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Land and Water Board

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July 19, 2022 File: W2020L2-0004

Laura Pacholski
Arctic Canadian Diamond Company Ltd.
900-606 4 Street SW
Calgary, AB T2P 1T1

Sent by email

Dear Laura,

Re: Ekati – AEMP – 2021 Annual Report – Lac de Gras, NT

The Wek'èezhìı Land and Water Board met on July 19, 2022 and considered Arctic Canadian Diamond Mine Ltd.'s (Arctic's) Aquatic Effects Monitoring Program Annual Report for 2021 (the Report).

As detailed in the attached Reasons for Decision, the Board has decided to approve the Report with direction for future AEMP Reports and the 2022 AEMP Re-evaluation.

Mike Nitsiza
Acting Chair, Wek'èezhìı Land and Water Board

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

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Reasons for Decision

Reference/File Number:	W2020L2-0004 (Type "A" Water Licence)
Licensee:	Arctic Canadian Diamond Company Ltd. (Arctic)
Subject:	AEMP Annual Report 2021

Decision from the Wek'èezhìi Land and Water Board
Meeting of July 19, 2022

1.0 Decision

On July 19, 2022, the Wek'èezhìi Land and Water Board (WLWB or the Board) considered Arctic Canadian Diamond Company Ltd.'s (Arctic's) Aquatic Effects Monitoring Program (AEMP) Annual Report for 2021.[1] The Report is required by Licence W2020L2-0004, Part J, Condition 6, and is for Board approval.[2] In consideration of the submission, previous Board direction, reviewer comments and proponent responses, the Board has made the following decisions:

1. To approve the 2021 AEMP Annual Report;
2. To direct Arctic to include an update on the investigation into abnormally low laboratory-measured pH values in the 2022 AEMP Annual Report.
3. With Regards to Version 8.0 of the AEMP Design Plan to be submitted with the 2022 AEMP Re-evaluation, Arctic is to:
    a. Incorporate field pH measurements; and
    b. Reflect the use of sample bottles with septa for ammonia samples; and
4. With regards to the 2022 AEMP Re-evaluation, Arctic is to:

[1] See WLWB Online Registry (www.wlwb.ca) for Ekati – AEMP – Plankton and Benthos Response Plan – V 2.0 – Oct 22_21
[2] See WLWB Online Registry for Ekati – 2020 AEMP Annual Report – Reasons for Decision – Aug 24_21

a. Include an update on the investigation into the baseline data used for arsenic in sediments;
b. Discuss the Ek-core sampling method, including limitations of the method, and how Arctic proposes to collect samples for all sediment quality variables;
c. Include confirmation of expected sediment variable detection limits for the next sediment sampling year;
d. To direct Arctic to include a discussion of the appropriateness of the chlorophyll *a* benchmark in relation to the 2021 benchmark exceedances observed in Counts, Ulu, and Horseshoe lakes, and propose if the benchmark is appropriate, with rationale; and
e. Include a discussion of Slimy Sculpin CPUE, including what data Arctic requires to better understand CPUE trends, and what factors Arctic could evaluate to determine if there are mine-related effects.

2.0 Background

The AEMP represents an extensive monitoring program, which includes the monitoring of water, sediment, and several types of living organisms around the Ekati site. The purpose of the AEMP is to measure and evaluate potential effects of the mine on the Receiving Environment. Part J, Condition 6 of the Licence requires that Arctic submit an AEMP Annual Report before March 31st to present the results from the previous year of monitoring. The AEMP Design Plan outlines the details for the sampling program (e.g., sampling locations, field and laboratory methods, and data analysis methods).

On March 31, 2022, Arctic submitted the Report that consisted of the following parts: Part 1 – Annual Report;[3] Part 2 – Statistical Report;[4] and Appendices: A – Data Report,[5] B – Historical Water Quality Report,[6] and C – Aquatic Response Framework Reporting.[7] Arctic also provided tabular data in excel format[8] in response to the Board's direction from January 25, 2018.[9] Additionally, Arctic provided a follow-up memorandum[10] regarding Cujo Lake Dissolved Oxygen (DO) concentrations as continued follow-up per the commitment made by Arctic in the 2019 Cujo Lake DO Memorandum.[11] The submission was distributed for public review on April 22, 2022. Reviewers were asked to provide comments by May 30, 2022. Comments were received from the Government of Northwest Territories – Environment and Natural Resources – Environmental Assessment and Monitoring (GNWT-ENR) and the Independent Environmental Monitoring Agency (IEMA). Environment and Climate Change Canada and Fisheries and Oceans Canada (DFO) indicated they had no comments or recommendations at this time. Board staff also submitted questions. Proponent responses were submitted by the deadline of June 13, 2022. Reviewer

