

# DE BEERS

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August 3 2018

Dear Ms. Love:

**Re: Undertakings resulting from Public Hearing – Responses (File MV2005C0032, MV2005L2-0015)**

De Beers Canada Inc. (De Beers) is pleased to provide responses to the three Undertakings that arose from the Public Hearing held July 25, 2018. The following outlines the Undertakings as outlined in a letter from the Board entitled Undertakings Resulting and Public Hearings – Responses Required dated July 26, 2018 and De Beers' responses.

## **UNDERTAKING ID: 1**

**Topic:** Effluent quality criteria for total cadmium for Lake N11 and Area 8

**Comment:** De Beers undertakes to evaluate the need for cadmium effluent quality criteria for discharges to Lake N11 and Area 8 based on the application of the CCME guideline for the protection of aquatic life for cadmium.

## **Proponent Response:**

### **Chronic Site-specific Water Quality Objective for Total Cadmium**

As discussed at the public hearing, the hardness-dependent Canadian Council of Ministers of the Environment (CCME) water quality guideline (WQG) for the protection of aquatic life was adopted as the chronic site-specific water quality objective (SSWQO) for total cadmium for Lake N11 and Area 8 (as opposed to the Health Canada drinking water guideline that was presented in the EQC Report [De Beers 2018]). The SSWQO were calculated at baseline hardness concentrations of 9 milligrams per litre as calcium carbonate (mg/L as CaCO<sub>3</sub>) and 14 mg/L as CaCO<sub>3</sub> (i.e., mean + 2 standard deviations) in Lake N11 and Area 8, respectively. When the hardness concentration is greater than 0 mg/L as CaCO<sub>3</sub> and less than 17 mg/L as CaCO<sub>3</sub>, the WQG is 0.00004 mg/L (CCME 2014). Therefore, the chronic SSWQO for total cadmium was set to 0.00004 mg/L in Lake N11 and Area 8.

### **Screening Process to Identify Whether Total Cadmium is a Parameter of Potential Concern**

The screening process to identify whether total cadmium was identified as a parameter of potential concern (POPC) was identical to the screening process described in the EQC Report (De Beers 2018), included as Attachment 3 to the Water Licence amendment application. The screening process involved three comparisons:

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1. Projected discharge concentrations were compared to baseline concentrations, to identify if the potential exists for concentrations to increase above baseline given the Water Management Pond (WMP) discharge to Lake N11 and the Area 7 discharge to Area 8.
2. Projected discharge concentrations were compared to SSWQO, to identify the potential for negative effects to aquatic life from the WMP discharge to Lake N11 and the Area 7 discharge to Area 8.
3. Projected concentrations at the edge of the mixing zone in Lake N11 and Area 8 were compared to baseline concentrations, to identify if the potential exists for concentrations to increase above baseline following mixing of the WMP discharge and the Area 7 discharge into the initial dilution zones within Lake N11 and Area 8, respectively.

### Screening Step 1: Comparison of Projected Discharge Concentrations to Baseline Concentrations

Tables 1-1 and 1-2 provide comparisons of the projected WMP discharge concentrations and Area 7 discharge concentrations for total cadmium to the baseline concentrations in Lake N11 and Area 8 minus 10%, respectively. If the projected discharge concentration to either Lake N11 or Area 8 was greater than the baseline concentration minus 10% (i.e., indicated by a “Yes” in Tables 1-1 and 1-2), then the parameter was carried forward in the screening process.

Total cadmium was carried forward in the screening process for Lake N11 and Area 8.

