therefore, the purpose of a Significance Threshold is to define the limit of acceptable change, beyond which can be referred to as the “no-go zone” for environmental effects. To date, the absence of defined Significance Thresholds that set the boundary on the level of acceptable change in water quality for the Kwetūᓃàà (Rayrock) Remediation Project has hindered determining whether Action Levels for the water quality component are set appropriately. Information provided in response to the IR issued to CIRNAC-CARD in November 2024 included proposed Significance Threshold values.

Non-Radioactive Parameters of Potential Concern

The updated AEMP Response Framework includes proposed site-specific significance threshold (SSST) values for non-radioactive parameters of potential concern. These thresholds are derived from a report titled "Development of Site-Specific Significance Thresholds for Sherman Lake, Rayrock Remediation Project (CanNorth, 2023)". The report was provided by CIRNAC-CARD as supporting information for the

¹⁴ See WLWB Online Registry for [Rayrock – AEMP Design Plan V.1.1 and 2022 AEMP Annual Report– Reasons for Decision - May 15 24](#).

¹⁵ See LWBs Policies and Guidelines (www.wlwb.ca) for [MVLWB/GNWT Guidelines for Aquatic Effects Monitoring Programs](#); p.23.

¹⁶ See LWBs Policies and Guidelines (www.wlwb.ca) for [MVLWB/GNWT Guidelines for Aquatic Effects Monitoring Programs](#); p.23.

AEMP Design Plan (Version 1.1) submission.¹⁷ These SSST values are considered protective of 50% of the aquatic community as derived from species sensitivity distribution (SSD) curves. The Board acknowledges that this approach is used by the Canadian Council of Ministers of the Environment (CCME) to develop the Canadian Water Quality Guidelines (CWQG) for the protection of aquatic life. This method is also commonly applied when developing of site-specific water quality objectives is required.

ECCC (comment 4) raised a concern regarding setting the Significance Threshold at a level where 50% of aquatic community may be potentially impacted, specifically noting that the proposed revised High Action Level could result in many aquatic species being affected before response actions are implemented (see Section 3.2 and 3.3 of this Reasons for Decision for further details). ECCC asked for further justification from CIRNAC-CARD regarding the proposed SSST values. Board staff (comment 20) also noted that the proposed SSST values are relatively high compared to actual water quality data. Board staff asked about the necessity of these high SSSTs given the conservative nature of the EQC for the Project and asked the Proponent to provide further supporting rationale including the consideration of values that protect a higher percentage of the aquatic community and better reflect actual water quality.

In response to these comments, CIRNAC-CARD provided the following clarification:

These SSSTs represent concentrations in Sherman Lake at the location of discharge and consider the potential effect of discharge of Mill Lake water effluent at this location based on a range of toxicity studies (see CanNorth 2023, section 2.1). These SSSTs are intended only to place Effluent Quality Criteria (EQCs) and receiving environment analytical data into context by showing the concentration that would be required at this location to have a theoretical effect on valued receptors at this location.

CIRNAC-CARD further explained that setting the SSST values at a level protective of 50% of the aquatic community represents a very low risk to receptors given the limited area of impact and the relatively small volume of discharge added over a relatively short period of time. CIRNAC-CARD reiterated that anticipated total project discharge volume represents less than 5% of Sherman Lake, which will be added over the planned three-year discharge period. As such, CIRNAC-CARD anticipates that any impact would be localized in a limited area and reversible. CIRNAC-CARD added that the magnitude of the concentrations of these SSSTs, when compared to EQCs and measured concentrations in Sherman Lake, show that the Mill Lake treated effluent cannot have an adverse effect on the receiving environment given the conservatism inherent in the approved EQC.

