



Mackenzie Valley Land and Water Board
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July 21, 2016

File: MV2005L2-0015

Ms. Sarah McLean
De Beers Canada Inc.
Gahcho Kué Project
Suite 300, 5120-49th St.
YELLOWKNIFE NT X1A 1P8

Email: Sarah.McLean@debeersgroup.com

Dear Ms. McLean:

**2015 Aquatic Effects Monitoring Program Annual Report – Approved
Water Licence MV2005L2-0015**

The Mackenzie Valley Land and Water Board (MVLWB or the Board) met on July 21, 2016 and reviewed the 2015 Aquatic Effects Monitoring Program (AEMP) Annual Report, which was submitted under Part I, item 6 of Water Licence MV2005L2-0015 on April 29, 2016.

The Board hereby approves the 2015 AEMP Annual Report as submitted. The Board notes that the recommendations for the proposed changes to the AEMP Design Plan, as listed in Section 15.5 of this 2015 AEMP Annual Report, are not approved at this time. The process to proceed with those proposed changes are outlined in the attached Reasons for Decision. In all circumstances, any proposed changes to the AEMP Design Plan are to be considered in processes outside of the approval of the AEMP Annual Report.

As per the Review Comment Table for the 2015 AEMP Annual Report, De Beers shall:

- Include a description of any changes to sampling locations (see ENR-3 for additional context), from the 2014 or 2015 sampling program into its 2016 AEMP Annual Report. The Board suggests that an appropriate place for the information might be Appendix 5A of the Annual AEMP Reports (Water Quality – Quality Assurance and Quality Control Procedures and Results) but De Beers may choose where the information is best added to the report. This information is being requested as per Schedule 6, item 3(k) of Licence MV2005L2-0015.
- Address the following points during the AEMP Re-Evaluation and revision of the AEMP Design Plan scheduled for 2019:

.../2

- Recommendations made by De Beers in Section 15.5 of the 2015 AEMP Annual Report;
- Clarify the specific interpretation of the Action Levels for plankton and benthic invertebrates in the AEMP Design Plan (see MVLWB – 7, 8, and 13 for additional context); and
- Consider the suggestions to change the statistical interpretation of determining a mine effect for water quality, particularly with respect to comparisons with the normal range (see ENR-8-10 for additional context).

The full cooperation of De Beers is anticipated and appreciated. If you have any questions or concerns, please contact Angela Love at (867) 766-7456 or email angela.love@mvlwb.com.

Yours sincerely,

A handwritten signature in black ink, appearing to read "F. M. Adlem". The signature is fluid and cursive, with a long horizontal stroke at the end.

Floyd Adlem
MVLWB A/Chair

Copied to: Distribution List

Attachment: Reasons for Decision



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Reasons for Decision

Issued pursuant to section 72.25 of the *Mackenzie Valley Resource Management Act* and section 54 of the *Waters Act*

Water Licence	
Preliminary Screener	MVLWB
Reference/File Number	MV2005L2-0015
Proponent	De Beers Canada Inc. – Gahcho Kué Mine
Submission/Project	2015 Aquatic Effects Monitoring Program Annual Report

Decision from Mackenzie Valley Land and Water Board Meeting of

July 21, 2016

Background

An AEMP Annual Report is required under Part I, item 6 of Licence MV2005L2-0015 as follows:

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.

The 2015 Aquatic Effects Monitoring Program (AEMP) Annual Report covers activities that link directly to AEMP monitoring which occurred in 2015. Field programs completed in 2015 included: hydrology (water quantity and flow), water quality, sediment quality, plankton (the small plants and animals that live in the water), benthic invertebrates (the small animals living in the mud of the lake bottom), fish habitat, and community, fish health and fish tissue chemistry.

De Beers submitted the 2015 AEMP Annual Report on April 29, 2016.

Pubic Review

By June 13, 2016, comments and recommendations on the 2015 AEMP Annual Report were received from three reviewers:

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

De Beers responded on June 20, 2016.

Security

The GNWT currently holds \$23,776,270.00 in reclamation security for the Gahcho Kué mine for this Licence. De Beers' next deposit of security (in the amount of \$40,713,234) is due prior to year 4 of Operations (the end of mining of the Hearn Pit).

Decision

After reviewing the submissions of the Proponent, the written comments received by the Board and the Staff report prepared for the Board, the Board, having due regard to the facts and circumstances, the merits of the submissions made to it, and to the purpose, scope, and intent of the MVRMA and the *Waters Act* and Regulations made thereunder, has decided to approve the 2015 AEMP Annual Report as submitted April 29, 2016 to fulfill Part I, item 6 of Water Licence MV2005L2-0015, but not approve the recommendations of the proposed changes to the AEMP Design Plan, as listed in Section 15.5 of the 2015 AEMP Annual Report. The process to proceed with those proposed changes are outlined in column 5 of Table 1 below; the Board will consider any proposed changes to the AEMP Design Plan in processes outside of the approval of the AEMP Annual Report.

