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Staff Report

Applicant: De Beers Canada Inc. - Gahcho Kué Project	
Location: Kennady Lake, NT	Application: MV2005C0032 and MV2005L2-0015
Date Prepared: September 6, 2017	Meeting Date: September 14, 2017
Subject: 2016 Aquatic Effects Monitoring Program (AEMP) Annual Report	

1. Purpose/Report Summary

The purpose of this Report is to present to the Mackenzie Valley Land and Water Board (MVLWB/the Board) De Beers Canada Inc.'s (De Beers) 2016 Aquatic Effects Monitoring Program Annual Report (AEMP Annual Report) for the Gahcho Kué Project. This submission is required under Part I, item 6 of Water Licence (Licence) MV2005L2-0015 and is for Board decision.

2. Background

- May 1, 2017 – 2016 AEMP Annual Report received;
- May 9, 2017 – Review commenced;
- June 2, 2017 – Deninu Kue First Nation request a comment deadline extension to July 14, 2017;
- July 6, 2017 – Original review comment deadline;
- July 14, 2017 – Revised reviewer comment deadline; review comments and recommendations received;
- July 21, 2017 – Responses due and received; and
- **September 14, 2017 – 2016 AEMP Annual Report presented to the Board for decision.**

3. Discussion

Part I, item 6 of Licence MV2005L2-0015 states the following:

On or before May 1 each year, the Licensee shall submit an AEMP Annual Report to the Board for approval. This Report shall satisfy the requirements of Schedule 6, item 3, and include information relating to data collected in the preceding calendar year.

Schedule 6, item 3 of Licence MV2005L2-0015 states the following:

The AEMP Annual Report referred to in Part I, item 6 of this Licence shall include, but will not be limited to, the following:

- a) A plain language summary of the major results obtained in the preceding calendar year and a plain language interpretation of the significance of those results;*
- b) A summary of activities conducted under the AEMP;*
- c) An update of the Project development activities and any accidents, malfunctions, or spills within the report time frame that could influence the results of the AEMP;*
- d) Tabular summaries of all data and information generated under the AEMP in an electronic and printed format acceptable to the Board;*
- e) An interpretation of the results, including an evaluation of any identified environmental effects that occurred as a result of the Project;*
- f) A comparison of predicted mixing and dilution of effluent in Lake N11 and Area 8 in comparison to monitoring data;*
- g) An analysis that integrates the results of individual monitoring components collected in a calendar year and describes the ecological significance of the results;*
- h) A comparison of monitoring results to Action Levels as set in the AEMP Design Plan;*
- i) An evaluation of the overall effectiveness of the AEMP to date;*
- j) Recommendations for refining the AEMP to improve its effectiveness as required; and*
- k) Any other information specified in the approved AEMP Design Plan or that may be requested by the Board before November 1 of any year.*

De Beers submitted the 2016 AEMP Annual Report on May 1, 2017 (attached).

4. Comments

Not applicable.

5. Reviewer Comments

By July 14, 2017, comments and recommendations on the 2016 AEMP Annual Report were received from the following reviewers:

- Environment and Climate Change Canada (ECCC);
- Department of Fisheries and Oceans Canada (DFO);
- Government of the Northwest Territories – Environment and Natural Resources (GNWT-ENR);
- Tlicho Lands; and
- Board staff.

De Beers responded on July 21, 2017. The Review Summary and Attachments (attached) presents the concerns identified through the review of the Annual Report.

ECCC recommended that, “if baseline data are available, habitat suitability (barriers, flow) should be quantified where practical and compared to baseline conditions, to assess the impact of mine activities on fish habitat. Number of fish moving up into Area 8 should also be compared between 2016 and baseline years” (ECCC comment ID-26). Although this comparison is not a requirement of

the AEMP Annual Report or AEMP Design Plan, and changes to baseline conditions due to flow alterations were predicted to occur in the Environmental Impact Statement (EIS), this baseline information has been established and could be provided to reviewers for their own comparisons.

Several recommendations were made which relate to components of the AEMP Design Plan. Board staff recommend these concerns, along with supporting rationale, be brought forth during the future review of the Aquatic Effects Re-evaluation Report, which is due to the Board, for approval, July 31, 2019. At that time, reviewers may propose evidence to be considered for updates to the AEMP Design Plan. Also, prior to or during the Re-evaluation Report submission process, a technical workshop may be held by Board staff to discuss these concerns and address reviewer recommendations.

ECCC comment ID-9 requested more information about the possibility that dewatering discharge entering Lake N11 is influencing the water chemistry in relation to the diffuser and under ice water quality concentrations. De Beers' response suggests no statistically significant effect was detected for several parameters despite small changes in water chemistry, although the 2016 AEMP Annual Report does suggest a significant effect. Board staff recommend De Beers clarify this conclusion with specific reference to the analysis being referenced.

The 2016 AEMP Annual Report further states that 2016 fish tissue samples from the flooded Lake D2/D3 will be considered as baseline data, since changes are unlikely to occur until 2-3 years after flooding. ECCC comment ID-35 and ENR comment ID-8 and 9 outline concerns with this, as construction of Dyke F commenced in fall of 2015, fish sampling took place August 2016, and an increase in water column mercury and methyl mercury was observed in 2016 data compared to 2013. As the concentration of methyl mercury could have increased in fish post-construction, and, although not yet significant, could contribute to an increasing trend or added variance that could confound the significance of future changes and not improve the statistical power, Board staff recommend that De Beers should keep all Lake D2/D3 fish tissue data separate from the 2013 baseline data for future submissions of the AEMP Annual Report. Fish tissue results from 2016 should not be considered baseline data because the construction of Dyke F commenced in fall of 2015.

GNWT-ENR comment ID-2 states the following:

"Section 5.4.2.5 notes 'it was predicted in the EIS that during the construction phase of the Mine development, water quality in Lakes D2/D3 could change (i.e., a minor change) due to the release of nutrients, mercury, and other substances from flooded sediments and vegetation as a result of water level changes'..."

GNWT-ENR then outlines that the 2016 AEMP Annual Report isn't clear if the measured water quality changes align with the predicted changes for Lake D2/D3. De Beers' response does not address this question but merely reiterates the predictions made in the EIS. De Beers should be required to complete an explicit comparison of measured changes in water and sediment quality with the predictions made in the EIS based on their own definition that *"A minor change is a measurable increase in a water quality parameter that is outside the range of baseline values but is still within water quality guidelines."* It is not clear that De Beers predicted the rate of increase but the magnitude of increase should be compared. Therefore, Board staff recommend that baseline data, predicted changes, and actual yearly results should be provided in all future iterations of the

AEMP Annual Report in a format that illustrates the changes that have been observed in the water and sediment quality (i.e. mercury of Lakes D2/D3) as they relate to predicted magnitude, extent, and rates of increase.

6. Security

The GNWT currently holds reclamation security in the amounts of \$23,776,270.00 under Licence MV2005L2-0015 and \$13,817,863.00 under Permit MV2005C0032 for the Gahcho Kué project.

7. Conclusion

Board staff concludes that further information was provided by De Beers in their responses to reviewer comments; however, some reviewers requested additional information be provided.

8. Recommendation

Board staff recommend the Board approve the 2016 AEMP Annual Report, as submitted May 1, 2017.

Board staff recommend the Board direct De Beers to clarify to the Board, by October 19, 2017, the conclusion in their response to ECCC comment ID-9, that no statistically significant effect was detected for several parameters despite small changes in water chemistry, because the 2016 AEMP Annual Report suggests a significant effect. Specific references to the analysis being referenced should be provided.

Board staff recommend including the following direction to De Beers be included in the decision letter:

- De Beers shall adhere to the commitments made during the review, specifically to ECCC comment ID-13 and ID-22.
- De Beers shall ensure the heading for Table 10.3-13 is updated for future iterations of the AEMP Annual Report (see ECCC ID-34).
- De Beers shall provide ECCC and the Board with the baseline data described in ECCC comment ID-26.
- In future submissions of the AEMP Annual Report, De Beers shall keep all Lake D2/D3 fish tissue data separate from the 2013 baseline data, as the construction of Dyke F commenced in fall of 2015, and therefore fish tissue results from 2016 should not be considered baseline data (see ECCC ID-35 and GNWT-ENR ID-8 and 9).
- Baseline data, predicted changes, and actual yearly results should be provided in all future iterations of the AEMP Annual Report in a format to illustrate the changes that have been observed in the water and sediment quality (i.e. mercury of Lakes D2/D3) as they relate to predicted magnitude, extent, and rates of increase (see GNWT-ENR ID-2).

9. Attachments

- [2016 AEMP Annual Report – Part 1](#)
- [2016 AEMP Annual Report – Part 2](#)
 - [Report Appendices Part 1](#)
 - [Report Appendices Part 2](#)
- Review Summary and Attachments
- Draft Decision Letter from the Board

Respectfully submitted,

A handwritten signature in blue ink that reads "Kierney Leach". The signature is written in a cursive, flowing style.

Kierney Leach
Regulatory Specialist

Review Comment Table

Board:	MVLWB
Review Item:	De Beers Gahcho Kue - AEMP Annual Report (MV2005L2-0015)
File(s):	MV2005L2-0015
Proponent:	De Beers Canada Inc - Gahcho Kue
Document(s):	2016 AEMP Annual Report Part 1 (5607 kB) 2016 AEMP Annual Report Part 2 (11098 kB) 2016 AEMP Annual Report - Appendices Part 1 (9100 kB) 2016 AEMP Annual Report - Appendices Part 2 (8664 kB)
Item For Review Distributed On:	May 9 at 13:09 Distribution List
Reviewer Comments Due By:	July 6, 2017
Proponent Responses Due By:	July 21, 2017
Item Description:	<p>July 10 Update - An extension request to the proponent comment deadline was received from De Beers which was granted by Board staff. The new response deadline for this item is now July 21.</p> <p>June 2 Update - An extension request to the reviewer deadline was received from Deninu Kue First Nation which was granted by Board staff. The new reviewer deadline for this item is now July 6 with the responses now due July 14.</p> <p>May 9 - De Beers Canada Inc. (De Beers) has submitted the 2016 AEMP Annual Report on May 1, 2017. This Report is required under Part 1, item 6 and Schedule 6, item 3 of Licence MV2005L2-0015.</p> <p>Reviewers are invited to submit questions, comments, and recommendations on this submission using the Online Review System (ORS) by the review comment deadline specified below.</p> <p>All documents that have been uploaded to this review are also available on our public registry. If you have any questions or comments about the ORS or this review, please contact Board staff identified below.</p>

General Reviewer Information:	<p>In addition to the email distribution list, the following organizations received review materials by fax:</p> <p>Fort Resolution Métis Council - Trudy King (867)394-3322</p> <p>Hay River Metis Council - Trevor Beck, President (867)874-4472</p> <p>NWT Metis Nation - Tim Heron, NWTMN IMA Coordinator (867)872-3586</p> <p>Angela Love 867-766-7456</p> <p>Jen Potten 867-766-7468</p> <p>Kierney Leach 867-766-7470</p>
Contact Information:	

Comment Summary

Environment and Climate Change Canada: Gabriel Bernard-Lacaille			
ID	Topic	Reviewer Comment/Recommendation	Proponent Response
41	General File	<p>Comment (doc) ECCC Comments Cover Letter</p> <p>Recommendation</p>	Noted.
1	General Comment - Environmental Effects Monitoring	<p>Comment Some of the following comments have a bearing in the context of the Environmental Effects Monitoring (EEM) program under the Metal Mining Effluent Regulations (MMER). Currently the MMER do not apply to diamond mines. However, ECCC has provided detailed comments relating to biological studies, which may also be helpful to the Proponent in light of the anticipated MMER amendments coming into force.</p> <p>Recommendation For information only.</p>	<p>July 20: De Beers notes the proposed amendment to the MIMER. De Beers has been meeting with ECCC to discuss the proposed changes and has several key concerns with MIMER as currently proposed.</p> <p>Noted.</p>

2	<p>3. Supporting environmental data; 3.4.3.1 Water temperature</p>	<p>Comment Tables 3.4-6 and 3.4-7 report monthly temperature data for Area 8 and N11 based on measurements at 2 m depth. Table 3.4-8 reports water temperatures at various lakes (N11, 410, Kirk, East, Lake 3 and D3) based on measurements at depths < 1 m. Area 8 was not included in this table, so it was not possible to compare temperatures with reference lakes at similar depths. Furthermore, East Lake mean/median temperatures appear to be approximately 1-2.5Â°C lower than in N11 in May-June, based on shallow depth measurements. Comparing N11 temperatures to Area 8 (at 2 m), spring mean temperatures are approximately 1Â°C warmer in Area 8. Consequently, the difference in temperature between Area 8 and East Lake may be sufficient to affect comparison of biological variables between lakes.</p> <p>Recommendation ECCC recommends that the De Beers Canada Inc. (the Proponent) ensure that water temperatures are measured at similar depths in core and reference lakes. ECCC also recommends that lower spring temperatures in East Lake relative to Area 8 should be taken into consideration when interpreting plankton, benthic invertebrate and fish results.</p>	<p>July 20: The water temperature data presented in Tables 3.4-6 and 3.4-7 were collected using temperature loggers deployed by De Beers of the purpose of collecting year-round water temperature data in the core lakes. These loggers were installed at a depth of around 2 m to ensure that they stay below the ice cover during the winter. The water temperature data presented in Table 3.4-8 were collected using water level loggers deployed by the Golder hydrology team and were installed to collect water level (depth) data. Since the water level loggers also record water temperature data, the resulting data were presented as additional information. These loggers were installed at a depth of less than 1 m to allow the field crews to easily access the loggers during installation, downloads, and retrieval. The differences in water temperature data measured by the loggers are minor (i.e., within a few degrees) and represent temperatures at the lake outlets, as opposed to the whole-lake temperatures in the main basins of the lakes where the biological communities are sampled. Furthermore, the biological communities are sampled during the July, August, and September field programs, and during these sampling periods, temperatures in the core and reference lakes were similar (Figures 5.4-5, 5.4-9, and 5.4-13).</p>	Acceptable response.
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3	<p>3. Supporting environmental data; 3.4.3.2 Date of ice-off and number of days of ice-cover versus open-water</p>	<p>Comment The report provided ice-off and ice-cover dates for Kennedy Lake and Lake N11, indicating an open water season of 122 days. Ice-off dates and open water season length were not reported for reference lakes (East and Lake 3). Differences in open water seasons could influence biological endpoints and confound comparisons between lakes. Recommendation ECCC recommends that ice-off dates and open water seasons should be provided by the Proponent for reference lakes and compared with core lakes for all years with available data.</p>	<p>July 20: Ice on and ice off dates are not available for the reference lakes (East Lake and Lake 3), because these lakes are located farther away from the Mine site than the core lakes and are not visited frequently during the fall and spring, when ice is forming and melting. However, it is expected that ice on and ice off dates for the reference lakes would be similar to the core lakes.</p>	<p>Acceptable response.</p>
4	<p>4. Hydrology; 4.2.1.4 Discharge and water level monitoring</p>	<p>Comment Watershed areas reported in Table 4.2-1 show considerable differences between core and reference lakes. Lake N11 (core) (11,528 ha) has a considerably larger watershed than the reference lakes (East Lake 1,957 ha; Lake 3 3,316 ha). Area 8 (core) (755 ha) has a considerably smaller watershed than the reference lakes. Comparisons between core and reference lakes could be confounded by differences in lake watershed size. Recommendation ECCC recommends that the Proponent consider adding alternate reference lakes with watersheds more similar in size to core lakes.</p>	<p>July 20: De Beers notes that the AEMP study design has been approved by the MVLWB and ECCC participated in this process. Reference lake selection was undertaken prior to approval of the AEMP, and the experience gained during this AEMP and others (e.g., Snap Lake Mine) has shown that ideal reference lakes are difficult to locate, or are not available. As a result, although efforts were made to locate reference lakes that are directly comparable to the core lakes monitored by the AEMP, they were not found. The purpose of monitoring reference lakes under the AEMP is to evaluate whether trends over time in monitored variables are similar between core lakes and reference lakes. Therefore, directly comparable reference lakes are not a requirement for this AEMP. No additional</p>	<p>Acceptable response. Recommendations (with supporting rationale) related to components of the AEMP Design Plan can be brought forth during the review of the Aquatic Effects Re-evaluation Report, which is due to the Board, for approval, July 31, 2019. At that time, reviewers may propose evidence to be considered for updates to the AEMP Design Plan.</p>

5	4. Hydrology; 4.4.3.2.6 Area 8; 4.4.4 Comparison to Action Levels	<p>Comment Figure 4.4-13 shows daily mean runoff at Area 8 hydrometric station; it is assumed this refers to discharge from Area 8. It is noted that the 2016 discharge was lower than projected for 'operations' in all months, despite above average precipitation in June, and increased flow from diversion of Lake A through J1 to Area 8. It would appear that dyking off Area 8 had a larger impact on downstream water levels than predicted. It is also noted that action levels are related to water level increases, not decreases. It is acknowledged that downstream flow mitigation measures are planned for subsequent years, however the Proponent should consider an action level related to decreased discharge.</p> <p>Recommendation ECCC recommends that the Proponent consider an action level related to decreased discharge to address changes associated with lower flows.</p>	reference lakes are planned for the AEMP at this time.	Acceptable response.
		<p>July 20: Figure 4.4-13 appears to show that 2016 was an unusually dry year, compared to the median values projected for Operations. However, the climate summary presented in Sections 4.4.1 and 4.4.2 and the runoff summaries presented in Figures 4.4-25 and 4.4-26 indicate that 2016 was a wetter than average year. After reviewing the analysis files for Area 8, it is confirmed that the discrepancy is that freshet in 2016 was earlier than usual, as shown in Figure 4.4-12, with a freshet peak occurring on May 19 and approximately 60% of the annual runoff occurring between May 16 and May 31. Therefore, the monitoring data are consistent with projections for Operations on an annual basis, though not on a monthly basis. Summary tables and figures in the EIS did not present values for the month of May, because runoff frequently does not begin until June, and the prevalence of zero runoff values prevented development of meaningful frequency analyses. Action levels for hydrology are related to direct effects on erosion due to high flows. Action levels related to low flows would be addressed by the fish and fish habitat component.</p>		

