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Staff Report

Applicant: De Beers Canada Inc. – Gahcho Kue Project	
Location: Kennady Lake, NT	Application: MV2005L2-0015
Date Prepared: September 6, 2018	Meeting Date: November 8, 2018
Subject: 2017 Aquatic Effects Monitoring Program 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) 2017 Aquatic Effects Monitoring Program (AEMP) Annual Report (AEMP Annual Report) for the Gahcho Kue Project. This submission is required under Part I, condition 6 of Water Licence (Licence) MV2005L2-0015 and is for Board decision.

2. Background

- April 30, 2018 – 2017 AEMP Annual Report received;
- August 27, 2018 – Review commenced;
- October 2, 2018 – Reviewer comments and recommendations due and received;
- October 16, 2018 – Responses due and received; and
- **November 1, 2018 – AEMP Annual Report presented to the Board for decision.**

3. Discussion

Part I, condition 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 2017 AEMP Annual Report on April 30, 2018 (attached).

4. Comments

Included in the Report is a section which shows where in the Report schedule 6, item 3 of the Licence is addressed. Table 1 below lists the components of the AEMP Annual Report as required in the Licence and provides details on the adequacy of the submission.

Table 1: Report Completeness

	Components of the Report as required in schedule 6, item 3 of the Licence	Board staff analysis of the adequacy of the Report in addressing the component
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;	A plain language summary was provided which included information on the study areas for the AEMP and general activities at the mine site in 2017 that may have influenced the surrounding and downstream receiving environments. Adequate.
b)	A summary of activities conducted under the AEMP;	De Beers stated that the main water management activities undertaken at the Mine relevant to the AEMP during 2017 included: - controlled area boundary and internal dyke construction; - operational pumping from the Water Management Pond (WMP) to Lake N11; and - downstream flow mitigation. De Beers separated out each activity conducted under the AEMP into the main AEMP components (i.e., water quality, sediment quality, plankton, benthic invertebrates, fish habitat and community, fish health, and fish tissue). Each section incorporated key information relevant to the aquatic ecosystems in the core lakes, reference lakes, downstream lakes and streams, and raised lakes and included Mine and non-Mine related data.

		Adequate.
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;	De Beers stated that no major changes to the Project Description relevant to the AEMP occurred at the Mine in 2017. A table was also provided which listed the reportable accidents, malfunctions, and spills that occurred from January to December 2017. It was determined that no negative effects to receiving surface waters were associated with these spills. Adequate.
d)	Tabular summaries of all data and information generated under the AEMP in an electronic and printed format acceptable to the Board;	De Beers has included various tables that summarize water quality, sediment quality, plankton, benthic invertebrates, fish habitat and community, fish health, and fish tissue, as well as various figures. Adequate.
e)	An interpretation of the results, including an evaluation of any identified environmental effects that occurred as a result of the Project;	De Beers provided a results and discussion section for each of the following specific components: - Hydrology - Water Quality - Sediment Quality - Plankton - Benthic Invertebrates - Fish Habitat and Community These sections also included data analysis to assist in the interpretation of the results. Adequate.
f)	A comparison of predicted mixing and dilution of effluent in Lake N11 and Area 8 in comparison to monitoring data;	De Beers stated that the 2017 water quality in Lake N11 and in Area 8 are within the Environmental Impact Statement predictions. Adequate.
g)	An analysis that integrates the results of individual monitoring components collected in a calendar year and describes the ecological significance of the results;	De Beers stated that the weight of evidence rankings are not intended to indicate the ecological significance of observed effects. For example, it is possible that there could be moderate or strong evidence for a particular impact hypothesis in an assessed waterbody, but the magnitude and significance of measured changes with respect to the ecological integrity of the waterbody could be mild. The weight of evidence assessment describes potential linkages between the Mine and observed changes in the aquatic environment, and supports decision making in the AEMP Response Framework (which specifies acceptable and unacceptable levels of

		<p>effects with respect to the ecological integrity of the aquatic environment in the core lakes and advises adaptive management actions).</p> <p>Adequate.</p>
h)	A comparison of monitoring results to Action Levels as set in the AEMP Design Plan;	<p>De Beers provided a comparison to action levels for each of the following specific components:</p> <ul style="list-style-type: none"> - Hydrology - Water Quality - Sediment Quality - Plankton - Benthic Invertebrates - Fish Habitat and Community <p>Adequate.</p>
i)	An evaluation of the overall effectiveness of the AEMP to date;	<p>De Beers stated that the results of the 2017 AEMP supporting environmental data program were examined to determine if any modifications to the AEMP sampling design and data analysis to improve the efficiency and effectiveness of future monitoring under the AEMP should be recommended. The current sampling design and data analysis procedures for the supporting environmental data program are considered appropriate to meet the component objectives. As such, no changes were recommended.</p> <p>Adequate.</p>
j)	Recommendations for refining the AEMP to improve its effectiveness as required;	<p>De Beers provided recommendations for the various components of the AEMP. The recommendations based on the 2017 AEMP results will be compiled along with all recommendations generated during the first three years of the AEMP, and further evaluated during the preparation of the Aquatic Effects Re-evaluation Report (scheduled to be submitted to the Board by July 31, 2019 as per Part I, condition 5 of Licence MV2005L2-0015).</p> <p>Adequate.</p>
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.	<p>De Beers provided a concordance table which addressed the Board's directives from the 2016 AEMP Annual Report.</p> <p>No additional details were requested by the MVLWB.</p>

5. Reviewer Comments

By October 2, 2018, comments and recommendations on the 2017 AEMP Annual Report were received from 2 reviewers:

- Environment and Climate Change Canada (ECCC); and
- Government of the Northwest Territories – Environment and Natural Resources (GNWT-ENR).