Table 1: Recommendations for Changes to the AEMP Design Plan from the 2015 AEMP Annual Report

Rec. #	Section of 2015 AEMP Annual Report	Recommendation provided in 2015 AEMP Annual Report	Comparison of recommendation to approved AEMP Design Plan – V5 – January 29, 2016	Board Decision
1	Water Quality, Section 5.8	Modify the low action levels for toxicological impairment and nutrient enrichment to reduce the occurrence of false positive triggers, while maintaining an early warning of potential change. Replacing the “OR” with “AND” in the water quality action level statements will require that multiple trigger statements must be true before a low action level is triggered. In particular, the low action level should consider reaching a 75% of the benchmark as a necessary criterion to be triggered, to prevent “false positives”. This modification to the low action level will focus investigation of changes to water quality that will have relevance to aquatic effects instead of on natural variability in water quality.	Low Action Level for toxicological impairment (Table 8.4-1): “Lake-wide average concentration greater than normal range or EIS prediction, supported by a visual temporal trend AND Lake-wide average concentration exceeds 75% of AEMP benchmark(c) OR Relative difference between core lake and reference lakes statistically significant compared to baseline (i.e., significant BACI effect detected)” Low Action Level for nutrient enrichment (Table 8.4-2): “Lake-wide average nitrogen and phosphorus nutrient concentrations greater than normal range or EIS prediction, supported by a visual temporal trend AND Lake-wide average nitrogen and phosphorus nutrient concentrations exceeds 75% of AEMP benchmark(b) OR Relative difference of nitrogen and phosphorus nutrient concentrations between core lake and reference lakes statistically significant compared to baseline (i.e., significant BACI effect detected)”	In its responses to comments on the 2015 AEMP Annual Report, De Beers has indicated that this change may not be required at this time. If De Beers would like to pursue this change to the AEMP Design Plan, it may apply to the Board as per Part I, item 3 of Licence MV2005L2-0015. As noted in comment/responses to MVLWB-13, the addition of 2015 data to the calculation of the normal ranges for water, sediment, plankton and benthics may alleviate some of the issues associated with false positives.

			Note that an extensive review process was used to set action levels for the approved AEMP Design Plan.	
2	Water Quality, Section 5.8	Given that no mine-related effects from dewatering were seen in the 2015 water quality data, the 2015 data should be incorporated into the baseline dataset and used to update the normal range and BACI analysis (as part of the baseline dataset) for future AEMP cycles. This will improve the normal range to represent the range of natural variability for the water quality parameters. If the results of monitoring during the construction phase (i.e., construction Year -1) continue to suggest no mine-related effects on water quality, then data collected in 2016 could be considered for use to supplement the normal ranges accordingly. It is anticipated that the normal ranges will be finalized prior to the commencement of operational discharge.	Updates to the normal range for water quality parameters was anticipated in the AEMP Design: section 9.2.4.4 states that “The data included in the estimation of the normal range will be baseline data for the given waterbody. Data collected in the given waterbody after construction has begun may be included as baseline data for the estimation of the normal range, if it can be shown that water quality has not been influenced by construction activities.”	In their review of the 2015 AEMP Annual Report, ECCC (e.g., ECCC-2 and 3) and ENR (e.g., ENR-6 and 18) asked some questions about De Beers’ conclusion that water quality has not been influenced by construction activities (i.e., no mine-related effects). De Beers has provided additional information in its comment responses; at this time ECCC and ENR should be asked whether they have any further concerns or if they agree that it would be reasonable to incorporate the 2015 water quality data into the calculation of the normal range for use in the 2016 AEMP Annual Report.
3	Sediment – Section 6.8	No mine-related effects from dewatering were evident in the 2015 water and sediment quality data; thus, the 2015 data should be included to refine the normal range and BACI analysis (as part of the baseline dataset) for future AEMP cycles. In particular, lower DLs were achieved for some metals during the 2015 AEMP surveys (i.e., antimony, beryllium, mercury, silver); use of these data would improve the normal ranges estimated for these sediment metals using previous baseline data. Incorporating the 2015 data into the baseline dataset will improve the normal range representation for the sediment quality parameters and account for the range of natural variability.	From Section 9.3.4 of the AEMP Design Plan: “The normal range will be defined using a 95% prediction interval for a single concentration (methods from Barrett et al. 2015). The data included in the estimation of the normal range will be baseline data for the given waterbody. Data collected in the given waterbody after construction has begun may be included as baseline data for the estimation of the normal range if it can be shown that water quality has not been influenced by construction activities.”	The AEMP Design Plan anticipated the potential inclusion of 2015 sediment data into calculations of the normal range for sediment based on the absence of a mine-related effect to water quality. The latter requires some further discussion as noted above under Recommendation #1.