6	5. Water quality; 5.2.1.1 Field methods	<p>Comment The report acknowledged several field-related issues, including a malfunctioning pH meter. Laboratory pH measurements were substituted in cases where the field pH measurement was considered unreliable (2016 winter sampling and one station in Lake 3 open water). As noted in the report, lab pH measurements may not be accurate, and should be regarded with caution - particularly if used to establish site-specific water quality guidelines for pH dependent parameters (e.g., Nitrate, metals). Elsewhere in the report, reported pH results suggest further possible issues with field measurement - e.g., Table 5.4-11, large pH range of 5-8.4 reported for dewatering discharge to N11; Table 8.4-8, range of 6.2-7.7 for Lake D2/D3.</p> <p>Recommendation ECCC recommends that the Proponent ensure that any concerns with field measured pH are flagged in the report where necessary. For future studies, ECCC recommends that field crews be equipped with multiple field meters, and ensure that meters are calibrated regularly.</p>	<p>July 20: Field data are reviewed as part of the data management and analysis process within the AEMP. For the data range as reported for Lake D2/D3 in Table 8.4-8, given it is a new lake entity as a raised lake in the watershed, the pH range was determined to be acceptable (these data will continue to be monitored). That being said, it is recognized that some of the field pH data as identified for the dewatering discharge to Lake N11 were outside the expected ranges (on the high end). As such, all field data will be screened and reviewed more rigorously in future programs, and as deemed appropriate, anomalous data will continue to be flagged or invalidated in the report. For example, field pH measurements collected during the 2016 winter field program were invalidated because the values were below expected ranges (i.e., outside of the 5.3 to 7 range), which was attributed to the extreme cold conditions during sampling. We note that calibration of the units was undertaken on site each morning during the program, with the calibration of pH determined to be acceptable. However, once in the field, the data measurements were anomalous. As a standard practice, the multi-parameter units (units) used during the field programs are calibrated regularly and are not used if the calibration checks are outside the acceptable ranges. As a contingency plan within the AEMP, field crews are equipped</p>	Acceptable response.
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			<p>with primary and alternate field meters in the case that one of the units or a sensor on one of the units, does not calibrate or work properly during the field program. In addition, during and following the programs where anomalous data were consistently measured, the unit's manufacturer was contacted to discuss the issues and to come up with solutions.</p>	
7	<p>5. Water quality; 5.2.1.1 Field methods</p>	<p>Comment Samples collected in July 2016 at surface and bottom were accidentally composited into a single mixed sample. The report indicates that these samples, which were collected at sites where a thermocline was present (47% of samples collected July 2016), were considered to be representative of mid-depth conditions, based on "post-sampling data review between stations and within sampling programs". It is unclear if this involved comparing mid-depth samples with mixed surface and bottom samples at specific sites; otherwise it should not be assumed that the composited samples are representative of mid column conditions for all parameters. Recommendation ECCC recommends that the Proponent clarify how it determined that the composited samples were representative of mid-column conditions and that the Proponent review water quality sampling procedures with field crews to avoid accidental compositing of samples.</p>	<p>July 20: To determine if the results from the accidentally composited samples were suitable to be included in the data assessment, concentrations in the composite samples were compared to those in mid-depth samples collected from other stations during the same sampling program, and also to results collected at the same locations in the previous year. Based on these comparisons, it was determined that the composite sample results were: . sufficient to be representative of the chemistry of the whole water column at the time of sampling; . similar to the results from other samples collected at mid-depth, and . similar to the results collected in July 2015 (i.e., Appendix 5B; Table 5B-3 in the 2015 and 2016 AEMP Reports). Therefore, the results from the composite sample results collected in July 2016 were considered to be representative of the water chemistry of the whole water column, and sufficient to be used in the data assessments. It is important to understand that the presence of a</p>	<p>The response is acceptable and reasonable. De Beers has described what they did and the measures they have taken to clarify procedures in the future.</p>

			<p>thermocline by itself does not imply that differences in the water chemistry throughout the water column exist that could potentially be relevant to the AEMP; the presence of a specific conductivity gradient (chemocline) and a corresponding dissolved oxygen gradient (or oxycline) are more appropriate indicators of potential water chemistry differences through the water column. Therefore, samples are to be collected near the surface and the bottom if specific conductivity (and dissolved oxygen) gradients are evident in the water column; if they are not, water samples will be collected at mid-depth. The field water quality sampling procedures to determine the appropriate depth to collect the samples are evaluated on an on-going basis. As a result of the oversight in 2016, the instructions to field crews were reviewed and updated prior to the 2017 field programs. These instructions now include an evaluation of specific conductivity changes through the water column, as well as dissolved oxygen and temperature as part of the decision-making process regarding water sampling depth(s).</p>	
8	<p>5. Water quality; 5.3.2 Summary of data validation results</p>	<p>Comment Regarding water quality Quality Control (QC), the report notes that "Based on duplicate results, the within site variability and field sampling precision were rated as low and high, respectively." A summary of results for duplicates and blanks would help to validate this</p>	<p>July 20: The "Summary of Data Validation Results" section (Section 5.3.2) only presented the main findings of the QC data validation; the detailed data validation methods and results are presented in Appendix 5A (Water Quality - Quality Assurance/Quality Control Procedures and</p>	<p>Acceptable response.</p>

		<p>statement.</p> <p>Recommendation ECCC recommends that the Proponent include descriptive statistics for Relative Percent Differences (RPDs) on duplicates, and identify specific parameters with high RPDs or elevated concentrations in blanks.</p>	<p>Results Appendix). More specifically, the relative percent differences (RPD) between duplicate samples, and identification of the parameters with high RPDs between duplicate samples, are presented in Table 5A-8, Section 5A.2.2.5, Appendix 5A. Additionally, the detailed results for the blank QC sample analyses are presented in Tables 5A-6 and 5A-7, Section 5A.2.2.4, Appendix 5A.</p>	
9	5. Water quality; 5.4.2.3.2 Lake N11	<p>Comment Negative correlations are reported for concentrations of Total Dissolved Solids (TDS), Chloride, Nitrate, Total Phosphorous (TP) and Barium in Lake N11 and distance from the diffuser. However, the possibility that this reflects an influence of dewatering inputs does not appear to have been discussed. It is also noted that TP concentrations exceeded the normal range in Lake N11.</p> <p>Recommendation ECCC recommends that the Proponent discuss results indicating negative correlations between water chemistry parameters and distance from the diffuser in N11, and the possible influence of dewatering on lake water chemistry.</p>	<p>July 20: Significant negative correlations were noted for TDS (calculated [Calc]), chloride, nitrate, TP, and total barium during the ice-cover season, which suggests that concentrations of these parameters decreased with distance from the diffuser. These may be related to the dewatering discharge to Lake N11 because the timing of the under-ice sampling (April 21 to May 1, 2016) occurred during the dewatering pumping from Areas 3 and 5 to Lake N1. However, the presence of ice-cover and resulting cryogenic concentration of many parameters complicates this evaluation. For TDS (Calc), chloride and barium, the negative gradient, although significant, represents a low rate of change, which makes a correlation to dewatering activity difficult. Nitrate and TP show larger rates of change, and therefore may be the parameters that are being influenced by dewatering activity. For the listed parameters, especially nitrate, the open water concentration decreased</p>	<p>De Beers' response addresses the question.</p> <p>BACI results in the 2016 AEMP Annual Report suggest a significant effect during Ice Cover between Lake N11 and Lake 3 in 2016 (p<0.05) - Table 5C-3B. However, De Beers' response suggests no BACI effect.</p> <p>Board staff recommend De Beers clarify this conclusion with specific reference to the analysis being referenced.</p>

substantially compared to the under-ice concentration, with the exception of TP. The TP concentration in the open water condition increased at four of the five stations relative to the under ice concentrations, which doesn't align with expectations based on the other parameter trends. However, further review of the TP concentrations in Lake N11 during under ice and open water conditions in Figures 5C-12b and 5C-45b, Appendix C, identified the following: • During ice-cover conditions, one measured TP concentration was above the normal range, but the TP range measured was consistent with measurements from the reference lakes. • During open-water conditions, a greater proportion of the TP concentrations in Lake N11 were above the normal range, but similarly, these concentrations were consistent with measurements from the reference lakes. • TP in Lake N11 did not differ from the measurements made in the reference lakes, and considering previous years' measurements, did not have a significant BACI effect in under-ice or open water compared to either of the reference lakes. It would therefore appear that the slightly elevated under-ice nitrate concentration that declined with distance from the diffuser in Lake N11 may have been influenced by dewatering discharge (i.e., the measured nitrate concentrations in Lake N11 was 0.005 to 0.01 mg N/L; Figure 5.4-

		<p>17). This range was within the concentration ranges for the EoMZ (SNP-01; 0.006 to 0.065 mg N/L) but lower than the EoP concentration range (SNP-02; 0.076 to 0.16 mg N/L). The under-ice concentrations did not extend into open water conditions, as concentrations were reduced to background concentrations (<0.005 N/L) with the onset of open water conditions. With the transition into operational discharge from the water management pond (WMP) to Lake N11 in the winter of 2016/2017, water quality changes are anticipated in Lake N11 in 2017, as per the EIS assessment (De Beers 2011, 2012). De Beers will continue to focus on water quality gradients from the diffuser during under ice and open water conditions in Lake N11. References: De Beers. 2011. Environmental Impact Statement for the Gahcho Kué Project. Volumes 3a Revision 2, 3b Revision 2, 4 Revision 2, and 5 Revision 2. Submitted to the Mackenzie Valley Environmental Impact Review Board in Response to the Environmental Impact Statement Conformity Review, July 2011. Yellowknife, NWT, Canada. De Beers. 2012. Environmental Impact Statement Supplemental Information Submission for the Gahcho Kué Project. Submitted to the Mackenzie Valley Environmental Impact Review Board, April 2012. Yellowknife, NWT, Canada.</p>	
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10	5. Water quality; 5.4.2.4.2 Area 8 - Open-water	<p>Comment The discussion of significant Before After Control Impact (BACI) results for Area 8 - Open Water notes that there was no mine-related activity associated with Area 8 in 2016. It should be noted that there was a diversion of water by pipeline from watershed A to Lake J1, which in turn discharges to Area 8.</p> <p>Recommendation ECCC recommends that the Proponent clarify why the diversion of water from watershed A through Lake J1 to A8 was not considered a mine related activity that could have influenced water chemistry in A8.</p>	<p>July 20: The diversion of water from Lake A1 to Area 8 through Lake J1 was a result of a revision to the mine plan as part of the Project Description Update in the 2012 EIS, to reduce the size of the Fine PKC Facility. With the reduction of the Fine PKC Facility and the establishment of the controlled area, Lakes A1, A2, A5, A6, and A7 were no longer permanently lost as per the original Mine plan, but were now a component of the upper watershed of Kennedy Lake that required being temporarily diverted from Kennedy Lake during Mine operations. In order to manage the annual freshet flow generated within the A watershed that flows to Lake A1 (approximately 300,000 m3), which would normally be directed to Kennedy Lake, this water is now pumped annually to Lake J1 and allowed to flow to Area 8. This natural watershed flow would normally discharge to Kennedy Lake, but due to the isolation of Areas 2 to 7 of Kennedy Lake during operations, is short-circuited to Area 8. Lake A1 is adjacent to the Fine PKC Facility, but due to the elevation of Lake A1 and the downstream gradient to the Fine PKC Facility, runoff and any seepage from the Fine PKC Facility is directed towards Kennedy Lake (i.e., Area 2), and does not influence Lake A1. The water quality of Lake A1, being a headwater lake of Kennedy Lake is consistent with that of Kennedy Lake (of which Area 8 is a sub-basin), so changes in water chemistry are</p>	<p>De Beers has addressed the question asked by ECCC.</p> <p>Board staff note that SNP-17 is sampled yearly, which captures any potential mine related effects from Dyke A1.</p>
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			<p>not expected. So although this temporary diversion is a mine-related change in the watershed, there is negligible consequence regarding effects to water quality in Area 8. At closure, Lake A1 will be allowed to reconnect with Kennedy Lake in Area 4.</p>	
<p>11</p>	<p>5. Water quality; 5.4.2.4.4. Lake N11 - Open-water</p>	<p>Comment Many of the significant increases in water quality parameters in the core lakes (as determined by BACI) are attributed in part to an improvement in analytical detection limits between 2015 and 2016. It is unclear how lower detection limits in 2016 could explain an increase in concentrations, unless the increase was within the margin of change in detection limits. Discussion of the magnitude of differences, relative to the difference in detection limits between 2015 and 2016 could help to clarify. Recommendation ECCC recommends that the Proponent provide clarification on how a decrease in detection limit contributed to findings of increased concentrations of water quality parameters in core lakes, including a comparison of the magnitude of change in concentration, relative to the change in detection limit.</p>	<p>July 20: Statistical differences were observed for fluoride, molybdenum, and vanadium in Lake N11 during open-water conditions, but the primary factor accounting for significant effects for these parameters was the lower analytical detection limits (DLs) in 2015 and 2016 compared to previous years. To complete the BACI analyses and for the mean calculations, the results that were reported as below the DL were substituted with a value of half of the DL. Prior to 2015, fluoride, molybdenum, and vanadium concentrations were similar and generally below the DLs, and because the mean concentrations were calculated using half of the DL, they were equal, or close to half of the DL. Once lower DLs were achieved (in 2015 and 2016 - during the "after" period) the data diverged, showing differences between the core and reference lakes. This resulted in significant BACI effects, even though the differences between core and reference lakes were likely present during the baseline period. Therefore, although significant BACI effects were detected, it is not possible to confirm that the differences are evidence of increases in concentrations</p>	<p>Acceptable response.</p>

12	5. Water quality; 5.4.2.5 Before-after analysis - Lake D2/D3	<p>Comment In the discussion of water chemistry results for Lake D2/D3, it is noted that the water was more turbid in 2016 (post-flooding) than in other years. There did not appear to be any measurements of turbidity provided to quantify the difference.</p> <p>Recommendation ECCC recommends that the Proponent provide any measurements of turbidity pre/post flooding in Lake D2/D3 and discuss causes of the increased turbidity.</p>	<p>in the core lakes after 2015; they more likely represent existing differences in water quality.</p> <p>July 20: Turbidity in Lake D2/D3 ranged from 0.5 to 3.0 nephelometric turbidity units (NTU) in 2015 (De Beers 2016), and 0.7 to 2.5 NTU in 2016. This range is within the range of measured turbidity under baseline conditions for the D and E lakes (0.3 to 30 NTU; Golder 2014). Even though the turbidity measurements were similar in 2015 and 2016, the field crew observed that they thought that the water in the raised lake appeared more turbid during the 2016 sampling program compared to the previous year. A relative increase in turbidity observed in 2016 was not validated, but could be due to the increased size of the lake from its raising relative to the previous year's visit. It is important to note that being one of the smaller lakes in the Kennedy Lake watershed, Lake D2/D3 is subject to wide ranging natural colour changes throughout the year (especially in fall; 7 to 125 TCU; Golder 2014). Changes to water quality were predicted in the EIS, particularly during the period immediately after dyke construction and rising lake level (De Beers 2011, 2012). As part of the AEMP monitoring of Lakes D2/D3, turbidity and TSS concentrations will continue to be seasonally monitored. References: De Beers. 2011. Environmental Impact Statement for the Gahcho KuÃ© Project.</p>	Acceptable response.
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13	5. Water quality; 5.4.2.5 Before-after analysis - Lake D2/D3	<p>Comment Table 5.4-38 indicates a 50% increase in field conductivity and 4% increase in TDS (calculated) between 2015-2016. The discrepancy in year-to-year change in these closely related parameters raises questions about the accuracy of the measurements.</p> <p>Recommendation ECCC recommends that the Proponent provide any additional information to support the accuracy of field conductivity and TDS measurements, or an explanation for the differences in year-to-year change of these parameters.</p>	<p>Volumes 3a Revision 2, 3b Revision 2, 4 Revision 2, and 5 Revision 2. Submitted to the Mackenzie Valley Environmental Impact Review Board in Response to the Environmental Impact Statement Conformity Review, July 2011. Yellowknife, NWT, Canada. De Beers. 2012.</p> <p>Environmental Impact Statement Supplemental Information Submission for the Gahcho KuÃ© Project. Submitted to the Mackenzie Valley Environmental Impact Review Board, April 2012. Yellowknife, NWT, Canada. De Beers. 2016. Gahcho KuÃ© Mine 2015 Aquatic Effects Monitoring Program Report. Submitted to the Mackenzie Valley Land and Water Board, Yellowknife, NWT, Canada, May 2016. Golder. 2014. Synthesis of Baseline Information for the Aquatic Environment. Gahcho KuÃ© Project. Submitted to De Beers Canada, February 2014.</p>	<p>Acceptable response.</p> <p>Board staff remind De Beers of the following commitment made in their response: "In future programs, correlations between field and laboratory data, and TDS (Calc) will be checked more vigorously to make sure that the specific conductivity data used in the WQ assessment are appropriately representative. If the field data are highly variable</p>
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		<p>laboratory measurements. Nevertheless, uncontrolled field conditions can cause differences between field and laboratory data (e.g., samples not collected consistently where and when a conductivity measurement is made). Differences between the field and laboratory conductivity values were noted in the 2016 AEMP dataset (i.e., RPDs ranged from 0 to 68%). On the occasions when high RPD between specific conductivity field values and the laboratory results were noted, the field specific conductivity values were higher than the laboratory values, but the actual differences were not large. This implies that the field data can trend towards overestimates. In these situations, reference to TDS (Calc) is a good proxy to confirm which of the datasets provides a more reliable measurement. As a standard QC check, $TDS (Calc) = 0.55 \text{ to } 0.7 \times \text{Conductivity (APHA 2012)}$. In future programs, correlations between field and laboratory data, and TDS (Calc) will be checked more vigorously to make sure that the specific conductivity data used in the WQ assessment are appropriately representative. If the field data are highly variable or suspect, the data will be flagged and/or invalidated. Having the TDS (Calc) data is beneficial to the AEMP, as it is a good analogue for the assessment of total ionic composition, and a highly reliable water quality indicator of potential Mine-</p>	<p>or suspect, the data will be flagged and/or invalidated.”</p>
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14	5. Water quality; 5.4.2.5 Before-after analysis - Lake D2/D3	<p>Comment Among the largest post-flood increases in Lake D2/D3 water chemistry parameters were mercury (+229%) and methyl mercury (+248%). These are notable results, given concerns that flooding these lakes would increase mercury concentrations. The Environmental Impact Statement (EIS) predicted a minor change in water quality in raised lakes, however given the toxicity of mercury and the magnitude of the increase in water immediately after flooding, it would seem this result should be considered more than a minor change in water quality.</p> <p>Recommendation ECCC recommends that the Proponent provide further discussion on the mercury results, including any relevant QC results, and whether there is any evidence that the increase was directly related to flooding. ECCC also recommends that the Proponent consider adding a suitable reference lake for D2/D3,</p>	<p>related changes (and year-to-year changes) in the receiving environment. This is because it is derived from the sum of the major ionic constituents in the waters which are reported using high-precision analysis, and is calculated using a standard method (APHA 2012). Reference: APHA (American Public Health Association). 2012. Standard Methods for the Examination of Water and Wastewater, 22nd Edition. Washington, DC, USA.</p> <p>July 20: The increases in mercury and methyl mercury concentrations between 2015 and 2016 in Lake D2/D3 are likely attributable to the raising of the lake (Figure 5.4-41). However, this figure also suggests an increasing trend in mercury for the years of monitoring data prior to 2010. That being said, increases in mercury and methyl mercury concentrations, and nutrient concentrations, in the raised lakes (particularly Lake D2/D3) were anticipated in response to inundation of formerly dry land. The measured mercury and methyl mercury concentrations are still relatively low. Despite the 200+% increase in concentrations, mean and median open water mercury concentrations in 2016 were still well below the chronic CCME PAL guideline for mercury (0.026 µg/L), and all methylmercury concentrations were well below its chronic CCME PAL guideline (0.004 µg/L). It was stated in the EIS (De Beers 2011) that a measurable increase in</p>	
				<p>Board staff acknowledge and take note of ECCC’s recommendation for De Beers to consider adding a suitable reference lake for D2/D3, to monitor natural variation in key parameters relative to post-flood changes. Board staff encourage ECCC to bring forth this recommendation during the review of the Aquatic Effects Re-evaluation Report, which is due to the Board, for approval, July 31, 2019.</p>