De Beers responded on October 16, 2018. The Review Summary and Attachments (attached) presents the comments identified through this review.

The following summarizes the main issues raised during the review:

ECCC submitted a comment indicating that they have no comments at this time.

The majority of the GNWT-ENR's comments were addressed or clarified in De Beers' responses. For example, in response to GNWT-ENR comment-9, De Beers indicated that they will ensure the field team is aware of the sampling plan and QA/QC procedures to avoid sampling errors. In response to the GNWT-ENR comment-3 regarding providing data in excel format, De Beers responded that they will provide excel files in addition to the pdf files for the 2018 AEMP Annual Report.

The GNWT-ENR comment-2 discusses how De Beers notes, throughout the AEMP Annual Report, that observed changes are consistent with the Environment Impact Statement (EIS) predictions, but that De Beers does not provide a direct comparison to EIS predictions. The GNWT-ENR recommended that the specific EIS predictions be included for reference where observed changes are deemed acceptable. As such, the Board could require De Beers to include specific EIS predictions where observed changes are deemed acceptable in all future AEMP Annual Reports, beginning with the 2018 AEMP Annual Report due to the Board May 1, 2019.

In GNWT-ENR comment-5, it is noted that there were Effluent Quality Criteria (EQC) exceedances for pH at Surveillance Network Program (SNP) station SNP-02 in 2017. The GNWT-ENR recommended that De Beers confirm if the results in Table 5.4-10 indicate that discharge from SNP-02 did not always comply with Water Licence requirements, and whether these results were brought to the attention of the Inspector. De Beers responded that, "Field pH values for SNP-02 in the 2017 AEMP shows that the discharge water quality was not always within the range in the Water Licence; however, the potential for adverse effects as a result of field pH measurements slightly below 6.5 is considered low." They also stated that the corresponding laboratory pH measurements for water samples collected at SNP-02 during periods of discharge in 2017 were all within the pH EQC, and are presented in the monthly SNP reports. Board staff note that the Licence MV2005L2-0015 does not specify if EQC is based upon field pH results or laboratory pH results, therefore any pH reading, including field results, outside of the range designated in Part G, condition 30 of the Licence (6.5-9.0) is a Licence EQC exceedance that should result in the ceasing of discharge and notification to the inspector. The Board could remind De Beers that, as per Part G, condition 32 of Licence MV2005L2-0015, if the EQCs listed in Part G, condition 30 are exceeded, De Beers shall cease all discharge from the Water Management Pond to Lake N11, shall notify the Board and an Inspector, and shall take the necessary corrective action to mitigate the exceedance, as outlined in the approved Operational Water Management Plan, to the satisfaction of an Inspector immediately.

6. Security

The status of security for this project will not be affected by the Board's decisions related to the 2017 AEMP Annual Report.

7. Conclusion

Board staff suggest this submission is largely in conformity with the requirements of Licence MV2005L2-0015.

Board staff conclude that further information was provided by De Beers in their responses to reviewer comments and the 2017 AEMP Annual Report, as submitted, can be approved.

8. Recommendation

Board staff recommend the Board **make a motion to approve the 2017 AEMP Annual Report, as submitted April 30, 2018.**

Board staff recommend including the following text in the decision letter:

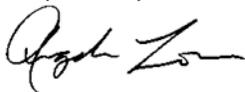
- The Board reminds De Beers that the approval of the 2017 AEMP Annual Report does not also mean approval for De Beers' suggested improvements to the AEMP described in this Annual Report. Any changes to the AEMP Design Plan would follow a separate approval process.
- The Board directs De Beers to ensure all future AEMP Annual Reports include EIS predictions for reference where observed changes are deemed acceptable, beginning with the 2018 AEMP Annual Report due to the Board May 1, 2019, as committed to in response to GNWT-ENR comment-2 in the attached Review Summary Table.
- The Board reminds De Beers to adhere to the commitments made in their responses to all review comments in the attached Review Summary Table, notably to GNWT-ENR comments-2, 3, & 9.
- The Board reminds De Beers that, as per Part G, condition 32 of Licence MV2005L2-0015, if the EQCs listed in Part G, condition 30 are exceeded, De Beers shall cease all discharge from the Water Management Pond to Lake N11, shall notify the Board and an Inspector, and shall take the necessary corrective action to mitigate the exceedance, as outlined in the approved Operational Water Management Plan, to the satisfaction of an Inspector immediately (see GNWT-ENR comment-5 attached).