**Table 1-1 Lake N11: Comparison of Projected Maximum Water Management Pond Discharge Concentrations up to and Including 2020 to Baseline Concentrations**

Parameters	Units	Projected Maximum WMP Discharge Concentrations in 2020 <sup>(a)</sup>	Lake N11 Baseline Concentrations		Are Projected Maximum Discharge Concentrations > Baseline Concentrations in Lake N11 Minus 10% (Yes/No)?
			Mean Concentration + 2SD <sup>(b)</sup>	Mean Concentration + 2SD Minus 10% <sup>(c)</sup>	
<b>Total Metals</b>					
Cadmium	mg/L	0.000042	0.000033	0.00003	<b>Yes</b>

Note: Bolded “Yes” indicates the parameter was carried forward in the screening process.

(a) Refers to projected maximum concentrations in the discharge from the WMP in 2020 (Attachment 2, Appendix C of the 2018 Water Licence Amendment Application).

(b) Refers to the baseline concentrations from Lake N11, represented by the mean + two standard deviations.

(c) Refers to baseline concentrations from Lake N11 minus 10 percent (%).

mg/L = milligrams per litre; SD = standard deviation; > = greater than; % = percent.

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**Table 1-2 Area 8: Comparison of Projected Maximum Area 7 Discharge Concentrations to Baseline Concentrations**

Parameters	Units	Projected Maximum Area 7 Discharge Concentrations <sup>(a)</sup>	Area 8 Baseline Concentrations		Are Projected Maximum Discharge Concentrations > Baseline Concentrations in Area 8 Minus 10% (Yes/No)?
			Mean Concentration + 2SD <sup>(b)</sup>	Mean Concentration + 2SD Minus 10% <sup>(c)</sup>	
<b>Total Metals</b>					
Cadmium	mg/L	0.00004	0.000023	0.000021	<b>Yes</b>

Note: Bolded "Yes" indicates the parameter was carried forward in the screening process.

(a) Refers to projected maximum concentrations in the discharge from Area 7 in 2027 (Attachment 2, Appendix C of the 2018 Water Licence Amendment Application).

(b) Refers to the baseline concentrations from Area 8, represented by the mean + two standard deviations.

(c) Refers to baseline concentrations from Area 8 minus 10 percent (%).

mg/L = milligrams per litre; SD = standard deviation; > = greater than; % = percent.

### Screening Step 2: Comparing Discharge Concentrations to Site-specific Water Quality Objectives

Tables 1-3 and 1-4 provide comparisons of the projected WMP discharge concentrations and the projected Area 7 discharge concentrations for total cadmium to the applicable SSWQO for Lake N11 and Area 8 minus 10%, respectively. If the projected discharge concentration was greater than the SSWQO minus 10% (i.e., indicated by a "Yes" in Tables 1-3 and 1-4), then the parameter was carried forward in the screening process.

Total cadmium was carried forward in the screening process for Lake N11 and Area 8.

**Table 1-3 Lake N11: Comparison of Projected Maximum Water Management Pond Discharge Concentrations up to and Including 2020 to Site-specific Water Quality Objectives**

Parameters	Units	Projected Maximum WMP Discharge Concentrations in Year 4 <sup>(a)</sup>	Site-specific Water Quality Objective for Lake N11 <sup>(b)</sup>	Site-specific Water Quality Objective Minus 10% <sup>(c)</sup>	Are Projected Maximum Discharge Concentrations > SSWQO Minus 10% (Yes/No)?
<b>Total Metals</b>					
Cadmium	mg/L	0.000042	0.00004	0.000036	<b>Yes</b>

Note: Bolded "Yes" indicates the parameter was carried forward in the screening process.

(a) Refers to projected maximum concentrations in the discharge from the WMP in 2020 (Attachment 2, Appendix C of the 2018 Water Licence Amendment Application).

(b) Refers to the SSWQO for Lake N11.

(c) Refers to the SSWQO for Lake N11 minus 10 percent (%).

mg/L = milligrams per litre; > = greater than; % = percent.