		<p>to monitor natural variation in key parameters relative to post-flood changes.</p>	<p>mercury and nutrient concentrations would occur during the raising of the diverted lakes, particularly during the initial years of the diversion. Lake D2/D3 was used as the representative raised lake in the AEMP because the water level change is most substantial in this lake. This lake originally consisted of two separate lakes in the D lakes watershed, which were combined following the construction of diversion Dyke F. The increase in surface area and depth of Lake D2/D3 following its raising, which was planned to take between two and three years, will result in the surface area of Lake D2/D3 doubling in size once it reaches its new full supply level in 2018 (raised level = 103 ha), with maximum depths of basin D2 and basin D3 increasing by 2.8 m and 1.6 m, respectively. The release of mercury and nutrients (and other substances) was addressed as a secondary pathway in the EIS (Section 8.6.2.3). The pathway discussion stated that methyl mercury and its availability to aquatic organisms is expected to increase in the initial years of flooding when new forms of inorganic mercury are introduced to water, and microbial activity increases due to nutrient additions (i.e., additional inorganic mercury and nutrients to the waterbody would be sourced from inundated soil and vegetation; Rudd 1995, Bodaly and Kidd 2004). Under these conditions, methyl mercury could become more concentrated</p>
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in higher trophic levels, particularly top-predator fish such as Lake Trout (Wright and Hamilton 1982, Bodaly et al 1984, Brouard et al 1990, Hecky et al 1987, 1991, Kidd et al 1995). Several physical, chemical, and biological factors have been identified in the literature that could lead to an increase in the potential for biomagnification in fish in a lake. These include: . lake size; small lakes tend to have fish with higher mercury concentrations; . larger upstream watershed size, or location of lakes lower down the watershed; . low pH and high dissolved organic carbon concentration; . longer food chain; species connected to the benthic food chain (e.g., Round Whitefish) tend to have lower mercury concentrations than species connected to the pelagic food chain (e.g., Lake Trout); . position of fish at or near the top of the food chain; and . age of the fish; larger, mature fish tend to be slower growing than younger fish and use the most of their ingested energy for reproduction, not growth; therefore, older fish tend to retain most of the ingested mercury. **July 20:** For the raised lakes, despite the projected increase in nutrients and mercury concentrations, mercury concentrations in fish high enough to impair the health of the fish, or wildlife that may eat the fish, are not anticipated because: . the amount of inorganic mercury available for methylation will be minimized through preparing the

area to be inundated before flooding (this was done for Lake D2/D3); . the number of Lake Trout, Burbot, and Northern Pike expected to be present in the raised lakes during operations is expected to be low; . Arctic Grayling, Slimy Sculpin, and Ninespine Stickleback (i.e., the fish most likely to persist in the diverted watersheds during operations) are planktivores or benthivores, and are therefore lower in the food chain; . the raised lakes are small headwater lakes in the Kennady Lake watershed (and remain so when they are diverted to the N lakes); . mercury concentrations in non-piscivorous fish typically peak in four to five years following inundation, and then return to pre-impoundment concentrations, usually within 10 to 15 years (Schetagne et al 1997, cited in Legault et al 2004; Bodaly et al 1997); . naturally low nutrient levels in the surface soils and cold temperatures throughout the year would limit bacterial production, resulting in much lower rates of processes such as decomposition (e.g., releasing nutrients) and methylation compared to warmer waterbodies, where large increases in nutrient releases to the water column and mercury accumulation in fish have been documented; . the raised lakes are temporary, and following operations and sometime in closure (i.e., the refilling of Kennady Lake), the diversion dykes will be breached allowing them the

flow back to Kennedy Lake; and . changes in sediment quality are predicted to be minor relative to baseline conditions. This is consistent with measured sediment mercury concentrations in Lake D2/D3 (20165 and 2016; Figure 6A-38, Appendix 6A, 2016 AEMP) . From a fish perspective, northern pike will persist in the diverted watersheds, but likely at low abundance due to their requirement for aquatic vegetation for spawning and rearing, which is limited in Lake D2/D3 and would require a number of years to establish at the new water level. Few Lake Trout have been captured in the D watershed and none have been reported in the E watershed. Lake Trout that have been captured in lakes in the D watershed are likely using the lakes seasonally for rearing and feeding. As it is unlikely that these lakes currently support self-sustaining Lake Trout populations, it is not expected that this species will persist in these lakes during operations. Small numbers of Burbot have been captured in Lakes D3 and D7, and have not been reported in the B watershed. Although they were captured in Stream E1 near the Kennedy Lake confluence, it is not known if they are present in Lake E1. These lakes will likely continue to provide the same amount of habitat for Burbot as currently exists. Water quality and sediment quality monitoring in the raised lakes will be conducted during operations and closure to

monitor change and identify any requirement for mitigation. De Beers has also committed to monitor mercury concentrations in edible fish tissue in the raised lakes prior to, and following raising the lake, and during operations, to evaluate whether there is a potential issue. As per the response to Round 1 Information Request DKFN_37 (De Beers 2012e) and Round 2 Information Request DFO 2-1 (De Beers 2012f), specific management response actions to an upward trend of mercury concentrations (adjusted for fish age, which is a major modifying factor) following water level increases would be developed, if and when necessary, through engagement with regulatory agencies, including ECCO, and Aboriginal communities. **July 20:** De Beers does not consider a reference lake for Lake D2/D3 or raised lakes necessary, as the mine activity or raising of the lake is unique in terms of its raised nature and is a temporary change (these are not permanently impounded lakes). There is also a good understanding of the background water chemistry (e.g., nutrients) of the small lakes in the Kennedy Lake watershed (e.g., A, D, E, J, I watersheds), particularly the D and E lakes, providing a reliable estimate of the background variation. These data are provided in the EIS (De Beers 2011), the Synthesis of Baseline Aquatic Information Report (Golder 2014a), and a subsequent

supplemental water quality monitoring report (Golder 2014b). However, Lake D2/D3 will be monitored at the same frequency as the core and reference lakes, with the exception of under-ice sampling, due to its small size and relatively shallow depth. References: De Beers. 2011. Environmental Impact Statement for the Gahcho KuÃ© Project. Volumes 3a Revision 2, 3b Revision 2, 4 Revision 2, and 5 Revision 2. Submitted to the Mackenzie Valley Environmental Impact Review Board in Response to the Environmental Impact Statement Conformity Review, July 2011. Yellowknife, NWT, Canada. Bodaly, R.A. and K.A. Kidd. 2004. Mercury Contamination of Lake Trout Ecosystems. In: Boreal Shield Ecosystems: Lake Trout Ecosystems in a Changing Environment. J.M. Gunn, R.J. Steedman, and R.A. Ryder (Eds). Lewis Publishers, Boca Raton, FL. Bodaly, R.A., R.E. Hecky and R.J.P. Fudge. 1984. Increases in Fish Mercury Levels in Lakes Flooded by the Churchill River Diversion, Northern Manitoba. Canadian Journal of Fisheries and Aquatic Sciences. 41: 682-691. Bodaly, R.A., V.L. St. Louis, M.J. Paterson, R.J.P. Fudge, B.D. Hall, D.M. Rosenberg and J.W.M. Rudd. 1997. Bioaccumulation of Mercury in the Aquatic Food Chain in Newly Flooded Areas. In A. Sigel and H. Sigel (eds.) Metal Ions in Biological Systems. Vol. 34. Mercury and its Effects on Environmental Biology. Marcel Dekker, Inc. pp. 259-287. Cabana, G. and J.B.

		<p>Rasmussen. 1994. Modelling Food Chain Structure and Contaminant Bioaccumulation Using Stable Nitrogen Isotopes. <i>Nature</i>. 372: 255-257. Brouard, D., C. Demers, R. Lalumiere, R. Schetagne and R. Verdon. 1990. Evolution of Mercury Levels in Fish of the La Grande Hydroelectric Complex, Quebec (1978-1989). Summary Report, Montreal, Quebec: Vice-Presidence Environnement, Hydro-Quebec and Goupe Environnement Shoener, inc. 97 pp. Golder (Golder Associates Ltd.). 2014a. Gahcho KuÃ© Project - Synthesis of Baseline Information for the Aquatic Environment. Submitted to De Beers Canada Inc. February 2014. Calgary, AB, Canada. 356 pp. + Appendices. Golder. 2014b. 2013 Gahcho KuÃ© Project - Supplemental Monitoring Report - Water Quality and Sediment Quality - Core, Reference, and Raised Lakes. Submitted to De Beers Canada Inc. April 2014. Calgary, AB, Canada. 158 pp. + Appendices. Hecky, R.E., R.A. Bodaly, D.J. Ramsey and N.E. Strange. 1991. Increased Methylmercury Contamination in Fish in Newly Formed Freshwater Reservoirs. In T.F.W. Clarkson, T. Suzuki, and A. Imura eds. <i>Advances in Mercury Toxicology</i>. Plenum Press, New York, NY. July 20: Hecky, R.E., R.A. Bodaly, D.J. Ramsey, P.S. Ramlal and N.E. Strange. 1987. Evolution of Limnological Conditions, Microbial Methylation on Mercury and Mercury Concentrations in Fish in Reservoirs of</p>
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15	5. Water quality; 5.8 Recommendations	<p>Comment The report recommends that 2015 and 2016 water quality data, collected during the dewatering and construction phase, be considered as baseline data and be included in calculation of normal ranges. Mine construction activities could have the potential to influence water quality in core lakes</p>	<p>Northern Manitoba. 1987 Summary Report. Canada-Manitoba Agreement on the Study and Monitoring of Mercury in the Churchill River Diversion. Harris, R.C. and R.A. Bodaly. 1998. Temperature, Growth and Dietary Effects on Fish Mercury Dynamics in Two Ontario Lakes. Biogeochemistry 40: 175-187. Kidd, K.A., R.H. Hesslein, R.J.P. Fudge, and K.A. Hallard. 1995. The Influence of Trophic Level as Measured by $\delta^{15}N$ on Mercury Concentrations in Freshwater Organisms. Water, Air, and Soil Pollution. 80: 1011-1015. Legault, M., J. Benoit and R. Berube. 2004. Impact of Reservoirs. In: Boreal Shield Ecosystems: Lake Trout Ecosystems in a Changing Environment. J.M. Gunn, R.J. Steedman, and R.A. Ryder, eds. Lewis Publishers, Boca Raton, FL. Wright, D.R. and R.D. Hamilton. 1982. Releases of Mercury from Sediments: Effects of Mercury Concentration, Low Temperature, and Nutrient Additions. Canadian Journal of Fisheries and Aquatic Sciences. 39: 1459-1466.</p>	
			<p>July 20: De Beers disagrees with this recommendation and suggests a pragmatic approach to deciding on this issue, using available monitoring data and operational activities at the Mine. Effects on the receiving environment do not necessarily begin at the start of operations, which provides an opportunity to accumulate additional data to characterize background variation, to arrive at realistic normal</p>	<p>Acceptable response. Recommendations made by De Beers from the AEMP Annual Report will be discussed in the review process for the AEMP Re-evaluation Report (due July 2019). Concerns on the recommendations can be brought forth at that time.</p>

16	6. Sediment quality; 6.4.4 Within-lake spatial patterns	<p>Recommendation ECCC recommends that the Proponent not consider data from the construction phase as baseline or pre-impact data.</p>	<p>ranges for use in evaluating Action Level triggers. De Beers considers the Aquatic Effects Re-evaluation process (due July 2019) as a mechanism to evaluate the component data collected during the first three years of the AEMP to determine the validity of using any data collected during the construction phase to further characterize background variation.</p>	
		<p>Comment Negative correlations were reported for metals in Area 8 sediment and distance from diffuser. However, the report suggests that mine-related trends are unlikely. To support this interpretation, the report notes that in some cases, RPDs were <30%, which suggested no spatial trend, and that dewatering, which did not occur in 2016, is the only pathway for metals from mine-related activities. It is acknowledged that spatial heterogeneity in sediment metals is high, and that a 30% difference between stations is relatively low, but it would not necessarily rule out a spatial trend.</p> <p>Recommendation ECCC recommends that the Proponent clarify explanations for the lack of mine-related spatial trends in Area 8 sediment metal concentrations.</p>	<p>July 20: De Beers does not believe that spatial trends in concentrations of a number of metals in sediments (e.g., aluminum, beryllium, cadmium, selenium, silver, vanadium, and zinc) in Area 8 in 2016 are the direct result of Mine activities. The only direct pathway for potential effects to sediment quality (i.e., decreasing concentrations trends away from the diffuser) is expected to be through dewatering. However, no dewatering to Area 8 from Area 3+5 occurred during 2016. It was stated in the AEMP Report that the within-lake variability of sediment quality of Area 8 is of a similar range to that under baseline conditions and in reference lakes, which suggests that the Area 8 sediment chemistry is naturally spatially heterogeneous. This heterogeneity, and the lack of a similar trend for a range of other ions, nutrients and metals, limited attributing the trend to a mine effect. Further to this, although not showing a significant correlation due to low sample size, there is a general decrease in the</p>	<p>Natural heterogeneity should not produce a spatial gradient; however, the changing sediment composition is a reasonable explanation.</p>

			<p>proportion of silt and clay with distance from the diffuser (i.e., from L1 to L4; see figures below), and an accompanying increase in the proportion of sand (i.e., from L1 to L4). This can influence the concentration of metals in sediment samples (i.e., fine sediment fractions have a much greater surface area for binding metals and ions) and is therefore suggested to be an additional influence. A significant increase of several metals is shown with decreasing grain size by several studies examining fluvial sediments impacted by land use activities (Stone and Droppo 1996; Horowitz and Elrick 1987). References: Horowitz A.J. and Elrick K.A. 1987, The relation of stream sediment surface area, grain size and composition to trace element chemistry. Appl. Geochem. 2: 437-451 . Stone M. and Droppo I.G. 1996, Distribution of lead, copper and zinc in size-fractionated river bed sediment in two agricultural catchments in southern Ontario, Canada. Environmental Pollution. 93: 353-362.</p>	
17	6. Sediment quality; 6.4.7 Before-after analysis - Lake D2/D3; Appendix 6A Figure 6A-38	<p>Comment Only two parameters were found to differ significantly between pre- and post-flood in D2/D3 (Antimony and Silver). Given concerns over mercury and the water column mercury results, further discussion of sediment mercury results is warranted. Although mercury did not increase significantly (low p-value of 0.155 in the BACI statistical analysis) between 2013 and 2016, there was an upward</p>	<p>July 20: Please refer to the response to ECCC Recommendation #14 for supplemental information regarding mercury projections in the raised lakes. This discussion focuses on mercury in water and aquatic organisms (fish), as these are the key changes that are expected in the raised lakes. De Beers does not believe that methyl mercury should be considered as an additional sediment quality parameter.</p>	<p>Recommendations (with supporting rationale) related to components of the AEMP Design Plan can be brought forth during the review of the Aquatic Effects Re-evaluation Report, which is due to the Board, for approval, July 31, 2019. At that time, reviewers may propose evidence to be</p>

18	6. Sediment quality; 6.8 Recommendations	<p>trend from 2012 onwards (figure 6A-38). Recommendation ECCC recommends that the Proponent provide further discussion of sediment mercury concentrations in pre and post-flood in D2/D3 and consider adding methyl mercury as a sediment quality parameter.</p>	<p>Methyl mercury has been shown to represent a very small fraction of the total sediment mercury concentration (~<1%), and is not always strongly correlated with the total mercury concentration in the sediment (i.e., it is not the amount of total mercury in the sediment that governs the proportion of methyl mercury in the sediment, but a function of other ambient conditions, e.g., organic carbon concentration, pH, dissolved oxygen status); this is in contrast to the proportion of methyl mercury to total mercury in water and fish tissue, where conditions are favourable for the generation of methyl mercury. Methylation of mercury and its availability to aquatic organisms increases as new sources of inorganic mercury are introduced to the water column along with corresponding microbial activity increases due to corresponding nutrient increases (i.e., as a result of the inundation of soil and vegetation in the case of the raising of these lakes), especially in the initial years after flooding. In this context, keeping total mercury as a measurement indicator in the suite of parameters in the AEMP sediment quality analysis is considered sufficient and appropriate for the raised lakes.</p>	considered for updates to the AEMP Design Plan.
		<p>Comment The report recommends that 2015 and 2016 sediment quality data, collected during the dewatering and construction phase, be considered as baseline data and be included in</p>	<p>July 20: Please refer to the response to ECCC Recommendation #15. To clarify, De Beers does not advocate considering data collected during the construction phase to be baseline data, but rather as additional</p>	<p>Acceptable response. Recommendations made by De Beers from the AEMP Annual Report will be discussed in the</p>

19		<p>calculation of normal ranges. Recommendation ECCC recommends that the Proponent not consider sediment data from the construction phase as baseline data.</p>	<p>data that are potentially useful to characterize background variability in sediment quality, if it can be shown that there was no pathway to an effect on sediment quality. De Beers considers the AEMP Re-evaluation process (due July 2019) as a mechanism to evaluate the sediment quality data collected during the first three years of the AEMP to determine the validity of using this data to further characterize background variation.</p>	<p>review process for the AEMP Re-evaluation Report (due July 2019). Concerns on the recommendations can be brought forth at that time.</p>
	<p>7. Plankton; 7.4.6.9 Before-after analysis</p>	<p>Comment Phytoplankton biomass decreased in Lake D2/D3 from 2015-2016, despite an increase in chlorophyll a (chl a) over the same period. It is unclear why these two closely related parameters would differ in terms of the direction of year-to-year change. Recommendation ECCC recommends that the Proponent discuss any explanations for the discrepancy in phytoplankton and chl a results, including assessment of any QC measures or possible sources of error for both parameters.</p>	<p>July 20: Chlorophyll a concentration is often used as an indicator of phytoplankton standing crop (i.e., biomass) during the open-water season. However, in some sub-arctic lakes, including Lac de Gras (Diavik AEMP; Golder 2016) and Snap Lake (De Beers AEMP; Golder 2012), no clear relationship exists between chlorophyll a concentration and phytoplankton biomass. Potential explanations for this observation include limited range in primary productivity and variation in community composition. It is possible that a greater range in nutrient concentrations, and hence primary productivity, is required for a relationship to emerge between chlorophyll a and phytoplankton biomass, than exists in these lakes. It is also possible that the lack of correlation may be in part related to differences in the community composition. For example, a station or lake may have phytoplankton biomass appropriate for its nutrient status, but be dominated by taxa</p>	<p>Acceptable response.</p>