A draft decision letter is attached.

9. Attachments

- [2017 AEMP Annual Report](#)
- Review Summary and Attachments
- Draft Decision Letter from the Board

Respectfully submitted,



Angela Love
Regulatory Specialist



Kierney Leach
Technical 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):	2017 AEMP Annual Report (39.7 MB)
Item For Review Distributed On:	Aug 27 at 16:15 Distribution List
Reviewer Comments Due By:	Oct 2, 2018
Proponent Responses Due By:	Oct 16, 2018
Item Description:	<p>De Beers Canada Inc. (De Beers) has submitted the 2017 AEMP Annual Report on April 30, 2018. This Report is required under Part I, 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>NWT Metis Nation - Tim Heron, NWTMN IMA Coordinator (867) 872-3586; rcc.nwtmn@northwestel.net</p>
Contact Information:	<p>Angela Love 867-766-7456 Jen Potten 867-766-7468 Kierney Leach 867-766-7470</p>

Comment Summary

Environment and Climate Change Canada: Melissa Pinto				
ID	Topic	Reviewer Comment/Recommendation	Proponent Response	Board Staff Analysis
1	General	<p>Comment Environment and Climate Change Canada has reviewed the AEMP Annual Report and has no comments at this time. Outstanding comments from previous reviews are expected to be addressed in the 2019 re-evaluation.</p> <p>Recommendation N/A</p>	<p>Oct 16: Acknowledged. De Beers will address outstanding comments from previous reviews in the AEMP Re-evaluation Report, which is due to the Board in 2019.</p>	Noted.
GNWT - ENR: Central Email GNWT				
ID	Topic	Reviewer Comment/Recommendation	Proponent Response	Board Staff Analysis
11	General File	<p>Comment (doc) ENR Letter with Comments and Recommendations</p> <p>Recommendation</p>		
1	Topic 1: Baseline Data	<p>Comment Throughout the report, DeBeers expresses the opinion that data collected during 2015 and 2016 could be used to augment the "Baseline" dataset. ENR include post-construction data in the baseline dataset when suggested in previous annual reports. ENR's concerns remain, and this issue requires additional discussion and evaluation. The Board has previously indicated that this issue is more appropriately included within the scope of the AEMP Design re-evaluation currently scheduled for summer 2019. ENR will defer to the Board regarding how to best address this issue, but concerns on this topic identified in previous reviews remain.</p> <p>Recommendation 1) ENR notes that the appropriateness of using post-construction data as part of the baseline dataset remains unresolved.</p>	<p>Oct 16: Acknowledged. De Beers will address the appropriateness of incorporating 2015 and 2016 data to augment the baseline dataset in the AEMP Re-evaluation Report.</p>	Board staff acknowledge this unresolved topic that will be addressed during the AEMP Re-evaluation report process in 2019.
2	Topic 2: Agreement with EIS Predictions	<p>Comment DeBeers includes statements such as "generally consistent with projected water quality conditions in the EIS", or</p>	<p>Oct 16: Acknowledged. De Beers will include specific EIS predictions for reference when applicable in the 2018 AEMP Annual Report. Note that this</p>	Appropriate response. Board staff recommend that De Beers be

		<p>“observed changes are consistent with EIS predictions” throughout the report, but does not provide a direct comparison to the EIS predictions. ENR raised this in comments on previous AEMP Annual Reports (e.g. 2016), and the Board responded with the following: "De Beers should be 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." Similarly in the Board's August 13, 2018 decision on De Beers AEMP Response Plan for toxicology and nutrient enrichment, the Board required the following information be included in a revised plan: "De Beers to update the necessary summary tables to include an additional column which outlines EIS prediction values (or ranges) for that parameter." These Board recommendations were for specific scenarios (Lake D2/D3 in the first quote and the Toxicology and Nutrient Enrichment Response Plan in the second), but ENR suggests that it would apply to all AEMP components, and would assist reviewers with evaluating the observed changes.</p> <p>Recommendation 1) ENR recommends that the specific EIS predictions be included for reference where observed changes are deemed acceptable because they are in accordance with these predictions.</p>	<p>commitment was also made in the Toxicology and Nutrient Enrichment Response Plan.</p>	<p>required to include the specific EIS predictions for reference where observed changes are deemed acceptable. This should be done for all future AEMP Annual Reports, beginning with the 2018 AEMP Annual Report due to the Board May 1, 2019.</p>
3	Topic 3: Electronic Data	<p>Comment Data tables were provided in pdf format, which makes it difficult for reviewers to conduct independent analyses of the data. This comment was raised during the last review, and De Beers provided electronic data as part of their response to reviewer comments. ENR notes that it would be more efficient if De Beers</p>	<p>Oct 16: Acknowledged. De Beers will provide excel files in addition to the pdf files for the 2018 AEMP Annual Report.</p>	<p>Acceptable response.</p>

