Review Comment Table

Board:	MVLWB
Review Item:	De Beers Gahcho Kue - March 2018 Amendment Applications - Geotechnical (MV2005L2-0015 and MV2005C0032)
File(s):	MV2005C0032 MV2005L2-0015
Proponent:	De Beers Canada Inc - Gahcho Kue
Document(s):	Application and Forms (1023.6 kB) Updated Project Description (9.8 MB) Environmental Screening Assessment (18.7 MB) Mine Rock Management Alternatives Analysis (12.6 MB) Effluent Quality Criteria Report (462.4 kB) Final Detailed Construction Plan West Mine Rock Pile V.2 (27.7 MB) Geochemical Characterization and Management Plan V.4 (2.4 MB) Groundwater Monitoring Program V.4 (2.2 MB) Operational Water Management Plan V.5 (23.6 MB) Processed Kimberlite and Waste Rock Management Plan V.6 (9.2 MB) Last Preliminary Screening Report Conducted by the Board - June 7, 2017 (484.6 kB) Update to Amendment Application - Water Intake Volume Change request (90 KB) March and May 2018 Amendments - Technical Session Agenda (163 KB)
Item For Review Distributed On:	Apr 3 at 16:09 Distribution List
Reviewer Comments Due By:	May 7, 2018
Proponent Responses Due By:	May 21, 2018
Item Description:	**May 23 Update** - Board staff have released the Technical Session Agenda for both the March and May 2018 Amendments and is attached. _____ **May 1 Update** - Please note that an additional document has been added to the review. This document/letter is listed below and is titled "Update to Amendment Application - Water Intake Volume Change request." This letter outlines that De Beers respectfully requests to change the annual volume of camp intake water from 35,000 m3 requested within this Water Licence Amendment Application to 45,000 m3. _____ **April 13 Update -** Please note that the deadline to submit comments on the amendment applications has been extended to May 7, 2018 with responses now due May 14, 2018 to reflect the Boards decision of May 12, 2018 to invoke paragraph 22(2)(b) of the Mackenzie Valley Land Use Regulations. **April 3 -** De Beers Canada Inc. (De Beers) has submitted a request to amend Land Use Permit (Permit) MV2005C0032 and Water Licence (Licence) MV2005L2-0015. De Beers is requesting to amend: Under Permit MV2005C0032: • Part B: **Definitions - Project** • Part C: **Condition 58a** Under Licence MV2005L2-0015 • Part A: Scope and Definitions: **1a)** • Part A: Scope and Definitions: **2. Definitions - Modification**

	• Part A: Scope and Definitions: **2. Definitions - Project** • Part G: **Condition 29**: Effluent Quality Criteria - Lake N11 and Area 8 • Part G: **Condition 30**: Effluent Quality Criteria - Lake N11 and Area 8 • Part G: **Condition 31**: Effluent Quality Criteria - Lake N11 and Area 8 • **Schedule 3 Part D: Water Use: Item 1b** • **Schedule 3 Part D: Water Use: Item 2b** Reviewers are invited to submit questions, comments, recommendations, and notices of application for water compensation, using the Online Review System (ORS) by the review comment deadline specified below. Please provide comments and recommendations on the: • Amendment Request (Application and Forms); • Updated Project Description; • Environmental Screening Assessment (includes the Engagement Log and Record); • Mine Rock Management Detailed Alternatives Analysis; • Effluent Quality Criteria Report; • Final Detailed Construction Plan - West Mine Rock Pile V.2; • Geochemical Characterization and Management Plan V.4; • Groundwater Monitoring Program V.4; • Operational Water Management Plan V.5; • Processed Kimberlite and Waste Rock Management Plan V.6; and • Last Preliminary Screening Conducted by the Board - June 7, 2017. (Your comments and recommendations on impacts and proposed mitigation measures will be used to help the Board make a preliminary screening decision. Please see below for additional information). Under the Preliminary Screening Requirement Regulations of the Mackenzie Valley Resource Management Act (MVRMA), the Board must conduct a preliminary screening for an amendment request, unless it is exempt from Part 5 of the MVRMA. Reviewers are encouraged to provide comments and recommendations (e.g. on impacts and mitigation measures) to assist with the completion of the preliminary screening. The most recent preliminary screening that was approved by the Board is located under Document(s) below. Board staff are proposing the following dates related to the regulatory process. Please ensure you provide comments/recommendations on these as well: • Technical Session - May 24, 2018 (in Yellowknife) • Pre-hearing Conference - June 11, 2018 • Deadline for Interventions - June 21, 2018 • Proponent response to Interventions - June 28, 2018 • Public Hearing - July 25-26, 2018 (in Yellowknife) 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.
General Reviewer Information:	In addition to the email distribution list, the following organizations received review materials by fax: Hay River Metis Council - Trevor Beck, President (867) 874-4472; hrmc@northwestel.net NWT Metis Nation - Tim Heron, NWTMN IMA Coordinator (867) 872-3586; rcc.nwtmn@northwestel.net
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Comment Summary

De Beers Canada Inc - Gahcho Kue (Proponent)				
ID	**Topic**	**Reviewer Comment/Recommendation**	**Proponent Response**	**Board Staff Analysis**
1	General File	**Comment** (doc) MV2005L2-0015 Mine Rock Amendment #1 _Proponent Responses Supporting Document Comment Attachment **Recommendation**		
2	General File	**Comment** (doc) MV2005L2-0015 Mine Rock Amendment #1 _Proponent Responses Supporting Document Figure 2-2 **Recommendation**		
3	General File	**Comment** (doc) MV2005L2-0015 Mine Rock Amendment #1 _Proponent Responses Supporting Document GK_Groundwater Monitoring Program V.4 March 2018_Figures 4_5 **Recommendation**		
4	General File	**Comment** (doc) MV2005L2-0015 Mine Rock Amendment #1 _Proponent Responses Supporting Document MVLWB-16_Lake_N11_Mass_Balance_Example_Calculation **Recommendation**		
5	General File	**Comment** (doc) MV2005L2-0015 Mine Rock Amendment #1_ Proponent Responses MVLWB-17_Edge_Of_Mixing_Zone_Example_Calculation **Recommendation**		
6	General File	**Comment** (doc) MV2005L2-0015 Mine Rock Amendment #1_ Proponent Respones WLA_Footprint_2018Proposed_Shapefile **Recommendation**		

Environment and Climate Change Canada: Melissa Pinto				
ID	**Topic**	**Reviewer Comment/Recommendation**	**Proponent Response**	**Board Staff Analysis**
1	General File	**Comment** (doc) ECCC Cover Letter **Recommendation**		
2	Amendment Application - Table 2 Part A: Scope and Definitions 1a) and 2. Definitions - Project, pdf pg. 5-6	**Comment** Errata: In both places the rationale for the change to the water licence refers instead to the land use permit: "The land use permit must cover the adjustments made to the mine plan as described in the UPD 2018". **Recommendation** ECCC recommends that the Proponent clarify the rationale for the change to Scope and Definitions 1a) and 2. Definitions - Project.	**May 21:** There was a typo in the letter. The statements in the rationale for Item Part A, scope and definitions 1a. and 2. should have both referenced the water licence, not the land use permit.	

3	Amendment Application - Table 2 Part G: Effluent Quality Criteria - Lake N11 and Area 8 Item 30, pdf pg. 7	**Comment** De Beers Canada Inc. (the Proponent) requests changes in the regulated discharge concentrations in effluent from the Water Management Pond (WMP) going to Lake N11. Increases have been requested for chloride, nitrate, aluminum, chromium, copper and iron. Reductions in discharge limits are proposed for sulphate, ammonia, and Total Phosphorus (TP). Molybdenum, nickel and uranium have been removed. Faecal Coliforms have been added. The revised table should specify total forms for the metals, and remove the units from the headers of the second and third columns as they are specified for each parameter. **Recommendation** ECCC recommends that table format edits should be done to specify total forms for the metals, and remove the units from the headers of the second and third columns as they are specified for each parameter.	**May 21:** The edits recommended by ECCC have been made and the table has been reproduced below (Table ECCC-3.1). Faecal coliforms have been removed from the table because of a typographical error in the plain language summary of the Effluent Quality Criteria (EQC) Report where faecal coliforms were inadvertently added to this section but are not in the main body of the report. De Beers does not want to propose EQC for faecal coliforms in the discharge from the water management pond (WMP) to Lake N11 or the discharge from Area 7 to Area 8. The Water Licence for the Mine has a maximum grab concentration (MGC) EQC for faecal coliforms of 20 CFU/100 mL. The MGC EQC is applied to the effluent from the sewage treatment (STP), which is the only source of faecal coliforms to the WMP from the Mine. It is proposed that the same EQC continue to be applied to the discharge from the STP to the WMP. Table ECCC-3.1: Effluent Quality Criteria for the Discharge from the Water Management Pond to Lake N11 at SNP Station 02	
4	Amendment Application - Table 2 Part G: Effluent Quality Criteria - Lake N11 and Area 8 Item 31, pdf pg. 8-9 Effluent Quality Criteria Report Section 1.1, pg. 2	**Comment** The Proponent is requesting to regulate discharge from Area 7 rather than the WMP, for discharges to Area 8. The proposed effluent quality criteria (EQC) for discharges from Area 7 to Area 8 include Cu, Faecal Coliforms, Total Suspended Solids (TSS), and Total Petroleum Hydrocarbons (TPH). Increasing the Area 7 parameter list from the proposed parameters of Cu, TSS, pH, Faecal Coliforms, and TPH to the existing EQC parameters for discharges from the WMP to Area 8 would allow for a confirmation of predicted effluent quality. The Proponent proposes this limited list, stating that there will be no contributions from the WMP. Area 7 receives runoff from disturbed surface areas, as well as from contact water in the drainage collection system from the South Waste Rock Pile and from run off from the mine stockpile pad. Area 7 is also located downwind of the open pits, and it may receive dust and blasting residues. In addition, Section 1.1 of the EQC Report states that water from the WMP will not be used for Area 8 downstream flow mitigation for the remainder of operations. However, it goes on to state that water from the WMP may be stored in Area 7 as a contingency measure, which would potentially introduce a broader suite of contaminants into Area 7 waters. **Recommendation** ECCC recommends retaining the current EQC parameter list for discharges from Area 7.	**May 21:** The Area 7 water quality modelling accounted for changes in parameter concentrations as a result of natural watershed runoff, drainage from the South Mine Rock Pile, and ROM stockpile pad. As described in the Effluent Quality Criteria (EQC) Report, total copper was identified as the only parameter that required EQC for the discharge from Area 7 to Area 8 for downstream flow mitigation. If water from the water management pond (WMP) is stored in Area 7 as a contingency measure, water in Area 7 would not be pumped to Area 8 for downstream flow mitigation. De Beers would either pump the water in Area 7 back to the WMP or to the bottom of a pit. If De Beers stored water from the WMP in Area 7 and then wanted to discharge that water from Area 7 to Area 8 for downstream flow mitigation, an EQC re-evaluation report would be prepared and submitted to the Mackenzie Valley Land and Water Board.	
5	Effluent Quality Criteria Report Table 2-2 and Table 2-7, pg. 8, 16	**Comment** Table 2-2 provides the chronic site-specific water quality objectives (SSWQOs) for Lake N-11. Cadmium is proposed to be 0.005 mg/L as a background water quality objective, based on the Health Canada drinking water guideline, which is a 100-fold times higher than	**May 21:** The site-specific water quality objective (SSWQO) for total cadmium is the same as the SSWQO identified in the Reasons for Decision for the Land Use Permit (MV2005C0032) and Water Licence (MV2005L2-0015)	

		the Canadian Council of Ministers of the Environment (CCME) long-term guideline for the protection of aquatic life. However, predictions in Table 2-7 indicate that discharges will be at approximately the CCME guideline, and edge of mixing zone will be below. Therefore, it is not clear why the Health Canada drinking water guideline is proposed rather than the CCME guideline. **Recommendation** ECCC recommends that the Proponent provide rationale for using the Health Canada Drinking Water Guideline as an objective, rather than the CCME protection of aquatic life guideline.	applications for the Mine (MVLWB 2014). At the time, the Mackenzie Valley Land and Water Board (MVLWB) adopted the Health Canada drinking water guideline for total cadmium of 0.005 mg/L even though De Beers proposed a lower SSWQO for total cadmium (De Beers 2014). The MVLWB concluded that the SSWQO that were adopted for the Mine are "protective of the designated water uses in Lake N11 and Area 8 as well as downstream areas during operations and that these SSWQO satisfy the intent of Suggestion 1 of EIR 0607-001". As a result, De Beers maintained the SSWQO for total cadmium of 0.005 mg/L in the amendment application. References: De Beers (De Beers Canada Inc.). 2014. Effluent Quality Criteria Report. Prepared for the Mackenzie Valley Land and Water Board. Yellowknife, NT, Canada. April 2014. MVLWB (Mackenzie Valley Land and Water Board). 2014. Reasons for Decision. Land Use Permit & Water Licence Applications. De Beers Canada Inc. Gahcho Kué Project - Kennady Lake, NT. File: MV2005L2-0015/MV2005C0032. August 11, 2014.	
6	Effluent Quality Criteria Report Table 2-2, pg. 7-8	**Comment** Hardness values used to calculate SSWQO for sulphate, copper and nickel were the baseline hardness of 9 mg/L for Lake N11. Using the baseline hardness is a conservative approach. However, the nitrate guideline was calculated using the projected whole lake average hardness in Lake N11 which ranged from 27 to 126 mg/L. As hardness in the lake is the same for all parameters, a consistent approach to calculating SSWQO should be used. **Recommendation** ECCC recommends that the Proponent clarify the inconsistency in the approach to calculating hardness-adjusted SSWQO for Lake N11.	**May 21:** When identifying parameters of potential concern (POPC) in the discharge from the water management pond (WMP) to Lake N11, De Beers applied site-specific water quality objectives (SSWQO) that were approved in the Reasons for Decision for the Land Use Permit (MV2005C0032) and Water Licence (MV2005L2-0015) applications for the Mine (MVLWB 2014). These SSWQO included hardness-dependent SSWQO calculated using the baseline hardness concentration in Lake N11 for sulphate, copper, and nickel and the CCME water quality guideline (WQG) of 2.93 mg N/L for nitrate. These SSWQO are presented in Table 2-2 of the Effluent Quality Criteria (EQC) Report. As noted by ECCC, Table 2-2 of the EQC Report also contains a hardness-dependent SSWQO for nitrate that was calculated using the projected whole-lake average hardness concentrations in Lake N11. Based on updated projected water quality concentrations in the WMP (Attachment 2, Appendix C of the 2018 Water Licence Amendment Application), the EQC calculated using the CCME WQG and the hardness-dependent SSWQO with a baseline hardness concentration in Lake N11 are not projected to be reasonably and consistently achievable for the proposed discharge from the WMP to Lake N11 in Years 3 and 4 of operations. These results were consistent with Version 2 of the EQC report that was prepared for the original Water Licence application for	

			the Gahcho Kué Mine (De Beers 2014). As a result, in this version of the EQC Report for the Water Licence amendment application, De Beers calculated the hardness-dependent SSWQO for nitrate using the projected whole-lake average hardness concentrations in Lake N11 because this method resulted in EQC that are reasonably and consistently achievable for the Mine. Predicted hardness in Lake N11 was used to derive the chronic SSWQO for nitrate rather than baseline hardness, because it represents the hardness concentrations to which aquatic life will be exposed. The use of ambient hardness for calculating hardness-dependent SSWQO was approved by the Wek'e`ezhi`i Land and Water Board for the Ekati Mine (W2012L2-0001; WLWB 2017) and the Mackenzie Valley Review Board for the Snap Lake Mine (MV2011L2-0004; MVEIRB 2014). Using the projected whole-lake average hardness concentrations in Lake N11 to derive EQC for sulphate and copper was not necessary because the EQC calculated using a baseline hardness concentration in Lake N11 for sulphate and copper produced results that were reasonably and consistently achievable for the proposed discharge from the WMP to Lake N11. References: De Beers (De Beers Canada Inc.). 2014. Effluent Quality Criteria Report. Prepared for the Mackenzie Valley Land and Water Board. Yellowknife, NT, Canada. April 2014. 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. WLWB (Wek'èezhìi Land and Water Board). 2017. Water Licence W2012L2-0001 for the Ekati Diamond Mine (amendment to include Ekati Jay Project), Yellowknife, NWT, Canada.	
7	Effluent Quality Criteria Report Table 2-8, pg. 16-18	**Comment** Table 2-8 presents the maximum concentrations predicted at the edge of the mixing zone in Area 8. Total dissolved solids (TDS), major ions, NO3, NH3, and TP, plus Sb, As, Cd, Cr, Cu, Fe, Pb, Mn, Se, Sr, Tl and Zn are shown as increasing in concentrations in the fully mixed Area 8 average as well as at the edge of the mixing zone. Mercury is shown as staying the same after dilution. It is not clear whether this is due to the model treating all of these parameters as conservative, which would not account for dilution and outflow. Parameters do not appear to be treated consistently between N11 and Area 8. **Recommendation** ECCC recommends that the Proponent clarify the	**May 21:** Parameters have been treated consistently between Lake N11 and Area 8. Parameters have been modelled conservatively in Lake N11 and Area 8, which means that parameters do not undergo processes where settling, decay, or formation occur. The models for Lake N11 and Area 8 accounted for dilution and outflow from the lakes. Table 2-8 only shows the projected maximum concentration in the discharge from Area 7 to Area 8, the projected maximum whole-lake average concentration in Area 8, and the projected maximum concentration at the mixing zone boundary in Area 8. The proposed discharge from Area 7 to	

		reason for apparent increase in concentrations in Area 8 above discharge concentrations, and/or between the mixing zone edge and the whole lake mixed concentrations.	Area 8 occurs during the open-water season in Years 5, 6, 9, and 11. The projected maximum whole-lake average concentration in Area 8 and the projected maximum concentration at the mixing zone boundary in Area 8 occur during the ice-cover season. Concentrations in Area 8 during the ice-cover season are greater than concentrations during the open-water season because the development of an ice cover reduces the available lake volume and mass is excluded from ice development (i.e., when ice forms, mass is rejected from the ice and remains in the lake). For some parameters, the increase in concentration in Area 8 during the ice-cover season causes concentrations to increase above the projected discharge concentrations from Area 7.	
8	Effluent Quality Criteria Report Table 2-7 and 2-8, pg. 16-18	**Comment** Lakes in the Project area are typically oligotrophic, with extremely low productivity. Nutrient loading would increase productivity, raising concerns for potential winter oxygen depletion and changes to the ecosystem. Predictions for whole-lake (fully mixed) concentrations of TP in both Lake N11 and Area 8 are at levels which represent meso-eutrophic conditions (per Wetzel 2001) or mesotrophic (CCME 2004) with increases to 13 ug/L and 12 ug/L, respectively. **Recommendation** ECCC recommends that the Proponent identify options to optimize their treatment plant to reduce phosphorus loadings in Lake N11 and Area 8.	**May 21:** De Beers does not have a treatment plant to treat the discharge from the water management pond (WMP) to Lake N11 or the discharge from Area 7 to Area 8. However, as compared to the existing water licence, the mine plan amendment application includes a reduced phosphorus EQC. The reduced phosphorus EQC has been proposed because phosphorus concentrations in the WMP thus far have been lower than were predicted in the EIS. The sewage treatment plant that treats sewage and greywater from the Mine discharges treated effluent to Area 7, which will eventually be added to the fine PK slurry pipeline. De Beers will continue to evaluate and optimize the sewage treatment plant for performance and effluent quality.	
9	Effluent Quality Criteria Report Section 2.4.1, pg. 22	**Comment** Page 22 lists parameters with discharge concentrations predicted to be below the screening threshold. Because many of these are conservative, and are predicted to accumulate in Area 8, screening them out at this stage may not be the most protective approach. **Recommendation** ECCC recommends that the Proponent identify the potential for parameters which behave conservatively in the receiving environment to reach elevated concentrations in Area 8.	**May 21:** As described in response to ECCC-7, all parameters have been modelled conservatively in Lake N11 and Area 8, which means that parameters do not undergo processes where settling, decay, or formation occur. The models for Lake N11 and Area 8 accounted for inflows to the lakes, dilution within the lakes, and outflow from the lakes. Table 2-8 presents the projected maximum whole-lake average concentrations in Area 8 . The first screening step in the process to identify parameters of potential concern (POPC), which is described in Section 2.4.1 of the EQC Report, compares projected WMP and Area 7 concentrations to baseline concentrations in Lake N11 and Area 8, respectively. If projected WMP and Area 7 concentrations are less than baseline concentrations in the receiving environment, then changes to parameter concentrations in the receiving environment would not be expected to be distinguishable from baseline concentrations. The first screening step is protective of the receiving environment because it retains	

			parameters in the screening process that have discharge-source concentrations that are greater than baseline concentrations in the receiving environment.	
10	Effluent Quality Criteria Report Table 2-13 and Section 2.4.4 Summary, pg. 30-31	**Comment** TDS was screened-in based on edge-of-mixing-zone concentrations being higher than baseline. However, the summary states that TDS was removed from the list of parameters of potential concern (POPC) in favor of developing EQC for a subset of the constituent ions (Cl, Fl, SO4) based on ecological risk through toxic effects on aquatic biota. **Recommendation** ECCC recommends that TDS be retained as a POPC based on the potential for ecological change associated with increases in TDS, and the potential for osmotic stress due to the cumulative change in TDS.	**May 21:** De Beers believes that having effluent quality criteria (EQC) for chloride, fluoride, and sulphate is sufficient to protect the downstream receiving environment. The Mine is not permitted to discharge acutely toxic effluent and the Mine has a well-established aquatics effects monitoring program to evaluate the short-term and long-term effects on the physical, chemical, and biological components of the aquatic ecosystems affected by the Gahcho Kué Mine, and to provide the necessary input for implementation of adaptive management throughout the lifespan of the project. The maximum TDS concentration in the discharge from the water management pond (WMP) to Lake N11 is projected to be approximately 700 mg/L and after dilution, maximum whole-lake average concentrations in Lake N11 are projected to be 253 mg/L. Based on the work of Chapman and McPherson (2015), TDS concentrations that resulted in negligible effects to taxa representative of resident biota in Snap Lake, ranged from greater than 1,100 mg/L to greater than 2,200 mg/L. Therefore, TDS concentrations of 700 mg/L in the discharge from the WMP to Lake N11 would not be expected to be acutely toxic and would not be expected to cause osmotic stress. Similarly, whole-lake average TDS concentrations of 253 mg/L would not be expected to be acutely toxic and would not be expected to cause osmotic stress. Reference Chapman PM and McPherson CA. 2015. Development of a Total Dissolved Solids (TDS) Chronic Effects Benchmark for a Northern Canadian Lake. Integrated Environmental Assessment and Management, 12 (2): 371-379.	
11	Effluent Quality Criteria Report Table 3-1, pg. 41 Environmental Screening Assessment Appendix C: Water Quality Model Update Table 8, pg. 17	**Comment** Acute objectives have been calculated for discharges from the WMP to Lake N11, for the purpose of evaluating end-of-pipe toxicity. Footnotes (b) and (d) provide information on calculation of Acute SSWQO concentrations. Chloride was calculated at a hardness of 267-300 mg/L; sulphate was calculated at a projected hardness of 160 mg/L as CaCO3 in the WMP, and copper was calculated at a projected hardness of between 267-364 mg/L as CaCO3 in the WMP. Table 8 in the updated Water Quality Model Report predicts WMP hardness levels ranging from 165 mg/L in the winter, to 365 mg/L during open water as maximum discharge concentrations. **Recommendation** ECCC recommends that the Proponent clarify why different hardness values were used to calculate SSWQOs from the same source, i.e. the WMP.	**May 21:** Acute site-specific water quality objectives (SSWQO) for chloride, sulphate, and copper were calculated using projected hardness concentrations during proposed periods of discharge from the water management pond (WMP) to Lake N11. In 2019 and 2020, discharge from the WMP to Lake N11 is projected to occur in September and October. In September and October 2019, hardness concentrations in the WMP are projected to be 267 and 272 mg/L as CaCO3, respectively. In September and October 2020, hardness concentrations in the WMP are projected to be 356 and 364 mg/L as CaCO3, respectively. For chloride, the acute SSWQO was calculated at projected hardness concentrations between 267 and 300 mg/L as CaCO3 because the acute	

			SSWQO equation for chloride applies between hardness concentrations of 30 and 300 mg/L as CaCO3. The minimum projected hardness concentration during periods of discharge from the WMP of 267 mg/L as CaCO3 falls within this range. The projected hardness concentrations during periods of discharge from the WMP of 356 and 364 mg/L as CaCO3 in 2020 are greater than 300 mg/L as CaCO3. At hardness concentrations greater than 300 mg/L as CaCO3, the acute SSWQO calculated at a maximum hardness concentration of 300 mg/L as CaCO3 applies. Therefore, the acute SSWQO for chloride was calculated at projected hardness concentrations between 267 and 300 mg/L as CaCO3. For sulphate, the acute SSWQO was calculated at a projected hardness concentration of 160 mg/L as CaCO3 because the acute SSWQO equation applies up to a hardness concentration of 160 mg/L as CaCO3. At hardness concentrations greater than 160 mg/L as CaCO3, the SSWQO calculated at a hardness concentration of 160 mg/L as CaCO3 applies. Hardness concentrations during proposed periods of discharge from the WMP to Lake N11 in 2019 and 2020 are projected to be greater than 160 mg/L as CaCO3. Therefore, the acute SSWQO for sulphate was calculated at a hardness concentration of 160 mg/L as CaCO3. For copper, the acute SSWQO was calculated at projected hardness concentrations between 267 and 364 mg/L as CaCO3 because the acute SSWQO equation applies between hardness concentrations of 13 and 400 mg/L as CaCO3. Hardness concentrations during proposed periods of discharge from the WMP to Lake are projected to fall within the hardness range of the acute SSWQO equation. Therefore, the acute SSWQO for copper was calculated at hardness concentrations between 267 and 364 mg/L as CaCO3. Table 8 in the Updated Water Quality Model Report presents maximum projected WMP hardness concentrations during the open water and ice cover seasons. Discharge is only proposed during the open water season. The projected maximum hardness concentration during the open water season of 364 mg/L as CaCO3 in Table 8 matches the projected maximum hardness concentration described above from October 2020.	
12	Effluent Quality Criteria Report Section 3.2.3, pg. 55 Environmental Screening Assessment	**Comment** The Proponent has requested removal of EQC for Ni, Mo and U for discharge from the WMP to Lake N11; and removal of TDS, sulphate, nitrate, total ammonia, TP, total chromium, molybdenum, nickel, and uranium EQC in the WMP discharge to Area 8. Although the predicted water quality in the WMP (Table 8, Water Quality Model	**May 21:** De Beers has developed a new list of parameters of potential concern (POPC) that require effluent quality criteria (EQC) for the third and fourth years of discharge from the water management pond (WMP) to Lake N11 as required by Part G, Condition 34 of the Water Licence, based on the	

	Appendix C: Water Quality Model Update Table 8, pg. 17-19	Update) shows low maximum concentrations of the metals, the major ions and nitrogen parameters are elevated in comparison to receiving water concentrations. Monitoring the full list of parameters would confirm whether the predictions are accurate as the model assumptions include layers of uncertainty. Ongoing monitoring for the variance in actual concentrations of the effluent quality for the four years of discharge to surface waters would provide further confidence in the Proponent's predictions. **Recommendation** ECCC recommends that the existing licence parameters and EQC for all discharges from the WMP be retained.	screening process outlined in the EQC Report. As a result, De Beers has requested removal of EQC from the Water Licence for total nickel, molybdenum, and uranium for the discharge from the WMP to Lake N11. These parameters were added to the list of POPC that require EQC in the Water Licence by the Mackenzie Valley Land and Water Board because of uncertainties in water quality model predictions (MVLWB 2014). Since the original Water Licence application was submitted, the Mine has started operations, monitoring data have been collected, and water quality model predictions have been updated. The monitoring data show that total molybdenum, nickel, and uranium concentrations in the WMP are orders of magnitude lower than the current EQC in the Water Licence and orders of magnitude lower than site-specific water quality objectives. Therefore, De Beers does not believe that total molybdenum, nickel, and uranium should be considered POPC and have requested that they be removed from the Water Licence. De Beers has also developed EQC for the discharge of water from Area 7 to Area 8 for downstream flow mitigation. The original EQC developed for Area 8 were based on the possible discharge of water from the WMP to Area 8 in Year 1 of operations for downstream flow mitigation. As the sources of water for the discharges are not the same, De Beers has requested removal of EQC for total dissolved solids, sulphate, nitrate, total phosphorus, and total chromium, molybdenum, nickel, and uranium from the Water Licence for the discharge to Area 8 because these parameters were considered POPC based on the original planned discharge from the WMP. However, water was never discharged from the WMP to Area 8 for downstream flow mitigation and water from the WMP will not be used for downstream flow mitigation for the remainder of operations. Therefore, De Beers proposed a new list of POPC that require EQC for the discharge from Area 7 to Area 8 for downstream flow mitigation. Even though a short list of parameters have EQC in the water licence, De Beers currently monitors a full suite of parameters (i.e., physical parameters, major ions and nutrients, total and dissolved metals, and hydrocarbons and volatile organic carbon) during discharge from the water management pond (WMP) to Lake N11 at SNP station 02. The full suite of parameter concentrations are presented in monthly surveillance network program reports and these reports are available on the Mackenzie Valley Land and	