The Board acknowledges that the SSSTs for non-radioactive parameters of potential concern have been developed using standard methods based on available toxicity data. Given the context of the Project being a contaminated site remediation occurring in a historically impacted area, and the overall short duration

¹⁷ See WLWB Online Registry for [Rayrock – AEMP Design Plan Version 1.1 – Appendix D](#) – May 22_24.

of this Project component, setting these SSST at values predicted to be protective of 50% of the aquatic community appears reasonable as the intent of the Significance Threshold is to represent the limit of what would be considered acceptable change. As CIRNAC-CARD has repeatedly stated, the conservative nature of the EQC and the intent of the Project is to never reach this level of change in the receiving environment. Sections 3.2 and 3.3 of this Reasons for Decision provide further consideration of how the proposed revised Action Levels and their triggers are set to avoid reaching the Significance Threshold. At this time, the Board is of the view that the proposed SSST values for the non-radioactive parameters are acceptable. The Board notes that monitoring is ongoing through the SNP and AEMP and should unforeseen changes in concentrations be observed in the receiving environment that are confirmed to be Project-related, then the SSST values can be revisited through the AEMP Annual Report.

ECCC (comment 5) also raised concerns about the SSD curve used to establish the SSST for nitrite. ECCC noted that the *Protocol for the Derivation of Water Quality Guidelines (CCME 2007)*¹⁸ for developing an SSD curve requires, at minimum, data from seven studies, but the Project's SSD for nitrite includes only six data points. ECCC stated that this results in significant uncertainty, as reflected by the large 95% prediction interval band but that no additional information regarding this uncertainty or further justification of the use of the SSD curve was provided. ECCC recommended that CIRNAC-CARD include sufficient data to meet the minimum requirements or, if this is not possible, account for the uncertainty in the SSD curve when setting the SSST value for nitrite.

CIRNAC-CARD acknowledged that the nitrite-related toxicity data are limited but noted that the data used to derive the SSD curve were collected using a current standardized analytical method and that the SSST for nitrite was based on the best possible data available. CIRNAC-CARD also noted that the existing CCME guideline for nitrite is based on a limited number of studies dating from the 1970s and stated that "it would not be possible for a remedial project with two-years remaining to complete a peer-reviewed toxicological study for this application; however, we would like to identify this as a possible guideline refinement for ECCC or GNWT-ECC should nitrite represent a broader concern." Additionally, CIRNAC-CARD indicated that the nitrogen-based parameters (i.e., ammonia, nitrate, and nitrite) were included as parameters of potential concern and EQC were set in the Licence due to the blasting activity at site, which is now complete except for work at the Mill Creek outlet. CIRNAC-CARD believes that although the number of aquatic species studied and the use of the SSD curve may affect the final absolute value, it will not affect the magnitude of the resulting nitrite SSST value; therefore, it is CIRNAC-CARD's opinion that further refinement of the calculated value is of low consequence and is not necessary nor more protective of the environment. CIRNAC-CARD also noted that the nitrite guideline for the protection of aquatic life has not been updated since its development in 1987.

¹⁸ See Canadian Council of Ministers of the Environment (<http://www.ccme.ca/en>) for [A Protocol for the Derivation of Water Quality Guidelines for the Protection of Aquatic Life \(2007\)](#).

The Board acknowledges that there are limitations and uncertainty associated with the proposed SSD and resulting SSST value for nitrite; however, the Board also acknowledges CIRNAC-CARD's point regarding the age of the CCME nitrite guideline and the limited data used to develop that value. Given the overall short-term duration of the discharge from Mill Lake to allow consolidation of the contaminated sediments and the conservative EQC in place for the Mill Lake discharge into Sherman Lake, developing a site-specific toxicity study for this project is unlikely to reduce the uncertainty in a timeframe required to meet the Project schedule. Noting that the risk factors for increased nitrogen are related to blasting activities that is mostly complete, setting a requirement to complete this additional toxicity work in the absence of an identified concern may be too conservative and would likely lead to a delay in the Project. The Board considers the SSD curve provided and the subsequent SSST value to be adequate at this time. The Board notes that nitrite concentrations are regularly monitored through the SNP and AEMP and should unforeseen changes in concentrations of nitrite in the receiving environment be observed and confirmed to be related to Project activities, then the details of the SSD curve and related SSST value can be revisited through the AEMP Annual Report.