		<p>included electronic (i.e. excel) data as part of the original submission.</p> <p>Recommendation 1) ENR recommends that De Beers provide excel data as part of the AEMP Annual Report submissions.</p>		
4	Topic 4: Monitoring at SNP-02	<p>Comment SNP-02 is described in the Water Licence as being "in-line monitoring for end of pipe discharge". However, ENR notes that AEMP samples are collected from this point during active discharge, as well as for two weeks after active discharge ends. ENR is uncertain where this sampling point is actually located, and what this data would represent.</p> <p>Recommendation 1) ENR recommends that De Beers confirm the location of SNP-02, and clarify the water that is being sampled (i.e. discharge water after the period of discharge ends?).</p>	<p>Oct 16: The description of the sampling location of SNP-02 is described in the Water Licence for the Mine (MV2005L2-0015) as 'in-line monitoring for end-of-pipe discharge from Kennady Lake to Lake N11'. This station is monitored as part of the Surveillance Network Program (SNP) to track the water quality of the water being discharged from the water management pond (WMP). Sampling for SNP-02 water quality data is completed in the WMP adjacent to the pumping intake because it is not possible to take in-line samples prior to pumping to Lake N11 (there is no water in the discharge pipeline prior to discharge) or during discharge. SNP samples are therefore collected from a location close to the intake to represent the water that will enter the pipeline once pumping starts or is occurring. In 2017, there were two periods of discharge from the WMP to Lake N11: January 1 to January 17, 2017 (which had commenced on October 29, 2016), and September 4 to November 13, 2017. During the pumping period in 2017, daily monitoring of dissolved oxygen, pH, specific conductivity, temperature, TSS, turbidity, as per the Water Licence, occurred. During the same periods, weekly monitoring of major ions, nutrients, total metals, extractable petroleum hydrocarbons, and BTEX was also conducted. The data corresponding to the final day of discharge (i.e., January 31, 2017) refer to monitoring and data collection two weeks after discharge was ceased on July 17. The pumping had to be stopped as the WMP water level was deemed too low at the time, which would impact the water reclaim pumping for processing. The sample collected on January 31 represented the "end of discharge" sampling requirement at both SNP-02</p>	De Beers has addressed ENR's recommendation.

			<p>and SNP-20, and was delayed due to the time required to expedite the tox sampling supplies to site. Water quality data for SNP 02 were also collected on January 16, 2017, which also can also be considered an applicable equivalent to the end of discharge. A comparison of the water quality data collected on January 16, 2017 to those data collected on January 31, 2017 show that the water quality conditions at SNP-02 were very similar (De Beers 2017). The data collected on January 16, 2017 data were included along with weekly data collected on January 2, 9, and 31, 2017 in the summary data presented in Table 5.4-11 of the 2017 AEMP Report, which are also available in the January SNP report (De Beers 2017), which was submitted to the Board on February 23, 2017. Reference De Beers (De Beers Group of Companies). 2017. Gahcho Kué Mine Monthly Surveillance Network Program Report (MV2005L2-0015) - January 2017. Submitted to Mackenzie Valley Land and Water Board, February 23, 2017. Yellowknife, NT, Canada. 38 pp. + Appendices.</p>	
5	Topic 5: pH and TSS at SNP-02	<p>Comment Table 5.4-10 provides a summary of data collected at SNP station SNP-02. ENR notes that the minimum pH of samples collected at this point was 5.5. Clause G.30 of the Water Licence identifies that the minimum pH of discharge to the environment at SNP-02 is 6.5. A similar result is reported in Table 5.4-15, where the lowest measured pH was 6.5. The maximum estimated TSS recorded in Table 5.4-10 is 29 mg/L. Per Clause G.30 of the Water Licence, the maximum grab TSS concentration at SNP-02 is 25. ENR notes that the TSS values reported in Table 5.4-10 are estimated based upon turbidity measurements. These results suggest that discharge from SNP-02 was not always in compliance with Water Licence limits. ENR is</p>	<p>Oct 16: pH: Field pH values for SNP-02 in the 2017 AEMP shows that the discharge water quality was not always within the range in the Water Licence; however, the potential for adverse effects as a result of field pH measurements slightly below 6.5 is considered low. De Beers has responded to this issue following similar Board comments in the past (e.g., in response to the 2016 WLAR comments). Field pH values measured at SNP-02 (and SNP-01) fall within the range of pH data for lakes within the Kennady Lake watershed and the N-lakes watershed under baseline, construction, and operating conditions (e.g., the range of field pH measured in the Kennady Lake basins is 5.3 to 8.3 [1995 to 2015; n = 121], in Area 3/5 the range is 5.9 to 8.1 [1995 to 2015; n = 121], in the N Lakes watershed the range is 5.8 to 7.8 [1998 to 2015; n = 78], and for Lake N11 the range is 5.4 to 7.8 [1998 to 2017; n =</p>	<p>Board staff note that the reported TSS value of 29mg/L is an error due to an invalidated sample, and that the correct maximum TSS concentration after removing the invalid TSS result is 7.2 mg/L.</p> <p>In regards to EQC exceedances for pH, Board staff recommend, as outlined in Part G, condition 32 of Licence MV2005L2-0015, that if the EQCs as listed in Part G, condition</p>