			Water Board's public registry. De Beers will continue to monitor a full suite of parameters during discharge from the WMP to Lake N11 and discharge from Area 7 to Area 8 for downstream flow mitigation and report parameter concentrations in monthly surveillance network program reports. Therefore, concentrations for the full suite of parameters will be available to confirm whether model predictions are accurate. Reference: MVLWB (Mackenzie Valley Land and Water Board). 2014. Reasons for Decision. Land Use Permit & Water Licence Applications. De Beers Canada Inc. Gahcho Kué Project - Kennady Lake, NT. File: MV2005L2-0015/MV2005C0032. August 11, 2014.	
13	Environmental Screening Assessment Appendix C: Water Quality Model Update	**Comment** Tables showing water quality predictions for the WMP during operations and for post-closure Kennady Lake show TSS concentrations of 1 mg/L, which was assumed based on observed baseline data. This appears to underestimate post-disturbance TSS, and also the concentrations of contaminants which are associated with TSS particulates. The water quality modeling report does not appear to show how contributions of parameters which are associated with TSS were accounted for (e.g. aluminum, iron). Additionally, the derivation of total (vs. dissolved) metals is typically done using a nominal TSS contribution of 15 mg/L. It isn't clear how that was done in this case. **Recommendation** ECCC recommends that the Proponent: a) clarify how the predicted TSS concentrations were developed, and provide a rationale for setting them at baseline, b) describe how total metals were estimated with the model results, and c) clarify whether particulate-associated parameters were accounted for in the modeling.	**May 21:** The site water quality model for the Gahcho Kué Mine is set up to model dissolved constituent concentrations. Total concentrations are then calculated by adding background particulate concentrations, calculated as the difference of the total and dissolved concentrations in the baseline model input, and a theoretical particulate to account for fugitive dust entering the Water Management Pond (WMP) from fleet and milling activities. The particulate model input assumptions are the same as those developed and approved as part of the water quality modelling completed for the Environmental Impact Statement (EIS) (De Beers 2010), the EIS update (De Beers 2011), EIS Supplement (De Beers 2012), and the Water Licence Application (Golder 2014). As described in Section 8.II.2.4.7 of Appendix 8.II of the EIS Supplement (De Beers 2012), ".the settling of dust was modelled using the hydrodynamic model (Section 8.II.4), and it was predicted that less than 1 milligram per litre (mg/L) of these solids would remain in suspension. Therefore, 1 mg/L of particulate matter was added to the water quality." This assumption is supported based on the monitoring results from the inline monitoring station of the discharge from the WMP to Lake N11 (SNP-02), where the average TSS from January 2017 to January 2018 is less than 1.0 mg/L (Figure ECCC-13.1). De Beers recognizes that there are TSS concentrations greater than 1 mg/L and the dataset is limited to one year. However, the maximum measured concentration is 2.5 mg/L, which is well below the EQC limit of 15 mg/L and closure to the 1 mg/L used to calculated particulate concentrations. Figure ECCC-13.1: Monitored SNP-02 TSS Concentrations If future water quality monitoring results indicate that TSS concentrations in the WMP are developing an increasing trend over several years, the water	

			quality model will be updated to evaluate if the Water Licence EQC for total constituents are at risk of being exceeded. References: De Beers (De Beers Canada Inc.) 2010. Environmental Impact Statement for the Gacho Kué Project. Volumes 1, 2, 3a, 3b, 4, 5, 6a, 6b, 7 and Annexes A through N. Submitted to the Mackenzie Valley Environmental Impact Review Board. December 2010. De Beers 2011. Environmental Impact Statement for the Gahcho Kué Project. Volumes 3a Revision 2, 3b Revision 2, 4 Revision 2, and 5 Revision 2. Submitted to the Mackenzie Valley Environmental Impact Review Board in Response to the Environmental Impact Statement Conformity Review. July 2011. De Beers 2012.Environmental Impact Statement Supplemental Information Submission for the Gahcho Kué Project. Submitted to the Mackenzie Valley Environmental Impact Review Board, Yellowknife, NWT, Canada. April 2012. Golder (Golder Associates Ltd.) 2014. Gaucho Kué Technical Sessions - Commitment 3, 2014 Updated Water Quality Predictions. Submitted to De Beers Canada Inc., March 6, 2014.	
14	2018 Updated Project Description (UPD) Closure and Reclamation	**Comment** The closure plan for the Hearne pit originally included placement of waste rock over the tailings being disposed of in the pit. With the amendment, closure planning will potentially involve revisions to pit water quality predictions with the different composition and amounts of materials in the Hearne pit. Similarly, the Fine Processed Kimberlite (PK) facility footprint will increase by 32 ha to hold 6.1 Mt of fine PK, and revisions may be required for closure planning for that facility. **Recommendation** ECCC recommends that the Proponent clarify whether closure planning for the Hearne Pit and/or the PK disposal facility will be affected by the planned changes.	**May 21:** The closure planning for both Hearne Pit and PK disposal facility has not materially changed from the previous project description	
15	Geochemical Characterization Plan Version 4 Section 4.1 Kimberlite, pg. 23	**Comment** The Proponent has committed to monitor and test rock samples continually to verify predictions. However, there are contradictory statements found in the Geochemical Characterization Plan. The Proponent states that "Olivine, quartz, amphibole, and k-feldspar were identified in small amounts. Carbonate minerals were identified in trace amounts, and sulphide minerals including pyrite, chalcopyrite, and pyrrhotite are rare". The Proponent then goes on to state that "Kimberlite contains significant neutralization potential. The dissolution of carbonate minerals during chemical weathering of kimberlite will buffer the acidity resulting from sulphide mineral oxidation." It is not clear where the "significant neutralization potential" is coming from when the first statement above indicates that carbonate minerals were identified in trace amounts. The other minerals described are less reactive and contribute little to	**May 21:** The neutralization potential (NP) of kimberlite ranges from 2.4 to 600 kg CaCO3/t (De Beers 2012, Appendix 8.III), with an average value of 124 kg CaCO3/t (509 samples). Neutralization potential is contributed by both carbonate minerals and non-carbonate minerals. The NP was greater than the carbonate NP for all but seven samples; when carbonate NP is less than bulk NP, much of the bulk NP is attributable to non-carbonate minerals. The NP of silicate minerals is generally in the tens of kg CaCO3/t; samples with a higher NP (> 100 kg CaCO3/t) contain appreciably more carbonate mineralization. Regardless, kimberlite generally has a low average sulphur concentration (0.04% [n = 509]). The results of humidity cell testing of kimberlite confirm that there is sufficient NP in the kimberlite samples to neutralize	

		neutralization potential. **Recommendation** ECCC recommends that the Proponent clarify what is meant by "significant neutralization potential" when there are only trace amounts of carbonate minerals identified in the kimberlite.	the acidity generated by sulphide oxidation. Reference: De Beers. 2012. Environmental Impact Statement Supplemental Information Submission for the Gahcho Kué Project. Submitted to the Mackenzie Valley Environmental Impact Review Board, Yellowknife, NWT. April 2012.	
16	New Canadian Air Quality Standards for NO2	**Comment** The Federal Government formally established Canadian Ambient Air Quality Standards (CAAQS) for NO2 through their publication on the Canada Gazette on December 9th, 2017 under the authority of the Canadian Environmental Protection Act, 1999 http://gazette.gc.ca/rp-pr/p1/2017/2017-12-09/html/notice-avis-eng.html The CAAQS were developed for the purpose of protection human health and the environment. They are supported by air quality management levels, which call for progressively more rigorous actions by jurisdictions as air quality approaches or exceeds the CAAQS, thereby ensuring that the CAAQS are not treated as "pollute-up-to" levels. The CAAQS for NO2 are more stringent than the objectives/standards used for the Environmental Impact Statement submission. **Recommendation** ECCC recommends that the Proponent consider how NO2 emissions from the Project may affect ambient air quality as compared to the CAAQS for NO2.	**May 21:** De Beers undertook a dispersion modelling revision exercise to evaluate the potential changes to air quality, including NO2 concentrations in the 2018 Air Quality Model Update (Appendix B of the 2018 ESA). The revised modelling work considered how new emission rates and locations could change ground level concentrations. The predictions from the new modelling were compared to the 2014 NWT Air Quality Standards for 1-hour, 24-hour, and annual averaging periods. This modelling was undertaken using the same methodology and approach, as was used to support the original Gahcho Kué Environment Impact Statement (EIS, De Beers 2012), and extensively for air quality assessment in the North and in other parts of Canada. De Beers did not include a direct comparison between the predicted NO2 concentrations in the 2018 Air Quality Model Update to the CAAAQS because an appropriate comparison between predicted NO2 data and the CAAQS cannot be made. De Beers does not agree that predicted air quality values should be used for comparison to the CAAQS. The main reasons that the comparison is not appropriate include the following: . The air quality dispersion modelling conducted for this Water Licence amendment application is highly conservative; . The number of predicted hourly concentrations generated by the model are too few to derive a value that can be directly compared to the CAAQS metric; and . The CAAQS were designed to be compared to monitored values in population centres, not to modelled values at remote locations. The conservative emission scenario chosen to drive the dispersion modelling assessment is considered the worst-case, worst-year scenario. By design, this assumption of worst-year emissions is intended to provide a highly conservative maximum predicted value for each of the modelled parameters, including NO2, and is unlikely to occur as modelled. This assumption alone means that every other year of potential emissions will be lower than the assessed value. The three-year average of the 98th percentile values of the hourly predictions (the CAAQS hourly metric) cannot be calculated without extensive and speculative modelling iterations that include sub-maximum emissions levels	

			assessed from otherwise lower-emissions years. Completing a modelling exercise that included that level of modelling would represent a significant change in air assessment methodology and introduce a level of redundancy that would be beyond the scope of the EIS and the 2018 update, so this modelling was not completed. Further to the above, the scope of work as it relates to air quality assessment for the 2018 update was to update the original modelling with the new haul routes and volumes and to change as little else as possible in the assessment so that a direct comparison between the EIS and the 2018 update could be made. The requirements for using a particular time period, e.g., number of years of meteorological data for air quality dispersion modelling in the Northwest Territories (NWT), is undefined by regulation. In as much, consistent with other and ongoing assessments in the NWT and throughout the North, a one-year meteorological dataset was used to drive the dispersion model for the air quality assessment portion of the EIS and the 2018 update. This component input of the modelling alone also makes comparison to the CAAQS using the prescribed metric, e.g., the three-year average of the 98th percentile values of the hourly predictions impossible; there are not enough data points to populate the three-year metric and make a meaningful comparison to the CAAQS. The mining sector was represented at the consultation meetings held between and amongst the various stakeholder groups tasked with negotiating the CAAQS. The position of the mining sector and others was that making comparisons between modelled data and the CAAQS was inappropriate. De Beers concurs with this assertion and agree that the CAAQS were designed to be compared to regional, zone-based monitoring data. This is evident in the text of the CAAQS wherein the responsibility for managing air quality lies primarily with the provinces and the territories. The following excerpt is taken from the Gazette. "To assist in the management of the air quality, provinces and territories have delineated their jurisdictions into local areas called air zones that have different air quality characteristics that are influenced by the number and type of air pollutant sources, meteorology and topography. Provinces and territories lead air quality management actions in the air zones, guided by a number of guidance documents developed by CCME in consultation with stakeholders." The management referred to is informed through monitoring as stated in GNWT policy.	

			It is on the basis of continuous measurements taken at regional population centres in the NWT that De Beers asserts actions commensurate with the CAAQS action levels, green through red should be made at a regional level, not on the basis of a worst-case dispersion model run executed at a remote mine site, a single facility. Comparing the predicted concentrations from the fenceline of an individual facility was never the intent for implementation of the CAAQS. In the context of air quality management in the NWT, "The GNWT operates four state-of-the-art continuous ambient air quality monitoring stations across the Northwest Territories, as well as the Giant Mine Ambient Air Quality Site. Stations are located in Fort Smith, Inuvik, Norman Wells and Yellowknife. Each of these stations sample and analyze air quality on a continuous basis for a variety of parameters including dust and chemicals. The network is part of the National Air Pollution Surveillance Network (NAPS), a federal program operated across the country." The data from these stations are the appropriate basis for making a comparison to the CAAQS. De Beers has implemented an air quality monitoring program at the Gahcho Kué Mine and has presented the data from that monitoring program in Appendix B of the Environmental Screening Assessment (ESA), Table B4.1-1 (De Beers 2018) and the Air Quality and Emissions Monitoring and Management Plan (De Beers 2015). To provide ECCC with further clarity regarding how the existing monitoring data from the site compare with the CAAQS, Table ECCC-16.1 shows the NO2 monitoring data presented in the Appendix B of the ESA, Table B4.1-1 (De Beers 2018). It has been transcribed and supplemented herein with additional 2017 data in in units of parts per billion to facilitate a better comparison to the annual NO2 CAAQS. Note also, however, that the appropriateness of this comparison remains tenuous because of the fenceline/near-site locations of some of the monitoring stations and the lack of a significant population centre in the region. Nonetheless, in each case, the monitored data indicate a wide margin of compliance with the CAAQS, showing data consistently in the "green" response zone, well below 2.0 ppb, indicating that clean areas are remaining clean. Table ECCC-16.1 - Annual NO2 Concentrations Measured at the Gahcho Kué Mine The air monitoring activities are ongoing at the Mine and will continue as planned in the AQEMMP. Comparisons to future years of monitoring data from the stations that are not on	

			the facility "fenceline" (the 1 km stations and 20 km station) can be expected to provide a reasonable data-set for comparison to the CAAQS in future years. References: De Beers (De Beers Canada Inc.). 2012. Environmental Impact Statement for the Gahcho Kué Project - 2012 Updated Air Quality Assessment. Submitted to the Mackenzie Valley Environmental Impact Review Board, Yellowknife, NWT. September 2012. De Beers Canada Inc. (De Beers). 2015. Air Quality Emissions Monitoring and Management Plan V.3 Gahcho Kué Mine. Submitted to the Mackenzie Valley Land and Water Board, Yellowknife, NWT. October 2015. De Beers (De Beers Canada Inc.). 2018. Water License (MV2005L2-0015) and Land Use Permit (MV2005C0032) Amendment Application. Environmental Screening Assessment, Appendix B. Submitted to the Mackenzie Valley Environmental Impact Review Board, Yellowknife, NWT. March 2018.	
Fisheries and Oceans Canada: Laura Watkinson				
ID	**Topic**	**Reviewer Comment/Recommendation**	**Proponent Response**	**Board Staff Analysis**
1	General File	**Comment** (doc) DFO Cover Letter **Recommendation**		
2	Offsetting - Reference: 2018 De Beers Gahcho Kue - Amendment Applications â€“ Attachment 3: Environmental Screening Assessment, section 4.6.3: pg. 96.	**Comment** DFO-FPP notes that De Beers has an existing Fisheries Act Authorization for the Gahcho Kue' project which authorized the serious harm to fish resulting from the dewatering of Kennady Lake and construction of dykes, which included the Permanent alteration and destruction of habitat within the dewatered areas of Kennady Lake. As part of the Fisheries Act authorization, DFO-FPP also notes that Condition 4.1 requires that " Fish Habitat shall be re-established in Kennady Lake at mine closure through the re-filling of Kennady Lake and breaching of dykes, allowing fish to migrate back to the lake and utilize fish habitat that was de-watered but not physically altered during mine operation". DeBeers states "As the design of the West Mine Rock Pile as part the mine plan, the area of Kennady Lake that will be re-established as fish habitat at closure will be smaller due to the extension of the rock pile into Area 5", as such the proposed increase in pit size is anticipated to decrease the surface area of Kennady Lake at closure (will be smaller compared to surface area under the current approved plan), which subsequently reduces the area available as fish habitat at closure. These changes will impact condition 4.1 of the existing Fisheries Act authorization and as a result will require updated accounting / quantification of the serious harm caused by the decreased lake area available at closure, and will require offsetting. DFO-FPP notes that De Beers has acknowledged the	**May 21:** While De Beers does not foresee any additional serious harm to fish, beyond what was described in the original EIS and authorized in the Fisheries Authorization, De Beers does acknowledge that the offsetting of impacts will also need to account for more offsetting off-site rather than on-site. De Beers will continue to work with DFO to ensure the off-setting plan addresses this need.	

		implications of their mine plan changes on their existing Fisheries Act authorization and provided DFO-FPP with an updated Offsetting plan 'Gahcho Kue' Mine 2018 Offsetting Plan Update' in February 2018. DFO-FPP also notes that De Beers has committed to working with DFO-FPP to update the offsetting plan, acknowledging (on pg. 96 of the Environmental Screening Assessment) that "Finalization of the offsetting plan with DFO will include the quantification of habitat losses and gains expected to be achieved through offsetting measures, and to demonstrate that the gains will counterbalance the losses predicted to occur as a result of the Mine's activities." DFO is currently reviewing the offsetting plan updates to determine if the additional losses are adequately accounted for and offset. DFO will continue to work with De Beers to ensure that additional losses are appropriately offset. **Recommendation** DFO also recommends that De Beers continue to work with DFO-FPP to update their offsetting plan to account for any additional serious harm resulting from the proposed mine changes.		
3	Downstream flow - Reference: 2018 De Beers Gahcho Kue - Amendment Applications â€“ Attachment 3: Environmental Screening Assessment, section 2.4.6.2: pg. 25.	**Comment** DFO notes that on page 25 of the Environmental Screening Assessment, results of the downstream flow mitigation and arctic grayling populations are provided for 2016. However, DFO notes that the most recent data for 2017 that was provided in the 'AEMP Response Plan to Low Action Level - Fish Habitat and Community'(submitted to MVLWB Dec 19th) indicating that no arctic grayling were found in the monitored streams K5 and L1, were not included in the Environmental Screening Assessment. **Recommendation** DFO recommends that De Beers includes and considers the most updated data when making impact predictions for the proposed mine changes.	**May 21:** At the time of preparation of the Environmental Screening Assessment (ESA) in 2017, the most recent available Aquatic Effects Monitoring Report (AEMP) was the 2016 AEMP (De Beers 2017), which was used to provide an indication of operational monitoring results for hydrology, water quality, plankton, benthic invertebrates, and fish habitat and community. At the same time as the preparation of the ESA, sampling and reporting was being completed for the 2017 AEMP. Although the 2017 data were not included in the summary of operational monitoring results in Section 2.4.6.2, the team was aware of the recent results for the fish community monitoring in Streams K5 and L2, and the results were considered in the screening where appropriate. However, it should be noted that the mine plan amendment does not change the volumes of water and timing for flow mitigation, although Area 7 has been identified as another potential source of water for pumping to Area 8 for downstream flow mitigation. The monitoring of the Arctic Grayling population downstream of the Mine will continue as per the existing AEMP and Response Plan and will be reported to the MVLWB under the existing AEMP mechanisms.	
4	Diversion - Reference: 2018 De Beers Gahcho Kue - Amendment Applications â€“ Attachment 3:	**Comment** DFO notes on page 92 of the Environmental Screening Assessment that "the D watershed cannot be reconnected at closure through the existing flow paths to Kennady Lake (i.e., Lake and Stream D1). Instead a diversion channel will be constructed to allow for the D watershed to be reconnected to Kennady Lake at closure." DFO	**May 21:** De Beers will provide additional information to DFO in a Request for Review related to the design of the proposed diversion channel, including information related to fish passage and use, once further design details are available. De Beers is committed to continuing to engage DFO with respect	

	Environmental Screening Assessment, section 4.6.3: pg. 92.	acknowledges DeBeers' diversion channel proposal but notes that detailed engineering designs for the proposed diversion channel have not yet been provided. In addition, DFO-FPP also notes that recstoration of flows to Lake D1 and Stream D1 were a condition (Condition 4.1) of the Fisheries Act authorizatoin. As such If the existing flow paths originally provided habitat for fish and cannot be restored at closure, these additional losses may need to be accounted for. DFO-FPP acknowledges that De Beers has provided an updated Offsetting Plan ' Gahcho Kue' Mine 2018 Offsetting Plan Update' which is currently under review to determine if all additional serious harm is adequately accounted for and offset. **Recommendation** DFO recommends that DeBeers provide detailed information and design drawings for the proposed diversion channel that includes, but is not limited to, proposed habitat features within the diversion channel, and hydrological modelling to support the ability of the channel to handle the diversion flows. This information can be provided to DFO as part of a 'DFO Request for Review' submission. DFO also recommends that De Beers continue to engage DFO to update and account for any additional serious harm (losses and gain) to fish associated with the permanent loss of the existing flow paths (Lake and Stream D1) .	to the accounting of losses and gains in the Updated Offsetting Plan, including for lake and stream D1.	
GNWT - ENR: Central Email GNWT				
ID	**Topic**	**Reviewer Comment/Recommendation**	**Proponent Response**	**Board Staff Analysis**
50	General File	**Comment** (doc) ENR Letter with Comments and Recommendations **Recommendation**		
1	Topic 1: Modifications	**Comment** De Beers has requested an amendment to the definition "modification" under Part A of the Water Licence so that it includes expansion. De Beers notes specifically: "The recent Board decision on Land Use Amendment #2 (MVLWB June 7, 2017 - MV2005C0032 Reasons for Decision) confirmed that an increase in the size of several dykes (D, A1, and L) can be considered a Modification under the licence). To ensure consistency in interpretation and understanding of modifications, De Beers requests that the definition of modification omit the exclusion of expansions." In those Reasons for Decision, the MVWLB did note that "the increase in size of dykes D, A1 and L, can be considered a Modification under Water Licence MV2005L2-0015" for the following reason: "As the sequencing adjustments described in the Permit Amendment Application were part of the 2013 Updated Project Description outlined in the scope of the Licence, the Board has decided that changing the size of engineered Dykes D, L and A1 is not considered an expansion. Additionally, these dykes do not alter the purpose or function of the structure; therefore, these activities are a	**May 21:** De Beers does not agree with ENR's interpretation. Not all increases in project footprint, due to an expansion of an engineered structure or other project need, should necessitate an amendment. Mines are always changing, and must be permitted some leeway to do so without overly burdensome regulatory processes. When a proponent describes a Project at the EIS or water licence or land use permit application stage, it is impossible for them to foresee all potential changes in mine footprint. Furthermore, the environmental impact assessments are not so precise as to arrive at different conclusions regarding impact ratings when footprints are marginally different. Nearly every modification of an engineered structure will result in some increase in footprint. Those potential increases should neither trigger amendment, nor prohibit the change from being considered through the modification process outlined in the licence. By removing the specific exclusion of 'expansion' from the	

		modification under Licence MV2005L2-0015." As such, the MVLWB did not determine that expansions should be included as a modification, but rather that the changing of the sizes of Dykes D, L and A1 were not considered an expansion. ENR also notes that De Beers made a similar request regarding an amendment to the definition of "modification" in a December 2013 amendment application for the Snap Lake Mine. In the MVLWB's Reasons for Decision dated June 8, 2015, the MVLWB decided the following: "The definition of Modification used in the approved Licence is consistent with recently issued licences. In its Intervention, GNWT-ENR identified that including "expansion" could lead to future confusion regarding the scope of activities licence. The Board agreed with the GNWT-ENR and did not amend the definition of modification as proposed." ENR's understanding is the specific intent of the exclusion of expansions within a modification is to ensure that there is no change in footprint of the project and potentially a change in scope. As such, any potential areal change (expansion) to infrastructure on site would not fall within the scope of a modification. **Recommendation** 1) ENR recommends that the definition not be changed as an expansion may include an alteration of the project footprint which could require an amendment.	definition of modification, it allows the Board more leeway or flexibility in interpretation. This is the sort of flexibility that is needed in order to reduce the regulatory burden from industry for what typically amounts to minor changes in facilities and little to no changes in environmental impacts.	
2	Topic 2: SNP Changes	**Comment** De Beers has requested that Part G, Item 29 be changed from: "The Licensee shall provide Water sampling results from SNP station 02 and 04 to an Inspector no later than five (5) days prior to any planned Discharge of Wastewater from the Water Management Pond to the Receiving Environment. Discharge shall not commence until authorized in writing by an Inspector." To: "The Licensee shall provide water sampling results from SNP stations currently active within the Water Management Pond to determine the ability for the water to meet Effluent Quality Criteria during discharge to N11 no later than five (5) days prior to any planned Discharge to the Receiving Environment. Discharge shall not commence until authorized in writing by an Inspector." The rationale provided by De Beers outlines that SNP-02 is fairly isolated and that an overview of all discharge locations within the Water Management Pond (WMP) would be more appropriate. ENR notes that the intent of this SNP location is to ensure that the water from the discharge location meets discharge limits prior to discharge into the environment. ENR notes that SNP-02 as described in the Water Licence relates to "in-line monitoring for end-of-pipe Discharge from Kennady Lake to Lake N11". It is unclear how this relates to the description provided by De Beers regarding the isolation of the SNP within the lake. Further, the current condition dictates all "Discharge of Wastewater from the Water Management Pond to the Receiving Environment" while the proposed condition from De Beers specifies discharge to N11. This would omit the	**May 21:** De Beers agrees that the intent of the change was not meant to take away the requirement to provide the results of any monitoring to the Inspector. There was simply a typo in the requested text. See response to GNWT: ENR Central email 4. De Beers would like to advise ENR that it is not possible to have in-line samples collected without active pumping. Pre-discharge sampling of SNP-02 occurs at the intake location in Area 3 and results are then provided to the Inspector with a request to commence discharge. Supplemental monitoring events as described within the SNP are taken during discharge using an in-line spigot and submitted to the laboratory with results reported monthly. The Water Management Pond is a large body of water with multiple stations identified to determine overall quality (SNP-06, SNP-02, and SNP-05). The request to allow for additional data to be considered, as well as those of SNP-02, was meant to allow the Inspector to evaluate water quality of a larger draw area and not only the semi-isolated area of SNP-02 prior to discharge. The semi-isolated area of SNP-02 may not always be representative of the entire pond and thus it should not be the only location permissible for consideration by the Inspector for discharge water quality. It is not expected that water quality in the Water Management Pond will allow for discharge to Area 8 and there is no current plan	

		potential discharge from Area 7 or the Water Management Pond into Area 8. As noted in Section 4.5.7 of Attachment 3: Environmental Screening Assessment, SNP-04 will remain for discharge from Area 7. Finally, the intent of this clause is to ensure sampling results are provided to the Inspector prior to discharge. On that note, the existing clause specifies that the results are provided to the Inspector, while the proposed condition does not specify the Inspector. **Recommendation** 1) ENR requests that De Beers clarify how the proposed amendments will provide a more accurate assessment of discharge water quality than in-line monitoring at SNP-02 and SNP-04.	to do so. All expected effluent discharge from the Water Management Pond will be directed to N11 and not to Area 8. Area 7 does not form part of the Water Management Pond and does not receive contact water. Area 7 to Area 8 water discharge is a mandatory requirement as continued freshet and rainfall within the area will eventually impact freeboard restrictions to Dyke K and threaten pit infrastructure if water is not managed and removed to Area 8.	
3	None	**Comment** None **Recommendation** 2) ENR requests that De Beers clarify why the proposed amendment references only Lake N11 and excludes Area 8.	**May 21:** De Beers is only requesting that prior to discharge from the WMP to Lake N11, there can be consideration for water quality samples from more than just SNP-02. This adjustment is requested because the water quality in the WMP at SNP-02 can at times be semi-isolated, particularly in the winter, until the pumps are turned on and the water is drawn from a larger area of the WMP. The same request is not required for discharge from Area 7 to Area 8 and therefore we are not requesting a change for SNP-04. De Beers would be open to alternative wording of this clause to ensure there is no confusion, but ensuring that we have an opportunity to provide additional water quality data to the Inspector to support his decision to authorize discharge from the WMP to Lake N11.	
4	None	**Comment** None **Recommendation** 3) ENR requests that De Beers clarify why the proposed amendment excludes specific reference to provide results to the Inspector.	**May 21:** This was a typo. The requested clause was intended to read: "The Licensee shall provide water sampling results from currently active within the Water Management Pond to an Inspector to determine the ability for the water to meet Effluent Quality Criteria during discharge to N11 no later than five (5) days prior to any planned Discharge to the Receiving Environment. Discharge shall not commence until authorized in writing by an Inspector." See comment above however about openness to alternative wording should the Reviewer or the Board like to suggest an improvement.	
5	Topic 3: SNP Changes	**Comment** Section 4.5.7 of Attachment 3: Environmental Screening Assessment notes that "SNP-04 will need to be relocated from its current location to the area where the flow mitigation diffuser will be located, or a new SNP station for this diffuser established." The description for SNP-04 notes that it is used for in-line monitoring for end-of-pipe Discharge from Kennady Lake to Area 8. ENR notes that the Water Management Pond and Area 7 are both parts of "Kennady Lake" so the SNP-04 description is still valid however it is unclear whether it requires relocation within Area 8.	**May 21:** The discharge location is anticipated to remain the same.	