[3] See WLWB Online Registry for Ekati – AEMP – 2021 AEMP Part 1 Annual Report – Mar 31_22
[4] See WLWB Online Registry for Ekati – AEMP – 2021 AEMP Part 2 Statistical Report – Mar 31_22
[5] See WLWB Online Registry for Ekati – AEMP – 2021 AEMP Part 1 Annual Report – Appendix A – Mar 31_22
[6] See WLWB Online Registry for Ekati – AEMP – 2021 AEMP Part 1 Annual Report – Appendices B to G – Mar 31_22
[7] *Ibid.*
[8] See WLWB Online Registry for Ekati – AEMP – 2021 AEMP Report – Data File – Mar 31_22
[9] See WLWB Online Registry for W2012L2-0001 – Ekati – AEMP – 2016 Annual Report – Board Directive and Reasons for Decision – Jan 25_18
[10] See WLWB Online Registry for W2012L2-0001 – Ekati – AEMP – 2020 Annual Report – Cujo DO Memo – Mar 31_21
[11] See WLWB Online Registry for W2012L2-0001 – Ekati – AEMP – 2019 AEMP Annual Report – Cujo 2019 DO Memo – Jun 30_20

comments and recommendations, as well as proponent responses, are available on the WLWB Online Review System (ORS).[12]

3.0 Reasons for Decision

The Report was reviewed for conformity to: Part J, Condition 6 of the Licence; Schedule 8, Condition 3 of the Licence; the approved changes to AEMP sampling;[13,] the AEMP Design Plan for 2020-2022;[14] and Board direction from the 2020 AEMP Annual Report.[15] All comments and proponent responses submitted during the public review period were also reviewed. In consideration of Arctic's submission, reviewer comments, and proponent responses, the Board has approved the 2021 AEMP Annual Report because:

1. The Report satisfies the relevant terms and conditions set out by the Licence; and
2. As discussed in more detail below, issues raised through the public review of this Report have been addressed through proponent responses or can be addressed through future AEMP-related submissions.

- ***Decision #1: The Board has approved the 2021 AEMP Annual Report.***

3.1 Physical Limnology

Physical limnology variables monitored during the 2021 AEMP season include temperature, dissolved oxygen (DO), specific conductivity, and Secchi depth. No physical limnology variable Action Level (AL) exceedances were detected in 2021.

3.1.1 Laboratory-measured pH abnormalities

In its review, GNWT-ENR and Board staff asked Arctic about the ongoing pH investigation for observed laboratory-measured pH values being abnormally low (GNWT-ENR comment 2 and Board staff comment 4). Board staff asked if these abnormal values could impact the analysis and evaluation of results in the 2021 AEMP Annual Report. Arctic noted that low laboratory-measured pH values were measured in both monitored and reference lakes, and thus the evaluation of it in the 2021 AEMP Annual Report is "considered to be reliable and unimpacted." GNWT-ENR recommended additional information be provided by Arctic to support how the AEMP program is able to detect mine-related changes to pH, as continued increases in pH could potentially result in increases beyond the CCME benchmark, but the data abnormalities prevent meaningful interpretation of pH. GNWT-ENR also recommended that following two full seasons of erroneous data, Arctic provide an update on the investigation into these data prior to the 2022 open water sampling season.

Arctic responded that laboratory-measured pH is the measured pH of sample water at the time of analyses and may be different than pH of the water in-situ, as they are not measured under the same conditions.

[12] See WLWB Online Review System for Ekati – 2021 AEMP Annual Report Review
[13] See WLWB Online Registry for W2012L2-0001 – Ekati – AEMP – Sediment Sampling Method Study – Reasons for Decision – Jun 22_21
[14] See WLWB Online Registry for Ekati – AEMP – 2020-2022 AEMP Design Plan V 7.1 – Dec 17_21
[15] See WLWB Online Registry for Ekati – 2020 AEMP Annual Report – Reasons for Decision – Aug 24_21

Arctic indicated laboratory-measured pH can be influenced by changes in atmospheric pressure, diffusion of atmospheric or dissolved carbon dioxide, and biological activity, and that laboratory-measured pH is expected to be lower than in-situ pH. The investigation into why the lab-measured pH has decreased is ongoing. Arctic also noted it will begin collection of in-situ pH measurements to reflect pH in the Receiving Environment at the time of sample collection. The Board is of the opinion that the collection of in-situ pH measurements should be reflected in the AEMP Design Plan to reflect Arctic's commitment. The Board thus directs Arctic to incorporate field pH measurements in the AEMP Design Plan with the 2022 AEMP Re-evaluation. Given the timing of the review of this annual report, the 2022 open water sampling season is currently ongoing, and the Board is of the opinion that an update on the investigation is more appropriate for inclusion in the next AEMP Annual Report. The Board thus directs Arctic to include an update on the investigation in the 2022 AEMP Annual Report.

