Index for Attachments to the Information Request-ORS Comments for DDMI's Depositing Processed Kimberlite in Pits and Underground (EA1819-01) (Part 1 of 3)

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PR#84

Canadian Northern Economic Development Agency

Agence canadienne de développement économique du Nord

5019 – 52nd Street
Yellowknife, NT X1A 1T5

June 21, 2019

Ms.Kate Mansfield
Senior Environmental Assessment Officer
Mackenzie Valley Environmental Impact Review Board
5102 – 50th Avenue
PO BOX 938
YELLOWKNIFE, NT X1A 2N7

VIA ONLINE REVIEW SYSTEM

Dear Ms. Mansfield,

Government of Canada Information Requests for Diavik's proposed project [EA1819-01]

On behalf of the Government of Canada, thank you for the opportunity to request additional information, for the environmental assessment of Diavik Diamond Mines Inc.'s (DDMI's) project proposal.

We have reviewed the documents and information provided for the review and the federal departments, Environment and Climate Change Canada and Fisheries and Oceans and submits the following information requests and attached table for your consideration.

We look forward to participating in further stages of the review of this proposed project. Should you have any questions, please do not hesitate to contact Senior Project Manager Adrian Paradis at 867-669-2595 or by email at adrian.paradis@canada.ca.

Sincerely,

FOL

Lisa Dyer
Director General
Northern Projects Management Office

Canada

cc:
David Rochette, Regional Director General, Crown Indigenous Relations and Northern Affairs Canada
Mary Taylor, Environmental Protection Operations Directorate Environment and Climate Change Canada
C. Thomas Hoggarth, Regional Director, Ecosystems Management Central and Arctic Region, Fisheries and Oceans Canada
Shari Currie, Regional Director General, Prairie and Northern Region, Transport Canada
David Kitchen, A/Director, Environmental Protected Persons, Health Canada
Mark Hopkins, Director General, Crown Indigenous Relations and Northern Affairs

Environment and Climate Change Canada | Environnement et Changement climatique Canada

Environmental Protection Operations Directorate
Prairie & Northern Region
5019 52nd Street, 4th Floor
P.O. Box 2310
Yellowknife, NT X1A 2P7

ECCC File: 5100 000 015/006
MVEIRB File: EA 1819-01

June 20, 2019

Via online submission http://lwbors.yk.com/LWB_IMS/ReviewComment.aspx?appid=12715

Catherine Fairbairn
Environmental Assessment Officer
Mackenzie Valley Environmental Impact Review Board
200 Scotia Centre
Box 938, 5102-50th Ave
Yellowknife, NT X1A 2N7

Dear Catherine Fairbairn:

RE: EA1819-01 – Diavik Diamond Mines Incorporated– Processed Kimberlite to Mine Workings Environmental Assessment – Summary Impact Statement

Environment and Climate Change Canada (ECCC) has reviewed the information submitted to the Mackenzie Valley Environmental Impact Review Board (MVEIRB) regarding the above-mentioned Summary Impact Statement and is submitting comments via online submission. ECCC's specialist advice is provided based on our mandate, in the context of the *Canadian Environmental Protection Act*, the pollution prevention provisions of the *Fisheries Act*, the *Migratory Birds Convention Act,* and the *Species at Risk Act*.

Please contact Russell Wykes at (867) 669-4743 or Russell.Wykes@Canada.ca for more information.

Sincerely,

Andrea McLandress
Regional Director

Attachment: ECCC Diavik IR's

cc: Georgina Williston, Head, Environmental Assessment North (NT and NU)

Fisheries and Oceans Canada | Pêches et Océans Canada

Suite 301, 5204 50th Avenue
Yellowknife, NT
X1A 1E2

May 24, 2019

MVEIRB file Votre référence
EA1819-01

DFO file Notre référence
98-HCAA-CA6-00021

Mark Cliffe-Phillips
Executive Director
Mackenzie Valley Environmental Impact Review Board
P.O. Box 938
Yellowknife, NT X1A 2N7

Dear Mark Cliffe-Phillips,

Re: EA1819-01 Information Requests – Diavik Diamond Mines Inc. Processed Kimberlite into Mine Workings Project

The Fish and Fish Habitat Protection Program (FFHPP) of Fisheries and Oceans Canada (DFO-FFHPP) wishes to thank the Mackenzie Valley Environmental Impact Review Board (MVEIRB) for the opportunity to request additional information and seek clarification of Diavik Diamond Mines Inc.'s (DDMI's) project and it's potential effects.

DFO-FFHPP reviewed DDMI's Submission Impact Statement for Processed Kimberlite into Mine Workings Project in accordance with our department's mandate and has considered both the Indigenous Knowledge (IK) and western science information presented by DDMI. At this time, DFO-FFHPP does not require further information from DDMI or MVEIRB.

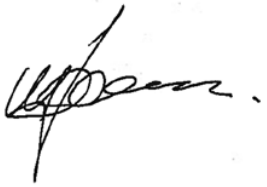
Additionally DFO-FFHPP reviewed the associated information relating to the abovementioned submission. Our department notes MVEIRB's Information Request #9 regarding potential impacts associated with not re-connecting the pit lakes to Lac de Gras. MVEIRB recommended that DDMI: "*Describe the implications of not reconnecting the pit lakes on the approved DFO No Net Loss Plan and how those habitat losses would be mitigated*." DDMI responded that: "*The compensation plan developed with Fisheries and Oceans Canada (DFO) to address the "No Net Loss" policy that existed in 1998 is based on re-connecting the dike areas. An alternative compensation plan would need to be developed with DFO and communities, and for DFO approval, if the preference was to not re-connect the pit lakes to Lac de Gras.*"

DFO-FFHPP is in agreement with DDMI's statement. Please see the Authorization for Works or Undertakings Affecting Fish Habitat DFO-File No. SC98001 (*Fisheries Act* Authorization) Section 6.0, Compensation for Harmful Alteration, Disruption or Destruction (HADD) of Fish Habitat, specifically 6.5 and 6.6 for complete details. These sections allow DDMI to submit a revised compensation within six months of

unacceptable water quality results and alter or modify habitat compensation as required by DFO-FFHPP to obtain the level of lake and stream habitat compensation to the satisfaction of our department.

For further inquiries related to this letter or DFO-FFHPP's mandate, please contact Dan Coombs at: 867-669-4927, or daniel.coombs@dfo-mpo.gc.ca

Sincerely,



Marek Janowicz
Regulatory Review Manager, DFO
Fish and Fish Habitat Protection Program
Fisheries and Oceans Canada

cc:
Dan Coombs, Senior Fisheries Protection Biologist, DFO
Angie McLellan, Fisheries Protection Biologist, DFO

June 20, 2019

Mark Cliffe-Phillips
Executive Director
Mackenzie Valley Environmental Impact Review Board
P.O. Box 938
Yellowknife, NT X1A 2N7

Re: EMAB comments and Information Requests

EMAB would like to thank the Mackenzie Valley Environmental Impact Review Board (MVEIRB) for the opportunity to review Diavik's Summary Impact Statement (SIS) for EA1819-01 Depositing Processed Kimberlite (PK) into Pits and Underground and respectfully submit the following comments and attached Excel table.

We contracted North-South Consultants (NSC) and Slater Environmental Consulting (SEC)to provide technical advice and we also review the document internally. We attach NSC's and SEC's review for your consideration.

We also want to provide a comment on the review process for the SIS and associated Information Requests.

EMAB had expected that the SIS would be a comprehensive document, similar to a Developer's Assessment Report, pulling together all the information provided by Diavik up to the submission date (May 17/19). Instead the SIS references various other documents submitted over the course of the review going back to June 2018, and is intended to be read along with Diavik's responses to MVEIRB's IR's (submitted May 9/19). This led to some confusion on the part of EMAB and our technical consultants in doing the review. To compound this we found it somewhat confusing to navigate the project review documents to access Diavik's IR Responses. As a result some of the IR's EMAB is submitting today may have been partially addressed in Diavik's May 9 IR Responses. It is our view that in most cases more fulsome answers are required than have been provided and we encourage MVEIRB, and Diavik, to view EMAB's IR's in this light.

We trust these comments are useful and urge you to give them full consideration. If you have questions or concerns, please contact John McCullum at 766-3682 or emab1@northwestel.net.

Sincerely,

Charlie Catholique
Vice-Chair

Cc Board Members and Alternates (by email)
Parties to the Environmental Agreement (by email)
Ryan Fequet, Executive Director, WLWB (by email)

North/South Consultants Inc.

83 Scurfield Blvd.
Winnipeg, MB R3Y 1G4
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REVIEW OF DIAVIK'S SUMMARY IMPACT STATEMENT FOR THE PROCESSED KIMBERLITE TO MINE WORKINGS PROJECT (MVEIRB FILE NO.: EA1819-01)

Technical Memorandum # 367-19-03

Prepared for:

Environmental Monitoring Advisory Board (EMAB)
P.O. Box 2577
Yellowknife, NT
X1A 2P9

Prepared by:

North/South Consultants Inc.

June 19, 2019

1.0 BACKGROUND AND SCOPE OF WORK

Diavik Diamond Mines (2012) Inc. (DDMI) submitted an application to the Wek'èezhìi Land and Water Board (WLWB) on June 1, 2018 to amend their Water Licence (W2015L2-0001) to allow Processed Kimberlite (PK) to be placed into mine workings (A418 pit and A418 underground; DDMI 2018a). The WLWB distributed the application on June 15, 2018 and review comments were submitted by August 2, 2018; North/South Consultants Inc. (NSC) submitted comments to EMAB on the Licence Amendment Request on August 1, 2018 (NSC 2018a).

On August 31, 2018 the WLWB determined insufficient information was available on the record to inform a preliminary screening decision and they issued the first of two rounds of Information Requests (IR) to DDMI. DDMI responded to the IR Round 1 on November 6, 2018 and the WLWB distributed the item ("DDMI Response to WLWB Information Request re: Water License W2015L2-0001 Amendment Request for the Deposition of Processed Kimberlite to Mine Workings" – hereafter referred to as DDMI 2018b) for review. The IR Round 1 response included a Technical Memorandum presenting the results of water quality modeling for the pits.

NSC conducted a technical review of the IR Round 1 Responses (DDMI 2018b) at the request of EMAB and submitted comments on December 10, 2018 (NSC 2018b). DDMI subsequently submitted responses to these and other comments on January 8, 2019 to the WLWB (DDMI 2019b). NSC was again retained by EMAB to review the DDMI information package and to provide further comments on these, and previous, responses submitted by DDMI on the Licence Amendment application. NSC provided draft responses to EMAB and attended a portion of the WLWB Technical Sessions held on January 16-17, 2019.

Subsequent to the Technical Meetings on January 16-17, 2019, the WLWB issued 15 IRs (IR Round 2) on January 23, 2019 in relation to the Licence Amendment Application. Thirteen of these IRs (IR# 1 to 5, 7 to 12, 14, and 15) were directed at DDMI. DDMI submitted responses to the IR Round 2 on February 11, 2019 (DDMI 2019c). NSC was retained by EMAB to review and provide comments on this submission (report submitted March 19, 2019). The intent of the latter report was to identify any outstanding or new comments or key issues and to provide any recommendations for additional information and/or follow-up, considering the information as a whole and incorporating the most recent information provided by DDMI.

On February 26, 2019 the Mackenzie Valley Environmental Impact Review Board (MVEIRB), referred the project to environmental assessment (EA). The MVEIRB filed a document entitled "Scope of the Environmental Assessment and Reasons for Decision" dated April 18, 2019 and subsequently issued IRs to parties April 29, 2019, and a clarification on scope and reasons for decision on May 21, 2019. DDMI produced a Summary Impact Statement (SIS) for the Processed Kimberlite to Mine Workings Project (MVEIRB File No.: EA1819-01) on May 17, 2019 (DDMI 2019a).

NSC was retained by EMAB to review the aquatic environment components of the SIS, and to provide comments and identify any IRs. It is noted that as the EA is largely a consolidation of previously submitted information, the review also considered whether required information was presented in previously submitted information that was not compiled within the EA document itself.

1.1 SCOPE OF WORK

The following document provides comments in relation to the EA, but also considers previous materials submitted by DDMI as noted above. This document focuses on identifying any outstanding or new issues, and providing requests for additional information that could address these issues.

2.0 KEY CONCERNS AND INFORMATION REQUESTS

The EA provides a useful compilation of information on the proposed Project, in particular in describing the proposed options for each of the pits. It is understood that placement of PK in pit A418 is the preferred option and that the A154 and A21 pits are alternates; however, comments are provided on all model outputs. In addition, it is understood that DDMI has withdrawn the activity of re-mining the extra fine PK form the PK facility and placing it in the mine workings as a component of the Project; however, results have been included in the report and associated comments on these results have been included in the review.

It should be noted that the EA does not include a consolidation of all methods related to the water quality modeling, but instead provides reference to multiple memorandums and documents prepared by Golder. A compilation of all these files and relevant methods and results into a single document would provide a more readily accessible document and review process, particularly in light of the number of documents and communications issued since submission of the Licence Amendment Request in 2018.

The information provided by DDMI in the EA is largely consistent with that provided previously, in particular in response to the second round of IRs issued by the WLWB after the January 2019 technical sessions; as such, several of the issues identified in this submission were identified in NSC's March 19, 2019 submission to EMAB, though updated to incorporate new or modified information presented in the SIS.

2.1 IR 1: WATER QUALITY MODELING: DISCREPANCY BETWEEN RESULTS

Comment:

The EA presents results for water quality parameters for each scenario at the surface and 40 m below the surface (assumed lower boundary of waters that would be used by fish) in Tables 4-7, 4-8 and 4-9. A time series of concentrations is presented in Appendix B (Figures B-10 to B-19). It is unclear if the 40 m below the surface plot in the appendices is actually the modelled concentration for the bottom as the numbers do not correspond to what is presented in the tables (e.g., compare Table 4-7 to Appendix Figure B-10). The time series plots are of interest as they enable assessment of the duration of any elevated concentrations of water quality parameters, as well as illustrate whether concentrations tend to decline or increase over time.

For the purposes of this review, it is assumed that the results in the tables (Tables 4-7 to 4-9) are correct.

Information Request 1:

Please confirm the assumption that data presented in tables are correct and provide corrected version of time series figures presented in Appendices. If the assumption is incorrect, provide revised tables, figures, and text as required.

2.2 IR 2: WATER QUALITY MODELING: CRITERIA FOR CONNECTING THE PIT LAKES TO LAC DE GRAS

Comment:

The EA (p. 25) states:

> *"Pit lake water quality will be monitored to confirm that meromictic conditions associated with water column stratification have been established, and to confirm required water quality criteria have been met. Once pit lake water quality meets applicable water quality criteria, the pit lakes will be reconnected to Lac de Gras by breaching the dikes."*

The EA defined acceptable water quality as (p. 55):

> *"Breach dikes of pit lake(s) A418, A154 and A21 once monitoring results confirm acceptable water quality (i.e., below AEMP benchmarks);"*

With respect to Fish and Fish Habitat (p. 105), the EA states:

> *"Breach the dikes to connect the mine workings to Lac de Gras only after monitoring shows that water in the top 40 m of the water column in the pit lake(s) is below the Aquatic Environmental Monitoring Program (AEMP) Effects Benchmarks (Golder 2017a)"*

Given that water quality in the pits will vary among zones in the pit (i.e., top, middle, and bottom), the depth criteria are important. The 40 m criterion listed above should be considered a minimum, given that the depth to which the mixolimnion circulates is not known. Ideally, conditions in the pit lakes would be assessed prior to dike breaching to determine the depth of the mixing zone that affects surface water quality, and water quality within this entire section of the water column be compared to AEMP benchmarks to determine whether the dikes should be breached.

Information Request 2:

Please describe the process whereby water quality in the pit lakes will be assessed to determine whether dikes should be breached including a description of the frequency and season of sampling (i.e., would a single sampling episode be considered sufficient?), the location and depth of sample collection, and the parameters and benchmarks that would be assessed.

2.3 IR 3: WATER QUALITY MODELING: STABILITY OF MEROMIXIS WITH A CLOSURE CAP OF < 100 M

Comment:

The EA (p. 53) states:

> *"However, the modelling indicated that a water cap of approximately 50 m depth was necessary to isolate the PK porewater from the surface and facilitate the stratification (stable meromixis) and was an effective mitigation for water quality based on the low surface water concentrations (Golder 2018)."*

However, later the EA states (p. 56):

> *"The modelling indicates that the high concentrations of TDS in the bottom layer will provide stable meromixis over the 100-year simulation period for pit lakes A418 and A154 (Figure 4-2 and Figure 4-3) but may break down after approximately 50 years for A21 (Figure 4-4) (Appendix B, Figures B1 – 9). The breakdown of meromixis and full mixing in A21 is a result of the shallower depth of water cover in A21 relative to A418 and A154."*

Results of modeling show that for all scenarios, stability of the meromictic gradient in A21 is not high. Even if the breakdown of the gradient results in few exceedances of water quality benchmarks, it allows mobilization of contaminants from PK porewater at the base of the pit. Even for an 85 m cap (Figure 4-4, scenario A21- 2a), the concentrations of TDS appear to become similar among depths, although it is difficult to interpret the relative concentrations precisely due to the difference in the scale bars on the graphs.

The lack of stable meromixis in pit lake A21 also results in effects to water quality at 40 m of depth (EA p. 60):

> *"For pit lake A21 under modelled scenarios 2a, 3a, and 4a, water quality constituents decrease very quickly at the surface but fluctuate at the 40 m depth. Nitrite, nitrate and molybdenum are predicted to exceed the AEMP benchmarks for scenario 3a and nitrite is predicted to exceed the AEMP benchmark in scenario 4a. All constituents are predicted to be below AEMP benchmarks for scenario 2a (Table 4-9)."*

The EA considered the implications for water quality of the lack of stability in A21 (p. 67):

> *"Given that the modelling indicates that pit lake A21 may not maintain stable meromixis, water quality predictions were evaluated for a breakdown of meromixis. The breakdown of meromixis was assessed using the data predicted for an accident and malfunction scenario for A21 (unanticipated mixing event due to geotechnical failure of a pit wall; discussed in Section 4.4.3; data in Appendix B, Table B4). These predictions were used as they would be*

similar for both a predicted and an unanticipated event. For pit lake A21 under modelled scenarios 2a and 3a, water quality would be below the AEMP benchmarks for all parameters. Under modelled scenario 4a, water quality would be below the AEMP benchmarks for all parameters except nitrite (0.062 mg/L, 3% higher than the benchmark)."

Information Request 3:

The conclusions of the EA should be modified to reflect the reduced stability of meromixis when the closure cap is <100 m. Would DDMI consider limiting storage of PK to pits where the closure cap can be greater than 100 m to increase the probability of long-term stable meromictic conditions?

2.4 IR 4: WATER QUALITY MODELING: SENSITIVITY ANALYSES

Comment:

The EA (p. 53-54) states:

"Sensitivity analyses were conducted to increase the confidence in the water quality modelling results by assessing sensitivity of hydrodynamic model results to changes in model input values and characterizing how uncertainty in model inputs could affect model results (Golder 2019a). Ten sensitivity scenarios were performed for A418 by changing one model input per simulation. It was assumed general findings of the sensitivity analyses would also apply to A154 and A21. The sensitivity analyses indicated the following:

- *PK temperature is not expected to change surface water quality within the pit lake;*
- *Local runoff from mine area is not anticipated to change surface water quality in the pit lake;*
- *Wind sheltering coefficient is not anticipated to change surface water quality in the pit lake;*
- *The required speed of wind required to turn over the lakes is beyond a plausible condition;*
- *Increased air temperatures as a result of future climate change are not anticipated to result in a change in pit lake water temperature or water quality predictions;*
- *The pit lake is predicted to remain stratified at lower than modelled consolidation rates (e.g., stable meromixis at 25% of modelled consolidation rate);*

- *Higher concentrations of constituents in porewater are not predicted to result in a measurable effect to the pit lake water quality because of the meromixis in the water column, which would be further strengthened by increased porewater concentrations;*

- *Water quality predictions are not sensitive to the tested initial conditions (i.e., assumptions about groundwater inflows, rock wall runoff, or initial TDS in porewater); and*

- *Water quality predictions are not sensitive to a higher maximum vertical eddy viscosity value because the maximum value is rarely or never met."*

The link to the sensitivity analysis provided in Appendix B is to a series of graphs and tables that were submitted in January 2019 for the WLWB Technical Session in response to EMAB-14 in conjunction with brief text providing the range of parameters included in the sensitivity analysis. Sensitivity analysis is a key component of the model analysis because it indicates the extent to which model results are robust in the face of uncertainty with input parameters. Therefore, a more fulsome description of the methods applied and results within this EA is warranted.

Information Request 4:

Please provide in a single document the methods used for the sensitivity analysis, including the rationale for selected input parameters, the results, and the significance of those results in terms of the model outputs presented in this assessment.

2.5 IR 5: WATER QUALITY MODELING: DILUTION OF PIT LAKE WATER BY LAC DE GRAS

Comment:

The concentrations of total dissolved solids in the water of the pit lakes declines over time at depth (see for examples Figures 4-2 to 4-4). Does this decline represent the movement of dissolved constituents in the water of the pit lakes into Lac de Gras over time? Is it correct to note that storage of PK in the pit lakes will result in a long-term, albeit with undetectable effects to water quality, movement of contaminants from porewater in the PK to Lac de Gras?

Information Request 5:

Provide a discussion of the long-term loading of constituents in the porewater to Lac de Gras or provide an explanation of the mechanism for the long-term decrease in concentrations observed at depth in the pit lakes.

2.6 IR 6: WATER QUALITY MODELING: POREWATER CHEMISTRY INPUTS

Comment:

The WLWB IR #5 (IR Round 2 after the technical session) requested that the chemistry results obtained from the PK *in situ* beach porewater saturated zone be used for water quality modeling.

As presented in Appendix Table B-2, the porewater quality used in the EA was based on fresh PK slurry chemistry. This differs notably for many constituents from the beach porewater; numerous parameters are notably lower for the PK slurry than for the *in situ* beach porewater, including from the saturated zone. Further, the fresh PK slurry averages used were based on a small sample size (2-3 results) and concentrations for many constituents varied widely between the samples.

Information Request 6:

Given that the porewater chemistry dataset used for modeling was based on limited PK chemistry data with a relatively large range of concentrations (i.e., the fresh PK slurry dataset), it is recommended that modeling be repeated using the maximum concentrations from the PK slurry dataset to provide a conservative estimate of potential effects and risks to aquatic biota. Furthermore, a rationale for use of these data, rather than data previously used in earlier submissions and the data that was identified to be used in the WLWB IR #5, should be provided.

If the fresh PK slurry is confirmed to be the most appropriate and representative source for estimating effects on water quality, it is recommended that additional sampling of the fresh PK slurry be completed and modeling be rerun using updated results.

2.7 IR 7: DISSOLVED OXYGEN

Comment:

The EA (p. 67) states:

> *"A change in water quality could result from a reduction in dissolved oxygen within the pit lake during stable meromixis. Although dissolved oxygen concentrations near the PK/porewater interface are expected to become depleted over time due to chemical oxygen demand in the PK or biological oxygen demand from bacterial decomposition of accumulated organic detritus, this oxygen-depleted water is not expected to mix with water in the shallower depths of the pit lakes. As a result, depletions of dissolved oxygen in the surface water of the pit lakes are not anticipated (DDMI 2019)."*

This text does not indicate the anticipated dissolved oxygen (DO) concentration in the majority of the pit, between the surface and bottom waters.

The EA further states (p. 70-71):

> *"In the event of a destratification event (e.g., A21), it is anticipated that a decrease in dissolved oxygen would occur within the intermediate zone of the pit lake. The anoxic bottom layers near the PK/porewater interface would mix with the oxygenated surface waters and result in low dissolved oxygen conditions, however not zero. Given the large volume of oxygenated water within the pit lake and wind generated aeration at the surface with the upper most layer, it is anticipated that surface waters will be re-oxygenated by wind generated currents. The duration of the anticipated period of low dissolved oxygen is not known, however it may be within the range of natural fluctuations in dissolved oxygen that occur within Lac de Gras currently (DDMI 2019)."*

The EA does not provide the basis for this conclusion, which appears to rely on water in the middle of the water column being well oxygenated to offset low DO at depth.

The EA states (p. 110):

> *"Dissolved oxygen concentrations in the upper 40 m of the pit lakes are expected to be above the Canadian Water Quality Guidelines (CCME 2019) for the protection of cold-water freshwater biota: 9.5 mg/L for early life stages (e.g., eggs and fry) and 6.5 mg/L for other life stages (e.g., juveniles and adults). This is because water in the upper 40 m of the water column will mix with oxygenated water from the surface of Lac de Gras during the open-water season and will also be oxygenated by wind generated currents in the upper most layer, albeit to a much smaller extent than what naturally occurs in the lake itself because of their much smaller fetch. Oxygen concentrations in the deeper portions of the mixolimnion in the pit lakes are also expected to be at least partially replenished during the spring and fall when water temperatures in the upper 40 m of the water column become uniform, allowing wind generated currents to increase internal circulation."*

Although the assumptions in the EA may be correct (i.e., that re-oxygenation through exchange with Lac de Gras and by surface mixing during the ice-free season would be sufficient to offset any losses due to chemical oxygen demand exerted by the PK at depth), DO is a critical water quality parameter that merits a more thorough assessment.

DDMI (2019c) provided a discussion of scientific literature regarding active avoidance of low DO by fish and noted that fish could leave the pit lake if DO depletion occurs. This is a reasonable assumption, however, in the event of a sudden mixing event, conditions in the pit lake will change relatively rapidly and more rapidly than natural, progressive decreases in DO that commonly occur in deep areas of lakes over the course of the ice-cover season. A more sudden change may preclude the ability of fish to egress the area, notably as they will be in a relatively isolated "basin" with limited locations for egress. In addition, if low DO extends to more shallow waters (e.g., if stratification in A21 breaks down or under ice cover in any of the pit lakes), less

mobile species (e.g., Sculpin) and less mobile life stages of mobile species (e.g., juvenile and eggs of Lake Trout) could be adversely affected.

Due to this potential risk to aquatic biota, DO dynamics in the pit lakes should be examined in greater detail.

Information Request 7:

We recommend that dissolved oxygen concentrations be further investigated considering:

(i) the development of anoxic conditions in bottom waters due in part to chemical oxygen demand from the PK;

(ii) DO depletion that would occur naturally at depth under ice cover, based on observed conditions in Lac de Gras;

(iii) the depth to which water would circulate below the upper 40 m given the narrow and deep profile of the pit lake. It should be noted that results of the sensitivity analyses indicated that the water column in the pit lakes would be quite stable; therefore the entire water column above the chemocline may not be well-mixed;

(iv) water circulation during most of the open water season in the upper 40 m of the water column given a thermocline between 5-15 m;

(v) the depth to which water is likely to become fully re-oxygenated on an annual basis vs the potential for long term depletion in the mid water column; and

(vi) theoretical surface concentrations of DO if, as a worst case, an anoxic monimolimnion was mixed to establish whether or not there is potential for a fish kill and/or critical risk to aquatic biota. It is recommended that DDMI conduct a mass-balance estimate of potential fully mixed DO concentrations in surface waters that could assume anoxic conditions in the monimolimnion and a reasonable estimate of concentrations in the overlying waters.

2.8 IR 8: WATER QUALITY MONITORING

Comment:

In a previous submission (DDMI 2019c), it was indicated that post-closure monitoring of water quality will be conducted at one site in each of the pit lakes at 3 depths on a monthly basis: (1) surface; (2) 15 m; and (3) 30 m (DDMI 2019c; Attachment #8). *In situ* depth profiles of temperature, conductivity, turbidity, and DO will be collected over the upper 30 m of the water column during each sampling event. If feasible, samples will also be collected from 35 m above the pit bottom two times per year. This monitoring would occur prior to breaching of the dykes.

After breaching, monitoring would be conducted twice per year. The list of parameters was not fully detailed in the provided attachment (e.g., a superscript is noted for "major ions").

The EA does not provide any detailed information on proposed monitoring.

Information Request 8:

Can a detailed monitoring program be provided for review, which includes a description of measurement parameters, sampling sites, frequencies, and methods, a response management framework, including benchmarks, actions levels, and associated actions and mitigation? This information is a critical part of the overall management and mitigation plan for this Project and is essential to ensuring that risk is minimized and can be adequately addressed moving forward.

2.9 IR 9: WATER QUALITY MITIGATION IN THE EVENT OF ADVERSE EFFECTS

Comment:

The EA in a summary of commitments (p. 78):

> *"Close the breaches or isolate the pit lake from Lac de Gras if water quality is later determined to pose a risk to water quality, fish and fish habitat, caribou. humans or cultural land uses."*

Information Request 9:

The above-stated commitment is a key component to address unforeseen effects to water quality and fish and fish habitat in Lac de Gras as it could effectively isolate the mine pits if they are found to be the source of unacceptable effects to water quality or result in periodic fish kills (e.g., if low DO occurs more often than anticipated).

However, this mitigation measure could be fleshed out more fully (e.g., response to a fish kill from low DO, response to breakdown of meromixis). Can DDMI provide additional information on how risks will be identified and defined and the process for determining where and when this mitigation would be implemented?

2.10 IR 10: EFFECTS TO FISH AND FISH HABITAT – BIOLOGICAL MONITORING

Comment:

The EA (p. 106) states:

> *"Potential long-term acute or chronic effects to fish or other aquatic biota are also not expected to occur due to deposition of PK into the A418 or A154 mine workings. This is*

because it is expected that water in these pit lake(s) will become stratified such that there is no mixing of PK or porewater ... As a result, all water quality constituents in the upper 40 m of the water column in A418 and A154 pit lakes, the depth zone within which most, if not all fish and aquatic biota, are expected to reside, are predicted to be below AEMP benchmarks for all Project scenarios."

The assumption that biota will remain within the upper 40 m of the water column is a critical component of the assessment. DDMI (2019c) responses to IRs #8 and #9 provided a literature review that supported DDMI's contention that: (i) fish will move to avoid low DO that may occur in the lower water collumn; and (ii) that fish will tend to use the upper portion of the water column, thereby avoiding exposure to concentrations of water quality parameters above AEMP benchmarks.

However, given that the upper waters of the pit lakes are being developed to provide productive fish habitat, that critically low concentrations of DO could potentially develop and could result in fish kills, and that fish not being exposed to concentrations of water quality parameters above AEMP benchmarks relies on their behaviour, predictions with respect to fish behavior should be confirmed through monitoring. It is also possible the fish would use deeper waters and this should be substantiated through monitoring.

Information Request 10:

Please provide a post-closure monitoring program of fish use and movements of the first pit lake to be restored. Depending on feasibility, the study should include monitoring of depths to which fish descend during periods of no thermal stratification in spring and fall and under ice, when deeper waters could provide more suitable habitat in terms of temperature. If monitoring of DO indicates the presence of critically low DO concentrations, then monitoring of fish movements should be adapted to confirm that fish are able to successfully avoid these areas. If monitoring demonstrates that fish are not behaving as anticipated and are at increased risk due to exposure to adverse water quality conditions, the closure plans for the other two pit lakes could be modified and the need for further mitigative action for the initial pit lake be assessed.

3.0 REFERENCES

Diavik Diamond Mines (2012) Inc (DDMI). 2019a. Summary Impact Statement for the Processed Kimberlite to Mine Workings Project (MVEIRB File No.: EA1819-01). Submitted to the MVEIRB May 17, 2019.

DDMI 2019b. DDMI Response to WLWB IRs re: Water License W2015L2-0001 Amendment Request for the Deposition of Processed Kimberlite to Mine Workings. Submitted to the WLWB, January 8, 2019.

DDMI. 2019c. DDMI Response to WLWB IRs re: Water License W2015L2-0001 Amendment Request for the Deposition of Processed Kimberlite to Mine Workings. Submitted to the WLWB, February 11, 2019.

DDMI. 2018a. DDMI Water License Amendment Application, including Attachment 1: Amendment Overview-Deposition of Processed Kimberlite into Mine Workings and Attachment 2: W2015L2-0001 Proposed Amendments (in track changes). Submitted to the WLWB, June 1, 2018.

DDMI. 2018b. DDMI Response to WLWB Information Request re: Water License W2015L2-0001 Amendment Request for the Deposition of Processed Kimberlite to Mine Workings. Submitted to the WLWB, November 6, 2018.

North/South Consultants Inc. 2018a. Review of Diavik's Water Licence Amendment Request for the Deposition of Processed Kimberlite to Mine Workings. Prepared for the Environmental Monitoring Advisory Board, August 1, 2018. Technical Memorandum # 367-18-03. 14 p.

North/South Consultants Inc. 2018b. Review of Diavik's Water Licence Amendment Request for the Deposition of Processed Kimberlite to Mine Workings – Diavik's response to Wek'èezhìi Land and Water Board (WLWB) Information Request. Prepared for the Environmental Monitoring Advisory Board, December 10, 2018. Technical Memorandum # 367-18-05. 20 p.

Executive Summary

Slater Environmental Consulting has reviewed DDMI's Summary Impact Statement (SIS) for the proposed Processed Kimberlite to Mine Workings (PKMW) Project. To support the environmental assessment, the current review provides input on DDMI's assessment methods, analysis and conclusions, in addition to other technical aspects addressed in previous license amendment reviews. There are some information gaps that should be addressed to develop a thorough understanding of potential environmental effects. These include gaps related to the assessment methods, water quality modelling and predictions, and assessment of effects on water quality.

For assessing the significance of effects, DDMI relies on thresholds and definitions that are the same as or "consistent with" the 1999 CEAA Comprehensive Study. In our view, the decision to rely on these significance thresholds and definitions does not consider changes that have occurred since the original assessment was conducted. For example, conditions and context for the Bathurst caribou herd are much different now than they were in 1999.

DDMI has not addressed effects that could occur during the operational phase, for example the creation of a large open water body in the pit that could attract waterfowl at some times. The water quality assessment does not consider the potential for wildlife to use the water.

In some cases, the descriptions of the modelling process lack detail, making it difficult to confirm the adequacy of the predictions. Additional information on inputs, assumptions, calibration, calculations, analysis, and results interpretation should be provided to confirm the outputs.

The assessment of effects on water quality should be revised to more thoroughly consider the potential for cumulative effects on Lac de Gras.

The scope of the assessment includes the placement of Fine PK and Extra Fine PK (EFPK) from the PK Containment Facility. Storage of PK in mine workings offers an opportunity to reduce long-term risks if the Fine PK and EFPK material can be moved from the PK Containment Facility to the mine workings. The PK Containment Facility relies on permanent dams that will require monitoring and maintenance, but the pits are permanent physically stable storage locations. However, the EFPK may behave differently when it is placed in the pits. Additional information about the characteristics of EFPK and its potential effects on water quality in the pits should be provided. As well, DDMI proposes a Feasibility Assessment about moving material from the PKC Facility. It should be undertaken soon to understand the effects and benefits of potential re-mining of PK in the PK Containment Facility.

Finally, in order to maintain improve our understanding and prediction of effects of the PK storage in pits and effectiveness of mitigation measures, there are additional monitoring and follow-up requirements that should be undertaken.

Memorandum

To: John McCullum, Allison Rodvang – Environmental Monitoring Advisory Board

From: Bill Slater, Rasheeda Slater – Slater Environmental Consulting

Date: June 20, 2019

Re: Diavik Diamond Mine – Processed Kimberlite to Mine Workings Project Summary Impact Statement

1.0 Introduction

As requested, Slater Environmental Consulting (SEC) has reviewed Diavik Diamond Mines (2012) Inc.'s (DDMI's) Summary Impact Statement (SIS) for the proposed Processed Kimberlite to Mine Workings (PKMW) Project. SEC has previously reviewed DDMI's application for amendment of its water licence including information provided in the following documents:

1. DDMI Amendment Request dated June 1, 2018 (the "June 2018 Amendment Application").
2. DDMI Response to Information Request dated November 6, 2018 (the "November 2018 Response").
3. DDMI Response to Reviewer Comments and Recommendations dated January 8, 2019 (the "January 2019 Response").
4. DDMI Response to WLWB Information Requests dated February 11, 2019 (the "February 2019 Response").

The current review was completed to support the Information Request component of the Analytical Phase of the Mackenzie Valley Review Board's environmental assessment. As a result, this review specifically considers DDMI's assessment methods, analysis and conclusions, in addition to other technical aspects addressed in previous reviews.

As stated in previous review memos, SEC is generally supportive of the concept of placing PK in mine workings because it offers the most physically secure long-term storage location, thereby minimizing physical failure risks. However, support for the concept is dependent on the ability to manage other risks.

2.0 Assessment Methods

2.1 Thresholds for Significance

For four of the five Valued Components[1] (VCs) considered in the SIS, DDMI defines thresholds for significance and describes the factors and quantitative measures used to characterize the significance of effects. For most VCs (i.e., Water Quality, Fish and Fish Habitat and Wildlife and Wildlife Habitat), DDMI relies on thresholds and definitions that are the same as or "consistent with" the 1998 Comprehensive Study, with a few noted minor modifications. It argues that applying the previously developed thresholds and definitions provides consistency with the original mine assessment, but does not provide any additional rationale for why the thresholds and definitions are still relevant and applicable. The definition of significance from the 1999 Comprehensive Study Report, completed under the *Canadian Environmental Assessment Act* (CEAA), is applied directly for Water Quality, and Wildlife and Wildlife Habitat:

> "*The definition of a significant adverse effect is an effect that has a high probability of a permanent or long-term effect of high magnitude, within the regional area, that cannot be technically or economically mitigated."*

For Water Quality for example, Table 4-2 in the SIS describes the factors and quantitative measures used to characterize effects. High magnitude effects are those where contaminant concentrations exceed the Aquatic Effects Monitoring Program (AEMP) Benchmarks by more than 20%. Long-term effects are those that last more than 30 years. The Regional Area is defined as anything more than 1 km from East Island. With DDMI's definitions and threshold, modelling would have to confidently predict contaminant concentration(s) more than 20% higher than AEMP Benchmarks for more than 30 years at distances more than 1 km from East Island before an effect would be considered significant.

While the significance thresholds and definitions for Cultural Use are not drawn from the 1999 CEAA Comprehensive Study, they apply similar methods and set thresholds of similar magnitude. Based on the definition of significance developed to evaluate effects on Cultural Use, effects will only be considered significant if the residual effects extend beyond decommissioning and abandonment and cause critical reduction or elimination of Cultural Use within the Regional Assessment Area (RAA). The RAA is a 13,865 km^2 area, shown in Figure 8-1 in the Summary Impact Statement. DDMI does not provide a definition for critical reduction of Cultural Use.

In our view, the decision to rely on significance thresholds and definitions from the 1999 CEAA Comprehensive Study does not adequately consider the changes in conditions and context that have occurred since that assessment was conducted.

Environmental conditions and contexts have changed and need to be considered. The issue needs to be addressed for all VCs, but most notably, the conditions and context for the Bathurst caribou herd have changed dramatically and the significance threshold has likely also changed.

[1] DDMI's VCs are Water Quality, Surface Water Quantity, Fish and Fish Habitat, Wildlife and Wildlife Habitat and Cultural Use.

When the 1999 Comprehensive Study was completed the Bathurst caribou herd had a population over 42 times the current population. At that time, such a definition of significance may have provided sufficient protection for the herd. In the "*Scope of the Environmental Assessment and Reasons for Decision*" document, the Review Board emphasizes the precarious state of the Bathurst caribou herd and states that any potential impact of the proposed activities on the herd should be carefully considered and mitigated. This careful consideration should extend to the thresholds for significance and the definitions used to characterize effects.

For the water quality assessment for zinc, DDMI proposes to rely on the AEMP benchmark of 30 µg/L as a basis for calculating significance thresholds. However, the context for this threshold has also changed. DDMI acknowledges that the Canadian Water Quality Guideline for the Protection of Aquatic Life has been decreased to 7 µg/L, but proposes to use the outdated guideline for consistency.

The cultural and legislative/policy context has also changed since the completion of the 1999 Comprehensive Study. CEAA no longer applies and has been replaced by the *Mackenzie Valley Resource Management Act*, with its foundation in land claim agreements with Indigenous groups. People's understanding of mining and its effects has also changed. Governments and citizens have much more experience with diamond mining. Reconciliation with Indigenous groups has become an important Canadian policy initiative.

The thresholds for significance appear to rely almost entirely on the technical characteristics of the effects (e.g., magnitude, geographic extent, duration), with little consideration of the values of society or the people that are most likely to be affected by the project. Nonetheless, societal values need to play a central role in determining significance of effects. Clearly the people who will be most affected by the project are those who use the area for their life sustaining activities. Consideration of these people's perspectives should be a fundamental part of determining the significance of effects, but the SIS does not address how perspectives and values have been considered in establishing the definitions and thresholds for significance.

The recalibration of the assessment that arises from updated definitions and thresholds could lead to identification of important effects that are not currently considered in the assessment. For example, the current assessment for Wildlife and Wildlife Habitat focuses on changes in wildlife health due to water quality effects during the closure and post-closure periods. Revisions of thresholds for wildlife may mean that other potential effects become relevant.

Information Request: DDMI should update its definitions and thresholds for significance to reflect the current conditions and context for the environmental assessment. The updated definitions and thresholds should be supported by rationale that includes information about how the perspectives and values of the people who will be most affected have been considered.

2.2 Temporal Boundaries

For all VCs, DDMI concludes that there are no project interactions during the construction and operation phases, and therefore no effects to be considered in the assessment. The operation of pits as PK disposal facilities will create large open water areas during operations. The pits will have supernatant water overlying the PK. The quality of this water likely will not meet AEMP

benchmarks during operations, and may have concentrations that exceed safe levels for wildlife and/or birds. In the north, it is common for active mine waste storage facilities to have open water earlier in the season than surrounding lakes. In this case, waterfowl may be attracted to the open water, leading to exposure to the pit water. This potential effect has not been considered in the assessment.

Information Request: DDMI should consider whether operational conditions may lead to establishment of an open water area that may attract wildlife. If this is possible, the potential effects should be addressed in the assessment.

3.0 Water Quality Predictions

The characterization and evaluation of effects on water quality rely on predictions of water quality in the pits once PK placement is complete and pits have been filled with water from Lac de Gras. Appendix B of the SIS provides a very short summary of the modelling with references to other memos prepared by Golder. I have reviewed the currently available memos that were provided as part of the water licence amendment process. However, Golder refers to "*Water Quality Modelling Results A418 (corrected) A154 and A21 Mined Out Pits – Scenarios 2a, 3a and 4a*" which is "*not yet available*."

I assume that the results presented and discussed in the SIS are from the most recent, corrected memo, but it is not clear what changes and corrections have been made. As a result, it is not possible to reach any conclusions about the modelling results presented.

Information Request: DDMI should provide the most recent detailed report describing the assumptions, inputs, analysis, results and interpretation for water quality predictions used in the effects assessment.

Detailed comments about modelling, based on review of previous documentation are provided in the following sections.

3.1 Loading Sources to Pits

Water quality modelling results provided in the June 2018 Amendment Application did not incorporate potential loading from pit walls or groundwater inflow. In the January 2019 Response, DDMI provided a sensitivity analysis that considered impacts of additional sources on long-term water quality conditions. It also considered a potential pool of water remaining on top of the PK at the initiation of pit filling. These scenarios were considered as separate events. There was no prediction of conditions of combined events, even though this is the most likely scenario.

The sensitivity analysis also considered different rates of pore water release from the PK, but only considered slower rates of release, making the optimistic assumption that conditions would not be worse than the initial predictions, but they could be better.

With respect to groundwater inflows, DDMI's sensitivity analysis considered a groundwater input of 177,647 m^3 during pit filling. This number seems small in comparison to the previous modelling that used the following approach:

> *"The groundwater inflow rate was estimated based on a linear relationship developed from historical pit dewatering rates and pit depths. ... the groundwater inflow rate at the start of filling was set to 28,300 m^3/day. It was then assumed to decline over the filling period as water levels in the pit increased, ultimately reaching a value of zero when the pit was full of water."* (Golder Associates. 2010. *Preliminary Pit Lake Mixing Study*. Appendix -3 of Interim Closure and Reclamation Plan, Version 3.2)

All of these load sources are likely to contribute to water quality in the pit and should be directly included in the modelling. They do not represent "sensitivity" conditions because they are expected sources, not uncertain contributors.

Information Request: DDMI should either provide updated water quality predictions that incorporate loading from all reasonable, foreseeable sources, or provide rationale why these sources are not relevant for predictions of water quality conditions.

3.2 PK Pore Water

Water quality and hydrodynamic modelling for deposit of PK in mine workings relies on an understanding of pore water quality from PK. The pore water expelled from PK as it consolidates is expected to be an important source of high Total Dissolved Solids (TDS) water at the pit bottom, supporting establishment of permanent stratification (layering) in the pit lakes. The PK pore water is also the main source of contaminant loading in the pit lakes, with modelling indicating that this load will gradually diffuse upward and disperse into Lac de Gras over a period of many decades.

The information provided in the June 2018 Amendment Application was not sufficient to understand the basis for DDMI's input assumptions about pore water quality. Each of the subsequent submissions provided additional information, with the January 2019 Response providing summary statistics for "*in situ PKC beach sampling.*" Unfortunately, the response did not clarify if this was surface or subsurface sampling from the beach, leaving outstanding uncertainty about the adequacy of the data supporting water quality input assumptions.

The February 2019 Response provides additional clarification about the sampling, with the Table in Attachment 1 referring to "PKC Beach Pore Water" samples and citing data from Moncur and Smith (2014) in the table notes. There is no reference provided for Moncur and Smith (2014) but I assume that it is a paper titled "*Four-Year Hydrogeochemical Field Investigation of Processed*

Kimberlite Weathering at Diavik Diamond Mines Inc.[2]" that was submitted to the Wek'èezhìi Land and Water Board as part of the Diavik 2014 ICRP Annual Progress Report. If this is the correct source, then the report appears to confirm that the samples are of pore water in PK material and the new information helps to support the modelling inputs that DDMI applied up to January 2019. One challenge with these inputs is that DDMI relied on average values so it is possible that more adverse conditions could occur. Nonetheless, DDMI continues to assert that its models represent a "*worst-case rather than being representative of the conditions that could be expected at Diavik*" (Responses in Review Comments Table, January 2019).

In the February 2019 Response, DDMI chose to reconsider its model inputs and use data from water collected from fresh PK slurry. Contaminant concentrations for this assumption are much lower than in previous modelling and therefore the models predict much lower effects on water quality in the pit and Lac de Gras. However, the results presented in Moncur and Smith (2014) appear to indicate that relying on water from fresh PK is likely to underestimate the pore water concentrations in deposited PK, for example:

- "*Although the exposed FPK had only been weathering for about one month, porewater extracted from the upper 0.25 m of the FPK had elevated dissolved concentrations of cations and SO_4, much higher than the PKC Pond water or water from the End of Pipe*." (Moncur and Smith [2014], Section 6.4)
- "*Within 1 month of fresh slurried FPK deposited over the East Beach of the PKC facility, elevated concentrations of dissolved SO_4 and major cations were observed in the upper 0.25 m of the FPK, suggesting rapid oxidation/dissolution of FPK minerals*." (Moncur and Smith [2014], Section 9.0)

DDMI's May 10, 2019 response to Review Board Information Request #19 confirms that the model relies on data from fresh PK slurry and also acknowledges that this may underestimate the concentrations in PK porewater. DDMI argues that its sensitivity analyses indicate that the model results for Lac de Gras are not sensitive to changes in porewater chemistry. This does not consider the potential characteristics of the water in the pit during operations. Also, the porewater is likely the largest source of contaminant loading in the pit lakes so models should be reflective of reasonably conservative estimates of loading.

The revised modelling in the February 2019 Response predicts that water quality in the pit will remain below the AEMP benchmarks even with full mixing of the pit. This may be an optimistic prediction given the revised input assumptions about pore water quality. The predictions for unanticipated mixing in the November 2018 Response are likely more realistic and should form the

[2] Moncur, Michael and Lianna Smith. 2014. *Four-Year Hydrogeochemical Field Investigation of Processed Kimberlite Weathering at Diavik Diamond Mines Inc*. Submitted to Gord MacDonald, Diavik Diamond Mines Inc.

basis for the additional modelling scenarios requested by the WLWB following the January 2019 technical session.

Attachment 7 of the January 2019 Response describes comparisons of laboratory and field scale predictions of PK effluent, but results are described as preliminary and no information is provided about how this information has or could inform model inputs and predictions.

Information Request: DDMI should revise its modelling to incorporate more realistic estimates of pore water quality that consider evolution of chemistry after placement of PK.

Both the November 2018 and January 2019 Responses rely on comparison with acute effects benchmarks to conclude that unanticipated mixing of the pit lake after it is connected with Lac de Gras would not cause unacceptable aquatic effects[3]. However, the predictions indicate that exceedance of chronic effects benchmarks could extend for periods of up to two years: "*As the time series … show, it would take an estimated one to two years for conditions within the pit to fall below AEMP benchmarks for all parameters following turnover*" (January 2019 Response, Attachment 6). In this case, chronic effects benchmarks appear more relevant. Also, it is worth noting that the assessment definitions and thresholds would not consider a two-year exceedance as a significant effect.

Information Request: DDMI should provide additional details about the benchmarks and used for evaluating the unanticipated mixing scenario, and rationale for the selected benchmarks and significance thresholds. It should also provide further information about potential chronic effects associated with exceedance of chronic benchmarks for periods of more than 30 days.

3.3 PK Density

The consolidation and density of PK material once placed in the pits has implications on the final depth of the water cover over the PK, the capacity of the pits for PK storage, the release of pore water from the PK during consolidation, and the volume of excess water that may require treatment during operations. The consolidation and water quality models rely on assumptions of density for making predictions of effects. The adequacy of operational water treatment capacity also relies on an understanding of consolidation and density.

The June 2018 Amendment Application stated assumptions about PK density and provided some information about existing data and measurements. However, there was still uncertainty about how PK may perform in pits. For example,

- Section 3.2 of the Amendment Overview referred to dry densities of various types of PK based on results of field trials (grit-rich Coarse PK 1.8 t/m^3, grit-poor Coarse PK 1.35 t/m^3,

[3] The February 2019 Response concluded that AEMP benchmarks will not be exceeded, likely because the pore water quality input assumptions rely on data from fresh PK.

Fine PK 0.75 t/m^3). Tables 7 and 8 in Section 3.3.2 of the Amendment Overview provided estimates of pit filling levels and excess water volumes based on dry density of placed PK of 0.8 t/m^3

- In Section 3.3.6 the Amendment Overview identified the slimes (Extra Fine PK) density in the PKC facility as 0.4 t/m^3 but proposed that density in the pit will be 25% higher at 0.5 t/m^3.

Following the January 2019 technical session, the WLWB requested an update of Table 8 in the June 2018 Amendment Application, "*based on a lower dry density of fine PK (based on a range of dry density estimates that is foreseeable in the future)*." The February 2019 Response provided a revised table of "Potential Decant Volumes" considering an assumed FPK dry density of 0.6 t/m^3. The table indicated that excess water volume would be greater for the lower dry density (i.e., less consolidated material). This was counterintuitive and indicated a potential error in the calculations.

Tables 2-2a through 2-2i provide updated information about volumes of settled PK and excess slurry water and appear to correct the previous error. However, there is no information about assumed densities for PK slurry or settled PK, or the basis for any of the calculations. The calculation of "*Supernatant Water Overlying PK Surface*" is not clear – it seems like it should be the difference between the "*Slurry Water Plus Groundwater*" and "*Total Decanted Water*" but the numbers do not reflect this result.

Information Request: DDMI should provide details about its estimates and calculations related to slurry density and water volumes. Any changes in calculated volumes should be considered and incorporated into the effects assessment, including any changes in volumes of water that may require treatment and discharge.

3.4 Model Calibration

DDMI states (SIS Section 4.4.1) that it was unable to calibrate its model because the pit lake is not yet established. Instead it states that its model relied on rates and constants from previous model calibrations in the region, and refers to the Jay Project at the Ekati Mine and the Gahcho Kue Project. It is our understanding that pit lakes also do not yet exist at these projects, so it is unclear how they could be used for calibration. Additional detail about calibration is needed.

Information Request: DDMI should provide additional details about the referenced model calibrations in the region.

4.0 Water Quality Effects

In Section 4.1.3 the SIS states that water quality changes could result in adverse effects to drinking water quality or water quality for the protection of aquatic life. Closure criteria for the Diavik Mine

also consider water quality for use by wildlife. The use of water by wildlife (including birds) should be considered when assessing potential effects on water quality.

Information Request: DDMI should consider wildlife uses in its assessment of potential effects on water quality.

Table 4.1.5 in the SIS describes the characterization for effects on water quality. For magnitude, effects are considered negligible if there is "*no measurable change or the concentration of the parameter is less than 5% above the AEMP benchmarks*." AEMP benchmarks are established based on use-protection for aquatic life, and can be much higher than natural conditions in a waterbody. As such, for some parameters a change that reaches an AEMP benchmark may constitute a substantial change in contaminant concentration. In our view, negligible change should be defined based on non-degradation of water quality conditions, not on use-protection.

Information Request: DDMI should provide additional rationale for its decision to apply a use-protection approach for defining negligible change in water quality.

The implications of the above definition of magnitude of effect are apparent in the cumulative effects assessment discussed in Section 4.5.2.1 of the SIS. DDMI proposes that no cumulative effects are anticipated because the dikes will not be breached until water quality meets the AEMP Benchmarks – defined as a negligible effect. However, achieving the AEMP Benchmarks does not mean that the pit reconnection will not degrade water quality in Lac de Gras: it only means that the Diavik project on its own will not lead to conditions that exceed the AEMP Benchmarks. Effects of Diavik-related changes that are less than AEMP Benchmarks still need to be considered in a cumulative effects assessment.

Information Request: DDMI should update its cumulative effects assessment for water quality to consider the predicted changes caused by the Diavik project (even though less than AEMP Benchmarks) in combination with other projects that also affect water quality in Lac de Gras.

Section 4.4.1.3 states that the bottom later of the pit lake(s) closest to the PK is predicted to sequester potential contaminants. The model results presented in Figures 4-2, 4-3 and 4-4, as well as the results in Appendix B of the SIS do not fully support this assertion. The model predicts that over time, contaminants from the bottom layer will migrate into the upper layers and be diluted by these larger volumes and the mixing with Lac de Gras. As this migration occurs, the concentrations in the bottom layer slowly decrease. The model predicts this will occur very slowly in A418, such that the bottom layer is still predicted to have high concentrations at the end of the 100-year model period. The model predicts changes will occur more quickly in A154, with much of the contaminant load diluted by the end of the 100-year model period. For A21, the model predicts a more rapid deterioration of the pit stratification, after approximately 50 years. This suggests that A418 is likely the preferred pit for PK disposal, and disposal of PK in A21 should be avoided if possible.