Radioactive Parameters of Potential Concern

CIRNAC-CARD proposed SSSTs for radioactive parameters of potential concern (radionuclides). The SSST values for the radionuclides were derived using a different approach that applies backward radiological dose calculations; methods related to the dose calculations were provided in CanNorth (2023) and were consistent with the values used in the 2018 HHERA (CanNorth 2018) for the site. This approach involved setting an upper limit threshold and back-calculating the radiological dose values for the different trophic levels, water, and sediment. CanNorth (2018, 2023) used a dose benchmark of 9.6 milligrays per day (mGy/d) as being protective of aquatic organisms, which was based on information from the Canadian Standard N288.6-22 (CSA 2012) for environmental risk assessments at nuclear facilities and uranium mines and mills.¹⁹ A dose equivalent to 10x this benchmark (i.e., 96 mGy/d) was then selected for the basis of the SSSTs for Sherman Lake. The rationale provided for this adjustment was that “[u]pper threshold limit guidance used by some regulatory agencies such as the Ontario Ministry of the Environment often apply a factor of 10 from a no effects level to determine an upper threshold limit.”²⁰ This adjustment was completed to increase the radiological dose above what is anticipated to be a no effect level (i.e., 9.6 mGy/day) to a level where adverse effects would be anticipated (i.e., 96 mGy/day).

ECCC (comment 6) commented on CIRNAC-CARD's approach of raising the radionuclide dose threshold for aquatic biota at Sherman Lake from 9.6 mGy/day to 96 mGy/day. ECCC noted that the original threshold of 9.6 mGy/day is established to prevent adverse effects at a population level and increasing it significantly may not be protective of fish and other aquatic species. In addition, the total absorbed radiation doses for fish (0.06 mGy/day) and benthic invertebrates (2.1 mGy/day) are well below the

¹⁹ See WLWB Online Registry for [Rayrock – AEMP Design Plan Version 1.1 – Appendix D](#) – May 22_24, PDF page 202.

²⁰ See WLWB Online Registry for [Rayrock – AEMP Design Plan Version 1.1 – Appendix D](#) – May 22_24, PDF page 202.

standard threshold. For aquatic plants, the calculated absorbed dose rate (9.8 mGy/day) slightly exceeds the original threshold, primarily due to radionuclides in sediment at Sherman Lake. ECCC recommended that CIRNAC-CARD continue to use the original threshold of 9.6 mGy/day or justify the ten-fold factor adjustment to the dose. ECCC also suggested that the CIRNAC-CARD should recalculate radionuclide concentration thresholds without applying the ten-fold factor and consider harvesting macrophytes to reduce the cycling of radionuclides back into Sherman Lake.

CIRNAC-CARD noted that levels of radionuclides in Sherman Lake are very low and currently represent no risk to the aquatic community as determined in the HHERA and, therefore, harvesting macrophytes is not justified. The Board agrees with CIRNAC-CARD that, at this time, there is no evidence to support the need for applying this mitigation or that the remediation-related activities at the site will result in creating such a need. CIRNAC-CARD will monitor and assess the receiving environment through the SNP and AEMP; therefore, if unforeseen circumstances arise, the validity of applying macrophyte harvesting methods can be considered at that time.

Regarding the approach of raising the radionuclide dose threshold, CIRNAC-CARD indicated that remediation activities in Mill Lake are not expected to significantly increase radionuclide levels in Sherman Lake. In the response to comment, CIRNAC-CARD noted that in the HHERA “the predicted radiological doses were more than an order of magnitude below the accepted reference dose of 9.6 mGy/d for aquatic plants, benthic invertebrates, predator fish and forage fish”. This means that the existing radiological dose would have to increase by a factor of ten to reach the no effects threshold level of 9.6 mGy/d due to remediation activities. CIRNAC-CARD noted that the Significance Threshold needs to be set at a level that marks the boundary where a significant adverse effect would be anticipated, to enable adaptive management actions to be implemented before reaching this Significance Threshold. CIRNAC-CARD referenced the Ontario Ministry of the Environment’s air quality guidance, which uses the concept of an Upper Risk Threshold set as ten times the air quality standard.²¹ CIRNAC-CARD stated that using a ten-fold factor to establish a theoretical Upper Risk Threshold for the radiological dose in Sherman Lake is a reasonable estimation and does not need to be recalculated, as it is anticipated that the dose will not exceed the no effects level of 9.6 mGy/day for fish and benthic invertebrates during Mill Lake remedial activities.