20	7. Plankton; 7.5.4 Conclusion	<p>Comment Nutrient status of the D2/D3 lakes was found to increase from oligotrophic under baseline conditions, to mesotrophic after the water level was raised. In the EIS, this was predicted to be an impact of dyking the outlet and raising water levels. There were no comparable reference lakes sampled to assess year-to-year variability in nutrient levels and plankton abundance.</p> <p>Recommendation ECCC recommends that the Proponent consider adding a comparable reference lake for Lake D2/D3, to track natural variation of nutrient concentrations and plankton abundance during subsequent post-flood years.</p>	<p>that contain only small amounts of photosynthetic pigments, resulting in no clear relationship between chlorophyll a and phytoplankton biomass. References: Golder (Golder Associates Ltd.). 2016. 2011 to 2013 Aquatic Effects Re-evaluation Report Version 3.2 for the Diavik Diamond Mine, Northwest Territories. Prepared for Diavik Diamond Mines (2012) Inc. Yellowknife, NT. June 2016. Golder 2012. Snap Lake - Aquatic Effects Re-evaluation Report. Prepared for De Beers Canada Inc. Yellowknife, NT. October 2012.</p>	
			<p>July 20: In the response to GNWT-ENR-4, De Beers references additional baseline data presented in the Synthesis of Baseline Information for the Aquatic Environment (Golder 2014), that more accurately characterize the raised lakes (e.g., Lakes D2, D3, and E1) as oligotrophic to mesotrophic and seasonally coloured, with TP ranging from 5 to 24 µg/L (median: 9 µg/L), colour ranging from 7 to 125 TCU (median: 15 TCU), and TOC ranging from 4.5 to 24 mg/L (median: 6.2 mg/L). As per the responses to ECCC-14, De Beers does not consider a reference lake for Lake D2/D3 or raised lakes necessary, as the mine activity or raising of the lake is unique in terms of its raised nature and is a temporary change. There is a good understanding of the background water chemistry (e.g., nutrients) of the small lakes in the Kennedy Lake watershed (e.g., A, D, E, J, I</p>	<p>Board staff take note of this concern and recommendation made by ECCC, and encourage ECCC to bring forth this recommendation again during the review of the Aquatic Effects Re-evaluation Report, which is due to the Board, for approval, July 31, 2019.</p>

21	8. Benthic invertebrates; 8.4.1.1 Variation in physical habitat	<p>Comment The report notes differences in sediment particle size among benthic stations. In core lakes and Lake 3, benthic stations are dominated by fine grained sediments, whereas East Lake stations are dominated by sand. As noted, substrate characteristics can influence benthic invertebrate community endpoints and may confound comparisons between lakes.</p> <p>Recommendation ECCC recommends that the Proponent consider field reconnaissance to locate more comparable sites in East Lake, or add a more suitable reference lake.</p>	<p>watersheds), particularly the D and E lakes, providing a reliable estimate of the background variation. In addition to these data, and the nutrient concentrations and plankton abundance data collected from the two reference lakes used in the AEMP, there is sufficient information to track the extent of change in the lakes as a consequence of their temporary raising. Lake D2/D3 will be monitored at the same frequency as the core and reference lakes, with the exception of an under-ice program due to its small size and relatively shallow depth.</p>	
			<p>July 20: No additional reference lakes are contemplated at this time. Please see the response to ECCC Recommendation #4. Beginning with the AEMP benthic invertebrate field survey in 2017, sediment samples collected from East Lake will be visually assessed during sampling to determine if the percentage of sand present at a given station is high relative to those at other AEMP stations. If the sand content is noticeably higher at a station, the field crew will be instructed to attempt to locate an alternative location to collect a sample, within an approximately 100 m radius of the original station, where finer grained sediment is present.</p>	<p>Acceptable response.</p> <p>Recommendations (with supporting rationale) related to components of the AEMP Design Plan can be brought forth during the review of the Aquatic Effects Re-evaluation Report, which is due to the Board, for approval, July 31, 2019. At that time, reviewers may propose evidence to be considered for updates to the AEMP Design Plan.</p>

22	<p>8. Benthic invertebrates; 8.4.1.2.1 Benthic invertebrate community summary variables</p>	<p>Comment Correlations between benthic endpoints (richness and density) with distance from the diffuser may have reflected a gradient in water depth, which increased with distance from the diffuser. If the Proponent is interested in assessing spatial trends relative to the diffuser, this should be taken into consideration.</p> <p>Recommendation For future studies, ECCC recommends that the Proponent select benthic stations such that water depth is not a confounding variable (i.e., does not vary with proximity to diffuser).</p>	<p>July 20: The influence of water depth on the significant negative correlation between invertebrate richness and distance from the Mine-effluent diffuser in Area 8 (discharge of Mine effluent did not occur in 2016) is likely to be minor. The three "middle" stations had water depth within 1 m of one another, and the overall acceptable range of 4 to 8 m water depth for the AEMP was selected based on a limited influence of water depth on benthic communities in the core and reference lakes. Accordingly, the strength of the relationship between richness and water depth was relatively weak (Spearman Rank correlation coefficient = 0.25), indicating that at most, depth explained a small proportion of the total variation in richness in Area 8. Water depth at stations in Area 8 ranged from 4.2 to 7.5 m, representing a difference of 3.3 m. This difference is unlikely to substantially affect habitat conditions at individual stations extending away from the diffuser in Area 8. This is supported by the finding that other habitat variables, including sediment particle size and total organic carbon content, which are often highly correlated with water depth, did not influence the pattern observed in richness. Furthermore, significant spatial trends in total density, SDI, evenness and density of Nematoda within Area 8 were not related to depth or to other habitat variables. Based on these considerations, although adjusting the</p>	<p>Acceptable response.</p> <p>Board staff remind De Beers of the commitment made in their response to carry out efforts during the 2017 field program to reduce depth variation among stations in the area discussed.</p>
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23	8. Benthic invertebrates; 8.4.3.2.1 Benthic invertebrate summary variables - before-after analysis	<p>Comment Significant increases in benthic invertebrate density were reported in streams in 2016, compared to baseline conditions (2013). The report notes that lower water flows in 2016 may have led to greater growth of periphyton, a food source for benthic invertebrates. Selection of sampling stations under low flow conditions may have also influenced the results as the field crew were limited to low to moderate flow areas, rather than erosional habitats.</p> <p>Recommendation For future studies on the impacts of dyking Area 8 on downstream flows, ECCC recommends that the Proponent include an assessment of periphyton abundance. ECCC recommends that suitable reference streams be selected to assess variability associated with natural flow regimes and to compare future artificial flows under proposed flow mitigation measures.</p>	station locations in Area 8 is not warranted, efforts will be made during the 2017 field program to reduce depth variation among stations in this area.	Acceptable response.
24	8. Benthic invertebrates; 8.6 Comparison to action levels	<p>Comment The increase in benthic invertebrate density in D2/D3 may reflect an increase in nutrient status post-flood. The report notes that further study is needed to confirm that these changes were related to the increase in water level after dyke construction.</p>	<p>July 20: It is acknowledged that periphyton data from streams may be useful to assist in the interpretation of effects resulting from changes in downstream flows. DeBeers will consider adding periphyton sampling as a future requirement in streams downstream of Area 8 as part of the upcoming AEMP re-evaluation report, which is scheduled to be submitted to the MVLWB in July 2019. The assessment of effects from Mine-related changes in hydrology on stream benthic invertebrate communities employs a before-after design, as discussed in the AEMP Design Plan. Sites are sampled before and after flow effects have taken place, thus avoiding problems caused by natural spatial variation among streams in benthic invertebrate communities. As the AEMP design plan has been approved by the MVLWB, no additional reference streams are contemplated at this time.</p> <p>July 20: No additional reference lakes are contemplated at this time. Please see the responses to ECCC Recommendations #14 and #20.</p>	<p>Recommendations (with supporting rationale) related to components of the AEMP Design Plan can be brought forth during the review of the Aquatic Effects Re-evaluation Report, which is due to the Board, for approval, July 31, 2019. At that time, reviewers may propose evidence to be considered for updates to the AEMP Design Plan.</p> <p>Recommendations (with supporting rationale) related to components of the AEMP Design Plan can be brought forth during the review of the Aquatic Effects Re-evaluation Report, which is due to the Board, for approval, July 31,</p>

25	8. Benthic invertebrates; 8.6 Comparison to action levels	<p>Recommendation ECCC recommends that a continued assessment of the impact of flooding on the benthic invertebrate community in D2/D3 should include monitoring of a comparable reference lake to assess natural patterns of variation in the benthic community.</p> <p>Comment Despite apparent impacts of mine construction on nutrient status and benthic community in Lake D2/D3 and on benthic communities in the streams downstream of Area 8, there did not appear to be action levels associated with these responses.</p> <p>Recommendation ECCC recommends that the Proponent consider developing action levels for benthic effects from flooding in D2/D3 and decreased flow in streams downstream of Area 8.</p>	<p>Recommendation ECCC recommends that a continued assessment of the impact of flooding on the benthic invertebrate community in D2/D3 should include monitoring of a comparable reference lake to assess natural patterns of variation in the benthic community.</p>	2019. At that time, reviewers may propose evidence to be considered for updates to the AEMP Design Plan.
			<p>July 20: As it is expected that it will take up to 3 years before the maximum predicted effect on water level from diversion of the D watershed by Dyke F is realized in Lake D2/D3 (i.e., overflow of Lake D2/D3 into Lake N14 in the N watershed). The system is currently in a state of flux and will remain so until water levels stabilize. It is anticipated that after water levels stabilize, it will take a number of years for biological communities to adapt to the new physical conditions. Evaluation of the Lake D2/D3 benthic invertebrate data against action levels is, thus, proposed to begin once the full hydrologic effect of diversion of the D watershed is realized and lake biological characteristics begin to stabilize. The AEMP Re-evaluation report will provide a recommendation regarding the development of Action Levels for benthic invertebrates in Lake D2/D3. The AEMP Response Framework would be updated as part of the next AEMP redesign to include Action Levels for benthic invertebrates in Lake D2/D3. As discussed in Section 8.6.2 of the report, the Action Levels for benthic invertebrates in streams were developed to</p>	Acceptable response.

			<p>assess effects from increased water flows, primarily via increased scouring, on the benthic invertebrate community downstream of Area 8. No modification to the Action Levels for benthic invertebrates in streams is proposed, as the Downstream Flow Mitigation Plan will be implemented in 2017, which is proposed to augment flows downstream of Area 8 during operations and refilling to avoid potential harmful effects to fish and fish habitat, which includes benthic invertebrates. Development of low action levels for decreased flows is not contemplated, as downstream flows will be supplemented by the downstream flow mitigation plan at least every three out of four years, and dependent on climate conditions.</p>	
26	9. Fish habitat and community; 9.4.2.1 Fish passage and habitat	<p>Comment The study found that fish habitat conditions were suitable to support grayling life stages in spring and early summer, flow conditions were suitable for spawning and young-of-the-year (YOY) were present in all monitored streams in 2016. The report did not indicate to what extent the low flow conditions, caused by dyking Area 8, reduced suitable habitat and flows compared to baseline conditions. The report also noted the return of three grayling to Area 8 in late May-early June, 44 fish documented in L and M streams moving upstream to A8 (fish fence and visual) and the presence of 14 YOY in the</p>	<p>July 20: De Beers notes that the AEMP Design Plan has been approved by the MVLWB and ECCC participated in this process. The Action Levels for Fish Habitat and Community consider changes to flows and water levels that occur outside the predictions of the EIS only and not relative to baseline conditions. Changes to baseline conditions due to flow alterations were predicted to occur in the EIS. As shown in Section 9.4.2.1 of the 2016 AEMP Annual Report, the location and formation of barriers to adult fish passage within these streams were shown to be consistent with observations made at similar stream discharges in previous years, prior to</p>	Board staff recommend that De Beers provide ECCC with the documentation of baseline information they have requested.

		<p>streams. It was unclear how these observations compared to previous years under normal flows.</p> <p>Recommendation ECCC recommends that, if baseline data are available, habitat suitability (barriers, flow) should be quantified where practical and compared to baseline conditions, to assess the impact of mine activities on fish habitat. Number of fish moving up into Area 8 should also be compared between 2016 and baseline years.</p>	<p>dewatering. However, in contrast to previous years, the formation of these barriers occurred earlier in the season (i.e., June 24, 2016). The earlier formation of stream barriers results in a shorter window where fish movements through the L and M watersheds are possible. The report also indicated that predictions for low flow conditions in Area 8 and the downstream L and M watersheds in 2016 are equivalent to those predicted in the EIS for conditions under the operations phase with no flow mitigation. That is, a reduction of available fish habitat (De Beers 2012), due to a decrease in water levels and lake areas in the L and M watersheds between Kennedy Lake and Lake 410 relative to baseline conditions (De Beers 2012). The EIS also indicated that under baseline conditions, barriers to fish migration would be present about 20% of the time in June, or in other words, would result in a barrier to migration approximately one out of five years. A comparison of fish numbers to baseline was not included as part of the approved AEMP. The rationale for this was provided in the development of the approved AEMP design through IR responses. The EIS also predicted that a reduction in the population size in Area 8 and in the streams downstream to Lake 410 was expected due to the fish out and reduced area of Kennedy Lake. Therefore, comparisons relative to baseline population size are not a relevant</p>	
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27	9. Fish habitat and community; 9.4.2.1 Fish passage and habitat	<p>Comment The report notes that fish passage was possible from the upper sections of stream L3 to Area 8 for most of the open-water season; this represents a very small upstream section of the area studied, and would suggest minimal movement of fish from Area 8 beyond the first sections of stream L3, or movement of fish from downstream lakes up towards Area 8. Additional discussion is required on the impact of low flow conditions on fish passage.</p> <p>Recommendation ECCC recommends that the Proponent clarify the effect of flow conditions in 2016 relating to restricted movement of grayling in Area 8 to a very small section of the study area.</p>	<p>comparison for the AEMP. References: De Beers. 2012. Environmental Impact Statement Supplemental Information Submission for the Gahcho Ku'Á© Project. Submitted to the Mackenzie Valley Environmental Impact Review Board, April 2012. Yellowknife, NWT, Canada.</p> <p>July 20: As indicated in Section 9.6 of the 2016 AEMP Annual Report, fish passage was possible from the upper sections of Stream L3 through to Area 8 during most of the open-water season, with the possibility of some adult restrictive movements towards the fall. In streams L2, L1c, L1b, L1a and M4 fish passage would have been restricted from late June onwards. Full fish passage and access to habitats from Area 8 downstream to Lake M4 was possible for the duration of the spring freshet through to the start of barrier formations on June 24 of 2016. As shown by the results in Section 9.4.2.2, this did not have an effect on spawning, or rearing in early summer in 2016. Decreasing flows in June likely triggered a migration response in most adult fish. Evidence of this migration was indicated by the return of the three adult Arctic Grayling to Area 8 in late May and early June 2016, and the return of all tagged adult Northern Pike to Area 8 by June 21. Full barriers to fish movements occur naturally in the streams downstream of Area 8 during the summer months due to declining flows as described in the EIS (De</p>	Appropriate response.
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		<p>Beers 2012). For fish remaining in downstream habitats between Area 8 and Lake M4 (under both natural conditions and project flows), fish passage to overwintering refugia is likely restricted to movements to localized deeper pools within each of the stream courses. Results from the University of Waterloo monitoring indicated that Arctic Grayling used Kennedy Lake, Lake L2, and Lake M4 as overwintering habitat. Fish that overwintered in Lake L2 in 2013 and 2014 were shown to survive the winter and subsequently migrate through stream L1a to Lake M4 (University of Waterloo 2016). References: De Beers. 2012. Environmental Impact Statement Supplemental Information Submission for the Gahcho KuÃ© Project. Submitted to the Mackenzie Valley Environmental Impact Review Board, April 2012. Yellowknife, NWT, Canada. University of Waterloo. 2016. Progress to Date. Investigation of the effects of dewatering of Kennedy Lake on the occupancy, habitat use, and migrations of Arctic Grayling (Thymallus arcticus) at Gahcho KuÃ© project site, NT. Prepared for: De Beers Canada Inc., Golder Associates, by: Leanne Baker & Heidi Swanson. Department of Biology University of Waterloo, Waterloo Ontario. Prepared for De Beers Canada Inc. November 2, 2016.</p>	
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28	9. Fish habitat and community; 9.5 Comparison to action levels	<p>Comment Action levels were not triggered because the presence of spawning grayling was confirmed in the spring of 2016. However, it seems likely that the low flows caused by the dyking of Area 8 could have impacted the number of grayling that successfully spawned, or the number of YOY.</p> <p>Recommendation ECCC recommends that the Proponent consider modifying the action levels for impacts to fish habitat to account for year-to-year differences in reproductive success.</p>	<p>July 20: De Beers notes that the AEMP Design Plan including the Action Levels has been approved by the MVLWB and ECCC participated in this process. Any potential for changes to Action Levels will be considered during the AEMP Re-Evaluation process. The Action Levels for Fish Habitat and Community consider confirmation that the physical conditions required for passage and rearing are present, and that fish are continuing to use the downstream habitats, is sufficient to confirm the persistence of the population. Natural year-to-year variability in fish movements, flow conditions and populations can make data interpretation challenging over short time periods.</p>	<p>Appropriate response.</p> <p>Recommendations (with supporting rationale) related to components of the AEMP Design Plan can be brought forth during the review of the Aquatic Effects Re-evaluation Report, which is due to the Board, for approval, July 31, 2019. At that time, reviewers may propose evidence to be considered for updates to the AEMP Design Plan.</p>
29	10. Fish health; 10.1 Introduction	<p>Comment A single sentinel species (ninespine stickleback) was selected for fish health studies. In 2015, stickleback were collected from core lakes, but could not be located in reference lakes. In 2016, it would appear that only the reference lakes were sampled. The reason for this is unclear; comparing fish health endpoints between groups sampled in different years is not a valid approach to assessing treatment effects due to the possible confounding effect of year-to-year variation.</p> <p>Recommendation ECCC recommends that a second sentinel species be selected by the Proponent, to increase the likelihood that target sample sizes are achieved each</p>	<p>July 20: The objectives of the 2015 and 2016 AEMP fish health sampling programs were to confirm sentinel species selection and to collect baseline data for comparison during future AEMP years. In 2015, insufficient numbers of Ninespine Stickleback were obtained from the reference lakes to meet baseline sampling requirements; however, their presence was confirmed. The duration (i.e., shorter than normally planned for a full AEMP fish program) and timing (later in the fall than normally planned for fish health sampling) of the 2015 program was largely responsible for low catch numbers in 2015. The 2015 fish health program was successful at confirming sentinel fish</p>	<p>Appropriate response.</p>

		<p>year for a least one species, and avoid the situation described in the report, where fish from different treatments were collected in different years.</p>	<p>species presence in all the study lakes, and the reconnaissance identified sampling locations in the reference lakes and effective fishing methods, which were used during the 2016 reference lake fish health program. As per the AEMP Study Design document (De Beers 2016), future fish health and fish tissue chemistry samples will be collected among the core (Area 8 and Lake N11) and reference study lakes within a single year. A non-lethal sampling program for Ninespine Stickleback has been included in the AEMP Study Design (De Beers 2016), in lieu of a second sentinel species. Ninespine Stickleback is the only small-bodied species to co-occur in all four lakes in sufficient abundance to satisfy the sample size requirements of the AEMP. Reference: De Beers. 2016. Aquatic Effects Monitoring Program Design Plan. Version 5. Gahcho KuÃ© Mine. Submitted to Mackenzie Valley Land and Water Board, Yellowknife, NWT. January 2016.</p>	
30	<p>10. Fish health; 10.2.1.2 Sampling locations and timing</p>	<p>Comment The 2016 fish survey in the reference lakes was conducted in August 2016, 2 weeks earlier than the 2015 survey. This could further confound the comparison of core and reference lakes, given seasonal effects on reproductive development and fish growth. Recommendation In future studies, ECCC recommends that fish surveys be conducted in the same year, at the same time of year, to the extent practical.</p>	<p>July 20: Agreed. As per the AEMP Study Design, future fish health and fish tissue chemistry AEMP studies will be conducted in the same year on the core (Area 8 and Lake N11) and reference study lakes, and at the same time of year, to the extent practical (i.e., anticipated to be completed within a 2-week period in August).</p>	Appropriate response.