5.0 Follow-up and Monitoring

Section 4.8 of the SIS lists proposed follow-up and monitoring activities aimed at verifying environmental effects predictions, and effectiveness of mitigation. Some additional components should be included in the monitoring and follow-up programs.

Information Request: DDMI should collect information needed to support modelling calibration and updates. As well, periodic calibration and update of consolidation, pit mixing, and water quality monitoring should be completed. In order to complete those elements, DDMI should update its list of follow-up and monitoring requirements to include:

- Monitoring of the quantity and quality of water in the pits once PK deposition starts. The monitoring program should be designed to establish a good understanding of temporal and spatial variability in water quality.
- Monitoring of quantity and quality of groundwater inflows into the pit where possible.
- Completion of proposed characterization of PK consolidation and release water (January 2019 Response, Attachment 2).
- Consideration of results re: comparison of laboratory and field-scale predictions of PK effluent (January 2019 Response, Attachment 7).
- Temperature monitoring in Lac de Gras to support modelling.

6.0 Feasibility Assessment – Re-mining of PK from PKC Facility

The SIS confirms that DDMI is not seeking authorization to re-mine PK from the Processed Kimberlite Containment (PKC) Facility for placement in the mine workings. However, it is seeking authorization to place PKC Facility material in the mine workings. As such the SIS considers the potential effects associated with placement and storage of re-mined material in the mine workings, but it does not consider effects that may arise from the re-mining activities, for example PKC Facility structural concerns, water management, dust generation and closure implications.

From an environmental perspective, a major advantage of depositing PK into mine workings is the ability to permanently store PK, especially Fine PK, in a location with virtually no long-term physical stability risks. However, at Diavik most of the long-term physical stability risk associated with PK storage already exists because the PKC Facility contains Fine and Extra Fine PK materials that will require long-term physical containment (using permanent dams) and create challenges for closure. The TK Panel has also expressed concern about potential long-term risks to wildlife arising from existing Fine PK in the PKC Facility. Because of this concern, the TK Panel has recommended that all PKC slimes be placed in mine workings.

Authorizing the requested storage of PK in mine workings addresses DDMI's operational need for additional storage capacity but it does not substantially reduce the closure and post-closure risks at

the site unless it includes re-mining of material from the PKC Facility. Relocation of Fine PK into mine workings should be seen as an opportunity that arises from use of mine workings for PK storage. Primarily it is an opportunity to reduce long-term physical stability risks at the site – risks that are inherent in the current closure plan for the PKC Facility.

It is good to see DDMIs statement (February 2019 Response) that it intends to continue to evaluate the feasibility and practicality of moving Extra Fine PK from the PKC Facility to the mine workings. The Studies and Reports Schedule indicates that the Feasibility Assessment will be completed in the first half of 2020. The Feasibility Assessment will help to inform methods and timing for PK re-mining including whether re-mining is most practical during operations or as part of closure. Therefore, it is important to proceed with the Feasibility Assessment soon to get a clear understanding of timing requirements as well as potential effects (e.g., physical stability, water management, water quality, and air quality) and benefits (e.g., reduced physical stability risks, potential for dry closure cover at PKC Facility) of re-mining.

7.0 Extra Fine Processed Kimberlite

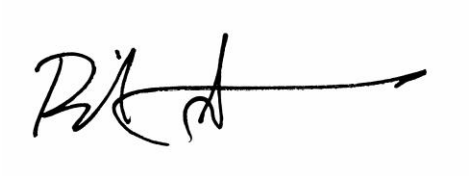
The scope of the assessment includes the placement of extra fine PK (EFPK) from the PK Containment Facility in pits. Because the material in the PK Containment Facility has segregated during the placement and settling processes, the material coming from re-mining at certain times may have very high content of fine or extra fine PK. This could lead to elevated TSS concentrations in the water in pits during periods of re-mining. EFPK could settle very slowly, especially with water depths that may be substantially larger than those in the PK Containment Facility. Slow settling of EFPK could lead to challenges for achieving AEMP benchmarks before reconnection of pits to Lac de Gras. DDMI's modelling included predictions for a "settleable constituent" (SIS Section 4.4.1), but there is no information to demonstrate that this modelling would represent behaviour of EFPK.

Information Request: DDMI should provide additional information about the characteristics of EFPK, its potential effects on TSS in the pit, and settling rates if the material is placed in pits. This may require mechanisms to predict TSS and establishment of appropriate significance thresholds (SIS Table 4-3).

8.0 Closing

If you have any questions about the review comments or recommendations, I would be happy to discuss them with you. Thank you for the opportunity to continue working with the EMAB on this project.

Sincerely,



Bill Slater

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Mark Cliffe-Phillips
Executive Director
Mackenzie Valley Environmental Impact Review Board
P.O. Box 938
Yellowknife, NT X1A 2N7

Dear Mr. Cliffe-Phillips,

RE: Fort Resolution Métis Council Information Requests for the Environmental Assessment of the Processed Kimberlite to Mine Workings Proposal (MVEIRB File No.: EA1819-01)

Fort Resolution Métis Council (FRMC) is pleased to provide information requests directed to Diavik Diamond Mines (2012) Inc. (DDMI) to the Mackenzie Valley Environmental Impact Review Board (MVEIRB or the board).

At this time, we also wish to raise to the attention of the Board the gaps in the Proponent's Summary Impact Statement (SIS) concerning the absence of baseline information specific to FRMC. To the extent possible, given our current capacity, FRMC intends to provide some of this critical information in FRMC's response to the Board's IR 1.1. We are, however, concerned that this responsibility (including financial onus) to gather a large amount of information has been placed on our community where normally the onus is on the Proponent to collect and or support collection of such information to understand the baseline and trend-over-time context of the receiving environment. For capacity limited groups like FRMC, this creates an onerous burden. FRMC is open to discussing solutions with the Board and Proponent for addressing these data gaps.

FRMC's information requests directed to DDMI are attached to this letter. We look forward to further participation in this environmental assessment review process.

Thank you,

Lloyd Cardinal

President Lloyd Cardinal
Fort Resolution Métis Council

Ms. Kate Mansfield
Senior Environmental Assessment Officer
Mackenzie Valley Environmental Impact Review Board
5102 – 50th Avenue
PO BOX 938
YELLOWKNIFE, NT X1A 2N7

JUN 20 2019

VIA ONLINE REVIEW SYSTEM

Dear Ms. Mansfield:

Government of the Northwest Territories' information requests for Diavik EA1819-01

I am pleased to notify you that information requests from the Government of the Northwest Territories (GNWT) for the environmental assessment of Diavik Diamond Mines Inc.'s proposal to deposit processed kimberlite in pits and underground [EA1819-01] have been uploaded to the Online Review System.

All GNWT departments with interests related to the abovementioned environmental assessment participated in the development of the information requests.

If you have any questions or concerns, please contact Katie Rozestraten, Project Assessment Analyst, at Katie_Rozestraten@gov.nt.ca or 867-767-9180 ext. 24022 or Melissa Pink, Project Assessment Manager, at Melissa_Pink@gov.nt.ca or 867-767-9180 ext. 24021.

Sincerely,

Lorraine Seale
Director, Securities and Project Assessment
Lands

Attachment: Comments in ORS format

Our File: EA1819-01

April 18, 2019

To: Sean Sinclair
Superintendent, Environment
Diavik Diamond Mines (2012) Inc.
P.O. Box 2498
Suite 300, 5201-50th Avenue
Yellowknife, NT X1A 2P8

Via email: Sean.Sinclair@riotinto.com

Deposit of Processed Kimberlite to Pits and Underground, Diavik Diamond Mines Inc.

Re: Information requests to the developer

The Review Board has released its *Scope of the Environmental Assessment and Reasons for Decision* (PR#40) for EA1819-01 and the environmental assessment has now entered the analytical phase. Please see the *Notice of Proceeding on Information Requests* (PR#41) and the *Updated Workplan* (PR#42) for more information about the analytical phase of the environmental assessment.

Step one involves the Review Board issuing information requests to the developer, Diavik Diamond Mining Inc[1]. The Review Board has identified two types of information required at this stage of the environmental assessment. First, the Review Board is requesting a Summary Impact Statement from the developer. Second, the Review Board has issued 24 additional information requests.

1 Summary Impact Statement

Parties have told the Review Board that the body of evidence on the public record for this environmental assessment is disjointed and difficult to assess. The project description has been refined during the water licence amendment process, resulting in a better understanding of project activities, likely deposition and filling scenarios, and potential impacts. Diavik indicated that it was willing to consolidate the information on the public registry with respect to water quality and fish and fish habitat. The Review Board is

[1] A full description of all steps in the Information Request stage of this environmental assessment can be found in the *Notice of Proceeding on Information Requests for EA1819-01* (PR#41)

encouraged by this commitment and is building on it to support an effective EA process by requesting the submission of a *Summary Impact Statement*.

The intent of the *Summary Impact Statement* is to function as an organized, consolidated document of all relevant information on the public record to date and as a basis for understanding the development and potential impacts on the environment including people. The *Summary Impact Statement* must contain:

1. a complete and updated project description and list of associated activities,
2. for each valued component described in the Review Board's *Final Scope and Reasons for Decision* for EA 1819-01(PR#40):
   a. a summary of current and pre-mining baseline conditions with links to relevant information as required,
   b. a description of the linkages between project activities and the valued component (that is, pathways of effects),
   c. an assessment of predicted impacts of the project, including a description of those impacts (that is, likelihood, direction, magnitude, geographic extent, duration and frequency, reversibility),
   d. a description of existing or planned mitigations that are available to or will be used by Diavik to minimize impacts of the project, their predicted effectiveness and rationale for this predicted effectiveness,
   e. a description of any residual impacts after mitigation (using the characteristics described in part c) above);
   f. an assessment of cumulative effects,
   g. a list of and links to all relevant monitoring and adaptive management plans, and
   h. a summary of modelling assumptions and uncertainties, with links to relevant documents as required.

The level of detail provided for each valued component should reflect the prioritization of issues described in the *Scope of Assessment and Reasons for Decision* (PR#40).

The Review Board recognizes that in order to produce the *Summary Impact Statement* as described above, some new evidence is required. However, in the absence of a Developer's Assessment Report, the Review Board believes that this information is necessary for parties to craft relevant and focused information requests, and as a basis for the rest of the EA process that will inform the Board's decisions.

The *Summary Impact Statement* will help parties to prepare their information requests and must, therefore be submitted by **May 9, 2019**.

2 Information requests

In addition to the request for a *Summary Impact Statement*, the Review Board has issued 24 information requests on the online review system. Diavik should respond to these information requests by **May 9, 2019.** The Review Board encourages Diavik to respond to these information requests within the *Summary Impact Statement* wherever possible. This will help meet the objective of consolidating information into one document.

Where Diavik responds to an information request within the *Summary Impact Statement*, the online review system response for that information request should include a summary of the response and reference to where the full response can be found. If Diavik cannot respond to the information request within the *Summary Impact Statement*, a full response should be submitted to the online review system.

The Review Board also **requests a concordance table** identifying where responses to each information request can be found.

3 Contact information

The project leads for EA1819-01 are Kate Mansfield, Senior Environmental Assessment Officer (867-766-7062, kmansfield@reviewboard.ca) and Catherine Fairbairn, Environmental Assessment Officer (867-766-7054, cfairbairn@reviewboard.ca).

Discussion Paper

DRAFT DISCUSSION PAPER ON RECOMMENDED ALLOWABLE HARVEST FOR BATHURST CARIBOU

SUBMITTED TO

Shin Shiga
Manager, Environment
North Slave Métis Alliance
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PREPARED BY

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ZOETICA
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Draft Discussion Paper on Recommended Allowable Harvest for Bathurst Caribou

1.0 BACKGROUND CONTEXT

The Bathurst caribou herd has dropped by about 96% since the mid-1980s, from a peak abundance of 472,000 in 1986 to a record low of 20,000 in 2015. Since 2003, the Government of Northwest Territories Department of Environment and Natural Resources (GNWT ENR) has been conducting calving ground photographic surveys every three years to estimate population size and demographics, and to monitor changes in the herd. Surveys in 2009 estimated the Bathurst herd at 32,000 animals, a 75% reduction from the 2006 population estimate of 128,000. At the time, 5,000-7,000 caribou – mostly cows – were being harvested each year, which was approximately 16-22% of the 2009 herd (Adamczewski *et al.*, 2009). This amount of harvest is unsustainable because it exceeds the breeding capacity of caribou. In 2010, The Tłı̨chǫ Government and the GNWT ENR jointly recommended a restricted harvest of 300 animals and 80% bulls, amounting to about 1% of the herd. In 2012, the population was estimated at approximately 35,000 and so the Bathurst herd appeared to be stable. Theoretical harvest of 1% continued for another three years, until the 2015 surveys found that the Bathurst herd had declined by 43%, down to 20,000 animals. Although other factors may have contributed to the decline (e.g., low adult survival, increased predation, climate change, etc.), this was a very concerning trend. In 2016, a total harvest ban came into effect, as recommended by the Wek'èezhìi Renewable Resources Board (WRRB). The status of the Bathurst herd will be re-assessed by the GNWT ENR during the next population surveys scheduled for June, 2018.

The Bathurst Caribou Advisory Committee's Technical Working Group has scheduled a meeting from January 30 – February 1, 2018 to discuss harvest thresholds for Bathurst caribou population management. Although it would be very informative to include the upcoming 2018 survey data to inform decision-making, we have made recommendations in this report for harvest thresholds based on the scientific data available, with consideration of other barren-ground caribou harvest management plans. We have taken a conservative approach for the Bathurst herd to ensure that a stable population can be achieved and possibly increase toward its historic numbers.

2.0 RESEARCH AND RATIONALE

The GNWT ENR has developed "a rule of thumb" approach to harvest recommendations for barren-ground caribou based on a herd's risk of further population decline (**Table 1**). This approach has been adopted into the harvest management plans of the Cape Bathurst, Bluenose-West, and Bluenose-East herds (ACCWM, 2014); as well as the Beverly and Qamanirjuaq herds (BQCMB, 2014). The science behind GNWT's harvest recommendations has been published in multiple reports and papers, which include population modelling and risk assessment of the Bathurst caribou herd (Boulanger *et al*., 2011; Boulanger & Adamczewski, 2015; 2016). Our subsequent recommendations for Bathurst caribou harvest thresholds are based on this "rule of thumb" approach. We have also reviewed and considered alternative harvest strategies that have been proposed for other barren-ground caribou herds, including the Porcupine herd (PCMB, 2010), George River and Leaf River herds (UPCART, 2017), and the two management plans mentioned above.

Table 1. "Rule of thumb" approach to harvest recommendations. Reproduced from Boulanger and Adamczewski (2016), Appendix A.

Suggested Acceptable Harvest (% of herd)	Recommended Aboriginal Harvest	Recommended Resident Harvest (assuming unrestricted Aboriginal harvest)	Recommended Commercial/Outfitter Harvest (assuming unrestricted Aboriginal harvest)
5 % or higher	Unrestricted, either sex	≥2 bull tags/hunter	Limited commercial tags
3-5 %	Unrestricted, promote bull harvest	2 bull tags/hunter	Limited commercial tags
2-3 %	Unrestricted, promote bull harvest	1 bull tag/hunter; possible limit on tags	Either no commercial tags or small numbers of tags
<2 %	Promote conservation voluntary bulls only	1 bull tag/hunter; possible limit on tags	No commercial tags
<1 %	Consider mandatory bulls only	No resident tags	No commercial tags
0.01 %	Consider closure; harvest for social/ceremonial reasons	No resident tags	No commercial tags

For their harvest model, Boulanger and Adamczewski (2016) created a matrix of relative risk levels of harvest based on a herd's size and trend. They then assigned population size and growth/decline thresholds to this matrix, starting with an "average" herd size of 100,000 (**Table 2**). Table 2 shows relative "risk scores" as a function of population trend and size, where lower numbers indicate lower risk, and higher numbers indicate higher risk. The colour coding corresponds to "risk categories", from very low risk (green) to very high risk (red), and extremely high risk (black).

Table 2. Thresholds of risk as a function of trend and population size. Reproduced from Boulanger and Adamczewski (2016).

		Population Size (thousands)				
Lambda	**% change**	**<30**	**30-60**	**60-90**	**90-120**	**>120**
>1.1	>10%	5	4	3	2	1
1.02-1.09	2-9%	10	8	6	4	2
0.98-1.02	-2 to +2%	15	12	9	6	3
0.9-0.98	-10 to -2	20	16	12	8	4
<0.9	<-10%	25	20	15	10	5

The authors applied this harvest model to the 2012 Bathurst herd. Estimated at 34,690 animals with a stable population trend, the Bathurst herd was initially categorized as being in the orange (moderate risk) zone. Despite above-average calf productivity (0.38), low cow survival (0.78) put the Bathurst into the red (high risk) zone during model simulations. Their results indicated that the Bathurst herd was at a high risk of further population decline, even with zero harvest (Figure 11 in Boulanger & Adamczewski, 2016). In addition, their model simulations showed that even with a herd size of 100,000 and zero harvest, low productivity and low survival (which are usually correlated with a declining population trend) would place a caribou herd at high risk of serious decline (Figure 6 in Boulanger & Adamczewski, 2016). It is not until a herd has high productivity and average survival, or average productivity and high survival (both are likely correlated with slowly increasing population trend), that the herd could remain in the yellow (low risk) zone with harvest of 3,000 animals (3% of the herd). When the authors ran the model using a range of herd sizes, they found that "high" populations of 130,000 could remain stable even with harvest levels of 5% or greater, and that "low" populations of 50,000 are at high risk of serious decline even with zero harvest (Figure 10 in Boulanger & Adamczewski, 2016).

Boulanger and Adamczewski (2016) were trying to develop a general harvest model that could apply to all barren-ground caribou herds. However, they advised that using population sizes and demographics specific to the particular herd would allow for more accurate risk assessments. For example, along with other monitoring indicators, a Qamanirjuaq herd of 250,000 (50% of the historic high) with good recruitment would be assessed at medium vulnerability, or moderate risk (BQCMB, 2014). A comparison of thresholds from other harvest management plans is shown in **Table 3**. The last row of Table 3 includes Zoetica's recommended demarcation of the number at which moderate and low categories should begin, as a percentage of the historic high of the herd.

Table 3. Population size thresholds to help determine herd risk status from harvest management plans. Note that the Porcupine herd has since increased to a new historic high of 218,000 in 2017. Numbers for the Bathurst herd are those recommended by Zoetica in this report.

	Historic High	Moderate (% of high)	Low (% of high)
Porcupine	178,000	80,000 (45%)	45,000 (25%)
Cape Bathurst	19,000	12,000 (63%)	4,000 (21%)
Bluenose-West	112,000	56,000 (50%)	15,000 (13%)
Bluenose-East	120,000	60,000 (50%)	20,000 (17%)
Beverly	276,000	N/A	N/A
Qamanirjuac	496,000	250,000 (50%)	N/A
George River	770,000	150,000 (19%)	50,000 (6%)
Leaf River	628,000	150,000 (24%)	50,000 (8%)
Bathurst	**472,000**	**200,000 (42%)**	**60,000 (13%)**

For the Bathurst herd, we would argue that 100,000 animals should not be considered "average", as this would only amount to 21% of the historic high of 472,000. Furthermore, 34,690 caribou is only about 7% of the historic high, and should be considered very low rather than "moderate". One of the goals of the

draft Bathurst Caribou Range Plan is to maintain caribou habitat "*to ensure the ability of the Bathurst herd to recover to over 400,000*" (GNWT ENR, 2018a). Based on the harvest modelling results, and using 400,000 animals as the benchmark of a very high population size that would no longer require harvest regulations (but should continue to be monitored), we recommend adjusting Table 2 to the following thresholds in **Table 4**:

Table 4. Adjusted thresholds for the Bathurst herd. Adapted from Table 2, Boulanger and Adamczewski (2016).

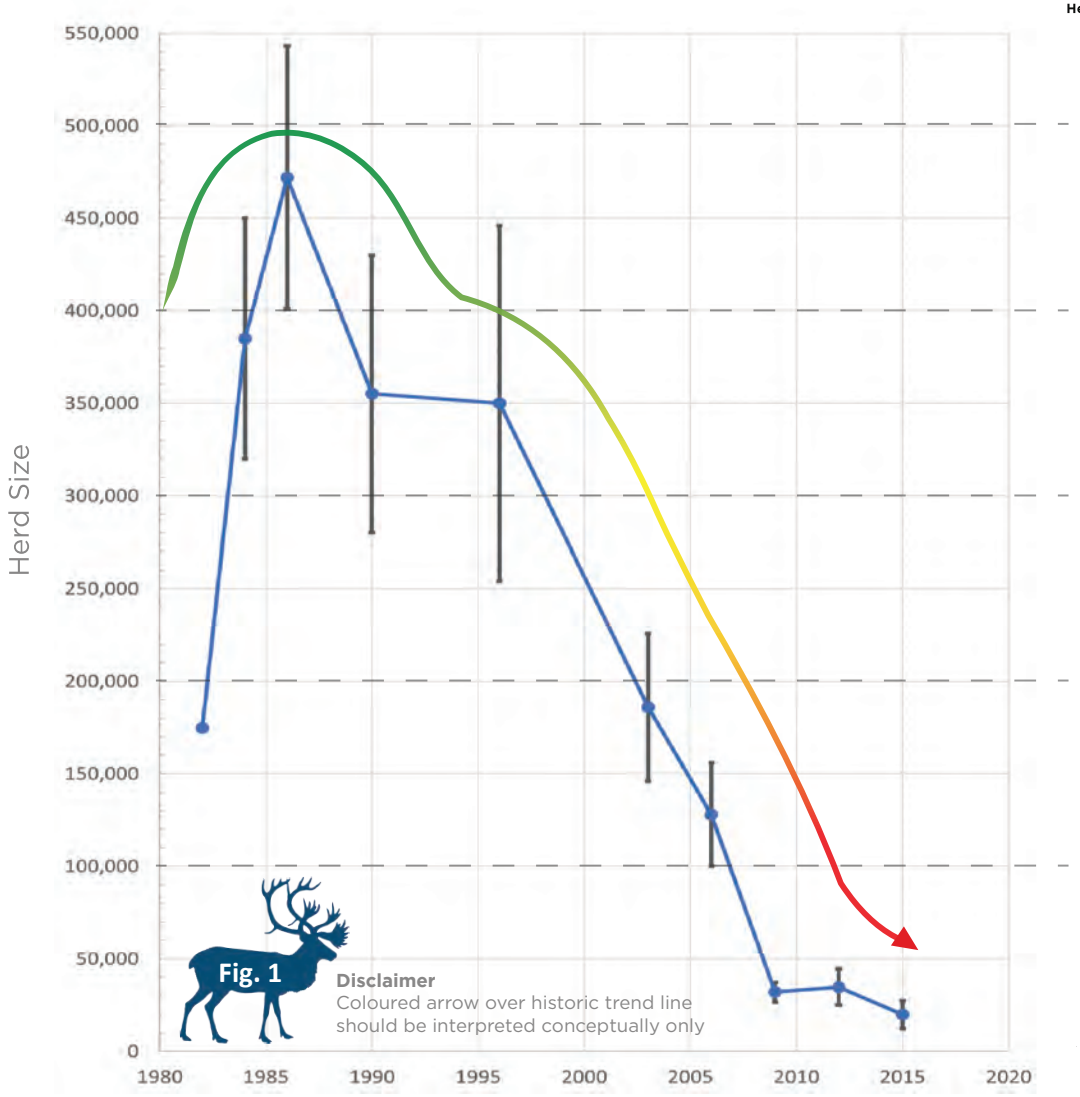
	Population Size (thousands)					
Population Trend	<60	60-100	100-150	150-200	200-250	>300
Fast Increase	25	5	4	3	2	1
Slow Increase	25	10	8	6	4	2
Stable	25	15	12	9	6	3
Slow Decline	25	20	16	12	8	4
Fast Decline	25	25	20	15	10	5

Using this template, we assigned risk scores to population sizes in 10,000 increments, from 10,000 to 550,000 (upper confidence limit of historic high). We then converted these risk scores and colour coding to the suggested acceptable harvest (% of herd) described in the "rule of thumb" approach (**Table 5**). Although Boulanger and Adamczewski's (2016) modelling results suggest that annual harvest rates of greater than 5% can be sustainable for a very large and/or rapidly increasing herd, we chose a more conservative approach for the low risk category, and capped harvest at a 5% maximum.

Table 5. Suggested acceptable harvest (% of herd) for each risk score/category. Adapted from Table 1, Appendix A, Boulanger and Adamczewski (2016).

Risk Score/Category	Harvest (% of herd)
1 - 4.5	3% - 5%
5 - 9.5	2% - 3%
10 - 16.5	1% - 2%
17 - 19.5	0.1% - 1%
20 - 24	0.02% - 0.1%
25	0.01%

BATHURST CARIBOU POPULATION ESTIMATES (LEFT) AND RECOMMENDED ALLOWABLE HARVEST (RIGHT)



Herd Size	Fast Decline <-10%	Slow Decline -10 to -2%	Stable -2 to +2%	Slow Increase 2 to 9%	Fast Increase > 10%
550,000	27500 (5.0%)	27500 (5.0%)	27500 (5.0%)	27500 (5.0%)	27500 (5.0%)
540,000	27000 (5.0%)	27000 (5.0%)	27000 (5.0%)	27000 (5.0%)	27000 (5.0%)
530,000	26500 (5.0%)	26500 (5.0%)	26500 (5.0%)	26500 (5.0%)	26500 (5.0%)
520,000	26000 (5.0%)	26000 (5.0%)	26000 (5.0%)	26000 (5.0%)	26000 (5.0%)
510,000	25500 (5.0%)	25500 (5.0%)	25500 (5.0%)	25500 (5.0%)	25500 (5.0%)
500,000	25000 (5.0%)	25000 (5.0%)	25000 (5.0%)	25000 (5.0%)	25000 (5.0%)
490,000	24500 (5.0%)	24500 (5.0%)	24500 (5.0%)	24500 (5.0%)	24500 (5.0%)
480,000	24000 (5.0%)	24000 (5.0%)	24000 (5.0%)	24000 (5.0%)	24000 (5.0%)
470,000	23500 (5.0%)	23500 (5.0%)	23500 (5.0%)	23500 (5.0%)	23500 (5.0%)
460,000	23000 (5.0%)	23000 (5.0%)	23000 (5.0%)	23000 (5.0%)	23000 (5.0%)
450,000	22500 (5.0%)	22500 (5.0%)	22500 (5.0%)	22500 (5.0%)	22500 (5.0%)
440,000	22000 (5.0%)	22000 (5.0%)	22000 (5.0%)	22000 (5.0%)	22000 (5.0%)
430,000	21500 (5.0%)	21500 (5.0%)	21500 (5.0%)	21500 (5.0%)	21500 (5.0%)
420,000	21000 (5.0%)	21000 (5.0%)	21000 (5.0%)	21000 (5.0%)	21000 (5.0%)
410,000	20500 (5.0%)	20500 (5.0%)	20500 (5.0%)	20500 (5.0%)	20500 (5.0%)
400,000	20000 (5.0%)	20000 (5.0%)	20000 (5.0%)	20000 (5.0%)	20000 (5.0%)
390,000	19500 (5.0%)	19500 (5.0%)	19500 (5.0%)	19500 (5.0%)	19500 (5.0%)
380,000	19000 (5.0%)	19000 (5.0%)	19000 (5.0%)	19000 (5.0%)	19000 (5.0%)
370,000	18500 (5.0%)	18500 (5.0%)	18500 (5.0%)	18500 (5.0%)	18500 (5.0%)
360,000	18000 (5.0%)	18000 (5.0%)	18000 (5.0%)	18000 (5.0%)	18000 (5.0%)
350,000	17500 (5.0%)	17500 (5.0%)	17500 (5.0%)	17500 (5.0%)	17500 (5.0%)
340,000	17000 (5.0%)	17000 (5.0%)	17000 (5.0%)	17000 (5.0%)	17000 (5.0%)
330,000	14850 (4.5%)	16500 (5.0%)	16500 (5.0%)	16500 (5.0%)	16500 (5.0%)
320,000	12800 (4.0%)	14400 (4.5%)	16000 (5.0%)	16000 (5.0%)	16000 (5.0%)
310,000	10850 (3.5%)	12400 (4.0%)	13950 (4.5%)	15500 (5.0%)	15500 (5.0%)
300,000	9000 (3.0%)	10500 (3.5%)	12000 (4.0%)	13500 (4.5%)	15000 (5.0%)
290,000	8120 (2.8%)	8700 (3.0%)	10875 (3.8%)	12325 (4.3%)	14500 (5.0%)
280,000	7280 (2.6%)	8120 (2.9%)	9800 (3.5%)	11200 (4.0%)	13300 (4.8%)
270,000	6480 (2.4%)	7290 (2.7%)	8100 (3.0%)	10800 (4.0%)	12825 (4.8%)
260,000	5720 (2.2%)	6760 (2.6%)	7540 (2.9%)	9750 (3.8%)	11700 (4.5%)
250,000	5000 (2.0%)	6000 (2.4%)	7000 (2.8%)	8750 (3.5%)	11250 (4.5%)
240,000	4431 (1.8%)	5280 (2.2%)	6480 (2.7%)	7800 (3.3%)	10800 (4.5%)
230,000	3892 (1.7%)	4830 (2.1%)	5980 (2.6%)	6900 (3.0%)	9775 (4.3%)
220,000	3385 (1.5%)	4231 (1.9%)	5280 (2.4%)	6600 (3.0%)	9350 (4.3%)
210,000	2908 (1.4%)	3877 (1.8%)	4830 (2.3%)	6090 (2.9%)	8400 (4.0%)
200,000	2462 (1.2%)	3385 (1.7%)	4400 (2.2%)	5600 (2.8%)	8000 (4.0%)
190,000	2046 (1.1%)	2923 (1.5%)	3990 (2.1%)	5130 (2.7%)	7600 (4.0%)
180,000	1569 (0.9%)	2631 (1.5%)	3600 (2.0%)	4680 (2.6%)	6750 (3.8%)
170,000	1044 (0.6%)	2223 (1.3%)	3138 (1.8%)	4420 (2.6%)	6375 (3.8%)
160,000	571 (0.4%)	1969 (1.2%)	2831 (1.8%)	4000 (2.5%)	5600 (3.5%)
150,000	150 (0.1%)	1615 (1.1%)	2538 (1.7%)	3600 (2.4%)	5250 (3.5%)
140,000	112 (0.1%)	1220 (0.9%)	2262 (1.6%)	3220 (2.3%)	4900 (3.5%)
130,000	78 (0.1%)	966 (0.7%)	2000 (1.5%)	2860 (2.2%)	4225 (3.3%)
120,000	48 (0.04%)	583 (0.5%)	1662 (1.4%)	2640 (2.2%)	3900 (3.3%)
110,000	22 (0.02%)	393 (0.4%)	1438 (1.3%)	2310 (2.1%)	3300 (3.0%)
100,000	10 (0.01%)	100 (0.1%)	1231 (1.2%)	2000 (2.0%)	3000 (3.0%)
90,000	9 (0.01%)	63 (0.1%)	669 (0.7%)	1385 (1.5%)	1980 (2.2%)
80,000	8 (0.01%)	40 (0.1%)	183 (0.2%)	800 (1.0%)	1292 (1.6%)
70,000	7 (0.01%)	14 (0.02%)	42 (0.1%)	160 (0.2%)	700 (1.0%)
60,000	6 (0.01%)	6 (0.01%)	12 (0.02%)	30 (0.1%)	60 (0.1%)
50,000	5 (0.01%)	5 (0.01%)	5 (0.01%)	5 (0.01%)	5 (0.01%)
40,000	4 (0.01%)	4 (0.01%)	4 (0.01%)	4 (0.01%)	4 (0.01%)
30,000	3 (0.01%)	3 (0.01%)	3 (0.01%)	3 (0.01%)	3 (0.01%)
20,000	2 (0.01%)	2 (0.01%)	2 (0.01%)	2 (0.01%)	2 (0.01%)
10,000	1 (0.01%)	1 (0.01%)	1 (0.01%)	1 (0.01%)	1 (0.01%)

Either sex harvest

Emphasis on increasing bull harvest

Bull harvest only

Annual Rate of Change

3.0 RESULTS

Figure 1 shows our recommended allowable harvest table, along with Bathurst caribou population estimates from the 1980s to the present. The graph of population estimates was adapted from data available on the GNWT ENR website (GNWT ENR, 2018b), as well as more recent calving ground photographic survey results (Boulanger *et al*., 2017; 2014; Nishi *et al*., 2010). We placed these components side-by-side to make it easy to see where we are in the harvest table with respect to the current status of the Bathurst herd compared to its historic trajectory.

The recommended allowable harvest table presents population size on the left, and population trend across the bottom. The colour coding follows the risk categories described above. The numbers in the table show the allowable harvest in terms of number of animals, calculated by multiplying the herd size by percentage of herd (shown in parentheses). Recommendations for sex ratio of harvest are also shown in the table, and follow the "rule of thumb" approach. The area bordered in red at the bottom is recommended to be bull harvest only, and corresponds to the high-risk zone, with allowable harvest of <1% of the herd. The area bordered in green at the top can be either sex harvest, and corresponds to the low-risk zone, with allowable harvest of >5% of the herd. In between, there should be increasing emphasis on bull harvest as the risk to the herd increases.

As per our defined thresholds and risk scoring in Tables 4 and 5, we recommend zero harvest when the Bathurst herd is below 60,000 animals, regardless of population trend. However, harvest of up to 0.01% of the herd may be allowed for Aboriginal social or ceremonial purposes. The recommended allowable harvest gradually increases with herd size as well as positive herd trend. At very high populations (>300,000), we would still recommend a maximum of 5% harvest; however, unrestricted harvesting could be considered, with appropriate monitoring of the herd. Here are some other examples of how to interpret the allowable harvest table:

- When the herd is rapidly increasing (which has not occurred for the Bathurst herd since the mid-1980s), annual harvest of ≥1% is acceptable when the population reaches 70,000.
- When the herd size is 100,000 and slowly increasing, annual harvest of up to 2,000 caribou (2%) is acceptable.
- When the herd size is 320,000 and stable or increasing, annual harvest of 16,000 caribou (5% of the herd) is acceptable.
- When the herd size is 250,000 and slowly declining, annual harvest of 6,000 caribou (2.4%) is acceptable.
- When the herd is rapidly declining, annual harvest is limited to <1% until the population reaches 190,000.

A comparison of estimated Bathurst herd harvest rates over the past two decades (1996 to 2009; years with population surveys), versus what our recommended harvest levels would have been had they been implemented retroactively, is presented in **Figure 2**. This time period corresponds to a marked population decline of the Bathurst herd. Harvest levels reached an estimated 22% in 2009, which was clearly unsustainable. As illustrated in Figure 2, as the herd size decreased, our recommendations would have tracked it and resulted in a ban on harvesting prior to the rapid decline from 128,000 to 32,000 that occurred between 2006 and 2009. However, when the herd is large, the estimated actual harvest from the Dogrib Harvest Study (Boulanger & Gunn, 2008) is similar to the recommendations in this report.

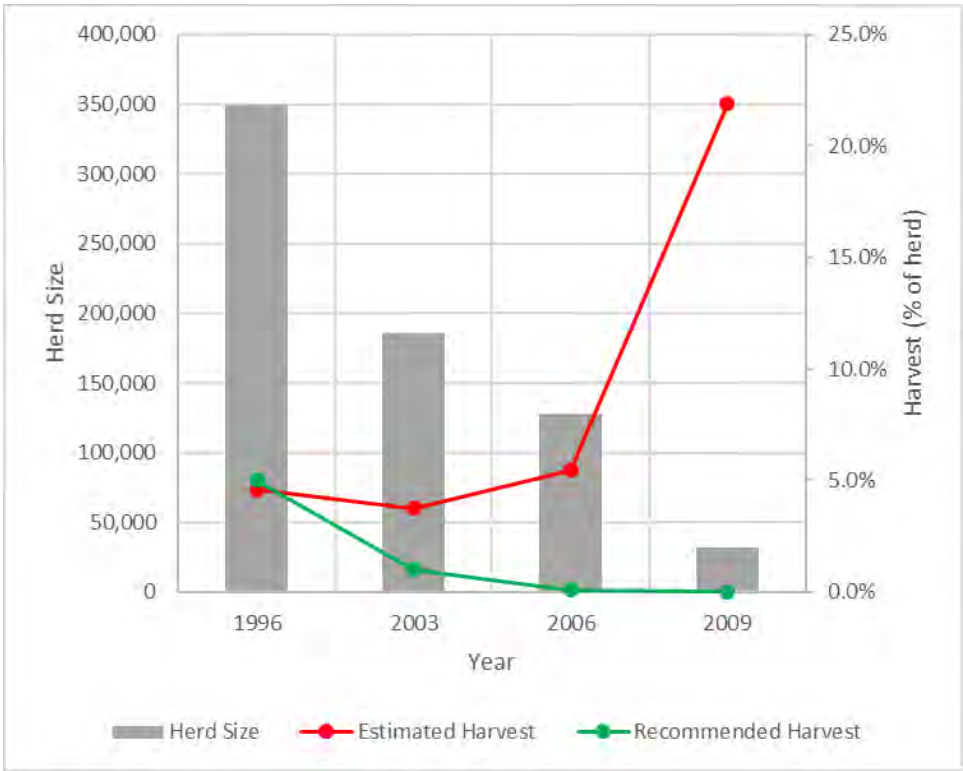


Figure 2. Comparison of estimated actual harvest vs. recommendations made by Zoetica in this report, but imposed retroactively through history. Estimated harvest of 16,000 caribou in 1996 is from the Dogrib Harvest Study (Boulanger & Gunn, 2008); estimated harvest of 7,000 caribou in 2003-2009 is from Adamczewski *et al.* (2009).

4.0 DISCUSSION

Although the risk assessment matrices presented in Tables 1 and 2 have been simplified down to a function of population size and trend, it is important to note that many other factors can affect the vulnerability of a caribou herd. A more comprehensive assessment of a herd's risk status can be made by considering multiple indicators. Regular monitoring through both Traditional Knowledge and scientific studies will be essential in providing accurate and up-to-date information for:

- Population size
- Population trend
- Calf productivity
- Adult cow survival
- Adult composition (sex ratio)
- Total harvest levels and sex ratio of harvest
- Body condition and health
- Predator population size and trend
- Range use and movement patterns
- Environment and habitat
- Human disturbance
- Total land disturbance (following thresholds set in the draft Bathurst Caribou Range Plan [GNWT ENR, 2018a])

Environment and habitat indicators include forest fires, snow cover and icing events, insect harassment, diseases and parasites, timing and rate of "green-up", forage quality and quantity, environmental contaminants, etc. These factors will also be impacted by climate change. Human and land disturbance include current and future mineral exploration and development projects, as well as associated activities that may impact caribou health, such as overhead flights and other sensory disturbances. It is important to consider the cumulative effects of all of these potential impacts when performing a risk assessment of the herd.

Herd demography estimates of calf productivity, adult cow survival, and adult sex ratio were included in Boulanger and Adamczewski's (2015, 2016) harvest models. However, model parameters were comprised of the most commonly observed values in barren-ground caribou herds, and it is possible that future estimates for the Bathurst herd may fall outside of these ranges. For example, Bathurst cow survival was estimated at 0.67 in 2009 (Boulanger *et al.*, 2011), whereas the model used 0.77 as the low survival estimate. In such cases, we recommend that the harvest model be re-run using modified parameters collected via monitoring data to obtain more accurate risk assessments.

Boulanger and Adamczewski (2016) suggest that harvest thresholds should be re-evaluated frequently because productivity and survival rates can change quickly. They also showed that the power to detect population change in three years (current GNWT ENR calving ground photographic survey timing) was limited to large changes in herd size (≥31%). Additional power analyses can be run to determine the frequency and/or precision of surveys needed to detect the annual rates of change for each trend category in Figure 1. Until the results of these analyses are available, we would recommend obtaining population estimates every 2-3 years, depending on the variability of the data from the previous survey. For example, there was a high degree of uncertainty around the mean estimate in 1996 (Figure 1), and it may be difficult to make management decisions with such uncertainty. For monitoring efforts that are less expensive and easier to undertake, we would recommend annual monitoring of these indicators. Reasonable monitoring frequencies have been recommended in other herd management plans (ACCWM, 2014; BQCMB, 2014), as well as in the Joint Management Proposal for Bathurst Caribou 2016-2019 (WRRB, 2015). High powered fixed-wing infrared (IR) devices with high zoom capacities are also becoming increasingly advanced. Such increasingly powerful IR-assisted surveys may be used to facilitate an increased precision in both enumeration estimates in the winter and identification of age groups and sexes during surveys. Powerful IR-assisted surveys can also be useful for collecting information on predator abundance and human presence on the landscape.

In addition to the recommended allowable harvest table, we have developed conservative rules to apply when adverse environmental, habitat, climate, or human-caused effects are observed anytime, but particularly after or between survey years. These rules are meant to allow the management of the Bathurst herd to take a precautionary approach prior to the next available data from surveys that would document the repercussion of these events.

Conservative Rules to Apply

1.	If a prior survey suggests that a population increase, but it is not statistically significant at α=0.1, assume no real change in trend. Inversely, if a prior survey suggests a population decrease, but it is not statistically significant at α=0.1, and where Power levels are < 0.80, assume a Type II (β) error (meaning the decrease is a true one, but you were unable to detect it statistically). The combination of #1 and #2, taken together, mean that in the absence of statistically significant changes in mean population size, you are more likely to accept a decreasing trend as true (conservative bias).
2.	If a large climate change event occurs outside of the range of historic variability and within any given year (e.g., large forest fire within Bathurst winter range, large thaw/freeze cycle rendering forage difficult to access), move position one position to the left, or one position down (if at furthest left column), even if this occurs in a year without a GNWT ENR population survey.
3.	If total land disturbance area exceeds the "high risk" thresholds proposed in the draft Bathurst Caribou Range Plan, cease harvest, as the population may not be self-sustaining. Focus on decommissioning historic roads, linear corridors, and old projects prior to re-establishing harvest.
4.	New projects should be evaluated for their ability to affect harvest rates as per point #3, recognizing that approaching or exceeding habitat fragmentation will directly affect the ability of First Nation, Métis, and Inuit to harvest caribou sustainably.

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Mark Cliffe-Phillips
Executive Director
Mackenzie Valley Environmental Impact Review Board
P.O. Box 938
Yellowknife, NT X1A 2N7

9 May 2019

Dear Mr. Cliffe-Phillips:

Subject: **DDMI Response to MVEIRB Information Requests for the Environmental Assessment of the Processed Kimberlite to Mine Workings Proposal (MVEIRB File No.: EA1819-01)**

Diavik Diamond Mines (2012) Inc. (DDMI) is pleased to provide to the Mackenzie Valley Environmental Impact Review Board (MVEIRB or the Board) responses to the Board's Information Requests (IRs) issued on April 18, 2019.

Please note that a full response to MVEIRB IR#1 (the Summary Impact Statement) will be provided to the Board by May 16, 2019 as per DDMI's letter to the Board on May 2, 2019. All other responses to the Board's IRs are addressed under this submission.

The Summary Impact Statement will include detailed modelling results for the transport, deposition, and storage of processed kimberlite, including extra fine processed kimberlite from the Processed Kimberlite Containment Facility, in all mine workings, as well as DDMI's assessment of the significance of effects and impacts to all valued components included in the Board's Final Scope for this Review.

In addition, DDMI has included corrections to tracer simulations in its original response to the Wek'èezhìi Land and Water Board's post-technical session information requests (WLWB IR#5) as an Erratum in this submission (see Appendix 3).

WLWB IR#5 provided water quality modelling results for the three scenarios requested by the WLWB. This modelling was only requested for the A418 mine area. DDMI was advised by several Parties that it would be helpful to provide similar modelling results for A154 and A21. This technical work has been completed with all results (A418, A21, and A154) included in the Summary Impact Statement and where appropriate included to address the MVEIRB IRs in the enclosed.

Details of DDMI's responses to Board IRs, including associated appendices and attachments, are appended to this letter. Please do not hesitate to contact the undersigned

RioTinto

or Kofi Boa-Antwi (867 447 3001 or kofi.boa-antwi@riotinto.com) if you have any questions related to this submission.

Sincerely,

Sean Sinclair

Superintendent, Environment

cc: Catherine Fairbairn, MVEIRB
Kate Mansfield, MVEIRB
Ryan Fequet, WLWB
Anneli Jokela, WLWB

RioTinto

Diavik Diamond Mines Inc.

Processed Kimberlite to Mine Workings

Response to Information Requests from the Mackenzie Valley Environmental Impact Review Board

Document #: ENVI-966-0519 R0

9 May 2019

RioTinto

Table of Contents

1. MVEIRB-IR#1

1.1 Topic

Summary Impact Statement

1.2 Reviewer Comment

In order for parties to craft relevant and focused information requests, the Review Board requires Diavik to submit a Summary Impact Statement.

1.3 Reviewer Recommendation

Prepare a Summary Impact Statement based on guidance in the letter issued by Mackenzie Valley Environmental Impact Review Board (MVEIRB) to Diavik Diamond Mines (2012) Inc. (DDMI).[1]

1.4 Developer's Response to MVEIRB-IR#1

The requested Summary Impact Report (SIS) will be submitted separately by May 16, 2019, as it took more time/effort to prepare this document to meet requirements of the Mackenzie Valley Environmental Impact Review Board.

The SIS will include detailed modelling results for the transport, deposition, and storage of processed kimberlite (PK), including extra fine processed kimberlite (EFPK) from the Processed Kimberlite Containment Facility, in A418, A154, and A21 mine workings based on scenarios 2a, 3a, and 4a (see Table 1 below).

Table 1: Processed Kimberlite to Mine Workings Project Summary Scenarios

Summary Scenario	Total FPK Volume Deposited to A418, A154 and/or A21	Total Volume EFPK Optionally Deposited to A418, A154 and/or A21	Depth of Porewater Overlying PK (where PK is deposited)
2a	5 Mm^3	-	5 m
3a	5 Mm^3	5 Mm^3	5 m
4a	5 Mm^3	-	15 m

[1] Letter for Summary Impact Statement issued by MVEIRB to DDMI on April 18, 2019.

2. MVEIRB-IR#2

2.1 Topic

Project description

2.2 Reviewer Comment

Diavik has applied for the option to put processed kimberlite in any or all of the pits and underground mine workings. The Review Board notes that A21 does not have underground mine workings but A48 and A514 do have underground mine workings.

2.3 Reviewer Recommendation

1. Considering the current mine plan and existing processed kimberlite storage requirements, please describe any circumstance under which Diavik would store processed kimberlite in more than one pit and associated mine workings.

2. If Diavik might store processed kimberlite in more than one pit and associated mine workings, please provide an assessment of the effects of doing so on the valued components and the worst-case scenario predictions.

2.4 Developer's Response to MVEIRB-IR#2

1. DDMI is seeking approval for the deposition of processed kimberlite (PK) into any combination of the three (3) mine workings (A418, A154 and A21). Based on the current mine plan, A418 is the preferred and likely option and A154 and A21 are alternates, subject to availability and changes to the mine plan. It is also plausible that, given coincident availability, deposition to a combination of mine workings would produce the lowest net effect on the water quality of Lac de Gras. An allowance for multiple mine workings may also be valuable if additional processing occurs beyond the currently defined resource (>5 Mm^3) and / or additional PK is available for transfer from the Processed Kimberlite Containment (PKC) Facility to Mine Workings. These options, should they become available, would be evaluated in detail and permitted as part of ongoing closure planning.

2. Detailed modelling results of PK deposition scenarios were completed independently for the A418, A154 and A21 mine workings. Results demonstrate that surface water quality in each of the flooded pits remained below the Aquatic Effects Monitoring Program (AEMP) benchmarks for the duration of all model scenarios, with the exception of nitrite in the A21 Mine Working (discussion on nitrite was included in DDMI's response to the Wek'èezhìi Land and Water Board Technical Session IR-5). If water quality in each of the individual mine workings remained below AEMP benchmarks then any concurrent multi-pit release of pit water to Lac de Gras (LDG) would likely also result in LDG water quality below AEMP benchmarks. Please refer to the Summary Impact Statement for a comprehensive effects assessment for all valued components included in the Mackenzie Valley Environmental Impact Review Board's Scope of Assessment for the Processed Kimberlite to Mine Workings Proposal.

3. MVEIRB-IR#3

3.1 Topic

Re-mining the Processed Kimberlite Containment Facility and Transporting extra fine processed kimberlite from the Processed Kimberlite Containment Facility to mine workings

3.2 Reviewer Comment

During the Wek'èezhi`i Land and Water Board process and the environmental assessment process, Diavik provided different statements about re-mining the (existing) Processed Kimberlite Containment Facility. During much of the Land and Water Board process, re-mining of the Processed Kimberlite Containment Facility and transporting extra fine processed kimberlite from the Processed Kimberlite Containment Facility to mine workings was considered part of the project and was included in modelling and studies. Most recently, in the online review comments during scoping for this environmental assessment, Diavik stated "…that the scope of development should not include the re-mining of processed kimberlite from the Processed Kimberlite Containment Facility". Re-mining the processed kimberlite containment facility has not been included in the scope of development for this environmental assessment.

3.3 Reviewer Recommendation

How does Diavik's current plan to not re-mine the existing Processed Kimberlite Containment Facility affect the models, effects assessment, or alternatives assessment that Diavik has provided to date?

3.4 Developer's Response to MVEIRB-IR#3

As explained in DDMI Letter of May 2, 2019 to the Mackenzie Valley Environmental Impact Review Board[2] (MVEIRB), while re-mining of the Processed Kimberlite Containment (PKC) Facility is not an activity being considered within the scope of development, the scope of assessment and water quality modelling consider deposition of processed kimberlite (PK) regardless of source and explicitly include the PKC Facility as one of the sources (Scenario 3a).

As part of the Summary Impact Statement to be submitted to the MVEIRB on May 16, 2019 in response to the MVEIRB's Information Request #1, DDMI has assessed the significance of effects and impacts to valued components from the transport,

[2] DDMI Letter to MVEIRB Re: Anticipated Submission of Summary Impact Statement and Request for Clarification on Scope Considerations, May 2, 2019.

deposition, and storage of PK from all sources (including processed kimberlite from the PKC Facility) in the mine workings. Studies conducted by DDMI to support the design of the Project, including water quality modelling, likely operational conditions during deposition and storage of PK, environmental effects assessments, and alternatives analysis, have been informed by plans to transport and deposit PK from both the processing plant and the PKC Facility to mine workings on site. This assessment should support the MVEIRB in its Review of aspects of the Proposal associated with the transport, deposition and storage of PK in pits and underground mine workings.

DDMI plans to continue to evaluate feasibility of activities associated with the removal of processed kimberlite from the PKC Facility as part of ongoing operations and closure planning. The feasibility study associated with the removal of processed kimberlite from the PKC Facility will be advanced once conceptual approval for the transport and storage of PK in mine workings is received from regulatory bodies, including MVEIRB and the Wek'èezhìi Land and Water Board, and would include an assessment of the preferred timing for removal of this material, in addition to evaluating PKC Facility design and closure considerations. DDMI will formally engage with stakeholders, including applicable regulatory bodies, regarding this option in the future.

4. MVEIRB-IR#4

4.1 Topic

Updates to monitoring, management, and closure and reclamation plans

4.2 Reviewer Comment

Based on the proposed changes to processed kimberlite storage, updates will be required to (at minimum) the Waste Management Plan, the Interim Closure and Reclamation Plan, and the Contingency Plan. Other plans and programs may also be affected by the proposal to put processed kimberlite into the pits and mine workings.

4.3 Reviewer Recommendation

1. Please identify all monitoring, management, and other plans that will require updates based on the proposal to put processed kimberlite into the pits and mine workings.

2. Please describe the changes that are required to each of these plans and programs.

4.4 Developer's Response to MVEIRB-IR#4

1. Monitoring Plan Updates:
    a. Surveillance Network Plan (SNP) during Operations
    b. Aquatic Effects Monitoring Plan (AEMP) and post closure site monitoring

    Management Plan Updates:
    a. Processed Kimberlite Containment Plan: Processed Kimberlite Containment Facility and Mine Workings (formerly the Processed Kimberlite Containment Facility Plan)
    b. Water Management Plan and Site Water Balance
    c. Contingency Plan
    d. Closure and Reclamation Plan
    e. Waste Management Plan

2. Monitoring Plan Updates:
    a. A new SNP station 1645-88 will be proposed based on the following schedule in Table 2:

Table 2: Water Quality Monitoring Program for Mine Workings

Description:	Mine Workings containing Processed Kimberlite		
Location:	Mine Workings – location dependent on stage in Mine life		
Sampling Frequency:	Bi-weekly from decant water pipeline (when active) during Operations	Following the completion of Mine Working being backfilled with water at one (1) station located in the center of the Open Pit: **Monthly** Bioprofile to monitor the chemocline development and stability. **Quarterly** (provided safe access via open water or sufficient ice thickness) one (1) sample shall be collected 2m below surface, one (1) sample shall be collected 2m above the chemocline, one (1) sample shall be collected 2m below the chemocline, and one (1) sample shall be collected 2m above the bottom. If a chemocline is not evident, four (4) samples shall be distributed evenly	Once prior to breaching dike and reconnecting Mine Workings to Lac De Gras at a minimum of five (5) stations evenly spaced along a longitudinal transect as approved by an Inspector. At each station, samples must be collected 2m below surface and at twenty (20) meter intervals with a final sample 2m above the bottom.

		throughout the water column.	
Sampling Parameters:	Total Arsenic, Dissolved Organic Carbon, Dissolved Oxygen, Field Parameters, ICP- MS Metal Scan (Total and Dissolved), Major Ions, pH, Nutrients, Total Mercury, Total Organic Carbon, Total Suspended Solids, Turbidity, Total Petroleum Hydrocarbons (TPH)	Bioprofile: pH, Turbidity, Temperature, Dissolved Oxygen, Conductivity Sample: Total Arsenic, Dissolved Organic Carbon, Dissolved Oxygen, Field Parameters, ICP- MS Metal Scan (Total and Dissolved), Major Ions, pH, Nutrients, Total Mercury, Total Organic Carbon, Total Suspended Solids, Turbidity, Total Petroleum Hydrocarbons (TPH)	Total Arsenic, Dissolved Organic Carbon, Dissolved Oxygen, Field Parameters, ICP- MS Metal Scan (Total and Dissolved), Major Ions, pH, Nutrients, Total Mercury, Total Organic Carbon, Total Suspended Solids, Turbidity, Total Petroleum Hydrocarbons (TPH)
Rationale for Station:	Monitor water quality of the Mine Working containing Processed Kimberlite to ensure that water quality is behaving according to model predictions and remains stable over time.		

b. AEMP and post closure site monitoring.

