



April 12, 2018

Angela Love  
Mackenzie Valley Land and Water Board  
PO Box 2130  
Yellowknife, Northwest Territories  
X1A 2P6

**Re: Notice of Exceedance of the Aquatic Effects Monitoring Program (AEMP) Response Framework Items (MV2005L2-0015)**

Dear Ms. Love:

De Beers Canada Inc. (De Beers) would like to notify the Mackenzie Valley Land and Water Board (MVLWB) of exceedances of Low Action Levels for toxicological impairment and nutrient enrichment, based on the 2017 Aquatics Effects Monitoring Program (AEMP) results. These Low Action Level exceedances were identified while synthesizing data collected for the 2017 AEMP under Part I of the Water Licence, MV2005L2-0015. The goal of the AEMP is to address potential Mine-related effects to the receiving aquatic ecosystem in a scientifically defensible manner. This letter provides notice that Low Action Levels were triggered as per the Water Licence Part I Condition 7, which states:

7. *If any Action Level as defined in the approved AEMP Design Plan is exceeded, the Licensee shall:*
  - a) *Notify the Board within thirty (30) days of when the exceedance is detected; and*
  - b) *Within ninety (90) days of when the exceedance is detected, submit an AEMP Response Plan that satisfies the requirements of Schedule 6, item 4 to the Board for approval.*

The 2017 AEMP was conducted based on the MVLWB approved AEMP Design Plan Version 5, which was submitted to the MVLWB in January 2016. Given the 2017 AEMP data and the evaluation process established in the AEMP Design Plan, Low Action Levels were triggered for:

- Toxicological impairment:
  - open-water concentrations of uranium in Area 8;
  - ice-cover concentrations of four water quality variables (i.e., calculated total dissolved solids [TDS], nitrate, nickel, and strontium) in Lake N11;
  - open-water concentrations of two water quality variables (i.e., strontium and barium) in Lake N11; and
  - one benthic invertebrate variable (i.e., Pisidiidae density) in Lake N11;

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- Nutrient enrichment:
  - ice-cover concentrations of nitrate in Lake N11;
  - phytoplankton community composition (by biomass) in Lake N11; and
  - five benthic invertebrate variables (i.e., total density, richness and the density of Nematoda, Pisidiidae, and *Micropsectra/Tanytarsus*) in Area 8.

Components of the aquatic environment that triggered the Low Action Levels are presented below, with a discussion as to the nature of the triggers.

### **Toxicological Impairment Low Action Level Triggers**

#### ***Water Quality***

During the open-water season, significant BACI effects relative to both reference lakes were measured for uranium in Area 8. Uranium concentrations did not exceed water quality guidelines or 75% of the AEMP benchmarks; however, lake-wide mean/median uranium concentrations exceeded the upper bound of the normal range for Area 8. As a result, a Low Action Level for uranium in Area 8 was triggered based on the toxicological impairment hypothesis.

During the ice-cover season, significant before-after control-impact (BACI) effects were detected in Lake N11 for concentrations of calculated TDS, nitrate, nickel, and strontium. Lake-wide mean/median ice-cover concentrations of these four parameters also exceeded the upper bound of the normal range for Lake N11. As a result, a Low Action Level for calculated TDS, nitrate, nickel, and strontium during ice-cover conditions was triggered based on the toxicological impairment hypothesis. In the Environmental Impact Statement (EIS), concentrations of nutrients, TDS, major ions, and some metals in Lake N11 were projected to increase as a result of operational discharge from the water management pond [WMP] to Lake N11.

During the open-water season, significant BACI effects with a positive effect size were detected for concentrations of barium and strontium in Lake N11. Lake-wide mean/median concentrations of these two parameters also exceeded the upper bound of the normal range for Lake N11. Therefore, open-water concentrations of barium and strontium in Lake N11 triggered a Low Action Level based on the toxicological impairment hypothesis. The number of parameters that triggered a Low Action Level in Lake N11 decreased from four during the ice-cover season to two during the open-water season. This suggests that the influence of the operational discharge on Lake N11 was relatively short-lived, and also that the lake was capable of recovering once operational discharge from the WMP to Lake N11 ceased.

Despite instances of significant BACI effects and normal range exceedances, in all cases, none of the parameters that triggered a Low Action Level in the core lakes had lake-wide average



concentrations that exceeded water quality guidelines (i.e., Canadian Council of Ministers for the Environment Canadian water quality guideline for the protection of aquatic life [CCME CWQG-PAL; CCME 1999] and Canadian Drinking Water Quality Guidelines [CDWQG; Health Canada 2014]), or 75% of the AEMP benchmarks.