31	10. Fish health; 10.2.1.2 Sampling locations and timing	<p>Comment The fish communities should be described and compared among lakes, as part of an assessment of the suitability of reference lakes for comparison to core lakes (e.g., presence of predators, position of sentinel species in the food web).</p> <p>Recommendation For future reports, ECCC recommends that the Proponent provide a description and comparison of fish communities in core and reference lakes.</p>	<p>July 20: The fish communities of these lakes have been extensively described previously in the EIS baseline reports (De Beers 2011, 2012) and Golder (2014); future AEMP reports will reference these documents, as appropriate. References: De Beers. 2011. Environmental Impact Statement for the Gahcho KuÃ© Project. Volumes 3a Revision 2, 3b Revision 2, 4 Revision 2, and 5 Revision 2. Submitted to the Mackenzie Valley Environmental Impact Review Board in Response to the Environmental Impact Statement Conformity Review, July 2011. Yellowknife, NWT, Canada. De Beers. 2012. Environmental Impact Statement Supplemental Information Submission for the Gahcho KuÃ© Project. Submitted to the Mackenzie Valley Environmental Impact Review Board, April 2012. Yellowknife, NWT, Canada. Golder. 2014. Gahcho KuÃ© Project - 2013 Fish Health Supplemental Monitoring Report. Submitted to De Beers Canada Inc., March 2014. Calgary, AB. 43 pp. + Appendices.</p>	Appropriate response.
32	10. Fish health; 10.2.3 Laboratory methods	<p>Comment The report states that otolith samples were archived, but does not appear to describe ageing methods. It is assumed otoliths were used to age the fish.</p> <p>Recommendation ECCC recommends that the Proponent clarify how fish were aged and provide any QC results for ageing methods.</p>	<p>July 20: As reported in Section 10.3.3.2.4 of the 2016 AEMP Annual Report, fish were aged using site-specific length-frequency distributions. Length-frequency distributions were evaluated by three qualified biologists independently, and any discrepancies were resolved based on consensus. Ninespine Stickleback otoliths were collected from a subsample of fish and archived for future reference. Otolith aging</p>	Acceptable response.

			<p>data has proven to be unreliable for Ninespine Stickleback in the NWT; therefore, length frequency data are preferred for producing accurate age classifications. Future AEMP reports will include details regarding length-frequency based age determinations in the methods section.</p>	
33	10. Fish health; 10.3.3.1 Catch data summary	<p>Comment The report acknowledged the use of different gear types among lakes, and provided a summary of fish sizes captured by each gear type (Fig. 10.3-1). Certain gear types appeared to collect different sizes of fish; and different gear types were used to collect the bulk of fish samples in each lake: hoop net in A8, backpack electrofishing/hoop net in N11, boat electrofishing/hoop net in East, and seine net in Lake 3. The report indicates that size selection bias may have influenced the results.</p> <p>Recommendation ECCC recommends that where practical, future studies should attempt to limit the use of different gear types to avoid size selection bias.</p>	<p>July 20: As discussed in Section 10.3.3.1 and presented in Table 10.3-2 of the 2016 AEMP Annual Report, the same gear types were deployed at all lakes to standardize effort as much as possible. However, fishing success of each method varied among the lakes (and without successful catches by each method, fish cannot be selected from the same method among the lakes). Therefore, as much as possible, gear selectivity will be minimized during future programs by continuing to standardize gear types and effort.</p>	Acceptable response.
34	10. Fish health; 10.3.3.3 Population survey	<p>Comment The heading for Table 10.3-13 refers to the 'Statistical comparison of lethal survey parameters.'; ECCC believes this could refer to 'non-lethal' parameters.</p> <p>Recommendation ECCC recommends that the Proponent clarify if the figure heading for Table 10.3-13 is indeed for lethal</p>	<p>July 20: Acknowledged. The heading for Table 10.3-13 should refer to non-lethal parameters.</p>	Board staff recommend De Beers ensure the heading is updated for future iterations of the AEMP Annual Report.

35	11. Fish chemistry; 11.2.3 Data analysis and interpretation	<p>survey parameters and not for non-lethal parameters.</p> <p>Comment The report suggests that 2016 fish tissue mercury in northern pike from the flooded Lake D2/D3 will be considered as baseline data since changes are unlikely to occur until two to three years after flooding. Given construction of Dyke F commenced in fall 2015, fish sampling in August 2016, and the increases in water column mercury and methyl mercury reported for 2016, it does not seem valid to consider the 2016 fish results as baseline data. If existing baseline data are inadequate to characterize pre-flood mercury levels, the Proponent could assess impacts through analysis of temporal trends in mercury concentrations post-flood.</p> <p>Recommendation ECCC recommends that the Proponent not consider the 2016 mercury data for northern pike in Lake D2/D3 as baseline data. Other data should be used for baseline or impacts should be assessed through the analysis of temporal trends in mercury concentrations post-flood. ECCC also recommends that the Proponent monitor mercury levels in northern pike in a suitable reference lake to assess year-to-year variation.</p>	<p>July 20: Mercury concentrations in Northern Pike from Lake D2/D3 will be compared among years during future sampling programs to examine trends in mercury concentrations over time, with data collected in 2013 (n=15) and 2016 (n=21) represented separately. As reported in Section 11.3 and presented visually in Figure 11.3-1 of the 2016 AEMP Annual Report, mercury concentrations in Northern Pike are not statistically different between 2013 and 2016, and therefore, data may be pooled and considered representative of baseline conditions for future statistical comparisons as part of the AEMP fish tissue chemistry component. Pooling of the 2013 and 2016 Lake D2/D3 dataset will improve the statistical power of future comparisons to detect changes over time (as compared to comparing separately to each year). Based on comparisons to other flooded systems (e.g., Bodaly et al. 1984), three months' time between raising water levels and fish sampling avoided any impact on fish tissue mercury concentrations (i.e., it generally takes two to three years for mercury increases due to flooding to show up in fish tissue, as mercury progresses from the water through the food chain). Changes in mercury concentrations are anticipated over time due to raised water levels in Lake D2/D3</p>	<p>Examination of the 2013 and 2016 data confirms that mercury concentrations were very similar between the two years, however it is recommended that the two datasets be kept separate as a clear demarcation between baseline and construction with no chance of confounding factors. Concentrations of methyl Hg did increase in 2016 and could have increased in fish post construction and, although not yet significant, contribute to an increasing trend or add variance to the dataset that could confound the significance of future changes and not “improve the statistical power.” Statistical power is not only dependant on the sample size available but also on the variance of the data, increased variance may hinder the programs ability to detect meaningful changes in the future and therefore data should not be pooled.</p> <p>Any studies of regional variation of Hg in fish should exclude Lake D2/D3 and any other lake in which construction or operational activities occur – to ensure that</p>
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			<p>(De Beers 2011). Regional variation in mercury concentrations will be monitored during the fish tissue chemistry studies in the AEMP study lakes, which will include Lake D2/D3, and mercury in fish tissue results will be considered holistically as part of the AEMP annual report interpretation (i.e., within the fish tissue chemistry component, and the weight of evidence component). References: Bodaly RA, Hecky RE, Fudge RJP. 1984. Increases in fish mercury levels in lakes flooded by the Churchill River Diversion, Northern Manitoba. Canadian Journal of Fisheries and Aquatic Sciences, 41:682-691. De Beers. 2011. Environmental Impact Statement for the Gahcho Ku'Ã© Project. Volumes 3a Revision 2, 3b Revision 2, 4 Revision 2, and 5 Revision 2. Submitted to the Mackenzie Valley Environmental Impact Review Board in Response to the Environmental Impact Statement Conformity Review, July 2011. Yellowknife, NWT, Canada.</p>	<p>the only regional variation described is due to non mine-related conditions.</p> <p>Board staff recommend that for future submissions of the AEMP Annual Report, De Beers should keep all Lake D2/D3 fish tissue data separate from the 2013 baseline data, as the construction of dyke F commenced in fall of 2015, and therefore 2016 fish tissue results should not be considered baseline data.</p>
36	11. Fish chemistry; 11.3 Results and discussion	<p>Comment It is unclear why metal concentrations were compared between core and reference groups sampled in different years (2015 for core lakes, 2016 for reference lakes).</p> <p>Recommendation ECCC recommends that the Proponent's future studies compare metal concentrations in fish from core lakes relative to reference lakes in the same year.</p>	<p>July 20: As per the AEMP Design Document (De Beers 2016), future fish health and fish tissue chemistry studies will be conducted in the same year and at the same time of year, to the extent practical. Reference: De Beers. 2016. Aquatic Effects Monitoring Program Design Plan. Version 5. Gahcho Ku'Ã© Mine. Submitted to Mackenzie Valley Land and Water Board, Yellowknife, NWT. January 2016.</p>	Acceptable response.

37	11. Fish chemistry; 11.3 Results and discussion	<p>Comment There was no significant difference for mercury concentration in D2/D3 northern pike pre- and post-flood. To justify this conclusion, a p-value of 0.781 is provided, but it is unclear which statistical test was used to obtain the p-value.</p> <p>Recommendation ECCC recommends that the Proponent clarify which statistical test was used to compare pre/post flood mercury concentrations in northern pike from Lake D2/D3.</p>	<p>July 20: As stated in Section 11.2.3.1 of the report, this statistical comparison was completed using ANCOVA with fish length as a covariate.</p>	Appropriate response.
38	11. Fish chemistry; 11.6 Summary and conclusions	<p>Comment Regarding analytical precision for metal concentrations in fish, the report notes that lab QC objectives were met, but since the QC criterion is 30% deviation from certified reference materials (CRMs), 2015 and 2016 results may be subject to a 60% error. It should be noted this would be the worst case scenario. QC results for spike recoveries and CRMs (which should have been analyzed at regular intervals in each batch) would indicate whether or not this level of analytical error was likely.</p> <p>Recommendation ECCC recommends that QC results documenting analytical precision of metal analysis should be reviewed and large deviations (e.g., approaching 30%) should be flagged and discussed to support the statement that a cumulative error of up to 60% may have affected 2015 and 2016 results.</p>	<p>July 20: In response to this comment, analytical precision was reviewed from the CRM quality control results of the 2015 and 2016 AEMP (see attached "Analytical Precision" document). The minimum and maximum deviations were compared for each metal between years. The combined errors ranged from 5.9% for boron, to 28.7% for cadmium, with an average error 19.6% for all metals. Laboratory precision is not anticipated to be a significant source of error during future cycles of the AEMP, as all samples will be analyzed in the same year. The results of the laboratory QC objectives can be found in Appendix 11A of the 2016 AEMP, and Appendix 11A of the 2015 AEMP.</p>	Acceptable response.

39	General comments	<p>Comment For each of the study components (water and sediment quality, plankton, benthic invertebrates, fish health and chemistry), the Proponent has recommended that data collected from core lakes during the construction phase in 2015 and 2016 should be considered as baseline or pre-impact data for the purpose of normal range calculations and BACI analyses.</p> <p>Recommendation ECCC recommends that the Proponent use only pre-construction data to calculate normal ranges and determine baseline conditions.</p>	<p>July 20: Please refer to the response to ECCC Recommendation #15.</p>	<p>Acceptable response.</p> <p>Recommendations made by De Beers from the AEMP Annual Report will be discussed in the review process for the AEMP Re-evaluation Report (due July 2019). Concerns on the recommendations can be brought forth at that time.</p>
40	General comments	<p>Comment Results from the 2016 AEMP suggest that East Lake may not be the most suitable reference lake for comparison to core lakes Area 8 and N11 because watershed size is not comparable to either core lake; spring water temperatures in 2016 were several degrees lower than Area 8; nutrient status appeared to be lower than in other lakes; benthic station substrates were dominated by sand, whereas other lakes had fine-grained sediments; and sentinel species could not be located in 2015.</p> <p>Recommendation ECCC recommends that the Proponent consider adding reference lakes that are more compatible with the core lakes.</p>	<p>July 20: Please refer to the response to ECCC Recommendation #4.</p>	<p>Acceptable response.</p> <p>Recommendations (with supporting rationale) related to components of the AEMP Design Plan can be brought forth during the review of the Aquatic Effects Re-evaluation Report, which is due to the Board, for approval, July 31, 2019. At that time, reviewers may propose evidence to be considered for updates to the AEMP Design Plan.</p>

Fisheries and Oceans Canada: Laura Watkinson

ID	Topic	Reviewer Comment/Recommendation	Proponent Response	Board Staff Response
1	General	<p>Comment DFO has reviewed the De Beers Gahcho Kue AEMP Annual Report in accordance with its mandate and has no comments at this time.</p> <p>Recommendation N/A</p>		Noted.

GNWT - ENR: Monica Wendt

ID	Topic	Reviewer Comment/Recommendation	Proponent Response	Board Staff Response
27	General File	<p>Comment (doc) ENR letter with comments.</p> <p>Recommendation</p>		Noted.
1	Topic 1: Mine Schedule	<p>Comment Table 2.2-1 "Schedule of Mine Activities" appears to outline a slightly different mine schedule than that presented in the Water Licence Annual Report. This may be a result of recent changes to timing associated with Hearne Pit.</p> <p>Recommendation 1) ENR requests that De Beers clarify whether the mine schedule in Table 2.2-1 is up to date.</p>	<p>July 20: Mine plans may fluctuate due to advancements in mining methods and/or new information. As such there may be some variability between tables as presented between documents even if they are only a few months apart which is the case between the WLAR and AEMP submissions. Table 2.2-1 is accurate except for the finalization of mining for Hearne pit which will now be completed in 2021.</p>	Acceptable response.
2	Topic 2: Raised Lakes	<p>Comment Section 5.4.2.5 notes "it was predicted in the EIS that during the construction phase of the Mine development, water quality in Lakes D2/D3 could change (i.e., a minor change) due to the release of nutrients, mercury, and other substances from flooded sediments and vegetation as a result of water level changes" and it was also noted that "(a) potential for minor change in</p>	<p>July 20: The assessment of the potential effects of flooding soils and vegetation around the temporary diversion lakes (Lake E1 and Lakes D2/D3) associated with the Mine was provided in Section 8.6.2.3 of the 2011 EIS Update (De Beers 2011) under the secondary pathway: Release or generation of nutrients, mercury, or other substances into Lakes A3, D2, D3 and E1 from flooded sediments and vegetation may change</p>	<p>The key point raised by ENR is "It is not clear in the above statements if these measured changes align with the predicted changes in Lake D2/Lake D3"</p> <p>De Beers response does not address this question but merely reiterates the predictions made in the EIS. De Beers should be</p>

		<p>water and sediment quality in the raised lakes (e.g., Lake D2/D3) to date was predicted to occur during the early stages of the Mine operational phase when these lakes were isolated and their water levels were raised. A minor change is a measurable increase in a water quality parameter that is outside the range of baseline values but is still within water quality guidelines." ENR notes that the changes were likely assessed based on magnitude and extent of change. It is not clear in the above statements if these measured changes align with the predicted changes in Lake D2/Lake D3. Has De Beers assessed these changes in respect to predicted magnitude and extent? What about the expected rate of change predicted (i.e. single season, annual changes, etc.)?</p> <p>Recommendation 1) ENR requests additional information on the changes that have been observed in the water and sediment quality (i.e. mercury of Lakes D2/D3) as they relate to predicted magnitude, extent and rates of increase.</p>	<p>water quality, and affect aquatic health and fish. This pathway was updated in the 2012 EIS Supplement (De Beers 2012) to exclude Lake A3 as a lake that will be raised, because the updated Fine PKC Facility was reduced in size and limited to Area 2. Further information regarding the potential effects related to mercury was provided in IR Round 1 responses: DFO&EC-55e, DFO&EC-58b, DKFN-25, and DKFN-37. A quantitative assessment of anticipated rate of change was not undertaken in the EIS. Based on the baseline understanding of the headwater lakes to be raised, their small size, the extent of their physical change (i.e., surface area and depth), the lack of a notable large-bodied fish populations in these lakes, the temporary nature of the raised condition of these lakes, and available literature on the topic, it was determined that although there is potential for temporary changes to surface water and sediment quality, especially nutrients and mercury concentrations, this potential effects pathway was characterized as a secondary pathway. Included in the rationale was consideration of mitigation, such as the preparation of areas to be flooded where necessary, which would limit the potential for long-term nutrient and metals releases to the lakes and mercury methylation, and monitoring under the AEMP that would track the changes and identify the potential for issues with fish</p>	<p>required to compete an explicit comparison of measured changes in water and sediment quality with the predictions made in the EIS based on their own definition that "A minor change is a measurable increase in a water quality parameter that is outside the range of baseline values but is still within water quality guidelines."</p> <p>It is not clear that De Beers predicted the rate of increase but the magnitude of increase should be compared.</p> <p>Board staff recommend that baseline data, predicted changes, and actual yearly results should be provided in all future iterations of the AEMP Annual Report in a format to illustrate the changes that have been observed in the water and sediment quality (i.e. Mercury of Lakes D2/D3) as they relate to predicted magnitude, extent, and rates of increase.</p>
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			<p>health and use of the fish. Although monitoring covers all of the aquatic components, the prime commitment that De Beers made through the EIR and permitting process in the raised lakes was the monitoring of mercury concentrations in edible fish tissue in Lake D2/D3 prior to and following raising the lake and during operations using non-invasive techniques, to determine whether there is a potential issue. Specific management response actions to an observed upward trend of mercury concentrations (adjusted for fish age, which is a major modifying factor) following water level increases would be determined, if and when necessary, through engagement with regulatory agencies, including ENR and ECCC , and Aboriginal communities.</p>	
3	Topic 3: Raised Lakes	<p>Comment Regarding Lake D2/D3, Section 7.4.6.9 notes a significant decrease in phytoplankton biomass. These results are inconsistent with the trends observed for chlorophyll a concentrations. ENR is troubled by these results because chlorophyll a concentrations are being used in the AEMP as a surrogate measure for phytoplankton biomass. De Beers should be required to explain why these two measurements which are proposed as surrogates do not show similar trends and whether they should be used as surrogates in future AEMP studies based on these results.</p>	<p>July 20: Please refer to the response to ECCC Recommendation #19.</p>	Acceptable response.