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**Table 1-4 Area 8: Comparison of Projected Maximum Area 7 Discharge Concentrations to Site-specific Water Quality Objectives**

Parameters	Units	Projected Maximum Area 7 Discharge Concentrations <sup>(a)</sup>	Site-specific Water Quality Objective for Area 8 <sup>(b)</sup>	Site-specific Water Quality Objective Minus 10% <sup>(c)</sup>	Are Projected Maximum Discharge Concentrations > SSWQO Minus 10% (Yes/No)?
<b>Total Metals</b>					
Cadmium	mg/L	0.00004	0.00004	0.000036	<b>Yes</b>

Note: Bolded "Yes" indicates the parameter was carried forward in the screening process.

(a) Refers to projected maximum concentrations in the discharge from Area 7 in 2027 (Attachment 2, Appendix C of the 2018 Water Licence Amendment Application).

(b) Refers to the SSWQO for Area 8.

(c) Refers to the SSWQO for Area 8 minus 10 percent (%).

mg/L = milligrams per litre; SSWQO = site-specific water quality objective; > = greater than; % = percent.

### Screening Step 3: Comparing Projected Concentrations at the Edge of the Mixing Zone to Baseline Concentrations

Tables 1-5 and 1-6 provide comparisons of projected concentrations at the edge of the mixing zone for total cadmium in Lake N11 and Area 8 to baseline concentrations minus 10%, respectively. Parameters with concentrations at the edge of the mixing zone greater than baseline concentrations minus 10% (indicated by a "Yes" in Tables 1-5 and 1-6) were considered POPC.

Total cadmium was identified as a POPC in Lake N11 and Area 8.

**Table 1-5 Lake N11: Comparison of Projected Maximum Concentrations at the Edge of the Mixing Zone to Baseline Concentrations**

Parameters	Units	Projected Maximum Concentrations at the Edge of the Mixing Zone <sup>(a)</sup>	Lake N11 Baseline Concentrations		Are Projected Maximum Concentrations at the Edge of the Mixing Zone > Baseline Concentrations in Lake N11 Minus 10% (Yes/No)?
			Mean Concentration + 2SD <sup>(b)</sup>	Mean Concentration + 2SD Minus 10% <sup>(c)</sup>	
<b>Total Metals</b>					
Cadmium	mg/L	0.000032	0.000033	0.00003	<b>Yes</b>

Note: Bolded "Yes" indicates the parameter is a POPC.

(a) Refers to projected maximum concentrations at the edge of the mixing zone in Lake N11.

(b) Refers to the baseline concentrations from Lake N11, represented by the mean + two standard deviations.

(c) Refers to baseline concentrations from Lake N11 minus 10 percent (%).

mg/L = milligrams per litre; POPC = parameter of potential concern; SD = standard deviation; > = greater than; % = percent.

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**Table 1-6 Area 8: Comparison of Projected Maximum Concentrations at the Edge of the Mixing Zone to Baseline Concentrations**

Parameters	Units	Projected Maximum Concentrations at the Edge of the Mixing Zone <sup>(a)</sup>	Area 8 Baseline Concentrations		Are Projected Maximum Concentrations at the Edge of the Mixing Zone > Baseline Concentrations in Area 8 Minus 10% (Yes/No)?
			Mean Concentration + 2SD <sup>(b)</sup>	Mean Concentration + 2SD Minus 10% <sup>(c)</sup>	
<b>Total Metals</b>					
Cadmium	mg/L	0.00004	0.000023	0.000021	<b>Yes</b>

Note: Bolded “Yes” indicates the parameter is a POPC.

(a) Refers to projected maximum concentrations at the edge of the mixing zone in Area 8.

(b) Refers to the baseline concentrations from Area 8, represented by the mean + two standard deviations (SD) (Appendix A).

(c) Refers to baseline concentrations from Area 8 minus 10 percent (%).

mg/L = milligrams per litre; N = nitrogen; POPC = parameter of potential concern; SD = standard deviation; > = greater than; % = percent.