   Details on DDMI's post-closure monitoring program are presented in Appendix 1 (post-closure monitoring and reporting).

Management Plan Updates:

a. **Processed Kimberlite Containment Plan**: Processed Kimberlite Containment Facility and Mine Workings (formerly the Processed Kimberlite Containment Facility Plan) – updated to include the following additional information:
   - a description, including maps to scale, of the locations of all monitoring stations within the Mine Workings, as well as discharge locations to and from the Mine Workings. The description should include the sampling protocols for each station;
   - a description of the management and scheduling of all Processed Kimberlite (PK) deposition within the Mine Workings;
   - stage-volume curves and water, solids and ice balance calculations showing life expectancy of the Mine Workings, as applicable
   - any operational and/or structural Modifications which may be implemented that will affect the management of the Mine Workings and associated wastewater operations;
   - a description of the methods that will be used to determine the volume in cubic metres of PK disposed of in the Mine Workings as well as the volumes disposed in, or relocated from, the Processed Kimberlite Containment Facility on an annual basis; and

- a description of the procedures that will be used to characterize the consolidation properties and pore water quality of the processed kimberlite within the Mine Workings.

b. **Water Management Plan and Site Water Balance**: updated to reflect operational water management shift from using the PKC as a source and sink for process water to the mine workings. There will be no change to the current single point of mine water discharge. All water will be treated at the North Inlet Water Treatment Plant (NIWTP) prior to entering Lac de Gras (LDG). Net impact to site water balance would be a modest decrease in gross transfers as underground mine dewatering demand decreases as mine workings are backfilled with PK.

c. **Contingency Plan** - Administrative updates limited to updating *Table 2: Summary of Environmental Risks, Management Actions & Contingencies* to include the additional risk to pit lake water quality and the related risk management and contingencies identified in the PK to Mine Working pit lake modelling.

d. **Waste Management Plan** – Administrative updates limited to identifying the location of additional PK mineral waste storage locations (Mine Workings).

e. **Closure and Reclamation Plan** – Update to reflect closure considerations and monitoring requirements resulting from the disposal of PK in Mine Workings.

5. MVEIRB-IR#5

5.1 Topic

Lessons learned and Ekati experience

5.2 Reviewer Comment

One of the reasons for the environmental assessment of this project was its use of new and untested technology in an ecologically and culturally sensitive area. Diavik mentioned that the Ekati Mine is disposing of processed kimberlite in pits at their mine (PR#34 p5). More details on the Ekati or other relevant projects would provide valuable comparative information.

5.3 Reviewer Recommendation

1. Please provide further information describing the fine processed kimberlite disposal to mined out pits at Ekati.

2. What is the expected and observed water quality in the pits used for processed kimberlite storage at Ekati?

3. How well do the results to date agree with the modelled estimates?

4. Please provide a summary of results and lessons learned from any other mines that have used similar approaches (such as meromixis) to contain processed kimberlite or other mine wastes.

5.4 Developer's Response to MVEIRB-IR#5

1. DDMI has engaged with Dominion regarding their plans for depositing processed kimberlite (PK) in mine workings. The primary focus of this engagment has been with regard to regulatory requirements for PK deposition in the Panda and Koala Pits as this was proceeding at the same time as Diavik's Water License Ammendment application. The expert analysis and modelling Dominion had completed was to address their final Water License conditions that would allow PK deposition to proceed.

   The Wek'èezhìi Land and Water Board (WLWB) amended the Ekati Water License W2012L2-0001 to allow the deposit and storage of PK in the Panda and Koala pits in May 2017 Ekati Water License Amendment Decision conditional on Part H Condition 2(c) requiring a revised Wastewater and Processed Kimberlite Management Plan (WPKMP) and Condition 33 requiring a Panda and Kola Deposition Study (Deposition Study). In January 2019 the WLWB approved submissions for both conditions and supported the deposition of processed kimberlite in the Panda and Koala open pits WLWB Approval - PK Deposition - Panda Koala. The Deposition Study approved by the WLWB included water quality modelling and the determination of a minimum freshwater cap depth PK Deposition Study - Panda Koala.

   DDMI reviewed the modelling approach taken by Dominion to address the final Water License conditions for a Deposition Study and decided to employ the same modelling approach to support the Water License application. While DDMI did not expect this level of detailed modelling would be required to support the amendment application, it was reasonable to assume it would likely be required to address a new future Water License condition so it would be proactive to begin this modelling work. DDMI retained the same expert water quality modelers from Golder Associates as Dominion and used the same mathematical models for consistency with what was approved by the WLWB and familiar to reviewers.

   The modelling work was designed to be phased with the initial preliminary modelling being conducted with the best available model input information at this time, including information from Ekati. A second phase of water quality modelling

would be conducted prior to any deposition and submitted for final Water License approvals with updated model input information.

The preliminary water quality modelling Diavik has conducted to date in support of the Environmental Assessment and Water License amendment application is more extensive than the modelling conducted to support the final approvals by the WLWB to allow deposition to proceed in the Panda and Koala open pits.

In addition to considering the regulatory process followed by Dominion, DDMI was also aware that Dominion has already completed PK deposition into the Beartooth Pit. Ekati began depositing PK into Beartooth Pit in 2013 as shown in the Figure 1 provided by Dominion Diamonds. The Beartooth information was reviewed with Dominion to determine if there was information and/or learnings from this that would be applicable to Diavik.

Figure 1: Beartooth Pit Solids and Water Levels

Dominion advised that water quality predictions for Beartooth were provided to the WLWB in the form of a Technical Memorandum (Golder 17 January 2018 Ekati- Pit Lake Closure Water Quality Modelling) included with Ekati's 2017 Annual Closure and Reclamation Progress Report Dominion 2017 Progress Report. DDMI did not consider this older water quality modelling when developing the modelling approach for Diavik.

The most helpful information was the water quality monitoring information for the surface water that accumulated on top of the deposited PK within the Beartooth Pit. These monitoring results are not indicative of final surface water conditions as the freshwater cap had not yet been added to create the final pit lake. The water quality information was helpful however to confirm/supplement information regarding potential pore water quality. The water quality modelling of the Panda and Koala Pits assumed pore water quality was the same as the measured water quality from the Beartooth Pit. Table 3 below summarizes the Beartooth Pit monitoring data, also used to represent pore water quality in final modelling of the Panda and Koala Pits, compared with the model input assumptions used most recently by Diavik for Scenarios 2a, 3a and 4a. The Beartooth Pit results are generally within the range of pore water conditions measured at Diavik with the exception of chloride. DDMI understands that the higher chloride levels at Beartooth are primarily related to groundwater that had accumulated in the pit bottom prior to PK deposition.

Table 3: Comparisons of Pore Water Chemistry assumed by DDMI for Water Quality Modelling with Ekati Measured and Assumed Pore Water

Table 1: Comparions of Pore Water Chemistry assumed by DDMI for Water Quality Modelling with Ekati Measured and Assumed Pore Water C

Parameter	Unit	Surface Water Quality Benchmark [a]	DDMI Assumed PK Pore Water Concentrations [f]	DDMI Assumed Slime Pore Water Concentrations [g]	Ekati Measured Beartooth Assumed Panda/Koala [h]
Major Ions					
Calcium	mg/L	-	12	11	-
Chloride	mg/L	120	63	39	776
Fluoride	mg/L	0.12	0.14	0.059	0.4
Magnesium	mg/L	-	7.2	27	-
Potassium	mg/L	-	138	56	-
Sodium	mg/L	52 [b]	85	54	-
Sulfate	mg/L	100 [c]	208	197	410
Nutrients					-
Nitrite as nitrogen	mg/L	0.06	0.59	0.59	-
Nitrate as nitrogen	mg/L	3	17	17	14
Ortho Phosphate	mg/L	-	0.031	0.032	-
Phosphorus	mg/L	-	0.035	0.039	0.011
Trace Elements					
Aluminum	µg/L	87 [b]	0.14	2.8	2
Antimony	µg/L	33 [b]	18	2.7	5.7
Arsenic	µg/L	5	5.9	4.8	3.4
Barium	µg/L	1000 [c]	155	51	100
Beryllium	µg/L	-	0.59	3.3	-
Boron	µg/L	1500	71	30	100
Cadmium	µg/L	0.1 [d]	0.2	0.51	0.06
Cobalt	µg/L	-	0.19	0.15	-
Copper	µg/L	2	2.6	1.0	0.4
Iron	µg/L	300	1.4	63	30
Lead	µg/L	1	0.51	0.28	0.1
Lithium	µg/L	-	5.0	-	-
Manganese	µg/L	-	0.34	6.1	28
Molybdenum	µg/L	73	242	385	320
Nickel	µg/L	25	2.5	10	29
Selenium	µg/L	1	0.72	0.5	1.1
Silicon	µg/L	2100 [b]	2781	1626	-
Silver	µg/L	0.1	0.24	0.24	0.02
Strontium	µg/L	30000 [e]	298	349	2700
Sulfur	µg/L	-	92090	54820	-
Thallium	µg/L	0.8	0.16	0.11	-
Tin	µg/L	73 [b]	4.1	1.6	-
Titanium	µg/L	-	0.25	1.1	-
Uranium	µg/L	15	0.2	0.56	0.21
Vanadium	µg/L	-	1.4	1.3	2.4
Zinc	µg/L	30	2.5	136	2

- = benchmark not available.

a) AEMP Design Plan Version 5.0 (DDMI 2017a); Table 5.3-1.

b) See AEMP Design Plan Version 5.0, Appendix B for description.

c) BCMOE (2013).

d) See Appendix IV.1 in DDMI (2007) and BCMOE (2001) for description.

e) Based on results from HydroQual (2009) and Pacholski (2009). See text for more information.

f) Results from direct sampling of PK slurry as discharged to the PKC - 1 sample from each of 2009, 2012, 2013.

g) In situ slimes samples were collectedin 2009, 2010 and 2011 from piezometers installed at depths from 10-75 ft beneath the water surface at the PKC Reclaim barge

h) Ekati Panda/Koala Deposition Study - median concentration calculated from monitoring results in Beartooth Pit - 16 October and June 15 2017

DDMI would like to acknowledge the support from Dominion staff and openness with sharing relevant Ekati information.

2. Expected water quality for the Beartooth Pit is provided by Dominion in Technical Memorandum (Golder 17 January 2018 Ekati - Pit Lake Closure Water Quality Modelling) included with Ekati's 2017 Annual Closure and Reclamation Progress Report. Dominion 2017 Progress Report. Expected water quality for the Panda and Kola Pits are included in the Panda and Koala Deposition Study PK Deposition Study - Panda Koala. Observed water quality in the Beartooth Pit, before addition of a freshwater cap, are summarized above in Table 3. There are no observed water quality data for the Panda or Koala Pits as PK deposition is only just proceeding.

3. DDMI has only briefly reviewed the original predictions of water quality for the Beartooth Pit to compare with monitoring data. A direct comparison of predicted and measured water quality is not appropriate because we understand that measured Beartooth water quality represents mostly accumulated PK slurry and pore water before a freshwater cap whereas the predictions represent conditions after a freshwater cap has been placed. The DDMI and Dominion pit lakes are expected to have very different water quality because of the location and resulting water balance for the respective pit lakes. Whereas Dominion's pit lakes will be located on land and will receive a large proportion of drainage from waste rock, DDMI's pit lakes will be located within Lac de Gras and the water balance will be driven by exchange with the lake. Therefore, in the long-term, the water quality in each pit lake will tend to resemble the water quality of its respective sources.

4. DDMI has considered the plans for and actual implementation of PK deposition to mine workings at Ekati as described above. DDMI will continue to follow and learn from these applications particularly if/when we move into engineering and deposition design. A summary of learnings to date from Ekati include:
    - Use of completed mine workings for PK deposition is practical at Ekati.
    - Deposition of PK into mine workings at Ekati is supported and has been approved by the WLWB.
    - The water quality modelling approach applied to the Panda and Koala Pits and the results obtained were approved by the WLWB. Learning was to use a similar approach where appropriate to maintain regulatory/reviewer familiarity and consistency.
    - Dominion concluded that a final water cover depth of 30 m was required compared with DDMI's preliminary determination of 50 m.
    - From a practical perspective DDMI learned about challenges/importance of considering pit access when designing the specifics of the deposition plan.
    - Accumulated PK pore water in the Beartooth Pit is generally similar to what DDMI anticipates for Diavik PK pore water.

- Nitrite results for Beartooth, combined with limited nitrogen data for Diavik PK have resulted in DDMI placing a greater emphasis on nitrogen forms in ongoing PK test work than the previous approach of focusing on geochemistry.

More broadly, the following is a general summary around the use of mine workings for storage of mine waste materials. This summary is based on a literature review of over 180 pit lakes from around the world representing the majority of published case studies globally (Golder 2017; Vandenberg and McCullough 2018, McCullough et al. 2018). DDMI found the Global Pit Lake Literature Review (Golder 2017) to be particularly useful to the the question of DDMI's pit lakes and the document is quoted extensively below, with minor re-wording for project-specific relevance.

The review evaluated the risks and benefits of incorporating various mine wastes into pit lakes at mine closure, and found that the practice generally provides the following benefits:

- moderation of peak flows and low flows,
- reduced need for above-ground tailings storage facilities,
- prevention of accidental releases,
- long-term geophysical and geochemical stability,
- prevention of acid and metalliferous drainage (AMD),
- hydrogeological containment,
- sediment trapping, and
- water treatment, which may be passive or semi-passive (i.e., requiring occasional intervention).

In contrast, the practice carries two main potential risks, namely:

- the creation or increase of legacy liability if improperly planned or if conditions and mine waste characteristics are not well understood, and
- the creation a different environment compared to pre-development (which is almost always a foregone conclusion once an open-pit mine is initiated).

Given that some pit lakes have become case studies in degraded environmental legacies, such as the superfund site Berkeley Pit Lake (Gammons 2006, 2009), a focus of the literature review was to understand which factors had led to the creation of successful versus unsuccessful pit lakes. Since few pit lakes fit these binary categories, success was defined where the pit lake:

- met its intended purpose such as fish and wildlife habitat, aquaculture, drinking water, recreation, water treatment, or other uses desired by stakeholders; and/or,
- had been certified for relinquishment by regulators.

The term unsuccessful applies to pit lakes that:

- have long-term water quality issues, requiring indefinite water treatment or artificial containment;
- did not meet regulatory requirements; and/or
- are not following a deliberately planned trajectory toward meeting regulatory requirements.

Notably, **the inclusion or exclusion of tailings from pit lakes was not a major differentiator in terms of successful outcomes globally**. There are both successful and unsuccessful examples of pit lakes with and without tailings, and success or failure was determined by other factors. A common theme associated with successful pit lakes is adherence to the following practices:

- study and understand the regulatory, social and environmental aspects as early in the mine life as possible, then manage appropriately; with monitoring demonstrating objective achievement and feeding back into a pre-developed adaptive management plan; and
- attain a detailed knowledge of mine pit construction and waste materials, and incorporate that knowledge into a comprehensive mine closure plan that identifies the most appropriate method of treating and storing each waste stream, and that is developed in advance of mining and adaptively managed throughout operations.

A common theme associated with unsuccessful pit lake case studies encountered in the case studies is:

- mining began before regulatory standards required a full closure plan, and before mine waste characterization and predictive modelling approaches became industry standards.

The literature review concluded that there were three (3) primary lessons for operators that are considering future placement of mine waste inside mine workings:

- Early planning is key – few closure management options exist at completion of a mine void, particularly so in the context of a largely completed overall mine site. Development of successful pit lakes typically entailed strategically identifying factors that are critical their success, then

incorporating those factors into adaptive closure planning, well in advance of 'Rubicon' moments of mine development.

- Problematic geochemistry must be understood and managed – most unsuccessful pit lake closures resulted from misunderstood and/or mismanaged enriched geochemistry within the pit void shell or in-pit waste materials, or by altering the conditions (e.g., redox, moisture) to which mine waste is exposed without understanding the implications of those alterations. A common outcome of this misunderstanding or mismanagement is AMD leading to low pH and elevated metal concentrations and salinity.
- Holistic planning views the pit lake as one part of a larger closure landscape – successful pit lake closures were typically well-planned in advance and in consideration of other post-mining landform elements across the closure landscape. Holistic planning may improve overall mine closure outcomes (reduced risk and liability) at the expense of reduced pit lake success.

DDMI considers the present state of planning and management of the pit lakes appropriate for the stage of the mining (i.e., pre-closure). For example, DDMI has a good working knowledge of the materials to be placed in the pit, and is working with the University of Alberta, in-house experts and consultants to close remaining knowledge gaps. The timelines to address the remaining knowledge gaps are shorter than the timelines to place materials in the pits, so there is adequate time to adapt plans if detailed information indicates a need to do so. Additionally, DDMI is considering the placement of materials in the pit as part of holistic mine closure planning, meaning that while there is always a non-zero level of risk associated with mine closure, the overall level of residual risk is lowest with the materials in the pits under tens of meters of water, as opposed to on land in any sort of terrestrial landform.

References

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Golder. 2017. Literature Review of Global Pit Lakes. Available at: https://www.cosia.ca/sites/default/files/attachments/Literature Review of Global Pit Lakes_0.pdf 91 pp. Calgary, Canada.

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6. MVEIRB-IR#6

6.1 Topic

Project alternatives

6.2 Reviewer Comment

Diavik has identified that two of the key disadvantages of its Option 1, a traditional dam raise, are footprint restrictions and limited closure options (PR#5 PDF p30). The preferred option includes both a dam raise and depositing processed kimberlite into mine workings. Diavik has also requested that re-mining the existing Processed Kimberlite Containment Facility be removed from the scope of development for this project.

6.3 Reviewer Recommendation

Considering that Option 1 (a traditional dam raise) is permitted and feasible, how are the space constraints enough of a disadvantage to make this option unacceptable?

6.4 Developer's Response to MVEIRB-IR#6

Lateral space constraints, an inability to expand the Processed Kimberlite Containment (PKC) Facility footprint outwards, result in a design focused on vertical expansion through traditional dam raises. While this type of expansion is permitted and technically feasible, the result is a taller land based PKC Facility, which will need to be managed into closure. DDMI considers the option of permanent subaqeous disposal of processed kimberlite in mine workings to be beneficial when compared to any land based storage option. This technical judgement exists regardless of the option between dam expansions which focus on unconstrained outward or constrained upward expansion. The original mine plan in 1999 did not identify that completed mine workings would be available for the purpose of deposition of processed kimberlite (PK). The mine plan has evolved over time and in 2017 DDMI identified an opportunity to consider the A418 mine workings for processed kimberlite disposal starting in 2022. The concept of PK deposition in mine workings was discussed during the 1999 Environmental Assessment for the Diavik Diamond Mine Project and the Responsible Authorities at the time recommended that Diavik pursue "…*opportunities to use processed kimberlite as underground backfill to reduce the long term* ***mitigation*** *requirements of the PKC facility" (Comprehensive*

Study Report pg 54). While an additional dam raise is acceptable, DDMI is challenging the status quo and following through with the recommendation from the Responsible Authorities in the persuit of management options which present a lower risk and more permanent disposal solution.

7. MVEIRB-IR#7

7.1 Topic

Environmental risks of the existing Processed Kimberlite Containment Facility

7.2 Reviewer Comment

Diavik states that depositing processed kimberlite in pits "[r]educes environmental risks related to PK storage" and addresses concerns regarding the long-term stability and environmental risks of the Processed Kimberlite Containment Facility (PR#13 PDF p9, 13). In 1999, the EA was approved with a conclusion of no significant adverse effects related to long term disposal of processed kimberlite in the Processed Kimberlite Containment Facility (PR#29).

7.3 Reviewer Recommendation

1. Please describe the concerns relating to long-term stability and environmental risks associated with continued or expanded processed kimberlite storage in the Processed Kimberlite Containment Facility.

2. Have these risks changed since the 1999 environmental assessment?

3. Are the environmental risks in question solely linked to increasing dam height of the Processed Kimberlite Containment Facility to accommodate processed kimberlite storage requirements for the remainder of mine life? If not, please describe additional risks that need to be managed.

4. How much processed kimberlite is in the Processed Kimberlite Containment Facility now?

7.4 Developer's Response to MVEIRB-IR#7

1. DDMI has received approval for designs involving dam raises to enable storage of all PK on-land in the Processed Kimberlite Containment (PKC) Facility. These designs can be constructed, operated and closed safely or they would not have been proposed or approved. Having said that, storage of processed kimberlite (PK) on-land was not the preferred storage option from a technical perspective. DDMI identified that from a geochemical and closure perspective the better option would be to store PK below Lac de Gras (see Comprehensive Study

Report Section 4.3.1 Alternative #3). For these same geochemical and closure reasons, storage of PK in mine workings is beneficial to storage on-land.

DDMI has identified technical closure challenges that have resulted from the decision to store PK on-land. In addition to general geochemical (water quality) concerns, DDMI has identified a closure challenge with the extra fine processed kimberlite or EFPK (also referred to as "slimes") fraction of PK that accumulates in the center of the PKC Facility. EFPK has the consistency of toothpaste that would likely not be safe for people or wildlife if it was accessible post-closoure. DDMI's preferred closure option, and the one that is approved by the WLWB, is to mainatin a pond over the EFPK post-closure ("wet-cover option") such that people and wildlife would not come into direct contact with the EFPK. The identified uncertainty with this closure option is the ability to maintain a pond given current seepage rates from the facility. If PK deposition into mine workings is permitted, DDMI would be able to commence closure of the PKC Facility several years sooner. This would start with dewatering the facility to allow further development of frozen conditions reducing seepage to improve expected ability to maintain a closure pond.

An alternative to the wet-cover option is to remove some or all of the EFPK from the PKC Facility and instead of a closure pond leave the facility in a dry but stable surface ("dry-cover" option). If PK deposition into mine workings is permitted, it would enable consideration of a dry-cover option because the EFPK could be disposed of in the mine workings. Without the option to dispose of PK in the mine workings, there is no other practical location to store EFPK that has been removed from the PKC Facility.

2. The geochemical and closure risks with on-land storage of processed kimberlite identified in the 1999 environmental assessment remain. See 1 above.

3. Please see 1 above.

4. There are currently about 33.4 Mt of processed kimberlite, both coarse and fine fractions, in the PKC Facility.

8. MVEIRB-IR#8

8.1 Topic

Volume of processed kimberlite to be deposited

8.2 Reviewer Comment

Diavik described a scenario for “maximum possible PK deposition – for example A418 – 23.9 Mt vs current concept of 4.1 Mt” (PR#13 PDF p84).

8.3 Reviewer Recommendation

1. What is the source of the additional 19.8 million tonnes of processed kimberlite referenced in the “maximum PK deposition scenario”?

2. When would the additional processed kimberlite be placed and how does this influence the Closure Plan for the site?

3. Please describe the depth of the freshwater cap on the A418 pit if all 23.9 MT of PK were to be deposited there.

8.4 Developer’s Response to MVEIRB-IR#8

1. The 23.9 Mt processed kimberlite mass used in the initial model scenarios was selected as an extreme worst-case mass of processed kimberlite (PK) deposion to simulate the corresponding worst-case effect to pit water quality. The current mine plan does not identify any conceivable scenario where 23.9 Mt of PK would be deposited into a mine working. Subsequent ‘realistic’ model scenarios evaluated the depostion of 4 Mt (5 Mm^3) (Scenarios 2a and 4a) of fine processed kimberlite (FPK) or 4 Mt of FPK overlain by 4 Mm^3 of extra fine processed kimberlite (EFPK) (3a) in each of the A418, A154 and A21 Mine Working. These results will be presented in detail in the Summary Impact Statement.

2. Deposition of PK exceeding the modelled 4 Mt of FPK and 4 Mt of EFPK may occur if additional mineral processing occurs beyond the currently defined mineral resource and / or additional PK is available for transfer from the PKC Facility to Mine Workings. Based on the results of pit lake modelling to date, a 50 m water cap is sufficient to establish stable meromixis and maintain surface and 40 m depth water quality below Aquatic Effects Monitoring Program (AEMP) benchmarks under expected conditions. The depostion of additional PK would be permitted as part of ongoing closure planning including updates to the Plan.

3. As described, the 23.9 Mt deposition scenario is not considered to be likely. If this mass of PK were deposited in the A418 mine working, the post PK consolidation water cap thickness would be roughtly 60m. Model results presented in the Water License Amendment Technical Session IRs suggest this is an adequate water cap thickness to maintain surface water quality in the A418 pit lake below AEMP Benchmarks.

9. MVEIRB-IR#9

9.1 Topic

Potential impacts associated with not reconnecting the pit lakes to Lac de Gras

9.2 Reviewer Comment

During the first round of information requests on the water licence amendment application process, the Wek'èezhi`ì Land and Water Board asked Diavik: "If reconnection is not possible, how would this affect future use of the flooded pits?" (PR#22, WLWB IR-18(4)). Diavik's response was that, if reconnection was not possible, "…this area would no longer be available as fish habitat. In addition, this area would no longer be navigable by boat via Lac de Gras". The scope of assessment for this environmental assessment (EA) includes, but is not limited to, consideration of impacts to traditional use of the area and wildlife.

9.3 Reviewer Recommendation

1. Please describe any additional potential impacts of not re-connecting the pits to Lac de Gras during closure, given the scope of assessment for this EA.

2. Please describe what mitigation options are available to Diavik to minimize any additional potential impacts associated with not reconnecting the pit(s) containing processed kimberlite to Lac de Gras.

3. Please describe the implications of not reconnecting the pit lakes on the approved DFO No Net Loss Plan and how those habitat losses would be mitigated.

9.4 Developer's Response to MVEIRB-IR#9

1. The 1998 Environmental Assessment Report – Fish and Water (DDMI 1998), associated with the the environmental review of the the original Diavik Diamond Mine Project, evaluated the impact of habitat loss in Section 6.4.7. During operations when the fish habitat within all of the dike areas were assumed to be lost from Lac de Gras, this was considered to have a "negligible" effect , with respect to magnitude, based on the determination tha fish habitat loss would represent less than 1% of available fish habitat in Lac de Gras. If reconnection of all three dikes was not preferred, as posed in Question 1, then the magnitude of potential effects would be classified as "negligible" (see DDMI 1998 Table 6-48) and the extent would be regional. What would change would be the duration of this effect. The original environmental assessment assumed reconnection and as such classified the habitat loss as "mid-term" duration to reflect that the loss would only occur during the period of operations. If reconnection was not possible, the duration would change from "mid-term" to "long-term" (see Comprehensive Study Report [CSR] Table 2-1 for summary of duration definitions). In summary, not re-connecting any of the dike areas with Lac de

Gras would change the effects classification from mid-term duration of negligible magnitude to a long-term duration with a negligible magnitude, both at a regional scale. Applying the CSR definitions of significance (CSR Section 2.4.3) would conclude that not reconnecting the dike areas with Lac de Gras would not cause a significant adverse effect.

2. Current water quality modelling does not suggest there is a significant risk of pit lake water quality preventing reconnection to Lac de Gras. If reconnection is not possible, this area would no longer be available as fish habitat. Possible contingency measures that would be considered if water quality in the pits does not reach established criteria includes the evaluation of insitu treatment options. Mine workings would not be reconnected to Lac de Gras until established criteria are met. Please refer to the Summary Impact Statement for a more comprehensive effects assessment.

3. The compensation plan developed with Fisheries and Oceans Canada (DFO) to address the "No Net Loss" policy that existed in 1998 is based on re-connecting the dike areas. An alternative compensation plan would need to be developed with DFO and communities, and for DFO approval, if the preference was to not re-connect the pit lakes to Lac de Gras.

10. MVEIRB-IR#10

10.1 Topic

Establishing re-connection criteria

10.2 Reviewer Comment

Diavik was asked what it would do if more processed kimberlite than expected is produced or if water quality is worse than predicted. Diavik responded that a possible contingency option is to establish criteria for reconnection (PR#22, WLWB IR-16). This may result in a temporary or permanent loss of fish habitat, should these reconnection criteria not be met.

10.3 Reviewer Recommendation

1. Please describe potential criteria for deciding whether to re-connect the pit lakes with Lac de Gras.

2. Please describe, in Diavik's view, what kind of processes would be used to establish, monitor, and ensure compliance with these criteria.

10.4 Developer's Response to MVEIRB-IR#10

1. The experience of developing pit lakes in other regions has established that flow-through pit lakes tend to produce better water quality than isolated or 'terminal'

pit lakes. For example, this has been a key learning from Australia coal mine pit lakes (McCullough et al. 2013, 2015) and Alberta oil sands pit lakes (Wylynko and Hrynyshyn 2012). In closing mine pit lakes, the question then becomes 'when' to re-connect pit lakes with the receiving environment.

AEMP Benchmarks are potential criteria for deciding when to re-connect the pit lakes with Lac de Gras.

References

McCullough CD, Marchand G, Unseld J. Mine closure of pit lakes as terminal sinks: best available practice when options are limited. Mine Water and the Environment. 2013 Dec 1;32(4):302-13.

McCullough, C. and Schultze, M., 2015, April. Riverine Flow-Through of Mine Pit Lakes: Improving both Mine Pit Lake and River Water Quality Values. In Proceedings of the 10th International Conference on Acid Rock Drainage and IMWA Annual Conference, Santiago, Chile (pp. 21-24).

Wylynko, D., and J. Hrynyshyn, editors. 2012. End Pit Lakes Guidance Document 2012. West Hawk Associates Inc.

2. In DDMI's view, reconnection criteria would be established by the Wek'èezhìi Land and Water Board (WLWB) through the review/approval of Diavik's Closure and Reclamation Plan. Once a pit has been filled, DDMI would monitor water quality following an established Surveillance Network Program (SNP). The SNP monitoring proposed by DDMI both during operations and to demonstrate compliance with a reconnection criterion, were described in response to ECCC-5 of December 18, 2018 at the preliminary screening stage of the Water Licence Amendment process for the Processed Kimberlite to Mine Workings Proposal. This response was included as Attachment # 4 of DDMI's January 8, 2019 submission to the WLWB and is presented in Table 4-1 below.

Table 4-1: Surveillance Network (SNP) Station 1645-88 (Proposed)

Description:	Mine Workings containing Processed Kimberlite		
Location:	Mine Workings – location dependent on stage in Mine life		
Sampling Frequency:	Bi-weekly from decant water pipeline (when active) during Operations	Following the completion of Mine Working being backfilled with water at one (1) station located in the center of the Open Pit: **Monthly** Bioprofile to monitor the chemocline development and stability. **Quarterly** (provided safe access via open water or sufficient ice thickness) one (1) sample shall be collected 2m below surface, one (1) sample shall be collected 2m above the chemocline, one (1) sample shall be collected 2m below the chemocline, and one (1) sample shall be collected 2m above the bottom. If a chemocline is not evident, four (4) samples shall be distributed evenly throughout the water column.	Once prior to breaching dike and reconnecting Mine Workings to Lac De Gras at a minimum of five (5) stations evenly spaced along a longitudinal transect as approved by an Inspector. At each station, samples must be collected 2m below surface and at twenty (20) meter intervals with a final sample 2m above the bottom.
Sampling Parameters:	Total Arsenic, Dissolved Organic Carbon, Dissolved Oxygen, Field Parameters[3], ICP- MS Metal Scan[1](Total and Dissolved), Major Ions[2], pH[4], Nutrients[5], Total Mercury, Total Organic Carbon, Total Suspended Solids, Turbidity, Total Petroleum Hydrocarbons (TPH)	Bioprofile: pH, Turbidity, Temperature, Dissolved Oxygen, Conductivity Sample: Total Arsenic, Dissolved Organic Carbon, Dissolved Oxygen, Field Parameters[3], ICP- MS Metal Scan[1](Total and Dissolved), Major Ions[2], pH[4], Nutrients[5], Total Mercury, Total Organic Carbon, Total Suspended Solids, Turbidity, Total Petroleum Hydrocarbons (TPH)	Total Arsenic, Dissolved Organic Carbon, Dissolved Oxygen, Field Parameters[3], ICP- MS Metal Scan[1](Total and Dissolved), Major Ions[2], pH[4], Nutrients[5], Total Mercury, Total Organic Carbon, Total Suspended Solids, Turbidity, Total Petroleum Hydrocarbons (TPH)
Rationale for Station:	Monitor water quality of the Mine Working containing Processed Kimberlite to ensure that water quality is behaving according to model predictions and remains stable over time.		

Water quality monitoring results at the 2 m, 20 m and 40 m depths from each of the 5 locations at SNP 1645-88 would be compared with the reconnection criteria. If all

results are below criteria then DDMI would seek approval from the Inspector to breach the dike and reconnect the pit lake with Lac de Gras. If water quality results for some parameters exceed closure criteria then DDMI would conduct a risk assessment. The results of the risk assessment could be used to request approval of a modified reconnection criteria. This approach of establishing closure criteria by first applying recognized standards, like AEMP benchmark, and then only proceeding to a risk assessment if a recognized standard is exceeded or expected to be exceeded is DDMI's understanding of the WLWB direction of December 17, 2018 with regard to the development of closure water quality criteria.

11. MVEIRB-IR#11

11.1 Topic

Consideration of climate change

11.2 Reviewer Comment

Diavik conducted a sensitivity analysis to investigate the sensitivity of model predictions to various factors including air temperature and windspeed. Diavik's baseline field investigations show that permafrost extends 240m below East Island, decreasing at the margins of Lac de Gras, and that permafrost is considered impermeable (from Diavik's response to GNWT-ENR IR#5 PR#23).

11.3 Reviewer Recommendation

Please describe if and how future permafrost conditions may affect pit wall stability, the stability of meromixis, groundwater inflow and/or water quality predictions in the pit lake and Lac de Gras.

11.4 Developer's Response to MVEIRB-IR#11

All three mines (A154, A418 and A21) have been developed behind water retention dikes to enable mining in areas that were originally under Lac de Gras and so largely not within permafrost. As a result, the mine workings are similarly not within permafrost with the exception of a few localized zones. This general lack of permafrost will remain in the future below the planned pit lakes. Beyond existing conditions, future reduced permafrost from filling pits with freshwater will be factored into the closure geotechnical analysis but is not expected to be a driving factor in pit lake geotechnical stability, stability of meromixis, groundwater inflow and/or water quality predictions in the pit lake and Lac de Gras.

12. MVEIRB-IR#12

12.1 Topic

Water quality modelling time frame

12.2 Reviewer Comment

Much of the detailed water quality modelling done to date has looked at a 100-year timeframe. However, ongoing diffusion of porewater towards the surface of the lake water might be expected after this point in time. Diavik performed a sensitivity analysis for the base case of pit A418 (PR#16 PDF p7). The base case assumes a water cap depth of 150 m, deposited processed kimberlite volume of 5,000,000 m3, pore water chemistry of 350 mg/L of total dissolved solids, and a reclaim pond depth of 5 m depth.

12.3 Reviewer Recommendation

1. For the base case, when would pit lake water quality reach a point of equilibrium or stasis?

2. For the base case, what are the expected concentrations of contaminants of potential concern in the surface waters of the pit lake at this point of equilibrium?

3. If the freshwater cap was only 50 m (the minimum committed to by Diavik), how would this affect the time required to reach equilibrium?

4. If the freshwater cap was only 50 m, what would the expected concentrations of contaminants of potential concern in the surface waters of the pit lake be at the point of equilibrium?

12.4 Developer's Response to MVEIRB-IR#12

1. Pit lakes are dynamic systems that will respond to natural and anthropogenic factors, and strictly speaking, they will never reach a state of equilibrium (a balance of all competing influences or reactions) or stasis (standing still or unchanging). Over time, anthropogenic factors will decline while natural process will become more dominant. Therefore, for the purposes of this question, the state of equilibrium or stasis has been defined as the time when the main anthropogenic and natural factors begin to balance. Specifically, DDMI has defined this equilibrium point as the point where the predicted total mass of tracer in the water column reaches a maximum. This is the point where the mass of constituent that is being added to the pit lake from processed kimberlite (PK) pore water release is equal to the mass of constituent loss from the pit lake through the dike breaches. For A418 Scenario-2a this occurs at year 91 of the simulation.

2. Table 5 shows the constituent concentrations for A418 Scenario 2a Year 91.

3. DDMI suggests considering the A21 results for Scenario 2a (85 m freshwater cap) to assess the effect of freshwater cap depth on time to reach equilibrium. An equilibrium is reached sooner (at Year 15) at A21 with a 85 m freshwater cap compared to Year 91 for the 158 m freshwater cap for A418 as shown in the

figures 2 and 3 below. This difference is because with a shallower freshwater cap constituent mass loss rate from the pit lake through the dike breaches is greater with a shallower (85 m) freshwater cap compared with a deeper (158 m) freshwater cap.

4. Table 5 shows the constituent concentrations for A21 Scenario 2a - Year 15.

Table 5: Predicted Water Quality in the Pit Lakes at expected "equilibrium" years

Parameters	Unit	Benchmark	A418 Scenario 2-a (158 m Water Cap, Year 91)		A21 Scenario 2-a (85 m Water Cap, Year 15)	
			Top Section	at Depth of 40 m Below Surface	Top Section	at Depth of 40 m Below Surface
Calcium	mg/L	-	2.6	2.6	1.6	1.7
Chloride	mg/L	120	3.5	3.5	2.2	2.5
Fluoride	mg/L	0.12	0.034	0.034	0.031	0.031
Magnesium	mg/L	-	1.2	1.2	1.0	1.0
Potassium	mg/L	-	1.1	1.1	0.9	1.6
Sodium	mg/L	52	3.1	3.1	1.7	2.1
Sulfate	mg/L	100	3.9	3.9	3	4
Nitrite as nitrogen	mg/L	0.06	0.0008	0.0009	0.001	0.004
Nitrate as nitrogen	mg/L	3	0.06	0.06	0.01	0.1
Ammonia_N	mg/L	4.7	0.038	0.038	0.04	0.05
Phosphate, Ortho	mg/L	-	0.0016	0.0016	0.0008	0.0009
Phosphorus	mg/L	-	0.0036	0.0036	0.0032	0.0034
Aluminum	µg/L	87	6.3	6.3	3.3	3.3
Antimony	µg/L	33	0.03	0.04	0.02	0.12
Arsenic	µg/L	5	0.28	0.28	0.23	0.26
Barium	µg/L	1000	3.5	3.5	2.3	3.1
Beryllium	µg/L	-	0.005	0.005	0.005	0.008
Boron	µg/L	1500	2.9	2.9	2.5	2.9
Cadmium	µg/L	0.1	0.0028	0.0028	0.003	0.004
Cobalt	µg/L	-	0.017	0.017	0.018	0.019
Copper	µg/L	2	0.59	0.59	0.61	0.62
Iron	µg/L	300	4.1	4.1	3.5	3.5
Lead	µg/L	1	0.0033	0.0033	0.004	0.007
Lithium	µg/L	-	2.0	2.0	1.7	1.7
Manganese	µg/L	-	3.3	3.3	1.9	1.9
Molybdenum	µg/L	73	0.9	0.9	0	2
Nickel	µg/L	25	0.77	0.77	0.92	0.92
Selenium	µg/L	1	0.02	0.02	0.02	0.024
Silicon	µg/L	2100	186	186	28	43
Silver	µg/L	0.25	0.0025	0.0025	0.003	0.004
Strontium	µg/L	30000	35	35	16	17
Sulfur	µg/L	-	1573	1583	1268	1744
Thallium	µg/L	0.8	0.0011	0.0011	0.0012	0.002
Tin	µg/L	73	0.011	0.011	0.03	0.05
Titanium	µg/L	-	0.51	0.51	0.28	0.28
Uranium	µg/L	15	0.12	0.12	0.1	0.1
Vanadium	µg/L	-	0.1	0.1	0.05	0.06
Zinc	µg/L	30	0.21	0.21	0.36	0.37

Bold indicates concentrations is exceeding benchmark

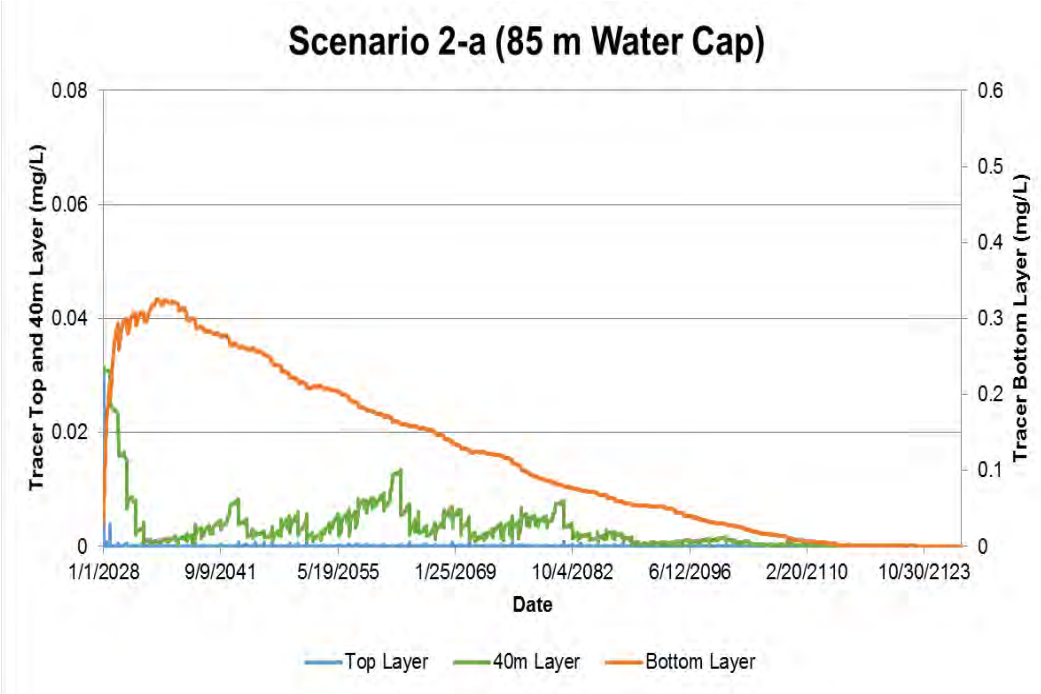


Figure 2: A21 Scenario 2a

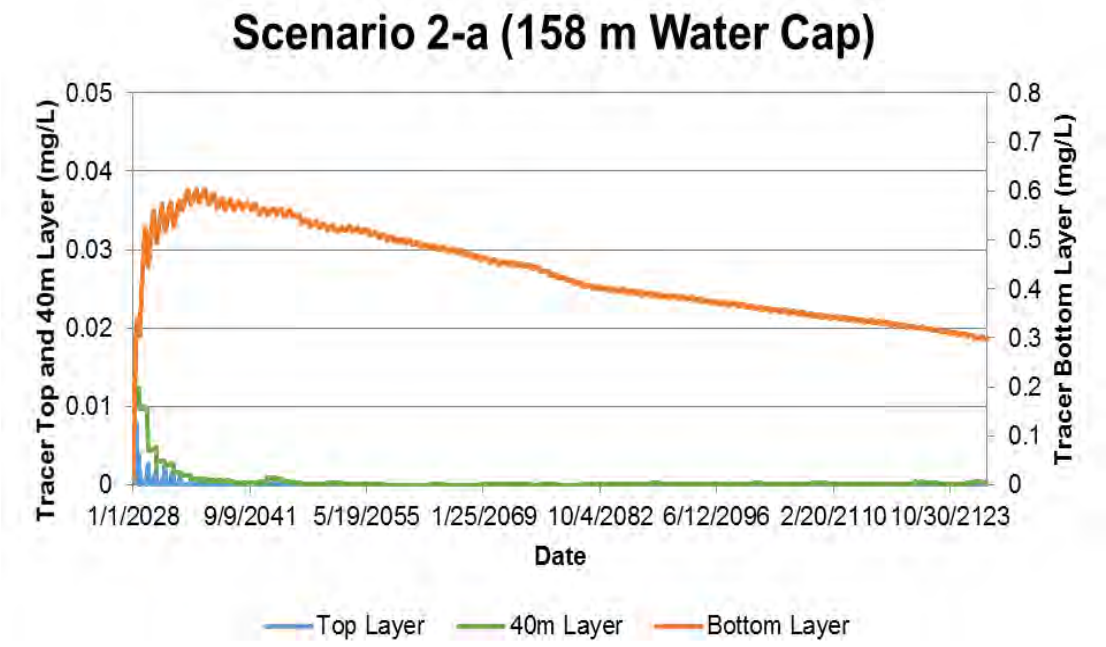


Figure 3: A418 Scenario 2a

13. MVEIRB-IR#13

13.1 Topic

Freshwater cap depth

13.2 Reviewer Comment

Diavik modelled the base case using a 150 m freshwater cap and modelled 20 m and 50 m freshwater caps scenarios (PR#16; PR#11). Diavik committed to using a freshwater cap of a minimum 50 m depth (PR#16, response to IR#15).

13.3 Reviewer Recommendation

1. Please describe the likelihood of Diavik using a freshwater cap of less than 150 m and what factors might influence this decision.

2. Please describe the minimum freshwater cap depth to establish and stabilize meromixis.

3. If different than above, please provide a minimum depth of the freshwater cap necessary to prevent the exceedance of Aquatic Effects Monitoring Program benchmarks and Canadian Council of Ministers of the Environment guidelines in surface waters if a mixing event occurs.

13.4 Developer's Response to MVEIRB-IR#13

1. There is a likelihood that a freshwater cap would be less than 150 m. For example the A418 Scenarion 3a and all A21 Scenarios (2a, 3a and 4a) have freshwater caps less than 150 m. For A418 Scenario 3a, the freshwater cap depth is 111 m and for A21 Scenarion 3a the freshwater cap depth is 51 m. The factors that might influence this decision to have a freshwater cap of less than 150 m would include but not be limited to:
    - mine working area used;
    - volume of processed kimberlite (PK) deposited – in particular volume of extra fine processed kimberlite (EFPK) from the Processed Kimberlite Containment (PKC) Facility; and
    - results from porewater monitoring during PK deposition.

2. DDMI has determined that a 50 m freshwater cap is adequate to establish and stabilize meromixis as described in DDMI response to WLWB IR-1 (November 2018) and Golder (2018) during the preliminary screening stage of the Water Licence Amendment process for the Processed Kimberlite to Mine Workings Proposal. This determination was based on maintaining surface and 40 m depth water quality below AEMP benchmarks under expected conditions. This is the depth of freshwater cap required to establish and stabilize meromixis. This

determination did not include a requirement for AEMP benchmarks to be achieved for a theoretical fully-mixed scenario.

3. As discussed in response to MVEIRB IR#16, a deeper freshwater cap does not necessarily reduce the maximum surface water quality constituent concentration under an unanticipated mixing event. The comparison discussed in MVEIRB IR#16 notes that fully mixed concentrations are lower in A21 with an 85 m freshwater cap compared to a 158 m freshwater cap in A418. This is because constituent mass loss rate through the dike breaches is expected to be higher for a shallow freshwater cap resulting in lower concentrations for an unanticipated mixing event. It is DDMI's opinion that the depth of the freshwater cap should be based on requirement to establish and stabilize meromixis over expected water quality for a theoretical mixing event.

14. MVEIRB-IR#14

14.1 Topic

Worst-case scenarios for water quality

14.2 Reviewer Comment

Diavik said that its modelling "…demonstrates the worst-case conditions…" for storage of processed kimberlite in the mine workings (PR#37, ORS comment 12).

14.3 Reviewer Recommendation

1. Please describe which modelling scenarios Diavik considers to be worst-case type scenarios (low-probability, high-consequence scenarios).

2. Please describe the risk (likelihood and consequence) of the worst-case type scenarios.

14.4 Developer's Response to MVEIRB-IR#14

1. The modelling scenarios originally assessed by DDMI and documented in Golder (2018) are considered by DDMI as worst-case type scenarios.

   These modelling scenarios are considered worst-case type because they include larger amounts of pore water release than are likely. For example DDMI expects around 2.0 Mm^3 of porewater to be release over 200 years as a base case (A418 Scenarion 2a) compared with the volumes assumed in Golder (2018) as follows:

   - 11.3Mm^3 over 200 years in A418;
   - 11.3Mm^3 over 200 years in A21; and
   - 21.1Mm^3 over 200 years in A154.

The Golder (2018) (see Appendix 2) modelling scenarios also assumed observed pore water quality from the Processed Kimberlite Containment (PKC) Facility that included results from unsaturated/weathered processed kimberlite (PK) material. This pore water generally contained higher concentrations of parameters of potential concern.

These worst-case modelling scenarios described above were then made even less likely by also assuming that a theoretical, unanticipated, full mixing event will occur as described in Golder (2018).

2. DDMI does not anticipate a reasonable likelihood that pore water release volumes of 21.3 or 11.3Mm^3 would occur. Golder (2018) demonstrates that even in these worst-case conditions Aquatic Effects Monitoring Program (AEMP). Benchmarks are achieved for the Development Cases.

   It is possible that some of the PK pore water could have water chemistry that is influenced by unsaturated/weathered PK in cases where the source of PK is the PKC Facility (all 3a Scenarios). Golder (2018) demonstrates that even in these worst-case conditions AEMP Benchmarks are achieved for the Development Cases.

   DDMI does not anticipate a reasonable likelihood that the accident/malfunction scenario of a pit-lake fully mixing would occur. Golder (2018) Table 3 (see Appendix 2) indicates that if the combination of unlikely large pore water volumes, higher than expected pore water quality and a theoretical, unanticipated mixing event occurred that AEMP benchmarks would likley be exceeded for several parameters in all development cases. Applying the CSR definitions of significance (CSR Section 2.4.3) would conclude that this single-event would not be classified as a significant adverse effect. Please see the Summary Impact Statement for a more comprehensive effects assessment.

   DDMI would like to emphasize that the unanticipated mixing event presented in Golder (2018) and described above was for an extreme worst case scenario and that updated modelling presented within the Summary Impact Statement describes more realistic risks (likelihood and consequence) for accident/malfunction scenarios.

15. MVEIRB-IR#15

15.1 Topic

Site-specific processed kimberlite characteristics and model predictions

15.2 Reviewer Comment

Diavik has responded to some information requests (PR#11: ENR3, ENR4, ENR 12, ENR14, WLWB1, WLWB5 WLWB18, WLWB22) with commitments:

- to further studies that are to be completed by the University of Alberta (e.g. processed kimberlite consolidation) in late 2019, and
- to additional modelling to be carried out in 2020 as part of the processed kimberlite Operating Plan or to inform the Closure and Reclamation Plan.

The Review Board seeks to understand key outstanding uncertainties and how Diavik plans to address these uncertainties.

15.3 Reviewer Recommendation

1. Do the sensitivity analyses completed by Golder in January 2019 cover the range of concerns and uncertainties raised by Parties in their information requests and the range of potential outcomes of the site-specific processed kimberlite testing being undertaken by the University of Alberta?

2. Does Diavik plan to repeat any of the pit modelling if results of the University of Alberta studies differ from the inputs used for existing models?

3. What is Diavik's level of confidence in the existing model results and how they may be influenced by the outcome of the University of Alberta studies?

15.4 Developer's Response to MVEIRB-IR#15

1. It is DDMI's understanding that the sensitivity analysis completed by Golder in January 2019 when combined with the additional model scneraios agreed to at the Wek'èezhìi Land and Water Board (WLWB) Technical Session cover the range of concerns and uncertainties raised by Parties. WLWB provided opportunity for all Parties to request additional information requests (IRs) following the Technical Session. No Party requested additional sensitivity analysis.

2. DDMI has consistently advised that the modelling work presented to date is preliminary and intended to address information requirements for the Preliminary Environmantal Screening (now Environmental Assessment) and the Water License Amendment Application. DDMI plans to conduct additional modelling in

the future to reflect updated information, including results from the University of Alberta studies. DDMI expects to submit updated modelling results in support of revised management plans and designs that we anticipate being required as a condition of an ammended water license.

3. DDMI has a high level of confidence in conclusions drawn from the collection of modelling results to date. Our view is supported by modelling and water quality experts who have conducted and advised DDMI, the conservative nature of the modelling structure, the worst-case of model input assumptions (as noted in MVEIRB IR#14) and the model sensitivity analysis. We expect results from the University of Alberta to confirm that the pore water quality conditions applied in Golder (2018) are towards the upper end of what might be expected in the future from anticipated processed kimberlite (PK) sources. Despite this confidence, if this project receives Environmental Assessment and Water License Ammendment approval work will continue to verify these conclusions with additional modelling and monitoring programs.

16. MVEIRB-IR#16

16.1 Topic

Surface water chemistry

16.2 Reviewer Comment

Diavik has modelled an unlikely destratification event at year 100 as a result of a pit wall collapse great enough to mix the entire 150 m deep water column. Under this scenario, Diavik has identified several AEMP benchmark exceedances, but concluded that these exceedances are "…unlikely to pose a risk to early life stages of fish…" (PR#13 PDF p118).

16.3 Reviewer Recommendation

1. Would an unanticipated mixing event before or after year 100 yield different effects to water quality? If so, please describe.

2. Would an unanticipated mixing event with a 50m water column yield different effects to water quality? If so, please describe.

3. Please describe any potential scenarios that would result in a greater disturbance to the pit lake (that is, full water column turnover and resuspension of processed kimberlite).

4. How does the threshold of "…unlikely to pose a risk to early life stages of fish" relate to existing or potential reconnection criteria?

16.4 Developer's Response to MVEIRB-IR#16

1. For the three (3) scenarios modelled for A418 following the Wek'èezhi`i Land and Water Board (WLWB) Technical Session as part of the Water Licence Amendment process for the Processed Kimberlite to Mine Workings Proposal, the maximum fully mixed concentration would occur before 100 years. Likewise, modelling of nine (9) scenarios that are presented in the Summary Impact Statement (SIS) demonstrates that the maximum fully mixed concentration also occurs within the first 100 years. Before or after 100 years fully mixed constituent concentrations would be lower in all scenarios. DDMI notes that for a few parameters in each of the modelled scenarios the maximum fully mixed concentration is at Year 0.

2. An unanticipated mixing event could yield different water quality results with a 50m freshwater cap compared with a 150m freshwater cap. A shallower freshwater cap allows more constituent mass to leave the pit lake than a deeper water cap. This is shown below by comparing A418 and A21 tracer results for Scenario 2a. An unanticipated mixing event within the first 10-30 years in A21 would yield a higher constituent concentration than if it occurred in A418. The converse is true if the unanticipated mixing event occurred in the final 10-30 years.