The Board agrees with CIRNAC-CARD that the purpose of the SSST values is to set the threshold at a level at or above which adverse effects would be anticipated to occur. While setting the SSST values at the no effects level is not necessarily appropriate, applying an approach used for air quality thresholds to the aquatic environment may also not be valid. Noting the low radionuclide concentrations that are well below both the no effects level and proposed SSST values, there is no immediate concern associated with the radionuclides entering the receiving environment. The Board requires CIRNAC-CARD to revisit the

²¹ See Guideline A-12: Guideline for the Implementation of Air Standards in Ontario at <https://www.ontario.ca/page/guideline-12-guideline-implementation-air-standards-ontario>.

Significance Threshold for radionuclides and provide additional information to support the application of the approach outlined in the Ontario air quality guidelines to the aquatic environment.

- ***Decision #3: Require CIRNAC-CARD to provide additional supporting information for the proposed approach for deriving the SSST values for radionuclides in water as part of the AEMP Annual Report to be submitted no later than June 30, 2025.***

3.2 Removal of Moderate Action Levels

The AEMP Guidelines outline three tiers of Action Levels (i.e., Low, Moderate, and High) that need to be set in a Response Framework. The intent of these tiered Action Levels is to “define magnitudes of environmental change that progressively signal the need for actions to understand, stop, and, if needed, reverse measured trends in the environment such that significance thresholds are never reached”.²² However, in the July 5, 2022, Reasons for Decision for Version 1.0 of the AEMP Design Plan, the Board indicated 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.”²³

CIRNAC-CARD submitted their response to the IR with a revised AEMP Response Framework that removed Moderate Action Levels (MALs) for all AEMP components. During the public review, ECCC (comment 2) raised concerns about the removal of the MAL for water and sediment quality, benthic invertebrates, and benthic and fish tissue chemistry. ECCC referenced the AEMP Guidelines highlighting the need for three tiers of Action Levels and indicating that the absence of a MAL may not provide sufficient time to reverse a trend to avoid breaching the Significance Threshold. ECCC recommended CIRNAC-CARD define MALs in the AEMP Response Framework for all elements monitored or provide sufficient justification regarding how the proposed Action Levels provide adequate time to respond to effects. CIRNAC-CARD responded that the MAL was removed following discussions with the WLWB staff regarding clarification on the IR and based on the above-mentioned Reasons for Decision where the Board indicated that three tiers of Action Levels may not be necessary for this project. CIRNAC-CARD also noted that the referenced guidelines are specifically designed for development projects and do not incorporate measures for remedial projects. CIRNAC-CARD believes that setting the HALs at 75% of the SSST values provides sufficient response triggers to implement response actions before the SSST values would be achieved. In addition, the primary source of contamination is Mill Lake effluent but if measured parameters in the effluent exceed EQC, the discharge of effluent would cease. Therefore, it is CIRNAC-CARD’s view that a MAL would not provide additional environmental protection.

²² See LWBs Policies and Guidelines (www.wlwb.ca) for [MVLWB/GNWT Guidelines for Aquatic Effects Monitoring Programs](#); p. 25.

²³ See WLWB Online Registry for [Rayrock – AEMP Design Plan Version 1.0 – Decision Letter and Reasons for Decision – Jul 5 22](#).

The Board recognizes that the previously proposed Action Levels resulted in repeated action level exceedances, which were not likely indicative of actual detrimental effects to the receiving environment.²⁴ The Board agrees with CIRNAC-CARD that, given the short-term nature of the discharge from Mill Lake (now in its second year) and considering the relatively low volume of water to be discharged along with conservative EQCs, a MAL may not offer additional protection to the receiving environment. As the Board noted in its July 5, 2022, Reasons for Decision, CIRNAC-CARD can propose fewer Action Levels, provided they are defined within the context of SSSTs and allow for timely responses to any changes trending in an undesirable direction. The Board believes that no revisions are needed at this time. However, as CIRNAC-CARD continues to complete SNP and AEMP monitoring and Action Levels assessment, the adequacy and effectiveness of the two-tier approach can be revisited through the AEMP Annual Report. Further details regarding this review are provided in Section 3.3 in relation to the HAL thresholds.