- ***Decision 2: The Board directs Arctic to include an update on the investigation into abnormally low laboratory-measured pH values in the 2022 AEMP Annual Report.***
- ***Decision 3a: The Board directs Arctic to incorporate field pH measurements in the AEMP Design Plan with the 2022 AEMP Re-evaluation.***

3.1.2 Hydrogeometry Measurements

Board staff commented that there were fewer manual stream measurements taken at Slipper-Lac du Gras and Logan Outflow in 2021 due to health and safety risks with high-water levels and asked if there were any implications to any conclusions due to these missing measurements (Board staff comment 1). Arctic responded that channel geometry had remained stable for both locations, and the results of a 2021 hydrogeometry study at Slipper-Lac du Gras also indicated no significant changes had occurred to the channel geometry. Arctic concluded that there were no implications to the hydrology data set or conclusions of the AEMP. The Board is of the opinion that Arctic's conclusions are reasonable and have no further concerns at this time.

3.2 Water Quality Variables

In the 2021 AEMP season, exceedances were reported for the low AL for chloride in Leslie and Moose Lakes. For potassium, the following exceedances were reported: the medium AL in Leslie Lake and the low AL in Moose Lake during the ice-covered season; and the low AL in Leslie and Moose lakes during the open-water season. As per the Response Framework, a low AL for a Response Framework water quality variable (with the exception of dissolved oxygen) is exceeded when the following conditions are met:

1. The average measured monthly concentration of the water quality variable at any near-field AEMP sampling location is greater than 50% of the water quality benchmark (Table 3.1-4); and
2. The variable shows an increasing annual trend for all sampling events based on data collected within the same month for which condition (1) is met.

The potassium medium AL is exceeded when the following conditions are met:

1. The average measured potassium concentration at any near-field AEMP sampling location is greater than 70% of the water quality benchmark; and
2. The average measured potassium concentration at any near-field AEMP sampling location is greater than 90% of the water quality benchmark.

3.2.1 Potassium in Leslie Lake

Concentrations of potassium have exceeded ALs in Leslie Lake for multiple years. The Potassium Response Plan was first required following the 2013 AEMP Annual Report to address a low AL exceedance. In Leslie Lake, there was a low AL exceedance for open water in 2016, a medium AL exceedance for under-ice in 2017, a high AL exceedance for under-ice in 2018, a medium AL exceedance for under-ice in 2019, and an under-ice and open-water low AL exceedance in 2020 for potassium.[16, 17] In 2021, Arctic notified the Board as per Part J, Condition 9(a) of the Licence of the following potassium AL exceedances: a medium AL in Leslie Lake for under-ice, a low AL in Moose Lake for under-ice, and a low AL during open-water in Leslie and Moose Lakes.[18,19] The notifications stated that the exceedances for potassium are addressed in the approved Potassium Response Plan Version 3.0,[20] and no updated Plan was required at this time. The exceedance notifications were emailed to the Ekati Distribution List, and no request for review of the exceedances were received. The approved response actions outlined in Version 3.0 of the Potassium Response Plan for a low AL exceedance include: water quality monitoring and reporting; operational water management; and investigation of cause.

IEMA commented that AL exceedances for potassium concentrations had occurred in lakes downstream of the Long Lake Containment Facility (LLCF) for another year, noting the low AL for under-ice potassium concentrations in Leslie Lake had been consistently exceeded for the past 10 years, including 2021 (IEMA comment 3). IEMA noted it was concerned that chronic effects to the most sensitive aquatic life may develop if AL exceedances continue to persist, and recommended Arctic investigate if potassium loading and observed elevated levels of potassium in Leslie Lake could lead to these chronic effects. IEMA noted possible impacts could either occur directly to plankton from the lake water or to benthic fish and invertebrates through potential sequestration of potassium into lake sediments (IEMA comment 3). IEMA indicated it had previously raised this concern in review of the 2020 AEMP Annual Report. Arctic responded that IEMA had not provided new information or evidence to support its recommendation since its review of the 2020 AEMP Report review, and no additional investigations were needed at this time. Arctic re-iterated its response to IEMA in the 2020 AEMP that "no toxicity to aquatic life, including no chronic effect, are anticipated to result from the potassium concentrations observed to date." Arctic