		<p>Recommendation 1) The disconnect between plankton metrics chlorophyll a (Figure 7.4-1), phytoplankton abundance (Figure 7.4-9) and phytoplankton biomass (Figure 7.4-11) in Lake D2/D3 should be further explored. ENR understands that this may be due the shift in chrysophyte abundance noted by De Beers; however, the implications of this change should be discussed and validity of the surrogacy determined.</p>		
4	Topic 4: Raised Lakes	<p>Comment Section 7.5.4 notes that the trophic status of D2/D3 has changed from oligotrophic to mesotrophic. However, there is little discussion on the implications of this change in trophic status. Are there any implications to this area, or to areas downstream, over the long-term or does this appear to be a temporary situation post-flooding? Are there currently any proposed actions related to this? Will there be any future actions if conditions do not revert to previous trophic status over time and continue to perpetuate increased eutrophication with time?</p> <p>Recommendation 1) ENR requests De Beers provide an analysis of potential impacts to Lake D2/D3 and downstream areas as a result of the change in trophic status as well as anticipated impacts over time.</p>	<p>July 20: The baseline trophic status for Lake D2/D3 presented in Table 7.5-1 is based on a single year of chlorophyll a data for Lake D3, as Lake D2 was not sampled in 2014. Based on additional baseline data presented in the Synthesis of Baseline Information for the Aquatic Environment (Golder 2014), the raised lakes can be more accurately categorized as mesotrophic and stained, with TP ranging from 5 to 24 µg/L (median: 9 µg/L), colour ranging from 7 to 125 TCU (median: 15 TCU), and TOC ranging from 4.5 to 24 mg/L (median: 6.2 mg/L). An increase in phosphorus concentrations and a changes in lake trophic status from oligotrophic to mesotrophic was predicted in the EIS for Kennedy Lake (De Beers 2011, 2012). While direct reference was not made in the EIS to the raised lakes, potential effects such as supplemental changes to nutrient status in Lake D2/D3 was discussed as a result of flooding and inundation of the surrounding shoreline. The biggest changes</p>	<p>Board staff take note of this concern and recommendation made by ECCC, and encourage ECCC to bring forth this recommendation again during the review of the Aquatic Effects Re-evaluation Report, which is due to the Board, for approval, July 31, 2019.</p>

		<p>in water chemistry in Lake D2/D3 are expected to occur during this flooding (transitional) period and shortly after, with some stability in hydrological and water quality components during the rest of the duration of its fully raised status (i.e., 7 to 8 years, Lake D2/D3 is expected to reach its full supply level during the freshet 2018). However, these changes will be temporary as the raised lakes return to their natural state following removal of the Dyke F at the end of operations. The D lakes were identified as small, mesotrophic headwater lakes, which flowed into Kennedy Lake. During Mine operations, they will flow to Lake N14, with a similar annual water yield. The projected increase in nutrient concentrations is not predicted to pose a risk within the raised lake, not to the downstream receiving environment. However, as per the AEMP Design Plan (De Beers 2016), the AEMP will continue to evaluate the aquatic components of Lake D2/D3, especially water quality, and monitor its status as a raised lake.</p> <p>References: De Beers. 2011. Environmental Impact Statement for the Gahcho KuÃ© Project. Volumes 3a Revision 2, 3b Revision 2, 4 Revision 2, and 5 Revision 2. Submitted to the Mackenzie Valley Environmental Impact Review Board in Response to the Environmental Impact Statement Conformity Review, July 2011. Yellowknife, NWT, Canada. De Beers. 2012.</p>
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			<p>Environmental Impact Statement Supplemental Information Submission for the Gahcho Ku'Ã© Project. Submitted to the Mackenzie Valley Environmental Impact Review Board, April 2012. Yellowknife, NWT, Canada. De Beers. 2016. Gahcho Ku'Ã© Mine Aquatic Effects Monitoring Program Design Plan Version 5. Submitted to Mackenzie Valley Land and Water Board, Yellowknife, NWT, Canada. January 2016. 235 pp + Appendices. Golder. 2014. Gahcho Ku'Ã© Project - Synthesis of Baseline Information for the Aquatic Environment. Submitted to De Beers Canada Inc. February 2014. Calgary, AB, Canada. 356 pp. + Appendices.</p>	
5	None	<p>Comment None Recommendation 2) ENR request that De Beers describe what degree of change in trophic status was proposed or predicted in the Environmental Assessment for Lake D2 and D3.</p>	<p>July 20: Please refer to the response to GNWT-ENR Recommendation #4.</p>	See above response.
6	None	<p>Comment None Recommendation 3) ENR requests De Beers outline if any actions are anticipated as a result of a change in trophic status of Lake D2/D3.</p>	<p>July 20: At this time, a change in trophic status of the raised lakes has not been identified (see response to GNWT-ENR Recommendation #4). Changes in water quality and lower trophic components (i.e., chlorophyll a, plankton, and benthic invertebrates) observed in Lake D2/D3 in 2016 are consistent with the expected effects from the construction of Dyke F, and are reflective of a waterbody in a state of flux as water levels have not yet stabilized.</p>	Acceptable response.

			<p>Monitoring during the 2017 open-water season will verify whether the observed trends in the raised lakes continue. Should results in future AEMP continue to show increasing trends of eutrophication beyond the baseline range, especially for water quality and plankton, a possible response could be to evaluate the potential for change in the downstream receiving environment (i.e., Lake N14).</p>	
7	Topic 5: Raised Lakes	<p>Comment Section 11.2.1 notes that fish tissues were collected in 2016 after the lakes were flooded. It is unclear if tissue levels (i.e. mercury) were consistent with baseline. De Beers notes that increases in mercury levels may not occur for several years, however this should be confirmed if tissue concentrations are available from 2016 and baseline levels are also available. ENR notes that any data collected in 2016 from the raised lakes should not be used as baseline or to augment the baseline record, particularly with respect to fish tissue concentrations such as mercury. Recommendation 1) ENR requests that De Beers confirm if tissues concentrations were taken from raised lakes (i.e. Lake D2/D3) in 2016 (post-flooding).</p>	<p>July 20: Tissue samples were collected from Northern Pike in August 2016, three months after water levels in Lake D2/D3 began to rise in May 2016 (See AEMP Section 4.4.3.2.13). Please see response to ECCC Recommendation #35 for additional information.</p>	Acceptable response.
8	None	<p>Comment None Recommendation 2) ENR requests that De Beers describe what their intentions are for fish tissue concentrations from 2016,</p>	<p>July 20: Please see response to ECCC Recommendation #35.</p>	See Board staff analysis to ECCC comment ID-35

9	None	<p>i.e. if they are planning to use this data to augment baseline data.</p> <p>Comment None</p> <p>Recommendation 3) ENR recommends that if De Beers is planning to use the 2016 fish tissue data to augment the baseline record, that they provide sufficient evidence and rationale for how and why this should occur and discuss implications of such. Note the raised lake condition is not natural and was the result of project activities (i.e. dewatering Kennedy Lake).</p>	<p>July 20: Please see response to ECCC Recommendation #35.</p>	See Board staff analysis to ECCC comment ID-35
10	Topic 6: Plume Delineation	<p>Comment Section 13.1 notes that plume delineation will occur in 2017. As stated in the report, "The purpose of this study will be to conform to the requirements of Schedule 6, Part 1, Item 3f of the Water Licence (MV2005L2-0015), which is to assess the mixing and dilution of the operational discharge from the WMP to Lake N11 and/or Area 8, to confirm mixing zone predictions of water quality around the diffuser outfall at each location." It is unclear when this will occur and ENR notes that the plume delineation should be conducted both during open water and under ice for the results to be meaningful. If discharge to Lake N11 is to be continuous, then plume delineations will also be required under ice.</p> <p>Recommendation ENR requests that De Beers clarify the times of year during which the plume delineation studies will</p>	<p>July 20: The plume delineation survey for the initial year of operational discharge to Lake N11 was conducted under ice on January 9, 2017. For context, the operational discharge of water from the water management pond (WMP) to Lake N11 commenced on October 29, 2016 and was completed on January 17, 2017. The results of the January plume delineation survey will be reported in the 2017 AEMP Annual Report.</p>	Appropriate response.

1.1	Topic 7: Data Format	<p>occur. ENR assumes that a standalone Plume Delineation Plan will be provided to the Board and reviewers prior to the plume delineation studies.</p> <p>Comment It is noted that raw data are provided in a portable document format (pdf). This format makes it difficult to conduct the assessment or analysis of data. An original source of the electronic data was used to produce the pdf document, data which could be provided with little effort. This information should be provided in electronic database form such as it is done for other operating diamond mines in the Northwest Territories (see WLWB public registry). As a result, calculations and data associated with the estimation of normal ranges were not reviewed at this time. However, a visual examination of the data suggests that phytoplankton biomass normal ranges may be narrower than they should be. Again, access to the raw data is necessary to corroborate these visual assessments as the normality of the data is of importance when selecting the appropriate statistical tools to assess data and detect differences.</p> <p>Recommendation 1) ENR recommends that De Beers provide the raw data electronically in a spreadsheet (e.g. Microsoft Excel) which would allow access to the data to all interested parties. This</p>	<p>July 20: The raw data associated with the 2016 AEMP Annual Report is provided in the report appendices. The Microsoft Excel versions of these appendices have been compiled and will be provided along with submission of this set of responses.</p> <p>July 23: See excel appendices</p>	Acceptable response.
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12	Topic 8: Action Levels	<p>request is in line with what is being done for the AEMPs for Diavik and Ekati.</p> <p>Comment De Beers has requested that the Low Action Level criteria for water quality, sediment quality, plankton, and benthic invertebrates should be revised by replacing the "OR" logical operators with "AND" between the Action Level criteria. This would require both (toxicological impairment) or all three (nutrient enrichment) criteria be met before a Low Action Level is triggered. By doing this, the effect being detected is no longer considered by ENR to be Low Level or Early Warning of change. Toxicological impairment on its own would be considered at the very least Low Level or Early Warning of change. Further, ENR and its technical reviewer notes that the sensitivity of the before-after-control-impact (BACI) analyses is a driver of changes to Action Levels proposed by De Beers however it is not possible to understand how sensitive the analyses are without substantially more information and unencumbered electronic data.</p> <p>Recommendation 1) ENR recommends strongly that the Low Action Levels remain unchanged in the document, i.e. that 'and' not be included as a logic operator and the 'or' remain.</p>	<p>July 20: De Beers disagrees with this recommendation based on experience gained during data evaluation for the AEMP annual report. However, no change to the Response Framework is proposed at this time. Rather, recommendations regarding the AEMP study design and Response Framework, as presented in the AEMP Reports to date, will be accumulated over the first three years of monitoring and considered together in the AEMP Re-evaluation Report. This re-evaluation will provide updated recommendations for the AEMP Design Plan update, with full supporting information gained from the three years of monitoring.</p>	<p>Recommendations made by De Beers from the AEMP Annual Report will be discussed in the review process for the AEMP Re-evaluation Report (due July 2019). Concerns on the recommendations can be brought forth at that time.</p> <p>Note that Board staff support ENR's recommendation for a logical "or" and not "and". This would be consistent with the Response Framework for Diavik, in which either nutrient enrichment or toxicological impairment are Action Level triggers.</p>
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13	None	<p>Comment None</p> <p>Recommendation 2) ENR recommends that De Beers also include degrees of freedom and mean square error estimates for all model terms so that an initial assessment of data support is possible. The analyses should also include predicted marginal model cell means and associated standard errors so that the magnitude and precision of the change may be assessed.</p>	<p>July 20: De Beers acknowledges ENR's freedom and mean square error estimates for all model terms. This inclusion of degrees of freedom may be incorporated in the future AEMP Annual Reports following the first AEMP Re-evaluation cycle. Inclusion of predicted marginal model cell means and associated standard errors will also be considered in the AEMP Re-evaluation.</p>	Acceptable response.
14	Topic 9: Action Levels	<p>Comment De Beers preamble states that "The evaluation of the 2016 data suggest that the set of variables used in evaluating the Low Action Level for plankton should be changed by including chlorophyll a and dropping zooplankton abundance, which is redundant." Section 1.6 notes that the intent is to "remove zooplankton abundance, because it is redundant to consider both zooplankton abundance and biomass in the Action Level assessment". However, De Beers has not provided any evidence of such redundancy. ENR notes that aquatic specialists and scientists were involved in drafting these action levels during the development of the AEMP.</p> <p>Recommendation 1) ENR recommends that evidence of the redundancy to date should be provided. This should be accompanied by a discussion regarding the expected correlation between these metrics over time and where, in association with diamond mining in the</p>	<p>July 20: Incorporating chlorophyll a in the Action Levels for plankton will improve the ability of the AEMP to detect Mine-related changes on the core and raised lakes. Chlorophyll a is an important monitoring variable and is part of the Action Levels for other diamond mind AEMPs including Diavik (Golder 2014). The recommendation to remove zooplankton abundance from the Action Levels was suggested on the basis that zooplankton biomass, which is already included in the Action Levels, is the standard indicator of the availability/supply of zooplankton as food for fish. This recommendation will be further reviewed as part of the AEMP Re-evaluation process, and if validated during the AEMP Re-evaluation process, reference to literature and relevant studies will be presented as justification for the proposed change. Reference: Golder. 2014. Diavik Diamond Mines Inc. - Aquatic Effects Monitoring Program - Study Design Version 3.5.</p>	<p>Appropriate response.</p> <p>Recommendations made by De Beers from the AEMP Annual Report will be discussed in the review process for the AEMP Re-evaluation Report (due July 2019). Concerns on the recommendations can be brought forth at that time.</p>

		<p>Arctic, such a correlation has been consistently demonstrated for a period of 5 or more years to support such a change. Reference to studies and literature should also be provided.</p>	<p>Prepared for Diavik Diamond Mines (2012) Inc. Yellowknife, NT, Canada. May 2014.</p>	
15	None	<p>Comment None Recommendation 2) ENR recommends that the Board not make a change to the AEMP until such time as these documents and supporting rationale is provided and adequately reviewed by interested parties.</p>	<p>July 20: Agreed. The ENR recommendation is consistent with the process applied to update AEMP design plans. However, De Beers considers it useful to provide recommendations arising during each year of monitoring, for consideration during the AEMP Re-evaluation process.</p>	<p>Recommendations made by De Beers from the AEMP Annual Report will be discussed in the review process for the AEMP Re-evaluation Report (due July 2019). Concerns on the recommendations can be brought forth at that time.</p>
16	Topic 10: BACI	<p>Comment ENR's technical consultant has identified an issue with the BACI interaction term in Equation 5.2-3. Specifically, the BACI interaction term in Equation 5.2-3 will be incorrectly estimated when the design is unbalanced. The issue is explained in technical terms by the following. Hypotheses tested by monitoring programs when designs are "unbalanced" occur when there are unequal numbers of replicates in the classifications cells, or simply "cells" created by structural model variables such as: "before or after"; "reference or exposure"; "time (when treated as a stratifying variable)"; etc.. These are not necessarily the hypotheses the analyst believes are being tested. This is due to the differential weighting of cells. There are however, methods for testing</p>	<p>July 20: De Beers stands by the current approach for calculating the magnitude of effect, which is based on the approved Design Plan. The current method aims to complement the BACI analysis, so as to convey information about the relative change and direction of potential effects in the case of a significant BACI interaction. The explanations provided by ENR are valid; however as discussed, ENR's recommendations related to the overall BACI model are considered within the overall BACI analysis model (outlined in Equation 5.2-2) described in the AEMP Report. The interaction term provided in Equation 5.2-3 is distinct from ENR's recommendation because it is an additional calculation that supplements the BACI analysis. Since these calculations are different for normal, log-normal, and non-</p>	<p>Board staff agree with ENR's recommendation. However, as the current approach for calculating the magnitude of effect is based on the approved AEMP Design Plan, Board staff encourage ECCC to bring forth this recommendation during the review of the Aquatic Effects Re-evaluation Report, which is due to the Board, for approval, July 31, 2019.</p>

		<p>hypothesis of interest. These method focus on the specific hypotheses of interest and focus on them. Another consequence of unbalanced designs is the effects detected may not be those expected by the data analyst. As a rule of thumb, predicted cell means (as opposed to those estimated from the raw data using naïve estimators) and standard errors are those used in hypothesis tests. The predicted cell means will differ from those naively estimated from the raw data to some degree depending upon the degree of imbalance. The BACI interaction term uses the predicted classification cell means when testing the hypothesis of no interaction between the before-after and control-impact classification variables. However, the numerator of the percent change reported by De Beers uses the naïve estimator using the raw data. Assuming that the correct test of significance was conducted (note the reviewer was not able to discern this as insufficient details are available in the AEMP), the use of the BACI interaction term estimated using Equation 5.2-3 will not affect the test of significance, but will, to an unknown degree, deviate from the BACI interaction term used in the hypothesis test.</p> <p>Recommendation ENR recommends that De Beers correct this section of the AEMP report, and in future, the design report, to</p>	<p>normal data, plotting the resulting means also helps with visualizing results. De Beers will consider such a change or clarification in approach through the AEMP Re-evaluation process.</p>
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17	Topic 11: BACI	<p>use predicted marginal means in this calculation.</p> <p>Comment De Beers states that BACI analyses for phytoplankton and zooplankton measurement endpoints, respectively, are conducted separately for each open water sampling event. De Beers should discuss why a random effect for the three within year plankton sampling events was not included in the BACI model. It is not clear whether BACI analyses for water quality data were conducted separately for each open water sampling event despite a review and examination of results presented in Appendix 5C. Without provision of the detailed statistical results mentioned in the previous recommendation (degrees of freedom, mean square error, etc.) it is difficult to understand what was done, which speaks to the transparency of the results. The second point is why the measurement endpoints may have been treated differently in the various BACI analyses.</p> <p>Recommendation 1) ENR requests that De Beers clarify whether BACI analyses for water quality data were conducted separately for each open water sampling season.</p>	<p>July 20: Monthly plankton data were treated separately in the BACI, because seasonal differences in phytoplankton and zooplankton abundance and biomass data were anticipated based on the variable nature of plankton communities. Water quality data showed little variation throughout the open-water season; therefore, the monthly data collected during July, August, and September were combined for the purposes of conducting the BACI analysis.</p>	De Beers has provided the appropriate clarification.
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18	None	<p>Comment None</p> <p>Recommendation 2) ENR requests that the statistical results included in the AEMP and future AEMPs so reviewers can review and verify assessments and any statements made about the data.</p>	<p>July 20: Detailed statistical outputs are not typically presented as part of an Annual AEMP Report. Tables summarizing the statistical results are provided as Appendices to the individual component sections.</p>	<p>Board staff encourage De Beers and GNWT-ENR to work together to share all requested information.</p>
19	Topic 12: BACI	<p>Comment De Beers suggests that BACI analyses are too sensitive because "During both years, this analysis (BACI) identified small changes that are not of concern to the aquatic environment" (Section 15.6). However, with respect to phytoplankton biomass, there does not appear to be a discussion of these small changes (although percent differences in the BACI interaction term relative to the pre-development exposure area condition are provided in appendices). The conclusion following BACI analyses of phytoplankton biomass is: "Although statistical differences were observed, these differences in phytoplankton biomass, which occurred during a single sampling event for each core lake, are likely attributable to natural variation and do not suggest a Mine-related effect in Area 8 and Lake N11 on the plankton communities" (Section 7.4.6.8). The degrees of change are presented graphically and superimposed over a band representing the estimated normal range. There is no discussion of the absolute changes or what they might mean ecologically (e.g. toxicological</p>	<p>July 20: De Beers acknowledges ENR's recommendation to include cell means and standard error estimates for all model terms in the BACI results tables. Inclusion of these terms will be considered as part of the first AEMP Re-evaluation process. Although all significant BACI effects warrant an enhanced review of the data to understand the driver(s), it is the persistent seasonal significant BACI effects that would indicate Mine-related effects. The intent of the Action Levels is to capture Mine-related effects and as such, significant BACI effects must be observed in the core lakes during at least two sampling periods within an AEMP year for an Action Level response to be triggered, in a consistent direction relative to trends observed in the reference lakes. With respect to phytoplankton biomass, significant BACI results were observed in Area 8 and Lake N11 during a single sampling event within 2016, and therefore are not expected to have had any ecological implications.</p>	<p>Acceptable response.</p> <p>Recommendations (with supporting rationale) related to components of the AEMP Design Plan can be brought forth during the review of the Aquatic Effects Re-evaluation Report, which is due to the Board, for approval, July 31, 2019. At that time, reviewers may propose evidence to be considered for updates to the AEMP Design Plan.</p>