3.3 Water Quality High Action Levels

The revised HAL trigger for water quality includes a HAL threshold, which is calculated as either 75% of the SSST value or, in instances where the baseline concentration exceeds the SSST value, as a doubling (100%) of the 95th percentile value. GNWT-ECC (comment 2) noted that the newly proposed HAL threshold values are significantly higher (i.e., up to two orders of magnitude greater) than the previously proposed HALs and they believe they do not align or assist with achieving either the objectives presented in the approved AEMP Design Plan²⁵ or the closure criteria outlined in the Remedial Action Plan Version 2.1 (currently under separate review)²⁶. The approved AEMP Design Plan states that the AEMP will test the prediction that there will be no impact to Sherman Lake and that remediation should not cause cumulative effects given the small volume of water to be discharged (i.e., less than 2% of Sherman Lake's volume) over a short period of time (i.e., three years). GNWT-ECC also highlighted that the Remedial Action Plan Version 2.1 includes the following closure criteria for the Confined Disposal Facility (closure criteria 3-2e): "post-remediation AEMP results do not change from background concentrations and meet AEMP benchmarks for over five years".²⁷ GNWT-ECC questioned how the proposed revised HALs, which are considerably above baseline concentrations, will assist in meeting the established closure objectives and closure criteria. GNWT-ECC noted that both the GNWT-ECC and the Tłjchq Government proposed alternative summary statistics for determining Action Levels that better align with AEMP objectives as outlined on the AEMP Design Plan V 1.1 Reasons for Decision.²⁸ GNWT-ECC recommended that the WLWB not approve the proposed AEMP Response Framework unless CIRNAC-CARD can provide acceptable

²⁴ See WLWB Online Registry for [Rayrock - Notification - Concentrations Exceeding AEMP HAL – Jul 14 24](#) – Jul 14_24 and [Rayrock - Notification - Concentrations Exceeding AEMP HAL – Jul 28 24](#).

²⁵ See WLWB Online Registry for [Rayrock - AEMP - Design Plan - Version 1.1 - Mar 1 24.pdf](#).

²⁶ See WLWB Online Revise System for [Rayrock \(Kwetjjaà\) Remediation Project Remedial Action Plan \(RAP\) Version 2.1](#).

²⁷ See WLWB Online Revise System for [Rayrock \(Kwetjjaà\) Remediation Project Remedial Action Plan \(RAP\) Version 2.1](#); pdf p. 108.

²⁸ See WLWB Online Registry for [Rayrock – AEMP Design Plan V.1.1 and 2022 AEMP Annual Report– Reasons for Decision - May 15 24](#).

rationale describing how the water quality HALs align with the AEMP Design Plan objectives and the Remedial Action Plan closure criteria, and that parties should be given an opportunity to review this information. Board staff (comment 26) also commented on the relatively high SSST values, and asked CIRNAC-CARD to provide supporting rationale for basing the HALs on 75% of the SSST values and a doubling of the 95th percentile values, and to explain how this approach is considered conservative.

The context of the SSST values in relation to defining the Significance Thresholds is discussed in detail in section 3.1 of this Reasons for Decision. The HAL trigger threshold is then intended to be set at a level that allows for mitigations to avoid reaching the Significance Threshold (i.e., the “no-go zone”) in a timely manner. CIRNAC-CARD responded that a 75% SSST represents an acceptable buffer that permits response action before reaching these thresholds. CIRNAC-CARD explained that the reasoning behind using “the 95th percentile of the baseline + 100% of the 95th percentile” is that Beta and Gamma Lakes have historically been affected but are not influenced by Mill Lake effluent, so their approach sets an upper limit for these lakes without automatically triggering a HAL, which would occur because the baseline concentrations exceed the SSST values as noted in the IR response. CIRNAC also emphasized that a HAL trigger in Beta and Gamma Lakes must be linked to a remedial action to be considered an exceedance, as the Mill Lake effluent discharge does not reach them. CIRNAC-CARD further noted that the HHERA for the Project outlines the necessary remedial actions and remediation for Beta and Gamma Lakes has not been required to date.