		<p>not certain whether these results were reported to the Inspector or to the Board.</p> <p>Recommendation 1) ENR recommends that De Beers confirm whether the results in Table 5.4-10 indicate that discharge from SNP-02 did not always comply with Water Licence requirements, and whether these results were brought to the attention of the Inspector.</p>	<p>86]). Numerous Project-related baseline water quality and supplemental water quality monitoring reports completed by De Beers prior to and during the EIS process, during the permitting process (e.g., Golder 2014), and during Mine construction and operations, have characterized the baseline pH range as frequently falling below CCME water quality guidelines for the protection of aquatic life (i.e., 6.5 to 9), especially during under ice conditions (which tend to have lower pH conditions than open water conditions). Slightly acidic pH values are a characteristic of the lakes in the area during baseline conditions, therefore pH values below 6.5 are to be expected. The corresponding laboratory pH measurements for water samples collected at SNP-01 and SNP-02 during periods of discharge in 2017 were all within the pH EQC, and are presented in the monthly SNP reports. TSS: The inclusion of a maximum recorded TSS concentration of 29 mg/L presented in Table 5.4-10 of the 2017 AEMP Report is an error. In the preparation of the AEMP Report, De Beers confirmed that the anomalous turbidity and TSS values collected on January 12, 2017 had been invalidated due to the presence of bubbles in the sample, which resulted in an incorrect elevated turbidity measurement. The corresponding TSS concentration derived from the anomalous turbidity value (i.e., 29 mg/L) was also invalidated. While the maximum turbidity value in Table 5.4-10 of the 2017 AEMP Report was updated after removing the invalid turbidity result, the maximum TSS concentration was not. The correct maximum TSS concentration after removing the invalid TSS result is 7.2 mg/L (mean = 2.0 mg/L and standard deviation = 1.6 mg/L), which complies with the Water Licence requirements. These invalidated turbidity and TSS values were not included in the raw data provided in Appendix 3A of the 2017 AEMP Report. In addition, to avoid future interference to the turbidity sensor, De</p>	<p>30 are exceeded, De Beers shall cease all Discharge from the Water Management Pond to Lake N11, shall notify the Board and an Inspector, and shall take the necessary corrective action to mitigate the exceedance, as outlined in the approved Operational Water Management Plan, to the satisfaction of an Inspector immediately.</p>
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			<p>Beers is currently using a more reliable TSS meter (Hach DR900) using photometric method at the onsite lab for all the daily SNP-02 TSS measurements. The samples will also be submitted to the off-site third party laboratory for the TSS analysis. References: APHA. 2012 (with updates to 2015). Standard Methods for the Examination of Water and Wastewater, 22nd Edition. Washington, DC, USA. Golder (Golder Associates Ltd.). 2014. Gahcho Kué Project - 2013 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.</p>	
6	<p>Topic 6: Table 5.4-20, Parameters</p>	<p>Comment TSS is not included in the results for Table 5.4-20. TSS is an SNP sampling requirement at this location (included with "Physical Parameters"), and ENR expects TSS would have been collected as part of the SNP Program.</p> <p>Recommendation 1) ENR recommends that De Beers clarify why TSS was not included as a parameter in Table 5.4-20.</p>	<p>Oct 16: The missing TSS concentration results under the parameter group Field Parameters in Table 5.4-20 of the 2017 AEMP Report are associated with field-measured TSS concentrations, which were not collected during the September 4 to November, 2017 discharge period. However, samples for TSS analysis were collected during this period; these data are included in Table 5.4-20 of the 2017 AEMP Report under the parameter group Conventional Parameters.</p>	<p>Acceptable response.</p>
7	<p>Topic 7: Elevated Nitrate, Section 5.4.1.2.2</p>	<p>Comment A nitrate concentration exceeding the AEMP benchmark (3.0 mg-N/L) for Lake N11 was reported at SNP-01A. De Beers suggests that this value is anomalous because it is a single monitored result, and the median nitrate concentration at this location was 0.64 mg-N/L ENR notes that the data provided in Appendix 3B indicates that nitrate was elevated at all three SNP-01 stations (a, b and c) on November 12. This suggests that the reading could be correct, and that nitrate could have been elevated in discharge during November.</p> <p>Recommendation 1) ENR recommends that De Beers describe what analysis was conducted to determine that the</p>	<p>Oct 16: The nitrate concentrations measured at the SNP-01 monitoring stations in November 12, 2017 ranged from 2.29 to 2.97 mg N/L, with the measurement at SNP-01A (2.97 mg N/L) only slightly exceeding the AEMP benchmark (2.93 mg N/L). The statement in the 2017 AEMP Report (pg. 5-36) that this concentration was anomalous was incorrect, as similar concentrations (but below the AEMP benchmark) were measured at the SNP-01B and SNP-01C stations. This statement was based on an inappropriate comparison of these higher concentrations to the full range of nitrate concentrations measured at SNP 01 over the September 4 to November 13, 2017 period of operational discharge. The corresponding nitrate concentration at SNP-02 (8.63 mg N/L), which represents the nitrate concentration in operational</p>	<p>De Beers has addressed ENR's recommendation.</p>