		<p>impairment). Instead the change is contextualized against the second action level criterion (range of natural variability) and used to dismiss the BACI analysis result. By interpreting the results this way (basically a circularity of reasoning) the AEMP write up effectively negates the conjunction "OR" joining the two low action level criteria discussed above for water quality, sediment quality, plankton, and benthic invertebrates and replaces it with an "AND".</p> <p>Recommendation 1) De Beers should present the estimated BACI cell means and standard errors and discuss the ecological implications of the estimated changes.</p>		
20	Topic 13: BACI	<p>Comment Statistical analyses such as BACI analyses can detect statistically significant effects. However statistical significance does not necessarily mean that results are ecologically significant. The failure to link a statistically significant BACI result with an ecologically meaningful change is at the root of the argument to change the low action level conjunction. In the development of this AEMP, discussions were had regarding what comprises a Low Level/Early Warning change from an ecological perspective. ENR notes that WLWB (2010) defines low action level as: "A Low Action Level is meant to be pre-emptive in nature and is well below the level at which a benchmark concentration is reached or a biological effect is</p>	<p>July 20: De Beers disagrees with the inclusion of a low action level trigger using effect size for the BACI interaction term. The BACI effect size is a relative measure, since it estimates the difference in slopes between Control/Impact and Before/After values (as an interaction model). In some cases, even large relative changes can have no ecological implication. It is more straightforward to examine the absolute concentrations or abundances relative to Control / Before / background ranges to evaluate their biological significance. Additionally, any significant changes determined for each of the aquatic components within the AEMP are integrated within the weight of evidence</p>	<p>Board staff have taken note of this comment and recommendation, and encourage ENR to bring forth this recommendation during the review of the Aquatic Effects Re-evaluation Report, which is due to the Board, for approval, July 31, 2019.</p>

21	Topic 14: BACI	<p>measured ". Thus, the low action level should be used as a BACI effect size to impart ecological relevance. Note that this effect size is distinct from a critical effect size which defines unacceptable changes. Recommendation 1) ENR recommends that De Beers discuss including a low action level as an effect size for the BACI interaction term.</p>	<p>section of the AEMP to evaluate their ecological significance.</p>	
<p>Comment De Beers proposes that BACI must have samples collected from exposure and reference groups at the same time. ENR would agree that this would be best practice; however, if the samples have not been taken at the same time, for example for the water quality component, interpretation of the data could still occur statistically. This interpretation would need to be done carefully and with an experience statistician that works regularly with environmental data. Underwood (1991) presented a BACI analysis where samples are collected at different times at the control and reference sites. This was done by carefully considering temporal confounding factors. The potential to apply such a BACI model to other measurement endpoints should be considered. Recommendation 1) ENR recommends that De Beers conduct sampling at exposure and reference areas at the same time.</p>		<p>July 20: As outlined in AEMP 2016 Annual Report and the AEMP Design Plan (De Beers 2016), De Beers will conduct sampling at core (i.e., exposure) and reference lakes at the same time for all AEMP components. Please see response to ECCC Recommendation #29 for additional information regarding the circumstances around fish health and fish tissue chemistry sample timing in 2015 and 2016. De Beers acknowledges ENRs recommendation to apply a BACI model as described in Underwood (1991), if samples are collected at different times at the exposure and reference sites. The use of a BACI model will be considered in the AEMP Re-evaluation. References: De Beers. 2016. Aquatic Effects Monitoring Program Design Plan. Version 5. Gahcho KuÁ© Mine. Submitted to Mackenzie Valley Land and Water Board, Yellowknife, NWT. January 2016. Underwood, A.J. 1991. Beyond BACI: Experimental designs for detecting human environmental impacts on temporal</p>	<p>Appropriate response.</p>	

22	None	<p>Comment None</p> <p>Recommendation 2) ENR recommends that De Beers use more complex tools and analyses techniques if data is collected from exposure and reference areas at different times. Reference: Underwood, A.J. 1991. Beyond BACI: Experimental designs for detecting human environmental impacts on temporal variations in natural populations. Aust. J. Mar. Freshwater Res. 42:569-87.</p>	<p>variations in natural populations. Aust. J. Mar. Freshwater Res. 42:569-87.</p> <p>July 20: Please see response to GNWT-ENR Recommendation #21.</p>	Appropriate response.
23	Topic 15: Baseline	<p>Comment In a June 30, 2016 Staff Report related to the Gahcho Kue 2015 AEMP Annual Report, it was recommended that "the Board run a short process, outside of the approval of the 2015 AEMP Annual Report, to work with the reviewers and the proponent to settle the question of whether it is appropriate to include the 2015 AEMP data into the calculation of the normal ranges for water quality, sediment, plankton and benthics for use in future AEMP Annual Reports". ENR notes that the inclusion of post-baseline data in a baseline dataset contravenes the definition of baseline data. As baseline data are used to estimate normal ranges that are critical to mine management, assessment of effects and confirmation of environmental assessment predictions. The fundamental question of adding post-</p>	<p>July 20: De Beers stands by the quoted statement and suggests that although ENR's definition of "baseline" is correct, the fundamental question is related to accumulating additional data to characterize background conditions (and hence normal ranges), rather than strictly baseline data. The timeline through project concept to approval and AEMP development rarely allows full characterization of background variability for use in an AEMP analysis, especially given that it is not possible to select AEMP stations during baseline work, before the development of an AEMP design. Therefore, opportunities to collect additional data to characterize background variability during the tenure of the AEMP should be explored, and useful data added to the baseline data set to allow estimation of reasonable</p>	<p>Recommendations (with supporting rationale) related to components of the AEMP Design Plan can be brought forth during the review of the Aquatic Effects Re-evaluation Report, which is due to the Board, for approval, July 31, 2019. At that time, reviewers may propose evidence to be considered for updates to the AEMP Design Plan.</p> <p>Prior to or during the Re-evaluation Report submission process, a technical workshop may be held to discuss this concern and address this recommendation.</p>

		<p>baseline data to a baseline dataset should be resolved through the process mentioned by Board Staff as soon as possible, particularly given the assertions that low action levels for benthic macroinvertebrates are being triggered but dismissed. For example an argument is presented that: "the normal ranges in Table 4 and Figures 1a and 1b likely do not adequately characterize natural variability in core lakes and are unrealistically narrow" (De Beers, 2016b). Recommendation 1) ENR recommends that a discussion about the baseline data and the 2015 data take place and that it precede the AEMP re-evaluation so that subsequent analyses, interpretations and reviews will not need to address this question.</p>	<p>normal ranges. Regarding the process to make a decision on the use 2015 data along with baseline data, De Beers suggests that a decision could be made based on the data summaries and recommendations to be prepared as part of the AEMP re-evaluation process.</p>	
24	Topic 16: Quality Assurance	<p>Comment The observed phytoplankton quality assurance level of effort is duplicate samples collected twice over the 15 samples (5 locations x 3 events) for each lake with the exception of East Lake where only one quality assurance sample was collected (Table 7.2-1). This level of effort is inconsistent with the AEMP design report which states: "At the fifth sampling station in each lake, two phytoplankton samples will be collected and analyzed separately for QC (quality control) purposes" De Beers (Gahcho KuÃ© Mine Aquatic Effects Monitoring Program Design Plan Version 5, Section 9.4.2.4).</p>	<p>July 20: De Beers would like to acknowledge ENR's careful attention to detail and for picking up on the discrepancy. During each of the monthly field programs in 2016 (i.e., July, August, and September), three duplicate chlorophyll a, phytoplankton, and zooplankton samples were also collected, representing 10% of samples. The duplicate samples were collected, filtered (where necessary), and analyzed separately to provide a measure of the combined amount of variation resulting from small scale spatial variation at the station, field sampling, and laboratory analysis. Upon review of the sampling procedures in 2016,</p>	Appropriate response.

		<p>Recommendation 1) ENR recommends that De Beers conduct AEMP sampling following the approved AEMP design plan as required under its Water Licence. ENR notes that this recommendation may also apply to other measurement endpoints. De Beers should confirm that the AEMP design plan quality assurance requirements are being met or, will be met in future monitoring, for all measurement endpoints.</p>	<p>De Beers acknowledges that QA/QC plankton sampling plan followed during the 2016 AEMP diverges from the AEMP Design Plan. The decision to reduce the number of duplicate samples collected was made based on an evaluation of the results from the 2014 and 2015 baseline programs, which showed a redundancy in sampling effort because the within-station variability was minimal and the original level of duplication was unnecessary and did not add any additional value to the AEMP. De Beers acknowledges that such changes to the sampling procedures should be left for the AEMP Re-evaluation.</p>	
25	Topic 17: Quality Assurance	<p>Comment It is not clear to reviewers from the description in the AEMP report how the duplicate quality assurance samples were treated when interpreting phytoplankton data.</p> <p>Recommendation 1) ENR recommends that De Beers clarify how duplicate samples were used for phytoplankton data.</p>	<p>July 20: The duplicate samples collected for chlorophyll a, phytoplankton, and zooplankton were compared to the original/parent sample using a calculation of the relative percent difference (RPD) and Bray-Curtis index (BCI) to provide a measure of the reproducibility of the dataset. The duplicate samples for chlorophyll a were averaged prior to data analysis, while the plankton duplicate samples were collected for QA/QC purposes only (and are not included in the data analysis).</p>	The response answers the question.
26	Topic 18: Exposure Reference “Visual Interpretations” Macroinvertebrates	<p>Comment De Beers provides a visual interpretation of the exposure and reference data pertaining to benthic macroinvertebrates. It is suggested that there are no visual interactions between these two areas but upon review ENR if of</p>	<p>July 20: Effects on benthic invertebrate communities in the core and reference lakes were evaluated using the BACI analysis described in Section 8.2.3.5.2. Plots of the data were also provided to allow visual review of spatial and temporal</p>	De Beers’ response addresses the question.

		<p>the opinion that visual interactions are evident.</p> <p>Recommendation 1) ENR recommends that the visual interpretation of the benthic macroinvertebrates be reviewed and supported by statistical tools to determine if indeed interactions or differences occur between exposure and reference data.</p>	<p>trends. A statistical evaluation of the influence of habitat variation on observed trends was also conducted. The AEMP report does not suggest that there are no visually determined interactions between core and reference areas. Rather, as stated in Section 8.4.1.2.1, the overall conclusion of the analysis was that although statistical differences were observed in benthic invertebrate community variables between Area 8 and the two reference lakes, the changes were unlikely to be mine related, as: 1. the responses were not consistent between the two reference areas; 2. variation in habitat contributed to the differences observed among lakes and years; and 3. there was no linkage between the observed responses and potential changes in other AEMP components, including water and sediment quality.</p>	
MVLWB: Angela Love				
ID	Topic	Reviewer Comment/Recommendation	Proponent Response	Board Staff Response
1	Cover Letter and Section 15.6: Recommendations	<p>Comment In the recommendations, De Beers stated that the evaluation of the 2016 data suggest that the set of variables used in evaluating the Low Action Level for plankton should be changed by: (1) including chlorophyll a; and, (2) dropping zooplankton abundance because it is redundant with biomass in the Action Level assessment.</p> <p>Recommendation Please provide further explanation as to why zooplankton</p>	<p>July 20: The recommendation to remove zooplankton abundance from the Action Levels was suggested on the basis that zooplankton biomass, which is already included in the Action Levels, is the standard indicator of the availability/supply of zooplankton as food for fish. This recommendation will be further reviewed as part of the AEMP Re-evaluation process, and if validated during the AEMP Re-evaluation process, reference to literature</p>	Acceptable response.

2	Section 14.3.1.2.1 Plankton Community: page 14-18 & Section 15.3.1	abundance is redundant in the context of the Action Level assessment. Comment For Zooplankton, this section states, "A shift in relative zooplankton community composition (by biomass) resulted in a Rating 1 for Evaluation of Community Structure. This observed shift triggered a Low Action Level for nutrient enrichment in Area 8; however, concentrations of nutrients did not increase in Area 8 between baseline and 2016. Other possible Mine-related effects, such as the disconnection of Area 8 from the rest of Kennedy Lake, may have contributed to the shift in zooplankton community composition observed in Area 8 in 2016." De Beers provides one example (by using the language such as) of the Mine-related effects that may have contributed to the shift in zooplankton community composition observed in Area 8 in 2016. Recommendation Please provide an explanation of all of the potential Mine-related effects that may have contributed to the shift in zooplankton community composition observed in Area 8 in 2016.	and relevant studies will be presented as justification for the proposed change. July 20: No dewatering or operational discharge to Area 8 occurred in 2016; therefore, the observed changes in zooplankton community composition in Area 8 are likely unrelated to the diffuser. Disconnection of Area 8 from the rest of Kennedy Lake was suggested as a possible cause of the shift in the zooplankton community, because of the removal of a potential upstream source of plankton to Area 8, and potentially other factors related to the reduction of the Area 8 catchment area and low flow condition in 2016 (the dry year conditions in Area 8 and its downstream flows corresponded to a 1:100 dry flow regime). However, there is insufficient information to identify any specific factors at this time. De Beers will continue to monitor zooplankton in Area 8 to further evaluate potential shifts in community composition.	Acceptable response.
3	Section 14.2: Methods	Comment This Section explains that the WOE Rankings are not intended to indicate the ecological significance of observed effects, which is an important distinction between the WOE assessment and the AEMP Response Framework	July 20: The application of a semi-quantitative approach in the future is not dependent on the stage of the Mine life or operational triggers. As more information generated by the AEMP is gathered and assessed it may be determined that a	Acceptable response.

		<p>described in the AEMP Design Plan. This Section goes on to say that the WOE approach is preliminary at this stage, and will likely be refined as information is generated by the AEMP. The WOE approach for the AEMP will initially be qualitative and incorporate a high degree of professional judgement, and that a semi-quantitative approach may be applied in the future, as information generated by the AEMP is gathered and assessed.</p> <p>Recommendation If possible, please outline at what general stages of mine life, or what operational triggers would need to occur for De Beers to consider moving to a semi-quantitative approach for the WOE Rankings from the current qualitative and interpretive approach?</p>	<p>scoring system (i.e., numerical scores for the weight assigned to each measurement endpoint, the magnitude of response, and the coherence of responses among multiple measurement endpoints) is needed to create a more formal WOE. Customizing the study design to suit site-specific circumstances, rather than application of "boiler-plate" assessments is the preferred approach, and in order to do this, site-specific data are required. However, provided the rationales for the evaluation and integration of lines of evidence apply professional best judgement and are clearly presented, it may also be determined that the qualitative WOE approach is sufficiently transparent for reviewers. The WOE approach during the first three years of monitoring will be evaluated during the first AEMP Re-evaluation, and recommendations will be provided regarding methods to be employed for future WOE analyses in the AEMP.</p>	
Tlicho Lands Protection Department: Tyanna Steinwand				
ID	Topic	Reviewer Comment/Recommendation	Proponent Response	Board Staff Response
1	Inadequate baseline/threshold change	<p>Comment One item that is noted is the inadequate baseline. This was previously noted in the review of the Action Level related to the Benthic Response Plan in 2016 and is a recommendation for almost every stream within this report. In part because of this, the project believes that at the next AEMP design/review stage that</p>	<p>July 20: De Beers agrees that thresholds for Action Levels need to be developed and adjusted, if necessary, with input from all stakeholders. Adjusting Action Levels to "calibrate" them for appropriate sensitivity, and thereby eliminate excessive false positive triggers while retaining an appropriate degree of conservatism, is a</p>	Appropriate response.

	<p>a number of Action Levels should be reconsidered. While fairness is important, it's also important to ensure that the triggers for actions remain appropriately framed. Once additional baseline (in some cases, no more than a year or two that existed when the AEMP was written - so with only a year of data, of course the sampling results will be out of the 'range') is in hand, then the recommendation for changes can be considered - which should be the first step of the recommendation that is implemented. Flagging these future action level changes is fine for now, but this is something that communities should be considering and working together to review.</p> <p>Recommendation The report states that a “false positive” equates to a need to change the thresholds for action levels. This is far too strong a statement - it is a need to reconsider the thresholds only - with a collective process to review if the need is there. This is particularly true where action levels rely on a baseline of only a single year or two, where the ‘root cause’ is not with trigger, but the lack of project effort to collect sufficient baseline information.</p>	<p>desirable process to arrive at an efficient monitoring program. Other diamond mine AEMPs have also undergone this process. The amount of baseline data accumulated for this Project is immense across aquatic components, but not always consistent among components. Baseline data for the Kennedy Lake, N lakes, and downstream waters are available back to 1996. During the EIS review and permitting processes, as the Project became more defined, baseline monitoring adjusted to become more aligned with an AEMP-type design (i.e., multiple stations per lake, seasonal, concurrent sampling frequencies, etc.). With further refinement as the AEMP was initiated, De Beers have recognized opportunities to accumulate additional component data to characterize background conditions due to the receiving environment conditions remaining under existing or 'baseline condition' (i.e., especially during the mine construction phase). In these circumstances, where 'baseline' AEMP data may appear limited for a component (or less data rich [e.g., fish tissue chemistry] than other components [e.g., WQ]), De Beers acknowledge that data collection under these circumstances may generate useful data that can be added to the dataset to allow estimation of reasonable normal ranges.</p>	
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2	Plain Language Summary page x	<p>Comment Fish health is a very important component of the AEMP for the Tlicho. We need to have reliable data in order to come to conclusions. It was disappointing to read that inconsistencies in fish size were likely due to using different sampling equipment.</p> <p>Recommendation Please aim for consistency when determining which sampling equipment will be used as this will ensure data collected is reliable and acceptable for review.</p>	<p>July 20: Biologists used multiple gear types at all lakes, and fished with these gear types for comparable periods of time at all lakes (i.e., gear was used consistently among lakes). The Ninespine Stickleback, however, were captured with variable success by each gear type at each lake (i.e., fish were not consistent among lakes in how they were captured). Future programs will continue to aim for standardized fishing effort among gear types at all the study lakes.</p>	Acceptable response.
3	Plankton Communities	<p>Comment Of particular note are the changes observed in the plankton communities. This is early days of the mine operations, but the changes in species composition and abundance, if observed in future years, represents a warning signal. Significant differences were observed in this AEMP year, but it fell short of triggering further action/study. This should be a matter of focus in next year's work, particularly for the 'raised lakes' which saw changes between pre/post dyke periods and may be a systemic shift.</p> <p>Recommendation Changes in plankton communities need to be closely monitored.</p>	<p>July 20: De Beers agrees with the Tlicho Government, and considers the plankton monitoring component robust.</p>	Appropriate response.