The Board agrees that the HAL triggers for Gamma and Beta Lakes need to be set differently for the reasons CIRNAC-CARD have outlined. The Board notes that the LAL thresholds for water quality are conservatively set, and no concerns were raised in conjunction with the proposed revisions. Given the overall context of this contaminated site remediation project (i.e., limited scope and duration) coupled with the conservative EQC set by the Board, the Board believes the proposed HAL are reasonable based on the evidence provided by CIRNAC-CARD. The Board notes, however, that the AEMP Guidelines require a review of upper tier Action Levels and acknowledge these may need revision once the related LAL has been triggered.²⁹ As such, the Board requires CIRNAC-CARD to include a review of the HAL for any water quality parameter that triggers the LAL and verify that the proposed HAL triggers remain appropriate as part of the AEMP Annual Report. If this review through the AEMP identifies that changes to the HAL are warranted, then these can be considered by the Board at that time. If a LAL was triggered during the 2024 monitoring season, the Board requires this review be provided with the 2024 AEMP Annual Report. In consideration that the Board is requesting additional information to be included in the 2024 AEMP Annual Report (i.e., requirements 3 and 4) and recognizing that the deadline for the submission of the 2024 AEMP Annual Report is approaching on May 31, 2025, the Board decided to extend the deadline for submission of the 2024 AEMP Annual Report to no later than June 30, 2025.

²⁹ AEMP Guidelines p. 27.

- ***Decision #4: CIRNAC-CARD is to include a review of the High Action Level (HAL) for any water quality parameter that triggers the Low Action Level (LAL) and verify that the proposed (HAL) triggers remain appropriate. If a LAL was triggered during the 2024 monitoring season, the Board requires this review be provided with the 2024 AEMP Annual Report (see Decision #5 for further direction);***

- ***In consideration that the Board is requesting additional information to be included in the 2024 AEMP Annual Report (i.e., requirements 3 and 4) and recognizing that the deadline for the submission of the 2024 AEMP Annual Report is approaching on May 31, 2025, the Board decided to extend the deadline for submission of the 2024 AEMP Annual Report to no later than June 30, 2025.***

3.4 Water Quality Contaminants of Potential Concern Selection Process

In section 12.3.3.2 of the proposed AEMP Response Framework, CIRNAC-CARD has outlined its approach for screening Contaminants of Potential Concern (COPCs) in Mill Lake effluent, water quality in Sherman Lake, and sediment in Mill Lake. Board staff (comment 10) noted that while screening effluent chemistry can help identify potential additional COPCs that may not require EQC but may need additional SSSTs in the AEMP Response Framework, screening COPCs in the receiving environment is not the common approach for assessing effects related to remediation activities. The AEMP aims to detect project-related changes in the receiving environment regardless of whether a parameter is defined as a COPC and/or has an associated EQC.

The approved AEMP Design Plan, Version 1.1, specifies the statistical analyses for water and sediment quality, with significant changes defined as increases exceeding the Critical Effect Size (CES) of 25% from baseline conditions. This LAL exceedance triggers the Response Framework. Board staff indicated that it is unclear how this 25% CES relates to the proposed ten-times baseline COPC screening criterion and whether the assessment method specified in Version 1.1 remains applicable in light of the revised Response Framework. Additionally, Board staff noted that it is unclear how the proposed Action Levels would be applied to non-COPC parameters that exceed the CES of 25%. If a non-COPC parameter exceeds the LAL, an SSST would be necessary to establish a HAL, but there is no defined mechanism for developing SSSTs for these parameters. Board staff asked CIRNAC-CARD for clarification on the comparison between the CES of 25% baseline and the proposed ten-times baseline COPC screening criterion, the validity of the assessment approach described in Section 10.3.7 of the approved AEMP Design Plan, and the linkages with the proposed Action Levels if it remains valid. Board staff also asked how SSSTs would be established for non-COPC parameters.