		Recommendation 1) ENR requests clarification on whether the discharge location into Area 8 will remain the same if the water source changes from the Water Management Pond to Area 7.		
6	Topic 4: AEMP	**Comment** Section 4.5.8 of Attachment 3 - Environmental Screening Assessment notes that while the AEMP is not proposed to be changed as a result of the amendment, there is mention that AEMP Re-evaluation will be in December 2019 and new design will be in September 2019. Shouldn't the re-evaluation be submitted for consideration prior to re-design? Is there a typo in one of those years? **Recommendation** 1) ENR requests clarification on the anticipated dates of AEMP re-evaluation and the submission of the new AEMP design.	**May 21:** There was a typographical error in this text within Section 4.5.8 of Attachment 3 of the Environmental Screening Assessment. Although the Aquatic Effects Re-evaluation Report will be completed and used for consideration to feed into any changes in the next AEMP Design Plan, De Beers plans to submit both documents to the MVLWB in late 2019.	
7	Topic 5: Effluent Quality Criteria - Hardness Adjustments	**Comment** Within the Effluent Quality Report, Section 3.1.5 includes "Acute Site-Specific Water Quality Objectives" which were developed and used in determining acute benchmarks for which to compare short-term EQC. Of note, several of these parameters such as chloride, copper and sulphate used hardness-adjusted values within their calculations. While ENR is aware of the use of hardness as a toxicity modifying or ameliorating factor, the application in this case is unclear. For example, in Table 3-1 of the EQC Report, in relation to chloride, it is noted that the "chloride SSWQO was calculated using the equation presented in Table 3-3 at projected hardness concentrations between 267-300 mg/L as CaCO3 in the WMP. The SSWQO is applicable up to a hardness concentration of 300 mg/L as CaCO3." This is also noted for sulphate and copper. De Beers discusses the hardness in the WMP when calculating appropriate short-term EQCs; however, the aquatic species being protected are within the receiving body, Lake N11. It must be ensured that the appropriate hardness values are considered in order to provide adequate protection for aquatic organisms in the receiving environment. **Recommendation** 1) ENR recommends that De Beers provide additional rationale on the use of the hardness of the effluent (i.e. WMP) as opposed to the hardness of the receiving environment (i.e. N11 or Area 8) when calculating acute benchmarks for use as screening tools within the EQC Report.	**May 21:** Projected hardness concentrations in the water management pond (WMP) were used to derive acute site-specific water quality objectives at end-of-pipe to prevent acute toxicity in the discharge from the WMP to Lake N11 and the discharge from Area 7 to Area 8. The Mine cannot discharge an effluent that is acutely toxic. Therefore, acute SSWQO were calculated based on hardness concentrations in the WMP and Area 7. To show that the effluent quality criteria (EQC) will also protect against acute toxicity in the receiving environment, chloride, sulphate, and total copper were modelled in Lake N11 and Area 8 assuming that each parameter was discharged from the WMP and Area 7 at its proposed maximum average concentration EQC and maximum grab concentration EQC for the duration of the discharge periods. Whole-lake average concentrations for each parameter were compared to acute hardness-dependent site-specific water quality objectives (SSWQO) based on whole-lake average hardness concentrations in Lake N11 and Area 8. The results of the comparison show that chloride, sulphate, and total copper concentrations in Lake N11 and Area 8 remain below the acute hardness-dependent SSWQO (Figures GNWT-ENR-7.1 (a,b,c) and GNWT-ENR-7.2), and therefore, remain protective of the receiving environment. References: BCMOE (British Columbia Ministry of Environment). 2017. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture; [accessed January 2018] https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines ERM (ERM Consultants Canada Ltd.). 2016. Ekati Diamond Mine: - Short-term Site-specific Water Quality Objective for Chloride. Prepared for Dominion Diamond Ekati Corporation by ERM	

			Consultants Canada Ltd.: Yellowknife, NWT, Canada. Rescan (Rescan Environmental Services Ltd.). 2012. EKATI Diamond Mine: Site-specific Water Quality Objective for Sulphate. Prepared for BHP Billiton Canada Inc. Yellowknife, NWT, Canada. Figure GNWT-ENR-7.1 (a,b,c): Comparison of Projected Whole-lake Average Chloride, Sulphate, and Total Copper Concentrations in Lake N11 to Acute Hardness-dependent Site-specific Water Quality Objectives Figure GNWT-ENR-7.2: Comparison of Projected Whole-lake Average Total Copper Concentrations in Area 8 to the Acute Hardness-dependent Site-specific Water Quality Objective	
8	None	**Comment** None **Recommendation** 2) ENR recommends that De Beers outline how this approach would ensure adequate protection of the receiving environment to acute toxicity given uncertainties about rate of dissipation of hardness and parameters of concern in the mixing zone.	**May 21:** Please see the response to GNWT-ENR-7. In the Lake N11 and Area 8 models, all parameters are modelled conservatively, which means that parameters do not undergo processes where settling, decay, or formation occur. Therefore, the rate of dissipation of hardness concentrations (i.e., calcium and magnesium) is the same as the rate of dissipation of chloride, sulphate, and total copper concentrations throughout the lake including the mixing zone. Typically, water quality samples are not collected within the mixing zone. The nearest water quality samples to the end of the discharge pipe are collected at the edge of the mixing zone. Based on the historical water quality data collected at the edge of the mixing zone in Snap Lake and the ability of the Snap Lake model to match historical concentrations, De Beers believes that hardness concentrations (i.e., calcium and magnesium) show the same rate of dilution or dissipation as other major ions, such as chloride and sulphate.	
9	Topic 6: Effluent Quality Criteria â€“ Total Metals	**Comment** Within the EQC Report, De Beers notes that parameters were eliminated if the parameter was represented by a "total value"; however, the report goes on to say that "total concentrations have been used as they include dissolved fractions and SSWQO are expressed more frequently as total concentrations". This appears to be inconsistent. Additionally, in the application form, the word "total" has been removed from the parameters in the amendment. Does this imply that total metals are being measured currently; however, De Beers would like to move to dissolved? **Recommendation** 1) ENR requests that De Beers clarify language within the application related to Ã¢Â€Âœtotal metalsÃ¢Â€Â and how this relates to the proposed EQC amendments for all discharges.	**May 21:** Dissolved metals were eliminated from the list of potential parameters of interest because dissolved fractions are represented by total fractions (i.e., total metals concentrations should be equal to or greater than dissolved metals concentrations). For example, dissolved copper was eliminated from the list of potential parameters of interest because it is represented by total copper. In the application form, the parameters in the amendment are total fractions (see the response to ECCC-3). Currently, concentrations of total and dissolved metals are being measured. De Beers is not requesting a change to the parameter suite.	
10	Topic 7: Dilution Factors	**Comment** The EQC report notes dilution factors of 35 and 90 for N11 and Area 8, respectively It is unclear if these dilution factors are	**May 21:** The dilution factors for Lake N11 and Area 8 have changed from Version 2 of the EQC Report (De Beers 2014)	

		carried over from the original EQC development and whether they are still applicable, e.g. is the amount of water in Area 8 still consistent since the dewatering of Kennady Lake, and could there be any impacts to the dilution factor as a result? **Recommendation** 1) ENR requests that De Beers confirm that dilution factors remain unchanged from the original EQC report.	(Table GNWT-ENR-10.1). The dilution factor in CORMIX is dependent on several factors, such as the diffuser design, characteristics of the receiving environment (i.e., depth and ambient density), and characteristics of the effluent (i.e., discharge density and discharge rate). As described in the 2018 EQC Report included with the Water Licence amendment application (De Beers 2018), the following updates were made to the models: . Characteristics of the submerged diffuser in Lake N11 were updated to reflect the as-built drawings (Golder 2017a). . Characteristics of the Area 8 diffuser were updated to reflect those in the detailed design report (Golder 2017b). . Projected characteristics of the discharge from the WMP and the discharge from Area 7 were updated to reflect the most recent Site water quality model results (Attachment 2, Appendix C of the 2018 Water Licence Amendment Application). Reference: De Beers (De Beers Canada Inc.). 2014. Effluent Quality Criteria Report. Prepared for the Mackenzie Valley Land and Water Board. Yellowknife, NT, Canada. April 2014. Table GNWT-ENR-10.1: Comparison of Projected Dilution Factors from End-of-Pipe in Lake N11 and Area 8	
11	None	**Comment** None **Recommendation** 2) If the dilution factors have not been updated from the original EQC report, ENR requests that De Beers provide evidence that the dilution factors are still valid (i.e. that there have been no substantial changes in volume in the receiving water bodies)	**May 21:** Please see the response to GNWT-ENR-10. The dilution factors have been updated from Version 2 of the EQC Report (De Beers 2014). Reference: De Beers (De Beers Canada Inc.). 2014. Effluent Quality Criteria Report. Prepared for the Mackenzie Valley Land and Water Board. Yellowknife, NT, Canada. April 2014.	
12	Topic 8: Effluent Quality Criteria â€“ Water Management Pond to N11 â€“ Chloride	**Comment** De Beers has requested that the EQC for chloride be increased from 160 mg/L maximum average and 320 mg/L maximum grab to 300 mg/L maximum average and 515 mg/L maximum grab. Table 2-9 of the EQC Report notes that the maximum anticipated chloride in the WMP discharge is 297 mg/L. The SSWQO for chloride in Lake N11 is currently 120 mg/L which is the CCME guideline for the protection of aquatic life. With the proposed projected maximum of 297 mg/L, De Beers predicts that the maximum chloride at the edge of the mixing zone in Lake N11 would be 104 mg/L. As it appears that the SSWQO will be maintained within Lake N11 and the current EQC will not be exceeded, ENR is unclear as to the necessity for an increase. **Recommendation** 1) ENR requests that De Beers clarify the necessity for an increased chloride EQC.	**May 21:** De Beers has requested increased chloride effluent quality criteria (EQC) because the current maximum average concentration EQC in Water Licence MV2005L2-0015 is 160 mg/L and chloride concentrations in the water management pond (WMP) discharge to Lake N11 are projected to be 210 mg/L and 214 mg/L in September and October 2019 and 290 mg/L and 297 mg/L in September and October 2020 (Attachment 2, Appendix C of the 2018 Water Licence Amendment Application). The water quality model outputs results on a monthly timestep; therefore these concentrations are projected to occur for the entire months of September and October. As a result, the maximum average concentration EQC of 160 mg/L is projected to be exceeded and the maximum average concentration EQC of 300 mg/L is required.	

13	Topic 9: Effluent Quality Criteria â€“ Water Management Pond to N11- Fluoride	**Comment** De Beers has requested that the EQC for fluoride be amended from 0.15 mg/L maximum average and 0.3 mg/L maximum grab to 1.5 mg/L maximum average and 3.0 mg/L maximum grab. Table 2-7 of the EQC Report notes that the maximum anticipated fluoride concentration outlined from the WMP into N11 is 0.35 mg/L. During the original licensing of Gahcho Kue, De Beers proposed a site specific water quality objective based on their own SSWQO derivation research; however, at that time it appeared that a lower value (i.e. CCME of 0.12 mg/L) was achievable and the Board determined that value to be an appropriate SSWQO. Given the predicted increases in fluoride, De Beers now proposes that SSWQO for fluoride based on recent literature would be more appropriate. While a SSWQO for fluoride of 1.94 mg/L was approved for Snap Lake, De Beers has proposed that drinking water guidelines of 1.5 mg/L be a more appropriate guideline, which is more protective. **Recommendation** 1) ENR supports the recommended SSWQO increase for fluoride.	**May 21:** Acknowledged	
14	Topic 10: Effluent Quality Criteria â€“ Water Management Pond to N11- Fluoride	**Comment** Within Section 2.4.2 of the EQC Report, a final screening step occurs by which maximum concentrations of a parameter are compared to SSWQO - 10% to determine if an EQC is required. Regarding fluoride it is noted that the maximum predicted concentration is 0.35 mg/L which is greater than the noted SSWQO - 10% which is listed as 0.11 mg/L. As a result, the final column should have denoted "YES" to remain in the screening process. However, ENR understands that a new SSWQO is being proposed (see previous comment) which would be above the projected maximum discharge, in which case the "NO" determination on whether the prediction was above SSWQOs would be accurate. **Recommendation** 1) ENR requests that De Beers clarify their findings on the necessity of an EQC for fluoride, specifically as it relates to Table 2-11 in the EQC report, the proposed amended SSWQO and the proposed amended EQC.	**May 21:** The GNWT-ENR is correct. Table 2-11 should have denoted "Yes" in the final column for fluoride to remain in the screening process and Table 2-13 in the EQC Report should have a row for fluoride. Table 2-11 (Table GNWT-ENR-14.1) and Table 2-13 (Table GNWT-ENR-14.2) from the EQC Report have been reproduced below for fluoride. Table GNWT-ENR-14.1: Lake N11 Comparison of Projected Maximum Water Management Pond Discharge Concentrations up to Year 4 to Site-specific Water Quality Objectives for Fluoride Table GNWT-ENR-14.2: Comparison of Projected Maximum Concentrations at the Edge of the Mixing Zone to Baseline Concentrations for Fluoride The interim water quality guideline (WQG) for the protection of aquatic life from the Canadian Council of Ministers of the Environment (i.e., 0.12 mg/L; CCME 1999) was used in the screening process so that fluoride was identified as a parameter of potential concern. As described in Section 3.2.1.2 of the EQC Report, if the interim WQG for the protection of aquatic life from CCME (1999) is adopted as the site-specific water quality objective (SSWQO) for Lake N11, the resulting EQC for fluoride are not achievable in Years 3 and 4 (i.e., 2019 and 2020) of operations based on projected water management pond (WMP) discharge concentrations (Figure 3-4 of the EQC Report). Therefore, the maximum average concentration of fluoride in drinking water of 1.5 mg/L (Health Canada 2017) was adopted as the SSWQO for Lake N11. Using a SSWQO of 1.5 mg/L to back-calculate EQC	

			results in an maximum average concentration (MAC) EQC and maximum grab concentration (MGC) EQC for fluoride of 3.5 mg/L and 6 mg/L, respectively (Table 3-6 of the EQC Report). These fluoride concentrations are greater than the projected maximum WMP concentration of 0.35 mg/L. To ensure that the amount of waste to be deposited to the receiving environment is minimized, De Beers recommends that the MAC EQC and MGC EQC for fluoride be reduced to 1.5 mg/L and 3 mg/L, respectively (Figure 3-5).	
15	Topic 11: Effluent Quality Criteria â€“ Water Management Pond to N11â€“ Sulphate	**Comment** De Beers has requested that the EQC for sulphate be decreased from 150 mg/L maximum average and 300 mg/L maximum grab to 100 mg/L maximum average and 155 mg/L maximum grab. Table 2-9 of the EQC Report notes that the maximum WMP discharge will be 42 mg/L. **Recommendation** 1) ENR has no concern with the reduction of the EQC for sulphate.	**May 21:** Acknowledged	
16	Topic 12: Effluent Quality Criteria â€“ Water Management Pond to N11â€“ Nitrate	**Comment** De Beers has requested that the EQC for nitrate be increased from 10 mg N/L maximum average and 20 mg N/L maximum grab to 20 mg N/L maximum average and 30 mg N/L maximum grab. The maximum anticipated nitrate outlined in the EQC Report from the WMP into N11 is 22 mg N/L. The previously approved SSWQO for nitrate in Lake N11 was CCME of 2.93 mg N/L. In Section 2.2.2 of the EQC Report, De Beers has proposed a hardness adjusted SSWQO for nitrate which has been approved for Ekati, which De Beers believes is suitable as the SSWQO for Ekati as it is used at a hardness range between 10-160 mg/L which is similar to Lake N11. De Beers notes that nitrate has been increasing since operations and the current EQCs are not achievable. It is unclear whether DeBeers has undertaken any work, such as with explosives management, in an attempt to control nitrate inputs at the source. **Recommendation** 1) ENR requests that De Beers summarize work that has been done on-site to reduce nitrate loading (e.g. explosive management, explosive storage, etc) prior to determining the necessity for an amended EQC.	**May 21:** In response to the high nitrate levels in the WMP, De Beers launched a nitrate steering committee charged with developing and implementing a nitrate reduction strategy. The Steering Committee is comprised of Senior Mining Management, Mining Engineers, Environmental Personnel, Support Personnel, Blasting Contractor Representatives, and the Mine General Manager. The objective of the committee is to work together to understand the reasons for the high nitrate levels in the water management pond and to put the right actions in place to reduce them. The response actions implemented so far include: - Immediate review of explosives QA/QC procedures with the onsite explosives management team - Immediate training to all Drill/Blast personnel regarding blast hole loading procedures and the importance of bottom loading of holes with emulsion as opposed to top loading - Blast Pattern QA/QC by Supervisors prior to ignition of a blast - Post blast review of any misfires that may occur - Immediate focus on the double priming of blasts with heighted focus on ore-body blasts which are generally at the bottom of the pit and adjacent to the water sump - Accelerated sampling frequency at SNP-08 and SNP-09 (daily as opposed to weekly) and the procurement of DR-6000 which gives instantaneous analytical results . Results are to be communicated to Drill and Blast Personnel to demonstrate improvements or deficiencies to Nitrate Management activities. De Beers is committed to reducing nitrate loadings to the water management pond through	

			aggressive source control measures in order to ensure we can meet the proposed EQC values in 2019 and 2020.	
17	Topic 13: Effluent Quality Criteria â€“ Water Management Pond to N11â€“ Nitrate	**Comment** In regards to the development of an EQC for nitrate, a mass balance model of Lake N11 was developed. This included an assumption that nitrate participates in nutrient cycling. It was also noted that this approach also assumed that nitrate concentrations in N11 behaved the same as nitrate concentrations in Snap Lake as "(t)he first-order decay rate and temperature coefficient were obtained from the fully-mixed calibration of nitrate concentrations in Snap Lake between 2004 and 2016." De Beers believed this to be a reasonable assumption given that the source of nitrate in both lakes is the same and climatic conditions are similar in both locations. **Recommendation** 1) ENR requests that De Beers outline if there are any variables that differ between Snap Lake and Lake N11 which may affect the assumptions related to the mass balance model of Lake N11.	**May 21:** To calculate EQC for nitrate concentrations in the discharge from the WMP to Lake N11 in the 2018 EQC Report, a mass balance model of Lake N11 was developed. In the Lake N11 model, nitrate concentrations were assumed to participate in nutrient cycling (e.g., update by phytoplankton and denitrification). The approach assumed that nitrate concentrations in Lake N11 will behave the same as nitrate concentrations in Snap Lake; this is a reasonable assumption because the source of nitrate in both lakes is the same (i.e., effluent discharge) and climatic conditions are similar at both locations. However, there are many variables that differ between Snap Lake and Lake N11, which may or may not affect the assumptions related to the mass balance model of Lake N11. The best way to determine if the assumptions in the Snap Lake model can be applied to the Lake N11 model is to continue to collect water quality data in Lake N11 that can then be used to calibrate the Lake N11 model. For the response to this comment, De Beers modelled nitrate concentrations in Lake N11 again. De Beers removed the assumptions that nitrate concentrations in Lake N11 would behave the same as nitrate concentrations in Snap Lake from the Lake N11 model. As a result, nitrate concentrations in Lake N11 were modelled conservatively, which means that parameters do not undergo processes where settling, decay, formation, or uptake occur. De Beers still proposes that that the MAC EQC and MGC EQC for nitrate be set to 20 mg N/L and 30 mg N/L, respectively, because based on whole-lake average model results, the Mine can discharge 20 mg N/L from the water management pond (WMP) to Lake N11 with nitrate concentrations remaining below the site-specific water quality objective (Figure GNWT-ENR-17.1).	
18	Topic 14: Effluent Quality Criteriaâ€“ Water Management Pond to N11-Ammonia	**Comment** De Beers has requested that the EQC for ammonia be decreased from 10 mg N/L maximum average and 20 mg/L maximum grab to 6 mg N/l maximum average and 10 mg N/l maximum grab. The maximum anticipated concentration for total ammonia outlined in the EQC Report from the WMP into N11 is 2.3 mg N/L. **Recommendation** 1) ENR has no concerns with the reduction in EQC for ammonia.	**May 21:** Acknowledged	
19	Topic 15: Effluent Quality Criteriaâ€“ Water Management	**Comment** De Beers has requested that the EQC for phosphorus be decreased from 0.03 mg P/l maximum average and 0.06 maximum grab to 0.022 mg P/L maximum average and 0.03 mg P/L maximum	**May 21:** Concentrations of total phosphorus are projected to increase in Lake N11 because of discharge from the water management pond.	

	Pond to N11 â€“ Phosphorus	grab. The maximum anticipated total phosphorus outlined in the EQC Report from the WMP into N11 is 0.022 mg P/L. Table 2-2 of the EQC Report notes that the SSWQO for Lake N11 is 0.0109 mg P/L which is to maintain oligotrophic status in the receiving environment. Given the projected maximum noted, De Beers is predicting a maximum concentration in Lake N11 (at the edge of the mixing zone and within the fully mixed lake) of 0.013 mg P/l which will move the lake from oligotrophic to mesotrophic status. On Page 109 of the Environmental Screening Assessment, De Beers notes that: Concentrations of phosphorus are projected to increase in Lake N11 during the operational discharge period, primarily from loading sources from the WMP due to loading from groundwater inflow, mine rock, and PK sources. Based on the maximum total phosphorus concentration projected for operations (0.013 mg/L), an increase in productivity at all trophic levels would be expected in Lake N11 during operations. The increase in total phosphorus in Lake N11 will be short-lived and will return to pre-development conditions after Year 4. As noted in the 2011 and 2012 EIS, the total phosphorus projection is bound by some conservatism. **Recommendation** 1) ENR requests that De Beers discuss phosphorus behavior in N11 that may result in an increase in phosphorus if Water Management Pond discharge concentrations are not the cause.		
20	None	**Comment** None **Recommendation** 2) ENR requests that De Beers discuss phosphorus loading in N11 and whether the screening tool for phosphorus (i.e. discharge limit lower than SSWQO) is appropriate if that is the case (i.e. phosphorous could accumulate in N11, creating SSWQO exceedances despite meeting EQC).	**May 21:** There are two sources of total phosphorus loading to Lake N11: natural inflows from the Lake N11 watershed and proposed discharge from the water management pond (WMP). In Years 3 and 4 of operations (i.e., 2019 and 2020), the total load of phosphorus to Lake N11 from natural inflows is approximately 100 kg/yr. The load of total phosphorus from the proposed discharge from the WMP in Years 3 and 4 of operations is projected to add an additional 58 kg/yr and 73 kg/yr to Lake N11, respectively. As a result, total phosphorus concentrations in Lake N11 are projected to increase (Figure GNWT-ENR-20.1). Total phosphorus concentrations in Lake N11 are projected to exceed the site-specific water quality objective (SSWQO) of 0.0109 mg P/L for a very short period of time during the ice-cover season in 2021 (Figure GNWT-ENR-20.1). However, with the cessation of discharge from the WMP to Lake N11, total phosphorus concentrations are projected to decrease to concentrations below the SSWQO. De Beers has also proposed a reduction in the total phosphorus MAC EQC and MGC EQC from 0.03 mg P/L to 0.022 mg P/L and from 0.06 mg P/L to 0.03 mg P/L.	
21	Topic 16: Effluent Quality Criteriaâ€“	**Comment** De Beers has requested that the EQC for aluminum be increased from 0.1 mg/L maximum average and 0.2 mg/L maximum	**May 21:** Similar to the response to GNWT-ENR-12 for chloride, De Beers has requested increased total aluminum	

	Water Management Pond to N11- Aluminum	grab to 0.23 mg/L maximum average and 0.35 mg/L maximum grab. Table 2-2 notes that the current SSWQO for aluminum is 0.1 mg/L which is the CCME guideline for the protection of aquatic life. The maximum anticipated aluminum concentration in Table 2-7 of the EQC Report from the WMP into N11 is 0.11 mg/L which would result in a project maximum aluminum concentration in Lake N11 of 0.06 mg/L at the edge of the mixing zone. As it appears that the aluminum SSWQO (0.1 mg/L) will be maintained within Lake N11 and the current maximum EQC (0.23 mg/L) will not be exceeded, ENR is unclear as to the necessity for an increase. **Recommendation** 1) ENR requests that De Beers clarify the rationale the proposed increase to the aluminum EQC for discharge from the WMP into N11.	effluent quality criteria (EQC) because the current maximum average concentration EQC in Water Licence MV2005L2-0015 is 0.1 mg/L and total aluminum concentrations in the water management pond (WMP) discharge to Lake N11 are projected to be 0.095 mg/L and 0.096 mg/L in September and October 2019 and 0.11 mg/L and 0.11 mg/L in September and October 2020 (Attachment 2, Appendix C of the 2018 Water Licence Amendment Application). The water quality model outputs results on a monthly timestep; therefore these concentrations are projected to occur for the entire months of September and October. As a result, the maximum average concentration EQC of 0.1 mg/L is projected to be exceeded and the maximum average concentration EQC of 0.23 mg/L is required.	
22	Topic 17: Effluent Quality Criteriaâ€“ Water Management Pond to N11- Chromium	**Comment** De Beers has requested that the EQC for chromium be increased from 0.002 mg/L maximum average and 0.004 mg/L maximum grab to 0.002 mg/L maximum average and 0.005 mg/L maximum grab. The maximum anticipated chromium concentration in Table 2-7 of the EQC Report from the WMP into Lake N11 is 0.002 mg/L. Given that the predicted maximum concentration is less than the current maximum grab, it is unclear what necessitates the EQC increase. **Recommendation** 1) ENR requests that De Beers clarify the rationale between the requested increase the chromium maximum grab from 0.004 mg/L to 0.005 mg/L.	**May 21:** The requested increase in the total chromium maximum grab concentration EQC is not necessary. A total chromium maximum grab concentration of 0.004 mg/L is achievable.	
23	Topic 18: Effluent Quality Criteriaâ€“ Water Management Pond to N11- Copper	**Comment** De Beers has requested that the EQC for copper be increased from 0.003 mg/L maximum average and 0.006 mg/L maximum grab to 0.004 mg/L maximum average and 0.007 maximum grab. The maximum anticipated copper concentration noted in Table 2-7 of the EQC Report from the WMP into Lake N11 is 0.0026 mg/L. Given that the predicted maximum concentration is less than the current maximum grab, it is unclear what necessitates the EQC increase. **Recommendation** 1) ENR requests that De Beers clarify the rationale behind the request to increase the EQC for copper.	**May 21:** The current maximum average concentration (MAC) effluent quality criteria (EQC) for copper in Water Licence MV2005L2-0015 was selected by the Mackenzie Valley Land and Water Board based on projected maximum concentrations in the water management pond (WMP). In the EQC Report included with the Water Licence amendment application, De Beers calculated EQC based on the methods described in the report. These methods have been reviewed by EcoMetrix (MVRB/MVLWB IR#15; De Beers 2014). De Beers would prefer that the MVLWB not select MAC EQC based on water quality model results because of the uncertainty associated with water quality model results, but instead approve the EQC developed through the methods described in the report for two reasons: n Based on the methods described in the EQC Report, the most important factor affecting MAC EQC is the volume of effluent discharged to the receiving environment (i.e., from the WMP to Lake N11 and from Area 7 to Area 8). De Beers has more control over the volume of water that is discharged from the	