[16] See WLWB Online Registry for W2012L2-0001 - Ekati - AEMP - 2020 Under-ice Action Level Exceedance Notification - Jul 31_20.pdf
[17] See WLWB Online Registry for W2012L2-0001 – Ekati – AEMP – 2020 Open-water Action Level Exceedance Notification – Oct 29_20
[18] See WLWB Online Registry for Ekati – AEMP – 2021 Under-ice Action Level Exceedance Notification Letter – Jul 30_21
[19] See WLWB Online Registry for Ekati – AEMP – 2021 Open-water Action Level Exceedance Notification Letter – Oct 27_21
[20] See WLWB Online Registry for W2012L2-0001 – Ekati – AEMP – Potassium Response Plan – Version 3.0 – Aug 30_19

further noted that sediment potassium was statistically evaluated for the first time with the 2021 AEMP, and that no statistically significant difference in sediment potassium concentrations were detected downstream of the LLCF and no consistent spatial gradient of decreasing concentrations with increasing distance from the LLCF was present. In its Decision on the 2020 AEMP Annual Report, the Board indicated "it is of the opinion that no additional investigations are required at this time and note that the requirement for AL notifications and AEMP Annual Reports will continue to provide opportunities to evaluate any trends in potassium concentrations downstream of the LLCF."[21] As no new evidence has been identified by IEMA to support additional investigations, and Arctic has provided evidence that sediment potassium concentrations do not appear to have increased, the Board is of the opinion that the Decision previously made by the Board is still appropriate.

3.2.2 Ulu Lake Concentrations Elevated

In the Report, Nitrate-N concentrations in Ulu Lake and Outflow were observed to be elevated in the 2020 open-water season and the ice-covered 2021 season, but that levels decreased during open water in 2021, and additional monitoring was needed to determine if the increase had persisted. Board staff asked Arctic how additional monitoring would confirm the increase had persisted (Board staff comment 11). Arctic replied that if monitoring during the 2022 ice-covered season indicated nitrate concentrations remain elevated, then the increase persisted. The Board is of the opinion that this approach is reasonable and no further information is needed at this time. In addition, the Board notes that there are Action Levels for Nitrate-N and that these levels have not been exceeded for Ulu Lake.

Board staff also commented on the reported increased concentrations in total barium, total nickel, total potassium, and total strontium observed for Ulu Lake, with no clear source of the change. Board staff asked if there was a possibility of seepage entering Ulu Lake undetected, and how additional monitoring would confirm the source of the increased concentrations (Board staff comment 12). Arctic responded that permafrost limits potential for subsurface flow to enter the Receiving Environment without visual observation, and seepage surveys at the Sable Waste Rock Storage Area (WRSA; which is the only potential WRSA seepage source for Ulu) had found no evidence of sustained or significant Seepage from the Sable WRSA entering the Receiving Environment. Arctic noted monitoring conducted during the 2022 ice-covered and open-water seasons will provide data to understand if the concentrations in Ulu Lake are increasing or decreasing, and if there are increasing concentrations there would be evidence of a mine-related effect, while decreasing concentrations may indicate natural variability is the source of the change. This appears to be a reasonable approach, and the Board is of the opinion that no further information is needed at this time.

3.2.3 Ammonia Concentration

Board staff commented that ammonia contamination was reported to regularly happen in AEMP samples, but that the 2021 QA/QC sample results suggested improved sampling handling had addressed the issue (Board staff comment 5). Arctic had also reported that the under-ice ammonia concentrations in 2021

[21] See WLWB Online Registry for Ekati – 2020 AEMP Annual Report – Reasons for Decision – Aug 24_21

showed relatively high variability in replicate samples at a number of sites, and some data were removed due to contamination. Board staff asked if Arctic could clarify if further investigation or mitigations were needed to resolve the noted contamination given the noted variability in the under-ice samples (Board staff comment 5). Arctic responded that sample bottles without septa had been used for the 2021 ice-covered season (which had the samples with high variability and data removed due to contamination) but then they used sample bottles with septa for the 2021 open-water season and had no ammonia contamination. It is the Board's understanding that this sampling method will be used going forward and to ensure this method is implemented, the use of sample bottles with septa is to be incorporated into the AEMP Design Plan as part of the 2022 AEMP Re-evaluation.