CIRNAC-CARD clarified that the screening of the receiving environment is meant to evaluate parameters that are already elevated in Sherman Lake and may cause potential impacts if the effluent also has elevated concentrations of this parameter. They noted that the use of the CES of 25% was removed from

the Response Framework for Version 1.2 due to the improved baseline dataset collected over three seasons, acknowledging that the previous dataset used in Version 1.1 was limited. The proposed water quality Action Levels incorporate a combination of CCME guidelines, SSST values, and 95th percentiles from each lake, and sediment Action Levels were changed from the use of the CES of 25% to percentage changes from the 95th percentile. The use of a CES is still in effect for the evaluation of the benthic invertebrate community data. CIRNAC-CARD intends to update the relevant sections of the AEMP Design Plan to align it with the updates to the Response Framework and to reflect processes that permit tracking of changes to concentration trends, but that maintain the understanding that observed trends are not necessarily indicative of a significant impact. Furthermore, if additional SSST values are needed for an emerging parameter of concern, CIRNAC-CARD will follow the process laid out in CanNorth (2023) to ensure consistency. However, they clarified that the Project will not investigate regional changes to emerging parameters (e.g., mercury) for which no Project-related source can be identified. The Board notes that in the Reasons for Decision on the AEMP Design Plan, Version 1.1, the Board required CIRNAC-CARD to update the relevant sections of the AEMP Design Plan (i.e., Version 1.2) once the Response Framework is approved. This updated AEMP Design Plan should align with the updates to the Response Framework and reflect processes that permit tracking of changes to concentration trends, as indicated in CIRNAC-CARD's response.

Section 12.3.3.2 of the Response Framework describes the process for identifying COPC in Mill Lake effluent and Sherman Lake water and sediment, but it lacks the datasets and criteria values. While the decision-making process for retaining or removing parameters is outlined, the rationale for using ten-times the background concentrations in Sherman Lake as a screening criterion is not provided. Additionally, the parameters removed at each screening step are unclear. Board staff (comment 12) asked CIRNAC-CARD to provide the datasets and criteria values used in the COPC screening process, as per the LWB (2023) *Document Submission Standards*, as well as the rationale for using ten-times Sherman Lake background concentrations and a list of parameters removed at each screening step. CIRNAC-CARD indicated that the datasets used in the screening process will be provided with the next submission of the AEMP Design Plan. CIRNAC-CARD also stated that the use of ten-times the background concentrations in Sherman Lake is only in relation to concentrations in the Mill Lake sediment, which the Board believes to be reasonable given the variability in sediment concentrations but notes that parties have not had the opportunity to review this information. Therefore, the Board requires CIRNAC-CARD to provide the datasets and criteria values used in the COPC screening process, as well as the list of parameters removed at each screening step, as part of the AEMP Design Plan Version 1.2 update for conformity by Board staff.

- ***Revision #1: CIRNAC-CARD is to provide the datasets and criteria values used in the COPC screening process, as well as the list of parameters removed at each screening step, as part of the AEMP Design Plan Version 1.2 update for conformity by Board staff.***

3.5 Aquatic Environment Action Level

The aquatic environment component of the AEMP involves the monitoring of water levels (hydrology) and shoreline surveys at Sherman Lake, Beta Lake, Gamma Lake, Lake A, and New Control Lake. Action Levels for this component are designed to trigger a response action if water levels in Sherman Lake exceed a specific threshold as a result of the Project. CIRNAC-CARD has proposed an increase in water level of 130 mm above the seasonal pre-discharge water level together with evidence of environmental change or stress along a percentage of shoreline survey observation points. In addition, these changes must occur during the effluent discharge from the Mill Lake Water Treatment Plant (MLWTP) to be linked to the Project.