3. A greater disturbance to the pit lake could occur if PK was re-suspended as well as water being fully mixing. Golder (2018) determined than re-suspension of PK material is prevented with a freshwater cap as shallow as 20m. If resuspension did occur, it would only exist for a short-term duration.

4. The evaluation of Accidents and Malfunctions (i.e. an unanticipated mixing event) is assumed to occur after the dikes have been breached and the pit-lakes reconnected with Lac de Gras so the reconnection criteria would not apply. The residual environmental effects from this single-event elevated water quality conditons would be classified as short-term duration, high magnitude but likely limited to the local assessment area and reversible (See Summary Impact Statement for Effects Classification descriptions).

17. MVEIRB-IR#17

17.1 Topic

Water quality modelling

17.2 Reviewer Comment

Most modelling and studies to date have focused on A418, but Diavik is requesting permission to put processed kimberlite in A154 and A21. These pits have different characteristics, including different shape, size and hydrogeology, including faults (e.g., Lyndon's fault in A154) (PR#5 PDF p41).

17.3 Reviewer Recommendation

1. In what ways could the shape, size and individual hydrogeology characteristics of the A154 and A21 pits alter or affect water quality modelling results?

2. Describe the additional modelling work that would be required if A154 or A21 pits and mine workings were used for processed kimberlite storage instead of, or in addition to, A418.

17.4 Developer's Response to MVEIRB-IR#17

1. Comparing the modelling results for A418, A21 and A154 indicates that size and shape do influence water quality results as shown in the figures 4, 5, and 6 below. Surface water tracer concentrations are lower in A154 compared with A418 due to a greater pit volume. A21 surface water tracer concentrations are higher – particularly initially – compared with A418 due to smaller pit volumes. Tracer concentrations remain longer, particularly in the bottom water, in A418 and A154 compared to A21. Most the pore water tracer leaves the A21 pit lakes within about 60 years.

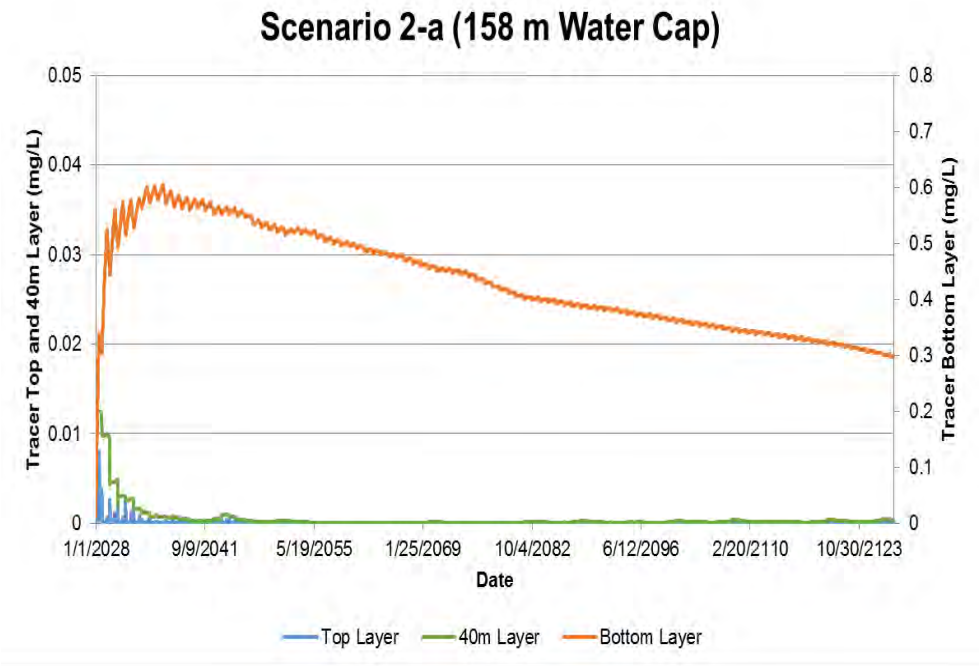


Figure 4: A418 Scenario 2a

A154 Scenario 2a

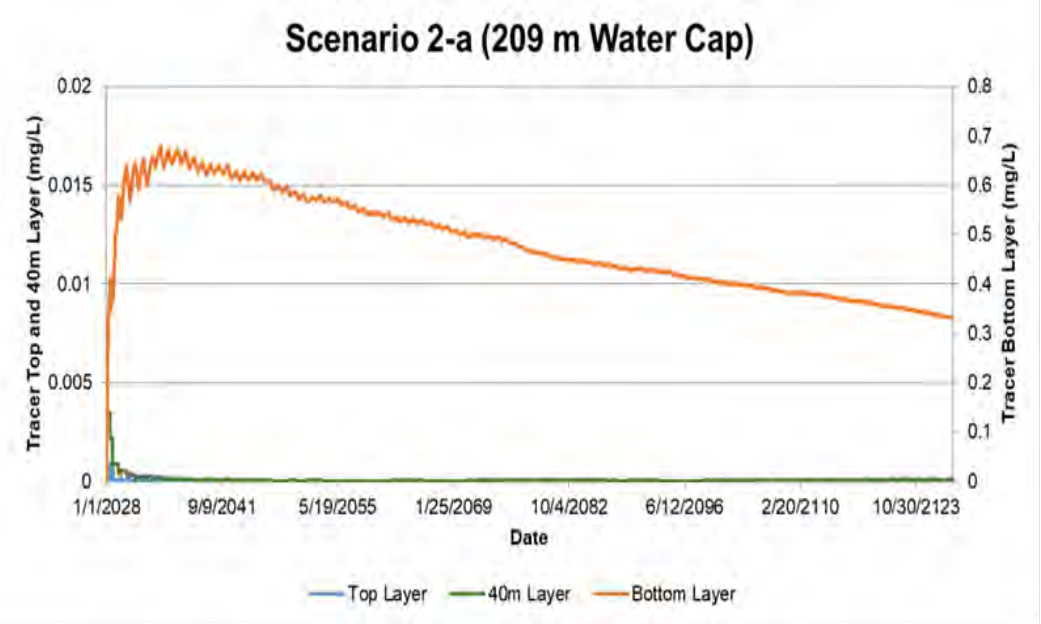


Figure 5: A154 Scenario 2a

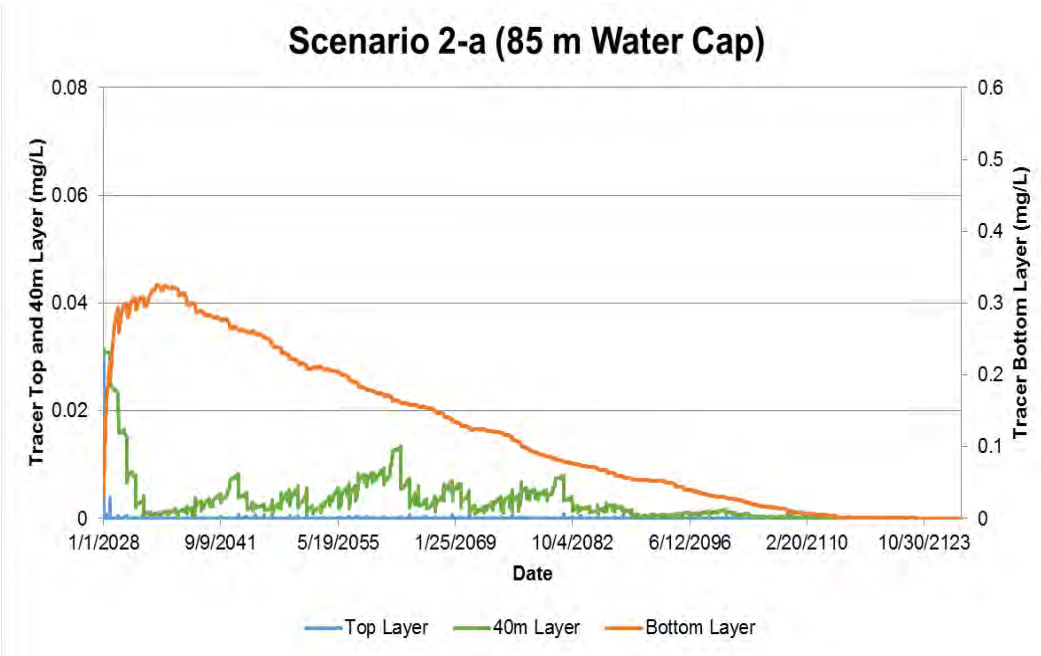


Figure 6: A21 Scenario 2a

2. Pit lake water quality modelling has now been completed for all three mine areas for a range of scenarios. As previously indicated this modelling is preliminary and intended to be indicative of expected pit lake water quality conditions to support requirements of an Environmental Assessment and Water License Amendment. Additional pit lake water quality modelling is planned to support future Water License submissions and will be specific to:
    - the planned processed kimberlite (PK) deposition location (A418, A154, A21),
    - the planned PK source (direct from process plant and/or removed from the Processed Kimberlite Containment [PKC] Facility),
    - planned PK volumes,
    - updated PK pore water chemistry and consolidation information, and
    - planned closure approach.

    DDMI's ongoing closure planning also includes modelling to predict post-closure water quality conditions in Lac de Gras resulting from:
    - elimination of the treated mine water discharge,
    - re-establishment of natural drainage routes for runoff from the east island,
    - runoff/seepage anticipated post-closure for waste rock storage areas, PKC Facility, site infrastructure and undisturbed areas; and
    - exchange of water with the pit lakes established in the three dike areas.

    DDMI provided a "Studies and Report Schedule" in response to the Wek'èezhìi Land and Water Board (WLWB) Technical Session IR-11. This has been revised and re-organized in Table 6 below to reflect anticipated current Environmental Assessment/Water License Amendment approval timelines and expected future Water License submission requirements for WLWB approval.

Table 6: Schedule for Future Studies and Reports

Planned Future Studies & Report Submission Schedule	2019		2020		2021		2022		2023		2024		2025
	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1
1. PK Laboratory Consolidation Testing													
2. Pit Lake Water Quality Modelling - PK to Mine Working Feasibility Study													
3. Hydrogeological and Geotechnical Assessment - PK to Mine Working Feasibility Study													
4. Mine Working Bulkhead Design													
5. Lac de Gras Water Quality Modelling - Predicted Post-Closure Conditions (V2)													
6. Processed Kimberlite Containment in Mine Working Design Report													
7. Processed Kimberlite Facility Management Plan - Update for PK to Mine Working													
8. Water Management Plan & Water Balance - Update for PK to Mine Working													
9. Contingency Plan - Update for PK to Mine Working													
10. Waste Management Plan - Update for PK to Mine Working													
11. Deposition of Operations PK to Mine Working													
12. EFPK Removal from PKC - Feasibility Assessment													
13. Pit Lake Water Quality Modelling - EFPK to Mine Working Option													
14. PKC Closure Options Assessment - Dry Cover vs Wet Cover													
15. Annual Closure and Reclamation Progress Report - PKC Closure Design Update													
16. Annual Closure and Reclamation Progress Report - LDG Water Quality Modelling Results (V3)													
17. Closure and Reclamation Plan													
18. Option - Deposition of EFPK from PKC													

Note:

Submissions Requiring WLWB Approval
Associated Studies
Deposition

18. MVEIRB-IR#18

18.1 Topic

Oxygen predictions for refilled pits

18.2 Reviewer Comment

Information requests ENR-3 and EMAB-30 from PR#23 speak to the composition of processed kimberlite and effect of fine processed kimberlite on dissolved oxygen status in the pits. In the absence of data on oxygen status or oxygen demand from processed kimberlite it is difficult to make predictions on oxygen status in the pits at closure and post closure. One might expect both chemical and nitrogenous oxygen demand from processed kimberlite, though biological oxygen demand appears less likely.

18.3 Reviewer Recommendation

Please provide an analysis of:

1. oxygen status in processed kimberlite pore water in the existing Processed Kimberlite Containment Facility, and

2. total oxygen demand in fine processed kimberlite and processed kimberlite at the time of deposition.

18.4 Developer's Response to MVEIRB-IR#18

1. Neither biological oxygen demand (BOD) nor chemical oxygen demand (COD) has been measured in the Processed Kimberlite Containment (PKC) Facility field investigations. However, dissolved oxygen (DO) was measured in 2011 and dissolved organic carbon (DOC) and redox potential (Eh) were measured in 2009, 2010 and 2011 in some pore water samples collected from the saturated zone of the PKC beach and from the water column and pore water of the fine processed kimberlite (FPK) beneath the barge. It should be noted that because the PKC also receives sewage, a source of organic carbon that is not present in the process circuit, caution should be applied to any comparison between the *in situ* measurements and any in-pit/underground or other direct deposition model.

   Pore water samples collected in 2011 from piezometers installed within saturated FPK on the PKC beach and the water column beneath the barge were anlayzed for DO using the Hach AccuVac Method 8166. Concentrations of DO in the three saturated beach FPK were 1.9, 4.4 and 5.8 mg/L at depths of 1.69, 2.65 and 3.83 m, respectively. Concentrations in the water column/FPK pore water beneath the barge were 0.9, 3.4, 2.1, 5.3, and 3.6 mg/L at depths of 10, 20, 30, 40, and 55 ft, respectively.

Concentrations of DOC typically ranged from 2.0 – 7.8 mg/L in pore water from saturated zones of the PKC beach, however shallower samples recorded concentrations between 16.7 and 41.4 mg/L. Samples collected in the water column and FPK pore water beneath the barge typically had much higher DOC concentrations in the more shallow samples (>35 ft deep; typically 35 – 630 mg/L) compared to the deeper samples (40- 75 ft deep; typically 3.3 – 6.9 m/L). The DOC in the PKC facility is likely related to sewage inputs. Nitrogen isotopic ratios ($\delta^{15}N\text{-}NO_3 + \delta^{18}O\text{-}NO_3$) measured from the PKC pond water and FPK pore water beneath the barge had signatures typical of sewage discharge.

Measurements of redox potential (Eh) in the water column and FPK pore water beneath the barge in 2009, 2010 and 2011, were typically 350-450 mV, including instances where concentrations of DOC were elevated. The lowest measured Eh value was 197 mV, suggesting mildly reduced conditions, at the deepest location measured beneath the barge (65 ft; 20 m) in 2009. Samples from this depth had measurements >350 mV in the subsequent sample years. Slurry discharge sampled in 2013 measured 351 mV. Measurements of Eh from saturated zones (n=21) in the FPK beach were more variable and typically lower than beneath the barge, with a range of -110.5 to 546.0 mV, but with values commonly between -85 and -46 mV; these values suggest the measured beach pore water was more reducing than the pore water from the FPK beneath the barge that were covered with a water cap. The dynamic nature of the water levels, sewage discharge, and slurry deposition confound interpretation.

The decomposition of organic matter occurs through a series of microbially-mediated reactions which liberate energy from the oxidation of organic molecules. In the decomposition process, microbial assemblages will preferentially utilize electron acceptors in order of their free energy yield. In the presence of dissolved oxygen, aerobic bacteria will utilize O_2 as a terminal electron acceptor since this redox reaction affords the greatest free energy. However, where the rate of O_2 consumption exceeds the rate of re-supply, oxygen will become depleted and other secondary oxidants will be utilized. These, in order of their free energy yield, include nitrate, Mn^{4+}-oxides (e.g. MnO_2), Fe^{3+}-oxides (e.g. $Fe(OH_3)$), sulphate (SO_4^{2-}), and carbon dioxide (CO_2) (Figure 7).

Next to oxygen, nitrate yields the greatest free energy, such that once oxygen is depleted, microbes will preferentially use nitrate as a terminal electron acceptor in the decomposition of organic matter. Nitrate concentrations in the bottom of the pit lake are predicted to be elevated which means there is a source of relatively high energy yield electron acceptors.

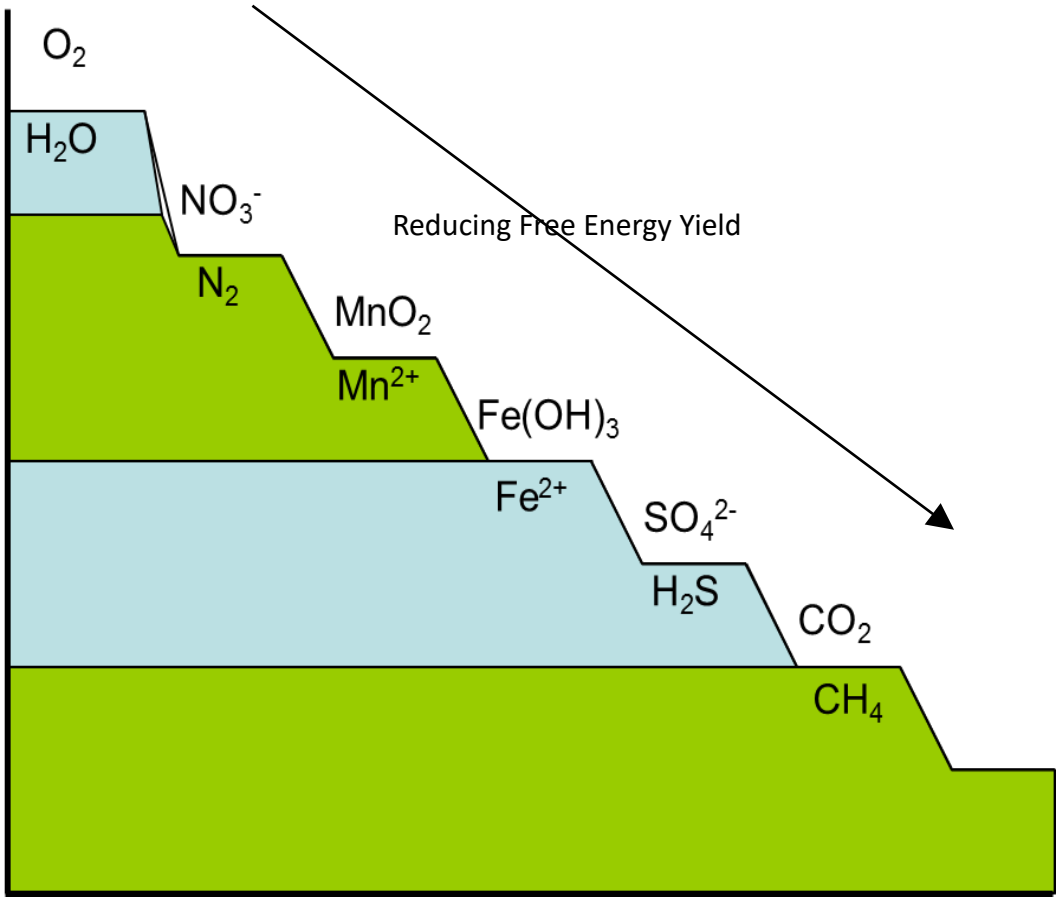


Figure 7: Terminal electron acceptors involved in the decomposition of organic matter and their related by-products, in order of free energy yield

2. To obtain information about COD and BOD of the fine processed kimberlite (FPK), DDMI collected FPK slurry directly from the process circuit on April 24, 2019. The FPK solids were analysed for total organic carbon (TOC) and the supernatant (i.e. process water) was measured for TOC, BOD and COD. The TOC of the FPK solids was 0.36%. The BOD of the process water was 6.1 mg/L, the COD was 26 mg/L and the TOC was 3.7 mg/L. It should be noted that the Process Plant reclaims water from the PKC facility, and, as noted above, sewage is discharged to the PKC facility and may be contributing organic carbon to the water used in ore processing.

19. MVEIRB-IR#19

19.1 Topic

Fresh processed kimberlite vs beach processed kimberlite pore water

19.2 Reviewer Comment

The Golder modelling report used pore water constituent concentrations from beach pore water samples for modelling (PR#11 PDF p13, Scenario 1a, Section 2.2.4.2 Table 1). Diavik later modified Scenario 1a by using pore water constituent concentrations derived from "fresh" processed kimberlite (at the time of deposition) for modelling (PR#16, IR5). However, for 27 of 35 constituents, concentrations in "fresh" processed kimberlite were substantially (up to 2 orders of magnitude) lower than in the beach pore water. The fine processed kimberlite will consolidate and exclude pore water over time.

19.3 Reviewer Recommendation

1. Please comment on the difference between results obtained using the two sources of pore water and which concentrations are most likely.

2. Which pore water inputs (fresh vs. beach) are the more likely and more conservative values to use?

19.4 Developer's Response to MVEIRB-IR#19

1. The sensitivity of A418 model results to the pore water chemistry was considered in response to a request from EMAB (EMAB-14) with results presented at the Wek'èezhìi Land and Water Board (WLWB) Technical Session. Sensitivity cases 7a increased pore water total dissolved solids (TDS) from 3504 mg/L to 6150 mg/L and 7b reduced TDS from 3504 mg/L to 346 mg/L. Predicted surface water quality was only slightly changed (decrease from 17 mg/L to 16 mg/L) when the TDS in the pore water was reduced (Sensitivity case 7b below). There was no change to the surface water quality from increasing the pore water TDS (Sensitivity case 7a below). Predicted bottom water quality was demonstrated to be very sensitive to the pore water quality. As shown in Table 7 below for Sensitivity Cases 7a and 7b, predicted water quality at the bottom of the pit lake is expected to be very similar to the assumed pore water quality.

Table 7: Sensitivity of A418 Model Results to Pore Water Chemistry (TDS Concentrations)

Parameter	Unit	Layer	Annual Average	Original Run	Sensitivity Case	
				A418 Pit Lake - Development Case	7a	7b
TDS Concentration	mg/L	Top (415 masl)	Year 1	16	16	16
			Year 20	16	16	16
			Year 30	16	16	16
			Year 100	17	17	16
		Bottom (265 masl)	Year 1	3019	5309	299
			Year 20	3540	6224	352
			Year 30	3533	6212	352
			Year 100	3521	6182	361

Separate from the sensitivity analysis, model results have been presented using different pore water quality. Golder (2018) (see Appendix 2) assumed pore water quality that was equal to the average measured pore water chemistry from studies conducted in the PKC Facility. These were expected to provide an upper end estimate of pore water quality because the results reflected weathered PK and PK that was not in a saturated condition. Both of these factors would be expected to generally increase constituent concentrations. The difference between saturated and unsaturated PKC beach pore water is shown below in Table 8. The profile used in Golder (2018) is shown in Table 8 as "In-situ PKC Beach Pore Water". At the Wek'èezhìi Land and Water Board Technical Session, discussion occurred around how representative this pore water would be of PK that would likely be disposed in mine workings. To address this DDMI developed two new pore water profiles to represent the two PK materials most likely to be deposited in mine workings, one for PK that is deposited directly from the process plant ("Fresh PK" in Table 8) and one that represents extra fine processed kimberlite (EFPK or "slimes") from the PKC Facility ('In situ Slimes Sampled from PKC barge" in Table 8). In the opinion of DDMI, the two profiles are based on the most representative data available. Both will be updated based on the results from the consolidation testing at the University of Alberta once they are available later in 2019.

2. The "Fresh PK" pore water profile is more likely than the "In-situ PKC Beach Pore Water" profile to represent PK that is being deposited directly from the process plant. The "In-situ PKC Beach Pore Water" profile would be more conservative and may a substantial overestimate. DDMI does acknowledge that the sample size for the "Fresh PK" is small and because the PK has not been in solution for very long, the constituent concentrations may be slightly underestimated. Again this uncertainty should be reduced with the University of Alberta.

Table 8: Comparison of water chemistry used as basis for assumption of future pore water chemistry from PK deposited to mine workings

			In situ PKC Beach Pore Water[1]				In situ PKC Beach Pore Water[2] Saturated Only				In situ PKC Beach Pore Water[3] Un-saturated Only				"Fresh" PK Slurry[4]			In situ Slimes Sampled from PKC barge[5]			
Parameter	Unit	Benchmark	Average	25th%tile of PK Pore Water Data	75th%tile of PK Pore Water Data	Number of Samples	Average	25th%tile of PK Pore Water Data	75th%tile of PK Pore Water Data	Number of Samples	Average	25th%tile of PK Pore Water Data	75th%tile of PK Pore Water Data	Number of Samples	Average	Data Range	Number of Samples	Average	25th%tile of PK Pore Water Data	75th%tile of PK Pore Water Data	Number of Samples
Calcium	mg/L	-	209	15	413	55	133	12	150	27	282	87	437	28	12	1.6 - 21	3	11	8	13	23
Chloride	mg/L	120	149	89	156	53	148	92	127	25	145	84	186	29	63	33 - 86	3	39	31	43	23
Fluoride	mg/L	0.12	0.14	0.0	0.0	53	0.4	<0.4	<0.4	25	0.4	<0.4	<0.4	29	0.14	<0.1 - 0.17	2	0.059	0.056	0.063	6
Magnesium	mg/L	-	412	19	677	55	241	13	191	27	578	126	968	28	7.2	2.2 - 16	3	27	21	33	23
Potassium	mg/L	-	166	49	290	55	117	41	135	27	213	127	297	28	138	66 - 176	3	56	42	68	23
Sodium	mg/L	52	155	61	235	55	115	56	131	27	194	89	264	28	85	43 - 109	3	54	46	63	23
Sulfate	mg/L	100	2315	112	4283	53	1327	57	969	25	3088	679	4887	29	208	59 - 329	3	197	162	234	23
Phosphate, Ortho	mg/L-P	-	0.059	<0.065	<0.13	53	0.065	0.033	0.131	25	0.065	0.033	0.131	29	0.031	<0.1 - 0.09	2	0.032	0.06	0.13	23
Phosphorus	mg/L	-	0.065	< 0.01	< 0.035	55	0.035	<0.003	<0.035	27	0.10	<0.01	0.063	28	0.035	<0.035 - <0.035	2	0.039	<0.035	<0.035	18
Aluminum	µg/L	87	153	21	93	55	172	24	80	27	134	18	140	28	0.14	<0.2 - 0.0054	3	2.8	<0.2	1.7	23
Antimony	µg/L	33	5.4	4.6	6.5	55	5.8	5.0	6.9	27	5.1	4.2	6.1	28	18	5.2 - 28	3	2.7	0.9	4.3	23
Arsenic	µg/L	5	3.0	2.2	3.7	55	3.0	2.3	3.7	27	3.1	2.2	3.5	28	5.9	1.6 - 11	3	4.8	3.1	6.1	23
Barium	µg/L	1000	449	124	438	55	452	72	432	27	446	150	434	28	155	81 - 264	3	51	43	58	23
Beryllium	µg/L	-	0.27	< 0.02	< 0.08	55	0.24	<0.08	<0.08	27	0.25	<0.25	<0.25	28	0.59	<0.03 - 0.59	3	3.3	<0.03	0.2	23
Boron	µg/L	1500	56	44	73	55	51	38	70	27	61	47	74	28	71	48 - 105	3	30	<0.2	50	23
Cadmium	µg/L	0.1	0.92	0.28	1.18	55	0.78	0.2	1.18	27	1.06	0.62	1.1	28	0.2	0.082 - 0.3	3	0.51	0.13	0.72	23
Cobalt	µg/L	-	5.6	0.52	7.35	55	1.6	0.4	2.3	27	9.4	2.5	9.8	28	0.19	0.17 - 0.2	3	0.15	<0.01	0.16	23
Copper	µg/L	2	8.6	3.0	11.8	55	7.5	2.5	7.7	27	9.8	4.2	13.8	28	2.6	<0.07 - 3.8	3	1.0	0.4	1.1	23
Iron	µg/L	300	234	18	171	55	97	15	76	27	366	32	310	28	1.4	<0.2 - 3.8	3	63	2	31	23
Lead	µg/L	1	0.88	0.16	0.79	55	0.65	0.14	0.56	27	1.09	0.38	0.83	28	0.51	0.068 - 1	3	0.28	0.02	0.23	23
Lithium	µg/L	-	3.8	2.1	5.2	55	2.9	1.4	4.0	27	4.6	2.5	6.9	28	5.0	5 - 5	1	-	0	0	0
Manganese	µg/L	-	82	11	116	55	31	6	38	27	131	21	173	28	0.34	<0.07 - 0.92	3	6.1	1.9	7.9	23
Molybdenum	µg/L	73	504	213	679	55	452	155	562	27	555	320	683	28	242	189 - 278	3	385	330	430	23
Nickel	µg/L	25	189	8.8	267.1	55	78	5	90	27	296	69	380	28	2.5	1.4 - 4.3	3	10	6	13	23
Selenium	µg/L	1	18	1.8	27.5	55	5	<0.2	2	27	23	8	34	28	0.72	0.72 - 0.72	1	0.5	0.08	0.58	22
Silicon	µg/L	2100	2605	<700	3880	55	2000	<200	<2000	27	3245	2386	4432	28	2781	2300 - 2300	3	1626	864	1182	23
Silver	µg/L	0.1	0.41	<0.004	0.314	55	0.24	<0.05	0.27	27	0.55	0.0	0.38	28	Note 6			Note 6			
Strontium	µg/L	30000	6701	< 1000	12510	55	4306	500	5118	27	8753	2446	12705	28	298	0.56 - 840	3	349	284	389	23
Sulfur	µg/L	-	782981	43195	1382000	55	474037	30575	364900	27	1080890	255600	1691750	28	92090	78180 - 106000	2	54820	47730	66130	7
Thallium	µg/L	0.8	0.65	0.26	0.72	55	0.5	0.25	0.46	27	0.8	0.32	0.89	28	0.16	<0.006 - 0.25	3	0.11	<0.07	0.06	23
Tin	µg/L	73	7.3	3.1	9.4	55	5.2	1.7	5.7	27	9.3	4.9	11.0	28	4.1	0.38 - 11	3	1.6	0.0	2.1	23
Titanium	µg/L	-	1.8	< 0.2	< 2.0	55	2.0	<2	<2	27	2.0	<2	<2	28	0.25	<0.2 - 0.34	3	1.1	0.0	0.3	23
Uranium	µg/L	15	1.1	0.061	1.099	55	0.7	0.0	0.1	27	1.6	0.3	2.0	28	0.2	0.058 - 0.45	3	0.56	0.01	0.8	17
Vanadium	µg/L	-	1.9	0.64	2.34	55	1.1	0.5	1.5	27	2.6	1.5	3.0	28	1.4	<0.03 - 2.8	3	1.3	0.0	2.1	23
Zinc	µg/L	30	348	15	321	55	130	10	113	27	557	64	418	28	2.5	7.4 - 7.4	3	136	1	13	23

1	Data from Moncur and Smith (2014) - assumed as basis for modelling pore water quality in Golder (2018)
2	Results summary for only samples from (1) with saturated conditions
3	Results summary for only samples from (1) with un-saturated conditions
4	Results from direct sampling of PK slurry as discharged to the PKC - 1 sample from each of 2009, 2012, 2013.
5	*In situ* slimes samples were collectedin 2009, 2010 and 2011 from piezometers installed at depths from 10-75 ft beneath the water surface at the PKC Reclaim barge
6	DDMI is not confident in the in situ slimes/slurry results and for the current modelling have assumed a slimes/slurry pore water quality of 0.24ug/L based on results for the saturated zone of in situ PK.

20. MVEIRB-IR#20

20.1 Topic

Sulphate in Pit Water

20.2 Reviewer Comment

Diavik provides predicted maximum concentrations in the surface waters of A418 after 100 years and compares the results to AEMP Benchmarks (PR#16, attachment 3). Sulfur concentrations of 1601 mg/L are predicted, and no benchmark is presented. Sulfur will oxidize to sulphate, and concentrations will exceed the Province of British Columbia hardness-dependent water quality objective for sulphate, which ranges from 128 mg/L in very soft (<30 mg/L) water to 429 mg/L in hard water (250 mg/L). Caribou will have access to the pit and the Canadian Council of Ministers of the Environment (CCME) provides a guideline of 1000 mg/L for livestock (although none for wildlife).

20.3 Reviewer Recommendation

1. Please provide an assessment of the potential for sulphate toxicity to aquatic life in the pit waters and wildlife consuming pit waters.

2. Please provide an assessment of potential aesthetic effects to water in Lac de Gras and the pit lake.

20.4 Developer's Response to MVEIRB-IR#20

1. DDMI notes that the units in the referenced predicted maximum concentrations in the surface waters of A418 after 100 years were incorrectly identified as mg/L. The predicted maximum concentration of sulfur in the surface waters of A418 is 1601 ug/L, or 1.601 mg/L. Assuming all sulfur oxidized to sulphate, the concentration will remain 25 times below the more stringent Province of British Columbia hardness-dependent water quality objective for sulphate in very soft water. Therefore, there is negligible risk for sulphate toxicity to aquatic life in the pits or wildlife consuming pit water.

2. At a sulfur concentration of 1.6 mg/L there is no expected aesthetic effect to the water in the pit lake, or Lac de Gras.

21. MVEIRB-IR#21

21.1 Topic

Toxicity of fine processed kimberlite

21.2 Reviewer Comment

In its application package, Diavik refers to “Updates to Monitoring and Management Plans to include…. Summary of toxicity studies done to date and upcoming studies” (PR#5 PDF p68). Diavik later stated that toxicity testing with processed kimberlite pore water showed no toxicity to fish and variable response to benthic invertebrates near processed kimberlite sediment (PR#13, p119).

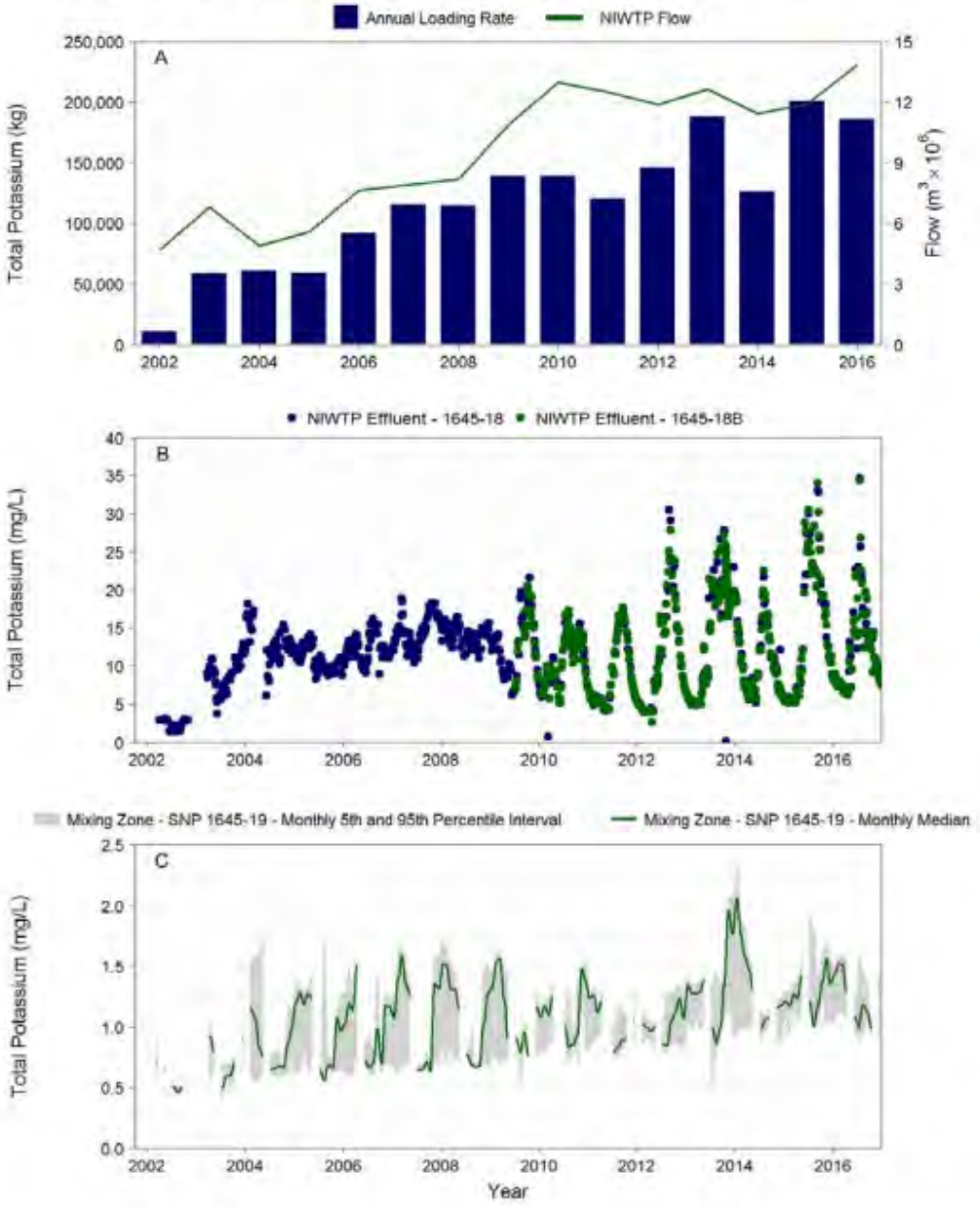
21.3 Reviewer Recommendation

Please provide a summary of all toxicity testing results for fine processed kimberlite and processed kimberlite pore water to fish and invertebrates.

21.4 Developer’s Response to MVEIRB-IR#21

DDMI regularly completes toxicity testing of water released to Lac de Gras as a condition of Water License W2015LS-0001. The water submitted for toxicity testing is from SNP 1645-18 and 1645-18B and is a mixture of underground and surface mine water, water pumped from the PKC Pond and collected site runoff. PKC Pond water quality is monitored regularly at SNP 1645-16 and reported monthly (see for example August 2018 SNP Report). PKC Pond water is a mix that includes both “Fresh PK Pore Water” and “In-situ PK Beach Pore Water” that are described in response to MVEIRB IR-19. PKC Pond water is pumped to the North Inlet seasonally and influences the concentrations of the water treated at the North Inlet Water Treatment Plant and released to Lac de Gras as shown below for potassium in Figure 4-9 (from the 2014-2016 AEMP Re-Evaluation Report 2014-2016 AEMP Re-Evaluation Report. Potassium concentrations in the treated discharge water (1645-18 and 1645-18B) increase seasonally from around 5 mg/L to around 25 mg/L primarily due to water pumped from the PKC Pond. PKC pond water can have potassium levels of 150 mg/L (see for example August 2018 SNP Report) so is not dissimilar to PK Pore Water (see Table 8 MVIRB IR#19). Water currently discharged to Lac de Gras at 1645-18/18B contains water quality constituents of PK pore water (such as potassium) with similar or higher concentration than modelled in post PK to Mine Working pit lake surface water. For example, predicted potassium results are shown in Figure 9 below for A418 Scenario 3a.

Figure 4-9 **Total Potassium: A) Annual Loading Rate from the North Inlet Water Treatment Plant and B) Concentration in Effluent (SNP 1645-18 and SNP 1645-18B) and C) at the Mixing Zone Boundary (SNP 1645-19), 2002 to 2016**



Note: Effluent values represent concentrations in individual samples. Mixing zone values represent the monthly median concentration and 5th and 95th percentile interval at three stations (i.e., SNP 1645-19A, SNP 1645-19B/B2, SNP 1645-19C) and five depths (i.e., 2 m, 5 m, 10 m, 15 m, and 20 m). Gaps in the mixing zone dataset reflect times when samples could not be collected due to hazardous sampling conditions (e.g., ice-on and ice-off periods).

NIWTP = North Inlet Water Treatment Plant; SNP = Surveillance Network Program.

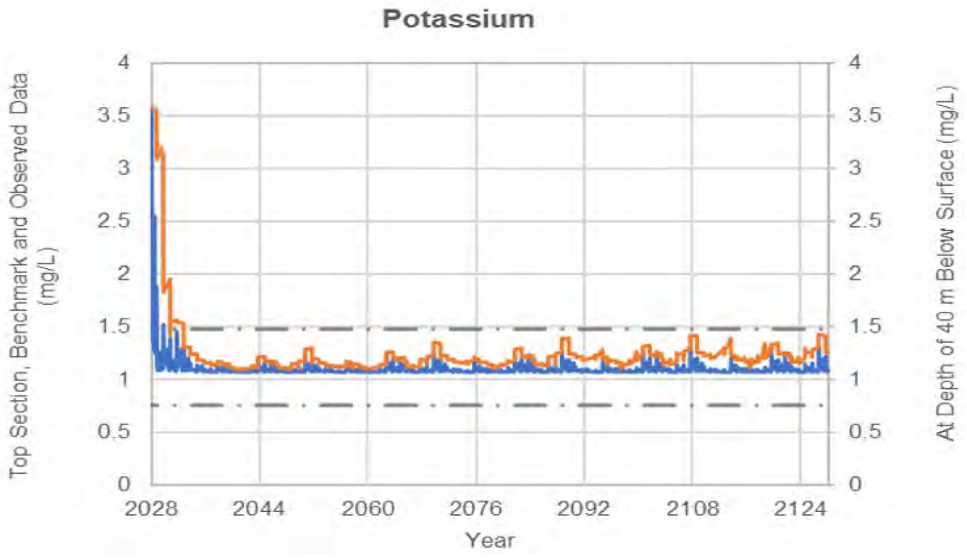


Figure 9: A418 Scenario 3a

For the reasons provided above DDMI suggests that the toxicity test results at 1645-18/18B can be considered when reviewing potential aquatic effects of PK deposition in mine workings. As such the following is a summary of these toxicity testing results (2008 – 2016) as reported in the 2014-2016 AEMP Re-Evaluation Report. In summary, all samples were generally non-toxic.

> *The results of lethal and sub-lethal toxicity testing from 2002 to 2016 indicated that the Mine effluent was generally non-toxic to aquatic test organisms (Tables 4-9 and 4-10; Golder 2016a,b,c and 2017c). From June 2002 to February 2008, a total of 160 effluent samples were submitted for acute and chronic lethality testing, and a total of 100 samples were submitted for sub-lethal testing. Toxicity test results demonstrated no toxic effects to aquatic test organisms in all but one of the samples submitted for lethal testing. Sublethal toxicity was observed in 12 samples during this period (see Golder 2016a, Appendix 4B, Tables 4B-1 and 4B-2). More recent results from March 2008 to December 2016 indicate that the effluent continues to be not acutely toxic, with only one of the 271 samples submitted for testing demonstrating acute toxicity (Table 4-9). One D. magna test in September 2010 at SNP 1645-18B had a result of greater than 50% mortality, indicating acute toxicity. To follow up on and confirm the September 2010 result, acute toxicity testing on D. magna was completed monthly in November and December 2010 and throughout 2011, and indicated no acute toxicity. Of the 191 effluent samples collected from March 2008 to December 2016 for sub-lethal toxicity testing, only six demonstrated sub-lethal toxicity (Table 4-10). Reductions in C. dubia reproduction were detected in tests of effluent conducted in June 2009, September 2010, March 2014, December 2014 and December 2015. A reduction in embryo vitality for Rainbow Trout was detected at Station SNP 1645-18B for a sample collected on 30 August 2016. Mean Rainbow Trout embryo viability was*

79.6% in the control and 69.2% in the sample exposed to 100% effluent. However, a follow-up sample collected at this location on 13 September 2016 had a relative difference of 0.8% from the control. The repeat sample was considered a pass, and results for all other test species demonstrated no toxic response.

Table 4-9 Acute and Chronic Lethality Toxicity Testing Results, North Inlet Water Treatment Plant Effluent, 2008 to 2016

Species	Month	2008[b]	2009		2010		2011		2012		2013		2014		2015		2016	
		1645-18	1645-18	1645-18B	1645-18	1645-18B	1645-18	1645-18B	1645-18	1645-18B	1645-18	1645-18B	1645-18	1645-18B	1645-18	1645-18B	1645-18	1645-18B
Rainbow Trout[a]	January	[c]	-	-	-	-	Pass	Pass	-	-	Pass	Pass	-	-	-	-	-	-
	February	[c]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	March	Pass	Pass	-	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
	April	Pass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	May	Pass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pass	Pass
	June	Pass	Pass	-	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	-	-
	July	Pass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	August	Pass	-	-	-	-	Pass	Pass	-	-	-	-	-	-	-	-	Pass	Pass
	September	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	-	Pass	Pass	-	-
	October	[d]	-	-	-	-	-	-	-	-	-	-	-	Pass	-	-	-	-
	November	[d]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	December	Pass	Pass	Pass	Pass	Pass	Pass	-	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass
Ceriodaphnia dubia[a]	January	[e]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	February	[e]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	March	[e]	[e]	[e]	[e]	[e]	[e]	[e]	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
	April	[e]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	May	[e]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pass	Pass
	June	[e]	[e]	[e]	[e]	[e]	[e]	[e]	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	-	-
	July	[e]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	August	[e]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pass	Pass
	September	[e]	[e]	[e]	[e]	[e]	[e]	[e]	Pass	Pass	Pass	Pass	Pass	-	Pass	Pass	-	-
	October	[e]	-	-	-	-	-	-	-	-	-	-	-	Pass	-	-	-	-
	November	[e]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	December	[e]	[e]	[e]	[e]	[e]	[e]	[e]	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

Table 4-9 Acute and Chronic Lethality Toxicity Testing Results, North Inlet Water Treatment Plant Effluent, 2008 to 2016

Species	Month	2008[b]	2009		2010		2011		2012		2013		2014		2015		2016	
		1645-18	1645-18	1645-18B	1645-18	1645-18B	1645-18	1645-18B	1645-18	1645-18B	1645-18	1645-18B	1645-18	1645-18B	1645-18	1645-18B	1645-18	1645-18B
Daphnia magna[a]	January	[c]	-	-	-	-	Pass	Pass	-	-	-	-	-	-	-	-	-	-
	February	[c]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	March	Pass	Pass	-	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
	April	Pass	-	-	-	-	Pass	Pass	-	-	-	-	-	-	-	-	-	-
	May	Pass	-	-	-	-	Pass	Pass	-	-	-	-	-	-	-	-	Pass	Pass
	June	Pass	Pass	-	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	-	-
	July	Pass	-	-	-	-	Pass	Pass	-	-	-	-	-	-	-	-	-	-
	August	Pass	-	-	-	-	Pass	Pass	-	-	-	-	-	-	-	-	Pass	Pass
	September	Pass	Pass	Pass	Pass	Fail[g]	Pass	Pass	Pass	Pass	Pass	Pass	Pass	-	Pass	Pass	-	-
	October	[d]	-	-	-	-	Pass	Pass	-	-	-	-	-	Pass	-	-	-	-
	November	[d]	-	-	Pass	Pass	-	-	Pass	Pass	-	-	-	-	-	-	-	-
	December	Pass	Pass	Pass	Pass	Pass	-	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Hyalella azteca[a]	January	[f]	Pass	-	-	-	-	-	-	-	-	-	-	-	Pass	Pass	-	-
	February	[f]	Pass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	March	[f]	Pass	-	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
	April	[f]	Pass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	May	Pass	Pass	-	-	-	-	-	-	-	-	-	-	-	-	-	Pass	Pass
	June	Pass	Pass	-	Pass	Pass	-	-	-	-	Pass	Pass	Pass	Pass	Pass	Pass	-	-
	July	Pass	[d]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	August	Pass	[d]	-	-	-	Pass	Pass	-	-	-	-	-	-	-	-	Pass	Pass
	September	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	[h]	[h]	Pass	-	Pass	Pass	-	-
	October	Pass	-	-	-	-	-	-	-	-	-	-	-	Pass	-	-	-	-
	November	Pass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	December	Pass	Pass	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	-	-	Pass	Pass

a) Test is considered a "fail" if mortality is ≥50%.
b) Results for SNP 1645-18B are reported from 2009 and later.
c) Acute toxicity testing results in January and February of 2008 are presented in Appendix 4A, Table 4A 1 of Golder 2016a.
d) Monthly testing was no longer required.
e) The *Ceriodaphnia dubia* test was not performed prior to March 2012.
f) The *Hyalella azteca* test was not performed prior to May 2008.
g) 100% mortality of test organisms reported.
h) The effluent sample collected in September for *Hyalella azteca* testing was misplaced in transit from the Mine to the analytical laboratory.
- = data not available.

Table 4-10 Sub-lethal Lethality Toxicity Testing Results, North Inlet Water Treatment Plant Effluent, 2008 to 2016

Species	Month	2008	2009		2010		2011		2012		2013		2014		2015		2016	
		1645-18	1645-18	1645-18B	1645-18	1645-18B	1645-18	1645-18B	1645-18	1645-18B	1645-18	1645-18B	1645-18	1645-18B	1645-18	1645-18B	1645-18	1645-18B
Rainbow Trout[a]	January	-	-	-	-	-	-	-	-	-	Pass	Pass	-	-	Pass	Pass	-	-
	March	Pass	Pass	-	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass
	April	-	-	-	-	-	-	-	-	-	-	-	-	-	Pass	Pass	-	-
	May	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pass	Pass
	June	Pass	Pass	-	Pass	Pass	-	-	Pass	Pass	-	-	Pass	Pass	Pass	Pass	-	-
	July	-	-	-	-	-	-	-	-	-	Pass	Pass	-	-	-	-	-	-
	August	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Fail[j]
	September	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass[g]	Pass	Pass	Pass	Pass	-	Pass	Pass	-	Pass
	October	-	-	-	-	-	-	-	-	-	-	-	-	Pass	-	-	-	-
	December	Pass	Pass	Pass	Pass	Pass	Pass	-	Pass	Pass	-	-	Pass	Pass	-	-	Pass	Pass
Ceriodaphnia dubia[b]	March	Pass	Pass	-	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail[h]	Pass	Pass	Pass	Pass	Pass
	May	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pass	Pass
	June	Pass	Pass[d]	-	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	-	-
	August	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pass	Pass
	September	Pass	Pass	Pass	Fail[e]	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	-	Pass	Pass	-	-
	October	-	-	-	-	-	-	-	-	-	-	-	-	Pass	-	-	-	-
	December	Pass	Pass	Pass	Pass	Pass	-	Pass	Pass	Pass	Pass	Pass	Fail[i]	Pass	Fail[i]	Pass	Pass	Pass
Pseudokirchneriella subcapitata[c]	January	-	-	-	-	-	-	-	-	-	-	-	-	-	Pass[f]	Pass[f]	-	-
	March	Pass	Pass	-	Pass	Pass	Pass[f]	Pass[f]	Pass	Pass	Pass	Pass	Pass[f]	Pass[f]	Pass[f]	Pass[f]	Pass[f]	Pass[f]
	May	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pass[f]	Pass[f]
	June	Pass	Pass	-	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass[f]	Pass[f]	Pass[f]	Pass[f]	-	-
	August	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pass	Pass[f]
	September	Pass	Pass	Pass	Pass	Pass	-	Pass[f]	Pass	Pass	Pass	Pass	Pass[f]	-	Pass[f]	Pass[f]	-	-
	October	-	-	-	-	-	-	-	-	-	-	-	-	Pass[f]	-	-	-	-
	December	Pass	Pass	Pass	Pass	Pass	-	-	Pass	Pass	Pass	Pass	Pass[f]	Pass[f]	-	-	Pass[f]	Pass[f]

a) Trout embryo (early life stage) survival test is considered a "fail", if reduction in viable embryos is ≥50% compared to control.
b) Test is considered a "fail" if inhibitory effect on reproduction compared to control in ≥50%.
c) Test is considered a "fail" if reduction in growth compared to control is ≥50%.
d) Initial test results indicated that% mortality was 60%. When the sample was reanalyzed to verify the results, mortality was 0%.
e) The% mortality in this sub-lethal test on effects to reproduction was 70%.
f) Lab results indicate enhanced algal growth compared to the control.
g) The result for this test was a marginal pass (reduction in viable embryos compared to the control was 48%).
h) The result for the test was a marginal fail (inhibitory effect on reproduction compared to the control was 53%).
i) The result for this test was a marginal fail (inhibitory effect on reproduction compared to the control was 50%).
j) The result for this test was a fail (embryo vitality was 69.2%; a relative difference compared to the control of 10.4%).

DDMI commissioned a toxicological characterization of the Extra Fine Processed Kimberlite (EFPK) also referred to as “slimes”. The study was done at the request of Diavik’s Traditional Knowledge Panel to help understand possible closure conditions within the Processed Kimberlite Containment (PKC) Facility with a shallow surface pond covering EFPK. This is the current approved PKC Facility closure plan.

The toxicological testing was conducted directly on whole EFPK, EFPK pore water and an EFPK leachate. This testing assumes benthic organisms, algae, zooplankton and fish would be living directly on or in the EFPK/EFPK water. While these are appropriate assumptions for toxicity characterization testing it is imperative that this context be considered when applying the toxicity characterization resultrs to PK deposited in mine workings. The PK deposited in mine workings would remain more than 50 m below the water surface and is not expected to be utilized by aquatic life. The testing was done using EFPK which is expected to have higher constituent concentrations than “Fresh PK” as discussed in response to IR-19.

With this important context, below is verbaitim from the Executive Summary of *Characterization of Extra Fine Processed Kimberlite Tailings from the Diavik Diamond Mine Processed Kimberlite Containment Pond.* Karsten Liber and Lorne Doig. Toxicology Center , Univeristy of Saskatchewan. January 2016 2015 Annual Closure and Reclamation Progress Report

> This study was designed to physically, chemically and toxicologically characterize the extra fine processed kimberlite tailings (EFPKTs) that have accumulated at the center of the Diavik Containment Pond located at the Diavik Diamond Mine, NT. The goal was to determine the effects that the whole EFPKTs, EFPKTs pore water (isolated from EFPKTs) and EFPKTs leachate (created from the tailings) would have on aquatic species representing a variety of trophic levels. The EFPKTs itself was tested as whole tailings using two benthic species, *Chironomus dilutus* and *Hyalella azteca*, which are routinely used in standardized sediment toxicity tests. In addition, *Hyalella azteca* were exposed to EFPKTs pore water and leachate, and to Containment Pond surface water. EFPKTs pore water and leachate were also tested with an algal species, *Pseudokirchneriella subcapitata* (pore water and leachate), a daphnid species, *Daphnia pulex* (pore water only), and a fish species, *Onchorhynchus mykiss* (leachate only). In addition, *P. subcapitata* and *D. pulex* bioassays were conducted with pore water extracted from the tailings to represent a worst-case exposure scenario. The water used as overlying water in the whole tailings tests and as leachate extraction water was formulated (i.e., reconstituted) to simulate the characteristics of Diavik Containment Pond Water (CPW).
>
> Whole EFPKTs, extracted pore water and leachate produced from the EFPKTs had mixed effects on the aquatic organisms used in this study. Biological endpoints such as growth and survival were reduced in the highest concentrations of whole tailings,

tailings pore water, or tailings leachate tested for some organisms and test durations, but the differences were often not statistically significant compared to the respective controls. However, whole EFPKTs clearly reduced *C. dilutus* survival. For *H. azteca*, the interpretation of response was complicated by stress accompanying exposure to CWP and uncontaminated RCPW compared to Saskatoon municipal water, but test results suggest that exposure to whole EFPKTs reduced animal survival (although not statistically significantly). Isolated pore water affected *D. pulex* in the acute 4-d test (reduced survival) and the chronic 21-d tests (reduced survival and reproduction; response was possibly complicated by the presence of waste water treatment polymers). Leachate demonstrated no statistically significant effects on *D. pulex* (4-d acute test) and *H. azteca* (10-d test), and was clearly not toxic to rainbow trout (*O. mykiss*; acute 4-d and chronic 28-d leachate exposures). From review of all data generated, the main constituents of toxicological concern in the whole EFPKTs appeared to be nitrogenous substances (specifically ammonia and nitrite). This is supported by the reduced toxicity of isolated pore water and leachate compared to whole EFPKTs. Isolated pore water and leachate were aerated prior to testing and as a result had substantially lower concentrations of ammonia compared to unmanipulated EFPKTs pore water. Based on their relative ease of extraction using dilute acid, metals such as chromium and nickel are potentially available through both aqueous and dietary routes of exposure for deposit feeders such as *C. dilutus* and could possibly contribute to toxicity in some cases.