			WMP to Lake N11 or from Area 7 to Area 8 than they have over projected water quality concentrations in the WMP or Area 7 from water quality models. n The methods described in the EQC Report are also protective of the receiving environment because EQC are calculated under reasonable "worst-case" or most limiting conditions (i.e., minimum dilution factor and maximum proportion of effluent in the receiving environment) assuming that the most limiting conditions existed for the duration of the discharge period. Similar to the response to GNWT-ENR-12 for chloride, De Beers has requested increased total copper EQC because the current maximum average concentration EQC in Water Licence MV2005L2-0015 is 0.003 mg/L and total copper concentrations in the WMP discharge to Lake N11 are projected to be 0.00262 mg/L and 0.00265 mg/L in September and October 2020 (Attachment 2, Appendix C of the 2018 Water Licence Amendment Application). The water quality model outputs results on a monthly timestep; therefore, these concentrations are projected to occur for the entire months of September and October. As a result, the maximum average concentration EQC of 0.003 mg/L is most likely to be exceeded and the maximum average concentration EQC of 0.004 mg/L is required. Reference: De Beers. 2014. De Beers Canada Inc. Response to Technical Session Information Requests for the Environmental Assessment, Snap Lake Amendment Project EA1314-02 and the Water Licence Amendment (MV2011L2-0004). Prepared for the Mackenzie Valley Land and water Board and the Mackenzie Valley Review Board, Yellowknife, NWT, Canada.	
24	Topic 19: Effluent Quality Criteriaâ€“ Water Management Pond to N11- Iron	**Comment** De Beers has requested that the EQC for iron be increased from 0.4 mg/L maximum average and 0.8 mg/L maximum grab to 0.6 mg/L maximum average and 1.0 mg/L maximum grab. The maximum anticipated iron concentration in the EQC Report from the WMP into Lake N11 is 0.4 mg/L. Given that the predicted maximum concentration is less than the current maximum grab, it is unclear what necessitates the EQC increase. **Recommendation** 1) ENR requests that De Beers clarify the rationale behind the request to increase the EQC for iron.	**May 21:** Similar to the responses to GNWT-ENR-12 for chloride and GNWT-ENR-21 for total aluminum, De Beers has requested increased total iron effluent quality criteria (EQC) because the current maximum average concentration (MAC) EQC in Water Licence MV2005L2-0015 is 0.4 mg/L and total iron concentrations in the water management pond (WMP) discharge to Lake N11 are projected to be 0.39 mg/L and 0.40 mg/L in September and October 2020 (Attachment 2, Appendix C of the 2018 Water Licence Amendment Application). The water quality model outputs results on a monthly timestep; therefore, these concentrations are projected to occur for the entire months of September and October.There there is insufficient allowance for variation from the prediction in the current EQC. Due to the inherent uncertainty in water quality model predictions, an	

			exceedence of the current MAC EQC is quite possible. Therefore, De Beers requested that the MAC EQC for total iron be increased to 0.6 mg/L	
25	Topic 20: Effluent Quality Criteriaâ€“ Water Management Pond to N11- Molybdenum	**Comment** De Beers has requested to remove molybdenum as an EQC between the WMP and Lake N11. Table 2-9 notes that the projected maximum WMP discharge concentration is 0.0067 mg/L. As this is greater than baseline, molybdenum was carried through in the screening process in Section 2.4.2. The final screening process for retention of a parameter as an EQC was outlined in Table 2-11 on whether predicted concentrations were above site-specific water quality objectives minus 10%. In this case, the projected discharge of molybdenum of 0.0067 mg/L was below the SSWQO (0.073 mg/L) - 10% = 0.066 mg/L and as such it was not retained as an EQC. While ENR follows the logical progression of EQC development outlined in the report, it is interesting that molybdenum was retained in the initial development of the EQCs for the Water Management Pond but has now been screened out. **Recommendation** 1) ENR requests that De Beers provide a summary of changes to molybdenum factors at site (predictions, observations, etc) and/or screening protocol that resulted in molybdenum being screened out when it was previously identified as a parameter of potential concern requiring an EQC.	**May 21:** To clarify, total molybdenum was not retained by De Beers in Version 2 of the EQC Report (De Beers 2014). Total molybdenum was added to the list of parameters of potential concern (POPC) that required EQC by the Mackenzie Valley Land and Water Board because of uncertainties in water quality model predictions (MVLWB 2014). In the screening that was completed as part of the Water Licence amendment application, total molybdenum was not retained as a POPC. Based on monitoring data in the water management pond (WMP), De Beers does not believe that it is necessary to retain total molybdenum as a POPC that requires EQC in the Water Licence. Data reported in monthly surveillance network program reports that are available on the MVLWB's public registry show that total molybdenum concentrations in the WMP are orders of magnitude lower than the current MAC EQC of 0.3 mg/L and MGC EQC of 0.6 mg/L in the Water Licence and orders of magnitude lower than the site-specific water quality objective of 0.073 mg/L. References: De Beers (De Beers Canada Inc.). 2014. Effluent Quality Criteria Report. Prepared for the Mackenzie Valley Land and Water Board. Yellowknife, NT, Canada. April 2014. MVLWB (Mackenzie Valley Land and Water Board). 2014. Reasons for Decision. Land Use Permit & Water Licence Applications. De Beers Canada Inc. Gahcho Kué Project - Kennady Lake, NT. File: MV2005L2-0015/MV2005C0032. August 11, 2014.	
26	Topic 21: Effluent Quality Criteriaâ€“ Water Management Pond to N11- Nickel	**Comment** De Beers has requested to remove nickel as an EQC for discharge from the WMP into Lake N11. Table 2-9 notes that the projected maximum WMP discharge concentration for nickel is 0.0063 mg/L. As this is greater than baseline, nickel was carried through in the screening process in Section 2.4.2. The final screening process for retention of a parameter as an EQC was outlined in Table 2-11 on whether predicted concentrations were above site-specific water quality objectives minus 10%. In this case, the projected discharge concentration of nickel of 0.0063 mg/L was below the SSWQO (0.025 mg/L) - 10% = 0.023 mg/L and as such it was not retained as an EQC. While ENR follows the logical progression of EQC development outlined in the report, it is interesting that nickel was retained in the initial development of the EQCs for the Water Management Pond but has now been screened out. **Recommendation** 1) ENR requests that De Beers provide a summary of changes to nickel factors at site (predictions, observations, etc)	**May 21:** Similar to the response to GNWT-ENR-25 for total molybdenum, total nickel was not retained by De Beers in Version 2 of the EQC Report (De Beers 2014). Total nickel was added to the list of parameters of potential concern (POPC) that required EQC by the Mackenzie Valley Land and Water Board because of uncertainties in water quality model predictions (MVLWB 2014). In the screening that was completed as part of the Water Licence amendment application, total nickel was not retained as a POPC. Based on monitoring data in the water management pond (WMP), De Beers does not believe that it is necessary to retain total nickel as a POPC that requires EQC in the Water Licence. Data reported in monthly surveillance network program reports that are available on the MVLWB's public registry show that total nickel concentrations in the WMP are at least an order of magnitude lower than the current MAC EQC of 0.09 mg/L	

		and/or screening protocol that resulted in nickel being screened out when it was previously identified as a parameter of potential concern requiring an EQC.	and MGC EQC of 0.18 mg/L in the Water Licence and at least an order of magnitude lower than the site-specific water quality objective of 0.025 mg/L. References: De Beers (De Beers Canada Inc.). 2014. Effluent Quality Criteria Report. Prepared for the Mackenzie Valley Land and Water Board. Yellowknife, NT, Canada. April 2014. MVLWB (Mackenzie Valley Land and Water Board). 2014. Reasons for Decision. Land Use Permit & Water Licence Applications. De Beers Canada Inc. Gahcho Kué Project - Kennady Lake, NT. File: MV2005L2-0015/MV2005C0032. August 11, 2014	
27	Topic 22: Effluent Quality Criteria â€“ Water Management Pond to N11 â€“Uranium	**Comment** De Beers has requested to remove uranium as an EQC for discharge from the WMP into Lake N11. Table 2-9 notes that the projected maximum WMP discharge concentration for uranium is 0.0032 mg/L. As this is greater than baseline, uranium was carried through in the screening process in Section 2.4.2. The final screening process for retention of a parameter as an EQC was outlined in Table 2-11 on whether predicted concentrations were above site-specific water quality objectives minus 10%. In this case, the projected discharge on uranium of 0.0032 mg/L was below the SSWQO (0.015 mg/L) - 10% = 0.014 mg/L and as such it was not retained as an EQC. While ENR follows the logical progression of EQC development outlined in the report, it is interesting that uranium was retained in the initial development of the EQCs for the Water Management Pond but has now been screened out. **Recommendation** 1) ENR requests that De Beers provide a summary of changes to uranium factors at site (predictions, observations, etc) and/or screening protocol that resulted in uranium being screened out when it was previously identified as a parameter of potential concern requiring an EQC.	**May 21:** Similar to the responses to GNWT-ENR-25 for total molybdenum and GNWT-ENR-26 for total nickel, total uranium was not retained by De Beers in Version 2 of the EQC Report (De Beers 2014). Total uranium was added to the list of parameters of potential concern (POPC) that required EQC by the Mackenzie Valley Land and Water Board because of uncertainties in water quality model predictions (MVLWB 2014). In the screening that was completed as part of the Water Licence amendment application, total uranium was not retained as a POPC. Based on monitoring data in the water management pond (WMP), De Beers does not believe that it is necessary to retain total uranium as a POPC that requires EQC in the Water Licence. Data reported in monthly surveillance network program reports that are available on the MVLWB's public registry show that total uranium concentrations in the WMP are orders of magnitude lower than the current MAC EQC of 0.06 mg/L and MGC EQC of 0.12 mg/L in the Water Licence and orders of magnitude lower than the site-specific water quality objective of 0.015 mg/L. References: De Beers (De Beers Canada Inc.). 2014. Effluent Quality Criteria Report. Prepared for the Mackenzie Valley Land and Water Board. Yellowknife, NT, Canada. April 2014. MVLWB (Mackenzie Valley Land and Water Board). 2014. Reasons for Decision. Land Use Permit & Water Licence Applications. De Beers Canada Inc. Gahcho Kué Project - Kennady Lake, NT. File: MV2005L2-0015/MV2005C0032. August 11, 2014.	
28	Topic 23: Faecal Coliforms	**Comment** Currently, Condition G, Item 27 of the Water Licence has an EQC for faecal coliforms of 20 CFU/100mL for the Sewage Treatment Plant at SNP-07. In the amendment application, De Beers has proposed that an EQC for faecal coliforms be added to EQCs from N11 and Area 7; however, the rationale is unclear. **Recommendation** 1) ENR recommends that De Beers outline the	**May 21:** As described in the response to ECCC-3, there is a typographical error in the plain language summary of the Effluent Quality Criteria (EQC) Report. De Beers does not want to propose EQC for fecal coliforms in the discharge from the water management pond (WMP) to Lake N11 or the discharge from Area 7 to Area 8. The Water Licence for the Mine has a maximum grab concentration (MGC) EQC for fecal	

		rationale behind the inclusion of an EQC for faecal coliforms for discharges from the Water Management Pond and Area 7.	coliforms of 20 CFU/100 mL. The MGC EQC is applied to the effluent from the sewage treatment (STP), which is the only source of fecal coliforms to the WMP from the Mine. It is proposed that the same EQC continue to be applied to the discharge from the STP to the WMP	
29	Topic 24: Baseline Concentrations in Area 8	**Comment** ENR notes that baseline concentrations are an important factor in screening parameters of interest and subsequently determining appropriate or necessary EQCs. While ENR did not undertake a comprehensive review of the baseline data provided, there are some uncertainties which require clarification. For example, in Table A1 of the Effluent Quality Criteria Report, the maximum TDS concentration for Area 8 at baseline (2011-2013) was noted as 130 mg/L. In comparison, Table 11 of Appendix C of the Environmental Screening Assessment notes that TDS in Kennady Lake baseline was 13.2 mg/L. Similarly, in Table A1 of the Effluent Quality Criteria Report, the maximum ammonia concentration for Area 8 at baseline (2011-2013) was noted as 0.230 mg N/L. In comparison, Table 11 of Appendix C of the Environmental Screening Assessment notes that ammonia in Kennady Lake baseline was 0.032 mg N/L. Given that Area 8 was within Kennady Lake prior to development, it is unclear why TDS and ammonia values would be 8-10x higher at that location than the values noted for Kennady Lake baseline. While TDS is not being proposed as an EQC, these examples raise a larger question of which values are being used for baseline for Area 8 and how this may impact EQC screening for this area. It is important to understand the baseline values being used as screening tools for Area 8 as it is directly related to De Beers' conclusion that copper is the only EQC required for discharge from Area 7 into Area 8. **Recommendation** 1) ENR recommends that De Beers provide additional information on the source of baseline values for Area 8 used within the EQC Report.	**May 21:** For consistency with previous reports, the baseline water quality presented for Kennady Lake in Table 11 of Appendix C are based on the baseline water quality dataset that was developed as part of the Environmental Impact Statement (EIS) (De Beers 2010) and used in the EIS update (De Beers 2011), EIS Supplement (De Beers 2012), and the Water Licence Application (Golder 2014). 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. In Version 2 of the EQC Report (De Beers 2014), De Beers used data from the entire Kirk Lake watershed to develop site-specific water quality objectives (SSWQO) for use in the EQC screening process. In the Reasons for Decision for the Land Use permit (MV2005C0032) and Water Licence (MV2005L2-0015) Applications for the Gahcho Kué Project (MVLWB 2014), the Mackenzie Valley Land and Water Board (MVLWB) describes that "the GNWT-ENR objected to the use of the regional baseline data because "using a regional value (i.e., Kirk Lake watershed) instead of a lake specific value (i.e., Lake N11, Area 8 etc.) as an estimate of baseline may not provide adequate protection to the specific receiving lakes."". The MVLWB agreed with the GNWT-ENR and stated "Since the mixing zones are within Lake N11 and Area 8, the Board concludes that the use of baseline concentrations for settling SSWQOs and EQC should be made with respect to the specific lake that receives the discharge". Therefore, De Beers used the mean plus two standard deviations from data collected between 2011 and 2013 in Area 8 to represent baseline concentrations in Area 8 as part of the EQC screening process that was presented in the Water Licence amendment application. It is conceivable that maximum concentrations in the Area 8 dataset could be higher than the average Kennady Lake basin-wide water quality for the following reasons: . Different sampling locations were used for the Area 8 and Kennady Lake basin-wide baseline water qualities (i.e., more data points were used in the Kennady	

			Lake Basin input water quality); . The statistical calculation ranges were different for the Kennady Lake basin-wide water quality (1998-2011) and Area 8 (2011-2013); and, . Maximum concentrations will always be higher than the average and it is not unreasonable that they would be 8-10x higher than the average, even if the same datasets were used to calculate these two statistics. References: De Beers (De Beers Canada Inc.) 2010. Environmental Impact Statement for the Gahcho Kué Project. Volumes 1, 2, 3a, 3b, 4, 5, 6a, 6b, 7 and Annexes A through N. Submitted to the Mackenzie Valley Environmental Impact Review Board. December 2010. De Beers 2011. Environmental Impact Statement for the Gahcho Kué Project. Volumes 3a Revision 2, 3b Revision 2, 4 Revision 2, and 5 Revision 2. Submitted to the Mackenzie Valley Environmental Impact Review Board in Response to the Environmental Impact Statement Conformity Review. July 2011. De Beers 2012.Environmental Impact Statement Supplemental Information Submission for the Gahcho Kué Project. Submitted to the Mackenzie Valley Environmental Impact Review Board, Yellowknife, NWT, Canada. April 2012. De Beers (De Beers Canada Inc.). 2014. Effluent Quality Criteria Report. Prepared for the Mackenzie Valley Land and Water Board. Yellowknife, NT, Canada. April 2014. Golder (Golder Associates Ltd.) 2014. Gahcho Kué Technical Sessions - Commitment 3, 2014 Updated Water Quality Predictions. Submitted to De Beers Canada Inc., March 6, 2014. MVLWB (Mackenzie Valley Land and Water Board). 2014. Reasons for Decision. Land Use Permit & Water Licence Applications. De Beers Canada Inc. Gahcho Kué Project - Kennady Lake, NT. File: MV2005L2-0015/MV2005C0032. August 11, 2014.	
30	Topic 25: Area 7 Water Quality Modelling	**Comment** The EQC report consists of various screening steps to determine whether a parameter requires retention as an EQC. These include: . Comparing the maximum predicted concentration of a parameter in discharge to baseline; . Comparing the maximum predicted concentration of discharge to SSWQOs for the receiving body; and . Comparing the maximum predicted concentrations at the edge of the mixing zone to baseline concentrations. In short, if predicted concentrations of a parameter are above the SSWQO and baseline at the edge of the mixing zone, it is retained for EQC development. In respect to Area 7 discharge into Area 8, as per the steps outlined above, all parameters were excluded with the exception of copper. As with all modelling and predictive exercises, it is important to understand the foundations on which predictions are made. All of the above steps are dependent on accurate information	**May 21:** Several water management strategies were evaluated during the development of the Water Licence application, including different discharge volumes and timing (e.g., open water versus under-ice). In addition, a sensitivity scenario of pumping 1 million cubic metres (Mm3) of water from the Water Management Pond (WMP) to Area 7, to create additional contingency storage in the WMP, was considered. De Beers decided EQC would not be established for this scenario since it is considered a contingency scenario should it be required. If water is pumped from the WMP to the Area 7 and there is a need to discharge that water to Area 8 rather than back into the WMP or into a pit, De Beers would apply to amend the approved EQC for the Area 7 discharge. Since this water management strategy is only a	

		related to water quality predictions from discharge. If predictions related to maximum concentrations within Area 7 were incomplete, the screening steps that followed may be inappropriate. De Beers has noted that Area 7 will contain run-off water and water quality predictions are contained within Appendix C of the Environmental Screening Assessment provided as supporting information to the application. ENR notes the following references to run-off water within Area 7 throughout the amendment application: . Environmental Screening Assessment: ? Page 111 - There are no direct mine water sources to Area 7, with the exception of a proportion of the watershed runoff coming into contact with the South Mine Rock Pile and a PK ore stockpile.(emphasis added) ? Page 113 - Concentrations of phosphorus are projected to increase in Area 8 during the operational discharge period, primarily from loading sources from the WMP (i.e., the 1 Mm3 pumped transfer in 2018) and Area 7 drainage, each of which has loading from mine rock and PK sources. The increase in total phosphorus is not as high as projected in Area 8 in the 2011 EIS. As for these projections, there is some conservatism in the phosphorus source terms inputs in the model (and projected concentrations do not account for any biological/biochemical decay through uptake), and thus, modelled projections are likely to be overestimated. (emphasis added). . Processed Kimberlite and Mine Rock Management Plan: v.6: ? Section 4.1 - The collected water within the sump will be subsequently pumped to the WMP, Area 7, or the mined-out Hearne Pit, depending on the operational year and operational requirements.(emphasis added) ? Section 4.6 - The west portion of drained Area 7 after Stage 1 construction of Dyke K will serve as a water collection pond CP1 during early years of mine operation.(emphasis added) ? . Operational Water Management Plan: ? 2.3.2 - pump runoff water collected in collection pond CP6 in Area 4 to WMP, or to Area 7, or to the process plant as portion of make-up water if required,.(emphasis added) ? Figures 11 & 12 - Note that CP1 is within Area 7 ? 2.3.14.1 - Runoff from the southern and eastern perimeters of the SMRP will be collected within the collection pond CP7, which will be pumped to the WMP or Area 7 (CP1).(emphasis added). ? Table 2.15 - outlines water inputs into Area 7 including CP7 **Recommendation** 1) ENR requests that during the technical session, De Beers provide an overview of water quality modelling that was undertaken for Area 7 run-off water, including inputs from run-off associated with mine rock and processed kimberlite sources.	contingency scenario, it was not carried forward into the Water Licence application water quality predictions and is, therefore, not discussed in the supporting modelling documents. Details of the approach to modelling Area 7, including the water management concept that was carried forward into the Water Licence application are provided in the Water Quality Model Updates report (Golder 2018). The conceptual model for Area 7 is presented in Section 2.1 and is pasted verbatim in this response. "Area 7 in the closed-circuited area of Kennady Lake stores water from the following sources: . catchment runoff; . a small watershed area of the South Mine Rock Pile (approximately 0.15 km2); and . a small watershed area of the kimberlite ore stockpile (approximately 0.2 km2). The majority of the inflow to Area 7 is from catchment runoff, and therefore, the quality of water stored in Area 7 is expected to be suitable for discharge. As such, De Beers is proposing EQC to allow for discharge from Area 7 to Area 8 in addition to the WMP and Lake N11 to supplement downstream flow mitigation on an intermittent schedule. Discharge will occur periodically to maintain contingency water storage in Area 7, should this be required." The associated model inputs for the above concept are provided in Section 3 and the model results are provided in Section 5.1.2. De Beers agrees to include presentation slides at the Technical Sessions on how the modelling and screening assessment was completed for Area 7.	
31	Topic 26: Water Management Discharge into Area 8	**Comment** Currently, the Water Licence outlines various EQC for discharge from the Water Management Pond into Area 8. In the application letter, it is indicated that De Beers no longer proposes to discharge from the Water Management Pond into Area 8 but instead	**May 21:** The current plan does not include water discharge from the WMP to Area 8. The current water balance and water management plan does not include pumping water from the water management pond to Area 7; however in the	

		proposes to use site run-off from Area 7 for flow augmentation into Area 8. As such, De Beers has proposed that current EQCs from the Water Management Pond into Area 8 be removed from the licence. However, ENR notes the following references in the application package to water from the Water Management Pond being discharged directly to Area 8 or indirectly via Area 7: . March 2018 Project Description: Table 1-1: ? Diversion of clean water from Lake N11 or other sources (e.g., WMP or Area 7 if quality is adequate) to manage inflow volumes and augment Area 8 flow (i.e., downstream flow mitigation [De Beers 2012]).(emphasis added) . Environmental Screening Assessment: ? In addition to water from Lake N11 and the WMP being used for Area 8 downstream flow mitigation, De Beers proposes that the runoff water collected in Area 7 also be used as a supplemental water source for Area 8 downstream flow mitigation (if water quality meets discharge criteria)(emphasis added) ? Page 110 - De Beers also proposes in this 2018 mine plan amendment that the runoff water collected in Area 7 be pumped to Area 8 for downstream flow mitigation in addition to the previously identified sources of Lake N11 and the WMP.(emphasis added) . Operational Water Management Plan, v.5: ? 2.3.2 - Pumping water from the WMP to mined out pits (5034 or Hearne) or other designated area (i.e. Area 7), if required to facilitate the water management, perform maintenance on infrastructure, and facilitate mining;(emphasis added) ? Table 2.9 - notes that water from the WMP may be discharged into Area 7. **Recommendation** 1) ENR requests that De Beers clarify whether water from the WMP will continue to be discharged into Area 8 either directly or indirectly via Area 7.	event of water quantity issues, Area 7 remains an option for temporary water storage. If water was placed in Area 7 from the WMP, the intent would be pump the water back to the WMP, or into a pit at a later date. If there is a need to pump this water to Area 8, an assessment of the water quality and EQCs would be required.	
32	Topic 27: Phosphorus Concentrations in Area 8	**Comment** Table 2-8 of the EQC Report notes that although projected maximum concentrations from Area 7 are 0.0075 mg P/L, predicted phosphorus concentrations in Area 8 are 0.012 mg P/L. Table 2-12 notes that the SSWQO for phosphorus in Area 8 is 0.011 mg P/L. Phosphorus was screened out as a parameter of interest as the discharge concentrations were lower than baseline; however, concentrations are predicted to exceed the SSWQO in Area 8. ENR notes in Table A1 that the maximum phosphorus concentration in Area 8 during baseline was 0.009 mg/L. **Recommendation** 1) ENR requests that De Beers discuss phosphorus behavior in Area 8 that may result in an increase in phosphorus.	**May 21:** A mass balance water quality model was developed to account for mixing of Area 7 discharge with other sources (e.g., natural runoff) flowing into Area 8. The mass balance included salt rejection from ice formation, which results in total phosphorus concentrations being greater than the maximum discharge concentration from Area 7 and the maximum baseline concentration in Area 8. The mass balance approach provides a conservative estimate of total phosphorus concentrations in Area 8 since it does not account for nutrient cycling (e.g., phytoplankton growth) which may limit concentrations.	
33	None	**Comment** None **Recommendation** 2) ENR requests that De Beers discuss the potential for phosphorus loading to Area 8 and whether the screening tool for phosphorus (i.e. discharge limit lower than SSWQO) is appropriate if that is the case (i.e. concentrations could cycle and accumulate in the	**May 21:** There are three sources of total phosphorus loading to Area 8: natural inflows from the Area 8 watershed, proposed discharge from Area 7 for downstream flow mitigation, and proposed discharge from Lake N11 for downstream flow mitigation. The load of total phosphorus to Area 8 from natural inflows is approximately 5 kg/yr. The	

		receiving environment beyond discharge limits and potentially create SSWQO exceedances).	load of total phosphorus from the proposed discharge from Area 7 is projected to add 9 kg/yr to Area 8 in Years 5, 6, 9, and 11 of operations (i.e., 2021, 2022, 2025, and 2027). The load of total phosphorus from the proposed discharge from Lake N11 is projected to add 6 kg/yr to Area 8 in Years 3, 7, and 10 of operations (i.e., 2019, 2023, and 2026). Total phosphorus concentrations in Area 8 are projected to be approximately 0.006 mg P/L during the open-water season and peak at approximately 0.012 mg P/L during the ice-cover season (Figure GNWT-ENR-33.1). Total phosphorus concentrations are projected to exceed the site-specific water quality objective (SSWQO) of 0.0109 mg P/L for very short periods of time during the ice-cover seasons (Figure GNWT-ENR-33.1), which consistently return to concentrations similar to existing conditions during the open water periods.	
34	Topic 28: Copper Concentrations in Area 8	**Comment** Page 114 of the Environmental Screening Assessment notes: "Despite the projected exceedance of the site-specific water quality objective, the potential for copper to cause adverse effects to aquatic life in Area 8 is considered low. The site-specific water quality objective for copper is based on the CCME guideline, which is intended to be conservative and protective of the most sensitive species. The CCME guideline is based on toxicity tests with naive organisms, whereas organisms inhabiting Area 8 are expected to potentially have some degree of acclimation or adaptation to copper, given that baseline sediment copper concentrations in Kennady Lake exceed the CCME ISQG (Section 2.4.3.1). Given the small magnitude by which projected maximum concentrations exceed the site-specific water quality objectives, and the potential for ameliorating factors, such as other water quality characteristics (e.g., dissolved organic carbon) to reduce bioavailability and ameliorate copper toxicity, the potential for adverse effects from copper is considered to be low." **Recommendation** 1) ENR requests that De Beers clarify if they have undertaken any studies to confirm that copper levels in water may not adversely affect organisms inhabiting Area 8 as they are Ã¢Â€Âœexpected to potentially have some degree of acclimation or adaptation to copper, given that baseline sediment concentrations in Kennady LakeÃ¢Â€Â as noted by De Beers in their application.	**May 21:** As part of the Gahcho Kué Project Environmental Impact Statement review process, Aboriginal Affairs and Northern Development Canada requested that De Beers assess copper toxicity in the context of hardness, alkalinity, and dissolved organic carbon using the biotic ligand model (BLM) from the United States Environmental Protection Agency. The BLM-derived chronic effects benchmarks for dissolved and total copper ranged from 1.63 µg/L to 2.30 µg/L and were similar to the Canadian Council of Ministers of the Environment water quality guideline for copper of 2 µg/L. Detailed results are described in De Beers (2012). De Beers has a well-established aquatic effects monitoring program to evaluate the short-term and long-term effects on the physical, chemical, and biological components of the aquatic ecosystems affected by the Gahcho Kué Mine and to provide the necessary input for implementation of adaptive management throughout the lifespan of the Mine. Reference: De Beers. 2012. Gahcho Kué Project Environmental Impact Statement Information Request Responses. Prepared for the Mackenzie Valley Review Board. Yellowknife, NT, Canada. April 2012. http://reviewboard.ca/registry/eir0607-001	
35	Topic 29: Area 7 Closure	**Comment** The Project Description notes that progressive closure options exist regarding restoring Area 7 earlier in the mine life. **Recommendation** 1) ENR requests clarification if the use of Area 7 for flow augmentation to Area 8 inhibits the potential to restore Area 7 earlier in the mine life.	**May 21:** The use of Area 7 for flow augmentation is not anticipated to inhibit the potential to restore Area 7 earlier in the mine life. Area 7 is an alternative source for downstream flow mitigation, and not the primary source. Lake N11 remains the primary source.	

36	Topic 30: Water Use	**Comment** De Beers has requested that annual water use from Area 8 be increased from 27,000 m3 to 45,000 m3, an annual increase of 18,000 m3. Based on discussions with De Beers, it is ENR's understanding that additional camp capacity and other developments at site have created a water shortage issue at camp. As noted in Section 2.4.1 of the Operational Water Management Plan v.5, the amount of water available under ice in Area 8 is 1,300,000 m3. De Beers notes that if 10% were withdrawn as per Fisheries and Oceans protocol, a total of 130,000 m3 would be available for use. ENR notes that there is a potential that since the initial assessment of available water within Area 8 was completed, Kennady Lake was dewatered. As a result, it is unclear if the previously referenced available water volumes are current. ENR notes that water withdrawal has the potential to impact the aquatic environment through the reduction of dissolved oxygen under ice. **Recommendation** 1) ENR requests that De Beers outline the date when the initial assessment of available water within Area 8 was completed.	**May 21:** Assessments of changes to Area 8 hydrology performed as part of the EIS (De Beers 2010) focused on changes to lake water surface elevation and discharge at the lake outlet. The assessment for water use during construction (i.e., 60,000 m3/yr) and operations (27,000 m3/yr) considered the construction of Dyke A and dewatering of Kennady Lake, as well as the reduced drainage area reporting to Area 8. The initial assessment of available water within Area 8 was completed as part of the Gahcho Kué Mine Construction Water Management Plan v.2 (June 2014). This was an addition to the original description of raw water supply presented in the draft Water Management Plan submitted as Attachment 21.2 of the Gahcho Kué Water Licence Application (November 2013). Operational data collected and reported annually, including surface water elevations in Area 8, were also taken into consideration during the environmental screening assessment conducted for the 2018 amendment (Attachment 2 of the application).	
37	None	**Comment** None **Recommendation** 2) ENR requests that De Beers provide an update on the volume of water available for use within Area 8, taking into account any changes in water levels that may have occurred as a result of the dewatering of Kennady Lake.	**May 21:** As described in Section 4.6.3 of the 2018 Environmental Screening Report (ESA), under the pathway of Changes to Water Withdrawals from Area 8 for Potable Water for the Camp may Affect Surface Water Quantity and Fish in Area 8, the potable water requirements are expected to be similar to the annual quantities withdrawn in 2015 and 2016 during construction. About 36,000 m3 of freshwater was used for potable water in 2015 and 39,000 m3 in 2016, less than the annual quantity of 60,000 m3 specified in the Water Licence for construction (Schedule 3, Part D). The conservative assessment of Area 8 water supply presented in the Gahcho Kué Mine Construction Water Management Plan v.2 (June 2014) and carried through to present considered: - An approximate lake water surface elevation of 420.7 m - An assumed 2 m thick ice cover The 2012 EIS supplement (De Beers 2012) projected changes in Area 8 water depth varying from -0.016 m (November) to -0.117 m (May), increasing on a monthly basis due to winter water withdrawal. This would indicate lake hydrostatic water surface elevations varying from 420.7 m in early winter to 420.6 m in late winter. Table GNWT-ENR-37.1 shows the Area 8 water surface elevations during monitoring during construction and operations from January 2015 to October 2017, as presented in annual AEMP reports. Table GNWT-ENR-37.1 Monitored Water Surface Elevations in Area 8 Note that dewatering discharges to Area 8 from Area 7 of Kennady Lake took place under ice covered	

			conditions from December 20, 2014 to January 2, 2015 and from May 15, 2015 to September 7, 2015. No dewatering discharges occurred in 2016 or 2017 (as the dewatering was already completed). Under normal conditions, Area 8 water surface elevations would be expected to be approximately equal to the Area 8 lake outlet zero-flow elevation (approximately 420.5 m) during the freeze-up period; the lake water surface elevation may increase over the winter period due to local runoff and precipitation while the lake outlet is frozen, which may partially offset water withdrawals. The data presented above show that late winter (February through April) water surface elevations at Area 8 have ranged from 420.62 m to 420.65 m in 2016 and 2017 (post-dewatering), which is slightly above the projected late winter water surface elevation of 420.6 m. As described in the 2018 ESA, potable water supply from Area 8 is a small annual supply volume compared to the volume of Area 8 and predicted outflows during construction and operations. The annual water use will be similar to that used during construction and monitoring will continue. Any effects to fish habitat from the increase in the annual water use during operations from 27,000 m3/y to 45,000 m3/y would be expected to be negligible (i.e., likely not measurable).	
38	Topic 31: Discharge Limits into N11	**Comment** Schedule 3, Part D, Item 2(b) of the Water Licence contains an annual discharge limit from the Water Management Pond into N11 of 3,450,000 m3/year. De Beers has requested an addition to this condition whereby if the discharge is not completed within the anniversary year of the licence, it may be completed within the subsequent anniversary year. De Beers' rationale outlines that the discharge pipe is only available outside of the downstream flow mitigation period. Given that the flow augmentation relates to flow from Lake N11 to Area 8 and the water discharge in the recommendation relates to discharge from the Water Management Pond into Lake N11, the relationship is unclear. Is the same discharge pipe utilized for both areas? Additionally, De Beers has noted that as a result of the Water Licence anniversary date occurring on September 24th, discharge may be limited to the period between September 1st and September 24th. Given that the "discharge balance" (i.e. 3,450,000 m3) would "reset" on the day after the anniversary licence, it is unclear why discharge would be limited to the period outlined by De Beers? The discharge period would be September 25 of one year to the following September 24, so discharge would not have to cease on the anniversary date. For example, Table 7-4 of the 2017 Annual Report notes that Water Management Pond Water was discharged	**May 21:** Discharge from the Water Management Pond to Lake N11 is limited to periods when the water quality meets EQC (predicted to be June-November) and when the pipe is available for use (September 1-May 31). The pipe to N11 is used annually from June 1-September 1 for downstream flow mitigation from Lake N11 to Area 8. Therefore, it is not available for use to convey water from the Water Management Pond to Lake N11 during that period. Water quality in the water management pond deteriorates each winter as ice formation excludes dissolved solids. Water quality improves each spring (beginning in June) as the ice melts and freshet inflows further dilute the water management pond. De Beers plans to discharge from the Water Management Pond to Lake N11 during ice-free periods in order to capitalize on this annual process of improved water quality. If water quality during the winter does meet EQCs, De Beers may discharge during the winter as we have in previous years, however we are not predicting that will be possible in either 2019 or 2020. The anniversary date of the licence is September 24th. Therefore, discharge is expected to be limited to the period between the end of	