The AEMP Design Plan Version 1.1 indicates that shoreline surveys will occur twice a year: once during freshet and once in late summer. Water level data will be downloaded each June, immediately prior to commencement of effluent discharge, and then on a monthly schedule during open water. Board staff (comment 7) noted that the AEMP Response Framework states that site access and operational limitations may delay start-up of the MLWTP until after the annual freshet, meaning water levels from Sherman Lake and Lake A will not reflect treated water discharge during this period. Based on this, it is the late summer survey that would be considered for the Action Level trigger, while the spring survey would help in defining the existing conditions.

Although CIRNAC-CARD stated that the likelihood of exceeding the 130 mm water level change due to discharge is extremely low, Board staff noted that the disconnect in terms of the timing of accessing water level data and occurrence of the shoreline survey may lead to a delay in applying adaptive management within the same discharge season. Board staff asked for clarification from CIRNAC-CARD on when the Action Level assessments would take place relative to discharge and application of any potential mitigations. CIRNAC-CARD indicated that water level data is collected year-round using in situ sensors. Data is gathered in June, coinciding with the spring survey, and then monthly during the open water season. CIRNAC-CARD also noted that if a water level change that needs to be more closely monitored is detected, data collection frequency could be increased.

The Board recognizes that the limited discharge window within the four-month open-water season constrains the ability for CIRNAC-CARD to respond to changes within the same discharge season. The Board also acknowledges that the relatively small volume of water to be discharged over the anticipated remaining two discharge seasons, coupled with the volumetric limit established in the amended Licence, reduces the likelihood of significant water level changes in Sherman Lake due to effluent discharge. It is unclear what, if any, further changes could be made to resolve these constraints and, given the low-level risk associated with this component, if any additional environmental protection would result. The Board is of the view that no additional revisions are necessary at this time but notes that monitoring results will be provided in the AEMP Annual Report and can be revisited if unanticipated issues arise.

3.6 Other comments

Removal of Lithium, Sulphate, and Molybdenum as Contaminants of Potential Concern

ECCC (comment 3) recommended that the Proponent define Action Levels for lithium, sulphate, and molybdenum or provide justification for their removal as contaminants of potential concern. CIRNAC-CARD responded that lithium was removed from the Water Quality Action Levels update based on the screening procedure, which eliminated parameters if 90% or more were non-detectable concentrations. CIRNAC-CARD noted that based on the HHERA (CanNorth 2018) completed for the Rayrock site, lithium, sulphate, and molybdenum are not considered contaminants of concern. In addition, there is no CCME guideline for aquatic life for sulphate, and molybdenum baseline concentrations were below the CCME water quality guideline. CIRNAC-CARD noted that the Action Level exceedance for molybdenum highlighted the sensitivity of previous Action Levels. The Board believes that CIRNAC-CARD has adequately addressed this concern and no further action is needed at this time.

Volume of effluent relative to the Sherman Lake volume

During the review, Board staff noted what appears to be an inconsistency in the estimated volume of effluent relative to the volume of Sherman Lake. Values ranging from less than 2.5% and less than 5% have been stated. CIRNAC-CARD is to resolve this discrepancy and provide the correct volume in the updated AEMP Design Plan (V1.2). The Board also notes that this discrepancy does not affect the final conclusions of this Reasons for Decision because this variation remains within an overall small volume range.

- ***Revision #2: The Board requires CIRNAC-CARD to provide the correct estimated volume of effluent relative to the Sherman Lake volume in the updated AEMP Design Plan Version 1.2 for conformity by Board staff.***

Administrative revisions the Proponent has agreed upon

A number of comments were not discussed in this Reasons for Decision because the Board believes that they were either straightforward revisions that CIRNAC-CARD agreed to incorporate, responses that sufficiently addressed the clarifications or questions, or comments identified as not requiring a response (e.g., informational comments from reviewers or comments associated with a cover letter). These comments include the following: ECCC comment 1; GNWT-ENR comment 1; and WLWB staff comments 1, 2, 3, 4, 5, 6, 8, 9, 11, 13, 14, 15, 16, 17, 19, 21, 22, 23, 24, 25, 27, 28, 29, 31, 32, 33.

Signed the 5th day of May 2025, on behalf of the Wek'èezhì Land and Water Board



Mason Mantla Witness
Chair, Wek'èezhì Land and Water Board



Witness