As described in Section 8.II.2.4.1 of the Appendix 8.II of the EIS Supplement (De Beers 2012), data from 1998 to 2011 were used to develop a Kennady Lake basin-wide average water quality, which was then used as the model input to represent drainage from natural areas and initial conditions in Kennady Lake, including Area 8. For total cadmium, the majority of the data collected between 1998 and 2011 in Kennady Lake were reported as below detection limits. The minimum detection limit was <0.00002 mg/L. As a result, drainage from natural areas was initially assigned a total cadmium concentration of 0.00002 mg/L. Because total cadmium was identified as a POPC, the total cadmium source term for natural runoff to Area 8 was updated so that concentrations of total cadmium in Area 8 more closely aligned with monitoring data in 2017. In 2017, the majority of total cadmium concentrations in Area 8 were reported as below a lower detection limit of <0.000005 mg/L. Because the detection limit in 2017 had decreased, drainage from natural areas was assigned a concentration of 0.000005 mg/L. As a result, the maximum concentration at the edge of the mixing zone was projected to decrease from 0.000054 mg/L (EQC Report; De Beers 2018) to 0.00004 mg/L (Table 1-6).

### Effluent Quality Criteria for Total Cadmium

Effluent quality criteria (EQC) for total cadmium were calculated using the methods described in the EQC Report (De Beers 2018) included as Attachment 3 to the Water Licence amendment application. Tables 1-7 and 1-8 provide the recommended EQC for the discharge from the WMP to Lake N11 and the discharge from Area 7 to Area 8 for total cadmium. The calculated EQC are achievable based on projected WMP discharge concentrations (Figure 1-1) and projected Area 7 discharge concentrations (Figure 1-2).

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**Table 1-7 Recommended Effluent Quality Criteria for the Water Management Pond Discharge to Lake N11 for Total Cadmium**

POPC	Maximum Average Concentration	Maximum Grab Concentration
<b>Total Metals</b>		
Cadmium (mg/L)	0.00008	0.00016

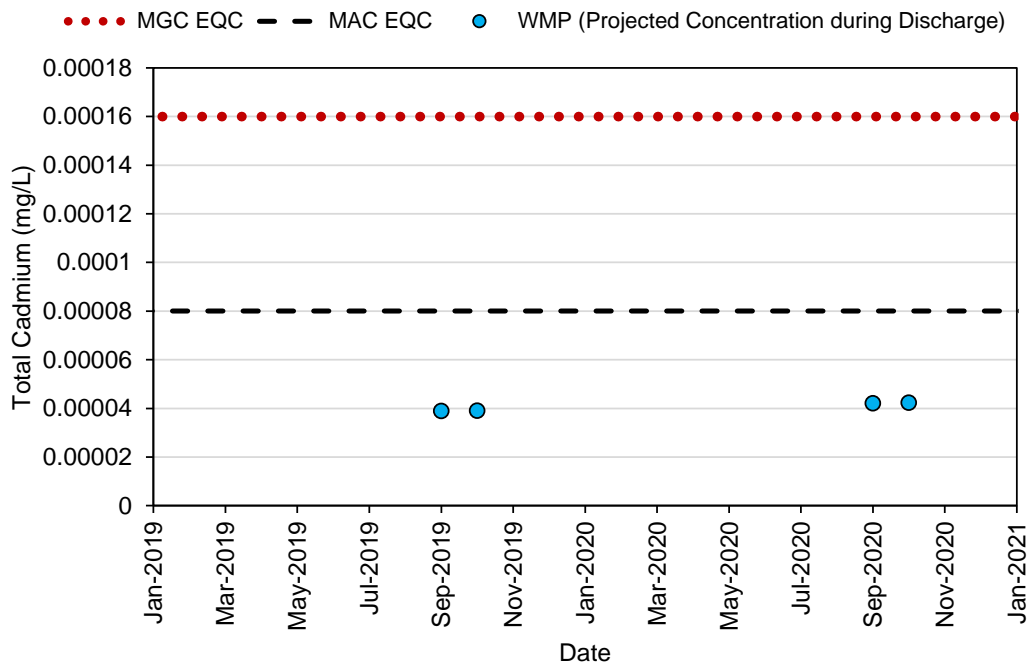
mg/L = milligrams per litre; POPC = parameters of potential concern.