		into N11 into January 2017 and from September into November 2017. **Recommendation** 1) ENR recommends that De Beers clarify the relationship between flow augmentation to Area 8 and discharge from the Water Management Pond into Lake N11 as it relates to the availability of the discharge pipe.	downstream flow mitigation (September 1) to the anniversary date of the licence (September 24) during any given year. This is an insufficient period of time to discharge the full annual allotment of 3.45 Mm3. As an example of how this can occur, imagine that water quality does not meet EQC within the calendar year of 2018 therefore there is no discharge. That allotment of 3.45 Mm3 of water however could still be discharged prior to September 24, 2019. With the spring inflows of freshet in 2019, imagine the water quality became sufficient for discharge. The entire 3.45 Mm3 would need to be discharged from Sept.1 to Sept. 23 in order to remain within the terms of the licence and the interpretation of ENR that the water discharge volume is tracked on licence year rather than calendar year. It is therefore requested that an annual allotment be allowed to carry over into the subsequent anniversary year of the licence so the discharge could proceed through the fall (over the anniversary date). Alternatively, the calendar year could be used as the water discharge year, consistent with all other aspects of the water licence.	
39	None	**Comment** None **Recommendation** 2) ENR recommends that De Beers clarify the scenario whereby discharge would be limited to September 1-24 in any given year.	**May 21:** See above - response to GNWT-ENR Central Email 38	
40	Topic 32: Alternative Analysis	**Comment** As part of the amendment application, De Beers provided Attachment 9, Mine Rock Management Alternatives Analysis. Table 6 outlines how options were weighted against each other. Some of these weighting inputs are unclear specifically for the chose option (Option A) and Option B (which created more land disturbance but less in-lake disturbance). **Recommendation** 1) ENR requests clarification on the following weighting items from the assessment analysis: ? Under maintenance of precedent of closure design, given the loss of additional footprint post-closure in Kennady Lake, shouldnÃ¢Â€Â™t this ranking be lower for Option A than Option B? ? Have additional offsetting costs been accounted for under closure costs for Option A potentially resulting in higher costs than Option B?	**May 21:** Option A and Option B were both scored 4.0 for "Maintain Precedent of Closure". Both options allow Kennady Lake to be reconnected to Watersheds E and D, with flow towards the original Kennady Lake Outlet, (Area 8). Although Option A had a larger footprint on the water, it had a smaller footprint on land than Option B. This balances off impacts, and therefore both options were rated similar. The offsetting costs have been based on the design presented in the updated project description, which is a slight variation of Option A.	
41	Topic 33: Waste Rock Expansion	**Comment** Table 7 of the Environmental Screening Assessment refers to "in-lake storage" for a portion of the PAG material in the West Mine Rock Pile. Section 3.2 and 5.3.2 of the West Mine Rock Pile Final Detailed Construction Plan specifies that approximately 4.0 Mt of PAG material will be in a "long-term submerged zone" which will include PAG from 5034 during Years 4&5 (2.0 MT), Hearne Pit Year 5 (0.5 MT)	**May 21:** Mine rock material will be managed to be maintained in a non-AG state within each rock pile, which is the current basis for the water quality modeling. If it is maintained in a non-AG state, no supplemental effects to the water quality predictions would be expected. During operations and closure, when the lake is refilling, the water	

		and Tuzo Year 4 (1.5 MT) while the remaining PAG material will be placed within the centre of the pile. Additionally, Page 21 of the Geochemical Plan, v.4 notes that "In the first two years of operation, PAG rock will be placed within the mine rock piles; the basal layer of the mine rock piles is below the final closure water level of Kennady Lake. Between Year 2 and Year 8, PAG rock will be segregated within the core of the mine rock piles. After Year 8, the PAG rock will be placed in the mined-out 5034 Pit, which will ultimately be below the final closure water level of Kennady Lake. Submersion of rock below the final water level of Kennady Lake will mitigate the acid generation potential of PAG rock." While it is clear that a portion of the PAG material will be submerged at closure, it is not clear if the material will be submerged during placement (low-lying areas of the lake that have retained water) or if it will be exposed until closure. **Recommendation** 1) ENR requests that De Beers clarify if PAG material below the high water mark will be submerged during operations or only during closure. If the latter: Ã¢Â€Â¢ ENR requests clarification on how long PAG material will be exposed prior to being submerged at closure. Ã¢Â€Â¢ ENR requests information on whether the amount of time the PAG material is exposed to air is increased as result of the West Mine Rock Pile expansion. If PAG material will be exposed for a longer time period, ENR recommends that DeBeers comment on whether this will affect the quality of seepage from the Rock Pile, both in the near term and during closure.	level around the rock piles will vary; water level projections are detailed in the OWMP (attachment 6 of the application). The water level in Area 3/5 is projected to be lower than 420.0 masl until approximately 2021. The water level will be lowered during the initial closure period, and then brought back to the original lake level 420.7 masl at the end of refilling (prior to the post closure period). On the basis of each rock pile: . The PAG rock below the South Mine Rock Pile is in a relatively dry state from the start of operations to about 16 years after start of refilling. It will be partially submerged for a short period (between 16 years to about 19 years after the commencement of refilling). . The PAG rock below the West Mine Rock Pile will be partially submerged for a few years during operation until the water level rises to about elevation 420 masl in 2021, and be then be submerged to until 2026. The water level will drop to about 417.0 masl while the pits are being filled. It will be partially submerged during the refilling phase. During the operations and closure period, site monitoring (e.g., SNP, geochemical characterization plan) will be undertaken, which will identify any seepage/water quality concerns around the rock piles during periods when the PAG rock is partially submerged.	
42	Topic 34: Waste Rock Expansion	**Comment** The Revision History for the updated design plan for the West Mine Rock Pile notes that within Section 5.3.3, Figure 22 has been updated. **Recommendation** 1) ENR requests that De Beers clarify the updates to Figure 22 of the West Mine Rock Pile Final Detailed Construction Plan.	**May 21:** Version 1 of the West Mine Rock Pile Detailed Construction Plan was for the first phase of the West Mine Rock Pile. Version 2 of the West Mine Rock Pile includes the expanded second phase of west mine rock pile. Figure 12 of the first version was modified to show the second phase of the West Mine Rock Pile and renamed Figure 22.	
43	Topic 35: Waste Rock Expansion	**Comment** Section 4 of the West Mine Rock Final Detailed Construction Plan, Version 2 references that runoff from the pile will flow directly into Area 5. Additionally, diversion ditches might be required along the western perimeter and that this will be further evaluated during construction. ENR understands that Area 5 is a component of the Water Management Pond during operations however uncontrolled runoff and seepage water from the pile may report directly to Kennady Lake during closure. Table 1 of Attachment 4 - Geochemical Characterization Plan V.4 - references a "Summary of Commitments of Geochemical Characterization Plan" which includes a condition from the Water Licence, Part G, Item 19: The Licensee shall construct, operate, and maintain the South Mine Rock Pile, West Mine Rock Pile, the Fine Kimberlite Containment Facility, and the Coarse Kimberlite Containment Facility, and all other Waste storage facilities, to design	**May 21:** As geochemical testing of mine rock and kimberlite material during baseline and on-going operations testing has indicated a low proportion of mine rock would be potentially acid-generating (PAG) (<7%) and all PK was non-acid generating (NAG), runoff and seepage from the mine rock piles and PK storage facilities (which will be covered by mine rock) in the post-closure phase are not anticipated to provide any adverse risk to Kennady Lake. However, the potential for acidic drainage and metals release will be addressed through ongoing environmental monitoring and seepage studies associated with the Geochemical Characterization Plan (De Beers 2018). Seepage quantity and quality from the mine rock piles will be monitored at survey stations established along the toes of the mine rock pile and/or in surface runoff	

		specifications/engineering standards such that: b) Any Seepage from the Waste storage facilities that occurs and does not meet effluent quality requirements, as specified in Part G, shall be prevented from entering the Receiving Environment; ENR notes that the actual Water Licence condition specifies Part G, items 27, 30 and 31 which outline the faecal coliform limit from the Sewage Treatment Plant (Item 27, SNP Station 07), discharges from the WMP to Lake N11 (Item 30, SNP Station 02) and discharges from (currently) WMP to Area 8. (Item 30, SNP Station 04). The Table also notes that this commitment corresponds to Section 6 of the Geochem Plan however Section 6 is limited to rock monitoring and analysis and does not appear to include water. As such, ENR notes that as none of the identified effluent quality criteria or other commitments relate specifically to water quality associated with the Waste facilities for waste rock or PK, it is unclear if current measures adequately protect the environment from seepage from these facilities, particularly during closure. **Recommendation** 1) ENR requests clarification from De Beers regarding the determination that seepage from Waste storage facilities is suitable for entry into the environment.	draining from the mine rock piles. In addition to the monitoring through operations and closure phases (when Kennady Lake is being refilled and before Kennady Lake is reconnected to the downstream environment), the ICRP (De Beers 2016) identifies two reclamation plans (i.e., 2.2: Post-closure seepage quality and quantity and 3.1: Physical stability of engineered rock covers; De Beers 2016) that will confirm and/or refine seepage mass loading predictions from the mine rock and PK disposal facilities in post-closure conditions and confirm the long-term performance of the designed mine rock covers for the Fine PKC Facility and Coarse PK Pile. The design of the mine rock piles, which includes storage of PAG material well within the piles, and the use of engineered mine rock covers on the Fine PKC Facility and Coarse PK Pile will facilitate surface runoff and further limit infiltration and water contact with PK or PAG mine rock material prior to entering Kennady Lake. Additionally, the quantity of infiltration within the mine rock and coarse PK piles will limit due to exposure to freezing surface temperatures and permafrost aggradation. Permafrost has not been assumed as a mitigating factor for seepage quality in these structures, but is predicted to provide an additional level of mitigation against potentially adverse water quality from seepage flows from the mine rock piles and PK storage facilities. During operations and closure phases, adaptive management action levels for seepage monitoring results at mine rock piles and the PK storage facilities have been established and approved as part of the Mine's Geochemical Characterization Plan (De Beers 2018). The action levels have been developed with two primary objectives: to prevent the formation of acid rock drainage, and minimize the potential for discharge of acidic drainage or seepage that could cause an adverse environmental effect. In addition to the seepage monitoring results acquired during mining, the predetermined action thresholds and consequent management responses provides an initial framework to inform closure planning. It is anticipated that seepage monitoring data collected during the mine operations and results of the reclamation research plans will further refine the understanding of seepage quantity and quality and be used to establish closure objectives to provide confidence that seepage from the mine rock and PK storage facilities is suitable for entry into the receiving environment.	

44	None	**Comment** None **Recommendation** 2) Should water related to these piles be unsuitable for the receiving environment, ENR requests clarification from De Beers regarding proposed water management for seepage and runoff water from the rock piles, during closure.	**May 21:** Water quality will be monitored throughout the Mine life and into closure within, and outside of, the controlled area through the SNP and the AEMP to identify future risks and deal with potential issues well in advance during mine operations and closure before Kennady Lake is fully restored. During closure, the rate of refilling of Kennady Lake is controlled by the pumping of water from N11 and by water flowing into Kennady Lake after the removal of Dykes E, F, and G. The following contingency measures have been identified as potential responses to water quality issues during closure: If a risk is identified near the end of Mine operation or during early mine closure, the closure and refilling plan can be adjusted accordingly. For example, breaching of Dykes E, F, and G can be delayed and refilling (pumping) from Lake N11 may be reduced or ceased to allow a longer closure period to address the potential water quality issue before the water level in the controlled basin is raised to its original lake elevation of 420.7 masl. ?Isolate the basin area within Kennady Lake with poor quality water from the area where the water quality can meet discharge criteria. This will allow early restoration of a portion of the refilled Kennady Lake. Raise the containment dykes to store the poor quality water until the water quality meets discharge criteria. Treat the poor quality water zone. Additional options are likely to be developed and evaluated once the key sources of the poor quality water had been identified.	
45	Topic 36: Waste Rock	**Comment** Table 7.3-1 of the Updated Project Description and Table 2 of the Summary of Mine Waste Production Schedule both indicated that no mine rock or ore will be removed from Hearne Pit in Year 4 but that mining will be resumed in Year 5 for one year. The rationale behind this is unclear. **Recommendation** 1) ENR requests that De Beers clarify that no mining will occur in Hearne Pit in Year 4.	**May 21:** The mine plan optimizes the availability of mine fleet to meet the ore requirements for the processing plant. During Year 4, ore is scheduled to be obtained from a large ore body in the 5034 pit. The mine plan and ore source will be adjusted somewhat throughout the mine life to accommodate specific conditions.	
46	Topic 37: Kennady Lake Post-Closure	**Comment** An implication of the expansion of the West Mine Rock Pile is that an additional permanent footprint will be required within Kennady Lake. Specifically, as noted on p.93 of the Environmental Screening Assessment, the loss of surface area of Kennady Lake will increase from 12.4% to 20.1%. The original anticipated loss was 11.8%. While the covering letter from De Beers does note that this area was already designated for disturbance, the dewatering of Kennady Lake to support the development of the mines and use as a water management structure was a temporary activity whereas the expansion of the WMRP into the lake will now be a permanent disturbance. De Beers has noted this circumstance as there is mention	**May 21:** Specifying a quantitative threshold (in terms of percentage of area) of Kennady Lake that can be lost is not an appropriate measure to evaluate if closure objectives will be maintained. The assessment considers the physical habitat characteristics at closure to provide suitable habitat conditions for the closure fish community. Based on the 2018 mine plan amendment, the total lake surface area of Kennady Lake in post-closure (including Area 8) will be approximately 649.7 ha, and as such, Kennady Lake will continue to be a medium-sized lake in the area that can support a fish assemblage similar to the pre-mining fish	

		that there will be discussions with Fisheries and Oceans Canada regarding any changes that will be required under the Fisheries Act Authorization and any additional offsetting that may be required. While De Beers references offsetting through DFO mechanisms as a tool to mitigate loss of aquatic habitat at Kennady Lake, ENR notes that the re-establishment of aquatic species within Kennady Lake post-closure was an important component of project development and approvals within the Environmental Impact Statement. As part of the amendment application, De Beers provided Attachment 9, Mine Rock Management Alternatives Analysis of which Table 4 states that the selected option meets closure objectives, which includes returning Kennady Lake to a state that will support a functioning aquatic ecosystem and traditional uses. As the available surface area of Kennady Lake has now been reduced, De Beers should outline the amount of permanent disturbance to Kennady Lake that can occur while still ensuring these closure objectives are met. This evaluation should consider the area lost due to alterations of the mine plan such as pit sequencing, pit expansions and expansion of the west mine rock pile, expansion of the Fine PK facility and Dyke L, etc. **Recommendation** 1) Given that in excess of 20% of Kennady Lake has now been permanently lost, ENR recommends that De Beers outline the amount of Kennady Lake that is required to maintain closure objectives related to the re-establishment of aquatic species within Kennady Lake.	community and other regional lakes of similar size. As examples, Lake N11 (538 ha) supports Lake Trout, Burbot, Northern Pike and several forage species, and East Lake (578 ha) supports Lake Trout, Lake Whitefish, Round Whitefish, Burbot and several forage species. Some areas of Kennady Lake will have the same bathymetry and substrate conditions as prior to development, which will provide fish spawning and overwintering habitat. Other areas will have modified or enhanced habitat where mine pits, dykes, and roads were located. As such, there will be additional overwintering habitat in the upper layer of the pits, and additional coarse substrate for rearing. In-lake habitat enhancements will also be created by De Beers as part of the Offsetting Plan; these include modifications to Dyke B at closure and the installation of finger reefs in Areas 6 and 7. Some new lake area will also be created where pit developments extended onto terrestrial areas that will be submerged at closure. As such, the increased footprint of the West Mine Rock Pile is not expected to change the ability of the refilled and reconnected Kennady Lake to support a functioning aquatic ecosystem and meet closure objectives.	
47	Topic 38: Kennady Lake Post-Closure	**Comment** De Beers notes in Table 7 of the Environmental Screening Assessment that the extension of mine life will have no linkage to water and sediment quality or fish. Page 90 of the document assesses impacts to N11 from additional pumping time from the source but it is not clear that closure implications to the re-establishment of Kennady Lake were also considered. **Recommendation** 1) ENR requests that De Beers explicitly consider whether the extension of mine life, specifically the delay of refilling of Kennady Lake from +12 years to +19 years, will have any impacts on closure objectives relating to aquatic species returning to inhabit Kennady Lake.	**May 21:** Although there will be an additional delay of approximately seven years during the refilling period, it is not expected that this delay will alter the overall ability of the lake to be recolonized. Recolonization is expected to occur from downstream habitats connected to Kennady Lake, such as Lake 410 and Kirk Lake, which are not affected by Mine operations, and the fish populations in these systems would be available for recolonization at closure, regardless of the delay. Following closure, the physical and chemical environment of Kennady Lake will be suitable for aquatic life and a functioning aquatic ecosystem will develop shortly after refilling. The phytoplankton community will begin to develop during the refilling period. The zooplankton community development is predicted to follow the phytoplankton community, with recovery of the benthic invertebrate community expected to be within the first 5-10 years following refilling. After development of the forage fish community, which would likely begin to develop during the refilling period, the larger-bodied predatory species, such as Northern Pike and Lake Trout, would colonize. These large-	

			bodied fish species are expected to colonize the refilled lake areas shortly after refilling, but it will take time for the populations to build, and then stabilize. The fish species assemblage within Kennady Lake in post-closure is expected to be similar to pre-development conditions, including the re-establishment of large-bodied fish populations, such as Northern Pike, Arctic Grayling, Burbot, Round Whitefish, and Lake Trout	
48	Topic 39: RECLAIM	**Comment** ENR notes that the expansion of the mine rock pile and fine PK facilities as well as other closure implications related to the pit expansions (e.g. extended duration of flooding of Kennady Lake post-closure) have resulted in additional liability on site. De Beers has initiated discussions with ENR in this regard and an updated security estimate was provided to GNWT in April 2018 for review. Both parties will continue to discuss and refine the estimate in advance of De Beers' June 30, 2018 submission deadline to the Board for the updated reclaim estimate. **Recommendation** 1) ENR will make formal recommendations regarding the security estimate as part of this process.	**May 21:** Acknowledged	
49	Topic 40: Increase in Project Footprint	**Comment** To better understand cumulative effects in the NWT, ENR-NWT Cumulative Impact Monitoring Program has developed the 'Inventory of Landscape Change' (ILC). One of the layers incorporated in the ILC is derived from public registry documents and validated through satellite imagery. Submission of standardized spatial data to public registries facilitates data acquisition for this layer. **Recommendation** 1) ENR recommends that De Beers Canada Inc. ensure, if they havenÃ¢Â€Â™t already done so, that geospatial data is provided for the proposed project footprint amendment at the commencement of the land use operation, and for the completed project footprint at the end of the land use operation to the Land and Water Board for posting on the public registry. The Ã¢Â€ÂœMVLWB Standards for Geographic Information Systems (GIS) SubmissionsÃ¢Â€Â should be followed when submitting spatial data.	**May 21:** Geospatial data related to the mine footprint amendment will be provided submitted to the Mackenzie Valley Land and Water Board upon approval of the amendment application (and at the end of the land use operation) following the "MVLWB Standards for Geographic Information Systems (GIS) Submissions".	
GNWT - Lands - North Slave Region: Joseph Heron				
ID	**Topic**	**Reviewer Comment/Recommendation**	**Proponent Response**	**Board Staff Analysis**
1	MV2005L2-0015 & MV2005C0032 Amendment Application	**Comment** The Inspector has reviewed the application and related documents. **Recommendation** No comments concerning the applications at this time.	**May 21:** Acknowledged	
MVLWB: Heather Scott				

ID	Topic	Reviewer Comment/Recommendation	Proponent Response	Board Staff Analysis
1	Land Use Permit Form	**Comment** In section 10 of the form, De Beers provides a list of equipment. **Recommendation** Please clarify if these are the only additional pieces of equipment for the Amendment.	**May 21:** These are the major pieces of additional equipment associated with the amendment.	
2	Updated Project Description 2018	**Comment** According to Table 1.1-1 in the UPD 2018, De Beers describes the depths of each pit as: - Hearne Pit = 216 m (up to 252 m) - 5034 Pit = 286 m (up to 310 m) - Tuzo Pit = 372 m (up to 373 m) However, in Section 1.2: Pits, De Beers states ".this can result in variation in final pit depth of +/-40m or more." **Recommendation** Board staff are seeking clarity on what is the maximum depth of each pit at this time as it will be used to conduct the preliminary screening.	**May 21:** The maximum pit depths are as follows: Hearne = 252; 5034 = 310; Tuzo = 373	
3	Updated Project Description 2018	**Comment** In Figure 5.4-2 in the UPD 2018, the figure shows a "Road to Area 8". Board staff do not recall seeing this land feature on any previous maps. **Recommendation** Please clarify if this road is a new feature as apart of this Amendment or is a previous feature.	**May 21:** This road is a previous feature and was always anticipated to be required for access along the downstream flow mitigation pipeline.	
4	Amendment Application: Additional year of discharge from WMP to Lake N11	**Comment** De Beers has requested an additional year of discharge from WMP to Lake N11 (Water Licence Application, section 7). However, other documents submitted with the application imply that additional years of discharge may be necessary. For example, p 39 of the Version 5 Water Management Plan states ""The maximum concentrations in the Water Management Pond for the EQC parameters listed in Table 2.6 are predicted based on various conservative assumptions (i.e. higher TDS concentration inputs from pit inflow and Area 2 Fine PKC Facility), it is expected that the actual concentrations in the WMP will be lower than predicted, which will result in a longer discharge period (beyond Year 4 (2020))." The footnote to Table 2.9 (Timeline) of the Water Management Plan states that "Discharge may continue beyond Year 4 if discharge criteria is met in the Water Management Pond." Section 4.2 of the March 2018 Environmental Screening Assessment proposes the "an additional year of operational discharge from the Water Management Pond to Lake N11 (i.e., in Year 4, if water quality meets discharge criteria) and the flexibility to carry over discharge allotments into the susequent year." **Recommendation** Please clarify if De Beers is requesting only one additional year of discharge (i.e., to "year 4" or 2020) or does De Beers want the water licence to allow discharges from the Water Management Pond to Lake N11 beyond 2020?	**May 21:** De Beers is only requesting 1 additional year ("Year 4") of discharge from the WMP to Lake N11.	

5	Amendment Application - Part G, item 31: Request for discharge from Area 7 to Area 8	**Comment** De Beers has requested "Area 7 be specifically referenced to clarify that Area 7 is an allowable discharge point." The rationale for the discharge is to support downstream flow mitigation. **Recommendation** The amended wording for Part G, item 31 that De Beers has proposed will no longer allow discharges from the WMP to Area 8. Please confirm that De Beers does not foresee any circumstances where water from the WMP would be needed for flow mitigation of Area 8.	**May 21:** De Beers does not foresee any circumstances where water from the water management pond would be needed for flow mitigation to Area 8	
6	Amendment Application - Part G, item 31: Request for discharge from Area 7 to Area 8	**Comment** In the 2017 Annual Water Licence Report, section 7.3, reports that water was transferred from Lake N11 and Lake A1 for the purposes of flow mitigation. According to Table 2.9 of the Water Management Plan, De Beers proposes water transfer from Lake N11 and Area 7 to Area 8 for flow mitigation but also diversion of water from watershed A to Area 8. **Recommendation** Please confirm the sources of water De Beers plans to use for flow mitigation to Area 8.	**May 21:** Lake N11, Area 7, and Lake A1	
7	Amendment Application - Part G, item 29: request to change compliance point station	**Comment** De Beers has requested to change this item to require samping results from SNP stations "currently active within the Water Management Pond" instead of from SNP stations 02 and 04 to the Inspector 5 days prior to discharge to Lake N11. The rationale given was that "water in SNP 02 is fairly isolated due to its bathymetry within the pond during non-discharge periods. During discharge from SNP 02 to the receiving environment, water is drawn from a larger portion of the pond. To ensure a better representation of the water management pond water prior to discharge, we request that the Inspector view all active SNP stations for water quality prior to permitting discharge. SNP 04 is acceptable as is. " Note that the SNP refers to station 02 as "in-line monitoring for end-of-pipe Discharge from Kennady Lake to Lake N11." **Recommendation** Part G, item 29 is a common type of condition in a water licence. It is meant to ensure that the Inspector is aware of the water quality of the effluent just prior to discharge to ensure compliance to EQC. The wording of De BeersÃ¢Â€Â™ request regarding station 02 makes is sound like either there is no Ã¢Â€Âœin-lineÃ¢Â€Â monitoring or that somehow there is a difference between the water quality measured at SNP02 and the water quality of the actual discharge. Please describe how and exactly where monitoring is conducted at SNP02; also whether there is some discrepancy between the SNP02 results and the quality of the discharge to Lake N11. Overall, further rationale is necessary to for this amendment request.	**May 21:** The reality of pre-discharge sampling from Area 3/5 to N-11 is that you cannot take an in-line sample without the commencement of discharge. Pre-discharge SNP-02 sampling is completed at the intake location while the pumps are turned off. Water quality samples are submitted to a laboratory with results tabulated and submitted to the Inspector as part of a request for authorization for discharge. The purpose of the change request related to the site specific conditions at the SNP-02 station particularly during winter where bathymetry and ice growth consuming water availably creates a semi-isolated area where water quality is not representative of the entire pond as proven through SNP-02 / SNP-06 sampling results. Key analytes including Nitrate are elevated in this small area due to the relative isolation however the suction from the pumps would allow for the draw of water from within the pond outside of this small isolated area thus allow for consistent discharge to N-11 De Beers only anticipates requiring this flexibility regarding supporting data to provide to the Inspector during potential winter discharges as in the summer sufficient mixing with the WMP is expected to occur.	
8	Environmental Screening Assessment	**Comment** The fourth paragraph of section 5.1.1 states "Maximum open water discharge concentrations are greater than under-ice	**May 21:** To clarify the comment in MVLWB-8, Table 8 in the Water Quality Model Updates report (Golder 2018) does not	