22. MVEIRB-IR#22

22.1 Topic

Processed kimberlite consolidation in a partially filled pit

22.2 Reviewer Comment

Estimates of pore water exclusion presented during the technical meeting appear to have been derived assuming that the pits are full of processed kimberlite (PR#13, PDF p42-43). Consolidation should increase with the weight of processed kimberlite. In other words, a full pit will compress more pore water from processed kimberlite at deeper lower depths. However, Diavik does not plan to fill the pits with processed kimberlite. This will change the estimates of pore water volume, and hence water quality, in the refilled pit.

22.3 Reviewer Recommendation

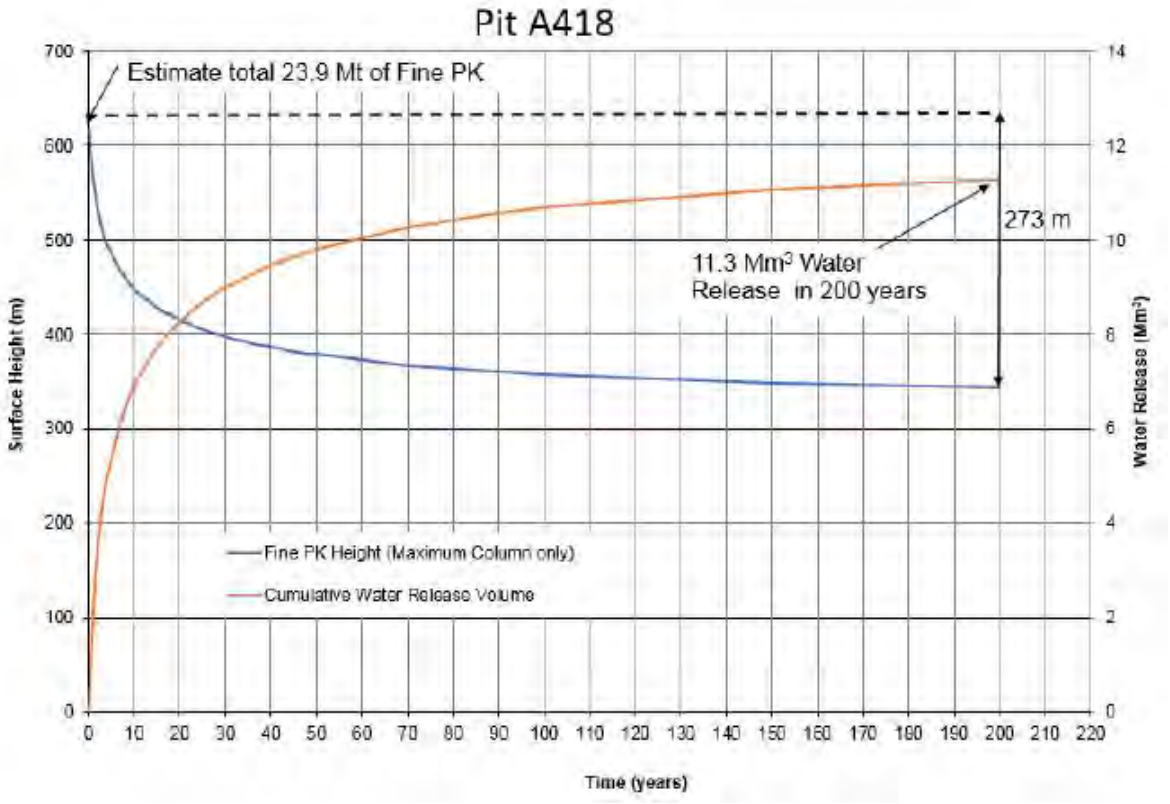
1. Please confirm if the estimate of processed kimberlite consolidation and pore water exclusion corresponds to a pit filled with processed kimberlite to within 150m of the top over the four-year planned infill period.

2. If not, please comment on how this may change the modelled estimates of water quality.

22.4 Developer's Response to MVEIRB-IR#22

1. Yes the pore water release rates used in the modelling scenarions for the Wek'èezhìi Land and Water Board (WLWB) Technical Session IR-5 were scaled down to represent a smaller volume of processed kimberlite (PK). For example, for A418 Scenario 2a the 5 Mm^3 of deposited PK over four (4) years is estimated to fills the pit/underground to the 258m elevation. The requested 5m of decant water brings the level of the top of the decant water to the 263m elevation. With a Lac de Gras water level of 416m this allows for a 150m (actually 153m) deep freshwater cap. In the modelling the pore water from consolidation is not assumed to start until the freshwater cap is placed – a conservative simplification. The time-series of pore water volume released in the A418-2a modelling is the sclaed down by a factor of 0.17 from the release curve shown below from Figure 2 in Golder (2018) (see Appendix 2) to account for the lesser amount of PK.

2. Please see response to 1 above.



23. MVEIRB-IR#23

23.1 Topic

Impacts to hydrology

23.2 Reviewer Comment

Diavik indicated that additional detail on the anticipated time required to backfill the pits could be found in V4.0 of the Interim Closure and Reclamation Plan, Appendix X-7.1 and X-7.2 (PR#23, GNWT-ENR IR#6). These documents offer a range of backfilling rates spanning 6 months to 2 years. Diavik has elsewhere indicated that the pits will be "rapidly filled", partially in order to minimize groundwater inputs (PR#11, PDF p19). Closure objectives M6 and M7 relate to maintaining pit fill rates that maintain water levels and protect fish and fish habitat in Lac de Gras and the Coppermine River, respectively (PR#8 p297).

23.3 Reviewer Recommendation

1. Please define the timeline implicit in a decision to “rapidly fill” the pits at closure.

2. Does putting processed kimberlite in the pits and underground mine workings change the considerations (such as rate and timing) for backfilling the pits at closure? If so, how?

3. If yes, please identify any and all potential impacts to:

   - the hydrology of Lac de Gras, the Narrows between Lac du Sauvage and Lac de Gras, and the outflow to the Coppermine River; and

   - fish or fish habitat in Lac de Gras, the Narrows between Lac du Sauvage and Lac de Gras, and the outflow to the Coppermine River.

4. Please discuss if and how putting processed kimberlite into pits and underground mine workings will affect Diavik's ability to meet closure objectives M6 and M7.

23.4 Developer's Response to MVEIRB-IR#23

1. DDMI has developed a range of pit filling design options that allow for freshwater cap fill rates ranging from 6 months to 2 years as shown below from Appendix X-7.2 of Closure and Reclamation Plan, Version 4.0. A "rapid fill" would be 6 months.

Table 4: Pit Back-Flooding System Design for Flooding from 0% to 100%

Parameter	Units	6 Months		1 Year		2 Years	
		A418	A154	A418	A154	A418	A154
Total Flow Rate	m^3/h	7,580	14,080	3,720	6,910	1,800	3,200
Number of Pipes	-	2	4	2	2	2	2
Operational Flow Rate per Pipe	m^3/h	3,790	3,520	1,860	3,455	900	1,600
Unrestricted Flow Rate per Pipe	m^3/h	4,011	3,661	2,092	3,661	927	2,092
Nominal Pipe Diameter	inch	36	36	30	36	20	30
Δz	m	6	5	4	5	6	4
Flow Velocity	m/s	2.41	2.18	1.79	2.18	1.79	1.79
Froude Number	-	0.88	0.79	0.71	0.79	0.87	0.71

2. The closure planning basis has been to fill at a high flow rate (6 months) once filling commences and this is not materially changed if processed kimberlite (PK) is deposited in mine workings. The volume of freshwater required would be at least $5Mm^3$ less if PK is deposited compared with the current closure plan because part of the mine void that would have required filling with freshwater would have already been filled with PK. Timing of filling with the freshwater cover could be delayed if it proves preferable to bring extra fine processed

kimberlite (EFPK) from the PKC and it takes more time to complete the EFPK removal.

3. Depositing PK in mine workings would not impact on hydrology, fish or fish habitat in Lac de Gras, the Narrows between Lac du Sauvage and Lac de Gras, or the outflow to the Coppermine River.

4. Depositing PK into mine pits and underground workings will not materially affect Diavik's ability to meet closure objectives M6 and M7. Depositing PK into mine pits and underground workings would reduce the amount of Lac de Gras water required for filling by at least 5Mm^3 as this volume would now be filled with PK.

24. MVEIRB-IR#24

24.1 Topic

Rate of pit Infilling with water and fine processed kimberlite disturbance

24.2 Reviewer Comment

Diavik provided details on how the rate of freshwater input to the pits at closure may influence density stratification (PR#11, response to EMAB IR#5; PR#13 slides 79-83). Based on Diavik's information, it appears that a substantial layer of high-density groundwater or excluded pore water is required prior to refilling in order to set up and maintain meromixis. The Review Board questions whether substantial hydraulic head and associated energy input may accompany the initial stages of pit infilling. This could induce mixing of the low-density fresh water with the higher density mine water, thus preventing the desired degree of stratification and meromixis.

24.3 Reviewer Recommendation

1. Please describe how stratification will be set up and maintained during infilling with Lac de Gras water if the turbulence associated with the inflow disturbs the higher density layer?

2. How will Diavik monitor the resuspension of fine processed kimberlite during the pit refilling?

3. How will Diavik mitigate any adverse effects of resuspension?

24.4 Developer's Response to MVEIRB-IR#24

1. Water quality modelling of A418 Scenario 2a (shown in Figure below) for example assumes a 5m deep layer of decant pore water over the deposited PK when the infilling with the freshwater cap begins. It is also assumed for these scenarios that the turbulence associated with the inflow would fully mix the higher density decant pore water layer with the freshwater cap. The initial full

mixing of the higher density decant pore water with the infilled freashwater cap is shown below where the initial TDS concentration (Year 2028) in the surface, 40 m depth and bottom are all around 25 mg/L. Over the first few years the higher density bottom layer establishes supporting a stable meromixis.

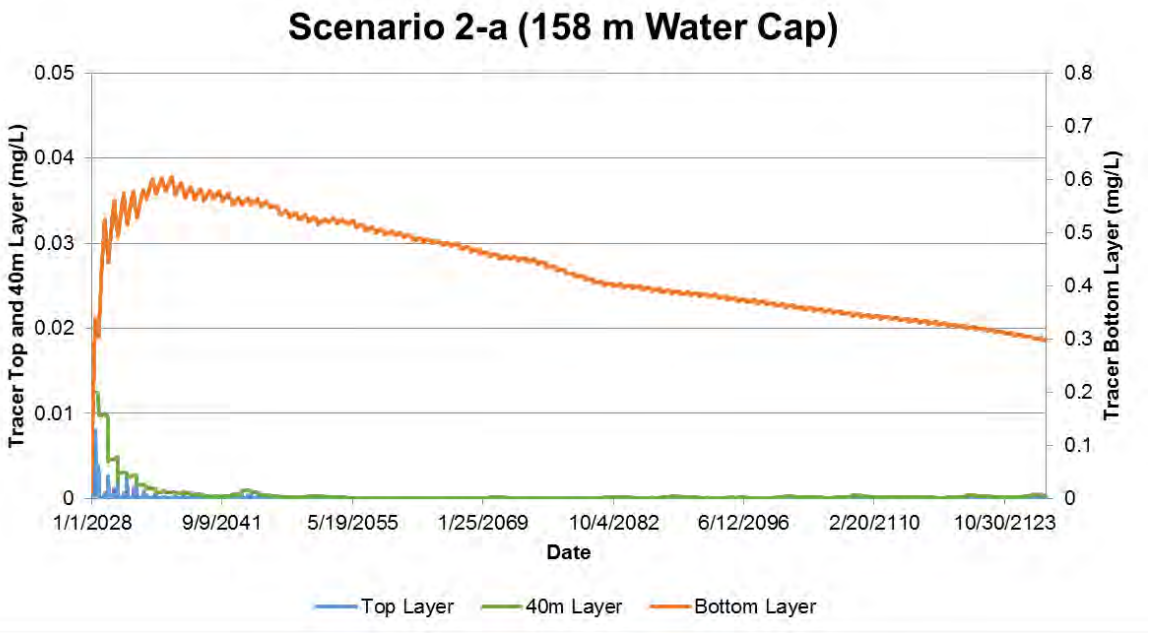


Figure 8: A418 Scenario 2a

2. Water quality monitoring during the short period of active infilling will not be practical/safe or necessary as the mine area will remain separated from Lac de Gras by the water retention dikes. Once the water level of the freshwater cap and Lac de Gras are equal, monitoring would commence as described in response to MVEIRB IR#10 above.

3. A two-year period is planned between when the infilling of the freshwater cap is complete and before the dike breaches are excavated. This period is designed to allow for settling of any re-suspended material and to monitor water quality to confirm that it is acceptable for reconnection with Lac de Gras. This approach is expected to mitigate any adverse effects from initial resuspension.

25. MVEIRB-IR#25

25.1 Topic

Groundwater inflow to A418

25.2 Reviewer Comment

Diavik provided estimated decant volumes as a function of inputs of fine processed kimberlite slurry and groundwater to A418 (PR#16, IR#1). The volume of groundwater inflow is the same in each of the four years of the analysis. One would expect that groundwater input would decrease as the pit is filled and hydraulic head in the pit increases.

25.3 Reviewer Recommendation

Please explain why Diavik considered the groundwater inputs to be constant for the four years of fine processed kimberlite infill to A418.

25.4 Developer's Response to MVEIRB-IR#25

During the four (4) years of processed kimberlite depostion in A418 the groundwater inputs would be expected to gradually reduce as the water level within the mine workings increases. In the simplified analysis Diavik has conservatively assumed groundwater inputs have remained constant over the four years. This conservative assumption results in an over-estimate of the amount of decant water that would need to be managed during operations. The operational treatment capacity of the North Inlet Water Treatment Plant is 33 Mm^3/year, or 131 Mm^3 between 2022 and 2025 (period of potential PK filling). The expected reduction of groundwater inflow would have a neglidgible impact on the site water balance and would remain within the treatment capacity of the plant.

RioTinto

Appendix 1

Post-closure Monitoring and Reporting

Post Closure Monitoring and Reporting

VI-1 Open Pit, Underground and Dike Areas

VI-2 Wasterock and Till Area (See NCRP-WRSA Final Closure Plan V1.1)

VI-3 Processed Kimberlite Containment Area

VI-4 North Inlet Area

VI-5 Mine Infrastructure Areas

Appendix VI-1 Post Closure Monitoring and Reporting - Open Pit, Underground and Dike Areas

Two types of post-closure monitoring programs are planned: performance monitoring specific to the open pit, underground and dike area and environmental effects monitoring which would include combined effects from all post-closure areas. These are described in Section 1.0 with the type and frequency of reporting described in Section 2.0.

1.0 Performance Monitoring

1.1 Geotechnical

During mining operation the dike, open-pit and underground areas undergo regular geotechnical inspections. As fish habitat work within the dike areas are complete geotechnical inspections will review these areas. Once the underground and pit areas have been flooded inspections will focus on dike and shoreline stability. No geotechnical instrumentation is planned once the back-flooding is complete.

An aerial drone survey will be conducted starting the year prior to back-flooding and then for the following 5 years. The survey before back-flooding will document the constructed fish habitat in each dike area and be submitted separately to Fisheries and Oceans Canada.

1.2 Water Quality

Water quality is monitored during operations at several SNP locations that include underground mine water, open-pit mine water and dike seepage water. This monitoring will cease once back-flooding commences. Immediately following completion of the back-flooding of each of the A154, A418 and A21 dike areas, post-closure SNP monitoring of the dike areas will begin at the following SNP locations:

SNP Site #	Description
1645-87 (new)	A154 Back-flooded area
1645-88 (new)	A418 Back-flooded area
1645-89 (new)	A21 Back-flooded area

Water quality will be sampled monthly until water quality is approved to allow breaching of each dike. Samples will be collected from surface, 15m depth and 30m depths. Water samples will be analyzed for the parameters listed below (source W2015L2-0001 – SNP 1645-81). Profiles for temperature, turbidity, conductivity and dissolved oxygen will be recorded over the first 30 m of depth during each sampling event. Twice per year deep water quality samples will be collected from approximately 25 m above the pit bottom, if feasible.

Sampling Parameters:	Total Ammonia, Field Parameters[3], ICP-MS Metal Scan[1](Total), Major Ions[2], pH[4], Total Petroleum Hydrocarbons

After each of the dikes have been breached and rejoined with Lac de Gras the frequency of SNP monitoring will be reduced to twice per year.

1.3 Wildlife

DDMI will employ existing monitoring procedures (as updated from time-to-time) to record wildlife use of the mine and dike areas and observations of behavior when animals are present in these

areas. These procedures include:

ENVR-031-0720 – Caribou Road Surveys
ENVR-517-0912 – Caribou Management/Observation
ENVR-531-0812 – Wildlife Monitoring

1.4 Dust

DDMI will use the existing Total Suspended Particulate (TSP) monitoring system and procedures (as updated from time-to-time) combined with visual observations to monitoring dust generated from the dike and mine areas post-closure. This monitoring will begin during at the same time as back-flooding.

1.5 Environmental Effects Monitoring

DDMI implements two environmental effects monitoring programs:

- Aquatic Effects Monitoring Program (AEMP)
- Wildlife Effects Monitoring Program (WEMP)

These are defined programs, updated or revised as warranted, to monitor mine effects on the Lac de Gras aquatic ecosystem and wildlife within a defined study area. These programs are conducted annually with specific scopes varying from year to year. For example the AEMP has an expanded program every three years and a base program annually. Towards the end of commercial operations, DDMI expects to reduce the scope and/or frequency of these programs as the need to implement operational management responses declines. Near-Field AEMP sampling locations will be adjusted to target runoff/seepage and water quality through dike breaches rather than the NIWTP effluent discharge. The attached Figure VI-1 shows the proposed relocated near-field AEMP stations renamed near-field closure (NFC). After the end of commercial production DDMI will continue these monitoring programs to monitor responses to the cessation of mining operations. The frequency would be reduced to every three years.

2.0 Reporting

2.1 Reclamation Completion Reporting

At the end of the calendar year following each of the dike breach excavations DDMI and the Engineer of Record will prepare a Reclamation Completion Report. The report shall include:

- Daily construction reports;
- Photographic documentation of construction works;
- Summary of construction problems and resolutions; and
- Completed construction checklist.

This report will be submitted to the WLWB as per Part K Item 5.

2.2 Performance Assessment Report.

Once sufficient information is available to evaluate the performance of the back-flooded dike area generally and Closure Objectives and Closure Criteria specifically, DDMI will submit a Performance Assessment Report to the WLWB for approval under Part K Item 6. The Report will be developed in accordance with the Mackenzie Valley Land and Water Board's *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites within the Northwest Territories*.

3.0 Monitoring and Reporting Schedule

The anticipated monitoring and reporting schedule for the dike area and site wide effects monitoring is shown below. This schedule is subject to change based on actual construction timeline as well as results from inspections and monitoring programs. The number of years of post-construction monitoring required to adequately assess performance is unknown at this time and will depend upon the results obtained. The monitoring duration will be adaptively managed to be responsive to conditions as they are evaluated. DDMI has assumed 3 year of monitoring after the dikes have been breached to provide sufficient information to support an assessment report.

Activity	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Geotechnical inspections																
Water quality monitoring																
Dust Monitoring																
Wildlife Use Monitoring																
Aquatic Effects Monitoring																
Wildlife Effects Monitoring																
Annual CRP Progress Reporting																
Reclamation Completion Report																
Performance Assessment Report																

Appendix VI-3 Post Closure Monitoring and Reporting - Processed Kimberlite Containment Area

Two types of post-closure monitoring programs are planned: performance monitoring specific to the Processed Kimberlite Containment (PKC) area and environmental effects monitoring which would include combined effects from all post-closure areas. These are described in Section 1.0 with the type and frequency of reporting described in Section 2.0.

1.0 Performance Monitoring

1.1 Geotechnical

Presently the PKC is inspected weekly to identify any stability issues and to identify seepage/runoff. This inspection frequency will continue until the end of commercial operations after which it will reduce to monthly (November to May) and weekly June to October.

Observation wells, collection wells, thermistors and slope inclinometers have been installed in the PKC area to monitor operational performance. Much of this instrumentation is expected to remain post-closure, however the final determination of post-closure instrumentation will not be made until the final closure plan is prepared.

Annually, visual inspection will include an aerial drone surveys. These surveys will commence with the end of commercial production.

1.2 Seepage/Runoff Water Quality

Seepage/runoff and PKC pond water quality monitoring is proposed at the following SNP locations:

SNP Site #	Description
1645-42	Collection Pond 4
1645-69	Collection Pond 5
1645-44	Collection Pond 7
1645-16	PKC Pond water within the PKC
1645-31	Groundwater GW4 West of PKC
1645-32	Groundwater GW4 South of PKC, between the Ammonia Nitrate Storage and Pond 7
1645-77	PKC Seepage
1645-78	PKC Seepage
1645-79	PKC Seepage
1645-80	PKC Seepage

Seepage or runoff quality will be sampled at a weekly frequency if sufficient volumes are identified during the weekly geotechnical inspections. Water samples will be analyzed for the following (source W2015L2-0001 – SNP 1645-81):

Sampling Parameters:	Total Ammonia, Field Parameters[3], ICP-MS Metal Scan[1](Total), Major Ions[2], pH[4], Total Petroleum Hydrocarbons

SNP 1645-42,69 and 1645-44 are currently located within the collection ponds. Once collection ponds are breached, DDMI proposes to relocate these stations to the outlet channel.

Additionally if the estimated flow volume from 1645-42, 69 or 44 is greater than 10 L/s following breaching of the collection ponds then a sample will also be collected quarterly and assessed for acute lethality to rainbow trout, *Oncorhynchus mykiss* as per Environment Canada's Environmental Protection Series Biological Test Method EPS/1/RM/13.

SNP 1645-31 and 1645-32 are currently inactive. DDMI will reactivate them post-closure to either confirm absence of groundwater flow or measure the quality of detected flow.

1.3 Wildlife

DDMI will employ existing monitoring procedures (as updated from time-to-time) to record wildlife use of the PKC area and observations of behavior when animals are present in the PKC area. These procedures include:

ENVR-031-0720 – Caribou Road Surveys
ENVR-032-0721 – Caribou PKC & NCRP Use
ENVR-517-0912 – Caribou Management/Observation
ENVR-531-0812 – Wildlife Monitoring

1.4 Dust

DDMI will use the existing Total Suspended Particulate (TSP) monitoring system and procedures (as updated from time-to-time) combined with visual observations to monitoring dust generated from the PKC area. This monitoring will begin during erosion cover placement and continue after the end of commercial production.

1.5 Environmental Effects Monitoring

DDMI implements two environmental effects monitoring programs:

- Aquatic Effects Monitoring Program (AEMP)
- Wildlife Effects Monitoring Program (WEMP)

These are defined programs, updated or revised as warranted, to monitor mine effects on the Lac de Gras aquatic ecosystem and wildlife within a defined study area. These programs are conducted annually with specific scopes varying from year to year. For example the AEMP has an expanded program every three years and a base program annually. Towards the end of commercial operations, DDMI expects to reduce the scope and/or frequency of these programs as the need to implement operational management responses declines. Near-Field AEMP sampling locations will be adjusted to target runoff/seepage and water quality through dike breaches rather than the NIWTP effluent discharge. The attached Figure VI-1 shows the proposed relocated near-field AEMP stations renamed near-field closure (NFC). After the end of commercial production DDMI will continue these monitoring programs to monitor responses to the cessation of mining operations. The frequency would be reduced to every three years.

2.0 Reporting

2.1 Reclamation Completion Reporting

Upon completion of construction activities at the end of each calendar year, DDMI and the Engineer of Record will prepare a Construction Record summary report. The report shall include:

- Daily construction reports;
- All testing records including a summary of all test sample locations and test results;

- Photographic documentation of construction works;
- Summary of construction problems and resolutions; and
- Completed construction checklist.

Upon completion of the PKC closure construction, a single comprehensive PKC Reclamation Completion Report will be prepared by the Construction Management team and Engineer of Record for submission to the WLWB as per Part K Item 5.

2.2 Performance Assessment Report.

Once sufficient information is available to evaluate the performance of the PKC closure design generally and Closure Objectives and Closure Criteria specifically, DDMI will submit a Performance Assessment Report to the WLWB for approval under Part K Item 6. The Report will be developed in accordance with the Mackenzie Valley Land and Water Board's *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites within the Northwest Territories*.

3.0 Monitoring and Reporting Schedule

The anticipated monitoring and reporting schedule for the PKC and site wide effects monitoring is shown below. This schedule is subject to change based on actual construction timeline as well as results from inspections and monitoring programs. The number of years of post-construction monitoring required to adequately assess performance is unknown at this time and will depend upon the results obtained. The monitoring duration will be adaptively managed to be responsive to conditions as they are evaluated. DDMI has assumed 3 year of monitoring from the time the PKC closure is completed until there is sufficient information to prepare an assessment report.

Activity	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Geotechnical inspections									■	■	■	■	■	■	■	■
Seepage/Run-off monitoring										■	■	■	■	■	■	■
Dust Monitoring	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Wildlife Use Monitoring										■	■	■	■	■	■	■
Aquatic Effects Monitoring										■			■			■
Wildlife Effects Monitoring										■			■			■
Annual CRP Progress Reporting	■	■	■	■	■	■	■	■								
Reclamation Completion Report														■		
Performance Assessment Report														■	■	■

Appendix VI-4 Post Closure Monitoring and Reporting - North Inlet Area

Two types of post-closure monitoring programs are planned: performance monitoring specific to the North Inlet (NI) and environmental effects monitoring which would include combined effects from all post-closure areas. These are described in Section 1.0 with the type and frequency of reporting described in Section 2.0.

1.0 Performance Monitoring

1.1 Geotechnical

Presently the NI is inspected weekly to identify any geotechnical issues. This inspection frequency will continue until the end of commercial operations after which it will reduce to monthly (November to May) and weekly June to October.

Thermistors and slope inclinometers installed for operations monitoring will remain post-closure. Once the NI area has been decommissioned the inspections will focus on the east dam and shoreline stability. No geotechnical instrumentation is planned once the east dam has been breached.

Annually, visual inspection will include an aerial drone survey of the area. These inspections will begin prior to decommissioning and continue until 2032.

1.2 Water Quality

SNP monitoring of the NI and NIWTP will continue as per operations when the NIWTP is operating. Once NIWTP operations are no longer required water quality monitoring is proposed at the following SNP locations:

SNP Site #	Description
1645-13	North Inlet – Influent prior to treatment

Water quality will be monitored monthly and analyzed for the following parameters (source W2015L2-0001 – SNP 1645-81):

Sampling Parameters:	Total Ammonia, Field Parameters[3], ICP-MS Metal Scan[1](Total), Major Ions[2], pH[4], Total Petroleum Hydrocarbons

Once water quality in the NI is approved for breaching of the NI east dam, then the monitoring frequency at 1645-13 will reduce to twice per year.

1.3 Sediment Quality

A sediment quality investigation will be conducted at the end of commercial operations to evaluate the sediment conditions in the NI. The investigation will follow the scope and procedures used in 2015 (Golder 2016 *Consolidated Report: North Inlet Sludge Management Report and North Inlet Hydrocarbon Investigation Report*. February 25, 2016).

1.4 Wildlife

DDMI will employ existing monitoring procedures (as updated from time-to-time) to record wildlife use of the NI area and observations of behavior when animals are present on the NCRP. These

procedures include:

ENVR-031-0720 – Caribou Road Surveys
ENVR-517-0912 – Caribou Management/Observation
ENVR-531-0812 – Wildlife Monitoring

1.5 Dust

DDMI will use the existing Total Suspended Particulate (TSP) monitoring system and procedures (as updated from time-to-time) combined with visual observations to monitoring dust generated from the NI area. This monitoring will begin during decommissioning of the NI east dam.

1.6 Environmental Effects Monitoring

DDMI implements two environmental effects monitoring programs:

- Aquatic Effects Monitoring Program (AEMP)
- Wildlife Effects Monitoring Program (WEMP)

These are defined programs, updated or revised as warranted, to monitor mine effects on the Lac de Gras aquatic ecosystem and wildlife within a defined study area. These programs are conducted annually with specific scopes varying from year to year. For example the AEMP has an expanded program every three years and a base program annually. Towards the end of commercial operations, DDMI expects to reduce the scope and/or frequency of these programs as the need to implement operational management responses declines. Near-Field AEMP sampling locations will be adjusted to target runoff/seepage and water quality through dike breaches rather than the NIWTP effluent discharge. The attached Figure VI-1 shows the proposed relocated near-field AEMP stations renamed near-field closure (NFC). After the end of commercial production DDMI will continue these monitoring programs to monitor responses to the cessation of mining operations. The frequency would be reduced to every three years.

2.0 Reporting

2.1 Reclamation Completion Reporting

Upon completion of NI closure DDMI and the Engineer of Record will prepare a North Inlet Reclamation Completion Report. The report shall include:

- Daily construction reports;
- All testing records including a summary of all test sample locations and test results;
- Photographic documentation of construction works;
- Summary of construction problems and resolutions; and
- Completed construction checklist.

This report will be submitted to the WLWB as per Part K Item 5.

2.2 Performance Assessment Report.

Once sufficient information is available to evaluate the performance of the NI generally and Closure Objectives and Closure Criteria specifically, DDMI will submit a Performance Assessment Report to the WLWB for approval under Part K Item 6. The Report will be developed in accordance with the Mackenzie Valley Land and Water Board's *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites within the Northwest Territories*.

3.0 Monitoring and Reporting Schedule

The anticipated monitoring and reporting schedule for the NI and site wide effects monitoring is shown below. This schedule is subject to change based on actual construction timeline as well as results from inspections and monitoring programs. The number of years of post-construction monitoring required to adequately assess performance is unknown at this time and will depend upon the results obtained. The monitoring duration will be adaptively managed to be responsive to conditions as they are evaluated.

Activity	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Geotechnical inspections																
NI pond water monitoring																
NI sediment investigation																
Dust Monitoring																
Wildlife Use Monitoring																
Aquatic Effects Monitoring																
Wildlife Effects Monitoring																
Annual CRP Progress Reporting																
Reclamation Completion Report																
Performance Assessment Report																

Appendix VI-5 Post Closure Monitoring and Reporting - Mine Infrastructure Areas

Two types of post-closure monitoring programs are planned: performance monitoring specific to the Infrastructure areas and environmental effects monitoring which would include combined effects from all post-closure areas. These are described in Section 1.0 with the type and frequency of reporting described in Section 2.0.

3.0 Performance Monitoring

3.1 Geotechnical

Aspects of the infrastructure area are inspected weekly during operations to identify any stability and or seepage/runoff. This inspection frequency will continue until the end of commercial operations after which it will reduce to monthly.

Annually, visual inspection will include an aerial drone survey of the infrastructure areas each year starting with the end of commercial production.

3.2 Seepage/Runoff Water Quality

Seepage/runoff water quality monitoring is proposed at the following SNP locations:

SNP Site #	Description
1645-45	Collection Pond 10
1645-46	Collection Pond 11
1645-47	Collection Pond 12
1645-33	Groundwater nearest to Bulk Fuel Storage
1645-81	Surface Runoff during freshet

Seepage or runoff quality is sampled at a weekly frequency if sufficient volumes are identified during the weekly geotechnical inspections. Water samples will be analyzed for the following (source W2015L2-0001 – SNP 1645-81):

Sampling Parameters:	Total Ammonia, Field Parameters[3], ICP-MS Metal Scan[1](Total), Major Ions[2], pH[4], Total Petroleum Hydrocarbons

SNP 1645-45,45 and 1645-47 are currently located within the collection ponds. Once collection ponds are breached, DDMI proposes to relocate these stations to the outlet channel.

Additionally if the estimated flow volume is greater than 10 L/s once the collection ponds are breached then a sample will also be collected quarterly and assessed for acute lethality to rainbow trout, *Oncorhynchus mykiss* as per Environment Canada's Environmental Protection Series Biological Test Method EPS/1/RM/13.

3.3 Wildlife

DDMI will employ existing monitoring procedures (as updated from time-to-time) to record wildlife use of the NCRP and observations of behavior when animals are present on the NCRP. These procedures include:

ENVR-031-0720 – Caribou Road Surveys

ENVR-517-0912 – Caribou Management/Observation
ENVR-531-0812 – Wildlife Monitoring

3.4 Dust

DDMI will use the existing Total Suspended Particulate (TSP) monitoring system and procedures (as updated from time-to-time) combined with visual observations to monitoring dust generated from the Infrastructure areas. This monitoring will begin at the end of commercial production.

3.5 Re-Vegetation

- Areas of re-vegetation would be assessed for overall health, including: cover, density, species identification and diversity, seed production, litter and evidence of wildlife grazing. Soils in re-vegetated areas would be sampled and analyzed for structure and texture, pH and organic matter. The need to obtain and analyze plants and soils for metal uptake levels will be evaluated based on risk.

- Additional re-vegetation monitoring items may include shoreline vegetation surveys around collection pond areas, PKC outlet, A154, A418, A21 and the North Inlet as well as documentation of areas of natural recovery, plant ingress/egress or identified invasive species.
- Re-vegetated areas will be inspected annually for two years following initial planting.

3.6 Environmental Effects Monitoring

DDMI implements two environmental effects monitoring programs:

- Aquatic Effects Monitoring Program (AEMP)
- Wildlife Effects Monitoring Program (WEMP)

These are defined programs, updated or revised as warranted, to monitor mine effects on the Lac de Gras aquatic ecosystem and wildlife within a defined study area. These programs are conducted annually with specific scopes varying from year to year. For example the AEMP has an expanded program every three years and a base program annually. Towards the end of commercial operations, DDMI expects to reduce the scope and/or frequency of these programs as the need to implement operational management responses declines. Near-Field AEMP sampling locations will be adjusted to target runoff/seepage and water quality through dike breaches rather than the NIWTP effluent discharge. The attached Figure VI-1 shows the proposed relocated near-field AEMP stations renamed near-field closure (NFC). After the end of commercial production DDMI will continue these monitoring programs to monitor responses to the cessation of mining operations. The frequency would be reduced to every three years.

4.0 Reporting

4.1 Reclamation Completion Reporting

Upon completion of construction activities at the end of each calendar year, DDMI and the Engineer of Record will prepare a Construction Record summary report. The report shall include:

- Daily construction reports;
- All testing records including a summary of all test sample locations and test results;
- Photographic documentation of construction works and any associated re-vegetation efforts;
- Summary of construction problems and resolutions; and

- Completed construction checklist.

Upon completion of the infrastructure closure, a single comprehensive Infrastructure Reclamation Completion Report will be prepared by the Construction Management team and Engineer of Record for submission to the WLWB as per Part K Item 5.

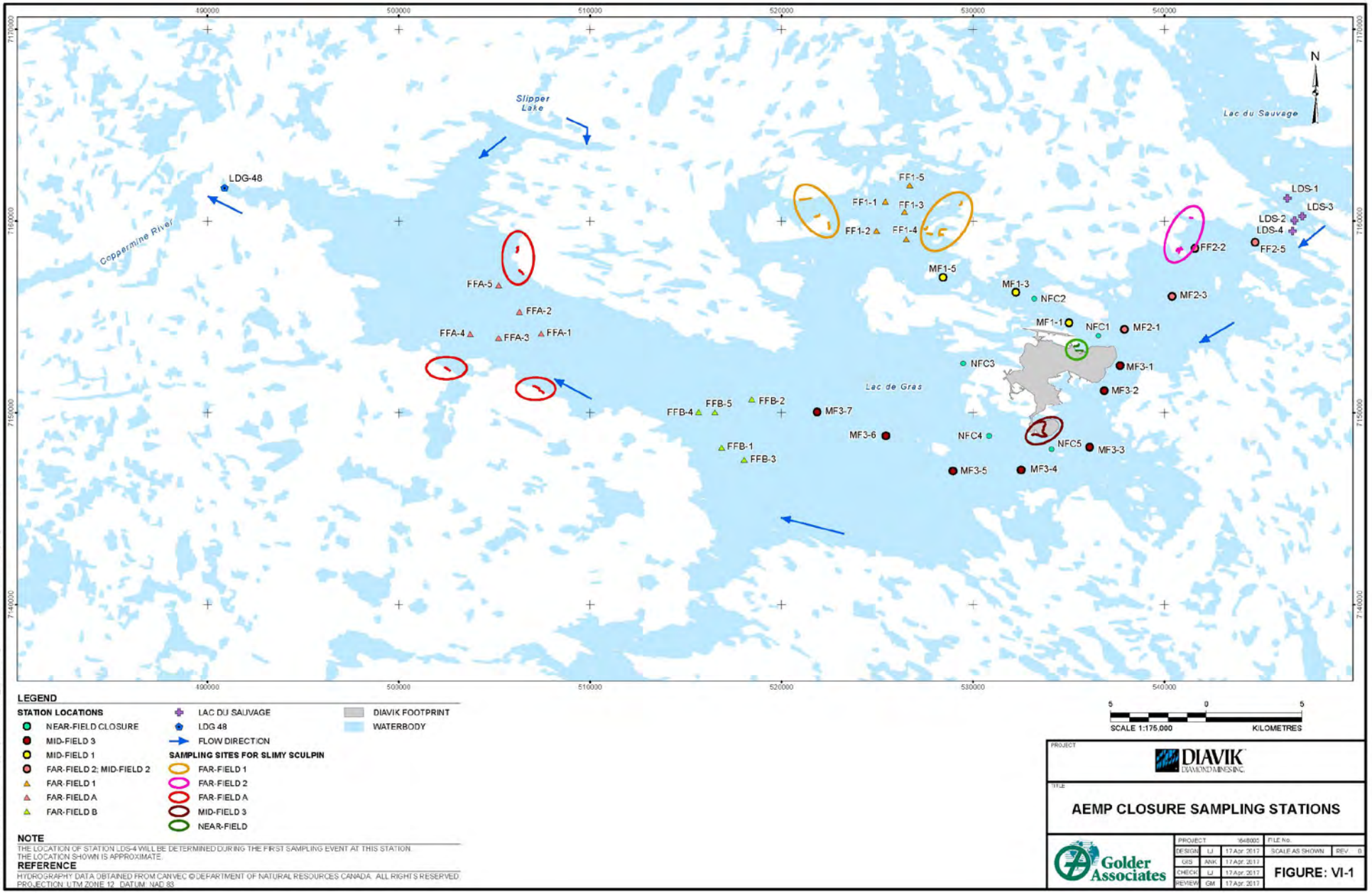
4.2 Performance Assessment Report.

Once sufficient information is available to evaluate the performance of the infrastructure area generally and Closure Objectives and Closure Criteria specifically, DDMI will submit a Performance Assessment Report to the WLWB for approval under Part K Item 6. The Report will be developed in accordance with the Mackenzie Valley Land and Water Board's *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites within the Northwest Territories*.

3.0 Monitoring and Reporting Schedule

The anticipated monitoring and reporting schedule for the Infrastructure and site wide effects monitoring is shown below. This schedule is subject to change based on actual construction timeline as well as results from inspections and monitoring programs. The number of years of post-construction monitoring required to adequately assess performance is unknown at this time and will depend upon the results obtained. The monitoring duration will be adaptively managed to be responsive to conditions as they are evaluated.

Activity	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Geotechnical inspections																
Seepage/Run-off monitoring																
Dust Monitoring																
Wildlife Use Monitoring																
Re-Vegetation Monitoring																
Aquatic Effects Monitoring																
Wildlife Effects Monitoring																
Annual CRP Progress Reporting																
Reclamation Completion Report																
Performance Assessment Report																



LEGEND

STATION LOCATIONS

- NEAR-FIELD CLOSURE
- MID-FIELD 3
- MID-FIELD 1
- FAR-FIELD 2; MID-FIELD 2
- FAR-FIELD 1
- FAR-FIELD A
- FAR-FIELD B
- LAC DU SAUVAGE
- LDG 48
- FLOW DIRECTION

SAMPLING SITES FOR SLIMY SCULPIN

- FAR-FIELD 1
- FAR-FIELD 2
- FAR-FIELD A
- MID-FIELD 3
- NEAR-FIELD

- DIAVIK FOOTPRINT
- WATERBODY

NOTE

THE LOCATION OF STATION LDS-4 WILL BE DETERMINED DURING THE FIRST SAMPLING EVENT AT THIS STATION. THE LOCATION SHOWN IS APPROXIMATE.

REFERENCE

PROJECTION: UTM ZONE 12 DATUM: NAD 83

I:\CLIENTS\DIAVIK\1648005\Mapping\MXD\CRP_updateFig VI-1 AEMP Closure Sampling Stations.mxd

PROJECT: DIAVIK DIAMOND MINES INC.

TITLE: **AEMP CLOSURE SAMPLING STATIONS**

Golder Associates

PROJECT	1648005		FILE No.	
DESIGN	LJ	17 Apr. 2017	SCALE AS SHOWN	REV. 0
GIS	ANK	17 Apr. 2017		
CHECK	LJ	17 Apr. 2017		
REVIEW	GM	17 Apr. 2017		

FIGURE: VI-1

RioTinto

Appendix 2

Diavik Mine – Water Quality Modelling of A418, A154 and A21 Mined Out Pits

(Golder 2018)

TECHNICAL MEMORANDUM

DATE 2 November 2018

Golder Reference No. 1893614-1698-TM-Rev1-3000

WORK PLAN No. 587 Rev.0

DIAVIK PO No. D04148

TO Gord MacDonald
Diavik Diamond Mines (2012) Inc.

FROM Shadi Dayyani and Jerry Vandenberg

EMAIL Shadi_Dayyani@golder.com; Jerry_Vandenberg@golder.com

DIAVIK MINE – WATER QUALITY MODELLING OF A418, A154 AND A21 MINED OUT PITS

1.0 INTRODUCTION

Diavik Diamond Mines (2012) Inc. (DDMI) is evaluating potential environmental effects related to storage of fine processed kimberlite (PK) in the mined-out A418, A154 and A21 Pits and underground workings (if applicable). At closure, the PK would be capped with freshwater and the overlying pit lake will be reconnected to Lac de Gras, consistent with the Revised Interim Closure and Reclamation Plan (Version 3.1; DDMI 2010). DDMI retained Golder Associates Ltd. (Golder) to develop hydrodynamic models for the A418, A154 and A21 pit lakes to evaluate the post-closure pit lake water quality following placement of freshwater caps over the deposited fine PK in these pits. The model domains included the pits, the diked area and a small connecting portion of Lac de Gras for each pit lake. The sub-level retreat and underground workings are assumed to be back-filled with PK and were not included in the models. The model domain extended from Lac de Gras water surface to the bottom of the open pit, although the simulations that included PK deposition only used the model cells above the PK-water interface. Concentrations of a full suite of water quality parameters in the pit lakes were estimated using the hydrodynamic results to provide an estimate of mixing and consequent mass balance.

The objectives of the hydrodynamic modelling were to determine (a) whether the pit lakes water column will turn over or remain stratified, thereby isolating mine-influenced water from mixing with surface water in the pit lake, (b) the long-term stability of stratification, and (c) the resulting influence of PK consolidation on pit lakes water quality for each scenario. The modelling was intended to answer these questions for preliminary planning purposes, and as such, simplifying assumptions were employed as described in Section 2.2. Based on DDMI's review of the findings and other closure planning, if a scenario is selected as the preferred option, that scenario can be modelled with greater certainty and presented in a format that would be suitable to support a full closure plan update.

To achieve these objectives, model predictions were generated for the following modelling scenarios:

- Base Case Scenario – No PK deposited in the pits
- Development Scenario – PK deposited in the pits with 150 m fresh water cap

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Three additional sensitivity scenarios were also evaluated to assess the effects of freshwater cap thickness and sizes of breaches in the dikes on the predicted pit lake water quality. Details of the sensitivity scenarios are provided in Section 2.3. This memorandum describes model development, simulations and results for the A418, A154 and A21 pit lakes.

2.0 METHODS

2.1 Model Platform

2.1.1 Consolidation Model

To account for the influence of PK settling and release of pore water on surface water quality, a conceptual consolidation model was developed to predict the pore water released to the pit lakes as a result of PK consolidation and associated settlement. In the consolidation model, solids component in the pits (i.e., deposited PK) was assumed to be a single layer from 20 m below the pit crest elevation for all the scenarios including PK (i.e., Development Case and Sensitivity scenarios; Section 2.3) to the bottom of the mined-out sub-level retreat. The consolidation curves estimated for the 20-m freshwater cap in each pit were applied to all the scenarios that included PK (Section 2.3).

2.1.2 Hydrodynamic Model

The A418, A154 and A21 models were developed using CE-QUAL-W2 (W2), which is a two dimensional (2-D), laterally averaged, hydrodynamic, and water quality model. The model is accessible within the public domain and is maintained and supported by the US Army Corps of Engineers Waterways Experiment Station.

The model simulates interactions of physical and chemical processes, including flow, thermal and substance mass loading regimes, meteorological forcing conditions, and lake-bottom interactions. The W2 model also includes a module to simulate ice-cover in the winter. The formation of a complete ice-cover prevents re-aeration, provides complete wind sheltering, and results in reduced thermal inputs via solar radiation. The model has established a well-recognized reputation as an effective and practical modelling tool for lake and reservoir hydrodynamics and water quality, and has been used extensively to simulate the potential performance of natural and constructed lakes, including mine pit lakes (Castendyk and Eary 2009; Castendyk et al. 2015; Vandenberg et al. 2015). The W2 model is in the public domain and has been used for similar studies in North West Territories (e.g., DDEC 2014; Vandenberg et al. 2015), as well as throughout North America and worldwide (Cole and Wells 2008).

The following constituents were included in the W2 hydrodynamic model: (1) TDS, (2) temperature, (3) a conservative, generic water quality constituent; and (4) a generic settleable water quality constituent. The generic water quality constituent (referred as tracer hereafter) was used to calculate the concentration of the all other water quality constituents. The generic settleable water quality constituent was included to evaluate fines resuspension associated with turbulent mixing of the lake.

The hydrodynamic parameters associated with the ice-module were maintained from the Jay Project (DDEC 2014) at the Ekati Mine, which was developed and calibrated for Lac de Sauvage for ice cover periods, ice thickness and annual evaporation. Given the geographical proximity between available ice-related observations and the project site, these data were determined to be suitable to use in A418, A154 and A21 pit lake models. Default model parameters were used for the thermal variables, with the following exceptions:

- The sediment temperature was set at a constant value of 5ºC.
- The maximum vertical eddy viscosity was set to 0.001 m^2/s.
- Albedo of ice was adjusted to 0.9 and water-ice heat exchange coefficient was adjusted to 15 $W/m^2/ºC$.

Initial conditions were set by assuming that the pit lake would be filled with Lac de Gras water.

2.1.3 Water Quality Model

A mass-balance approach was used to predict concentrations of major ions, nutrients, and metals in the A418, A154 and A21 pit lakes. In the modelling scenarios (Section 2.3) that included PK, a tracer concentration of 1 mg/L was defined for pore water being released to the bottom of the Pit Lake as a result of PK consolidation. The tracer was initialized to zero everywhere else in the model domain. This initial tracer distribution was set to understand mixing processes in the lake and to estimate the resulting water quality in the pit lakes resulting from PK pore water release to the bottom of the pit lakes. The tracer was assumed to behave conservatively in the water column, which means that it would not undergo chemical reactions (i.e., precipitation) or physical processes (i.e., settling). Water quality constituent concentrations were predicted using the following equation:

$$C_{Pit} = C_{Tracer} * (C_{PK} - C_{LdG}) + C_{LdG} \qquad \text{Equation 1}$$

where C_{Pit} is the constituent concentration in the pit lake at any time at any location of interest (mg/L); C_{Tracer} is the concentration of the tracer in the pit lake as a result of pore water release at any time at any location of interest (mg/L); C_{PK} is concentration of constituent in pore water; C_{LdG} is concentration of the constituent in Lac de Gras. Note that this equation is the same as the formula for dilution of a single effluent into a waterbody, which is essentially the case in this simplified model – the effluent is the PK pore water being released to the overlying water column that was filled with Lac de Gras water.

The generic settleable constituent was initialized with a value of 1 mg/L everywhere in the domain. The initial distribution of the settleable tracer was set to determine if full settlement of fine material would be likely over time.

The modelled constituents included in the water quality model were those most relevant to water quality and aquatic health in Lac de Gras (Table 1).

The site-specific surface water quality benchmarks, as defined in DDMI's Aquatic Effects Monitoring Program (AEMP) Version 5.0 (DDMI 2017a), were used to screen the modelled post-closure water quality projections for the pit lakes (Table 1).

2.2 Model Inputs

Inputs to the A418, A154 and A21 pit lake models include geometric, meteorological, hydrologic, and water quality data, as described in the following sections. Because the modelling is being completed for planning purposes, minor inflows such as groundwater were not included at this stage.

2.2.1 Geometric Data

A critical aspect of any hydrodynamic model involves reasonably accurate representation of the shape, depth, and volume of the waterbodies. Model segmentation is the discretization of a physical domain into small grid cells that can be used by the model to iteratively calculate state variables at all locations within the lake and to propagate momentum and mass among cells at each time step. For each pit lake, a 2-D grid was developed based on a volume-area-elevation curve to represent the A418, A154 and A21 pit lakes. Each model domain also included a small portion of Lac de Gras to account for circulation of water to and from the lake. The grids are illustrated in plan view in Figure 1.

The grid spacing for segments within each lake ranged as follows:

- **A418 Pit Lake**: between 200 and 300 metres [m] along the flow path, and vertical resolution from 1 m near the surface, to 5 m near the pit bottom. Width of segments covering the pit lake ranged between 520 and 700 m. The grid included a total of 7 active segments, and 105 active vertical layers.
- **A154 Pit Lake:** between 300 and 400 m along the flow path, and vertical resolution from 1 m near the surface to 5 m near the pit bottom. Width of segments covering the pit lake ranged between 500 and 950 m. The grid included a total of 14 active segments, and 130 active vertical layers.
- **A21 Pit Lake**: about 200 m along the flow path, and vertical resolution from 1 m near the surface to 5 m near the pit bottom. Width of segments covering the pit lake ranged between 430 and 715 m. The grid included a total of 9 active segments, and 115 active vertical layers.

These model grids were used for all simulations, although the simulations that included PK deposition (Section 2.3) only used the upper cells above the PK-water interface.

The models were oriented such that they extended laterally along the longest axis of the pit, and flow exchange with Lac de Gras occurred through the segments representing the breaches in the dikes.

The total volume of the A418, A154 and A21 Pit, as represented in the W2 model for the Base Case Scenario, was approximately 30.5, 60.1 and 23.3 million m^3, respectively.

The breach designs for A418, A21 and A154 pits were extracted from Golder (2008), Golder (2017) and Golder (2003), respectively.

Figure 1: Model Segmentation and Inputs for A418, A154 and A21 Pit Lakes – Plan View

2.2.2 Meteorological Data

Meteorological inputs are key drivers of lake circulation and thermal dynamics, which could affect the mass balance of constituents within the lake. The following meteorological input data were required for this hydrodynamic model: air temperature, dew point temperature, wind direction, wind speed and solar radiation.

An hourly time-series was constructed for each of these inputs during the modelling time period (i.e., 2028 to 2128) based on observed data from on-site meteorological stations between 2014 and 2017 and data collected at nearby meteorological stations between 1999 and 2013. Both data sets have measured data for rainfall, temperature, relative humidity, solar radiation, wind speed, and direction. Where data gaps existed, those were either filled by interpolation (small gaps) or by the previous year's value for the specific hour (larger gaps).

An hourly time series of atmospheric pressure was constructed from the Environment Canada Yellowknife A Climatologic Station (ID 2204101). Hourly time series of wet bulb temperatures were calculated based on recorded air temperature, relative humidity, and atmospheric pressure.

2.2.3 Hydrologic Inputs

Hydrologic inputs to the A418, A154 and A21 Pit lakes were: (1) inflow from Lac de Gras into the pit lakes through the breaches in the dike; (2) direct precipitation on the lake; (3) local runoff from the mine area (included in the A418 Pit Lake model only) and (4) volume of pore water released to the pit lake as a result of PK consolidation (in scenarios which include PK). The outflows in the model were the outflow to Lac de Gras through the dike breaches and evaporation. Groundwater inflow into the filled pit and local runoff from the mine area was assumed to be negligible at this stage of modelling. Inflows and outflows included in the model are presented in Figure 1.

Inflow from Lac de Gras to the pits and outflow from the pits to the Lac de Gras were calculated by the model based on the difference in head boundary between observed water level elevations at the Lac de Gras and predicted water level elevations in the pit lakes at each time step. Observed water level elevations in Lac de Gras (2008 to 2013) were applied an as upstream head boundary condition in the models to the segments representing Lac de Gras.

Inflow associated with direct precipitation was evenly distributed over the entire domain as a function of the surficial area.

Inflow associated with pore water released by consolidation of PK to the pit lakes was assumed to enter the pits uniformly over the bottom layer and varying with time. Fine PK is predicted to settle in the pits over time, thus the volume liberated from PK consolidation and its corresponding chemical constituent mass were incorporated into the lowest layer in the overlying water body. This inflow was applied to all the deep segments within the pit lakes. The consolidation model is based on a one-dimensional section, so the fine PK settling is assumed to be distributed evenly horizontally across the pit. In reality, maximum settling would occur in the centre of the pit, resulting in a semi-elliptical surface with maximum fine PK elevations along the walls of the pit. Such non-uniform consolidation would lead to a more narrow, deeper lake bed, and consequently stronger stratification than what is predicted by the 2-D model.