**Table 1-8 Recommended Effluent Quality Criteria for the Area 7 Discharge to Area 8 for Total Cadmium**

POPC	Maximum Average Concentration	Maximum Grab Concentration
<b>Total Metals</b>		
Cadmium (mg/L)	0.00004	0.00008

mg/L = milligrams per litre; POPC = parameters of potential concern.

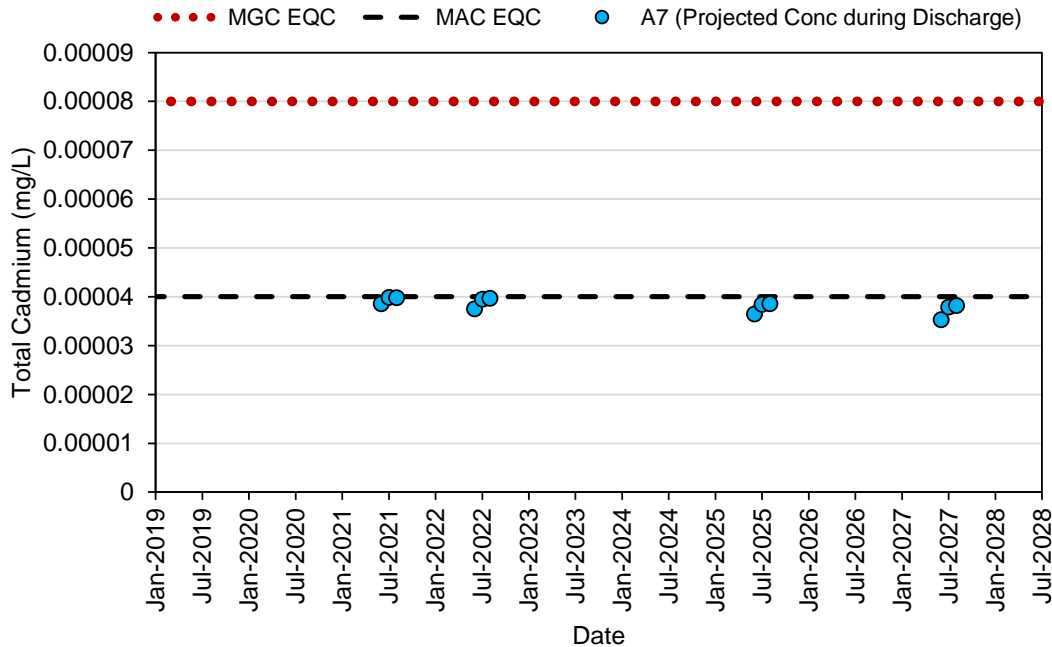
**Figure 1-1 Comparison of Calculated Effluent Quality Criteria for Total Cadmium to Projected Water Management Pond Discharge Concentrations**



mg/L = milligrams per litre; EQC = effluent quality criteria; MGC = maximum grab concentration; MAC = maximum average concentration; WMP = water management pond.

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**Figure 1-2 Comparison of Calculated Effluent Quality Criteria for Total Cadmium to Projected Area 7 Discharge Concentrations**



mg/L = milligrams per litre; EQC = effluent quality criteria; MGC = maximum grab concentration; MAC = maximum average concentration; A7 = Area 7.

**UNDERTAKING ID: 2**

**Topic:** Effluent quality criteria for total suspended solids

**Comment:** De Beers undertakes to provide evidence in support of the request, per s.4.2 of De Beers’ 2018 EQC Report, to increase the total suspended sediment (TSS) EQC for discharge to Area 8 from the current values of 6 mg/L and 12 mg/L for maximum average and maximum grab concentrations to values of 15 mg/L and 25 mg/L, respectively.