4	Plankton – Section 7.6	Reduce the number of field QC (i.e., duplicate) samples collected for chlorophyll a, phytoplankton and zooplankton to 10% of the total samples collected during each sampling program. Currently, one duplicate sample is collected from each lake during each sampling program. However, 2015 duplicate results indicate that the within-station variation is relatively low for these variables. Therefore, the number of field QC samples can be reduced without reducing the ability to detect effects on chlorophyll a and plankton communities	Section 9.4.5 states: “Duplicate and blank (i.e., travel and field) nutrient samples will be collected during each sampling period for QC purposes, representing 10% of depth-integrated nutrient samples.” And that “Duplicate phytoplankton and zooplankton samples will also be collected from one sampling station in each lake during each sampling program.”	If De Beers would like to pursue this change to the AEMP Design Plan, it may apply to the Board as per Part I, item 3 of Licence MV2005L2-0015.
5	Plankton – Section 7.6	All individual action level criteria should be met before the low action level is triggered (i.e., change the “OR” to “AND” in the definition of the low action level). This modification to the low action levels for the plankton component will address the sensitivity of the BACI analysis while still allowing for an early warning of potential change.	Original low action level for plankton (Table 8.4-2): Lake-wide average value for total phytoplankton biomass, zooplankton abundance, or zooplankton biomass persistently (three consecutive years) above normal range OR An ecologically relevant change in phytoplankton or zooplankton community composition OR A statistically significant relative difference in total phytoplankton biomass, or zooplankton abundance or biomass, between core lake and reference lake.” Note that an extensive review process was used to set action levels for the approved AEMP Design Plan.	In its responses to comments on the 2015 AEMP Annual Report (e.g, MVLWB-9 and 13), De Beers has indicated that this change may not be required at this time. If De Beers would like to pursue this change to the AEMP Design Plan, it may apply to the Board as per Part I, item 3 of Licence MV2005L2-0015.
6	Plankton – Section 7.6	Given that no mine-related effects from dewatering were seen in the 2015 water quality data, include the 2015 data in the normal range (i.e., as baseline data) and BACI analysis (i.e., as “before-impact” data) as part of the baseline dataset for future AEMP cycles. This will improve the ability of the normal range to estimate the range of natural variability for the plankton endpoints, and will also improve the ability of the BACI analysis to detect significant changes of relevant magnitude in the plankton community.	Section 9.4.4: “The data included in the estimation of the normal range will be baseline data for the given waterbody. Data collected in the given waterbody after construction has begun may be included as baseline data for the estimation of the normal range if it can be shown that water quality has not been influenced by construction activities.”	The AEMP Design Plan anticipated the potential inclusion of 2015 plankton data into calculations of the normal range for plankton based on the absence of a mine-related effect to water quality. The latter requires some further discussion as noted above under Recommendation #1. Note also that ENR raised a separate point for consideration with respect to using post-dewatering plankton data from Area 8 and Lake N11 which was the direct

				addition of Kennady Lake plankton in the dewatering discharge.
7	Benthics – Section 8.8	Normal ranges for benthic invertebrate variables should be re-calculated in 2016 using both the 2011 baseline data and 2015 AEMP data for core and reference lakes, and the 2013 baseline data and 2015 AEMP data for streams. Inclusion of the 2015 AEMP data in reference data sets used to calculate the normal range would provide a more robust estimate of natural variability in benthic invertebrate community descriptors in the core lakes and would address issues with the sensitivity of the normal range to detect mine-related changes. Analysis of the 2015 AEMP data provided no consistent evidence of effects on the benthic invertebrate community, or of exposure of the benthic community to mine-related inputs or hydrologic changes, indicating that the 2015 data could be included in the baseline dataset during future AEMP cycles.	Section 9.5.4.2: “The data included in the estimation of the normal range will be baseline data for the given waterbody. Data collected in the given waterbody after construction has begun may be included as baseline data for the estimation of the normal range if it can be shown that water quality has not been influenced by construction activities”	The AEMP Design Plan anticipated the potential inclusion of 2015 benthic data into calculations of the normal range for benthic based on the absence of a mine-related effect to water quality. The latter requires some further discussion as noted above under Recommendation #1.
8	Benthics – Section 8.8	As discussed above for the normal range, the 2015 AEMP benthic invertebrate data should be included in the before-impact treatment group in the BACI model during future AEMP cycles.	Same as above.	See above for Recommendation #7.
9	Benthics – Section 8.8	The criteria used for assigning a low action level for toxicological impairment and nutrient enrichment hypotheses should be revised so that the sensitivity of the action level framework is appropriate for detecting mine-related effects. Under the current response framework, a low action level is triggered if (1) the lake-wide average of a benthic invertebrate variable exceeds the normal range or (2) if there is a significant BACI effect between the core and reference lakes compared to baseline. The recommended revision is to require that both criteria be met for triggering a low action level.	Original Benthics Low Action Level is given in column 3, as per Table 8.4-2. Note that an extensive review process was used to set action levels for the approved AEMP Design Plan.	In its responses to comments on the 2015 AEMP Annual Report (e.g, MVLWB-13), De Beers has indicated that this change may not be required at this time. If De Beers would like to pursue this change to the AEMP Design Plan, it may apply to the Board as per Part I, item 3 of Licence MV2005L2-0015.