		<p>high nitrate concentration returned at SNP-01a on November 12 is anomalous as opposed to indicating elevated nitrate in discharge during November.</p>	<p>discharge from the WMP, was below the nitrate maximum average concentration (MAQ) effluent quality criteria (EQC) for SNP-02 (10 mg/L). The higher than anticipated nitrate concentrations measured at SNP-01, while the SNP discharge met EQC, was attributed to a lower level of discharge mixing within the mixing zone boundary of Lake N11 due to discharge occurring under ice conditions. Future discharge conditions as described for the Water Licence Amendment will limit discharge to open water conditions, which will increase the potential for discharge dispersion (ice cover reduces the volume of water that discharge can mix and eliminates the added benefit of wind-driven mixing conditions). Additionally, as a result of the higher than anticipated nitrate concentrations being measured in the WMP, De Beers is actively managing the nitrogen input into the WMP through explosives and blasting management to reduce ammonia and nitrate concentrations in discharge from the WMP. This plan includes operational controls to reduce the residual volume of explosives that can dissolve and be directed to the WMP from pit dewatering or seepage through the fine PK in the Fine PKC Facility. Such plans have successfully been implemented at the Ekati and Diavik diamond mines in the Northwest Territories. Although the measured concentration at SNP-01A on November 12, 2017 was measured above the existing AEMP benchmark for nitrate, the potential for significant adverse effects is considered low. Rescan (2012) developed a nitrate Site Specific Water Quality Objective (SSWQO) for the Ekati Diamond mine that is hardness-dependent over a range of hardness concentrations from 10 to 160 mg/L as calcium carbonate (CaCO₃). This hardness-dependent SSWQO was adopted for the Ekati Diamond mine in May 2013 (WLWB 2013), and was determined to be protective of aquatic life in Snap Lake (MVEIRB 2014). At the measured hardness at SNP-01A (41 mg/L)</p>	
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			<p>when the high nitrate concentration was reported, the corresponding chronic nitrate benchmark is 4.5 mg N/L. This benchmark is 50% higher than the maximum nitrate concentration measured at SNP-01 on November 12, 2017 when operational discharge to Lake N11 concluded. As part of the Water Licence Amendment application due to the higher than anticipated nitrate concentrations in the WMP, De Beers has proposed to: . maintain the CCME WQG for the protection of aquatic life for nitrate of 2.93 mg N/L as the AEMP nitrate benchmark when hardness concentrations are less than 27 mg/L as CaCO₃ in Lake N11; but . adopt the hardness-dependent equation developed for the Ekati Diamond mine as the AEMP nitrate benchmark in Lake N11 (Table 2-4; Rescan 2012) when hardness concentrations are greater than or equal to 27 mg/L as CaCO₃ in Lake N11. References: MVEIRB (Mackenzie Valley Environmental Impact Review Board). 2014. Report of Environmental Assessment and Reasons for Decision. De Beers Canada Inc. Snap Lake Amendment Project; [accessed February 2018]. http://reviewboard.ca/registry?f%5B0%5D=project%3A440 Rescan (Rescan Environmental Services Ltd.). 2012. Ekati Diamond Mine: Site-Specific Water Quality Objective for Nitrate. Prepared for BHP Billiton Canada Inc. by Rescan Environmental Services Ltd. Yellowknife, NWT, Canada. WLWB (Wek'èzhìi Land and Water Board). 2013. Water Licence W2012L2-0001 for the EKATI Diamond Mine, Yellowknife, NWT, Canada.</p>	
8	Topic 8: Section 5.4.2.1.1, D2/D3 - L1 Readings	<p>Comment Water temperature measured under ice at D2/D3-L1 was highest just below the ice-cover at 6.4°C decreasing to 4°C at the bottom. De Beers notes that these values were unexpected, and are considered anomalous. De Beers does not comment regarding whether these results were a result of malfunctioning equipment, transcription errors, or</p>	<p>Oct 16: The temperature data measured under ice at D2/D3-L1 (i.e., highest just below the ice-cover at 6.4°C decreasing to 4°C at the bottom) were determined to be inconsistent relative to the expected range of values or other data collected in the other stations in the same lake. As part of the standard quality assurance and quality control procedures that apply to water quality data collected for the AEMP, field data, field notes,</p>	<p>De Beers' response addresses ENR's recommendation.</p> <p>Board staff agree that the additional protocols suggested by De Beers should be built into the</p>