The consolidation curves applied in the pit lake models are presented in Figure 2. The consolidation model for A418 Pit predicts an approximated inflow from PK pore water ranging from 0.0686 m^3/s in Year 1 to 0.0001 m^3/s in Year 200. The consolidation model predictions for inflow from PK pore water for A154 Pit ranges from 0.1282 m^3/s in Year 1 to 0.0003 m^3/s in Year 200. The consolidation curve developed for the A154 was applied to the A21 Pit Lake model as well.

A constructed time-series, with temporal resolution that varied according to the availability of information for each source, formed the basis of the water balance for the hydrodynamic model (Golder 2016). Daily information was available for precipitation. Modelled PK inflow, obtained from the consolidation model, provided annual estimates.

2.2.4 Water Quality Inputs

2.2.4.1 Lac de Gras

Water quality was represented by the average constituent concentration from water quality monitoring results for Lac de Gras collected between 2016 and 2018 (DDMI 2017a and unpublished data for 2018 provided by DDMI), during the open-water season, from the sampling locations near the pits: MF3-1 and MF3-2 representing quality of inflows from Lac de Gras to the A418 and A154 pit lakes and MF3-3 and MF3-4 representing quality of inflows from Lac de Gras to the A21 Pit Lake (Table 1).

Observed water temperature data was not available for Lac de Gras, therefore, temperature time-series was developed using data from Snap Lake dated from 2008 and 2012 (De Beers 2013). Temperature ranges from 0.5°C in the winter to 16.6°C in the summer.

2.2.4.2 PK Pore Water (Supernatant Water)

Water quality of the pore water (Table 1) was represented by the average constituent concentration from water quality monitoring results collected in beach pore water samples provided by DDMI (DDMI 2017b, pers. comm.).

The average concentrations applied as input chemistry are conservative because, for the non-detect values the detection limit was used in the calculations. This specifically applies to phosphorus concentrations with high detection limits analysed by ICP-MS method, with majority of samples being below detection limit. The lack of modelled settling or biological uptake of phosphorus results in highly conservative predictions for this constituent.

The samples provided did not include alkalinity or fluoride, thus TDS concentration was approximated based on the following ions: calcium, magnesium, sodium, potassium, sulphate, chloride, silica and nitrate.

Table 1: Lac de Gras and PK Pore Water Input Chemistry and Surface Water Quality Benchmarks

Parameter	Unit	Surface Water Quality Benchmark [a]	Average Observed PK Pore Water Concentrations [f]	Average Observed Concentrations at AEMP Sites: MF3-1 & MF3-2 [g]	Range of Observed Concentrations a AEMP Sites: MF3-1 and MF3-2 [g]	Average Observed Concentrations at AEMP Sites: MF3-3 & MF3-4 [g]	Range of Observed Concentrations a AEMP Sites: MF3-3 and MF3-4 [g]
Major Ions							
Calcium	mg/L	-	209	2.6	1.46 - 6.36	1.6	0.005 - 2.38
Chloride	mg/L	120	149	3.5	1.9 - 5.2	2.2	0.25 - 3
Fluoride	mg/L	0.12	0.14	0.034	0.029 - 0.038	0.031	0.005 - 0.04
Magnesium	mg/L	-	412	1.2	0.901 - 1.66	1.0	0.0025 - 1.48
Potassium	mg/L	-	166	1.1	0.757 - 1.48	0.88	0.005 - 1.28
Sodium	mg/L	52 [b]	155	3.1	1.44 - 8.32	1.7	0.005 - 2.58
Sulfate	mg/L	100 [c]	2315	3.9	2.19 - 5.47	3.3	0.052 - 5.81
Nutrients							
Nitrite as nitrogen	mg/L	0.06	0.42	0.00078	0.0005 - 0.003	0.00055	0.0005 - 0.0015
Nitrate as nitrogen	mg/L	3	96	0.055	0.001 - 0.105	0.015	0.001 - 0.0495
Ortho Phosphate	mg/L	-	0.06	0.0016	0.0005 - 0.0051	0.00078	0.0005 - 0.0016
Phosphorus	mg/L	-	0.065	0.0036	0.0024 - 0.0055	0.0032	0.0022 - 0.0051
Trace Elements							
Aluminum	µg/L	87 [b]	153	6.3	4.46 - 9.74	3.3	0.41 - 5.72
Antimony	µg/L	33 [b]	5.4	0.033	0.01 - 0.064	0.022	0.01 - 0.044
Arsenic	µg/L	5	3.0	0.28	0.202 - 0.401	0.23	0.01 - 0.332
Barium	µg/L	1000 [c]	449	3.5	2.02 - 8.17	2.3	0.01 - 3.27
Beryllium	µg/L	-	0.27	0.005	0.005 - 0.005	0.005	0.005 - 0.005
Boron	µg/L	1500	56	2.9	2.5 - 6.1	2.5	2.5 - 2.5
Cadmium	µg/L	0.1 [d]	0.92	0.0028	0.0025 - 0.0054	0.0025	0.0025 - 0.0025
Cobalt	µg/L	-	5.6	0.017	0.011 - 0.034	0.018	0.0025 - 0.034
Copper	µg/L	2	8.6	0.59	0.5 - 0.661	0.61	0.025 - 0.857

Parameter	Unit	Surface Water Quality Benchmark [a]	Average Observed PK Pore Water Concentrations [f]	Average Observed Concentrations at AEMP Sites: MF3-1 & MF3-2 [g]	Range of Observed Concentrations a AEMP Sites: MF3-1 and MF3-2 [g]	Average Observed Concentrations at AEMP Sites: MF3-3 & MF3-4 [g]	Range of Observed Concentrations a AEMP Sites: MF3-3 and MF3-4 [g]
Iron	µg/L	300	234	4.1	1.2 - 9.3	3.5	0.5 - 9.3
Lead	µg/L	1	0.88	0.0033	0.0025 - 0.007	0.0043	0.0025 - 0.017
Lithium	µg/L	-	3.8	2.0	1.56 - 3.59	1.7	0.25 - 2.46
Manganese	µg/L	-	82	3.3	1.16 - 7.74	1.9	0.025 - 3.99
Molybdenum	µg/L	73	504	0.88	0.265 - 2.79	0.28	0.025 - 0.442
Nickel	µg/L	25	189	0.77	0.642 - 0.886	0.92	0.01 - 1.32
Selenium	µg/L	1	18	0.02	0.02 - 0.02	0.02	0.02 - 0.02
Silicon	µg/L	2100 [b]	2605	186	25 - 885	28	25 - 52
Silver	µg/L	0.1	0.41	0.0025	0.0025 - 0.0025	0.0025	0.0025 - 0.0025
Strontium	µg/L	30000 [e]	6701	35	14.4 - 106	15.6	0.025 - 23
Sulfur	µg/L	-	782981	1571	1030 - 3020	1268	50 - 1740
Thallium	µg/L	0.8	0.65	0.0011	0.001 - 0.002	0.0012	0.001 - 0.0021
Tin	µg/L	73 [b]	7.3	0.011	0.005 - 0.055	0.026	0.005 - 0.088
Titanium	µg/L	-	1.8	0.51	0.25 - 2.34	0.28	0.25 - 0.71
Uranium	µg/L	15	1.1	0.12	0.092 - 0.157	0.096	0.001 - 0.206
Vanadium	µg/L	-	1.9	0.1	0.025 - 0.289	0.052	0.025 - 0.18
Zinc	µg/L	30	348	0.21	0.11 - 0.38	0.36	0.05 - 1.03

- = benchmark not available.

a) AEMP Design Plan Version 5.0 (DDMI 2017a); Table 5.3-1.

b) See AEMP Design Plan Version 5.0, Appendix B for description.

c) BCMOE (2013).

d) See Appendix IV.1 in DDMI (2007) and BCMOE (2001) for description.

e) Based on results from HydroQual (2009) and Pacholski (2009). See text for more information.

f) DDMI (2017b). Personal Communication.

g) DDMI (2017a).

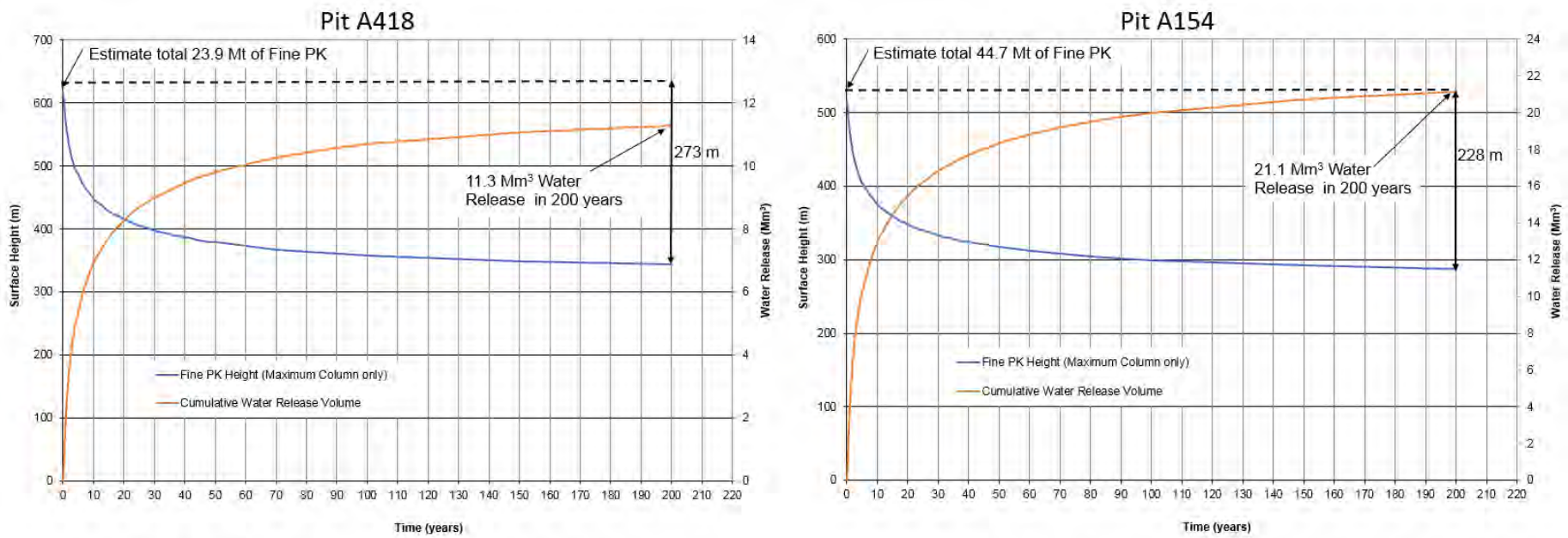

Figure 2: Estimated Pit Post Closure PK Settlement and Water Release

2.3 Model Scenarios

A key objective of the hydrodynamic model was to determine whether the A418, A154 and A21 pit lakes will turn over and bring soluble constituents to surface, or remain stratified and isolate mine-influenced water following the placement of PK in the pit and rapid filling of the pit water column. All simulations assumed the pits to be filled at the start of the simulation and extended for a period of 100 years. The selected modelling scenarios are described as follows:

- **Base Case Scenario**: No PK; represents the reference scenario to assess if, given the pit lake geometry, bathymetry and atmospheric conditions, the resulting pit lake would be meromictic. Sediment temperature was assumed as 5°C.
- **Development Case Scenario**: PK with 150 m fresh water cap - Pit lake geometry included only the top 150 m of the lake overlying deposited PK. Inflow corresponding to the volume of pore water released from the PK into the pit lake as a function of expected consolidation was included as a point source at the bottom of segments. Sediment and PK inflow temperatures were assumed as 5°C.

Three additional sensitivity scenarios were assessed to understand the depth at which the lake would begin to stratify, and whether mixing is sensitive to size of breaches in the dike.

- **Sensitivity Scenario 1**: PK with a 50 m freshwater cap above the PK.
- **Sensitivity Scenario 2**: PK with a 20 m freshwater cap above the PK.
- **Sensitivity Scenario 3**: increasing size of the two breaches in the dikes (only assessed at A418 pit lake with 20 m freshwater cap above PK).

In Base and Development cases and sensitivity scenarios 1 and 2, breaches were 30 m wide, 60 m long and 2 m deep. In Sensitivity Scenario 3 (only A418 Pit Lake model) the breaches were 60 m wide, 60 m long and 2 m deep.

2.4 Quality Assurance

Quality assurance procedures were implemented to check the following items against the objectives of the model:

- **Model framework** — Other modelling software packages were considered, and the W2 (a 2-D model) was selected as it provides the shortest simulation times while producing reliable vertical mixing predictions.
- **Model linkages** — Model linkages considered for this study include the flows from the GoldSim water balance (Golder 2016) modified to represent closure conditions, and predicted PK pore water discharge to the pit (as a function of consolidation) that was estimated using a one-dimensional tailings consolidation model.

- **Data used for model inputs** — The lake volume calculated based on the model grid and bathymetry were plotted to confirm the lake geometry was accurately represented (within 1% agreement at each 1-m layer increment and cumulatively). The meteorological data were plotted and reviewed visually to confirm there were no outliers or anomalies in the dataset.
- **Model set-up** — A grid was set up for the lake's physical domain using the bathymetry file. The model input files were loaded into the model to define boundary conditions, and model parameters were set up.
- **Calibration** — Because the pit lake is not yet constructed, model calibration is not possible at this time. However, rates and constants were applied from previous model calibrations in the region. The approach used is commensurate with the model set up for the Jay Project (DDEC 2014) at the Ekati Mine and the pit lakes at the Gahcho Kue Project (DeBeers 2012; Vandenberg et al. 2015). The parameter values in the ice module were taken from calibrated hydrodynamic models developed nearby, where water temperature data measured were available. The objective of the calibration was to match simulated and observed timing for ice formation/melting on the lake. The calibrated model predicts that ice starts forming on the lake around mid-October and melts by mid- to late June, in agreement with available measured proxy data. The predicted time for ice melting in the pit lakes leads to an open-water season which is longer than that observed at Lac de Gras, where ice melt generally occurs in mid-July. The extended open water season represents a more conservative approach, as the exposure to wind-driven forces over the pit lakes surface is extended over time.
- **Review** — Peer reviews and senior reviews of the model were performed at various stages throughout its development, which was an iterative process whereby issues were identified and addressed.

3.0 MODEL LIMITATIONS AND UNCERTAINTY

Modelling requires the use of many assumptions related to determining the physical and chemical characteristics of a system. Predictions are based on several inputs, all of which have inherent uncertainty. The modelling presented herein was intended to answer basic questions about lake hydrodynamics, and the following simplifying assumptions were employed:

- **Average water chemistry**: It is assumed that the water chemistry data used as inputs to the models are representative of their respective sources and will continue to be so in the future. Inflows to the model were characterized using representative water quality, estimated based on available measured, modelled or proxy data.
- **No groundwater inflows**: Under the assumption of a refilled pit lake, the estimated groundwater inflow is assumed to be negligible in terms of both volume and mass, in comparison to the flow exchange with Lac de Gras.
- **No local runoff from mine area**: Because the modelling is being completed for planning purposes, minor inflows such as local runoff from mine area was not included at this stage in the A154 and A21 Pit Lake models.
- **No wall rock runoff**: the mass load from flushing of wall rock was estimated to be negligible in comparison to the other inflows to the pit and was not included in the model.

- **Transient filling**: Initial conditions assumed the pit lake to be full up to Lac de Gras water elevation. As the pit lakes will be rapidly filled, the model was not used to simulate the transient period corresponding to the filling process and was assumed to be fully mixed at the start of the simulation.
- **2D modelling approach**: The governing equations in W2 are laterally averaged. Lateral averaging assumes that lateral variations in velocities, temperatures, and constituents are negligible. This limitation is not expected to materially affect pit lake simulations, which are primarily concerned with one-dimensional (vertical) water stratification.
- **Salt exclusion**: Although W2 can model formation of ice cover, it does not include salt exclusion. Salt exclusion is expected to be minimal in this system, which has low TDS in surface waters.
- **Fully mixed during filling period**: Initial concentration in the pit lake was estimated under the assumption that water from Lac de Gras would fill the pit lake from the top of the PK (or bottom of the pit if no PK is considered) to the water surface.
- **Static bathymetry**: Simulations including the PK were assumed to be static, where the bathymetry was not changing as the consolidation process advances. As a result, the PK pore water inflow (assumed to occur at the bottom cells) would force the water to move up overflowing on surface to Lac de Gras. In reality, as the consolidation process advances, there is available volume at the bottom of the pit, able to accommodate the additional volume. The assumption of static bathymetry overestimates the mixing potential of the pit lake and TDS concentration along the vertical column because it does not account for narrow, deepening lake beds.
- **Rates and coefficients**: Because the lake does not exist, and calibration is not yet possible, default rates and coefficients were applied throughout the model, except as listed in Section 2.4.
- **PK Consolidation**: is conceptual and based on estimates of PK material properties. The PK consolidation curves developed for 20 m freshwater cap was applied to 150 m, and 50 m freshwater caps. Consolidation curve estimated for A154 pit lake (20 m freshwater cap) was applied to A21 for all scenarios including PK.

With the limitations noted above, the results from the modelling scenarios and sensitivity cases are considered to represent the mixing conditions in the A418, A154 and A21 pit lakes under the modelling assumptions described in Section 2.0 and to satisfy the objectives listed in Section 1.0.

4.0 MODEL RESULTS

4.1 Hydrodynamic Results

The following sections describes the predicted mixing behaviour for A418, A154 and A21 pit lakes.

4.1.1 A418 Pit Lake

Temperature and TDS predicted vertical profiles are presented in Figures 3 and 4, respectively, for the modelled scenarios. Vertical profiles are graphed at selected representative dates in Year 100 of the simulation period (post closure). The dates shown in Figures 3 and 4 were selected to show under ice (15-April), early summer (01-July), late summer (15-August) and fall (15-October).

Predicted vertical temperature profiles show similar seasonal and spatial patterns in the top 20-m of water for all modelled scenarios (Figure 3). The thermocline is located at approximately 5 to 15 m below surface, depending on the season. The difference among scenarios relates only to water column depth, with uniform temperatures below the seasonal thermocline.

The TDS concentrations for the Base Case, sensitivity scenarios 2 and 3 are predicted to stay relatively constant along the vertical profile, indicating a lack of permanent stratification (Figure 4). For sensitivity scenarios 2 (20-m freshwater cap) and 3 (20-m freshwater cap and change in breach size), TDS concentrations are predicted to be similar to the Base Case Scenario because of a high volume of exchange with lake water by Year 100 post-closure.

Predicted TDS vertical profiles for the Development Case (150 m freshwater cap) and Sensitivity Scenario 1 (50 m freshwater cap) show permanent stratification along the water column created by the high TDS concentrations associated with the inflow of PK pore water at the bottom of the water column.

A time-depth profile (contour plot) of TDS and tracer in the deepest section of the A418 Pit Lake during the simulation period (100 years) are presented in Figures 5 and 6. Concentrations in the contour plots are depicted by discrete contour intervals, and concentrations in each interval are represented with an identical colour. Figure 6 does not include a graph for Base Case because there is no PK in the Pit Lake and thus no tracer from pore water release. These graphs (Figures 5 and 6) show that the A418 Pit Lake is predicted to:

- remain fully mixed in the Base Case Scenario
- permanently stratify in the Development Case and Sensitivity Scenario 1
- stratify for about 25 years and mixes vertically thereafter in the sensitivity scenarios 2 and 3

For the Development Case and Sensitivity Scenario 1, the contour plots show a reduced stability of the stratification over time (predicted TDS concentrations display diffusion over time, as seen in Figure 5).However, the diffusion is thought to be over-estimated in these simulations because they do not account for the dynamic settling of PK, which will lead to a substantially deeper and more narrow pool of water with elevated density, and both of these factors will increase the strength of stratification over the long term. Beyond these time scales, it is anticipated that a very small amount of this water will reach the surface through chemical diffusion and occasional wind mixing; however, both the conceptual and numerical models suggest that this amount will be very small compared to the exchange with lake water and will likely be unmeasurable. If such an exchange does occur, it will reduce the mass of constituents stored at the lake bottom over time.

The pattern observed for the pit lake with a 20-m freshwater cap (Sensitivity Scenario 2) is a result of continuous inflow of high TDS flow (PK pore water) to the bottom of the Pit Lake and low TDS flow (Lac de Gras) to the surface layers of the Pit Lake, with gradual breakdown of meromixis and full mixing of the lake which occurs 25 years post closure.

The TDS concentrations in the surface layers of the pit are predicted to remain below 30 mg/L, 120 mg/L and 300 mg/L over the simulation period (100 years post-closure) for Development Case, Sensitivity Scenario 1 and Sensitivity Scenario 2, respectively. At Year 100 post-closure TDS concentrations of surface layers for all modelled scenarios are predicted to be lower than 100 mg/L.

Predicted TDS and tracer concentrations for sensitivity scenarios 2 and 3 (Figures 5 and 6) show that the change in the breach size is not predicted to affect the mixing conditions in the Pit Lake, under the assumptions applied in Sensitivity Scenario 3.

Contour plots of settleable generic constituent concentrations for the Base Case and Sensitivity Scenario 2 (shallowest water cap) are presented in Figure 7. The results indicate that resuspension of fines would not occur following initial deposition (predicted concentrations of zero for this constituent everywhere in the pit lake over the simulation period). This finding is consistent with empirical data from another pit lake (Vandenberg and Litke 2017); in that case, tailings, process water and surface runoff were co-deposited and, even during co-deposition, settlement was rapid. Theoretical work by Lawrence et al. (1991) indicated that a 6-m water cap would be required to maintain solids settling in another pit lake with much larger fetch, and this work was recently verified through detailed field studies (Lawrence et al. 2016). Samad and Yanful (2005) suggested even shallower depths to minimize resuspension in tailings ponds.

Because this material is not predicted to resuspend in the 20-m deep pit lake, it would not be anticipated to resuspend in deeper lakes, so further modelling of fines resuspension is not necessary at this stage.

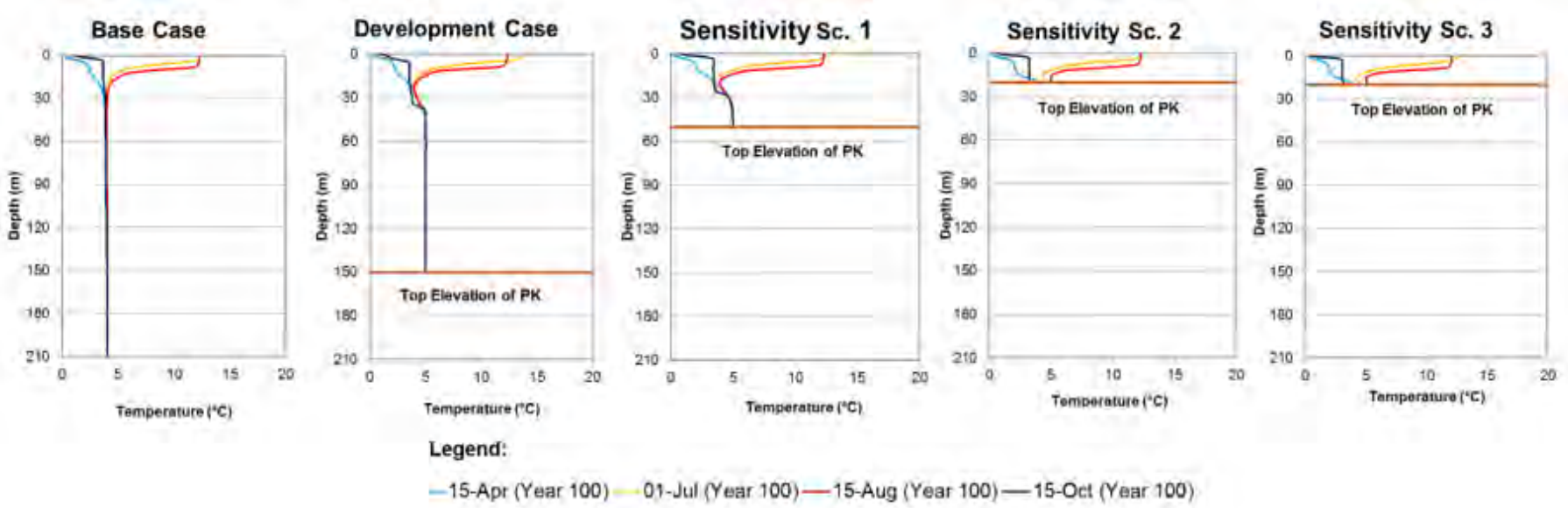

Figure 3: Predicted Vertical Profiles of Water Temperature in the A418 Pit Lake at Selected Dates of Year 100

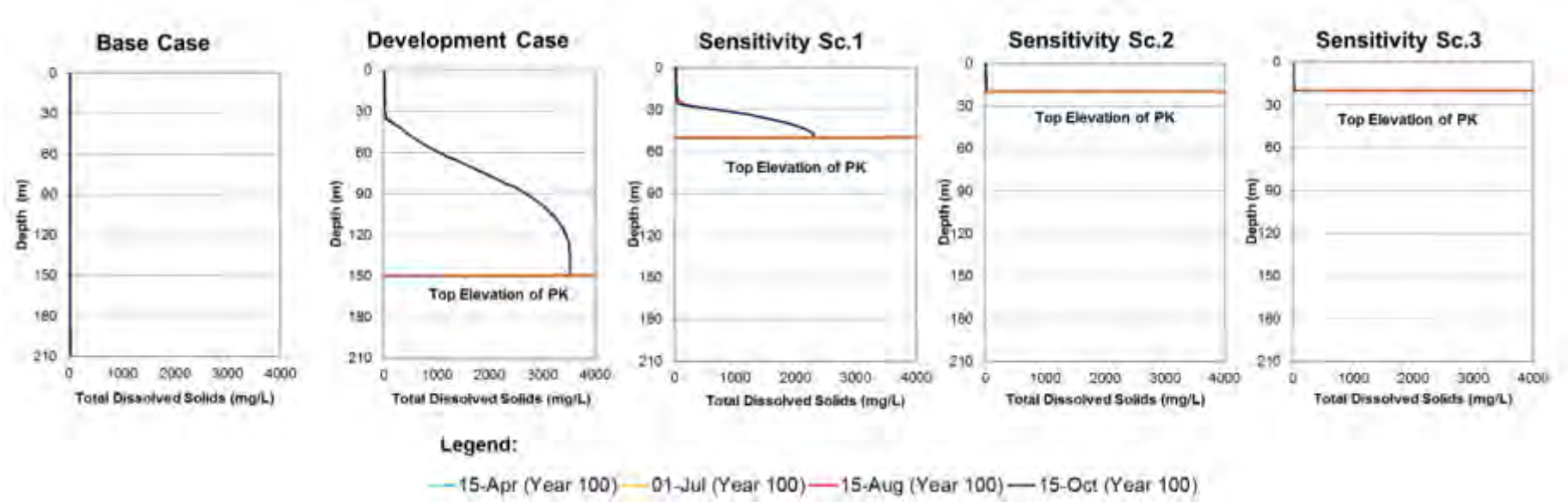

Figure 4: Predicted Vertical Profiles of Total Dissolved Solids Concentrations in the A418 Pit Lake at Selected Dates of Year 100

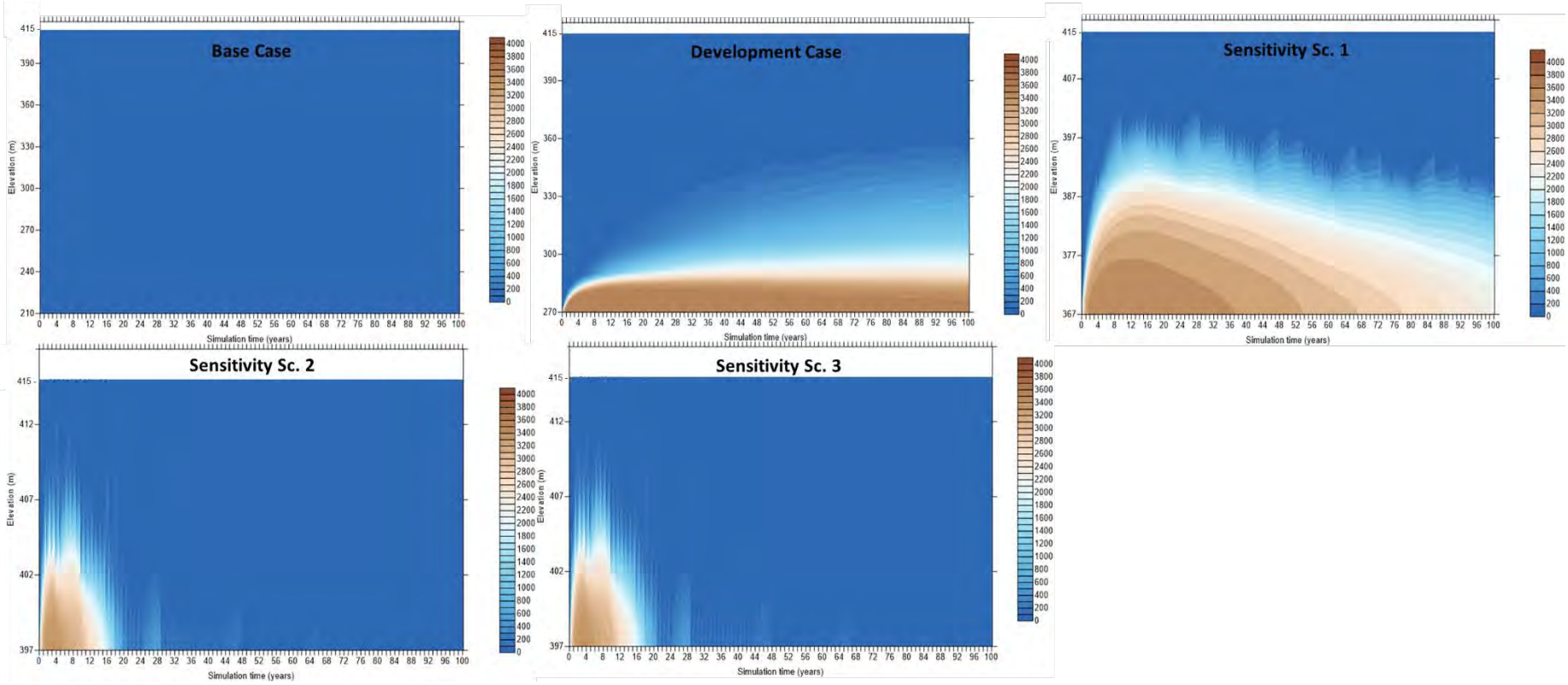

Figure 5: Contour Plots of Predicted Total Dissolved Solids Concentrations in the A418 Pit Lake over the Simulation Period (100 Years Post-Closure)

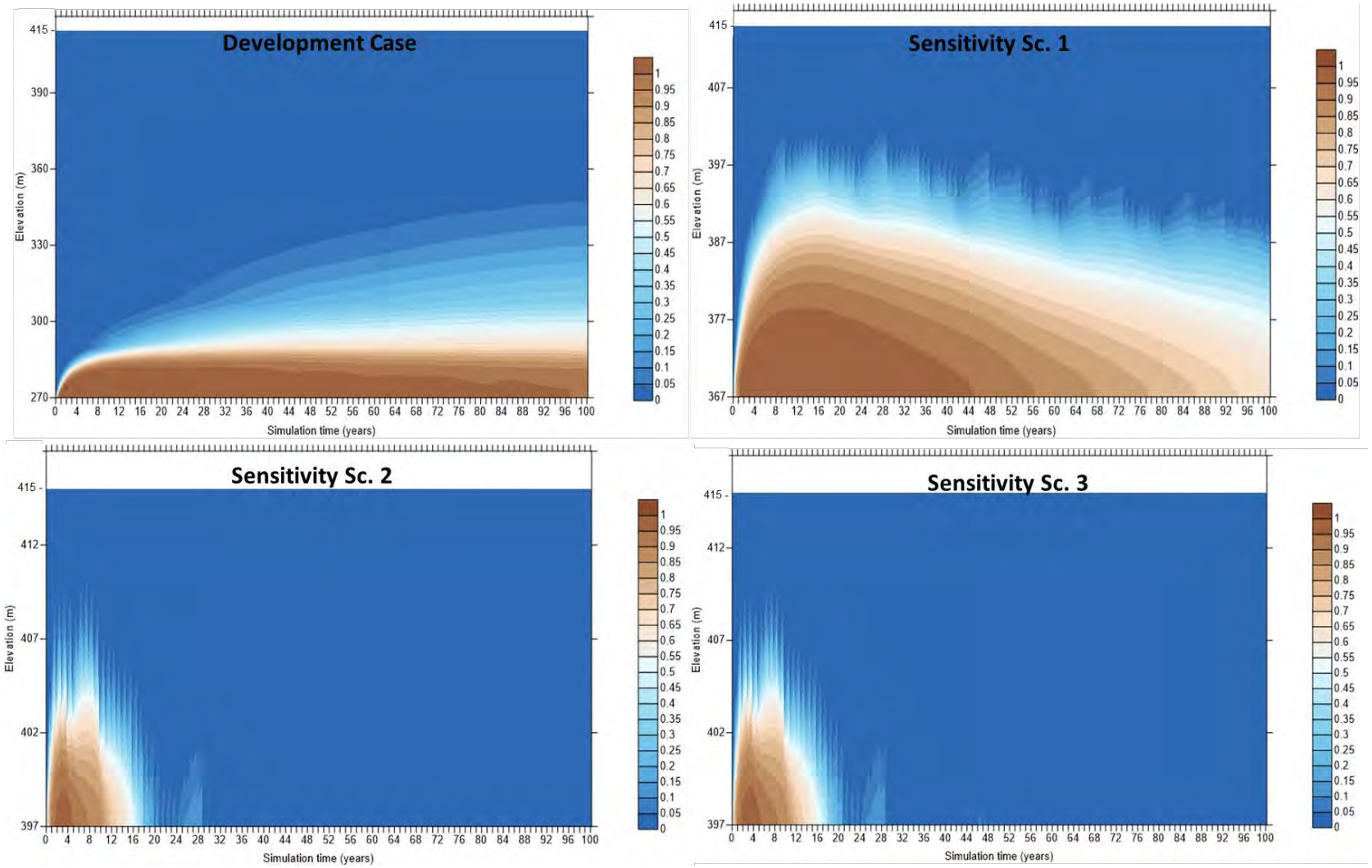

Figure 6: Contour Plots of Predicted Tracer Concentrations in the A418 Pit Lake over the Simulation Period (100 Years Post-Closure)

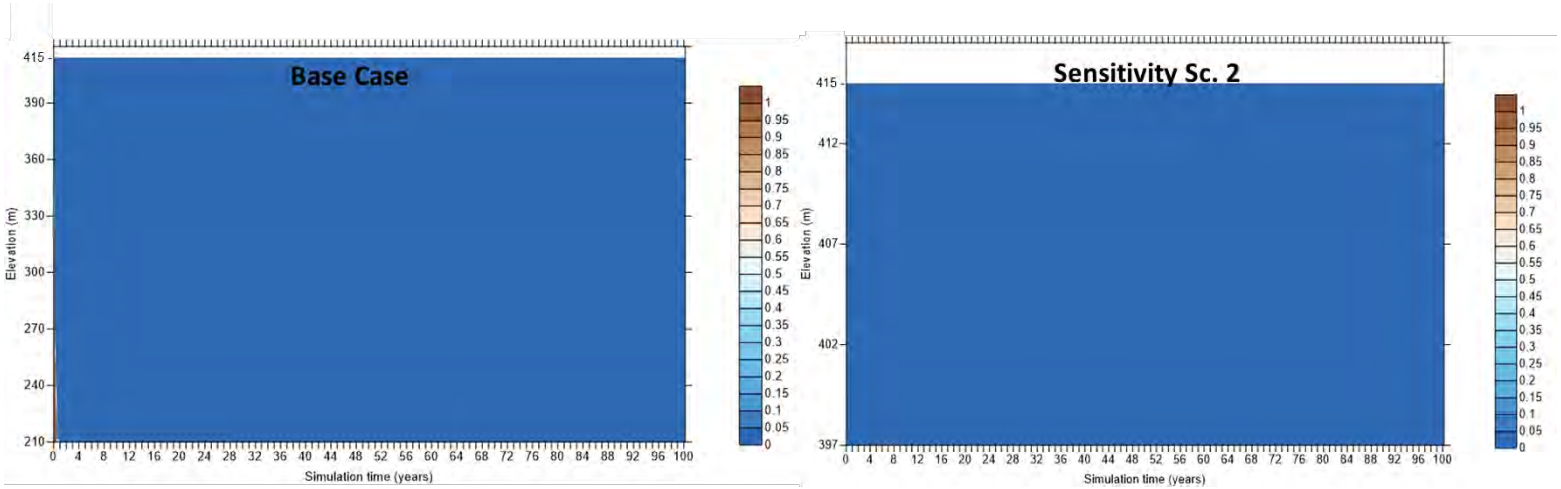

Figure 7: Contour Plots of Predicted Settleable Constituent in the A418 Pit Lake over the Simulation Period (100 Years Post-Closure)

4.1.2 A154 Pit Lake

Temperature and TDS predicted vertical profiles are presented in Figures 8 and 9, respectively, for the modelled scenarios. Similar to the A418 Pit Lake predicted vertical temperature profiles for the A154 Pit Lake show similar seasonal and spatial patterns in the top 20-m of water for all modelled scenarios (Figure 8). The difference among scenarios relates only to water column depth, with uniform temperatures below the seasonal thermocline.

The TDS concentrations for the Base Case, Sensitivity Scenarios 2 are predicted to stay relatively constant along the vertical profile, indicating a lack of permanent stratification (Figure 9) because of a high volume of exchange with lake water by Year 100 post-closure.

Predicted TDS vertical profiles for A154 Pit Lake for the Development Case (150-m freshwater cap) and Sensitivity Scenario 1 (50-m freshwater cap) show permanent stratification along the water column created by the high TDS concentrations associated with the inflow of PK pore water at the bottom of the water column.

Contour plots of TDS and tracer concentrations during the simulation period (Figures 10 and 11) show that the A154 Pit Lake is predicted to:

- remain fully mixed in the Base Case Scenario
- permanently stratify in the Development Case and Sensitivity Scenario 1
- stratify for about 14 years and mixes vertically thereafter in the Sensitivity Scenario 2

For the Development Case and Sensitivity Scenario 1, the contour plots show a reduced stability of the stratification over time (predicted TDS concentrations display scattering over time, as seen in Figure 10). Similar to the rationale provided for A418 pit lake, stability is expected to be stronger than indicated by these simulations over the long term.

Similar to the A418 Pit Lake, the pattern observed for the A154 Pit Lake with a 20-m freshwater cap (Sensitivity Scenario 2) is a result of continuous inflow of high TDS flow (PK pore water) to the bottom of the Pit Lake and low TDS flow (Lac de Gras) to the surface layers of the Pit Lake, with gradual breakdown of meromixis and full mixing of the lake which occurs 14 years post closure.

The TDS concentrations in the surface layers of the pit are predicted to remain below 20 mg/L, 40 mg/L and 100 mg/L over the simulation period (100 years post-closure) for Development Case, Sensitivity Scenario 1 and Sensitivity Scenario 2, respectively. At Year 100 post-closure TDS concentrations of surface layers for all modelled scenarios are predicted to be lower than 50 mg/L.

Contour plots of settleable generic constituent concentrations for the Base Case and Sensitivity Scenario 2 (shallowest water cap) are presented in Figure 12. The results indicate that resuspension of fines would not occur following initial deposition. As discussed in Section 4.1.1, this finding is consistent with empirical data from another pit lake (Vandenberg and Litke 2017).

Because this material is not predicted to resuspend in the 20-m deep pit lake, it would not be anticipated to resuspend in deeper lakes, so further modelling of fines resuspension is not necessary at this stage.

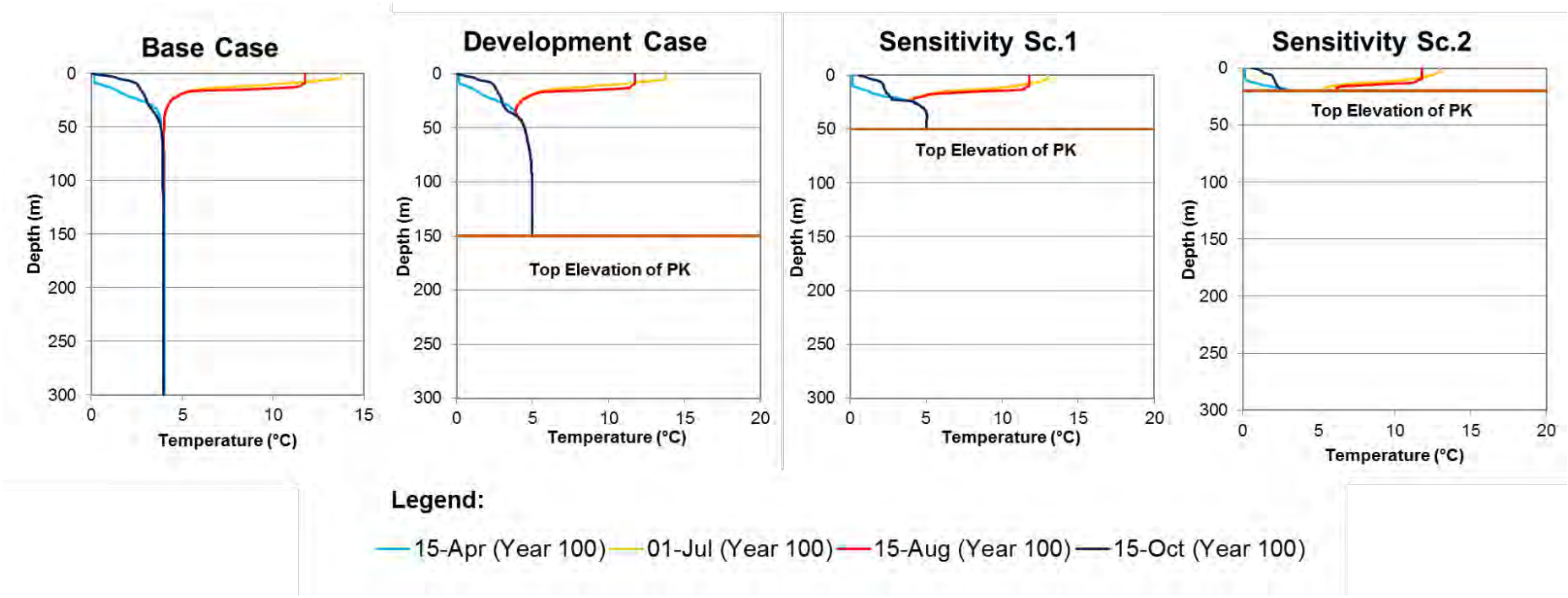

Figure 8: Predicted Vertical Profiles of Water Temperature in the A154 Pit Lake at Selected Dates of Year 100

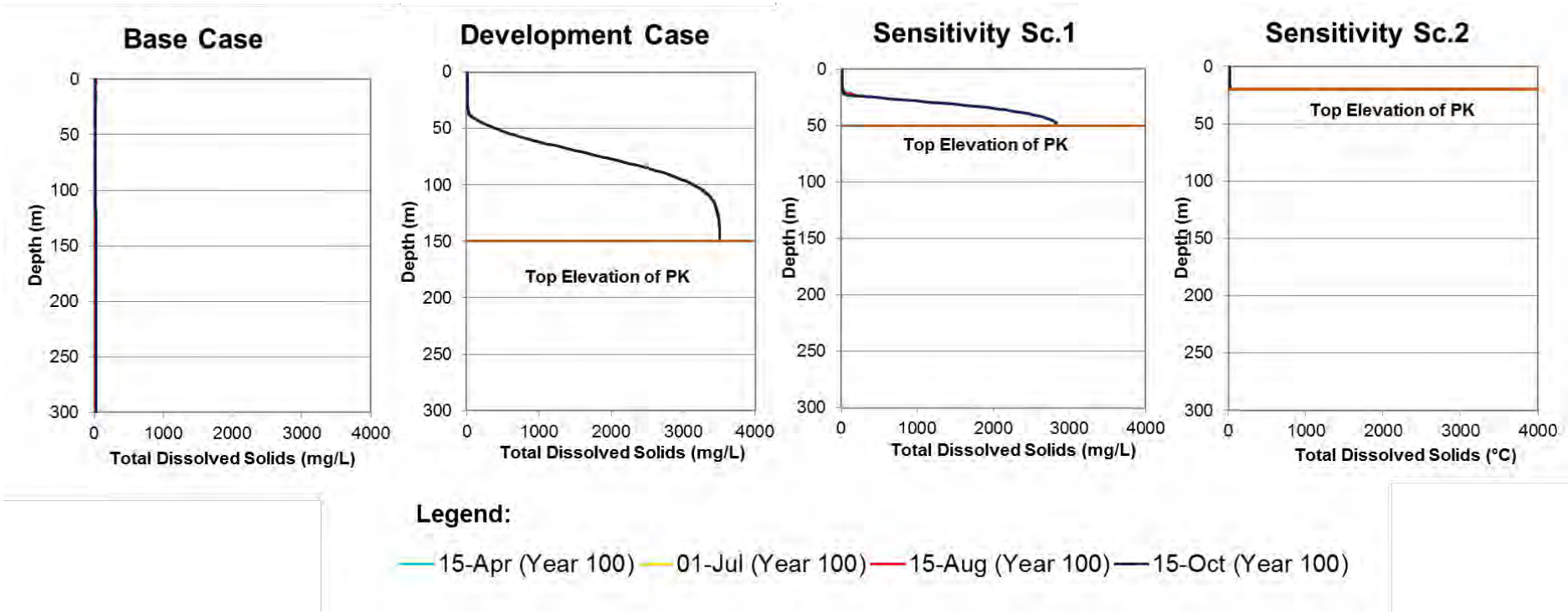

Figure 9: Predicted Vertical Profiles of Total Dissolved Solids Concentrations in the A154 Pit Lake at Selected Dates of Year 100

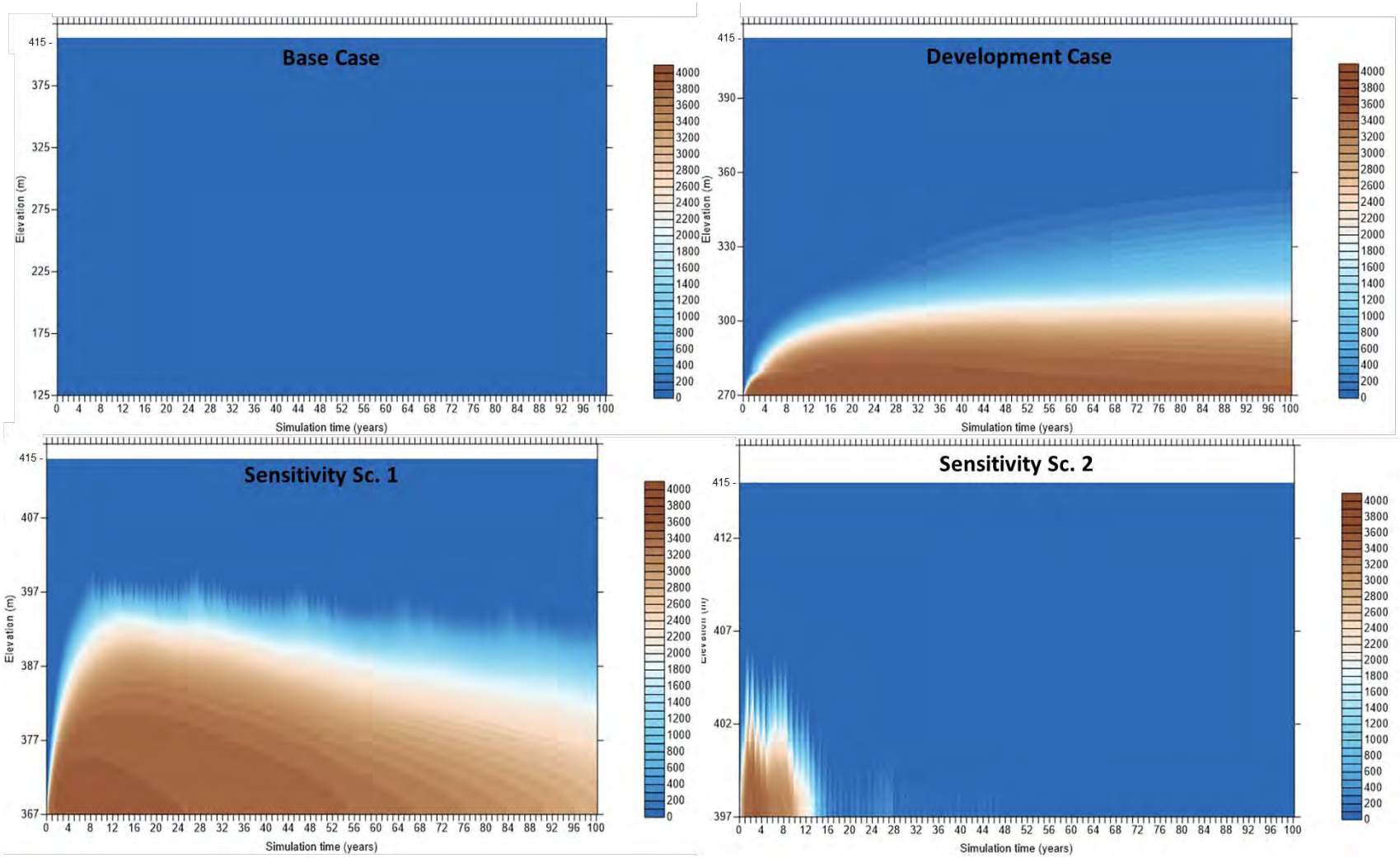

Figure 10: Contour Plots of Predicted Total Dissolved Solids Concentrations in the A154 Pit Lake over the Simulation Period (100 years Post-Closure)

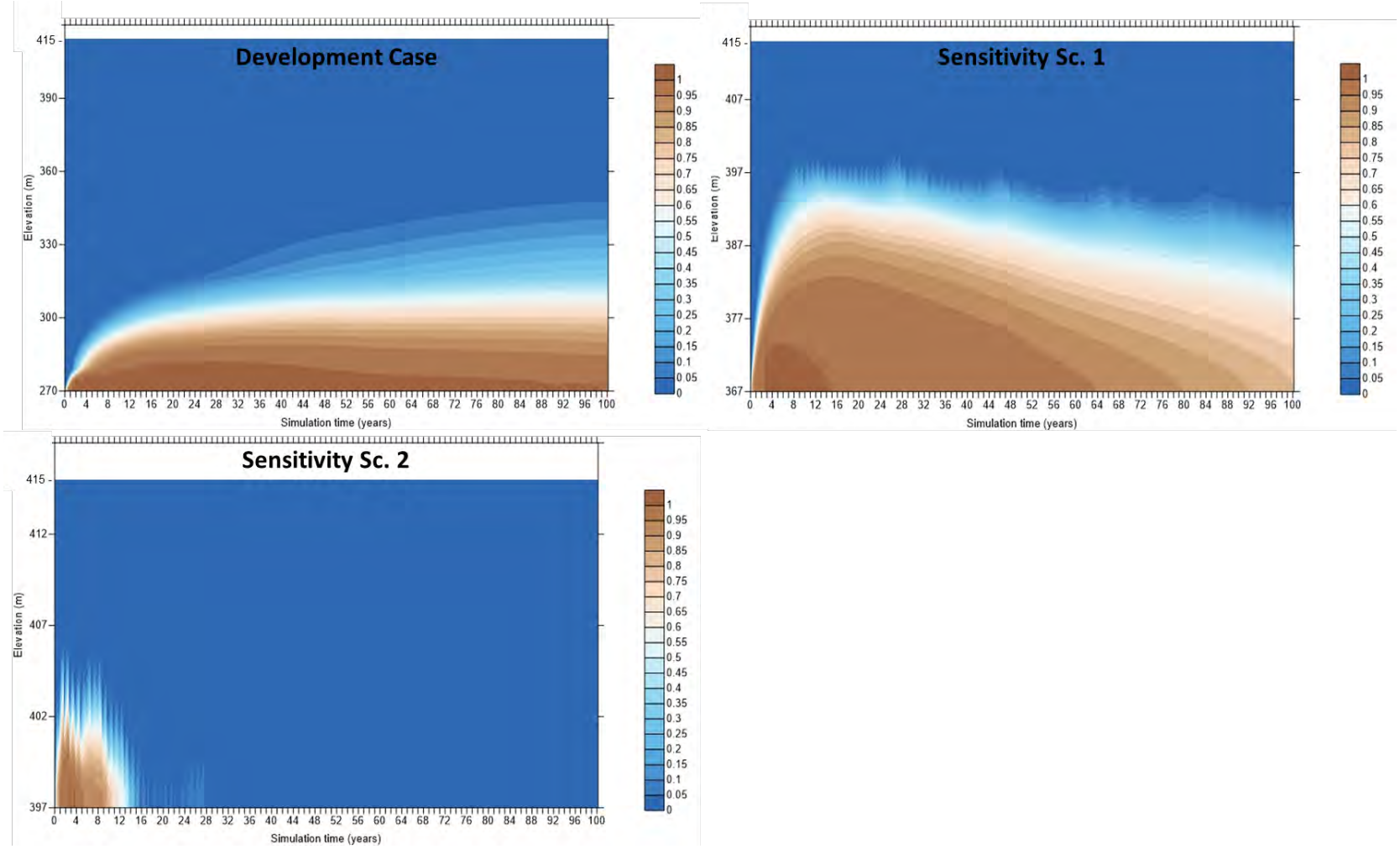

Figure 11: Contour Plots of Predicted Tracer Concentrations in the A154 Pit Lake over the Simulation Period (100 years Post-Closure)

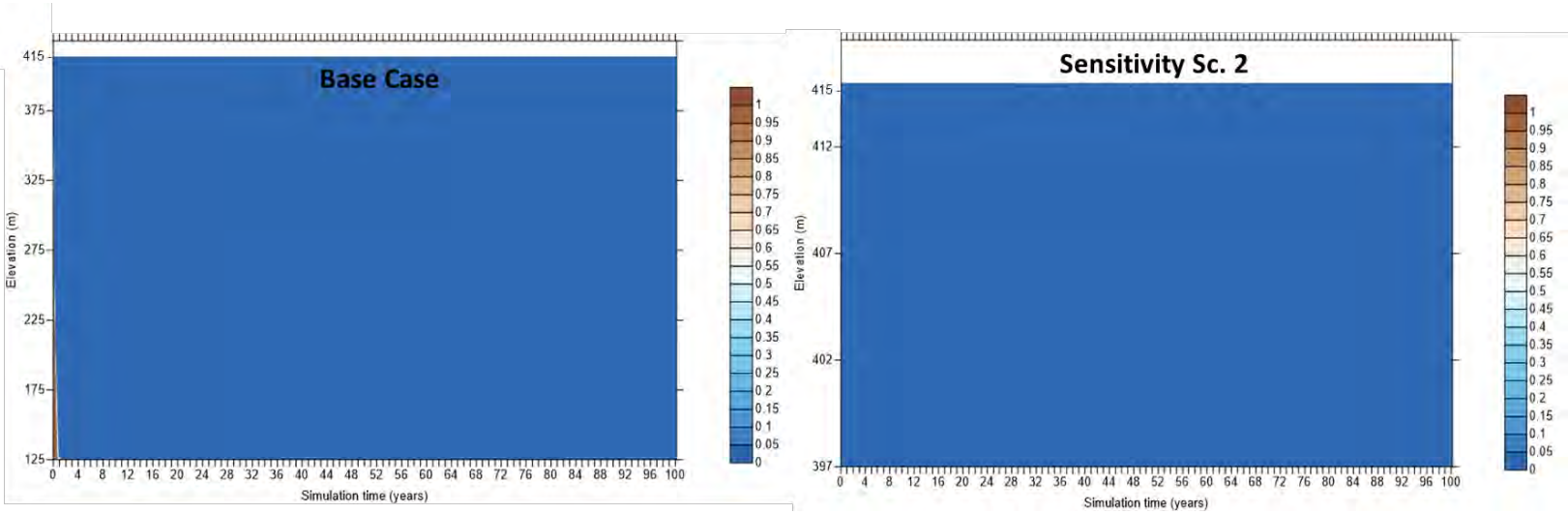

Figure 12: Contour Plots of Predicted Settleable Constituent in the A154 Pit Lake over the Simulation Period (100 years Post-Closure)

4.1.3 A21 Pit Lake

Temperature and TDS predicted vertical profiles are presented in Figures 13 and 14, respectively, for the modelled scenarios. Similar to the A418 and A154 pit lakes, predicted vertical temperature profiles for the A21 Pit Lake show similar seasonal and spatial patterns in the top 20-m of water for all modelled scenarios (Figure 13).