- ***Decision 3b: The Board directs Arctic to reflect the use of sample bottles with septa for ammonia samples in the next AEMP Design Plan submission for the 2022 AEMP Re-evaluation.***

3.3 Sediment Quality Variables

Sediment quality samples are collected and sediment quality variables are evaluated every three years as per the AEMP Design Plan. Sediment samples in 2022 were collected using the "Ek-core" method, which involved collecting cores from an undisturbed Ekman sample. This method was approved by the Board in its June 22, 2021 Decision.[22]

3.3.1 Antimony in sediments in Cujo

GNWT-ENR noted the sediment antimony concentrations in Cujo Lake exceeded the lower limit alert threshold of 2 mg/kg but not the "Predicted No Effect Concentration" (PNEC) level of 11.2 mg/kg or midpoint effects guideline level of 13.5 mg/kg (GNWT-ENR comment 3). GNWT-ENR recommended that Arctic provide more information on antimony concentrations in sediments, including the frequency of exceedances of the alert concentration and the range of measured concentrations for comparison against the PNEC and midpoint effects guideline level. Arctic responded that there was an error in the AEMP Annual Report, and the actual measured concentration was 0.573 mg/kg as reported in the Data Report (Appendix A), and that the Cujo Lake sediment concentrations had not exceeded the alert level. Therefore, no further information is needed at this time.

3.3.2 Further evaluation of antimony in sediments

In the AEMP Annual Report, Arctic stated that the lower limit alert threshold should be used as a screening value for identifying if a contaminant required further evaluation. Given exceedances of the 2 mg/kg threshold in Leslie, Moose, and Nema, Board staff asked whether further evaluations were being considered (Board staff comment 6). Arctic responded that concentrations had been highest in Leslie Lake and had been stable at 4 mg/kg since 2010. Arctic suggested the evidence indicated sediment antimony concentrations in Leslie Lake were in equilibrium with water concentration, and that the sediment antimony had stabilized at concentrations approximately three-fold lower than the PNEC. Therefore,

[22] See WLWB Online Registry for W2012L2-0001 – Ekati – AEMP – Sediment Sampling Method Study – Reasons for Decision – Jun 22_21

Arctic maintains that no adverse effects to aquatic life are expected, and no further evaluation is required. As Arctic has indicated, there had been no increase in sediment antimony concentrations, and no other reviewers raised concerns with antimony in sediments. Therefore, the Board is of the opinion that further evaluation is not needed at this time.

3.3.3 Uranium in sediments

In review of the Report, GNWT-ENR noted the observed sediment uranium concentration in Cujo Lake had increased four-fold since sampling began in 2011, and a mine related effect was identified for uranium in Cujo Lake sediments (GNWT-ENR comment 4). Arctic had provided a literature review of uranium to determine the likelihood of toxicity to aquatic life, which focused on two research papers, as there are no guidelines. GNWT-ENR pointed out that other studies identified lower effect level concentrations which had not been considered in the literature review. GNWT-ENR suggested other peer review sources indicate the average concentrations in Cujo Lake may be approaching a level sufficient to result in adverse effects and recommended that Arctic reconsider its proposed uranium sediment concentration effect level of 599 mg/kg, and use more recent peer reviewed literature and a reasonable safety factor to propose a new benchmark (GNWT-ENR comment 4). Arctic responded with rationale for why it believed the studies referenced by GNWT-ENR were not suitable, including not being evidence-based, use of artificial sediments, and uncertainties with spiking procedures. Arctic further noted it is collecting the top 1 cm of sediment, and that higher metals concentrations were typically measured in the top 1 cm, as compared with its previous recommendation that sediment quality data be evaluated using 2 cm Ekman samples. Arctic noted that CCME guidelines are applicable to "surficial sediments" described as the "upper few centimetres", and that screening thresholds had been developed using sediment chemistry data from the upper 10 cm. Arctic concluded that the comparison of concentrations from the top 1 cm to sediment guidelines that use thicker sediment layers adds additional conservatism, and the screening threshold used in the 2021 AEMP Annual report is appropriate. The Board notes that sediment quality is evaluated every three years. Given the expected timing of the next AEMP Re-evaluation submission in late 2022, it is more appropriate to discuss potential benchmark changes during review of that submission.