		<p>other causes, and whether additional QA/QC protocols may be appropriate (i.e. in the case of a data handling error).</p> <p>Recommendation 1) ENR recommends that De Beers comment on the potential reasons for these anomalous temperature readings, and whether they indicate a need for additional QA/QC protocols.</p>	<p>calibration logs, and previous monitoring data from the same location and season were reviewed after the field data were collected. In this situation, the uploaded temperature data from Lake D2/D3 were firstly compared to the original field notes, after which the other field physico-chemical data collected at Lake D2/D3 (i.e., pH, dissolved oxygen and specific conductivity) were compared to expected data ranges for this lake during under-ice conditions. Based on the field data review and comparison, the temperature data from D2/D3-L1 were flagged to indicate that inconsistent temperature values were observed in the water column during under-ice conditions at this station. These anomalous temperature data are likely attributed to the readiness state of the field meter and/or temperature sensor; as D2/D3-L1 was the first station visited on that day, it is possible that the temperature measurements were recorded before the temperature sensor was completely stable. An additional protocol that will be built into the under-ice sampling program will be a reminder to the field crew of the expected field physico-chemical data at the AEMP lakes during under-ice conditions. This reminder will be stated in the specific work instructions (SWI) and reiterated during the pre-field program meetings. This will allow the field crew to identify anomalous readings while in the field, thus allowing the physico-chemical profile measurements to be retaken should anomalous data be identified (in contrast to being identified after the crew had returned to the environment lab at the Mine, or when the data are reviewed by the component lead).</p>	<p>under-ice sampling program.</p>
9	Topic 9: Section 6.2.1	Comment There was an error when collecting sediment samples	Oct 16: The Gahcho Kue Mine QA/QC Plan in accordance with Annex A, Part A,	Appropriate response. Board

	- Sampling Location Error	<p>from Lake N11. One series of samples was collected from the edge of the mixing zone, and the other series was collected from the pre-operational diffuser stations. These samples were collected using different sampling methods (composites from 5 cm grab samples vs. top 1 cm cores), and the intent was to compare the sediment chemistry generated from the two sampling methods. This analysis could not be completed due to a mix-up in sampling locations. The AEMP report does not identify whether additional QA/QC protocols have been established to minimize the potential for samples to be collected from incorrect locations during future sampling programs.</p> <p>Recommendation 1) ENR recommends that QA/QC protocols should be established to ensure that samples are collected from the correct locations during future monitoring programs.</p>	<p>Section 6 of the Water Licence includes the sediment sample collection method and location for SNP-01. As described in the report, the inconsistent sampling location is due to an error in the field. De Beers will ensure the sampling plan is well reviewed and communicated with the field team in the future.</p>	<p>staff recommend De Beers ensure field staff are properly trained/educated in QA/QC Plan procedures.</p>
10	Topic 10: Section 7.2.3.9, Plankton Edibility Assessment	<p>Comment Plankton edibility assessment was not conducted because "major changes in water quality and plankton communities in the core lakes and raised lakes were not observed in 2017". The level of change that would be required before an edibility assessment is required does not appear to be established.</p> <p>Recommendation 1) ENR recommends that De Beers propose a level of change that would trigger a plankton edibility assessment.</p>	<p>Oct 16: De Beers suggests that low Action Level triggers for nutrient enrichment in plankton AND water quality components (open-water) would be needed before an edibility assessment is recommended in a response plan.</p>	<p>De Beers has addressed ENR's question. This could also be discussed further during the AEMP Re-evaluation process in 2019.</p>



October 2, 2018

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

Dear Ms. Leach,

**Re: DeBeers - Gahcho Kue
Water Licence – MV2005L2-0015
2017 AEMP Annual Report
Request for Comment**

The Department of Environment and Natural Resources (ENR), Government of the Northwest Territories has reviewed the plan 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.

Topic 1: Baseline Data

Comment(s):

Throughout the report, DeBeers expresses the opinion that data collected during 2015 and 2016 could be used to augment the “Baseline” dataset. ENR include post-construction data in the baseline dataset when suggested in previous annual reports. ENR’s concerns remain, and this issue requires additional discussion and evaluation. The Board has previously indicated that this issue is more appropriately included within the scope of the AEMP Design re-evaluation currently scheduled for summer 2019.

ENR will defer to the Board regarding how to best address this issue, but concerns on this topic identified in previous reviews remain.

Recommendation(s):

- 1) ENR notes that the appropriateness of using post-construction data as part of the baseline dataset remains unresolved.

Topic 2: Agreement with EIS Predictions

Comment(s):

DeBeers includes statements such as “...generally consistent with projected water quality conditions in the EIS”, or “...observed changes are consistent with EIS predictions” throughout the report, but does not provide a direct comparison to the EIS predictions. ENR raised this in comments on previous AEMP Annual Reports (e.g. 2016), and the Board responded with the following:

“De Beers should be 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...”

Similarly in the Board’s August 13, 2018 decision on De Beers AEMP Response Plan for toxicology and nutrient enrichment, the Board required the following information be included in a revised plan:

“De Beers to update the necessary summary tables to include an additional column which outlines EIS prediction values (or ranges) for that parameter.”

These Board recommendations were for specific scenarios (Lake D2/D3 in the first quote and the Toxicology and Nutrient Enrichment Response Plan in the second), but ENR suggests that it would apply to all AEMP components, and would assist reviewers with evaluating the observed changes.

Recommendation(s):

- 1) ENR recommends that the specific EIS predictions be included for reference where observed changes are deemed acceptable because they are in accordance with these predictions.

Topic 3: Electronic Data

Comment(s):

Data tables were provided in pdf format, which makes it difficult for reviewers to conduct independent analyses of the data. This comment was raised during the last review, and De Beers provided electronic data as part of their response to reviewer

comments. ENR notes that it would be more efficient if De Beers included electronic (i.e. excel) data as part of the original submission.