**Proponent Response:**

In Version 2 of the EQC Report (De Beers 2014) for the Gahcho Kué Mine, De Beers proposed total suspended solids (TSS) maximum average concentration and maximum grab concentration effluent quality criteria (EQC) of 15 milligrams per litre (mg/L) and 25 mg/L, respectively, for the discharge to Lake N11 and the discharge to Area 8. The proposed EQC for TSS were based on best available technology.

In the Reasons for Decision for the Land Use Permit (MV2005C0032) and Water Licence (MV2005L2-0015) applications for the Mine (MVLWB 2014), the Mackenzie Valley Land and Water Board (MVLWB) calculated EQC for TSS based on water quality based EQC derivation methods described in Section 3 of

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Version 2 of the EQC Report (De Beers 2014). As a result, for Area 8, the maximum average concentration was reduced from 15 mg/L to 6 mg/L and the maximum grab concentration was reduced from 25 mg/L to 12 mg/L.

In the EQC Report (De Beers 2018), included as Attachment 3 to the Water Licence amendment application, De Beers is again proposing maximum average concentration and maximum grab concentration EQC for TSS of 15 mg/L and 25 mg/L for the discharge from Area 7 to Area 8 because:

- TSS do not behave conservatively in a waterbody; for example, TSS will settle from the water column. As a result, the concentrations calculated using the methods described in Section 3 of the EQC Report (De Beers 2014, 2018) are lower than the concentrations that could be discharged to a waterbody and still meet the site-specific water quality objective. The methods described in Section 3 of the EQC Report (De Beers 2014, 2018) do not account for settling of suspended solids from the water column. As a result, De Beers did not use the methods described in Section 3 to propose EQC for TSS in the Water Licence amendment application.
- The proposed EQC for TSS are consistent with other Water Licences in the Northwest Territories (i.e., the Diavik Mine [W2015L2-0001] and the Ekati Mine [W2012L2-0001 - Amendment #5]) for any Mine water or waste that enters the Receiving Environment.
- The proposed EQC for TSS are consistent with or lower than Metal and Diamond Mining Effluent Regulations for TSS (Maximum Authorized Monthly Mean Concentration = 15 mg/L, and the Maximum Authorized Concentration in a Grab Sample = 30 mg/L; Government of Canada 2018).

The proposed EQC are therefore expected to remain protective of the receiving environment.

## **UNDERTAKING ID: 3**

**Topic:** Area 7 definition

**Comment:** De Beers undertakes to provide the Board with draft wording for the definition of “Area 7.”

### **Proponent Response:**

Area 7 is the portion of the former Kennady Lake between Dyke A and Dyke K within the Controlled Area. It receives run off from the adjacent watershed and may receive pumped water from the water management pond and collection ponds.

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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,



Sarah McLean,  
Environment and Permitting Manager  
De Beers Canada Inc.

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## References

- CCME (Canadian Council of Ministers of the Environment). 2014. Canadian water quality guidelines for the protection of aquatic life: Cadmium. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg, MB, Canada.
- De Beers (De Beers Canada Inc.). 2012. Environmental Impact Statement Supplemental Information Submission for the Gahcho Kué Project. Prepared for the Mackenzie Valley Environmental Impact Review Board, Yellowknife, NWT, Canada. April 2012.
- De Beers. 2014. Effluent Quality Criteria Report. Prepared for the Mackenzie Valley Land and Water Board. Yellowknife, NT, Canada. April 2014.
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- Government of Canada, 2018. Regulations Amending the Metal Mining Effluent Regulations. Department of the Environment. Canada Gazette Part II. Extract Vol. 152, No. 11. Ottawa. Published by the Queen's Printer for Canada, 2018.

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