The TDS concentrations for the Base Case, Sensitivity Scenarios 2 are predicted to stay relatively constant along the vertical profile, indicating a lack of permanent stratification (Figure 14) because of a high volume of exchange with lake water by Year 100 post-closure.

Predicted TDS vertical profiles for the Development Case (150 m freshwater cap) and Sensitivity Scenario 1 (50 m freshwater cap) show permanent stratification along the water column created by the high TDS concentrations associated with the inflow of PK pore water at the bottom of the water column. These results are consistent with predictions made for A418 and A154 pit lakes.

Contour plots of TDS and tracer concentrations during the simulation period (Figures 15 and 16) show that the similar to A418 and A154 pit lakes, the A21 Pit Lake is predicted to:

- remain fully mixed in the Base Case Scenario
- permanently stratify in the Development Case and Sensitivity Scenario 1
- stratify for about 10 years and mixes vertically thereafter in the Sensitivity Scenario 2

Similar to the rationale provided for A418 pit lake, stability is expected to be stronger than indicated by these simulations over the long term.

Similar to the other two pit lakes, the pattern observed for the A154 Pit Lake with 20 m freshwater cap (Sensitivity Scenario 2) is a result of continuous inflow of high TDS flow (PK pore water) to the bottom of the Pit Lake and low TDS flow (Lac de Gras) to the surface layers of the Pit Lake, with gradual breakdown of meromixis and full mixing of the lake which occurs 10 years post closure.

The TDS concentrations in the surface layers of the pit are predicted to remain below 20 mg/L, 30 mg/L and 80 mg/L over the simulation period (100 years post-closure) for Development Case, Sensitivity Scenario 1 and Sensitivity Scenario 2, respectively. At Year 100 post-closure TDS concentrations of surface layers for all modelled scenarios are predicted to be lower than 80 mg/L.

Contour plots of settleable generic constituent concentrations for the Base Case and Sensitivity Scenario 2 (shallowest water cap) are presented in Figure 17. The results indicate that resuspension of fines would not occur following initial deposition. As discussed in Section 4.1.1, this finding is consistent with empirical data from another pit lake (Vandenberg and Litke 2017).

Because this material is not predicted to resuspend in the 20-m deep pit lake, it would not be anticipated to resuspend in deeper lakes, so further modelling of fines resuspension is not necessary at this stage.

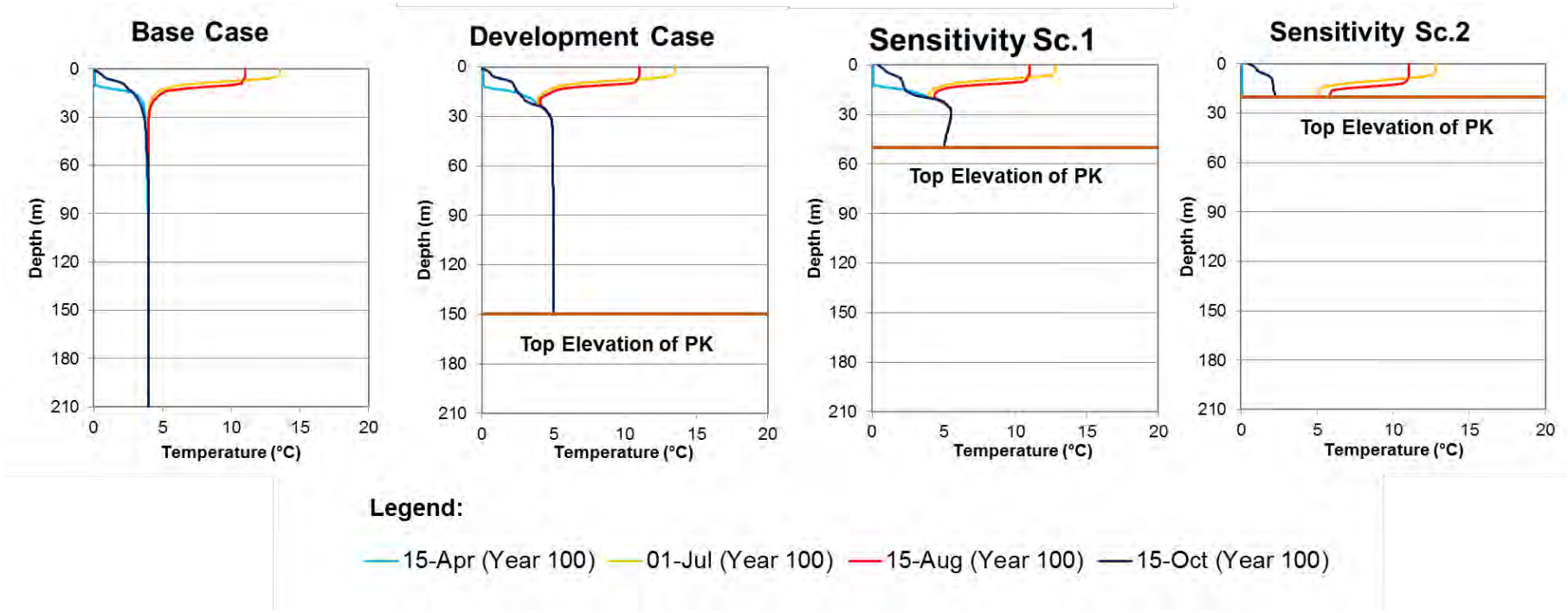

Figure 13: Predicted Vertical Profiles of Water Temperature in the A21 Pit Lake at Selected Dates of Year 100

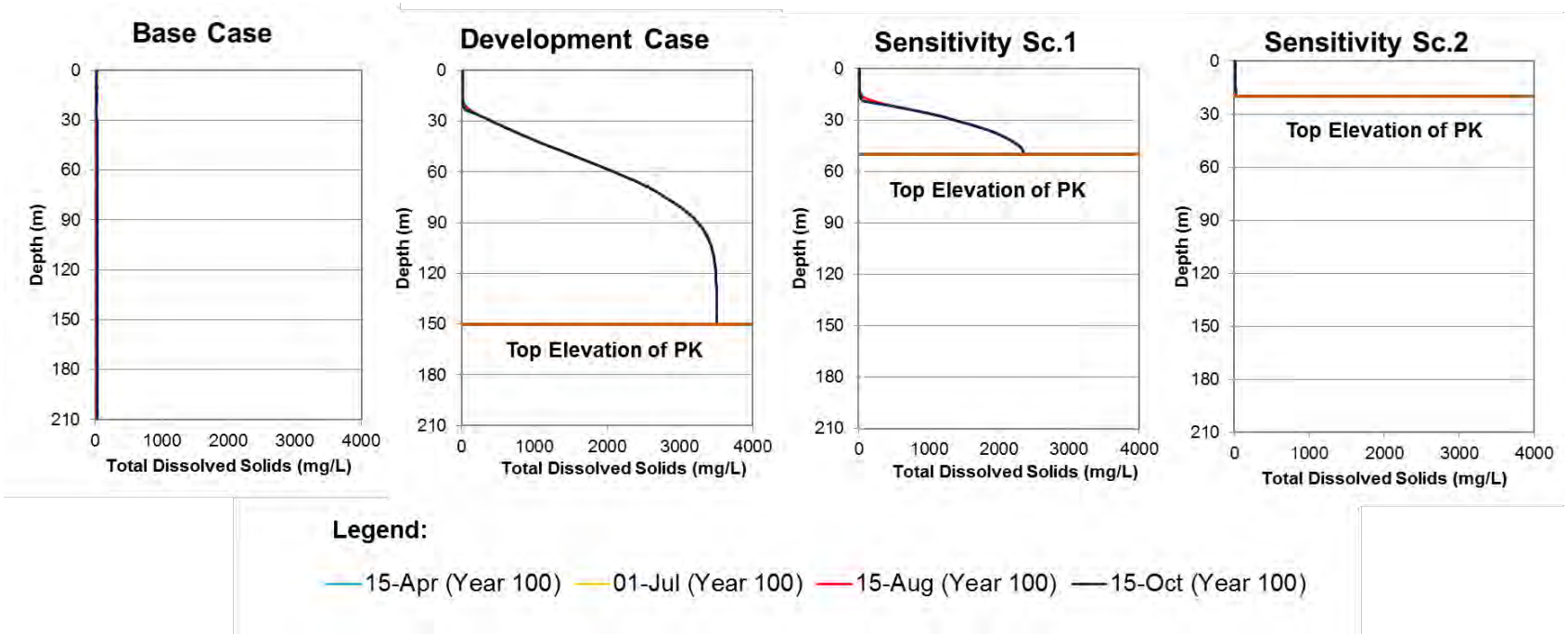

Figure 14: Predicted Vertical Profiles of Total Dissolved Solids Concentrations in the A21 Pit Lake at Selected Dates of Year 100

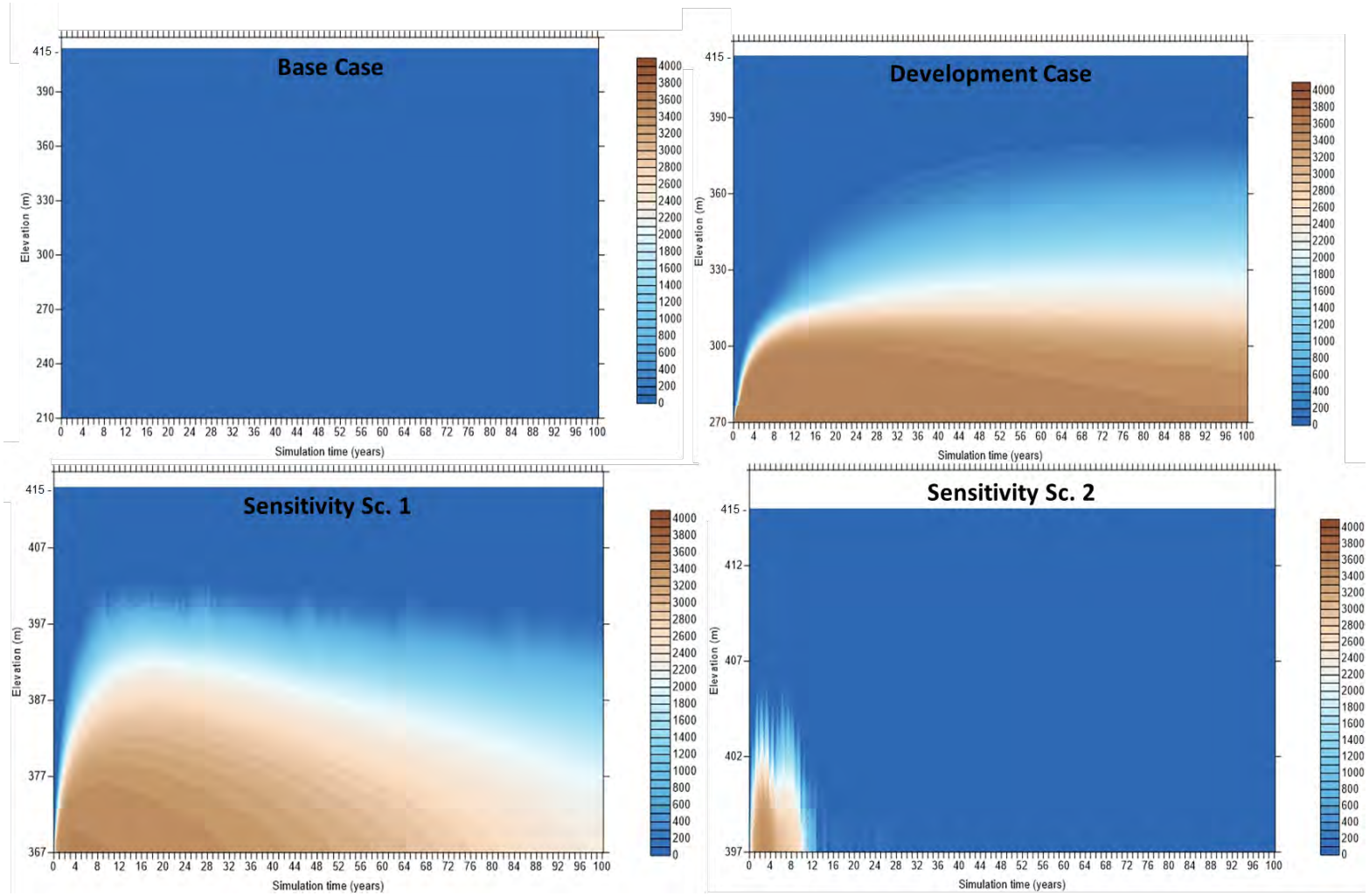

Figure 15: Contour Plots of Predicted Total Dissolved Solids Concentrations in the A21 Pit Lake over the Simulation Period (100 years Post-Closure)

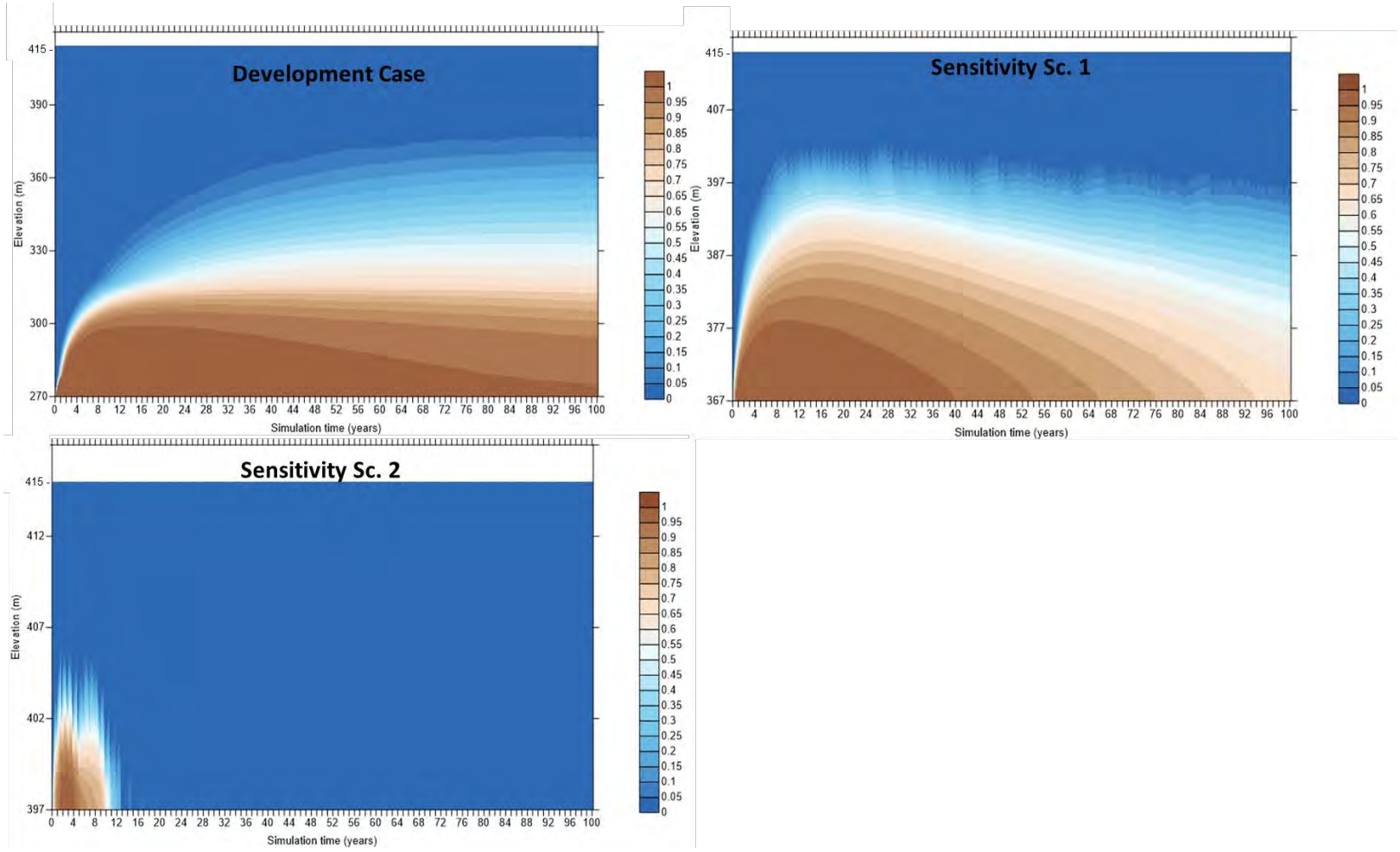

Figure 16: Contour Plots of Predicted Tracer Concentrations in the A21 Pit Lake over the Simulation Period (100 years Post-Closure)

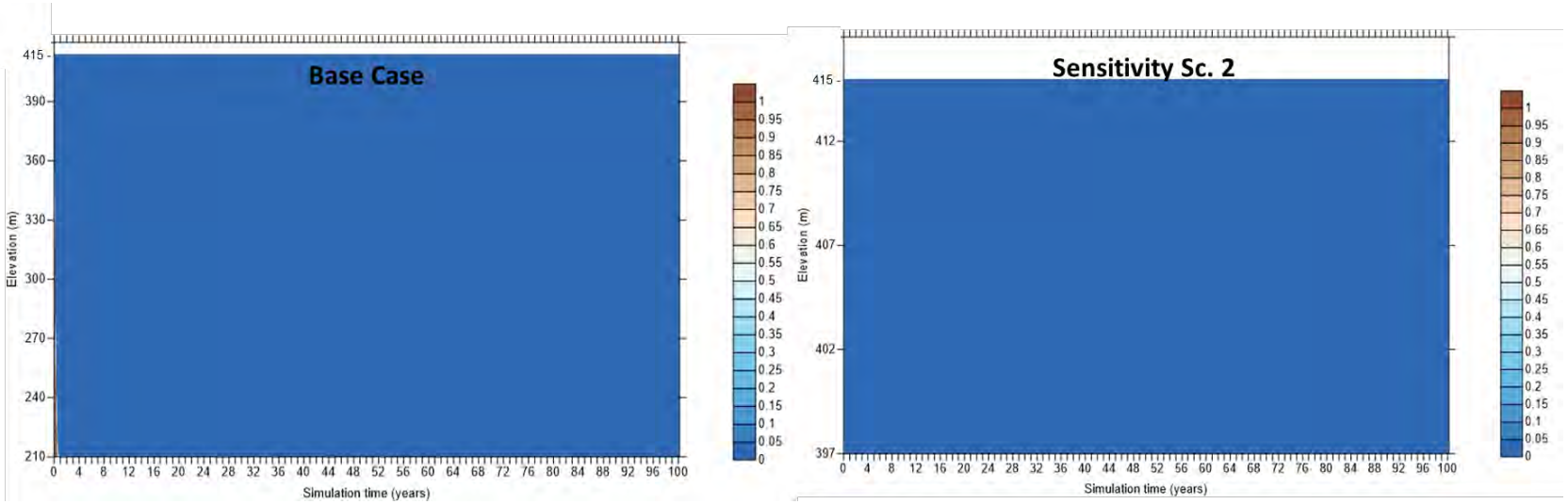

Figure 17: Contour Plots of Predicted Settleable Constituent in the A21 Pit Lake over the Simulation Period (100 years Post-Closure)

4.2 Water Quality Results

Timeseries of predicted average tracer concentration in the top five and bottom five layers of each pit lake (water column) are presented in Appendix A, Figures A-1 to A-9 for the modelled scenarios. Water Quality predictions are not presented for the Base Case and Sensitivity Scenario 3 (A418 Pit Lake) because in the Base Case there are no PK pore water inflow, so the pit lakes' water quality is similar to Lac de Gras water quality, and for the Sensitivity Scenario 3, results are similar to the Sensitivity Scenario 2 (A418 Pit Lake).

Diavik's surface water quality benchmarks and range of observed concentrations in Lac de Gras (Table 1) are also presented on the timeseries graphs.

As can be seen from the timeseries graphs, for the scenarios in which the pit lakes are predicted to be stratified (Development Case and Sensitivity Scenario 1), concentrations of all water quality constituents are predicted to remain below the surface water quality benchmarks (Figures A-1, A-2, A-4, A-5, A-7, A-8).

For the Sensitivity Scenario 2 in which pit lakes are predicted to reach fully mixed conditions between 10 to 25 years post-closure, concentrations of all constituents are predicted to remain below surface water quality benchmarks in the surface and bottom layers of the pit lake once the pit lakes reach fully mixed conditions (25 years for A418, 14 years for A154, and 10 years for A21).

Maximum projected daily concentrations over 100-year post closure modelled timeframe are presented in Table 2 and compared to the surface water quality benchmarks for Development Case and sensitivity scenarios. The maximum modelled concentrations of all constituents in the pit lakes are projected to remain below surface water quality benchmarks under all modelled scenarios, with the exception of sulphate, nitrate as nitrogen and selenium in the A418 Pit Lake under Sensitivity Scenario 2 (20-m freshwater cap). The concentrations of these three constituents are predicted to exceed benchmarks several times during the first 25 years of the simulation period. Each exceedance is predicted to last for approximately 10 days (Figure A-3).

Table 2: Predicted Maximum Daily Concentrations in the Surface Water (Top Section) of A418, A154 and A21 Pit Lakes over 100-year Period after Closure

Year for the Predicted Peak Concentration		Benchmarks [(a)]	A418			A154			A21		
			Development Case	Sensitivity Scenario 1	Sensitivity Scenario 2	Development Case	Sensitivity Scenario 1	Sensitivity Scenario 2	Development Case	Sensitivity Scenario 1	Sensitivity Scenario 2
			2126	2050	2031	2123	2049	2030	2108	2051	2031
Calcium	mg/L	-	2.9	7.7	19	2.7	3.6	6.6	1.9	2.5	5.0
Chloride	mg/L	120	3.7	7.1	15	3.6	4.1	6.3	2.3	2.8	4.5
Fluoride	mg/L	0.12	0.034	0.037	0.043	0.034	0.035	0.036	0.031	0.031	0.033
Magnesium	mg/L	-	1.7	11	34	1.4	3.0	9.0	1.4	2.7	7.7
Potassium	mg/L	-	1.3	5.1	14	1.2	1.8	4.2	1.1	1.6	3.6
Sodium	mg/L	52	3.3	6.8	15	3.2	3.8	6.0	1.8	2.3	4.2
Sulfate	mg/L	100	7.2	61	**186**	5.1	14	48	5.7	13	41
Nitrite as nitrogen	mg/L	0.06	0.0014	0.011	0.033	0.00098	0.0027	0.0087	0.00098	0.0023	0.0073
Nitrate as nitrogen	mg/L	3	0.19	2.4	**7.6**	0.1	0.49	1.9	0.11	0.42	1.6
Phosphate, Ortho	mg/L	-	0.0017	0.003	0.0061	0.0016	0.0018	0.0027	0.00083	0.001	0.0017
Phosphorus	mg/L	-	0.0037	0.0051	0.0084	0.0036	0.0038	0.0047	0.0033	0.0035	0.0042
Aluminum	µg/L	87	6.5	9.9	18	6.4	7.0	9.1	3.4	3.9	5.7
Antimony	µg/L	33	0.04	0.17	0.46	0.036	0.057	0.14	0.028	0.045	0.11
Arsenic	µg/L	5	0.28	0.35	0.5	0.28	0.29	0.33	0.23	0.24	0.27
Barium	µg/L	1000	4.1	14	39	3.7	5.5	12	2.8	4.2	9.6
Beryllium	µg/L	-	0.0054	0.012	0.026	0.0051	0.0062	0.01	0.0053	0.0061	0.0094
Boron	µg/L	1500	3.0	4.2	7.1	2.9	3.1	3.9	2.6	2.7	3.4
Cadmium	µg/L	0.1	0.0041	0.026	0.075	0.0033	0.007	0.02	0.0035	0.0064	0.017
Cobalt	µg/L	-	0.025	0.15	0.45	0.02	0.042	0.12	0.024	0.041	0.11
Copper	µg/L	2	0.6	0.79	1.2	0.6	0.63	0.75	0.62	0.64	0.74

Year for the Predicted Peak Concentration		Benchmarks [(a)]	A418			A154			A21		
			Development Case	Sensitivity Scenario 1	Sensitivity Scenario 2	Development Case	Sensitivity Scenario 1	Sensitivity Scenario 2	Development Case	Sensitivity Scenario 1	Sensitivity Scenario 2
			2126	2050	2031	2123	2049	2030	2108	2051	2031
Iron	µg/L	300	4.4	9.8	22	4.2	5.2	8.5	3.8	4.5	7.3
Lead	µg/L	1	0.0045	0.025	0.072	0.0037	0.0073	0.02	0.0052	0.0079	0.018
Lithium	µg/L	-	2.0	2.1	2.2	2.0	2.0	2.1	1.7	1.7	1.7
Manganese	µg/L	-	3.4	5.2	9.5	3.3	3.6	4.8	2.0	2.3	3.2
Molybdenum	µg/L	73	1.6	13	41	1.1	3.2	11	0.8	2.4	8.5
Nickel	µg/L	25	1.0	5.4	16	0.86	1.6	4.4	1.1	1.7	4.0
Selenium	µg/L	1	0.046	0.47	**1.5**	0.029	0.1	0.37	0.039	0.097	0.32
Silicon	µg/L	2100	189	246	376	187	197	232	31	39	70
Silver	µg/L	0.1	0.0031	0.013	0.035	0.0027	0.0044	0.01	0.0029	0.0042	0.0092
Strontium	µg/L	30000	44	199	560	38	65	162	23	44	124
Sulfur	µg/L	-	2667	20828	63093	1965	5123	16519	2076	4552	13964
Thallium	µg/L	0.8	0.002	0.017	0.052	0.0014	0.0041	0.014	0.0019	0.0039	0.012
Tin	µg/L	73	0.021	0.19	0.58	0.014	0.044	0.15	0.034	0.057	0.14
Titanium	µg/L	-	0.52	0.54	0.61	0.51	0.52	0.54	0.28	0.29	0.3
Uranium	µg/L	15	0.12	0.14	0.2	0.12	0.12	0.14	0.097	0.1	0.11
Vanadium	µg/L	-	0.11	0.15	0.24	0.11	0.11	0.14	0.054	0.059	0.081
Zinc	µg/L	30	0.7	8.8	28	0.38	1.8	6.9	0.72	1.8	6.0

NOTE:

BOLD font indicates concentration exceeds chronic guideline.

(a) = No guideline/No data.

4.3 Impacts of Unanticipated Mixing

The impacts of unanticipated mixing in the pit lakes was assessed by estimating the timeseries of TDS and tracer concentrations, under the assumption of fully mixed conditions along the vertical column for the Development Case Scenario. This was assessed as a “what if” scenario and was not predicted by the hydrodynamic model; in fact, this follows the opposite behaviour of the hydrodynamic predictions. The stage-storage curve of each pit lake and hydrodynamic modelled concentration (per vertical layer) were used to calculate the mixed concentration along the depth. Timeseries of predicted TDS and tracer concentrations for each pit are presented in Figures 18 to 20.

These timeseries show predicted instantaneous fully mixed concentration of the water column that would be observed if the pit lake were to suddenly overturn at any time along this time series. Based on the results of hydrodynamic modelling for the Sensitivity Scenario 2 (Section 4.1), it is predicted that surface water concentrations in the pit lakes reach Lac de Gras concentrations between one to two months after each turn over in the lake. Thus, it is expected, that shortly after lake turnover, concentrations in the pit lake, at least near the surface, to quickly return closer to lake concentrations due to the high volume of water exchange with Lac de Gras. Conceptually, this process would be similar to the rapid flushing of surface waters predicted in sensitivity scenarios 2 and 3 (Figure 5).

For the Development Case scenario, the maximum calculated mixed daily concentrations over the 100-year period, and for year 5 and year 100 into post-closure are presented in Table 3 and compared to the surface water quality benchmarks. In the event of unanticipated mixing, the maximum estimated mixed concentrations would generally exceed the benchmark for the following constituents: sodium, sulfate, nitrate and nitrite as nitrogen, cadmium, copper, molybdenum, nickel, selenium, silver and zinc. The exceedances are projected to occur generally on all pits, with the maximum exceedance occurring in pit A21 and exceeding the benchmark for sulfate by approximately one order of magnitude. As noted above, such an unexpected turnover would be unlikely, and the elevated concentrations are expected to be short lived.

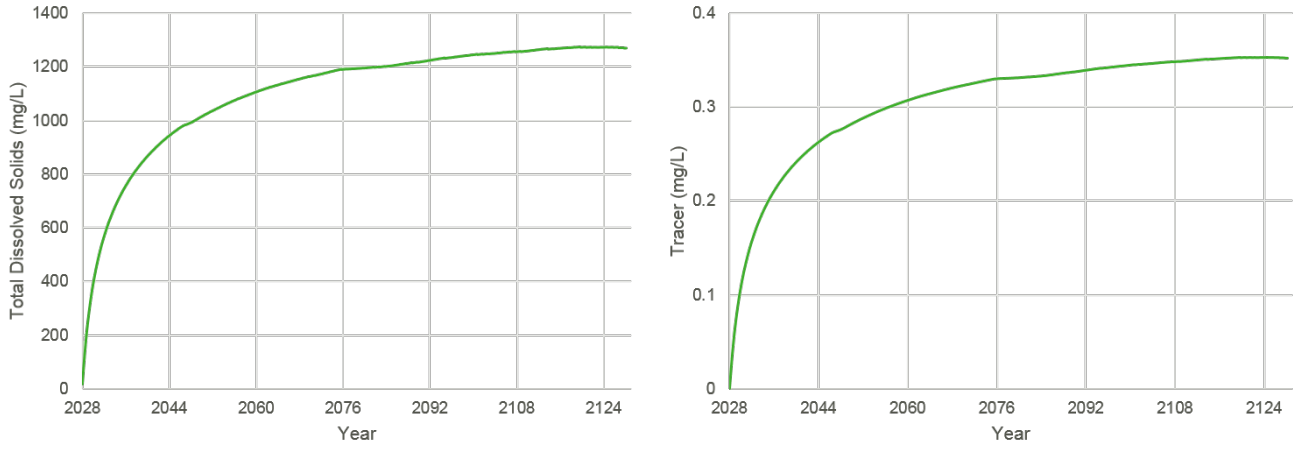

Figure 18: Time Series of Predicted Instantaneous TDS and Constituent Concentrations in the A418 Pit Lake for the Development Case Scenario over the Simulation Period (100 years Post-Closure)

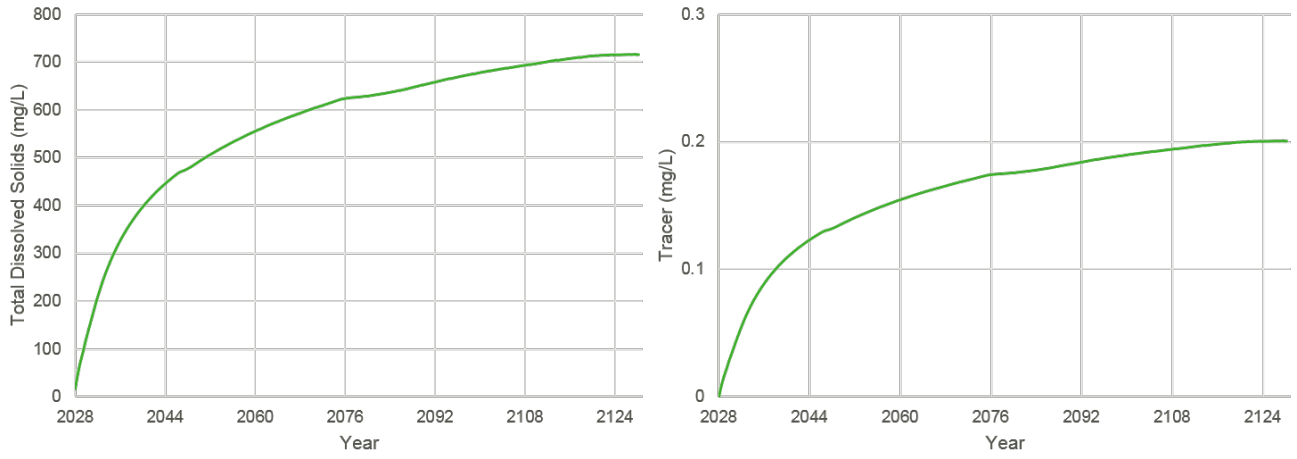

Figure 19: Time Series of Predicted Instantaneous TDS and Constituent Concentrations in the A154 Pit Lake for the Development Case Scenario over the Simulation Period (100 years Post-Closure)

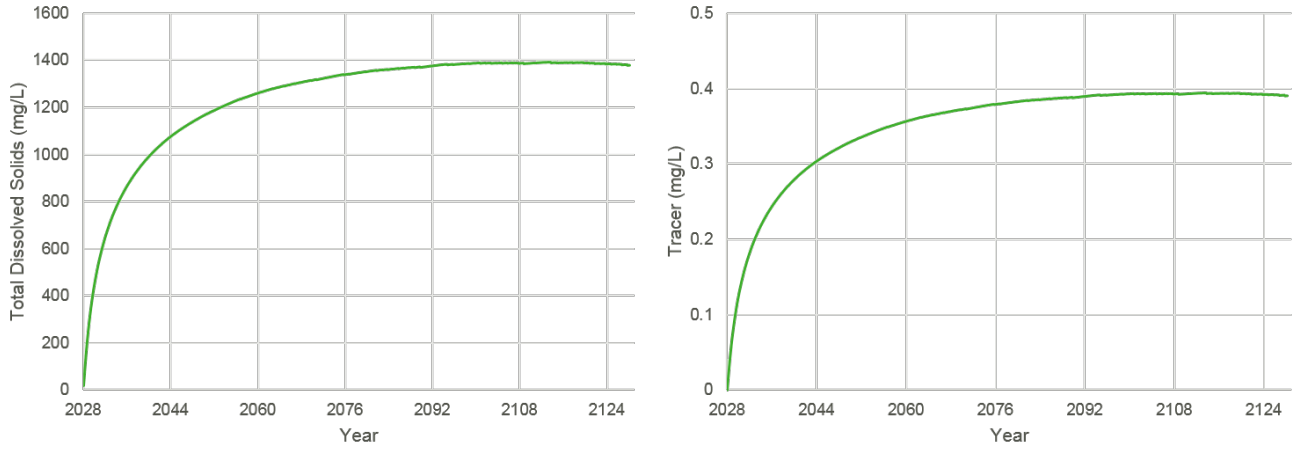

Figure 20: Time Series of Predicted Instantaneous TDS and Constituent Concentrations in the A21 Pit Lake for the Development Case Scenario over the Simulation Period (100 years Post-Closure)

Table 3: Predicted Fully Mixed Concentrations of A418, A154 and A21 Pit Lakes over 100-year Period after Closure

Year for the Predicted Concentration		Benchmarks	A418			A154			A21		
			Peak Concentration	Year 5 Average	Year 100 Average	Peak Concentration	Year 5 Average	Year 100 Average	Peak Concentration	Year 5 Average	Year 100 Average
			2124	2032	2127	2127	2032	2127	2113	2032	2027
Calcium	mg/L	-	75	37	75	44	15	44	83	41	83
Chloride	mg/L	120	55	28	55	33	12	33	60	30	60
Fluoride	mg/L	0.12	0.072	0.052	0.071	0.055	0.041	0.055	0.074	0.052	0.074
Magnesium	mg/L	-	146	69	146	84	26	84	163	80	162
Potassium	mg/L	-	59	28	59	34	11	34	66	33	65
Sodium	mg/L	52	**57**	28	**57**	34	12	34	**62**	31	**62**
Sulfate	mg/L	100	**819**	**387**	**818**	**467**	**144**	**467**	**916**	**448**	**908**
Nitrite as nitrogen	mg/L	0.06	**0.15**	**0.07**	**0.15**	**0.084**	0.026	**0.084**	**0.16**	**0.08**	**0.16**
Nitrate as nitrogen	mg/L	3	**34**	**16**	**34**	**19**	**5.9**	**19**	**38**	**19**	**38**
Phosphate, Ortho	mg/L	-	0.022	0.011	0.022	0.013	0.005	0.013	0.024	0.012	0.023
Phosphorus	mg/L	-	0.025	0.014	0.025	0.016	0.0073	0.016	0.028	0.015	0.027
Aluminum	µg/L	87	58	31	58	36	15	36	62	32	62
Antimony	µg/L	33	1.9	0.93	1.9	1.1	0.36	1.1	2.2	1.1	2.1
Arsenic	µg/L	5	1.2	0.73	1.2	0.83	0.45	0.83	1.3	0.76	1.3
Barium	µg/L	1000	161	77	160	93	30	93	179	88	177
Beryllium	µg/L	-	0.1	0.05	0.1	0.059	0.021	0.059	0.11	0.057	0.11
Boron	µg/L	1500	22	12	22	14	6.1	14	24	13	23
Cadmium	µg/L	0.1	**0.33**	**0.16**	**0.33**	**0.19**	0.059	**0.19**	**0.37**	**0.18**	**0.36**
Cobalt	µg/L	-	2.0	0.94	2.0	1.1	0.35	1.1	2.2	1.1	2.2
Copper	µg/L	2	**3.4**	1.9	**3.4**	**2.2**	1.1	**2.2**	**3.8**	**2.2**	**3.8**

Year for the Predicted Concentration		Benchmarks	A418			A154			A21		
			Peak Concentration	Year 5 Average	Year 100 Average	Peak Concentration	Year 5 Average	Year 100 Average	Peak Concentration	Year 5 Average	Year 100 Average
			2124	2032	2127	2127	2032	2127	2113	2032	2027
Iron	µg/L	300	85	42	85	50	18	50	94	48	94
Lead	µg/L	1	0.31	0.15	0.31	0.18	0.056	0.18	0.35	0.17	0.35
Lithium	µg/L	-	2.7	2.3	2.7	2.4	2.1	2.4	2.5	2.1	2.5
Manganese	µg/L	-	31	16	31	19	8.1	19	34	17	33
Molybdenum	µg/L	73	**179**	**84**	**178**	**102**	31	**102**	**199**	**97**	**198**
Nickel	µg/L	25	**67**	**32**	**67**	**39**	12	**39**	**75**	**37**	**75**
Selenium	µg/L	1	**6.5**	**3.1**	**6.5**	**3.7**	**1.1**	**3.7**	**7.3**	**3.5**	**7.2**
Silicon	µg/L	2100	1039	587	1038	671	332	671	1045	524	1036
Silver	µg/L	0.1	**0.15**	0.071	**0.15**	0.085	0.027	0.085	**0.16**	0.082	**0.16**
Strontium	µg/L	30000	2387	1141	2383	1372	438	1371	2654	1301	2631
Sulfur	µg/L	-	277235	131226	276767	158291	48852	158192	309709	151521	307060
Thallium	µg/L	0.8	0.23	0.11	0.23	0.13	0.04	0.13	0.26	0.13	0.26
Tin	µg/L	73	2.6	1.2	2.6	1.5	0.45	1.5	2.9	1.4	2.9
Titanium	µg/L	-	0.96	0.72	0.96	0.77	0.59	0.76	0.87	0.57	0.86
Uranium	µg/L	15	0.47	0.29	0.47	0.32	0.18	0.32	0.5	0.29	0.5
Vanadium	µg/L	-	0.72	0.4	0.72	0.46	0.21	0.46	0.76	0.4	0.76
Zinc	µg/L	30	**123**	**58**	**123**	**70**	21	**70**	**138**	**67**	**136**

NOTE:

BOLD font indicates concentration exceeds chronic guideline.

(a) = No guideline/No data.

5.0 CONCLUSIONS

Hydrodynamic and water quality models of Diavik A418, A154 and A21 mined-out pits were developed to understand lake mixing behaviour in pit lakes with no PK (Base Case) and pit lakes with PK under different thicknesses of freshwater cap.

The Base Case scenario was a pit lake containing only water. This lake was predicted to fully overturn at least once per year. Under scenarios that include PK with 150-m and 50-m freshwater cap thickness, all three of the pit lakes are predicted to stratify over the simulation period. Beyond that time, the conceptual model suggests long-term stability of the predicted stratification for the three pits, possibly with a very small amount of upward diffusion of mass. Under scenarios that included PK with a 20-m freshwater cap, model results indicated that all three the pit lakes will start to turn over at around 10 to 25 years post closure, which mixes the inflows from Lac de Gras with the high TDS water at the bottom of the pits.

In all modelled scenarios with different thickness of freshwater cap, for all three pit lakes (A418, A154 and A21), concentrations of modelled constituents in the top layers are predicted to remain below surface water quality benchmarks during the simulation period, except for A418 pit under the assumption of 20 m fresh water cap.

Results of the sensitivity scenarios indicated that, under the modelling assumptions, a water cap of approximately 50 m or more would be necessary to isolate PK pore water from the surface.

In the event of unanticipated mixing along the vertical columns, concentrations of some of the modelled constituents are predicted to exceed the surface water quality benchmarks during the simulation period for all of the pits. The maximum exceedance is predicted to be in the range of one order of magnitude higher than the benchmark. It is noted that this information is presented as a “what if” scenario, even though the hydrodynamic model suggests it will not occur; furthermore, it is expected that such an event to lead to short-lived concentrations throughout the pit lake due to a high volume of exchange with Lac de Gras.

6.0 CLOSURE

The reader is referred to the Study Limitations section, which follows the text and forms an integral part of this memorandum.

We trust that the content of this technical memorandum meets your expectations. Please do not hesitate to contact the undersigned should you have any questions or comments.

Golder Associates Ltd.

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Attachments: Study Limitations
Attachment 1: Water Quality Results - Figures A-1 to A-9

https://golderassociates.sharepoint.com/sites/22444g/deliverables/issued/1698-tm-rev1-3000-pit lakes wq modelling/1893614-1698-tm-rev1-3000-pit_lakes_wq_modelling_02nov_18.docx

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STUDY LIMITATIONS

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ATTACHMENT 1

Water Quality Results - Figures A-1 to A-9

Figure A-1: Predicted time Series of A418 Pit Lake Constituent Concentrations – Development Case Scenario

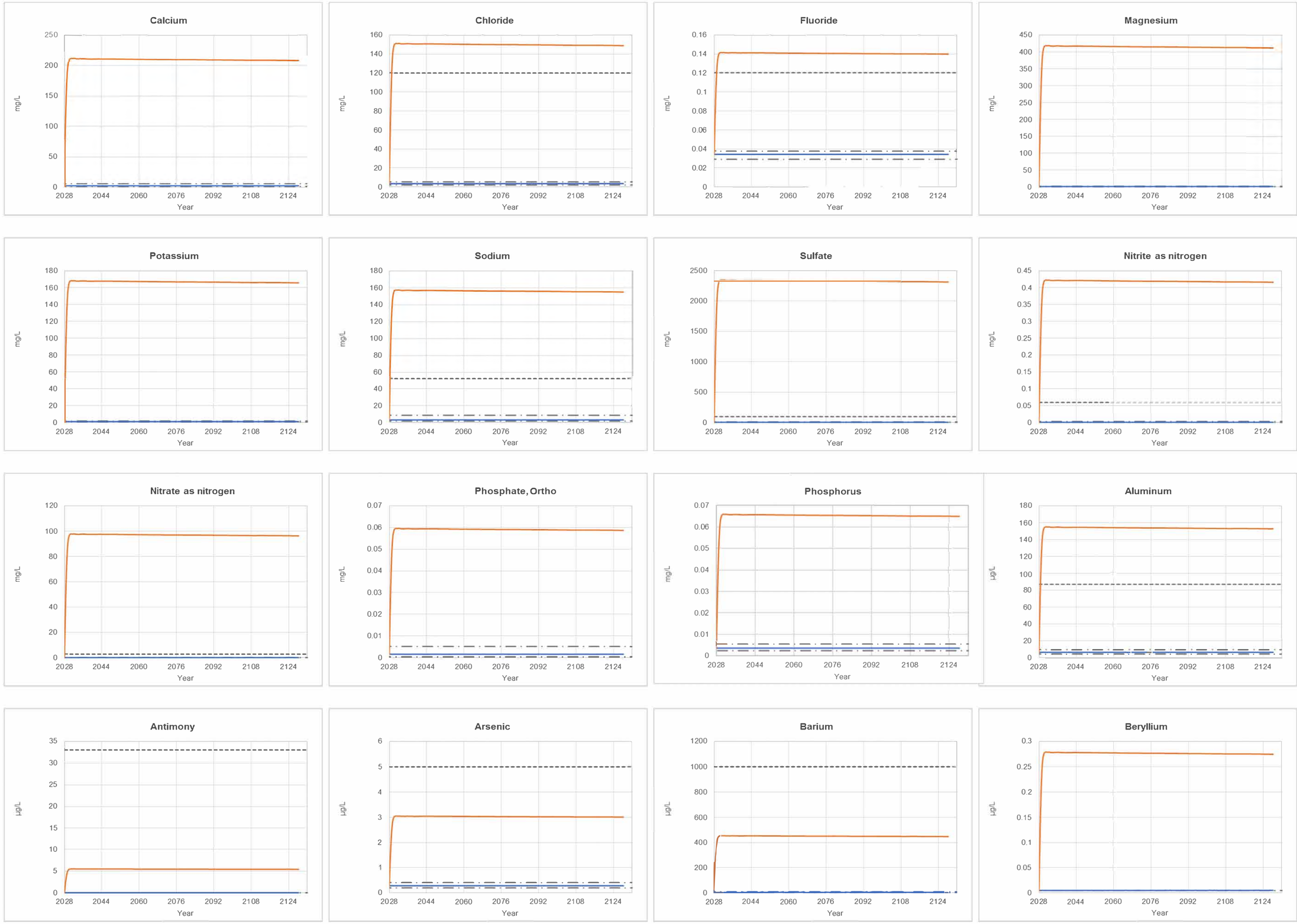
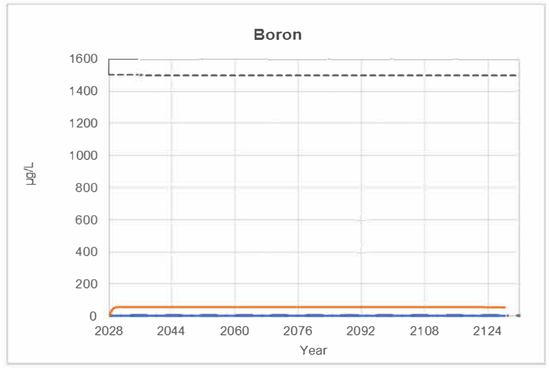
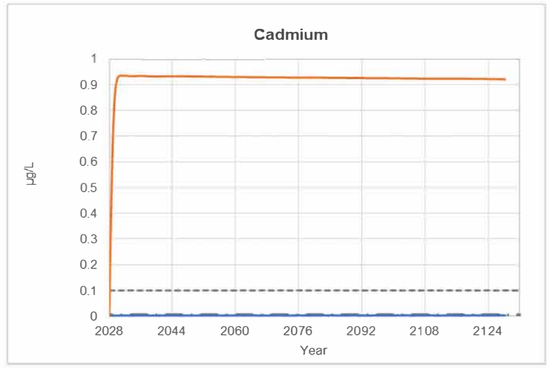
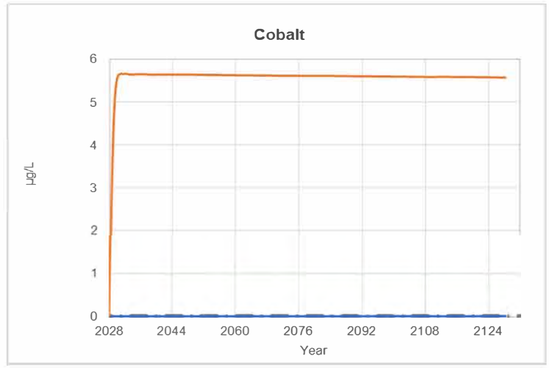
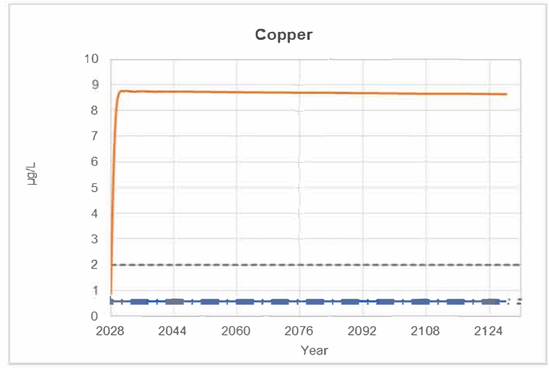


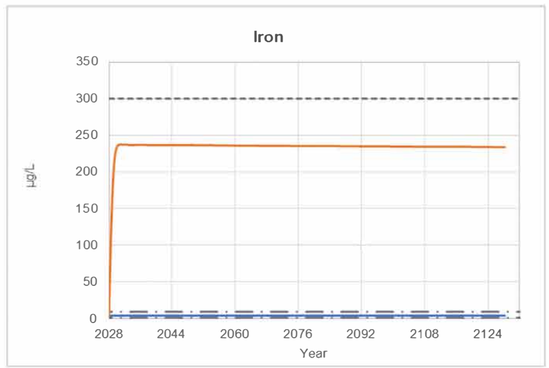
Figure A-1: Predicted time Series of A418 Pit Lake Constituent Concentrations – Development Case Scenario (continued)