3.3.4 Arsenic in sediments

Board staff noted that mean arsenic concentrations exceeded the CCME ISQG guideline at all monitored and reference sites, and the PEL guideline at all but Horseshoe and Lower Exeter Lakes in 2021 (Board staff comment 13). Arctic had noted in the Report that "graphical analysis indicates that arsenic in Horseshoe Lake sediments have remained stable through time whereas the after period mean increased relative to the before period mean in downstream lakes and the reference lakes" and it "appears to be associated with the change in sampling method." Board staff asked how Arctic had confirmed this statement, and if a similar change had been observed for other parameters (Board staff comment 13). Arctic responded that the collection of the top 1 cm of sediments instead of 2 cm had been observed to have difference in sediment concentrations in reference and monitored lakes, and was observed for many variables, without a consistent direction of change among variables or sampling location, although typically higher concentrations were measured in the top 1 cm. Arctic noted it was considered reasonable that the same general pattern would be present in Horseshoe and Lower Exeter lakes. Arctic further

responded that Horseshoe Watershed and Lower Exeter Lake have historically received low volumes of water, and prior to Discharge from the Two Rock Sedimentation Pond (TRSP) in 2021, no water had been discharged that likely would have contained mine water. Arctic pointed out that this was particularly relevant to sediment concentrations, as an increase in detectable concentrations takes time to be evident in sediment, which is unlikely due to the low Discharge volumes since 2021. Arctic noted it will be completing an investigation to test and conclude that the correct baseline data years have been correctly identified, as part of the AEMP Re-evaluation. The Board believes Arctic's rationale appears to be reasonable given previously reported differences but Arctic's commitment to conduct an investigation into the baseline data should be reflected in the 2022 AEMP Re-evaluation requirements.

- ***Decision 4a: The Board directs Arctic to include an update on the investigation into the baseline data used for arsenic in sediments, in the 2022 AEMP Re-evaluation.***

3.3.5 Sediment sampling method

The 2021 AEMP was the first year that Arctic conducted a full sediment sampling program using the Ek-core combination sampling method. Board staff asked if any challenges had been encountered, how effective the QA/QC methods were, and if there were limitations to obtaining sufficient sample material, specifically related to the nitrogen sediment analysis as it was reported that there was no core data in 2021 for Koala, Lac de Gras, and reference lakes for nitrogen in a footnote to Figure 3.3-2 of the Report (Board staff comments 2 and 3). Arctic responded that the approved QA/QC protocol was followed as described in the AEMP Design Plan Version 7.1, and no concerns were raised. Arctic noted there were no unanticipated challenges, but that it had been anticipated there may be difficulty in obtaining large enough sample quantities for all analyses. Arctic noted this difficulty was related to the collection of the top 1 cm of sediment as it is largely comprised of a fluffy layer with high water content. Arctic responded that almost double the currently collected samples (i.e., double the effort) would be needed to obtain the required sample quantity to complete nitrogen analysis, which it considered an unacceptable use of limited monitoring resources. Arctic further observed that while there were some limitations in the 2021 dataset, it was a significant improvement over what was achieved in previous sampling years, and overall the Ek-core had provided a great proportion of core data for 29 of 30 sediment chemistry variables. The Board acknowledges that this is an improvement on the overall dataset, and Arctic has provided rationale for the limitations in sample material with this method. However, this change was not reported in the sampling plan exceptions in the Report, and it is unclear if Arctic is requesting a change in the sediment sampling method in order to collect nitrogen samples using just Ekman sampling. The Board directs Arctic to discuss the Ek-core sampling method in the 2022 AEMP Re-evaluation, including limitations of the method, and how Arctic proposes to collect samples for all variables.

- ***Decision 4b: The Board directs Arctic to discuss the Ek-core sampling method in the 2022 AEMP Re-evaluation, including limitations of the method, and how Arctic proposes to collect samples for all sediment quality variables.***

Board staff commented that it was reported that not all Total Metals achieved the targeted detection limit for all sediment samples, sometimes by a magnitude of 10 to 100 times the target value (Board staff

comment 16). Board staff also noted that the Board had previously made decisions regarding alignment of detection limits with the Diavik Diamond Mine AEMP to better help identify potential Project-related effects in the western portion of Lac de Gras and help assess cumulative impacts (Board staff comment 15). Board staff asked if Arctic would propose changing detection limits with the next AEMP Re-evaluation, and to further explain the change in achievable target detection limits as well as the magnitude in difference. Arctic responded that the 2021 laboratory analysis was completed by the same laboratory that completes sediment analysis for the Diavik AEMP, and that the vast majority of elevated detection limits was due to dilution of the sample in order to bring the analyte within calibration range. The magnitude of differences was explained to be due to differences in laboratory protocols, and Arctic noted the raised detection limit "should not diminish confidence in the sediment quality results reported for the 2021 AEMP." Arctic provided a comparison of 2017 and 2021 sediment metal results, noting that 2.4% of results were below detection limit in 2017 and 2.6% were below detection limit in 2021, and with no substantial difference in proportion of results below the detection limit, there is no reason for concern with the achieved limits and no change in interpretation of the sediment quality data. Arctic noted that detection limits change over time, and Arctic cannot predict what achievable detection limits will be in the next sediment sampling year. Arctic noted it would confirm whether the laboratory's detection limits have changed since 2021 during the next AEMP Re-evaluation, and continue to report on the detection limit achievability in the AEMP Annual Report. The Board is of the opinion that Arctic has provided reasonable rationale for the deviations in sediment detection limits. The Board directs Arctic to include the information committed to with respect to confirmation of laboratory sediment detection limits in the next AEMP Re-evaluation.