	- Appendix C, Water Quality Modeling Updates (March 2018): Section 5.1.1 Water Management Pond	discharge concentrations since after November 2017, water will only be discharged during the open water period and concentrations in the WMP incread during the operational period." Table 8 provides maximum predicted concentrations in the open water and under-ice periods. **Recommendation** The quoted sentence is confusing, as is the data in Table 8. Generally, under-ice concentrations are higher than open-water concentrations because of the exclusion effect of freezing. Appendix C to the Version 5 Water Management Plan gives monthly predicted concentrations of the operational discharge from the Water Management Plan; in those tables, the winter concentrations appear higher than the summer concentrations which is the opposite of Table 8 of the Water Quality Modeling Update report. Can De Beers further clarify the meaning of the quoted sentence as well as the apparent discrepancy between the referenced tables in the two documents?	provide the maximum predicted concentrations in the open water and under-ice conditions, but rather, Table 8 presents the maximum open water and under-ice concentrations during periods of discharge. The maximum concentrations presented in Table 8 are calculated based on projected Water Management Pond (WMP) concentrations only when discharge is occurring. Salt rejection during ice-formation is included in the model, which generally results in under-ice concentrations being greater than open water concentrations. Table 8 in the Water Quality Model Updates report (Golder 2018) presents a paradox because the open water concentrations are higher than the under-ice concentrations. The text in Section 5.1.1 was included to clarify that this occurs as a result of the different time periods in which the under-ice and open water concentrations are presented. For example, the last under-ice discharge in the model occurs in November 2017 but open water discharge is planned to continue until October 2020. The water quality model indicates that total dissolved solids concentrations will increase in the WMP during operations, and therefore, maximum concentrations are lower in under-ice conditions when discharge occurs, in comparison to open water conditions when discharge occurs. If maximum under-ice concentrations were compared to open water concentrations for each modelled year, the under-ice concentrations would be higher as shown in the timeseries plots in Appendix D of the Water Quality Model Updates report and in the tables provided in Appendix C of Version 5 of the Operational Water Management Plan (De Beers 2018). References De Beers (De Beers Canada Inc.) 2018. Gahcho Kué Mine Operational Water Management Plan Version 5. March 2018. Golder (Golder Associates Ltd.) 2018. Gahcho Kué Mine - Water Quality Model Updates. Submitted to De Beers Canada Inc. March 2018.	
9	Environmental Screening Assessment - Appendix C, Water Quality Modeling Updates (March 2018): Section 5.1.1 Water Management Pond	**Comment** In comparing the monthly predicted discharge concentrations in Appendix C of the Version 5 Water Management Plan to Table 8 in the March 2018 Water Quality Modelling Updates, it appears that the "current model results" for open water in Table 8 correspond to the predicted October 2020 concentations from the Water Management Plan. But it is unclear how the under-ice concentrations in Table 8 were calculated. **Recommendation** Please explain the relationship between the data in Appendix C of the Water Management Plan (v5) to Table 8 of the March 2018 Water Quality Modelling Updates, including how the	**May 21:** The tables in Appendix C of the Operational Water Management Plan Version 5 provide projected monthly constituent concentrations in the Water Management Pond (WMP) whereas, Table 8 of the Gahcho Kué Mine - Water Quality Model Updates (Golder 2018) report presents the maximum concentration while discharge is occurring (i.e., the Water Management Plan Version 5 tables also include projected constituent concentrations when discharge is not occurring from the WMP) as described in the response to MVLWB-8. The water quality model was initialized on	

		under-ice concentrations reported in the latter document were derived.	January 1, 2017 and in this year, a discharge occurred in November 2017, which is considered an under-ice month in the water quality model. As described in Section 5.1.1 of the Gahcho Kué Mine - Water Quality Model Updates report (Golder 2018), there is no under-ice discharge planned after 2017. Therefore, the maximum under-ice discharge concentration is not presented in the tables in the Water Management Plan v5, since this report only provides projected constituent concentrations in the WMP from 2018 onwards (i.e., when only open water discharge occurs). The Mackenzie Valley Land and Water Board is correct that the maximum open water discharge concentration in Table 8 of the Water Quality Model Updates report (Golder 2018) occurs in October 2020, which corresponds to the last planned operational discharge month. Details of how ice-formation is accounted for in the water quality model is discussed in Section 3.6 of the Gahcho Kué Mine - Water Quality Model Updates (Golder 2018). In the water quality model, ice was assumed to be present from November to May. At the beginning of November, the upper 1.3 metres (m) of water was instantaneously removed from reservoirs storing water (e.g., WMP). Ice-formation results in increased constituent concentrations because 100% salt rejection was assumed resulting in the total mass stored in a reservoir being dissolved in a smaller volume of water during under-ice months. The instantaneous formation of ice provides a conservative estimate of under-ice constituent concentrations because the maximum ice thickness (i.e., 1.3 m) would not occur until the end of under-ice conditions. References: De Beers (De Beers Canada Inc.) 2018. Gahcho Kué Mine Operational Water Management Plan Version 5. March 2018. Golder (Golder Associates Ltd.) 2018. Gahcho Kué Mine - Water Quality Model Updates. Submitted to De Beers Canada Inc. March 2018.	
10	Environmental Screening Assessment - Appendix C, Water Quality Modeling Updates (March 2018): Section 5.1.1 Water Management Pond	**Comment** It would be helpful to understand how well the previous Golder model for water quality in the Water Management Pond correlated to actual measured values since operations began. A reasonable correlation would give additional confidence in the updated model. **Recommendation** Has De Beers done an analysis of how well the 2014 water quality predictions for the Water Management Pond compare to measured values since discharge began in 2016? Please provide information or a reference to any comparison of predicted versus	**May 21:** Changes to the mine water management plan since the mine operation commenced make it challenging to simply evaluate model performance through comparing the modelled projections of water quality to measured concentrations. The updated water quality predictions (Golder 2018) build on the model developed as part of the EIS (De Beers 2010) and subsequently updated as part of the EIS Supplement (De Beers 2012) and Water Licence application (Golder 2014). The model updates account for the changes to the mine plan including: ? A higher PK	

		measured values for water quality in the Water Management Pond to date.	production rate; ? A delay in mining of Hearne Pit; ? Deeper mining of the pits; and ? The updated water management plan. As part of the water quality model development, the predicted concentrations were compared to recent measured parameter concentrations in the WMP and where necessary, were subsequently calibrated to better align observed and predicted concentrations. Since the 2014 water quality model has been updated to reflect mine plan changes since 2014, the calibration plots provided in Appendix C of Golder (2018) are considered a reasonable comparison to test the performance of the model. De Beers does not consider comparing model predictions, based on an earlier iteration of the mine plan, to observed concentrations that accounted for an updated water management plan to be a useful comparison for evaluating the performance of a model that has been updated. References De Beers (De Beers Canada Inc.) 2010. Environmental Impact Statement for the Gahcho Kué Project. Volumes 1, 2, 3a, 3b, 4, 5, 6a, 6b, 7 and Annexes A through N. Submitted to the Mackenzie Valley Environmental Impact Review Board. December 2010. De Beers 2012.Environmental Impact Statement Supplemental Information Submission for the Gahcho Kué Project. Submitted to the Mackenzie Valley Environmental Impact Review Board, Yellowknife, NWT, Canada. April 2012. Golder (Golder Associates Ltd.) 2014. Gaucho Kué Technical Sessions - Commitment 3, 2014 Updated Water Quality Predictions. Submitted to De Beers Canada Inc., March 6, 2014. Golder 2018. Gahcho Kué Mine - Water Quality Model Updates. Submitted to De Beers Canada Inc. March 2018.	
11	Environmental Screening Assessment - Appendix C, Water Quality Modeling Updates (March 2018): Calibration Plots	**Comment** In the calibration plots for Area3/5, several of the plots show that although the modeled values are generally higher than the measured values, the upward trend in concentrations is being captured by the model. However, for many parameters, the model seems to predict a sharp increase in concentrations after Sept 2017 in the plots. **Recommendation** Is the sharp increase just a seasonal variation or due to some predicted event?	**May 21:** The sharp increase is related to salt exclusion during ice formation. In the water quality model, 1.3 metres (m) of ice is assumed to form by removing an equivalent volume of pristine water (i.e., containing no dissolved mass) from the WMP. Ice-formation is assumed to begin in October and be completed by November. This is a conservative estimate since maximum ice-thickness will not be achieved until towards the end of the winter. The assumption that ice is immediately formed results in a sharp increase in constituent concentrations in the water management pond. In the calibration plots, it appears that the ice formation occurs in September. In the calibration plots, the x-axis and major unit is auto-generated by Excel and each vertical line may not correspond to the beginning of the month. For example, the vertical Sep-2017 line represents the end of September and	

			predicted value to the right represents the simulated monthly concentration for October.	
12	Environmental Screening Assessment - Appendix C, Water Quality Modeling Updates (March 2018): Calibration Plots	**Comment** SNP data from Nov 2017 at SNP02 or Dec2017 from SNP06 show much lower concentrations of some parameters than the calibration plots of the model would suggest (data from the 2017 Annual Water Licence Report). For example, the calibration plot for chloride in Area 3/5 (page 439 of the report pdf) would suggest that in Nov 2017, the chloride concentration would be about 120 mg/L, when in fact it was 57 mg/L. The pattern is similar for nitrate (page 441 of the report pdf); the model predicted that nitrate concentrations would be close to 14 mg/L in late 2017 but measured values show it was about 8 mg/L. **Recommendation** The concern is that the model is overpredicting concentrations and, as a result, the EQC could be set unnecessarily high. Can De Beers please explain the discrepancy in the measured values and the modeled values after September 2017.	**May 21:** A discussion of the concentration increase seen after September 2017 is provided in the response to MVLWB-11. However, De Beers would like to add that the water removed from the model during ice formation is added back into the Water Management Pond (WMP) and an associated sharp decrease in predicted concentrations occurs as seen in the timeseries plots presented in Appendix D of the Gahcho Kué Mine - Water Quality Model Updates (Golder 2018). As there is no proposed under-ice discharge planned, the over-prediction during under-ice conditions will not result in effluent quality criteria (EQC) that are set unnecessarily high. In addition, the EQC are calculated independently of the water quality predictions. The water quality predictions are only used to evaluate if the proposed EQC are achievable. Because the proposed discharge occurs during open-water conditions, only the projected WMP concentrations for open-water were considered when proposing EQC. References Golder (Golder Associates Ltd.) 2018. Gahcho Kué Mine - Water Quality Model Updates. Submitted to De Beers Canada Inc. March 2018.	
13	Environmental Screening Assessment - Section 4.5.7 SNP	**Comment** The second paragraph in this section states: "The SNP is not expected to require major changes to incorporate the 2018 mine plan amendment. For Area 8 and any operational discharge from Area 7, SNP 04 will remain. However, the current mixing zone station in Area 8 (SNP 04) will need to be relocated from its current location to the area where the flow mitigation diffuser will be located, or a new SNP station for this diffuser established." **Recommendation** The reference to the "current mixing zone station in Area 8" as being SNP04 appears to be an error. Please confirm that station SNP03 might need to be moved for the reasons mentioned.	**May 21:** Correct. The statement regarding SNP relocation was meant to refer to SNP-03	
14	Effluent Quality Criteria Report - March 2018: Section 2.2.2, SSWQO for Nitrate	**Comment** De Beers has recommended the CCME guideline value for the nitrate SSWQO when the hardness level is below 27 mg/L in Lake N11 and the hardness-dependent equation (developed for a nitrate SSWQO at Ekati in 2012) when the hardness in Lake N11 is higher than 27 mg/L. **Recommendation** What is the advantage of having two SSWQOs?	**May 21:** When the hardness level is below 27 mg/L as CaCO3 in Lake N11, the hardness-dependent site-specific water quality objective (SSWQO) for nitrate is less than the Canadian Council of Ministers of the Environment (CCME) water quality guideline (WQG) for nitrate (Table MVLWB-14.1). Therefore, the advantage of having two SSWQO is to have the ability to use the CCME WQG as the minimum SSWQO and to be able to switch to the hardness-based SSWQO when hardness concentrations in Lake N11 increase to values that result in the hardness-based SSWQO for nitrate being greater than the CCME WQG.	

15	Effluent Quality Criteria Report - March 2018: Section 2.2.2, SSWQO for Nitrate	**Comment** The report notes that a hardness dependent SSWQO for nitrate was developed for the Ekati mine in 2012 and deemed appropriate for Snap Lake in 2014. **Recommendation** Is De Beers aware of any follow-up studies that have been done regarding the hardness-dependent SSWQO for nitrate since 2014 regarding the validity or effectiveness of the derived SSWQO equation?	**May 21:** De Beers is not aware of any follow-up studies that have been done regarding the hardness-dependent SSWQO for nitrate since the work completed in 2014.	
16	Effluent Quality Criteria Report - March 2018: Section 2.3	**Comment** Table 2-7 provides the projected maximum concentrations for the "fully mixed" Lake N11. Although there is an equation for the calculation of the projected maximum at the edge of the mixing zone, there is no equation to show how the fully mixed concentrations were calculated. **Recommendation** Please provide a sample calculation for the fully mixed concentrations. Has the accumulation of the parameters over time, as discussed in section 3.1.1 (and in Figure 3-1), been accounted for in the calculations?	**May 21:** Yes, the accumulation of the parameters over time has been accounted for in the "fully mixed" model of Lake N11. The "fully mixed" model of Lake N11 is based on Equation 1. Please see the attached excel file (MVLWB-16) for an example calculation. ??C?N11/?t VN11=QIN CIN-QOUT CN11 [Equation 1] Where: QIN = inflows to Lake N11 CIN = parameter concentration in the inflows to Lake N11 QOUT = outflows from Lake N11 CN11 = parameter concentration in Lake N11 t = time V = volume in Lake N11	
17	Effluent Quality Criteria Report - March 2018: Section 2.4.3	**Comment** Table 2-13 provides the "projected maximum concentrations at the edge of the mixing zone" in Lake N11. However, there is no detailed explanation as to how these values were calculated. Please provide an explanation or sample calculation for these predicted values. Was the accumulation of parameters over time in Lake N11, as discussed in section 3.1.1 (and graphed in Figure 3-1), taken into account in the projected maximums? **Recommendation** Was the accumulation of parameters over time in Lake N11, as discussed in section 3.1.1 (and graphed in Figure 3-1), taken into account in the projected maximums at the edge of the mixing zone?	**May 21:** Yes, the accumulation of parameters over time has been accounted for in the "fully mixed" model of Lake N11 and in the calculation of the projected maximum concentrations at the edge of the mixing zone. Please see the attached excel file (MVLWB-17) for an example calculation.	
18	Effluent Quality Criteria Report - March 2018: Section 2.4.2	**Comment** Section 5.1.1 of the March 2018 Water Quality Model Update provides the maximum nitrate discharge concentrations predicted if De Beers implements a nitrogen response plan. However, Table 2-11 reflects the unmitigated case. **Recommendation** When does De Beers plan on implementing the Nitrogen Response plan? How soon could nitrate loads be reduced in the WMP discharge and to what extent?	**May 21:** The nitrogen response strategy has already been implemented and there is some indication that nitrogen reporting to the WMP is decreasing however the strategy is in its infancy and further monitoring to verify the actual success of the efforts is required. Major decreases in nitrogen levels are not anticipated, however we have assumed a 10% reduction in Nitrogen loading by early 2019 which we are working hard to achieve in order to ensure we can meet our nitrate EQC in future discharge years.	
19	Effluent Quality Criteria Report - March 2018: Section 3.1.1	**Comment** Equations 2 and 3 in section 3.1.1 show how the waste load allocations were calculated but it isn't clear what values were used for the natural inflows to Lake N11 or Area 8 (Qin) or for the discharge volumes to those water bodies (QWMP or QA7). **Recommendation** Please define the quantities used in the WLA calcuations for the terms QIN, QWMP or QA7.	**May 21:** The proposed discharge rate from the water management pond (WMP) (i.e., QWMP) to Lake N11 was 64,800 m3/day (i.e., the proposed discharge rate in September of Years 3 and 4 of 1,944,000 m3/month divided by 30 days). The proportion of WMP water in Lake N11 was projected to be 34.5%. Based on this proportion, the natural inflow to Lake N11 (i.e., QIN) was 123,026 m3/day. The	

			proposed discharge rate from Area 7 to Area 8 during downstream flow mitigation years (i.e., QA7) was 24,194 m3/day (i.e., the proposed discharge rate in July of 750,000 m3/month divided by 31 days). The proportion of Area 7 water in Area 8 was projected to be 100% during those years. Based on this proportion, the natural inflow to Area 8 (i.e., QIN) was 0 m3/day.	
20	Effluent Quality Criteria Report - March 2018: Section 3.1.4	**Comment** In section 3.1.4, the EQC calculation for nitrate is discussed but it is not clear whether any accumulation of nitrate over time in Lake N11 was accounted for. It also isn't clear how hardness will change in Lake N11 over time or which nitrate SSWQO will be valid at what time. **Recommendation** It would be helpful if De Beers could provide additional explanation of nitrate EQC calculations either in response to this question or during the technical session.	**May 21:** Nitrate accumulation in Lake N11 is accounted for in the fully mixed model of Lake N11. Please see the response to MVLWB-16 for an example calculation from the fully mixed model of Lake N11. The example calculation was provided for total dissolved solids, but calculation steps are the same for all parameters, including nitrate and hardness (i.e., calcium and magnesium). Figure MVLWB-20.1 shows how whole-lake average hardness concentrations are projected to change over time in Lake N11. De Beers has requested that the Canadian Council of Ministers of the Environment (CCME) water quality guideline (WQG) for nitrate of 2.93 mg N/L be valid when hardness concentrations in Lake N11 are less than 27 mg/L as CaCO3. Please see the response to MVLWB-14 for a comparison between the hardness-based site-specific water quality objective and the CCME WQG for nitrate. Figure MVLWB-20.1: Projected Whole-lake Average Hardness Concentrations in Lake N11	
21	Effluent Quality Criteria Report - March 2018: Section 3.2.1.4	**Comment** Figure 3-8 compares the proposed nitrate EQC to predicted concentrations of nitrate in the WMP discharge. **Recommendation** Why has only a 10% reduction in nitrate been contemplated in Figure 3-8? What is the evidence for what kind of reduction in nitrate loading is reasonable if the nitrogen response plan was implemented?	**May 21:** See response to MVLWB Heather Scott 18 A nitrogen response strategy has been implemented on site focused on improving blasting practices in an effort to reduce the nitrogen residual resulting from blasting, and surface water management considerations. There is some early indication that nitrogen (i.e., nitrate and ammonia) reporting to the WMP from the 5034 Pit sump is decreasing; however, the strategy is in its infancy and ongoing monitoring to verify the actual success of the efforts is required. Substantial decreases in nitrogen concentrations in the WMP are not anticipated; however, a 10% reduction in nitrogen loading to the WMP by early 2019 has been assumed to support the EQC modelling work. A 10% reduction in nitrogen loading will increase the likelihood that EQC for operational discharge from the WMP to Lake N11 will be achievable as per the amended water management plan.	
22	Proposed EQC	**Comment** In section 2.34 of the 2016 AEMP Annual Report, it stated that a plume study was being conducted in January 2017.	**May 21:** Methods and results of two plume delineation studies were reported in the 2017 AEMP Annual Report (De	

		Recommendation Are there any results from the 2017 plume study that are relevant to EQC calculations for this amendment?	Beers 2018). Field programs for the plume delineation studies were conducted in Lake N11 during ice-cover conditions, between 6 and 9 January 2017, and during open-water conditions, between 3 and 5 October 2017 during operational discharge from the water management pond (WMP) to Lake N11. The dilution factors calculated for ice-cover and open-water conditions were 7 and 30, respectively. The lower than predicted dilution factor for the WMP discharge in Lake N11 during January (i.e., 7) is attributed to winter conditions, where ice cover, shallow depths, and limited currents would be expected to reduce the potential for dispersion of the diffuser discharge in Lake N11. The open water dilution factor (i.e., 30) was also lower than the modelled dilution factor of 40 (De Beers 2014); this lower open water dilution factor was attributed to discharge occurring in the fall months where the potential for dispersion would be reduced due to limited currents relative to spring and summer conditions. However, the dilution factor calculated for open-water conditions is within the range of accuracy of the CORMIX model predictions. Results from CORMIX are generally accurate to within ± 50% with respect to dilution factors, concentrations, and plume geometry (Doneker and Jirka 2007). Nevertheless, the model is considered adequate to characterize general central trends of effluent mixing in ambient aquatic environments. No changes were made to effluent quality criteria calculations for this amendment based on the results of the plume studies. References: De Beers. 2018. Aquatic Effects Monitoring Program 2017 Annual Report. Gahcho Kué Mine Type A Water Licence MV2005L2-0015. Prepared for the Mackenzie Valley Land and Water Board, Yellowknife, NT, Canada. May 2018. De Beers. 2014. Effluent Quality Criteria Report Version 2. Gahcho Kué Mine. Prepared for the Mackenzie Valley Land and Water Board. Yellowknife, NT, Canada. April 2014. Doneker RL, Jirka GH. 2007. CORMIX User Manual: A Hydrodynamic Mixing Zone Model and Decision Support System for Pollutant Discharges into Surface Waters. Portland OR: Department of Civil and Environmental Engineering, Portland State University.	
23	Proposed EQC	**Comment** Data from the 2016 or 2017 AEMP Annual Reports that could aide in decisions about proposed EQC for this amendment. **Recommendation** Is there any information from the AEMP that could aide in the decisions about EQC for this amendment? In particular are the AEMP results thus far consistent with predictions of effects due to	**May 21:** In the 2017 AEMP Annual Report (De Beers 2018), concentrations from monitoring data at Station SNP-02 were compared to projected water quality concentrations in the water management pond (WMP) for Year 3 of operations from De Beers (2014). Water quality parameters with	

		effluent discharge? Are the measured trends in Lake N11 consistent with the 2014 modelling of water quality in that water body?	effluent quality criteria (EQC) during operational discharge at Station SNP-02 were measured at concentrations below maximum average concentration (MAC) EQC and maximum grab concentration (MGC) EQC. However, maximum fluoride concentrations at Station SNP-02 were measured at the MAC EQC of 0.15 mg/L. As a result, De Beers proposed to increase the MAC EQC and MGC EQC for fluoride in this amendment application. Measured trends in water quality concentrations in Lake N11 were not compared to projected trends in water quality concentrations in Lake N11 from De Beers (2014). However, measured water quality parameter concentrations in Lake N11 in 2017, remained within EIS predictions and within AEMP benchmarks . References: De Beers. 2018. Aquatic Effects Monitoring Program 2017 Annual Report. Gahcho Kué Mine Type A Water Licence MV2005L2-0015. Prepared for the Mackenzie Valley Land and Water Board, Yellowknife, NT, Canada. May 2018. De Beers. 2014. Effluent Quality Criteria Report Version 2. Gahcho Kué Mine. Prepared for the Mackenzie Valley Land and Water Board, Yellowknife, NT, Canada. April 2014.	
24	Version 5, Operational Water Management Plan: Table 2-6	**Comment** Table 2-6 reports the predicted maximum discharge concentrations in the Water Management Pond. **Recommendation** Note that the values reported for the 4 metals are the dissolved values although the table is likely meant to present the total values.	**May 21:** Acknowledged, the 4 metals presented in Table 2.6 are the dissolved values. Total concentration values can be found in Table 8 of March 2018 Water Quality Modelling Updates. De Beers will revise these values in the next version.	
25	Gahcho KuÃ© Mine - Geochemical Characterization Plan, version 4, March 2018	**Comment** Table 5 on page 26 tabulates the number of samples and % of total samples classified as PAG. The 2017 data indicates 14 samples (of 2,290) and 6.3%. These values do not agree and it appears that either the total number of PAG samples or the % is in error. **Recommendation** It is recommended that DeBeer's reviews tabulated data in Table 5 and confirm and/or revise as necessary.	**May 21:** Table 5 of the Geochemistry Characterization Plan has been reviewed and the data for 2017 have been updated in Table MVLWB-25.1.	
26	Gahcho KuÃ© Mine - Water Quality Model Updates, Appendix A of Amendment - Environmental Screening Assessment - March 19, 2018	**Comment** Section 3.2 of Appendix A describes the Mine Rock Model Inputs to the Updated Water Quality Model. Page 11 of the appendix indicates the updated concentrations are based on the most up-to-date geochemical testing dataset (Attachment 4 of the 2018 Water Licence Amendment). Updated input concentrations are provided in Table 4. Table 4 only provides updated model input concentrations for phosphorus. Other parameters are not included in the table. Attachment 4 referenced in the appendix refers to Attachment 4 the Geochemical Characterization Plan V.4. That plan describes what is done to assess and monitor the geochemistry of the mine components but it does not provide data on the updated monitoring and water chemistries that were used as inputs to the water quality model.	**May 21:** The reference to the Geochemical Characterization Plan in the updated Water Quality Model Report (Golder 2018) regarding the geochemical source term inputs was an error. With the exception of phosphorus, the geochemical water quality inputs in runoff from the mine rock PK storage facilities developed as part of the EIS Supplement (De Beers 2012) were preserved as part of the Golder (2018) water quality model update. For each lithology in these facilities, a chemical profile was developed based on humidity cell testing, which are subsequently prorated based on the relative proportion of each lithology in the pile. The input water quality for water in contact with each lithology are	

		Recommendation It is recommended that DeBeer's provides tabulated data and reasoning for all inputs from the mine rock components to the updated water quality model.	provided in Table 8.II-4 in Appendix 8-II of the EIS Supplement (De Beers 2012). However, as discussed in Section 3.2 of Golder (2018), the proportion of PAG mine rock was increased. Therefore, the data provided in Table 8.II-4 were prorated to account for the updated proportion of PAG rock. With respect to phosphorus inputs, the water quality model over-predicted total phosphorus concentrations. This was in part due to conservative inputs developed as part of the EIS Supplement (De Beers 2012) using the approach described in Section 3.2 of Golder (2018). To better align the predicted concentrations with observed, input concentrations for this constituent were updated using the most up-to-date humidity and saturated column test results. As described in Section 3.2 of Golder (2018), input total phosphorus concentrations were calculated as follows: . Saturated fine PK and mine rock was assigned the median of the median concentrations, calculated based on all measured concentrations, for each saturated fine PK and mine rock column tests, respectively; and . Unsaturated coarse PK and mine rock were assigned the median of the median concentrations, calculated based on all measured concentrations, for each coarse PK and mine rock humidity cell tests. References De Beers 2012.Environmental Impact Statement Supplemental Information Submission for the Gahcho Kué Project. Submitted to the Mackenzie Valley Environmental Impact Review Board, Yellowknife, NWT, Canada. April 2012. Golder 2018. Gahcho Kué Mine - Water Quality Model Updates. Submitted to De Beers Canada Inc. March 2018.	
27	Gahcho KuÃ© Mine - Water Quality Model Updates, Appendix A of Amendment - Environmental Screening Assessment - March 19, 2018	**Comment** Section 3.2 of Appendix A describes the Mine Rock Model Inputs to the Updated Water Quality Model. Page 11 indicates that the updated water quality included a proportion of PAG equal to 6.6% based on operational monitoring data through 2017. Table 5 of the Geochemical Characterization and Management Plan, V.4 (March 19, 2018) indicates the proportion in 2016 was 9.0% and in 2017 was 6.3%. The Table 5 values are presumed to be based on samples collected and that the value used in the model (6.6%) may be a volumetric estimate based on tonnage mined. **Recommendation** It is recommended that De Beers confirms the source of the estimate of 6.6% and if the proportion varies consider including senstivitiy analyses in water quality model updates in the future to assess whether the predictions are sensitive to expected variability in PAG proportions.	**May 21:** A subset of the 2017 geochemical monitoring data formed the basis of the PAG rock estimate used in the model update. The estimate of 6.6% PAG rock was determined from available 2017 monitoring data, in which 143 samples of 2,175 samples had a sulphur concentrations greater than 0.1%. At the end of 2017, when the full set of samples (2,290 samples) analyzed under the Geochemical Characterization Plan (De Beers 2018) were finalized, the proportion of samples classified as PAG was 6.3%. In the water quality model, it is assumed that 95% of the mine rock is granite and that 5% of the granite is PAG. This classification is based on the mine rock proportions developed as part of the Metal Leaching and Acid Rock Drainage Report developed as part of the EIS Supplement (De Beers 2012). Geochemical operational monitoring data does not segregate PAG	

			proportions into lithological units. Therefore, the assumption that 5% of the granite is PAG was preserved in the water quality model updates and the remaining percentage of the total PAG rock evenly distributed among other lithologies to be encountered during mining. As a result, the difference of 0.3% (i.e., 6.6% minus 6.3%) in PAG rock volume is not expected to change the outcomes of the water quality model. References De Beers (De Beers Canada Inc.) 2012. Environmental Impact Statement Supplemental Information Submission for the Gahcho Kué Project. Submitted to the Mackenzie Valley Environmental Impact Review Board, Yellowknife, NWT, Canada. April 2012. De Beers 2018. Gahcho Kué Mine Geochemical Characterization Plan Version 4. March 2018.	
28	Gahcho KuÃ© Mine - Water Quality Model Updates, Appendix A of Amendment - Environmental Screening Assessment - March 19, 2018	**Comment** Section 3.1. of Appendix A, Table 3 on page 10 provides data of the average 5034 Pit Sump Water Quality During 2017. Not all parameters of interest are included in the tabulated data. Of note, nitrate, nitrite, sulphate, and TDS are missing. **Recommendation** It is recommended that De Beers consider evaluating a range of expected PAG volumes as a sensitivity analysis to see whether or not variability around the expected range has a significant effect on predicted water quality for any of the parameters of interest.	**May 21:** De Beers is not clear on what the MVLWB is requesting since mine rock PAG volumes have no influence on groundwater inflow chemistry, which is the model input discussed in Section 3.1 of Golder (2018), and what is discussed in the comment reviewer's comment above. To provide additional information to the comment in MVLWB-28, the groundwater source term developed as part of the EIS Supplement (De Beers 2012) was carried forward into the Golder (2018) water quality model update. As described in Section 8.II.2.4.5.2 of Appendix 8.II of the EIS Supplement (De Beers 2012), groundwater inflow consisted of parameters that were correlated or not correlated to TDS. However, to add a level of conservatism in the water quality model predictions, non-correlated constituents were assigned the maximum of the concentration observed in the 5034 Pit or the input concentration assigned as part of the EIS Supplement (see Table 8.II-7 of Appendix 8.II of the EIS Supplement). This maximum function was only applied to non-correlated parameters as defined as part of the EIS. Table 3 in Golder (2018), therefore, contains the same list of parameters as presented in Table 8.II-7 in Appendix 8.II of the EIS Supplement (De Beers 2012). A maximum of 5034 Pit and calculated concentrations based on regression equations for parameters correlated to TDS (see Table 8.II-5 of Appendix 8.II of the EIS Supplement) was not applied in the model. TDS concentrations were calculated based on the calibrated hydrogeological model (see Appendix A of Golder ([2018)]), which accounted for the measured concentrations of TDS in the 5034 Pit sump. The regression equations developed as part of the EIS were used to calculate the input	

			concentration of parameters correlated to TDS (e.g., sulphate). As described in Section 3.5, all nitrogen load originating from explosives usage was conservatively added to the Water Management Pond (WMP). Nitrogen species are not modelled in the pit sumps since pumping of the pit water to the WMP would result in a double counting of the nitrogen load to the WMP. References De Beers 2012.Environmental Impact Statement Supplemental Information Submission for the Gahcho Kué Project. Submitted to the Mackenzie Valley Environmental Impact Review Board, Yellowknife, NWT, Canada. April 2012. Golder 2018. Gahcho Kué Mine - Water Quality Model Updates. Submitted to De Beers Canada Inc. March 2018.	
29	Gahcho KuÃ© Mine - Water Quality Model Updates, Appendix A of Amendment - Environmental Screening Assessment - March 19, 2018	**Comment** Section 3.4. of Appendix A, Table 6 on pages 12 and 13 provides Kimberlite Ore Stockpile Chemistry Profile. Not all parameters of interest are included in the tabulated data. Of note, nitrogen species and phosphorus are missing. **Recommendation** It is recommended that De Beers provide a full summary of water chemistry included in the inputs and if parameters of interest have been excluded, then provide rationale for their exclusion.	**May 21:** Not all parameters of interest are include in Table 6 of Golder (2018), as Table 6 provided the input water quality used to represent drainage from the kimberlite ore stockpile in Area 7 based on geochemical test work. However, all parameters of interest were accounted for in the water quality model. Nitrate and total phosphorus were accounted for differently in the water quality model as described below. Total phosphorus was consistently below the detection limit not analyzed in the humidity cell test used to represent the drainage from the kimberlite ore stockpile. Total phosphorus was analyzed using ICP-MS which has an elevated detection limit of <0.3 mg/L. Therefore, to avoid over-predicting the total phosphorus concentrations that were consistently below the detection limit in the ICP-MS analyses, the input phosphorus concentration for saturated fine PK was used (Table 4 of Golder 2018) to represent the drainage quality of this constituent from the Kimberlite Ore Stockpile. As noted in the response to MVLWB-28, it was assumed that all nitrogen originating from explosives usage was instantaneously assumed to be dissolved in the Water Management Pond. Therefore, drainage from the kimberlite stockpile was not assigned input nitrate and ammonium source terms since this would result in a double counting of the mass load to the WMP. Reference Golder 2018. Gahcho Kué Mine - Water Quality Model Updates. Submitted to De Beers Canada Inc. March 2018.	
30	Gahcho KuÃ© Mine - Water Quality Model Updates, Appendix A of Amendment - Environmental	**Comment** Section 3.5. of Appendix A, pages 13 and 14 describes the approach to modeling water chemistry related to explosives. The revised nitrogen speciation and residuals loss factors to reflect monitoring data is supported. The description includes the following: The total mass of explosive was assumed to be released linearly over	**May 21:** MWLWB is correct that the entire ANFO load calculated for each timestep is directed to the Water Management Pond (WMP) for that timestep. This approach is consistent with previous submissions (e.g., De Beers 2012, Golder 2014) and is conservative for the following reasons: ?	