### ***Benthic Invertebrate Community***

One variable (Pisidiidae density) in Lake N11 had a significant BACI effect compared to both reference lakes, with a response pattern showing an overall decrease in density relative to each of the reference lakes. Hence, this variable triggered a Low Action Level based on the toxicological impairment hypothesis.

Although this variable satisfied the Low Action Level conditions, overall results of the benthic invertebrate assessment do not provide consistent evidence that toxicity-related effects have occurred in the core lakes. Average values for all variables in Lake N11 were within the normal range.

### **Nutrient Enrichment Low Action Level Triggers**

#### ***Water Quality***

During the ice-cover season, significant BACI effects were detected in Lake N11 for concentrations of nitrate. The lake-wide mean/median ice-cover concentration of nitrate also exceeded the upper bound of the normal range for Lake N11. As a result, ice-cover concentrations of nitrate in Lake N11 triggered a Low Action Level based on the nutrient enrichment hypothesis.

#### ***Plankton***

Based on the 2017 results, one of the plankton endpoints (phytoplankton community composition) triggered a Low Action Level for nutrient enrichment in Lake N11.

According to non-metric multidimensional scaling (nMDS) results, the phytoplankton community (by biomass) in Lake N11 during June/July, August, and September, 2017 was unique from baseline and the other AEMP sampling periods. Analysis of similarity (ANOSIM) results and examination of community composition time series plots confirmed that the 2017 community differed from baseline and reference lakes during June/July and September. The differences from baseline and reference lakes were observed during two sampling events; therefore, this was considered to be an ecologically relevant change in community composition, triggering a Low Action Level for nutrient enrichment in Lake N11 based on phytoplankton.

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During the open-water season, some changes in water quality were observed in Lake N11. However, no significant effects were detected on the concentration of the limiting nutrient (i.e., phosphorus); additionally, other plankton variables sensitive to nutrient enrichment (i.e., chlorophyll a, total phytoplankton, and zooplankton biomass) did not indicate effects consistent with nutrient enrichment. Therefore, some uncertainty exists regarding nutrient enrichment being the cause of the shift in phytoplankton community composition in Lake N11.

### ***Benthic Invertebrates***

Lake-wide means for total density, richness, and the density of three common taxa (Nematoda, Pisidiidae, and *Micropsectra/Tanytarsus*) exceeded the upper bound of the normal range in Area 8 in 2017. Hence, these variables triggered a Low Action Level based on the nutrient enrichment hypothesis. Density of Pisidiidae in Area 8 also had a significant BACI effect, with a response pattern showing an overall increase in density relative to both reference lakes. Lake-wide means for all variables were within the normal range in Lake N11. At Lake N11, no significant BACI effect consistent with nutrient enrichment was detected in any of the variables.

Although some of the variables satisfied the Low Action Level conditions, overall results of the benthic invertebrate assessment generally do not provide consistent evidence that enrichment-related effects have occurred in the core lakes. Under the currently approved AEMP Response Framework, Action Levels for several benthic invertebrate variables were dependent on the results of comparisons of AEMP data to the normal range; however, these were based on a single year of baseline data and are likely too narrow to fully encompass natural variability. This interfered with the ability of the Action Level evaluation to differentiate between Mine-related effects and year-to-year variability in the benthic invertebrate community. Hence, even though Action Level criteria have been triggered, the changes do not appear to be Mine-related. These results indicate that the Low Action Level trigger represents a false positive, and therefore, the Action Level criteria require adjustments.

In 2017, some water quality parameters triggered a Low Action Level in the core lakes, yet none of these parameters had lake-wide average concentrations that exceeded water quality guidelines, or 75% of the AEMP benchmarks. Furthermore, the aquatic biota in the core lakes failed to demonstrate consistent evidence of a toxicological effect. Together, this validates the conclusion that negligible changes to water quality are occurring in the core lakes.

The appropriateness of the Low Action Levels developed for the AEMP were evaluated again this year. Factors that may account for Action Level exceedances representing false positive triggers will be discussed in the follow up 2017 AEMP Annual Report, and recommendations will be provided for refining Action Levels to achieve an appropriate level of sensitivity to environmental

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change. The Aquatic Effects Re-evaluation Report and the AEMP Design Plan update will provide an opportunity to re-evaluate the Action Levels for the AEMP.

Should you have any questions, comments, or require further clarification, please contact me by email [Sarah.McLean@debeersgroup.com](mailto:Sarah.McLean@debeersgroup.com) or by phone at 867-688-9227.

Sincerely,

A handwritten signature in blue ink that reads "Sarah McLean".

Sarah McLean  
Environment and Permitting Manager  
De Beers Canada Inc.

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