Recommendation(s):

- 1) ENR recommends that De Beers provide excel data as part of the AEMP Annual Report submissions.

Topic 4: Monitoring at SNP-02

Comment(s):

SNP-02 is described in the Water Licence as being “in-line monitoring for end of pipe discharge”. However, ENR notes that AEMP samples are collected from this point during active discharge, as well as for two weeks after active discharge ends. ENR is uncertain where this sampling point is actually located, and what this data would represent.

Recommendation(s):

- 1) ENR recommends that De Beers confirm the location of SNP-02, and clarify the water that is being sampled (i.e. discharge water after the period of discharge ends?).

Topic 5: pH and TSS at SNP-02

Comment(s):

Table 5.4-10 provides a summary of data collected at SNP station SNP-02. ENR notes that the minimum pH of samples collected at this point was 5.5. Clause G.30 of the Water Licence identifies that the minimum pH of discharge to the environment at SNP-02 is 6.5. A similar result is reported in Table 5.4-15, where the lowest measured pH was 6.5.

The maximum estimated TSS recorded in Table 5.4-10 is 29 mg/L. Per Clause G.30 of the Water Licence, the maximum grab TSS concentration at SNP-02 is 25. ENR notes that the TSS values reported in Table 5.4-10 are estimated based upon turbidity measurements.

These results suggest that discharge from SNP-02 was not always in compliance with Water Licence limits. ENR is not certain whether these results were reported to the Inspector or to the Board.

Recommendation(s):

- 1) ENR recommends that De Beers confirm whether the results in Table 5.4-10 indicate that discharge from SNP-02 did not always comply with Water Licence requirements, and whether these results were brought to the attention of the Inspector.

Topic 6: Table 5.4-20, Parameters

Comment(s):

TSS is not included in the results for Table 5.4-20. TSS is an SNP sampling requirement at this location (included with “Physical Parameters”), and ENR expects TSS would have been collected as part of the SNP Program.

Recommendation(s):

- 1) ENR recommends that De Beers clarify why TSS was not included as a parameter in Table 5.4-20.

Topic 7: Elevated Nitrate, Section 5.4.1.2.2

Comment(s):

A nitrate concentration exceeding the AEMP benchmark (3.0 mg-N/L) for Lake N11 was reported at SNP-01A. De Beers suggests that this value is anomalous because it is a single monitored result, and the median nitrate concentration at this location was 0.64 mg-N/L

ENR notes that the data provided in Appendix 3B indicates that nitrate was elevated at all three SNP-01 stations (a, b and c) on November 12. This suggests that the reading could be correct, and that nitrate could have been elevated in discharge during November.

Recommendation(s):

- 1) ENR recommends that De Beers describe what analysis was conducted to determine that the high nitrate concentration returned at SNP-01a on November 12 is anomalous as opposed to indicating elevated nitrate in discharge during November.

Topic 8: Section 5.4.2.1.1, D2/D3 – L1 Readings

Comment(s):

Water temperature measured under ice at D2/D3-L1 was highest just below the ice-cover at 6.4°C decreasing to 4°C at the bottom. De Beers notes that these values were unexpected, and are considered anomalous. De Beers does not comment regarding whether these results were a result of malfunctioning equipment, transcription errors, or other causes, and whether additional QA/QC protocols may be appropriate (i.e. in the case of a data handling error).

Recommendation(s):

- 1) ENR recommends that De Beers comment on the potential reasons for these anomalous temperature readings, and whether they indicate a need for additional QA/QC protocols.

Topic 9: Section 6.2.1 – Sampling Location Error

Comment(s):

There was an error when collecting sediment samples from Lake N11. One series of samples was collected from the edge of the mixing zone, and the other series was collected from the pre-operational diffuser stations. These samples were collected using different sampling methods (composites from 5 cm grab samples vs. top 1 cm cores), and the intent was to compare the sediment chemistry generated from the two sampling methods. This analysis could not be completed due to a mix-up in sampling locations.

The AEMP report does not identify whether additional QA/QC protocols have been established to minimize the potential for samples to be collected from incorrect locations during future sampling programs.

Recommendation(s):

- 1) ENR recommends that QA/QC protocols should be established to ensure that samples are collected from the correct locations during future monitoring programs.

Topic 10: Section 7.2.3.9, Plankton Edibility Assessment

Comment(s):

Plankton edibility assessment was not conducted because “major changes in water quality and plankton communities in the core lakes and raised lakes were not observed in 2017”. The level of change that would be required before an edibility assessment is required does not appear to be established.

Recommendation(s):

- 1) ENR recommends that De Beers propose a level of change that would trigger a plankton edibility assessment.

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

Should you have any questions or concerns, please do not hesitate to contact Patrick Clancy, Environmental Regulatory Analyst at (867) 767-9233 Ext: 53096 or email patrick.clancy@gov.nt.ca.

Sincerely,



Patrick Clancy
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Environmental Assessment and Monitoring Section
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