	Screening Assessment - March 19, 2018	the mine life to develop estimates of nitrogen-species concentrations from blasting activities. Water reporting to active open pits is expected to mobilize the majority of explosives residues, and the mass of explosives released during each month was added to the WMP. Based on that description, it is implied that all explosives residuals (5% of ANFO) used in a given month will report to the WMP in that month. While this may be an appropriate expectation for residuals on pit walls, it may not be an appropriate time-related release assumption from explosives residuals that get deposited in the waste rock piles. **Recommendation** It is recommended that De Beers clarify if the same time-step for release was assumed for the waste rock piles as for the open pits and if so provide discussion as to how that could influence the predicted results (i.e. it could result in higher concentrations for a short time that drop off rapidly once waste deposition on the piles cease and possibly misrepresent the longer timeline in waste rock seepage).	If residual explosives is directed to the mine rock storage piles and allowed to "bleed out" of these storage areas, the loading rate to the WMP would be lower than currently assumed resulting in lower predicted nitrogen concentrations in the WMP; ? A component of the residual ANFO would conceptually be "locked up" in the piles as a result of channelization effects, which would also reduce the load; and ? Permafrost development in the WRSA could also potentially isolate residual explosives precluding them from leaching from the piles. It is important to note that the main purpose of the water quality model is to provide conservative estimates of discharge water quality for the purpose of evaluating Effluent Quality Criteria. De Beers agrees that some blasting residual nitrogen will be retained in the mine rock piles and a leaching lag time from the pile could occur. If operational monitoring data suggests the loadings could influence the post-closure water quality predictions, De Beers will update the model to account for this process as part of future closure and reclamation planning. References De Beers (De Beers Canada Inc.) 2012. Environmental Impact Statement Supplemental Information Submission for the Gahcho Kué Project. Submitted to the Mackenzie Valley Environmental Impact Review Board, Yellowknife, NWT, Canada. April 2012. Golder (Golder Associates Ltd.) 2014. Gaucho Kué Technical Sessions - Commitment 3, 2014 Updated Water Quality Predictions. Submitted to De Beers Canada Inc., March 6, 2014.	
31	Gahcho KuÃ© Mine - Water Quality Model Updates, Appendix A of Amendment - Environmental Screening Assessment - March 19, 2018	**Comment** Calibration Plots provided in Appendix C of Appendix A include data as well as WQ model output curves. It is not clear whether the output curves are based on calibrated model runs or whether the comparison of the data to the output informed the calibration factors described in Section 4.0. Given calibrations are based on, at best, nine months of data, it might be expected that the calibration factors carry significant uncertainty to date and could differ substantially the next time the model is updated. **Recommendation** It is suggest that De Beers consider an evaluation that does not apply calibration factors until such time as there is more monitoring data available with which to calibrate to (perhaps a few years). It would be informative to provide non-calibrated results with a discussion around hypotheses as to why results may differ from early monitoring data in the cases where output over-predicts or under-predicts chemistry rather than introducing calibration factors at such an early stage in the mine life. This recommended type of approach may allow De Beers to assess the appropriateness of inputs	**May 21:** De Beers respectfully disagrees with this recommendation. As discussed in Section 4.0 of Golder (2018), in general, the calibration was focused on adjustment of parameters that were under-predicted and "constituents whose concentrations were over-predicted were not adjusted to carry forward an additional level of conservatism into the water quality model, unless they were constituents that can affect the EQC evaluation.". Not adjusting constituents that are under-predicted would not allow for an accurate screening of Effluent Quality Criteria (EQC) (i.e., they may not be screened in as requiring EQC) and it is therefore considered more prudent to calibrate the model, even for a limited set of monitoring data. In Section 8.II.5 of Appendix 8.II of the EIS Supplement (De Beers 2012), De Beers highlighted some of the uncertainties in the water quality model inputs. Based on an understanding of the input uncertainties in the model at the time it was originally	

		rather than adjusting (calibrating) outputs. For example, Table 7 includes a significant calibration factor for chloride related to the process water. It suggests that the assumed input has under-predicted chloride. Cross-referencing that parameter on Table 6 indicates that the first flush concentration of chloride is significantly higher (order of magnitude) than the steady-state concentrations. Perhaps the reason a large calibration factor is needed for chloride relates to the assumed usage of first flush input versus steady state inputs in the model and would provide insight into the operational time frame that first flush chemistry from processed kimberlite may be expected.	developed, it was recognized that input parameters may have to be adjusted based on monitoring results. De Beers also recognizes that model validation and calibration is an ongoing process. As more monitoring data become available, De Beers will compare to the water quality predictions and update the model, as required. However, not calibrating the model because less than a year of monitoring data is available could influence the outcomes of the EQC assessment. References De Beers (De Beers Canada Inc.) 2012. Environmental Impact Statement Supplemental Information Submission for the Gahcho Kué Project. Submitted to the Mackenzie Valley Environmental Impact Review Board, Yellowknife, NWT, Canada. April 2012. Golder (Golder Associates Ltd.) 2018. Gahcho Kué Mine - Water Quality Model Updates. Submitted to De Beers Canada Inc. March 2018.	
Ni Hadi Xa: Dawn Keim				
ID	**Topic**	**Reviewer Comment/Recommendation**	**Proponent Response**	**Board Staff Analysis**
1	Flow augmentation (2018 UPD, Section 9.6.5)	**Comment** Flows downstream of Area 8 will be augmented by pumping supplemental water from Lake N11, the WMP and/or Area 7 (if water quality requirements are met). Flow augmentation targets are presented in Table 9.6-2. However, our review of Section 9.8 suggests that water from N11 is not available in dry years (see comments above re the 2018 UPD water balance, Table 9.8-1. page 9-23) **Recommendation** Clarify how the flow augmentation targets will be met in dry years. Will make-up water be provided from Area 7 or the WMP? If so, is there sufficient evidence to expect that quality of water from Area 7 and the WMP will meet discharge requirements.	**May 21:** As described in the Gahcho Kué Flow Mitigation Plan (Golder 2012), the primary long-term source of water for downstream flow mitigation is pumping from Lake N11. The N watershed is relatively large and mitigation measures are implemented to protect flows in the N watershed under dry conditions. An annual volume limit is included in the Water Licence (1,555,200 m3 per year for every 3 out of 4 years). The flow rate at the outlet of Lake N11 is also monitored continuously on a weekly basis during the open water season to ensure that outflow rate does not drop below the 1 in 5 year dry condition. Water can not be withdrawn from N11 when Lake N11 outflow drops below this point. During these periods, water for flow mitigation can be obtained from A1 or Area 7 as available as described in Section 2.4.5 of the Operational Water Management Plan. The WMP will not be used for downstream flow mitigation. If sufficient water is not available from these sources, flow mitigation many not occur for a period; this would count as 1 out of 4 years when flow mitigation does not occur. Note that Table 9.8-1 does not represent the availability of water in Lake N11, but instead is representative of inflows and outflows to the system. The Flow Mitigation Plan and commitments were previously in place as determined through the Water Licence process for the Gahcho Kué Mine. The Water Licence	

			amendment application has not changed the plan for Lake N11 to be the primary source of water for downstream flow mitigation. However, De Beers is requesting that Area 7 be included as a secondary source for supplemental flow, where a volume consistent with the annual augmentation target will be pumped from Area 7 to Area 8 on an intermittent basis when there is sufficient water available in Area 7 and water quality meets discharge criteria. EQC have been developed and proposed in the Effluent Quality Criteria Report (De Beers 2018). There are no direct mine water sources to Area 7, with the exception of a proportion of the watershed runoff coming into contact with the South Mine Rock Pile and an ore stockpile. Therefore, it is expected that the water in Area 7 will meet EQC and be available for discharge to Area 8 for downstream flow mitigation. However, if EQC are not met, De Beers will not discharge from this area, and instead use Lake N11 as the source.	
2	Fish habitat (2018 UPD, Section 12.7.10.1 Updated Offsetting Plan and 2018 ESA Section 4.6.3 Interactions with Secondary Linkages)	**Comment** An updated Offsetting Plan is being developed that will include updated calculations of habitat losses based on the new mine plan. According to DFO's Fisheries Productivity Investment Policy (FPIP): A Proponent's Guide to Offsetting (DFO 2013), the Offsetting Plan also includes measures that account for the time delay between the damage caused by the impact (i.e., dewatering Kennady Lake) and the functioning of the offsetting habitat to make up for the lost fisheries' productivity. The effects of the additional time required to refill Kennady Lake are not considered in the 2018 ESA. It is also not clear whether the time lag between the loss of habitat from the dewatering of Kennady Lake and the time required for the fish habitat to become functional on refilling has been accounted for in the Offsetting Plan. In the case of Kennady Lake, this delay is an additional 7 years. DFO's FPIP sets out step-by-step procedures for developing an Offsetting Plan under the fisheries protection provisions of the Fisheries Act. The FPIP, specifies that Offsetting Plan must include the rationale for selecting the appropriate offsetting measures and amount of offsetting needed. In particular, the Offsetting Plan should demonstrate how the benefits of the proposed offsetting measure are proportional to the loss caused by the project; how uncertainty associated with the proposed offset is managed; and how the proposed offsetting measures account for the time lag between the impact and the time it takes for the offsetting measures to become functional. **Recommendation** Will the updated Offsetting Plans be consistent with requirement DFOÃ¢Â€Â™s FPIP (DFO 2013)? How will the proposed offsetting measures account for the overall time lag between the	**May 21:** The Offsetting Plan is consistent with DFO's Fisheries Protection Policy (DFO 2013a) and Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting (DFO 2013b), as well as Fisheries Act Authorization 03-HCAA-CA6-00057.1 issued to De Beers by DFO for the serious harm to fish associated with the construction, operation, and closure of the Mine. As per the Authorization, Areas 2 to 7 (totaling 670 ha) were included in the permanent alteration and destruction of habitat in Kennady Lake. The Authorization also stipulates that fish habitat will be re-established in Kennady Lake at closure. It is recognized that this area will be smaller due to the extension of the rock pile into Area 5 in the 2018 mine plan amendment; as such, the offsetting plan was updated based on the 2018 changes to the footprint of the mine. De Beers has provided an update to the Offsetting Plan to DFO and will continue to consult with DFO on the quantification of habitat losses and gains from the proposed offsetting measures to demonstrate that the gains will counterbalance the losses predicted to occur as a result of the Mine's activities. The Final Offsetting Plan will include offsetting measures as required by DFO to achieve equivalency as per Authorization 03-HCAA-CA6-00057.1.	

		impact and the time it takes for the offsetting measures to become functional and specifically how will it account for the additional 7+ years it will take to re fill Kennady Lake and for the lake to become functional once again?		
3	Fish habitat (2018 UPD, Section 12.7.10.1 Updated Offsetting Plan)	**Comment** Offsetting measures in the current Authoriziation potentially include works to re-establish upstream fish passage for migratory species on the Redknife River at the Mackenzie Highway crossing to offset residual serious harm to fish arising from the Gahcho Kue Project. DFO's FPIP recognizes such "out-of-kind" approaches to offsetting, where offsetting measures target the factors limiting productivity, measures other than direct replacement of what has been lost. The use of "out of kind" offsetting requires a detailed quantitative analysis of equivalency to demonstrate that impacts of the project (i.e., loss of the habitat in Kennady Lake due to dewatering for a period of 32 years or more) and the benefits of the offsetting activity (i.e., re-establishing upstream passage for migratory fish species on the Redknife River or other suitable project) **Recommendation** De Beers should make sure that the updated Offsetting Plan is consistent with the DFO's FPIP (DFO 2013). In particular, the updated Offsetting Plan should provide a detailed analysis of equivalency analysis that demonstrates how the benefits of the proposed offsetting are proportional to the loss caused by the project and how uncertainty has been factored into the calculations	**May 21:** The Offsetting Plan is consistent with DFO's Fisheries Protection Policy (DFO 2013a) and Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting (DFO 2013b) and Fisheries Act Authorization 03-HCAA-CA6-00057.1. De Beers has provided an update to the Offsetting Plan to DFO and will continue to consult with DFO on the quantification of habitat losses and gains from the proposed offsetting measures to demonstrate that the gains (i.e., from the Redknife River project) will counterbalance the losses predicted to occur as a result of the Mine's activities. The Final Offsetting Plan will include offsetting measures as required by DFO to achieve equivalency as per Authorization 03-HCAA-CA6-00057.1.	
4	Fish habitat (2018 UPD Section 12.7.10.2 Monitoring Effectiveness of Compensation)	**Comment** Details related to the offsetting monitoring will be included in the updated Offsetting Plan and will be developed in consultation with DFO. **Recommendation** Will the offsetting monitoring program identify the needs and triggers for contingency measures, should deficiencies in effectiveness of the offsetting measures be determined?	**May 21:** There are conditions related to monitoring outlined in Fisheries Act Authorization 03-HCAA-CA6-00057.1 for the Gahcho Kué Mine. A detailed monitoring plan will be designed in consultation with DFO to meet the conditions of the Authorization and the specific offsetting measures included in the Final Offsetting Plan. Monitoring results will be used, if necessary, to adjust mitigation and offsetting measures and make design improvements as required. Habitat monitoring will be key to confirming the offsetting measures have counterbalanced the project impacts.	
5	Fish presence (2018 ESA Section 2.4.6.2 Operational Monitoring of Fish Habitat and Community â€“AEMP	**Comment** Access to spawning habitat during the spring freshet, the presence of suitable Arctic Grayling habitat and the presence of newly hatched fish and adult fish in the affected streams was reported during the low flow period in 2016. It was concluded that no changes to the fish habitat or fish communities had occurred. This may be so. However, it is not clear if fewer fish were able to access the suitable habitat nor whether the amount or suitability of habitat had decreased. **Recommendation** Please justify this conclusion based on the limited quantitative information	**May 21:** The referenced text in Section 2.4.6.2 is a brief summary of the 2016 AEMP (De Beers 2017). Section 9 and Appendix 9A (downstream flow monitoring report) of the 2016 AEMP provide additional information and results, including quantitative support. Overall, Section 2 provides an environmental setting summary for the environmental screening of the 2018 mine plan amendment. It should be noted that Section 2.4.6.2 indicates that no changes to fish habitat and communities were documented in 2016 in the downstream flow paths, outside of those predicted in the EIS	

			- not that no changes had occurred. As described in the AEMP, no barriers to fish passage were present in late May and early June indicating that suitable spawning habitats were present and that Arctic Grayling were able to access spawning habitats. However, barriers were observed during the remainder of the open-water season. It is expected that the majority of adult and juvenile Arctic Grayling would have moved out of the streams into the upstream lakes as flows decreased, with only a small percentage of individuals remaining within the streams. Based on the 2016 results, little to no effects on the population as a result of the low flows were anticipated (De Beers 2016). Further monitoring for the fish habitat and community component of the AEMP was completed in 2017 and the results will be reported in the 2017 AEMP (in progress).	
6	Loss of fish habitat (2018 ESA Section 4.6.3 Interactions with Secondary Linkages - The Increased Footprint of the West Mine Rock Pile may Cause Alteration or Loss of Fish Habitat, pages 81-82)	**Comment** The effect of the loss of wetted habitat area due to the increase in the footprint of the West Rock and its corresponding encroachment into Kennady Lake was considered negligible because the loss would be offset by measures described in the updated Offsetting plan. The conclusion is appropriate but cannot be verified until the updated Offsetting Plan has been provided. **Recommendation** Will the updated Offsetting Plan be consistent with the requirement set out in DFOÃ¢Â€Â™s FPIP and will it demonstrate that the offsetting measures account for the losses resulting from the encroachment of the West Mine Rock Pile into Kennady Lake.	**May 21:** The Offsetting Plan is consistent with DFO's Fisheries Protection Policy (DFO 2013a) and Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting (DFO 2013b) and Fisheries Act Authorization 03-HCAA-CA6-00057.1. The Offsetting Plan will account for the 2018 changes to the footprint of the Mine, including the extension of the West Mine Rock Pile into Area 5.	
7	Mine footprint size	**Comment** The increase in the mine footprint appears to differ between the 2018 UPD and the 2018 ESA. Table 1-1 in the 2018 UPD states that the mine footprint will increase from 1172 ha (2013 UPD) to 1292 ha (2018 UPD). This is an increase of 120 ha. In the 2018 ESA, Section 1, page 3 indicates an increase in the mine footprint of 30.25 ha due to previous amendments. Page 4 states that the increase in mine footprint will be approximately 26 ha due to the additional mine rock. This would account for a 56.25 ha increase since 2013. **Recommendation** Please explain the discrepancy in the mine footprint	**May 21:** The Mine footprint has increased over time through both amendments to the land use permit and inspector authorizations. Table Ni Hadi Xa 7-1 of footprint changes is included as an attachment.	
8	General housekeeping (2018 UPD)	**Comment** The "Controlled Area Boundary" is referred to in the text but is not shown anywhere. We assume that the most outer "Catchment Boundary" shown on Figure 2-2 of the 2018 UPD is the Controlled Area Boundary, but it would be better if De Beers was explicit. This is important to avoid any miscommunication or misunderstandings about the limits of the controlled area in the future. **Recommendation** On Figure 2-2, add a line and legend entry for "Controlled Area Boundary".	**May 21:** Revised Figure 2-2 attached.	

9	General housekeeping (2018 UPD)	**Comment** Lake N11 is referenced in many locations throughout the 2018 UPD and other documents. It is an important water source for the mine and for downstream flow augmentation. The location of Lake N11 is not shown on any figures. **Recommendation** Add a figure to highlight the location of Lake N11 and the infrastructure to transfer water to the mine or to downstream flow augmentation.	**May 21:** Revised Figure 2-2 attached.	
10	General housekeeping (2018 UPD)	**Comment** Lake N6a is referenced on page 2-5 of the 2018 UPD as the reason for including a new containment berm across Area 2. Lake N6a is not shown on any figure. **Recommendation** On Figure 2-2, add a label to show the location for Lake N6a.	**May 21:** Revised Figure 2-2 attached.	
11	Sulphur determination consistency and clarification (2018 Geochemical Characterization Plan V4)	**Comment** In Section 6.4, page 34 of the GCP, it states that total sulphur analyses of blast hole cuttings samples will be done in an accredited laboratory. In Appendix A, Section A2 (page 60 of 62 in the PDF) it states that samples will be analyzed on site for total sulphur. **Recommendation** Clarify where the total sulphur determinations will be made and any planned accreditations for this laboratory.	**May 21:** The total Sulphur determinations are completed at the on-site LECO Laboratory. The LECO instrument was calibrated on site by the LECO representative and a subset of the on-site samples are sent off site to an accredited lab for quality assurance (GCP Appendix A, Page A4)	
12	Sulphide measurements and management (2018 Geochemical Characterization Plan V4, Sections 6.4 Sample Collection and Analysis and 6.6 Physical Handling of Mine Rock)	**Comment** Monitoring planned under the GCP will be done as part of mine operations, with sulphur determinations made onsite, based on blast hole chip sampling. In general, the concentration of sulphide in mine rock and kimberlite is very low meaning that it is likely that the sulphides are heterogeneously distributed within the rock matrix and may escape detection during blast hole drilling and chip sampling. **Recommendation** Describe the mode of occurrence of sulphide minerals within potential acid generating materials. Are they homogeneously or heterogeneously distributed in the rock matrix? Discuss how different modes of occurrence of sulphides within the mine rock and kimberlite may impact the identification and adaptive management of potential acid generating materials.	**May 21:** Sulphide minerals occur as disseminated mineral grains, heterogeneously distributed in granitic waste rock and kimberlite. In general, the sulphide mineral content of the mine rock and kimberlite is negligible. Sulphide mineralization is challenging to detect visually in blasted rock; therefore, sulphur analysis is recommended to identify zones of PAG waste rock. If zones of PAG rock are identified by sampling and analysis conducted prior to blasting, the material will be managed as prescribed in the Geochemical Characterization Plan. If a greater than anticipated volume of material is encountered, adaptive management will include: a review of samples relative to the mine plan to identify geochemical and mineralogical trends; confirmation of availability of space in the mine rock piles to sequester PAG rock; and initiation of a follow-up investigation to determine the implications of greater than anticipated amount of PAG rock.	
13	General housekeeping (2018 Groundwater Monitoring Program, Version 4)	**Comment** Figures 4 and 5 are unreadable due to font issues with the PDF file. **Recommendation** Resolve font issue	**May 21:** Font issues resolved. See attached Figures 4 and 5	
14	Hydrogeology modelling (2018 ESA, Appendix C, Water Quality Update -	**Comment** In history-matching the groundwater compositions of the observed 2016 to 2017 5034 pit inflows, the "Modified Gahcho Kué" TDS-depth profile was generated (shown on Figure 6 of the hydrogeology model update; page 398 of 484 in the 2018 ESA), which	**May 21:** The revised hydrogeological model developed in 2018 was calibrated to the measured sump quantity and quality. A detailed discussion of the changes to the 2010 model, which was presented in the EIS, to derive a	

	Appendix A, Hydrogeology Model Calibration and Predictions - 2018 Water Licence Amendment [pages 397 to 398/484 and Figure 6 in the 2018 ESA PDF]).	resulted in a factor of 3 increase in TDS at any particular depth compared to the TDS-depth profile used in prior assessments (the "Gahco Kué" profile, Figure 6). However, baseline groundwater monitoring data for Gahcho Kué plotted on the same figure (blue diamonds) appears to show that the "Modified Gahcho Kué" TDS-depth profile exceeds all but 6 assumed baseline data points at Gahcho Kué. As such, the Modified Gaucho Kué curve shows significantly higher TDS than the Gahcho Kué curve for any particular depth. **Recommendation** Explain the differences between the "Gahcho Kué" and the "Modified Gahcho Kué" TDS-depth profiles shown on Figure 6 of the 2018 hydrogeology model update. The three-fold increase in TDS with depth may imply the existence of a previously unknown flow path or flow system beneath Gahcho Kué. Do differences in groundwater quality or groundwater type explain the increased TDS observed in the 2017 inflows? Describe the effects that a three-fold increase in TDS-depth relations would have on the overall mine water management system and discuss whether this higher TDS-depth profile was used developing the 2018 Environmental Screening Assessment and the 2018 Operational Water Management Plan.	satisfactory calibration in the 2018 model is presented in Appendix C of the Environmental Screening Report. The measured inflow quantity was less than predicted by the 2010 model, but the TDS concentration was higher than predicted. To derive a satisfactory fit of measured compared to the predicted sump quality and quantity the following was required: 1) The as-built mine plan and schedule were simulated in the model. 2) the enhanced permeability zone (EPZ) that was present in the 2010 model was removed from the 2018 model. The assumed presence of the EPZ in the 2010 hydrogeological model resulted in predicted inflow quantities that were higher than observed and TDS concentrations that were lower than observed. The reason for this is that the EPZ in the 2010 model resulted in inflow of low TDS water from nearby lakes thereby reducing the TDS concentration, but increasing the inflow quantity. Seepage surveys conducted in the 5034 Pit found that the assumed EPZ is not present. 3) the TDS profile was revised to the "Modified Gahcho Kue" TDS Profile. The "Modified Gahcho Kue" Profile does not imply the presence of an unknown flow path or flow system. The calibrated model was then used to predict the inflow quantity and quality for the life of the mine, closure, and post closure. The predicted quantity and quality was input to the site-wide water quality model and used to develop the 2018 Environmental Screening Assessment and 2018 Operational Water Management Plan.	
15	Water quality (2018 ESA, Appendix C, Water Quality Update - Appendix A, Hydrogeology Model Calibration and Predictions 2018 Water Licence Amendment [pages 397 to 398/484 in the 2018 ESA PDF]).	**Comment** Long term mine water predictions made in the 2018 Water Quality Update predicted average 5034 pit inflow TDS of 2,640 mg/L for 2017. Data for April-August 2017 reported in the Hydrogeological Model update show that average TDS was 3,498 mg/L over this period. To match the 5034 inflow chemistry, the hydrogeology model update increased the TDS-depth curve by a factor of 3 meaning that TDS at any specific depth was tripled. It appears that the input chemistry for the 5034 pit used in the water quality update may not have been similarly adjusted upwards. **Recommendation** Confirm that the water quality predictions from the 2018 Hydrogeology Model Calibrations and Predictions report were used to estimate TDS and chloride concentrations for the WMP in the 2018 Water Quality Update report. If not, describe what the effects of the higher TDS-depth profile used in the 2018 hydrogeology modelling would be on predicted water quality in the WMP. Explain how this would affect the requested change in EQC for chloride and other ions in surface water. Discuss any changes in residual water quality impacts/effects, if any.	**May 21:** It is confirmed that the water quality predictions from the 2018 Hydrogeological Model were used in the estimate of the TDS and chloride concentrations for the WMP in the 2018 Water Quality Update report.	

16	Groundwater Modelling (2018 ESA, Appendix C, Water Quality Update - Appendix A, Hydrogeology Model Calibration and Predictions - 2018 Water Licence Amendment [page 392/484 in the 2018 ESA PDF]).	**Comment** Density dependent flow is assumed to not be a factor during operations and most of closure because of the strong hydraulic gradients (compared to post closure). While this may be true there are no calculations or references provided to show the relative magnitude of the driving forces that will govern groundwater movement. **Recommendation** Please provide references relevant to site conditions or calculations based on site specific data that show density dependent effects can be neglected during operations.	**May 21:** A measure of the relative importance of the gravity (density)-driven flow component is the Driving Force Ratio (DFR) as presented in Davies (1989). The DFR is the dimensionless ratio of the magnitude of the gravity term to the magnitude of the pressure term. The ratio expressed in terms of fluid density is as follows: DFR=??|?E|/(?f |?Hf |) where DFR = driving-force ratio [-] ?? = difference between actual fluid density and reference fluid density [kg/m3] ?(f)= density of freshwater [kg/m3] |?E| = magnitude of the gradient of elevation [-] |?Hf | = magnitude of the equivalent freshwater head gradient [-] A DFR of 0.5 is considered an approximate threshold at which density-related gravity effects may become significant (Davies 1989). The following presents calculations of the DFR for two different depths of the Tuzo pit, which is the deepest of the three pits at Gahcho Kué. During operations, when the Tuzo pit is at a depth of about 100 m (about 302 m elevation), a DFR of 0.23 is calculated. Using the total dissolved solids (TDS)/depth profile for the Gahcho Kué Mine as presented in Figure 6 of Appendix A, this calculation assumes a TDS of 4,000 mg/L at the bottom of the pit (equivalent to a density of 1,003 kg/m3) and a TDS of 50,000 mg/L at 750 m depth below ground (approximately -350 m elevation and equivalent to a density of 1,040 kg/m3). During operations, when the Tuzo pit is at maximum depth of about 340 m (61 m elevation), a DFR of 0.04 is calculated. Using the TDS/depth profile for the Gahcho Kué Mine as presented in Figure 6 of Appendix A, this calculation assumes a TDS of 10,000 mg/L at the bottom of the pit (equivalent to a density of 1,008 kg/m3) and a TDS of 50,000 mg/L at 750 m depth (approximately -350 m elevation and equivalent to a density of 1,040 kg/m3). In the above calculations, the DFR is below the threshold of 0.5 for both the shallow and the deep pit scenarios during operations. The shallow pit has a higher DFR than the deep pit. This is because the pressure gradient is less in a shallow pit compared to the deep pit and the density related effects for the shallow pit are relatively higher. Similarly, during closure, as the water level in the pit rises, the pressure gradient becomes progressively less, and the density related effects become more significant. During post-closure when the pressure gradient is essentially zero, density driven flow is significant; therefore, it is considered in the post-closure hydrogeological modelling presented in the Water Licence amendment application (Appendix C of the 2018 ESA).	