10	Benthics – Section 8.8	The sampling station in Stream K5, should be re-located during future monitoring so that it is situated upstream of the fish fence. This will reduce the potential for confounding effects from disturbance related to the fish fence on the benthic invertebrate community.	There is no detail on the location of the station at Stream K5 in the AEMP Design Plan.	This recommendation does not seem to represent a departure from the approved AEMP Design Plan; therefore, De Beers may implement it if it wishes to do so.
11	Fish Health - Section 10.7	Sentinel Species – Based on data collected during the 2015 fish health survey, Ninespine Stickleback can be considered a potential sentinel species for the fish health component of the Gahcho Kué AEMP. Ninespine Stickleback was one of only three species that co-occurred in all four lakes sampled. It is recommended that the reference lakes be re-visited in 2016 to confirm whether sufficient numbers of Ninespine Stickleback can be collected to select this species as the sentinel species, and to complete the pre-operational baseline dataset for the AEMP.	Section 7.5.5.2: “The small-bodied fish health program will include one or two sentinel species, which may consist of Ninespine Stickleback, Slimy Sculpin, or Lake Chub. Fish species will be selected for monitoring based on presence and abundance in each of the monitored lakes.”	Given that the approved AEMP Design Plan left the selection of the sentinel species open to results obtained through ongoing sampling efforts, there does not seem to be an impediment to De Beers proceeding with this recommendation at this time. Board notes that De Beers is planning some follow-up work this year and that the discussion of the use of Ninespine Stickleback may be revisited based on these results.
12	Fish Tissue Chemistry – Section 11.6	Detection Limits – Detection limits presented in the AEMP Design Plan (De Beers 2016) are based on those provided by ALS for tissue chemistry using routine analysis, which requires a minimum sample volume of 5 g. Because of the small size of Ninespine Stickleback (i.e., less than 2 g), low volume analysis is required. Detection limits differ between routine and low volume analysis. As a consequence, the DLs based on routine analysis outlined in the AEMP Design Plan (De Beers 2016) do not reflect achievable DLs, and we recommend updating the DLs outlined in Table 9.8-1 of the AEMP Design Plan (De Beers 2016) to those presented in Table 11.2-2.	Section 9.8.2: “Small-bodied fish carcasses will be pooled to obtain 8 to 10 composite samples of a minimum 5 g weight each per species and location. Composite samples will be made up of similar sized (i.e., medium and large) and same sex (i.e., male only and female only) fish. The remaining carcasses will be archived. Northern Pike will be targeted in Lakes D2 and D3 and sampled non-lethally using dermal plugs for tissue chemistry.”	The basis for this recommendation is not clear. As noted in column 4, the approved AEMP Design Plan envisioned the use of composite fish carcass samples to achieve a minimum weight of 5 g; however, the recommendation implies that only individual fish carcasses can be analyzed and these weigh less than 2 g for Ninespine Stickleback. Since the sentinel species had not been chosen as the time the AEMP Design Plan was approved, it may be that the need for low volume detection limits was simply not

				flagged at the time. In comments ENR-28 and 29 on the 2015 AEMP Annual Report, ENR states that it has concerns with changing the detection limits. Board recommend that De Beers use the best achievable detection limits for the fish tissue chemistry analysis based on the requirements for Ninespine Stickleback.
13	Fish Tissue Chemistry – Section 11.6	Calculation of Mean Concentrations – Section 9.8.4 of the AEMP Design Plan (De Beers 2016) states that “If all results for one parameter are below the DL, no mean will be calculated, and the result will be reported as non-detect”. This statement is incorrect as written and we recommend updating to “If more than 50% of the values for one parameter are below the DL, the mean will not be calculated, and the result will be reported as non-detect”	Relevant statement from approved AEMP Design Plan is quoted in column 3.	In comment ENR-31 on the 2015 AEMP Annual Report, ENR flagged this recommendation and suggest further analysis was required. No such change to the analysis of fish tissue chemistry results was anticipated in the AEMP Design Plan; therefore, if De Beers would like to pursue this change to the AEMP Design Plan, it may apply to the Board as per Part I, item 3 of Licence MV2005L2-0015.

SIGNATURE

Mackenzie Valley Land and Water Board



Floyd Adlem A/Chair

July 21, 2016

Date