4	Fish Tasting	<p>Comment The reporting on the Fish Tasting (section 12.4) omits mention of the large number of parasites found. While this seemed to be a regional phenomenon, it must be recorded here - this is the primary results for the year. In reading this section, one would never be aware that anything out of the ordinary was observed.</p> <p>Recommendation Please include mention of large number of parasites found in fish used for the fish tasting.</p>	<p>July 20: The fish tasting report clearly noted the higher number of parasites in 2016 and included necropsy results that included parasites. De Beers requests clarification as to what additional evidence should be provided.</p>	<p>Appropriate response. Board staff encourage Tlicho Lands to contact De Beers for any desired further explanation.</p>
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July 6, 2017

Kierney Leach
Regulatory Officer
Mackenzie Valley Land and Water Board
7th Floor – 4910 50th Avenue
P.O. Box 2130
Yellowknife, NT
X1A 2P6

Dear Ms. Leach,

**Re: DeBeers - Gahcho Kue
Water Licence – MV2005L2-0015
2016 AEMP Annual Report
Request for Comment**

The Department of Environment and Natural Resources (ENR), Government of the Northwest Territories has reviewed the report at reference based on its mandated responsibilities under the *Environmental Protection Act*, the *Forest Management Act*, the *Forest Protection Act*, the *Species at Risk (NWT) Act*, the *Waters Act* and the *Wildlife Act* and provides the following comments and recommendations for the consideration of the Board.

Review - Gahcho Kue AEMP

Topic 1: Mine Schedule

Comment:

Table 2.2-1 “Schedule of Mine Activities” appears to outline a slightly different mine schedule than that presented in the Water Licence Annual Report. This may be a result of recent changes to timing associated with Hearne Pit.

Recommendation:

- 1) ENR requests that De Beers clarify whether the mine schedule in Table 2.2-1 is up to date.

Topic 2: Raised Lakes

Comment:

Section 5.4.2.5 notes “it was predicted in the EIS that during the construction phase of the Mine development, water quality in Lakes D2/D3 could change (i.e., a minor change) due to the release of nutrients, mercury, and other substances from flooded sediments and vegetation as a result of water level changes” and it was also noted that “(a) potential for minor change in water and sediment quality in the raised lakes (e.g., Lake D2/D3) to date was predicted to occur during the early stages of the Mine operational phase when these lakes were isolated and their water levels were raised. A minor change is a measurable increase in a water quality parameter that is outside the range of baseline values but is still within water quality guidelines.”

ENR notes that the changes were likely assessed based on magnitude and extent of change. It is not clear in the above statements if these measured changes align with the predicted changes in Lake D2/Lake D3. Has DeBeers assessed these changes in respect to predicted magnitude and extent? What about the expected rate of change predicted (i.e. single season, annual changes, etc.)?

Recommendation:

- 1) ENR requests additional information on the changes that have been observed in the water and sediment quality (i.e. mercury of Lakes D2/D3) as they relate to predicted magnitude, extent and rates of increase.

Topic 3: Raised Lakes

Comment:

Regarding Lake D2/D3, Section 7.4.6.9 notes a significant decrease in phytoplankton biomass. These results are inconsistent with the trends observed for chlorophyll a concentrations. ENR is troubled by these results because chlorophyll a concentrations are being used in the AEMP as a surrogate measure for phytoplankton biomass. DeBeers should be required to explain why these two measurements which are proposed as surrogates do not show similar trends and whether they should be used as surrogates in future AEMP studies based on these results.

Recommendation:

- 1) The disconnect between plankton metrics chlorophyll a (Figure 7.4-1), phytoplankton abundance (Figure 7.4-9) and phytoplankton biomass (Figure 7.4-11) in Lake D2/D3 should be further explored. ENR understands that this may be due the shift in chrysophyte abundance noted by De Beers; however, the implications of this change should be discussed and validity of the surrogacy determined.

Topic 4: Raised Lakes

Comment:

Section 7.5.4 notes that the trophic status of D2/D3 has changed from oligotrophic to mesotrophic. However, there is little discussion on the implications of this change in trophic status. Are there any implications to this area, or to areas downstream, over the long-term or does this appear to be a temporary situation post-flooding? Are there currently any proposed actions related to this? Will there be any future actions if conditions do not revert to previous trophic status over time and continue to perpetuate increased eutrophication with time?

Recommendation:

- 1) ENR requests De Beers provide an analysis of potential impacts to Lake D2/D3 and downstream areas as a result of the change in trophic status as well as anticipated impacts over time.
- 2) ENR request that De Beers describe what degree of change in trophic status was proposed or predicted in the Environmental Assessment for Lake D2 and D3.
- 3) ENR requests De Beers outline if any actions are anticipated as a result of a change in trophic status of Lake D2/D3.

Topic 5: Raised Lakes

Comments:

Section 11.2.1 notes that fish tissues were collected in 2016 after the lakes were flooded. It is unclear if tissue levels (i.e. mercury) were consistent with baseline. De Beers notes that increases in mercury levels may not occur for several years, however this should be confirmed if tissue concentrations are available from 2016 and baseline levels are also available.

ENR notes that any data collected in 2016 from the raised lakes should not be used as baseline or to augment the baseline record, particularly with respect to fish tissue concentrations such as mercury.

Recommendation:

- 1) ENR requests that De Beers confirm if tissues concentrations were taken from raised lakes (i.e. Lake D2/D3) in 2016 (post-flooding).
- 2) ENR requests that De Beers describe what their intentions are for fish tissue concentrations from 2016, i.e. if they are planning to use this data to augment baseline data.
- 3) ENR recommends that if De Beers is planning to use the 2016 fish tissue data to augment the baseline record, that they provide sufficient evidence and rationale for how and why this should occur and discuss implications of such. Note the raised lake condition is not natural and was the result of project activities (i.e. dewatering Kennady Lake).

Topic 6: Plume Delineation

Comment:

Section 13.1 notes that plume delineation will occur in 2017. As stated in the report, "The purpose of this study will be to conform to the requirements of Schedule 6, Part I, Item 3f of the Water Licence (MV2005L2-0015), which is to assess the mixing and dilution of the operational discharge from the WMP to Lake N11 and/or Area 8, to confirm mixing zone predictions of water quality around the diffuser outfall at each location." It is unclear when this will occur and ENR notes that the plume delineation should be conducted both during open water and under ice for the results to be meaningful. If discharge to Lake N11 is to be continuous, then plume delineations will also be required under ice.

Recommendation:

- 1) ENR requests that De Beers clarify the times of year during which the plume delineation studies will occur. ENR assumes that a standalone Plume Delineation Plan will be provided to the Board and reviewers prior to the plume delineation studies.

Topic 7: Data Format

Comment:

It is noted that raw data are provided in a portable document format (pdf). This format makes it difficult to conduct the assessment or analysis of data. An original source of the electronic data was used to produce the pdf document, data which could be provided with little effort. This information should be provided in electronic database form such as it is done for other operating diamond mines in the Northwest Territories (see WLWB public registry).

As a result, calculations and data associated with the estimation of normal ranges were not reviewed at this time. However, a visual examination of the data suggests that phytoplankton biomass normal ranges may be narrower than they should be. Again, access to the raw data is necessary to corroborate these visual assessments as the normality of the data is of importance when selecting the appropriate statistical tools to assess data and detect differences.

Recommendation:

- 1) ENR recommends that De Beers provide the raw data electronically in a spreadsheet (e.g. Microsoft Excel) which would allow access to the data to all interested parties. This request is in line with what is being done for the AEMPs for Diavik and Ekati.

Topic 8: Action Levels

Comment:

De Beers has requested that the Low Action Level criteria for water quality, sediment quality, plankton, and benthic invertebrates should be revised by replacing the “OR” logical operators with “AND” between the Action Level criteria. This would require both (toxicological impairment) or all three (nutrient enrichment) criteria be met before a Low Action Level is triggered. By doing this, the effect being detected is no longer considered by ENR to be Low Level or Early Warning of change. Toxicological impairment on its own would be considered at the very least Low Level or Early Warning of change.

Further, ENR and its technical reviewer notes that the sensitivity of the before-after-control-impact (BACI) analyses is a driver of changes to Action Levels proposed by De Beers however it is not possible to understand how sensitive the analyses are without substantially more information and unencumbered electronic data.

Recommendation:

- 1) ENR recommends strongly that the Low Action Levels remain unchanged in the document, i.e. that “and” not be included as a logic operator and the “or” remain.
- 2) ENR recommends that De Beers also include degrees of freedom and mean square error estimates for all model terms so that an initial assessment of data support is possible. The analyses should also include predicted marginal model cell means and associated standard errors so that the magnitude and precision of the change may be assessed.

Topic 9: Action Levels

Comment:

De Beers preamble states that “The evaluation of the 2016 data suggest that the set of variables used in evaluating the Low Action Level for plankton should be changed by including chlorophyll a and dropping zooplankton abundance, which is redundant.” Section 1.6 notes that the intent is to “remove zooplankton abundance, because it is redundant to consider both zooplankton abundance and biomass in the Action Level assessment”.

However, De Beers has not provided any evidence of such redundancy. ENR notes that aquatic specialists and scientists were involved in drafting these action levels during the development of the AEMP.

Recommendation:

- 1) ENR recommends that evidence of the redundancy to date should be provided. This should be accompanied by a discussion regarding the expected correlation between these metrics over time and where, in association with diamond mining in the Arctic, such a correlation has been consistently demonstrated for a period of 5 or more years to support such a change. Reference to studies and literature should also be provided.
- 2) ENR recommends that the Board not make a change to the AEMP until such time as these documents and supporting rationale is provided and adequately reviewed by interested parties.

Topic 10: BACI

Comment:

ENR's technical consultant has identified an issue with the BACI interaction term in Equation 5.2-3. Specifically, the BACI interaction term in Equation 5.2-3 will be incorrectly estimated when the design is unbalanced.

The issue is explained in technical terms by the following. Hypotheses tested by monitoring programs when designs are "unbalanced" occur when there are unequal numbers of replicates in the classification cells, or simply "cells" created by structural model variables such as: "before or after"; "reference or exposure"; "time (when treated as a stratifying variable)"; etc.. These are not necessarily the hypotheses the analyst believes are being tested. This is due to the differential weighting of cells. There are however, methods for testing hypothesis of interest. These method focus on the specific hypotheses of interest and focus on them. Another consequence of unbalanced designs is the effects detected may not be those expected by the data analyst. As a rule of thumb, predicted cell means (as opposed to those estimated from the raw data using naïve estimators) and standard errors are those used in hypothesis tests. The predicted cell means will differ from those naively estimated from the raw data to some degree depending upon the degree of imbalance. The BACI interaction term uses the predicted classification cell means when testing the hypothesis of no interaction between the before-after and control-impact classification variables. However, the numerator of the percent change reported by De Beers uses the naïve estimator using the raw data. Assuming that the correct test of significance was conducted (note the reviewer was not able to discern this as insufficient details are available in the AEMP), the use of the BACI interaction term estimated using Equation 5.2-3 will not affect the test of significance, but will, to an unknown degree, deviate from the BACI interaction term used in the hypothesis test.

Recommendation:

- 1) ENR recommends that De Beers correct this section of the AEMP report, and in future, the design report, to use predicted marginal means in this calculation.

Topic 11: BACI

Comment:

De Beers states that BACI analyses for phytoplankton and zooplankton measurement endpoints, respectively, are conducted separately for each open water sampling event. De Beers should discuss why a random effect for the three within year plankton sampling events was not included in the BACI model. It is not clear whether BACI analyses for water quality data were conducted separately for each

open water sampling event despite a review and examination of results presented in Appendix 5C.

Without provision of the detailed statistical results mentioned in the previous recommendation (degrees of freedom, mean square error, etc.) it is difficult to understand what was done, which speaks to the transparency of the results. The second point is why the measurement endpoints may have been treated differently in the various BACI analyses.

Recommendation:

- 1) ENR requests that De Beers clarify whether BACI analyses for water quality data were conducted separately for each open water sampling season.
- 2) ENR requests that the statistical results included in the AEMP and future AEMPs so reviewers can review and verify assessments and any statements made about the data.

Topic 12: BACI

Comment:

De Beers suggests that BACI analyses are too sensitive because “During both years, this analysis (*BACI*) identified small changes that are not of concern to the aquatic environment” (Section 15.6). However, with respect to phytoplankton biomass, there does not appear to be a discussion of these small changes (although percent differences in the BACI interaction term relative to the pre-development exposure area condition are provided in appendices).

The conclusion following BACI analyses of phytoplankton biomass is: “Although statistical differences were observed, these differences in phytoplankton biomass, which occurred during a single sampling event for each core lake, are likely attributable to natural variation and do not suggest a Mine-related effect in Area 8 and Lake N11 on the plankton communities” (Section 7.4.6.8). The degrees of change are presented graphically and superimposed over a band representing the estimated normal range. There is no discussion of the absolute changes or what they might mean ecologically (e.g. toxicological impairment). Instead the change is contextualized against the second action level criterion (range of natural variability) and used to dismiss the BACI analysis result. By interpreting the results this way (basically a circularity of reasoning) the AEMP write up effectively negates the conjunction “OR” joining the two low action level criteria discussed above for water

quality, sediment quality, plankton, and benthic invertebrates and replaces it with an “AND”.

Recommendation:

- 1) De Beers should present the estimated BACI cell means and standard errors and discuss the “ecological” implications of the estimated changes.

Topic 13: BACI

Statistical analyses such as BACI analyses can detect statistically significant effects. However statistical significance does not necessarily mean that results are ecologically significant. The failure to link a statistically significant BACI result with an ecologically meaningful change is at the root of the argument to change the low action level conjunction. In the development of this AEMP, discussions were had regarding what comprises a Low Level/Early Warning change from an ecological perspective. ENR notes that WLWB (2010) defines low action level as: “A Low Action Level is meant to be pre-emptive in nature and is well below the level at which a benchmark concentration is reached or a biological effect is measured ...”. Thus, the low action level should be used as a BACI effect size to impart ecological relevance. Note that this effect size is distinct from a critical effect size which defines unacceptable changes.

Recommendation:

- 1) ENR recommends that De Beers discuss including a low action level as an effect size for the BACI interaction term.

Topic 14: BACI

Comment:

De Beers proposes that BACI must have samples collected from exposure and reference groups at the same time. ENR would agree that this would be best practice; however, if the samples have not been taken at the same time, for example for the water quality component, interpretation of the data could still occur statistically. This interpretation would need to be done carefully and with an experience statistician that works regularly with environmental data.

Underwood (1991) presented a BACI analysis where samples are collected at different times at the control and reference sites. This was done by carefully considering temporal confounding factors. The potential to apply such a BACI model to other measurement endpoints should be considered.

Recommendation:

- 1) ENR recommends that De Beers conduct sampling at exposure and reference areas at the same time.
- 2) ENR recommends that De Beers use more complex tools and analyses techniques if data is collected from exposure and reference areas at different times.

Reference:

Underwood, A.J. 1991. Beyond BACI: Experimental designs for detecting human environmental impacts on temporal variations in natural populations. *Aust. J. Mar. Freshwater Res.* 42:569-87.

Topic 15: Baseline

Comment:

In a June 30, 2016 Staff Report related to the Gahcho Kue 2015 AEMP Annual Report, it was recommended that “the Board run a short process, outside of the approval of the 2015 AEMP Annual Report, to work with the reviewers and the proponent to settle the question of whether it is appropriate to include the 2015 AEMP data into the calculation of the normal ranges for water quality, sediment, plankton and benthics for use in future AEMP Annual Reports”.

ENR notes that the inclusion of post-baseline data in a baseline dataset contravenes the definition of baseline data. As baseline data are used to estimate normal ranges that are critical to mine management, assessment of effects and confirmation of environmental assessment predictions. The fundamental question of adding post-baseline data to a baseline dataset should be resolved through the process mentioned by Board Staff as soon as possible, particularly given the assertions that low action levels for benthic macroinvertebrates are being triggered but dismissed. For example an argument is presented that:

“the normal ranges in Table 4 and Figures 1a and 1b likely do not adequately characterize natural variability in core lakes and are unrealistically narrow” (De Beers, 2016b).

Recommendation:

- 1) ENR recommends that a discussion about the baseline data and the 2015 data take place and that it precede the AEMP re-evaluation so that subsequent analyses, interpretations and reviews will not need to address this question.

Topic 16: Quality Assurance

Comment:

The observed phytoplankton quality assurance level of effort is duplicate samples collected twice over the 15 samples (5 locations x 3 events) for each lake with the exception of East Lake where only one quality assurance sample was collected (Table 7.2-1).

This level of effort is inconsistent with the AEMP design report which states: “At the fifth sampling station in each lake, two phytoplankton samples will be collected and analyzed separately for QC (*quality control*) purposes” De Beers (Gahcho Kué Mine Aquatic Effects Monitoring Program Design Plan Version 5, Section 9.4.2.4).

Recommendation:

- 1) ENR recommends that De Beers conduct AEMP sampling following the approved AEMP design plan as required under its Water Licence. ENR notes that this recommendation may also apply to other measurement endpoints. De Beers should confirm that the AEMP design plan quality assurance requirements are being met or, will be met in future monitoring, for all measurement endpoints.

Topic 17: Quality Assurance

Comment:

It is not clear to reviewers from the description in the AEMP report how the duplicate quality assurance samples were treated when interpreting phytoplankton data.

Recommendation:

- 1) ENR recommends that De Beers clarify how duplicate samples were used for phytoplankton data.

Topic 18: Exposure Reference – Visual Interpretations – Macroinvertebrates

Comment:

De Beers provides a visual interpretation of the exposure and reference data pertaining to benthic macroinvertebrates. It is suggested that there are no visual interactions between these two areas but upon review ENR is of the opinion that visual interactions are evident.

Recommendation:

- 1) ENR recommends that the visual interpretation of the benthic macroinvertebrates be reviewed and supported by statistical tools to determine if indeed interactions or differences occur between exposure and reference data.

Comments and recommendations were provided by ENR technical experts in the Water Resources Division and were coordinated and collated by the Environmental Impact Assessment Section, Conservation, Assessment and Monitoring Division (CAM).

Should you have any questions or concerns, please do not hesitate to contact Monica Wendt, Environmental Assessment Analyst at (867) 767-9233 Ext: 53098 or email monica_wendt@gov.nt.ca.

Sincerely,



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MVLWB File: MV2005L2-0015

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Via online submission

RE: MV2005L2-0015 – De Beers Canada Inc. – Gahcho Kue - Aquatic Effects Monitoring Program Annual Report

Attention: Jen Potten

Environment and Climate Change Canada (ECCC) has reviewed the information submitted to the Mackenzie Valley Land and Water Board regarding the above-mentioned Aquatic Effects Monitoring Program Annual Report. ECCC's specialist advice is provided based on our mandate, in the context of the *Canadian Environmental Protection Act*, the pollution prevention provisions of the *Fisheries Act*, the *Migratory Birds Convention Act*, and the *Species at Risk Act*.

Should you require further information, please do not hesitate to contact me at (867) 669-4746 or Gabriel.Bernard-Lacaille@canada.ca.

Sincerely,

Gabriel Bernard-Lacaille
Environmental Assessment Coordinator

Attachment(s): ECCC Comments Excel Sheet

cc: Melissa Pinto, Senior Environmental Assessment Coordinator
Georgina Williston, Head, Environmental Assessment North (NT and NU)