			Reference: Davies, P.B. 1989. Variable-Density Ground-Water Flow and Paleohydrology in the Waste Isolation Pilot Plant (WIPP) Region, Southeastern New Mexico. U.S. Geological Survey, Open-File Report 88-490.	
17	Groundwater Modelling (2018 ESA, Appendix C, Water Quality Update - Appendix A, Hydrogeology Model Calibration and Predictions - 2018 Water Licence Amendment [page 396/484 in the 2018 ESA PDF]).	**Comment** In Section 3.1 it is stated that direct precipitation and surface runoff inflows to the pits can be as much as 50% of the GW inflows. It also seems to state TDS in these surface water components of flux reporting to the pits is also 50% higher than what is in groundwater. If this statement is what was intended, it is counter intuitive that surface water TDS concentrations would be higher than the TDS in groundwater. The claim that TDS in in the surface water flux component is 50% higher than the TDS is groundwater is used to assert that calibrating the groundwater flow model to sump flow rates and sump water chemistry provides a conservative result. While calibrating the model to sump flow rates would be conservative because these flows would include both surface water and groundwater components, it would not be conservative from a water quality perspective (if the TDS of surface water is significantly lower than the TDS of the groundwater). This is because the sump water will be a mixture of higher TDS groundwater and lower TDS surface water. **Recommendation** Please clarify how calibrating to sump water chemistry can be considered conservative when making predictions if water reporting to the sump is derived from both groundwater and a significant amount of surface water. Similar assertions regarding the conservativeness of the calibration approach are made elsewhere in the appendix.	**May 21:** The hydrogeological model predicts groundwater inflows to the pit only. Although the quantity and quality of groundwater inflow provides a significant amount of the sump water quantity and quality, there are other sources of water to the sump that are not predicted by the hydrogeological model. These other sources are surface water sources and the primary contributions from surface water to TDS concentrations in the sump during mining are increases in TDS in nearby lakes and wall rock runoff; these sources are in addition to the predictions made by the hydrogeological model. In the hydrogeological model, the TDS concentrations of nearby lakes, including the Water Management Pond (WMP), are assumed to be zero throughout the mine life. However, the TDS concentration in the WMP will vary over time and this change is predicted using the site-wide water quality model. As this water in the WMP (with higher than zero TDS) flows to the pits, it will add additional TDS to the sump water. This additional TDS is accounted for in the site-wide model through a feedback loop. The parameters associated with this feedback, which consist of groundwater travel time and percent of water originating from the WMP, is predicted by the hydrogeological model. The site-wide model predicts the TDS concentrations of the sump, and therefore, the quantity and quality of water directed from the sump to the WMP. Both of these surface water components increase the predicted TDS of the water in the sump over that predicted by the hydrogeological model. The hydrogeological model does not include these two other sources of quantity and quality to the sump water; therefore, calibration of the hydrogeological model to the sump quantity and quality is conservative, because the sump water is not only composed of groundwater.	
18	Groundwater Modelling (Gahcho KuÃ© Mine - Water Quality Model Updates, Appendix A, pg 12) (2018 ESA, Appendix C, Water	**Comment** TDS data from the sump indicates a significant increase as mining progressed from the initial mining phase (September 2016 to March 2017; referred to as Stage 1 in the groundwater modelling appendix) to the interval between April and August 2017 (Stage 2); however, this "directional result" was not reproduced with the model, where the TDS was essentially the same between the two stages. At the relatively shallow depths mined to date, the model result does not	**May 21:** As discussed in Appendix A (Hydrogeology Model Calibration and Predictions - 2018 Water Licence Amendment) included in the 2018 ESA, the hydrogeological numerical model predicts groundwater inflows to the pits only. Water in the sump is the total of groundwater inflow together with other sources of water discussed in the response to NHX-17 (i.e., surface water inputs). These	

	Quality Update - Appendix A, Hydrogeology Model Calibration and Predictions - 2018 Water Licence Amendment [page 400/484 in the 2018 ESA PDF]).	seem to capture a TDS versus depth dependence in the sump water chemistry. This could be due to the vertical gradient of the TDS versus Depth profile not being steep enough at these shallower depths or that the model is simulating too much influx from the shallow groundwater system relative to the deeper groundwater system. If the numerical model cannot replicate increasing TDS levels as the mine advances deeper, the composition of water reporting to the pits may be underestimated. **Recommendation** Please clarify how the model will be periodically refined and compared against data collected through the on-going monitoring program as the mine advances to deeper levels. If an apparent inconsistent trend continues to evolve whereby measured sump water TDS increases significantly faster than the predicted TDS increase, confirm that the conceptual hydrogeological model will be re-evaluated and possibly refined and the numerical model updated through a re-calibration work plan.	combined sources result in an increase in the water quantity and TDS concentrations in the sump over that predicted by the hydrogeological model. Therefore, the use of sump data for calibration is considered to provide a conservative estimate of the groundwater contribution only. The hydrogeological model predicted a TDS concentration of approximately 2,460 mg/L over the first calibration period (September to March 2017) which is greater than the average TDS concentration measured in the pit sump of 2,022 mg/L (approximately 20% higher). For the second period (April to August 2017), the model predicts a TDS concentration of 2,500 mg/L, which is lower than the measured average TDS of 3,498 mg/L (approximately 30% lower). However, as shown in the Table 7 of Appendix A, once the site wide water quality model considers other sources of TDS in the sump, the average predicted TDS concentration in the sump for all of 2017 is 3,493 mg/L. Therefore, once the other sources of water quality and quantity are accounted for in the sump, the model is well calibrated. The Gahcho Kué Groundwater Monitoring Program, Version 4, March 2018 describes in Table 6 the responses to monitoring data trends in water quantity and/or quality that are above those predicted by the hydrogeological model. If trends in measured TDS and/or groundwater quantity in the sump are greater than predicted by specified percentages over a 6-month period, then the monitoring data will be reviewed to assess the causes of these differences. If it is determined that the hydrogeological model needs to be refined to account for charges in mine schedule or a re-calibration of the numerical hydrogeological model is required, it will be undertaken at that time and the hydrogeological model used to predict future groundwater inflow quantity and quality.	
19	Reclamation trials (2018 UPD, Section 12.1.1, page 12-3)	**Comment** Closure and reclamation commitments include reclamation trials. The commitment to reclamation trials is also confirmed by De Beers in their re-submission of the reclamation research plan and closure options letter dated May 5, 2017. DeBeers plans to start implementing certain tasks of the Reclamation Reseach Plan in 2018 (Section 14 of the 2017 Water Licence Annual Report). Section 5.4.3 of the UPD indicates that progressive reclamation of the Area 2 Fine PKC Facililty will be underway in operations years 4 to 7. This does not leave very much time to collect data from the RRP and then to implement findings in the progressive reclamation of the Area 2 Fine PKC Facility. The Interim Closure and Reclamation Plan - Closure	**May 21:** The option to commence progressive reclamation of the Fine PK Facility could commence at the end of PK deposition to this facility, which is currently projected to occur in year 2022. The RRP has scheduled the revegetation test plots to commence in 2019, and review of cover options and performance in year 2018/2019 (see Figure E.1 of the RRP). Research completed will inform final cover design of the facility. At this time, no contingency is considered necessary.	

		Options and Reclamation Reseach Plans, September 14, 2017 letter from the MVLWB presents tasks associated with updating the RRP in Table 2. For example, in Table 2, Section 2.3: Site Wide: Post Closure Seepage Quality and Quanity, the Task 2 Comment indicates that De Beers should reference Plans regarding to action levels or mitigation measure in the RRP. The comment then goes on to talk about what should be in version 4 of the ICRP. It is not clear if the RRPs will be updated at the same time as version 4 of the ICRP or before that. It is not clear if the MVLWB review of version 3 of the ICRP and RRPs, and then De Beers subsequent responses, was done with the knowledge of this most recent amendment application. **Recommendation** Operations began in 2016. Based on current research, does De Beers believe that they will be able to implement successful progressive reclamation in Area 2 within operations years 4 to 7? If yes, how would De Beers integrate information collected during their reseach trials into the progressive reclamation in Area 2? Does De Beers have a contingency should there be insufficient data collected from the RRP to use during the early stages of reclamation? Can De Beers provide a timeline for updating the RRPs? Can De Beers provide assurance that the reclamation trials will not be delayed until the ICRP is updated to version 4? Will the ICRP or the RRPs require additional revisions to address changes due to the amendment?		
20	Soil recovery commitments (2018 UPD, Section 12.1.1, page 12-3)	**Comment** Closure and reclamation commitments incude soil recovery commitments . In review of the 2018 UPD, the 2018 ESA, and the 2016 and 2017 vegetation and soil monitoring reports, we could not find reference to soil recovery or the attempts of soil recovery during construction activities. **Recommendation** If there is information on soil recovery during construction and operations, please provide us details on where that information is located. If soil has not been recovered, please provide rationale why soil has not been recovered and what actions De Beers will do to recover soil in the future.	**May 21:** Throughout construction and operations, materials not used in construction of dykes and berms were relocated to the overburden stockpile located as part of the South Mine Rock Pile. A prime construction material for many dykes on site is till which forms a large part of the excavation activities. While dyke construction will continue throughout the life of mine, the demands on till will begin to become lighter as dykes are completed thus allowing for the additional material to be stockpiled and used for closure activities.	
21	Reclamation and closure timeline impacts on local communities.	**Comment** The socio-economic impacts focus on employment opportunities during construction and operations. Table 7 of the 2018 ESA (page 73) under Operational Activities lists Community Health and Wellbeing as Valued Components and again focus on the workforce. There are numerous mining operations in the Northwest Territories that have operated and are now being reclaimed, are in a care and maintenance phase, or being remediated (e.g. Snap Lake, Jericho, Colomac, Giant, Pine Point, Lupine) however there is no information in the ESA on how the length of time between the cessation of operations and the final reclamation impacts communities that use and interact with the land. **Recommendation** How will De Beers assess how the additional time	**May 21:** For the purpose of the 2018 ESA, the Valued Component (VC) "community health and wellbeing" was focused on population demographics, community infrastructure and services, income disparity, and social maladies (e.g., crime, addictions and substance abuse). Access to and availability of resources harvested on the land by communities is assessed under the VC "culture, heritage and archaeology". Table 7 of the 2018 ESA considers the impact of closure and reclamation activities on environmental conditions and resources harvested by communities on pages 74 and 75. Sections 4.6.3 (p. 92-97) and 4.6.4 (p. 114-117) provides the assessment of closure	

		needed for reclamation and closure impacts communities that use and interact with the land?	and reclamation effects on the land and resources ultimately used by communities. The timeline of closure and reclamation activities begins with the expected end of mining operations in Year 12. After two years of active closure to remove most of the site infrastructure and disposal of materials from the controlled area, lake refilling will begin. Refilling Kennady Lake is expected to take approximately 19 years following the end of operations. This represents seven additional years of monitoring and ongoing reclamation activities, and a seven year extension to the length of time until land use can resume. Kennady Lake will not be reconnected to Area 8 until water quality in Kennady Lake meets all regulatory closure objectives. The exact schedule for this reconnection is not known at this time, but will be the subject of ongoing water quality monitoring.	
22	Vegetation monitoring results	**Comment** Page 82, 2nd paragraph of the 2018 ESA states that "Vegetation monitoring at the Mine indicates that the changes in plant species richness and abundance across sampling areas and years are unrelated to Mine effects and largely related to local site conditions during baseline data collection and other natural factors (Golder 2017a). Although dust deposition was higher in 2016 than the previous three years, no effects on vegetation from dust were observed." Baseline data was collected in 2013 and 2014. There have been two monitoring events in 2016 and 2017 representing construction and operations. The monitoring reports indicate challenges with dust data collection such as no solution in sampling containers, broken sampling containers and contamination in some sampling containers. Also the 2017 Vegetation and Soil Monitoring report states that "Summer 2017 results are anomalous, and included outlier values due to sample contamination and were not included" (Section 5.1). The 2017 report also states "After pooling data across sampling periods, the apparent trend of decreasing dust deposition rates with increasing distance from the Mine observed in 2017 (Figure 5.1-1) is not statistically significant". This is a limited data set for both vegetation and dust to determine that mining operations has not impacted vegetation. With an increase in the amount of rock being mined there is a potential to increase dust deposition on vegetation. **Recommendation** Please provide your rationale for pooling the dust data across sampling periods and for determining there was sufficient data to draw the conclusion that there were no effects on vegetation from dust.	**May 21:** The vegetation and soil monitoring program (VSMP) is ongoing, and currently Mine-related effects from increased dust on plant species richness and abundance have not been statistically detected during two years of baseline and two years of construction/operation data. Vegetation monitoring data will be collected and analyzed in future years through the VSMP (next cycle is 2018), and continue to increase the strength and confidence in testing the effects from the Mine and natural factors on plant communities. The 2017 program collected and analyzed data on dust deposition (and soil microclimate) only; no vegetation data were collected in 2017. Dust deposition and soil microclimate data are collected each year to estimate cumulative annual dustfall from the Mine and temporal variation in soil temperature and moisture levels among sampling areas. Dust deposition data from three sampling periods in 2017 were pooled at each sampling area to investigate the relationship between dust deposition rate and the distance from the Mine. A linear regression indicated that there was no statistically significant trend between dust deposition rates and distance from the Mine. No conclusion was drawn from the effects of dust on vegetation in 2017. As mentioned above, further data collection in 2018 (vegetation, dustfall, soils) will be used to test Mine-related effects on plant species richness and abundance.	
23	Revegetation (2018 UPD, Section 12.8.2, page 12-18)	**Comment** The 2018 UPD Project description references two documents from 2005 for northern revegetation. It then goes on to say that studies from the Ekati Diamond mine and experience from	**May 21:** The MVLWB directed as part of the ICRP review process, De Beers to complete Task 1 of the revegetation research as detailed in the RRP. This information includes a	

		Ekait and Diavik will be used to assist in the revegetation at Gahcho Kue. The document does reference the studies done at Ekati. **Recommendation** Please confirm that there is not more current published studies for northern reclamation. Also provide details on how the information from Ekati and Diavik (studies or experience) will be used to inform the reclamation trials at Gahcho Kue.	review of previous studies and is to be submitted with the next ACRPPR. This is currently a work in progress. During the ICRP review process in June 2017, De Beers provided to the MVLWB a summary of relevant revegetation research completed for the Snap Lake mine and noted its relevance to the Gahcho Kue site.	
24	Hydrology assumptions (2018 Operational Water Management Plan, Section 2.2.2, Table 2.3, page 36)	**Comment** The hydrology assumptions include 105 mm/yr net annual runoff for the mine waste rock piles during initial placement, and 210 mm/yr after completion of rock placement. The basis for this difference in hydrology is not explained. We assume that precipitation and snowmelt will infiltrate the large rock voids and flow out along the toe of the waste rock pile with little or no buildup of any internal water table. As well, the rock piles will not be covered or vegetated (page 12-8 of the 2018 UPD). We therefore question the need for different hydrology assumptions. Overall, the amount of rock in the waste rock piles has been amended. The resulting runoff is also amended. Any runoff through the rock piles may affect water chemistry in the water management pond. Some of the amended rock pile volume will be below ground, but the rock pile will also be extended higher above ground. **Recommendation** Confirm the hydrology assumption for runoff from the waste rock piles. A clear rationale for the hydrology assumption will provide confidence that the amount of water and associated water chemistry from the waste rock piles is reasonable and will not result in a future upset condition that might affect the ability of the mine to discharge water.	**May 21:** Field observations from northern operating mines indicate that the unit area annual runoff (including surface runoff and seepage) from waste rock piles is generally less than that from other disturbed ground, especially during initial years. This is due to water loss due to surface wetting of the newly placed dry waste rock; water loss in the voids of the waste rock due to freezing and trapping snow cover within newly placed mine rock of the winter. The Gahcho Kue site water balance was calibrated to the measure data from the first operation year. The predicted water levels agreed with the measured water levels using the parameters as presented in the OWMP.	
25	Water balance (2018 UPD, Section 9.8, page 9-22)	**Comment** The text indicates that "the table was compiled using net runoff data for for a median year (one-in-two return period)". Median year does not equal the one-in-two year return period. The one-in-two year return period normally refers to a recurrence interval from the perspective of high/wet or low/dry. **Recommendation** Confirm that the water balance is intended to be a median or P50 year. If it is actually intended to be a one-in-two year return period high volume or low volume, the confidence in the water management plan may be eroded.	**May 21:** The run-off values used in the water balance is a one in two year return period as average values as detailed in the Operational Water Management Plan. Average runoff values provide a better estimate of the water quantities and water quality over multiple years than median values. Section 9.8 in the UPD should read "average year", not "median year".	
26	Water balance (2018 UPD, Section 9.8, Table 9.8-1, page 9-23)	**Comment** Downstream flow mitigation relies on a diversion from Lake N11. This diversion volume is not shown in the water balance, but is listed in the Application and Forms document as available in 3 out of 4 years. We understand that De Beers is committed to a target flow augmentation of 0.1 m3/s in dry years (Table 9.6-2 on p. 9-18 of the 2018 UPD). However, this minimum flow commitment may not be achievable when the water licence to withdraw water from Lake N11 is unavailable during a dry year (1:5 year return period or drier). Note	**May 21:** The commitment for downstream flow mitigation is for at least 3 out of 4 years. The downstream flow mitigation is based on three categories - wet, average, and dry (see Section 2.5 of the operational Water Management Plan). The provision for withdrawing water from Lake N11 for downstream flow mitigation is included in Schedule 3, Part D of the Gahcho Kué Water Licence (maximum annual withdrawal volume of 1,555,200 m3 for every 3 out of 4	

		that Lake N11 water will be used to refill Lake Kennady; the licence limit is 3.7 million m3; and the flow augmentation target is 0.1 m3/s, equivalent to 3.7 million m3 per year. The requested licence quantity for downstream flow mitigation is 1.55 million m3/yr. The withdrawal amounts from N11 appear to exceed the available limit. **Recommendation** Confirm the commitment for downstream flow mitigation is not 100% of the time, or clarify how the flow augmentation targets will be met in dry years. The total withdrawal rate from Kennady Lake may not be achievable. A clear water balance for N11 with all withdrawals listed will help to clarify.	years). This water withdrawal has been included in the Operational Water Management Plan (see Table 2.9 and Section 2.4.5). The detailed water balance (Section 2.5 of the Operational Water Management Plan and Section 9.8 of the 2018 UPD) was developed specifically to focus on inflows and outflows of Areas 1 to 7 and the mine-out pits to evaluate the overall water balance for the Mine; as a result, the diversion of water from Lake N11 is not listed in the tables in these sections, but it has been considered in the overall water management plan for the Mine. Most years sufficient water will be available from Lake N11 to support the downstream flow mitigation plan as required. Withdrawal can not occur from Lake N11 when the N11 outflows fall below the 1 in 5 year low flows. As described in Section 2.4.5 of the Operational Water Management Plan, if required, additional water will be pumped from other sources for flow mitigation, such as Lake A1, or Area 7 as available. In the worst case if water can not be pumped from Lake N11 due to flow restrictions and water is not available from other sources the flow mitigation may not be able to meet it's flow targets. This would count as a year that flow mitigation does not occur.	
27	Climate change (2018 UPD, Section 3.4 page 3-6)	**Comment** De Beers estimates that the refilling time for Kennady Lake will be 20 years after operations are completed (2018 UPD, Table 3.1-1) however it could take more/less than that under unusually dry/wet hydrological conditions (2018 UPD, Section 3.4 page 3-6). We could not find discussion on how climate variability may impact the amount of water available to refill Kennady Lake. **Recommendation** What is the range of time to fill Kennady Lake for different climate scenarios? What methodologies were used to derive these results?	**May 21:** The time to refill Kennady Lake considered mean precipitation and runoff values. The refilling period will vary according to the actual precipitation and runoff. The 20 year moving average of the historical climate records were examined to evaluate the variation in precipitation values. The 20 year moving averages varied between -14% and +8.3% of the mean. The lower 20 year averages were from the beginning period of the record and higher values were from the more recent periods. Climate change projections for Gahcho Kue Mine Site precipitation were evaluated using the climatic change projection tool (SNAP at https://www.snap.uaf.edu/sites/all/modules/snap_community_charts/charts.php) developed by the University of Alaska Fairbanks (UAF). This tool was developed for predicting the future climate in the Arctic. SNAP uses five different global circulation models (GCMs) as a basis for the down-scaled climate projections. Projections are based on the Representative Concentration Pathway (RCP) scenarios, which are adopted by the IPCC as of its fifth Assessment Report (AR5) in 2014 to depict a range of possible future atmospheric greenhouse gas concentrations. The available climate change scenarios in SNAP are RCP4.5, RCP6.0, and	

			RCP8.5. At the location of the Gahcho Kué Mine the projected average annual precipitation to increase in the periods 2010-2019 by from 6% to 8% and 2040-2049 by 10% to 17% using the 1961 to 1990 as a baseline. This increased precipitation could potentially decrease the filling time for Kennady Lake. The reported filling times have conservatively not been included an increase in precipitation due to climate change.	
28	Dyke lifespan (2018 Processed Kimberlite and Waste Rock Management Plan V.6, Section 4.6, Earth Structures for Mine Waste Management, subheading "Fine PK Management;" and Figures 4 to 9)	**Comment** Fine PK will be stored in Area 2. In year 1, the operating level will be roughly equal to the adjoining Lake N7 outside of Dyke D. Dyke D provides containment for the Fine PK. As the mine progresses, the operating level for the Fine PK will gradually exceed the elevation of Lake N7. By closure, the maximum operating level for saturated fine PK will be 6 m above Lake N7. Dyke D will remain on the landscape at closure to continue providing containment. The design of Dyke D includes a constructed liner to prevent seepage through the dyke. A similar dyke arrangement exists near Lake A1 and A2 along Dyke A1. **Recommendation** What is the expected lifespan of the Dyke D liner? If the lifespan is relatively short, seepage from the Fine PK may have unintended consequences to water quality in Lake N7 and further downstream.	**May 21:** Dykes D and A1 contain two separate layers to control seepage. The first layer is till that is approximately 7 m wide. The second layer is a HDPE geomembrane liner. This is the same liner normally used in landfills throughout the world for the past 30+ years. The lifespan of an HDPE liner is a function of whether it is exposed or buried, service temperature, chemistry of the contained material, and other environmental factors. Buried liners (as is being used in the Gahcho Kue dykes) perform very well and their life span is in excess of their service life to date (Peggs 2010). Studies done on the long term properties of liners have shown that the antioxidants in the non-exposed liners at 20ºC are projected to start to deplete after 200 years with a half-life of greater than 400 years. The fine PK facility will be in operation for approximately six years, after which time it will be progressively reclaimed and eventually closed. After closure it is planned that there will be no ponded water in the facility, thereby reducing seepage risk to the environment.	
29	Dyke leakage (2018 Processed Kimberlite and Waste Rock Management Plan V.6, Section 4.6 Earth Structures for Mine Waste Management, subheading "Fine PK Management;" and 2018 Geochemical Characterization Plan, Section 4.2.2, p. 24)	**Comment** As discussed above, fine PK is stored in Area 2, impounded behind dykes A1, D and L. Should the liners degrade, water from A2 could seep through the dykes. The 2018 Geochemical Characterization Plan (GCP) report describes the fine processed kimberlite as non-acid generating, but there are issues with some metals including arsenic, selenium, iron, molybdenum, boron, antimony, lithium, chromium, and zinc; phosphorous may also be an issue (GCP, Section 4.2.2. page 24). **Recommendation** Explain management options for potential leakage of fine processed kimberlite leachate through Dyke A1, Dyke D and Dyke L.	**May 21:** Dyke A1 and Dyke D are constructed to retain fine PK and water in Area 2. Dyke L is a seepage dyke; it will contain fine PK and a head of water, but is intended to allow seepage from Area 2 to Area 3. As described above, Dykes A1 and Dykes D have both a layer of till, and an HDPE liner to control seepage. In the event that seepage is observed, there are several options to reduce the seepage, or collect the seepage and pump it back to Area 2. The best solution is a function of the location where the seepage is occurring, the quantity of seepage, and how the how the seepage is coming through the dyke. Seepage can be reduced by depositing additional fine PK against the dykes, thereby moving the ponded water away from dykes. The fine PK itself is a low permeable material. The dyke can also be remediated through dyke modifications such as active or passive ground freezing or foundation grouting. The applicability of these solutions is a function seepage characteristics. Seepage can be collected through a series of pumping wells in the	

			downstream portion of the dyke or seepage collection trenches and ponds downstream of the dyke.	
30	Water quality (2018 Effluent Quality Criteria Report)	**Comment** The report describes updates to the parameters for which EQCs were developed for the Water Management Pond discharge to Lake N11 and for Area 7 discharge to Area 8, respectively. The updated EQCs are presented in Tables 3.8 and 3.9. Rationale provided to develop and select the EQCs is sound. However, adequacy of EQCs must be confirmed by water quality and aquatic effects monitoring programs **Recommendation** Please describe how the the water quality and aquatic effects monitoring programs will confirm that downstream aquatic receptors are not affected by the effluent dischages in Lake N11 and Area 8	**May 21:** As a condition of the Water Licence, De Beers is required to have an Aquatics Effects Monitoring Program (AEMP). The AEMP sampling design includes Area 8 and Lake N11 as core lakes, and has associated sampling sites in these waterbodies and downstream to evaluate for Mine effects. The AEMP includes hydrology, water quality, sediment quality, plankton, benthic invertebrates, fish habitat and community, fish health, and fish tissue chemistry. As part of AEMP reporting, results from each years sampling are reviewed and compared to the pre-defined action levels included in the Response Framework section of the AEMP Design Plan (De Beers 2016). The goal of the AEMP Response Framework is to systematically respond to monitoring results such that the potential for significant adverse effects are identified, and mitigation actions are undertaken to prevent a significant adverse effect from occurring. Action levels are pre-defined levels of environmental change or effect that trigger certain types of management actions and are linked to quantitative benchmarks. As such, the existing AEMP and Response Framework will be able to assess potential mine-related effects to the aquatic ecosystems of Area 8 and Lake N11, and identify the need for additional mitigation if required such that the aquatic ecosystems and their uses are adequately protected.	
31	Wildlife monitoring schedule	**Comment** As part of the 2014 Wildlife Effects Monitoring Program (WEMP; Version 2), wildlife monitoring will be completed for caribou, grizzly bear, wolverine, raptors and upland birds. The planned schedule for monitoring is different for each species/species group and a consolidated schedule outlining the years that surveys would be conducted in was not included in the WEMP. **Recommendation** Please provide a schedule that outlines wildlife monitoring surveys completed to date (including year of survey) as well as the proposed survey schedule moving forward.	**May 21:** A summary of the wildlife monitoring surveys conducted, as well as the schedule for surveys throughout the life of the mine, is included in the annual wildlife monitoring report (Table Ni Hadi Xa 31-1) and also attached here as an attachment	
32	Wildlife monitoring timelines	**Comment** As part of the WEMP (Section 3.2, page 15), monitoring would be completed during construction (2 years), operations (11 years) and closure (12+ years). **Recommendation** Please confirm that the timeline for monitoring during construction, operations and closure will be adjusted based on the new schedule. Please provide the number of years of monitoring that will be completed for each Project phase (i.e., construction, operations, closure).	**May 21:** Monitoring will be ongoing throughout construction, operations and closure. The 2 years of construction is now complete. Monitoring will proceed throughout operations, which is now expected to last for 11.7 years, during active closure (2 years) and during the extended closure period of refilling (~19 years). De Beers also anticipates monitoring after reconnection to the downstream for 5 years.	

33	Wildlife monitoring timelines	**Comment** As part of the WEMP (Section 3.2, page 15), monitoring would be completed during closure (12+ years). **Recommendation** Given the timeline for reclamation of wildlife habitat, please provide updated information on the timeline for closure monitoring.	**May 21:** Monitoring of wildlife is anticipated to occur during closure until the relevant closure objectives are achieved.	
34	Caribou	**Comment** DeBeers has implemented mitigation and monitoring to understand potential impacts caribou from the Project. Following the development of the WEMP and WWHPP in 2014, additional guidance on caribou mitigation relevant to the Project area has been published including the Interim Discussion Document for the Bathurst Caribou Range Plan. A draft range plan for the Bathurst Caribou Range was also released in early 2018. **Recommendation** Please outline how DeBeers has or will incorporate recommendations from the Draft Bathurst Caribou Range Plan into the WEMP	**May 21:** The Bathurst Caribou Range Plan is a proposed plan and may undergo changes following review. The WWHPP and WEMP (i.e., Wildlife Mitigation and Monitoring Plans) were designed to avoid and minimize incremental direct and indirect effects from the Mine on caribou. For example, mitigation to minimize direct and indirect effects by the Mine include: -limiting the area of the mine footprint; -promote natural re-vegetation and practice progressive reclamation as the mine develops; -maintain downstream flows within baseline levels; and, -use dust suppression strategies (following GNWT Guidelines for Dust Suppression, ENR 2013), such as regular road watering during open conditions. Thus, the mitigation and monitoring actions for the Mine decrease the cumulative effects to the annual and seasonal ranges from human and natural disturbances, which is the focus and objectives of the Bathurst Caribou Range Plan (Section 1.1.2 and Section 1.2.2). The Gahcho Kué Mine will adaptively manage its WWHPP and WEMP to meet new or modified requirements for compliance with the NWT Wildlife Act.	
35	Wildlife movement	**Comment** Table 9.3-1 in the 2018 UPD has a list of dykes that are remaining after final reclamation and will not be restored to baseline habitat types. **Recommendation** Please provide information on the potential impacts to wildlife movement from leaving the dykes in place.	**May 21:** Effects on wildlife movement from the presence of dykes was assessed in the EIS (Sections 7 and 11; De Beers 2010). Construction of dykes will cause changes to drainage flow patterns and surface water elevations in some lakes, which may alter local patterns of wildlife habitat availability and distribution and influence site-specific movements of individual animals or groups of animals. The residual effect was assessed as negligible (secondary pathway) to wildlife populations in the EIS. Seven dykes are planned to be permanent as part of the 2018 UPD and will result in permanent effects that will remain as minor localized changes to surface flows and water levels and wildlife habitat availability, and associated site-specific movements of some animals. The presence of seven dykes during post-closure are predicted to have a negligible influence on regional wildlife populations and do no alter the conclusions of the EIS.	
36	Sensory disturbance to wildlife	**Comment** The increased size of the Project footprint as well as Project construction and operations may increase noise levels, which could	**May 21:** An independent assessment of noise was not completed in the ESA. However, the effects pathway for	

		impact the sensory disturbance to wildilfe. **Recommendation** Please indicate if the noise assessment has been completed which accounts for changes to noise, if any, from updated project activities.	sensory disturbance, which includes noise, was assessed as secondary for wildlife (Section 4.6.3). The 2018 UPD includes limited additional sources of noise and other sensory disturbances (six additional haul trucks and 40 additional staff). Activities associated with the 2018 UPD will occur primarily within the core Mine area and are not expected to result in a measurable change in the magnitude or spatial extent of sensory disturbance. Noise monitoring is completed at the Mine and future monitoring results can be compared to noise levels under existing conditions to verify predictions.	
North Slave Metis Alliance: Nicole Goodman				
ID	**Topic**	**Reviewer Comment/Recommendation**	**Proponent Response**	**Board Staff Analysis**
2	General	**Comment** The North Slave Metis Alliance expresses our support for the comments submitted by Ni Hadi Xa on May 7 2018. **Recommendation** None	**May 21:** Acknowledged	