- ***Decision 4c: The Board directs Arctic to include confirmation of expected sediment variable detection limits for the next sediment sampling year in the next AEMP Re-evaluation.***

3.4 Biological Variables

3.4.1 Plankton Variables

The Response Framework[23] states that the low AL for phytoplankton, zooplankton, or benthos biomass or total density variables is exceeded when the following conditions are met:

1. Based on AEMP methods for determining mine effects for phytoplankton, zooplankton and benthos biomass or total density, a statistically significant difference from a slope of zero and reference conditions in at least two reference lakes, or a statistically significant Before-After-Control-Impact (BACI) interaction is concluded for a near-field lake site; and

2. Using the biological benchmarks based on upper and lower quantiles (p = 0.05) of the fitted distributions, the average of the biological variable being assessed is less than the lower benchmark or greater than the upper benchmark for the current AEMP year and the previous two years at any near-field site.

[23] See WLWB Online Registry for W2012L2-0001 – Ekati – AEMP – Response Framework – Version 3.0 – Jun 29_18

Low AL exceedances were noted in 2021 for: phytoplankton biomass (as chlorophyll *a*) in Kodiak and Leslie lakes, phytoplankton community composition in Leslie and Moose lakes, zooplankton community composition in Leslie and Moose lakes, phytoplankton biomass in Cujo Lake, phytoplankton density in Cujo Lake, and zooplankton community composition in Cujo Lake. The Response Plan for Plankton and Benthos was previously implemented to address the exceeded ALs in Leslie and Moose Lakes, and an updated Response Plan (Version 2) was submitted to address the low AL exceedance in Kodiak Lake on October 22, 2021.[24] The Plan was reviewed by Parties on the Online Review System (ORS), and the Board approved the Plan on May 4, 2022, with additional direction for Arctic.[25]

Chlorophyll a Concentrations in Horseshoe Watershed

It was reported that mean chlorophyll *a* concentrations in 2021 were greater than the benchmark range in Ulu and Horseshoe lakes, but that the benchmark was also exceeded in the before period (i.e., in 2016 and 2018). The benchmark was also noted to have been exceeded in one of the reference lakes (i.e., Counts Lake). Arctic indicated chlorophyll *a* in these lakes may naturally exceed the benchmark. Board staff asked Arctic to comment on the appropriateness of the benchmark for chlorophyll *a* given the exceedance in the before period (Board staff comment 14). Arctic responded that the AEMP Re-evaluation is a more appropriate venue for addressing approved benchmarks and noted that the AEMP Design Plan Version 7.1 describes that there is a one in 20 chance that an individual observation will be greater than the benchmark by chance alone. Arctic replied that the benchmark exceedances observed in Counts Lake will be considered in the 2022 AEMP Re-evaluation, and that the benchmark is conservative, based on empirical evidence, and considered appropriate for the purposes of screening for potential low AL exceedances for phytoplankton biomass. Arctic noted the biological benchmarks are periodically updated to incorporate baseline data for new development areas and more recent reference data. The approved AEMP Design Plan V 7.1 outlines that phytoplankton benchmarks are developed by "identifying reasonable normal ranges based on reference and baseline conditions. The benchmarks are based on modelled distributions of baseline and reference lake or stream observations occurring within the lower and upper extremes of these modelled distributions."[26] The Plan also notes that biological benchmarks "should be periodically updated to incorporate baseline data for new development areas and more recent reference data." Given Arctic's commitment to discuss the benchmark exceedances in Counts Lake in the 2022 AEMP Re-evaluation, the Board directs Arctic to include this, along with discussion of the appropriateness of the chlorophyll *a* benchmark as it is not clear to the Board how it is appropriate for the benchmark to exceed baseline data.

- ***Decision 4d: The Board directs Arctic to include a discussion of the appropriateness of the chlorophyll a benchmark in relation to the 2021 benchmark exceedances observed in Counts, Ulu, and Horseshoe lakes, and propose if the benchmark is appropriate, with rationale, in the 2022 AEMP Re-evaluation.***

[24] See WLWB Online Registry for Ekati – AEMP – Plankton and Benthos Response Plan – V 2.0 – Oct 22_21
[25] See WLWB Online Registry for Ekati – AEMP – Plankton and Benthos Response Plan – V 2.0 – Reasons for Decision – May 4_22
[26] See WLWB Online Registry for Ekati – AEMP – 2020-2022 AEMP Design Plan V 7.1 – Dec 17_21

3.4.2 Fish Variables

The Response Framework states that the low AL for fish variables is exceeded when one or both of the following conditions are met:

1. Based on AEMP methods for determining mine effects in monitored Slimy Sculpin, a mine-related effect is concluded for a near-field lake for a [Response Framework] fish variable.
2. Based on AEMP methods for determining mine effects in monitored large-bodied fish, a mine-related effect is concluded for a near-field lake for a [Response Framework] fish variable.

A low AL exceedance was reported in 2021 for selenium in small-bodied fish tissue in Leslie and Moose Lakes. Version 3.0 of the Fish Response Plan was submitted in response to this exceedance and is currently under review on the ORS.[27]

Slimy Sculpin Catch Per Unit Effort

GNWT-ENR noted the Slimy Sculpin catch per unit effort (CPUE) had declined by an average of 62.1 ±12.3% in all monitored lakes between 2007 and 2021, and it was reported that more years of data were needed to understand Slimy Sculpin trends (GNWT-ENR comment 1). GNWT-ENR commented that the current design did not call for sampling of small-bodied fish until 2024 but given the uncertainty in the CPUE trends and need for additional data, a revised sampling schedule should be considered (GNWT-ENR comment 1). Board staff also asked about Slimy Sculpin CPUE, why more data was needed to understand trends, and what Arctic was uncertain about with respect to effects (Board staff comment 7). In response to Board staff, Arctic indicated uncertainty for some mine effects was due to a lack of obvious rationale. Arctic responded to GNWT-ENR that while there had been a decline in the Slimy Sculpin CPUE, this decline had been consistent across lakes between 2007 and 2021 and the trend had improved in more recent years of monitoring. Arctic noted that increases in relative size of the Slimy Sculpin population occur more slowly than can be captured in annual sampling, and an accelerated sampling schedule could result in more fishing pressure on the population. Arctic indicated the use of Slimy Sculpin as a sentinel species was added to the AEMP to mitigate impacts of lethal sampling on fish populations in AEMP lakes, and that it had made a significant effort to avoid further pressuring populations by using AEMP fish monitoring every three years for small-bodied fish. The Board agrees with Arctic's rationale that further pressure on the fish population should be avoided at this time and given a lack of other concerns raised by GNWT-ENR related to Slimy Sculpin, is of the opinion that additional sampling is not needed at this time. However, it is unclear to the Board what further data is needed to understand the trends, and what rationale or causes Arctic will be monitoring for. The Board has decided further information be required through the 2022 AEMP Re-evaluation.

- ***Decision 4e: The Board directs Arctic to include a discussion in the 2022 AEMP Re-evaluation of Slimy Sculpin CPUE, including what data Arctic requires to better understand CPUE trends, and what factors Arctic could evaluate to determine if there are mine-related effects.***

[27] See WLWB Online Review System for Ekati – Fish Response Plan Version 3.0

3.5 Other Comments

3.5.1 Use of Traditional Knowledge

In review of the Report, IEMA noted it was disappointed with the amount of TK input into the 2021 AEMP, and that TK input is only incorporated into large-bodied fish sampling every six years. IEMA recommended greater efforts be made with communities for inclusion of TK in all biota and non-biological components in the AEMP (IEMA comment 2). Arctic responded that it recognized the importance of incorporating TK from Indigenous governments and communities, and there had been limitations for mine travel and in-person consultation during the COVID-19 pandemic. Arctic noted it was planning the first in-person visit for community members to the mine in June 2022, and community representatives would continue to be involved in monitoring and environmental programs at the mine, including the AEMP. The Board agrees with Arctic that the COVID-19 pandemic presented limitations for mine travel and in-person consultation. The Board is of the opinion that more specific recommendations around incorporation of TK in the AEMP is appropriate during review of the AEMP Re-evaluation Report that is expected towards the end of 2022.

3.5.2 Comments not discussed

IEMA had a number of comments that did not have a recommendation or question, and as such are not discussed here, including IEMA comments 1, 4, and 5. Board staff also had a number of questions with respect to Slimy Sculpin variables, for which in the Board's opinion, Arctic provided sufficient answers and rationale, and are not discussed further here, including Board staff comments 8, 9, and 10.

Signed the 19th day of July 2022, on behalf of the Wek'èezhìi Land and Water Board

Mike Nitsiza
Acting Chair, Wek'èezhìi Land and Water Board

Witness