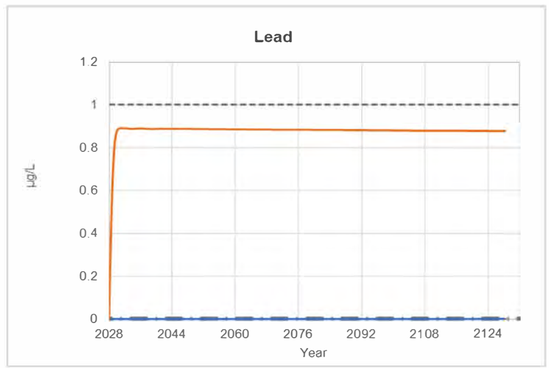


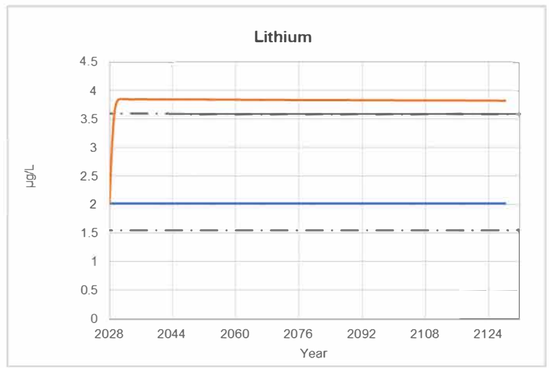


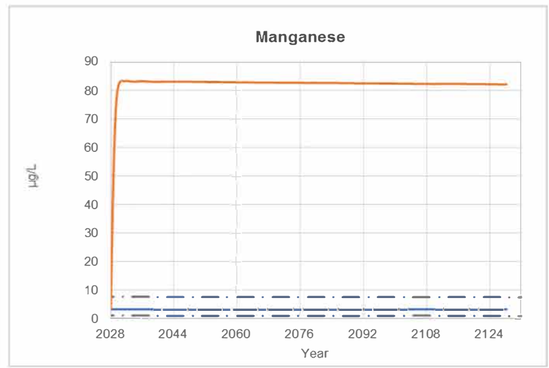


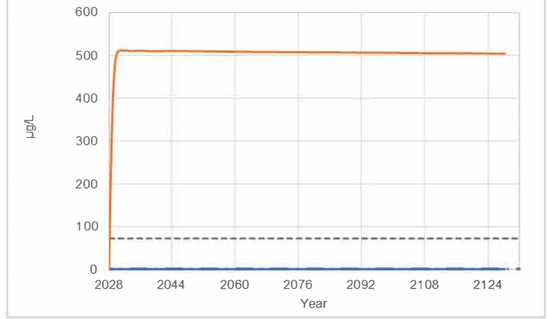


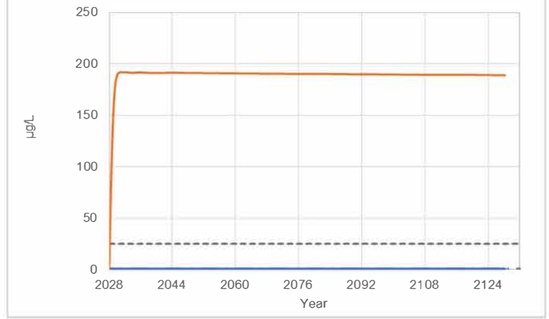


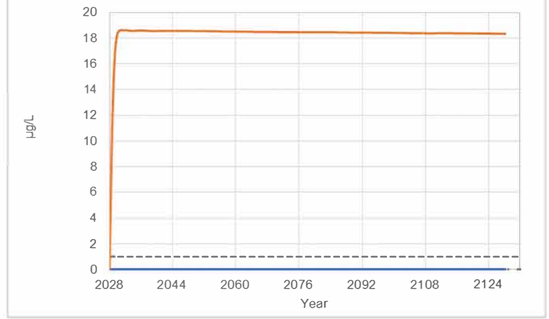


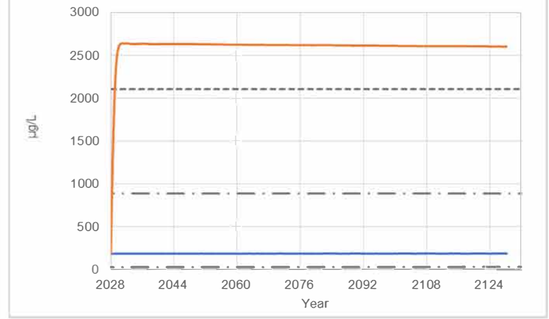


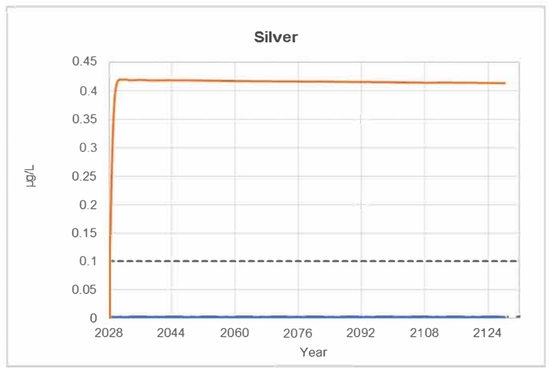


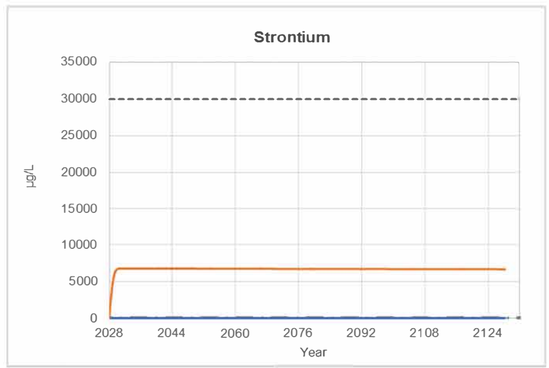


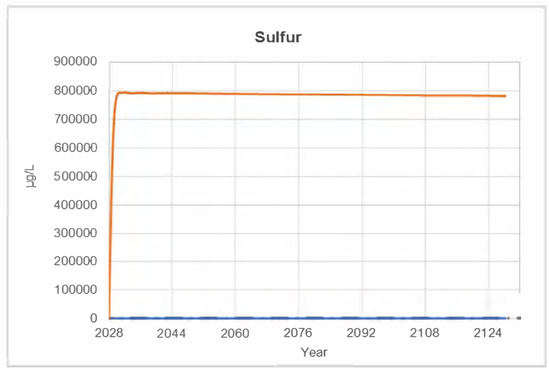












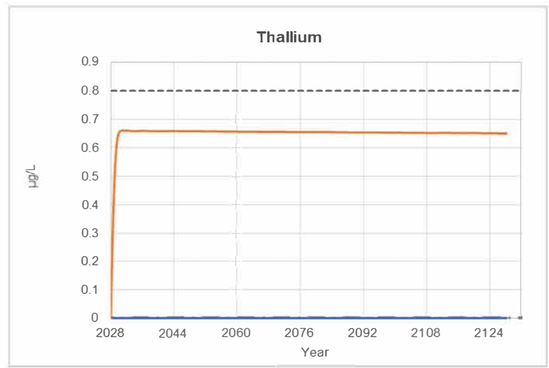
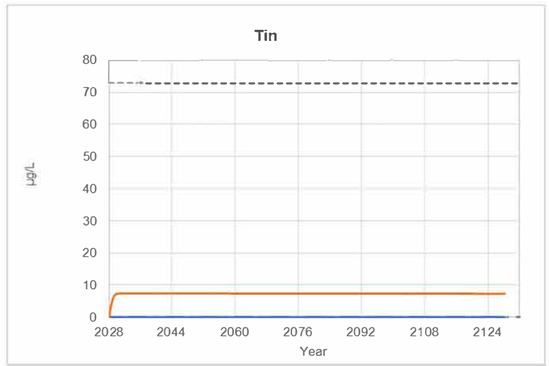
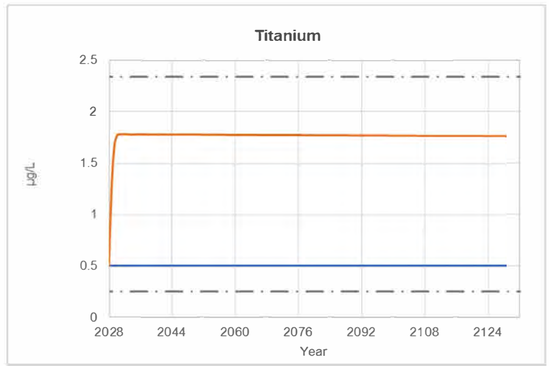
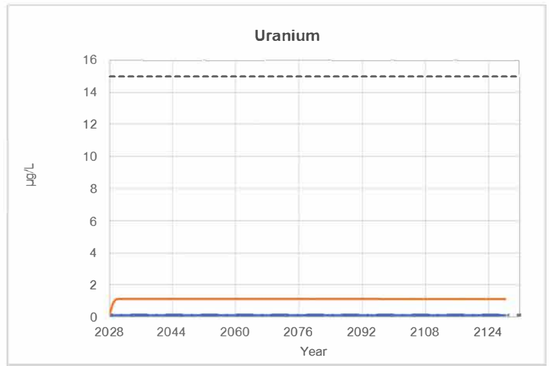
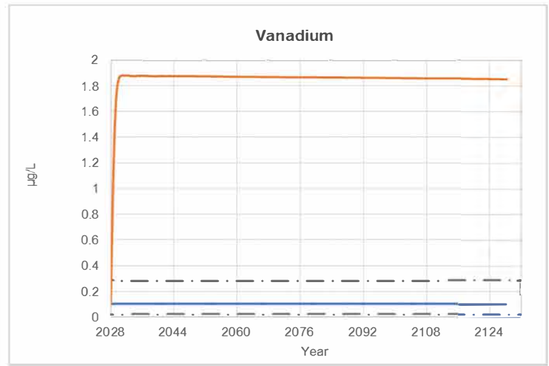


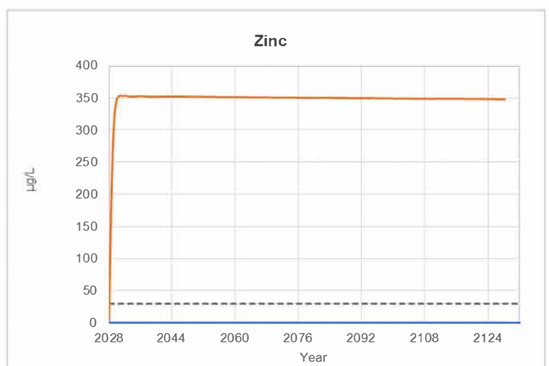
Figure A-1: Predicted time Series of A418 Pit Lake Constituent Concentrations – Development Case Scenario (continued)











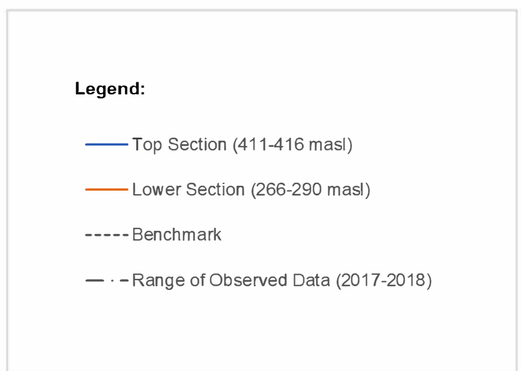


Figure A-2: Predicted time Series of A418 Pit Lake Constituent Concentrations – Sensitivity Scenario 1

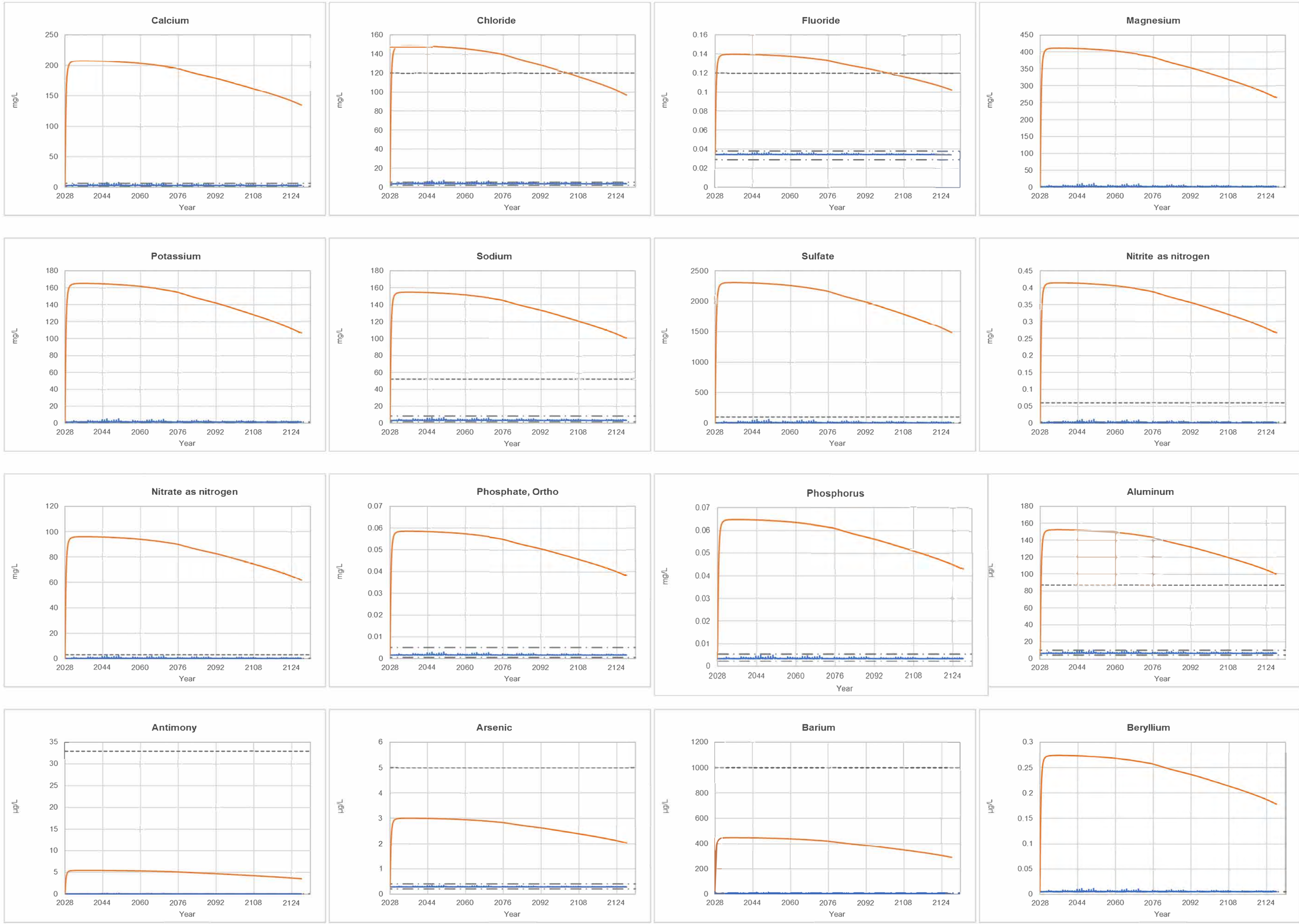
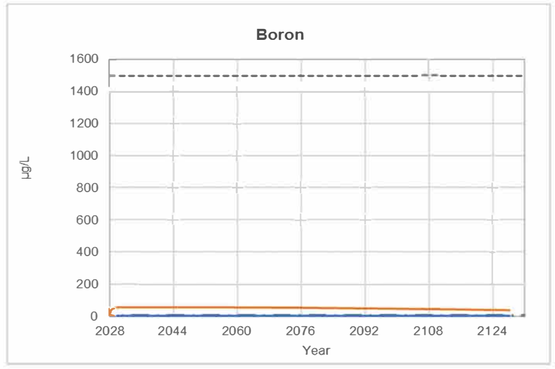
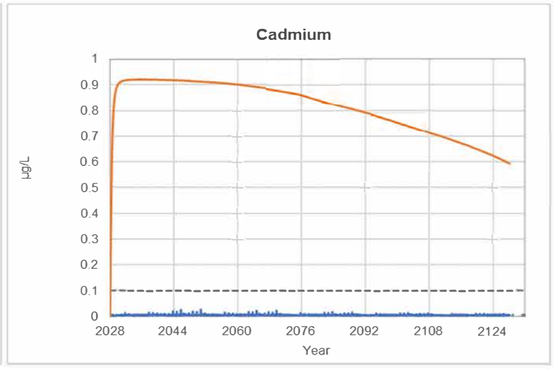
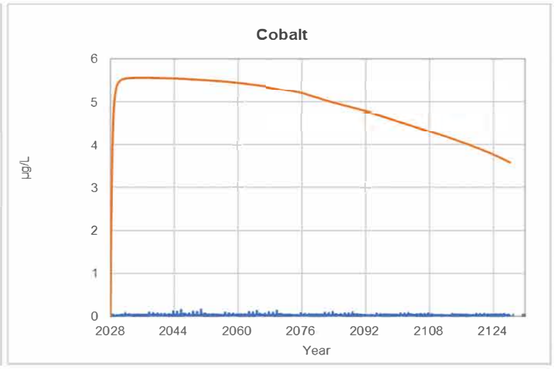
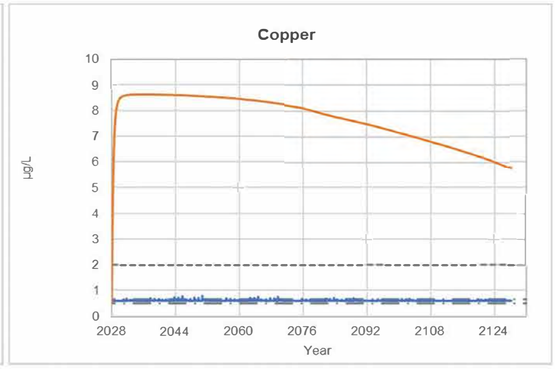


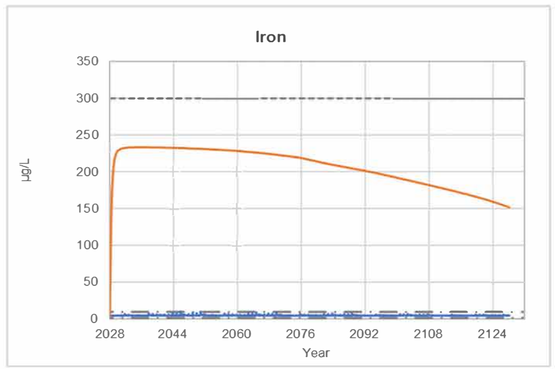
Figure A-2: Predicted time Series of A418 Pit Lake Constituent Concentrations – Sensitivity Scenario 1 (continued)

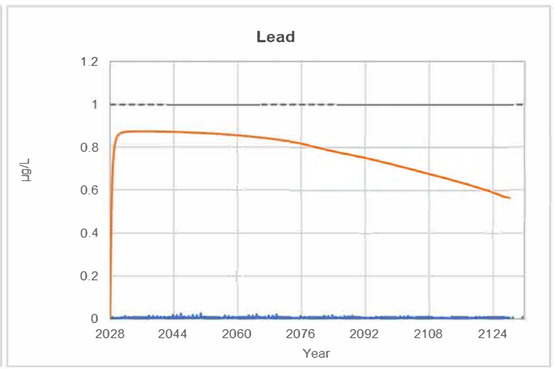


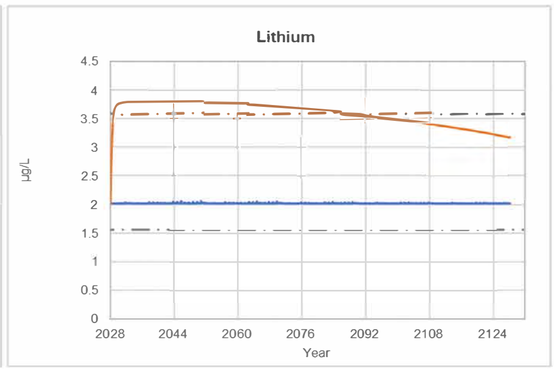


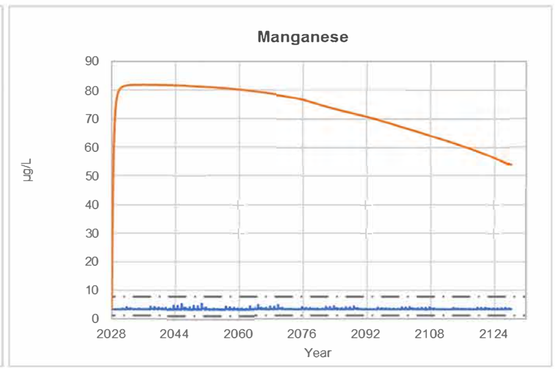


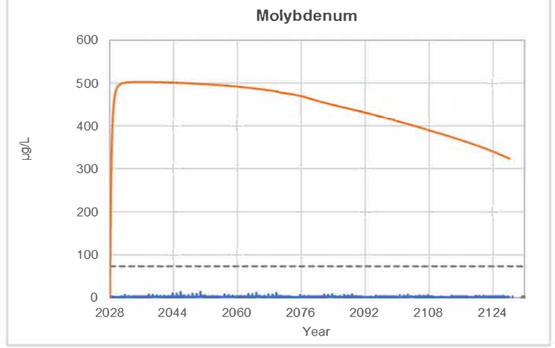


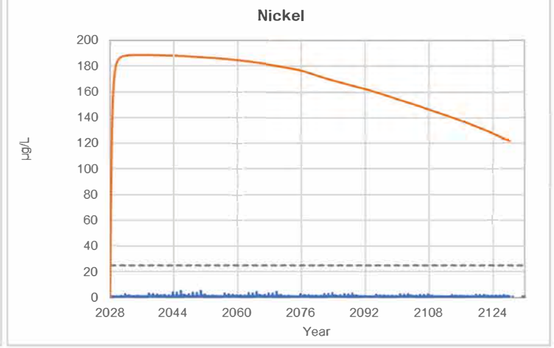


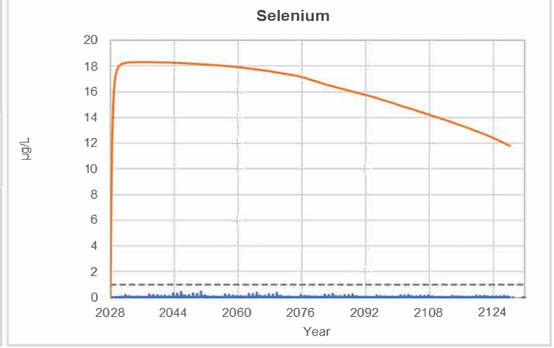


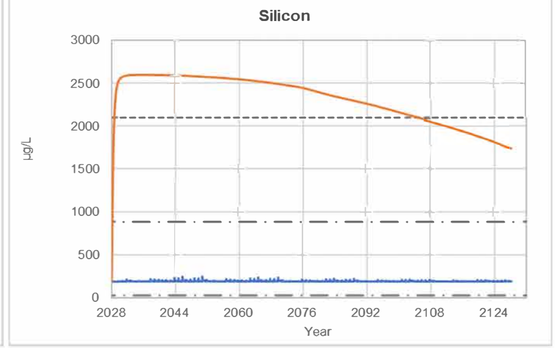


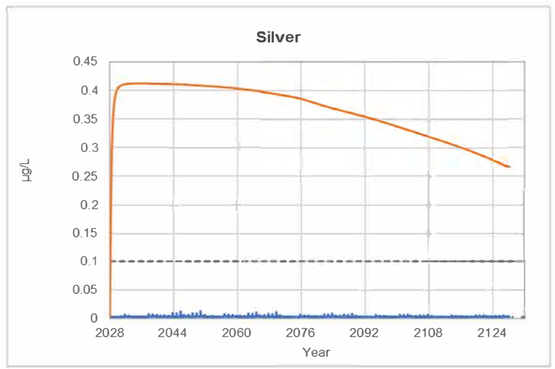


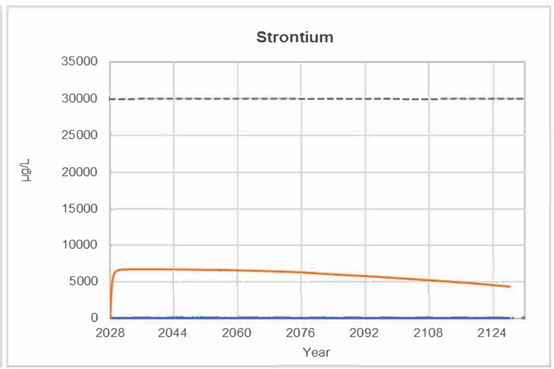


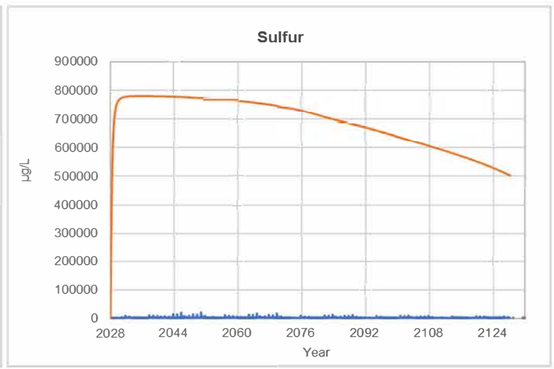












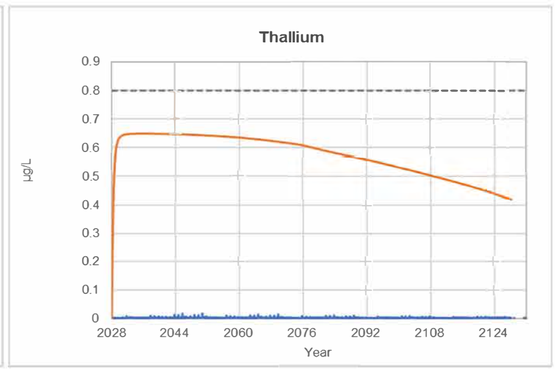


Figure A-2: Predicted time Series of A418 Pit Lake Constituent Concentrations – Sensitivity Scenario 1 (continued)

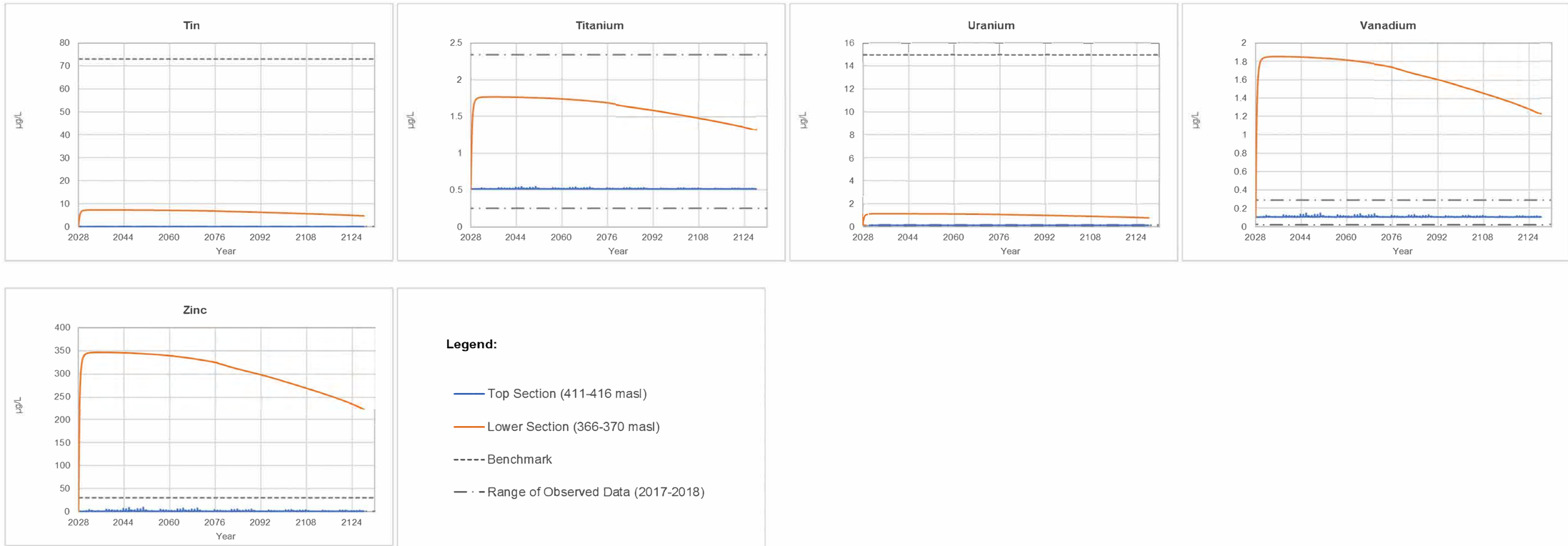


Figure A-3: Predicted time Series of A418 Pit Lake Constituent Concentrations –Sensitivity Scenario 2

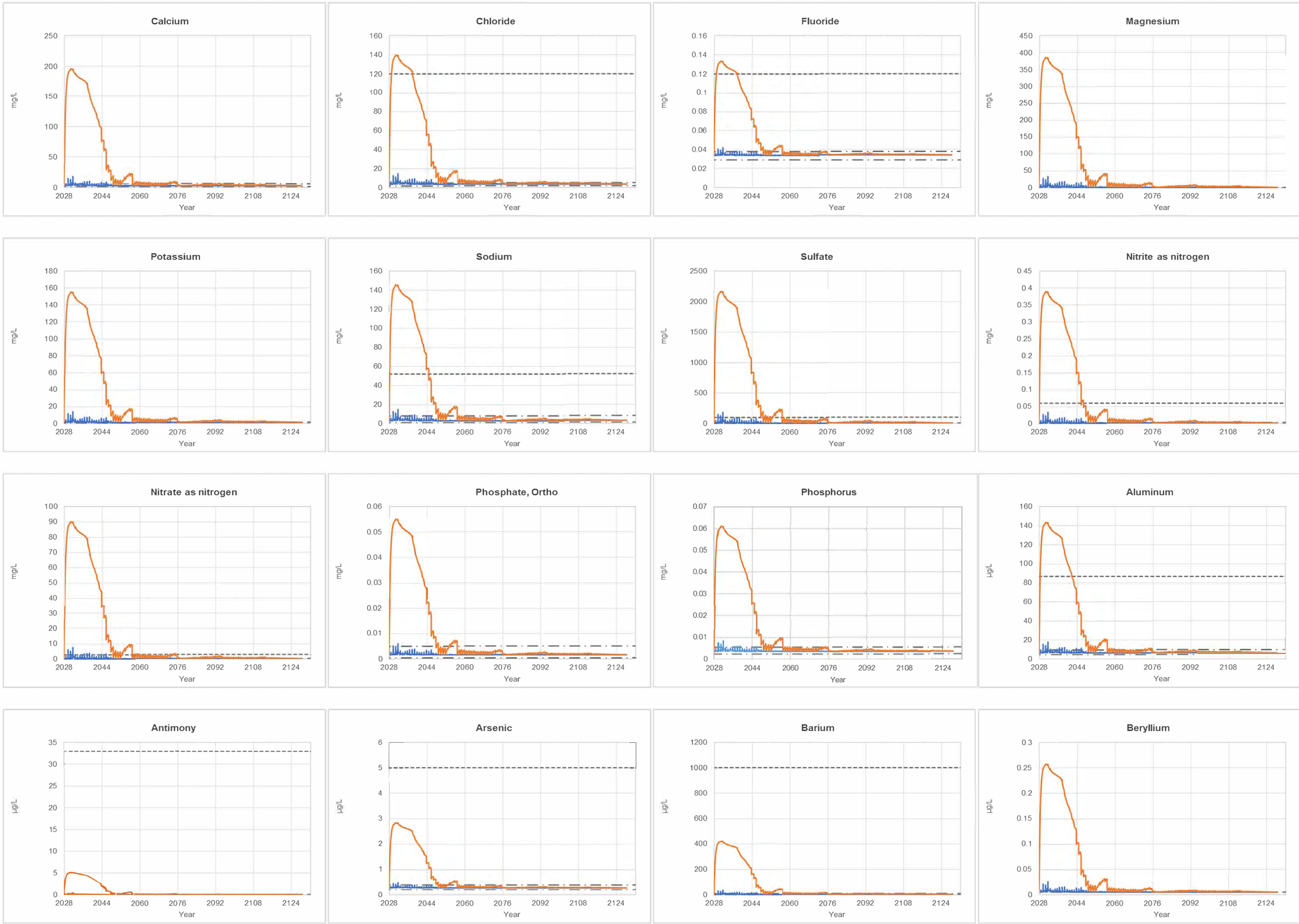


Figure A-3: Predicted time Series of A418 Pit Lake Constituent Concentrations – Sensitivity Scenario 2 (continued)

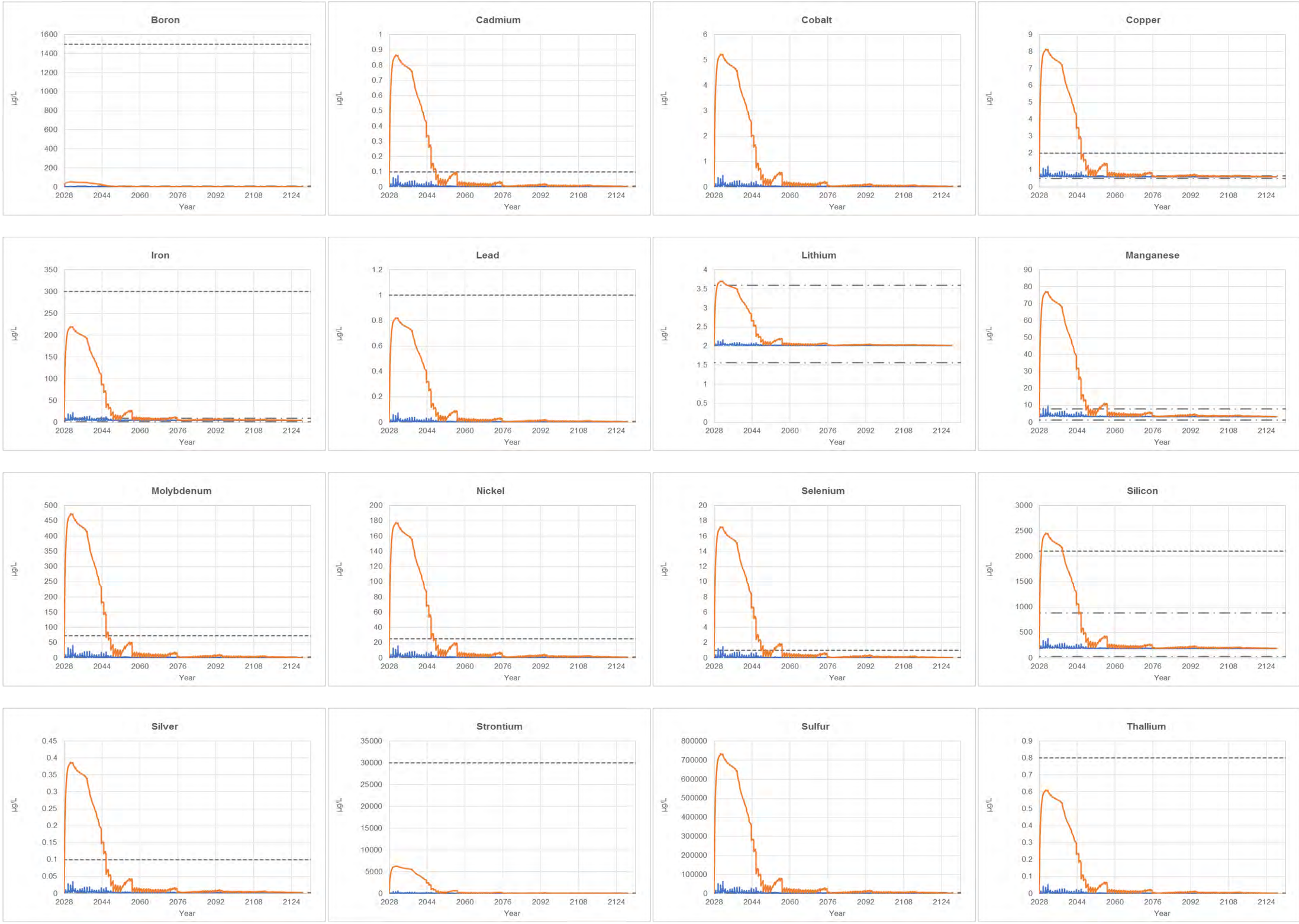


Figure A-3: Predicted time Series of A418 Pit Lake Constituent Concentrations – Sensitivity Scenario 2 (continued)

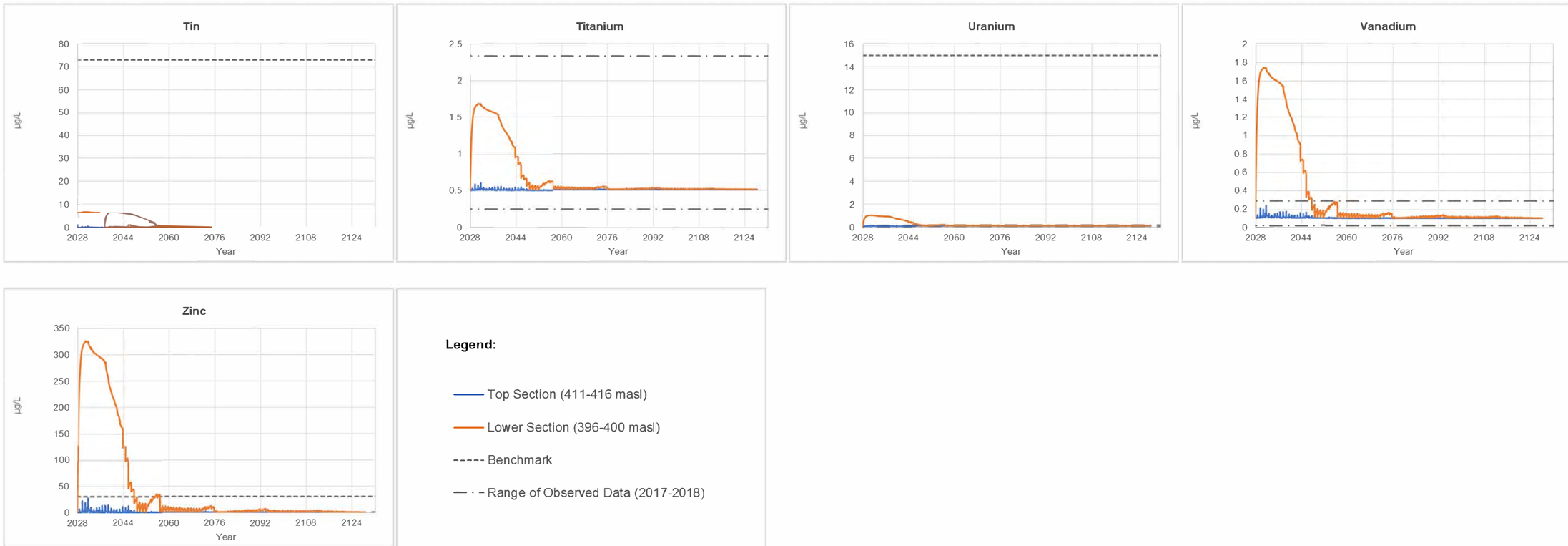


Figure A-4: Predicted time Series of A154 Pit Lake Constituent Concentrations – Development Case Scenario

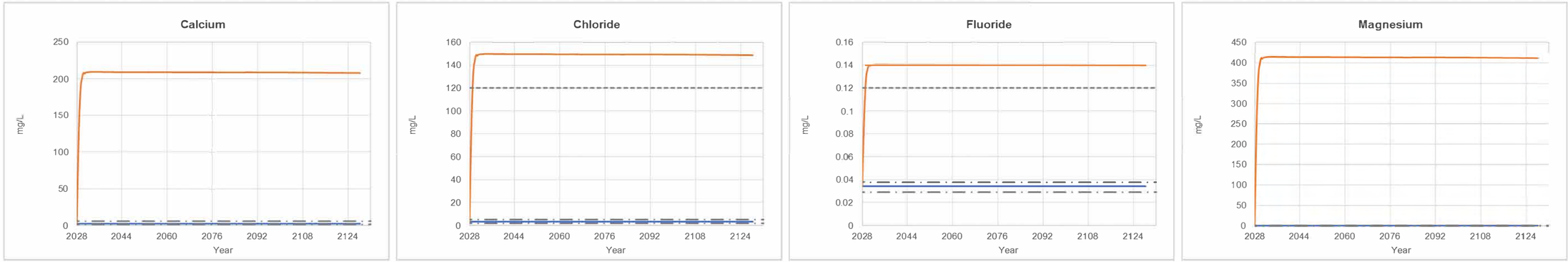
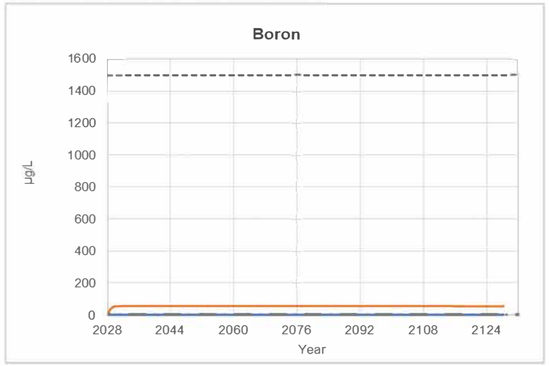
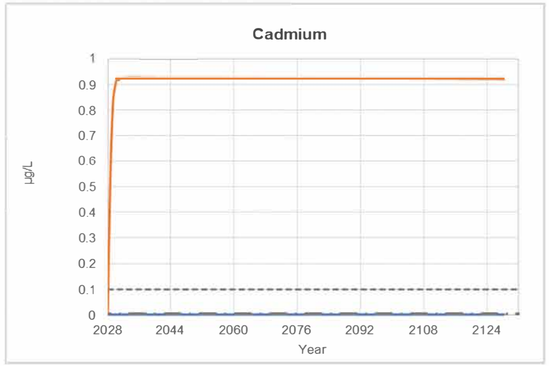
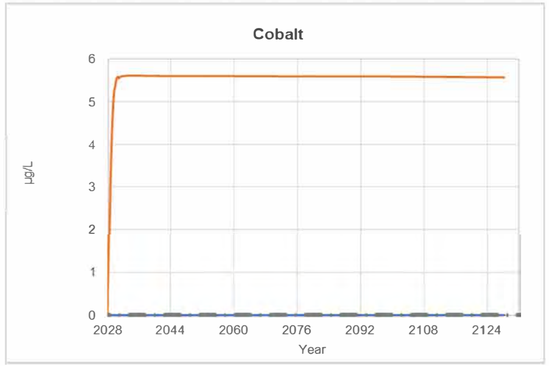
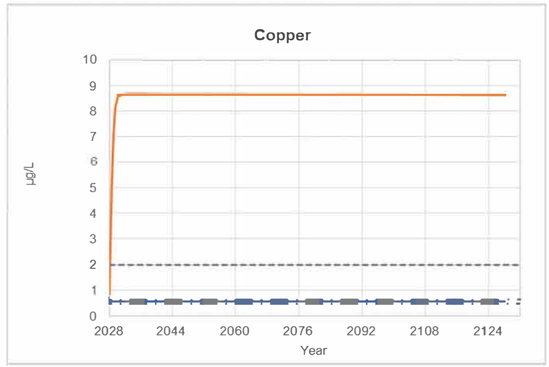


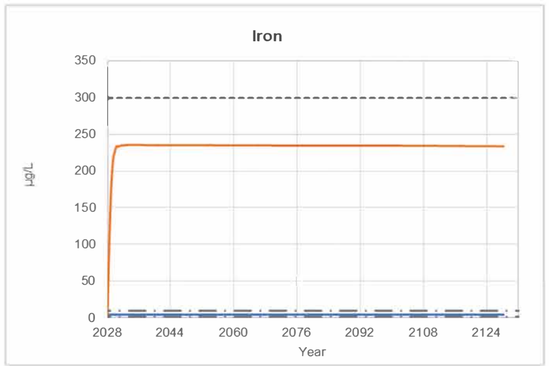
Figure A-4: Predicted time Series of A154 Pit Lake Constituent Concentrations – Development Case Scenario (continued)

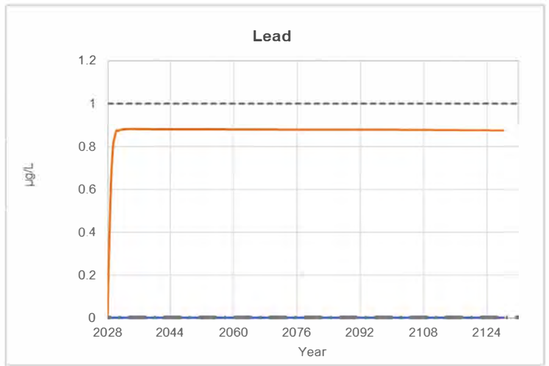


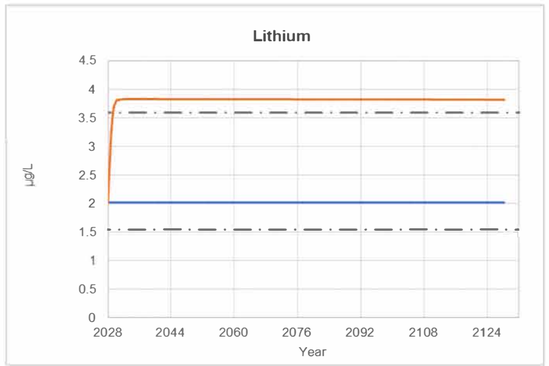


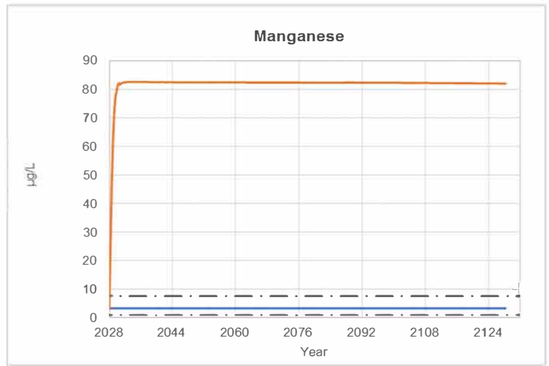


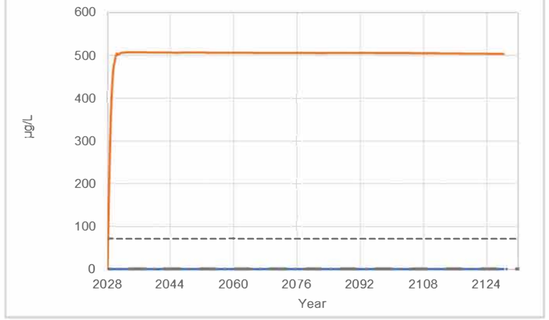


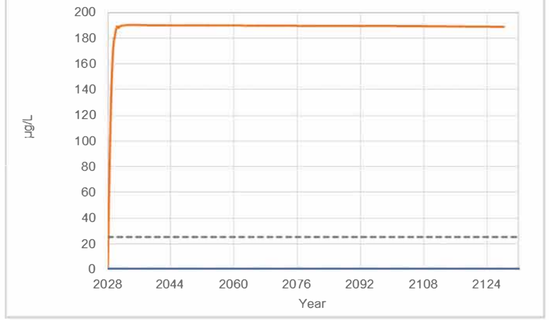


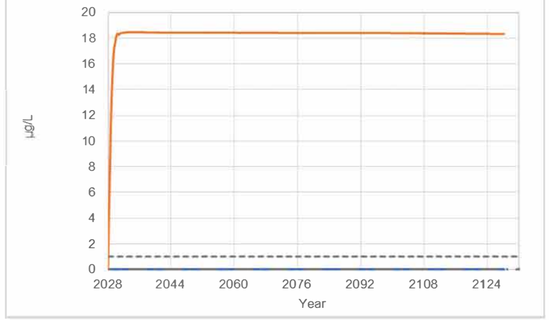


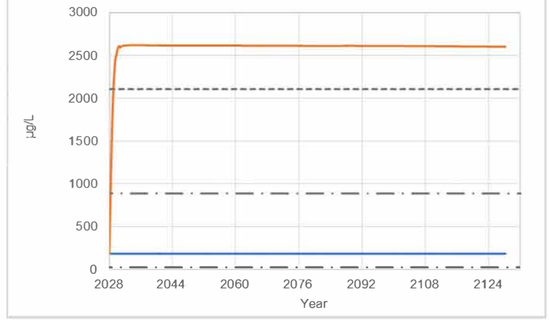


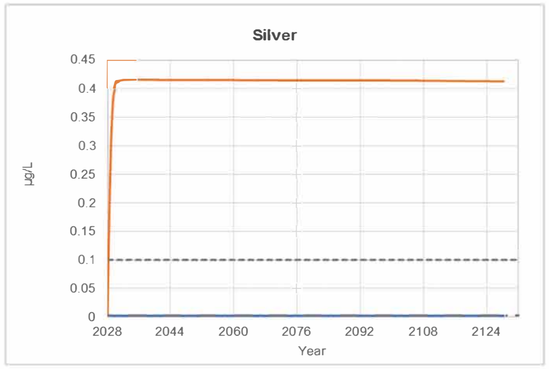


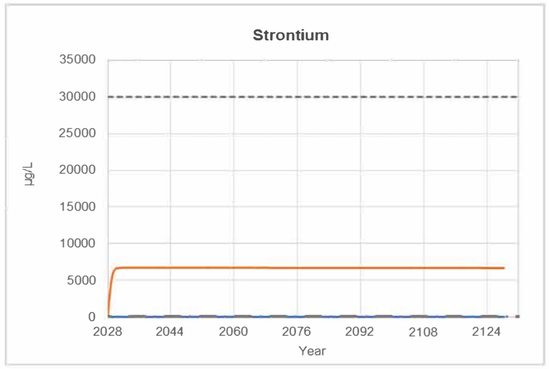


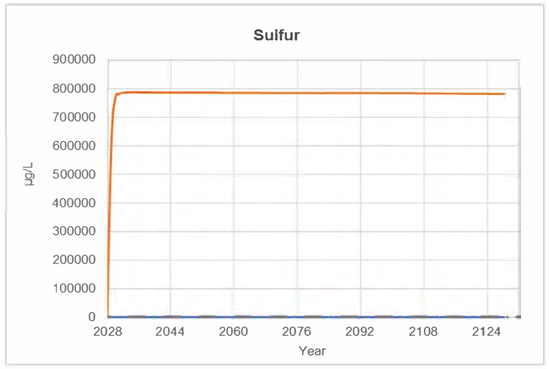












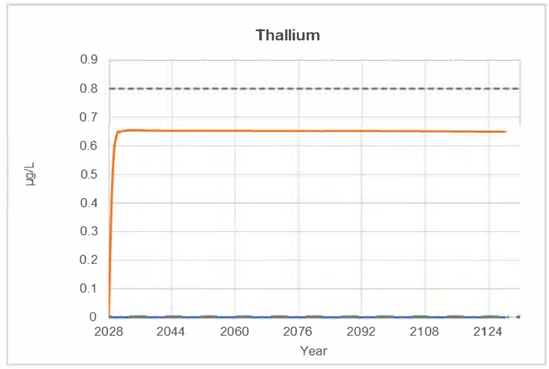
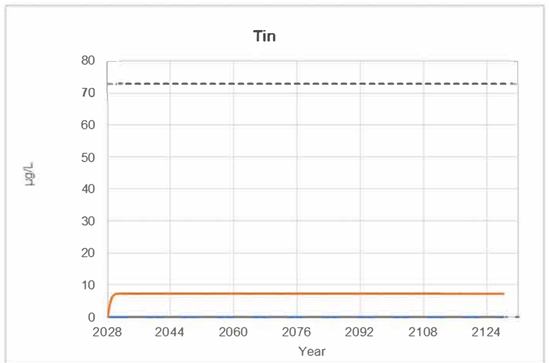
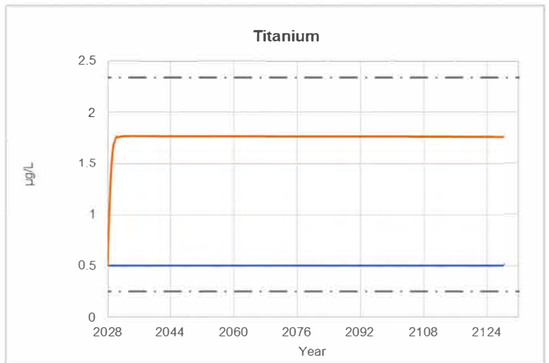
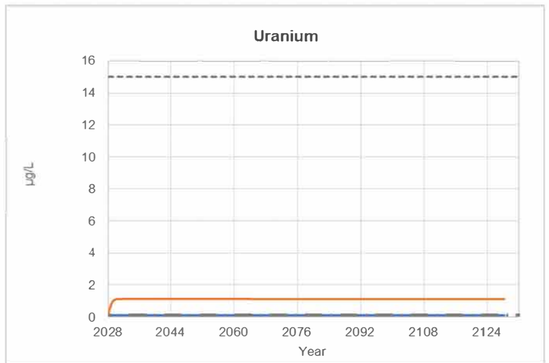
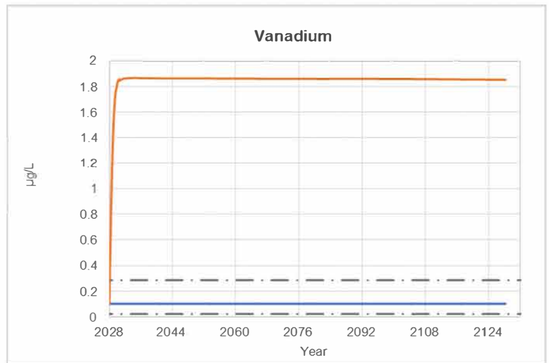


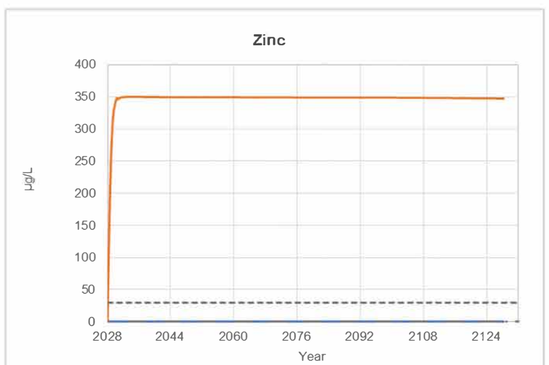
Figure A-4: Predicted time Series of A154 Pit Lake Constituent Concentrations – Development Case Scenario (continued)











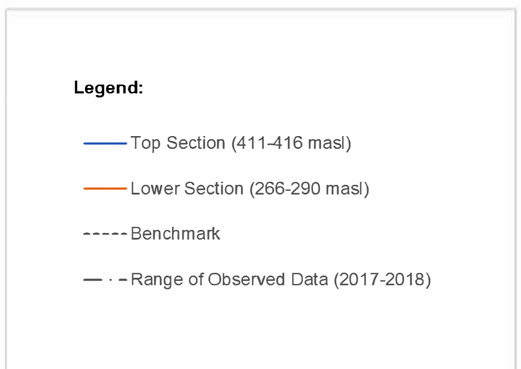
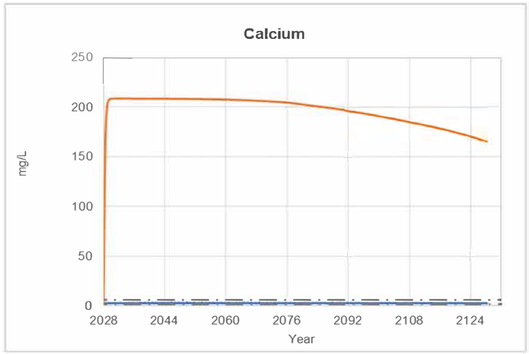
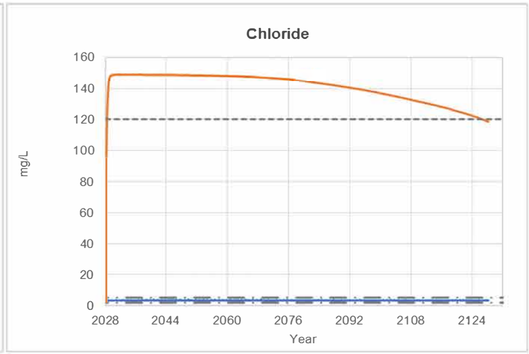
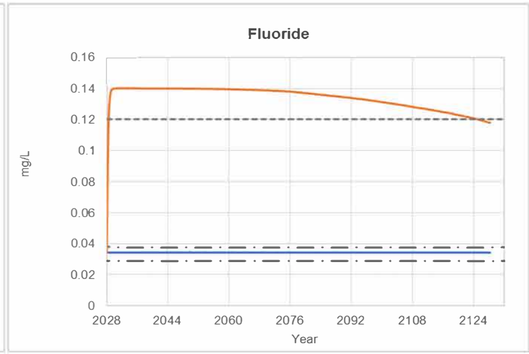
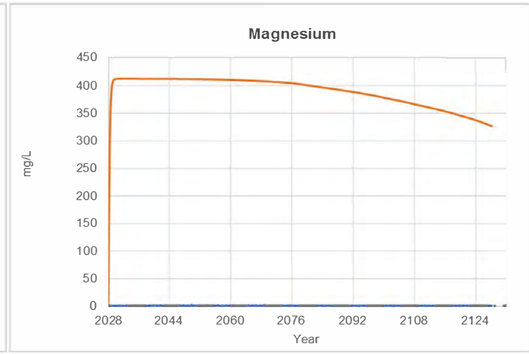


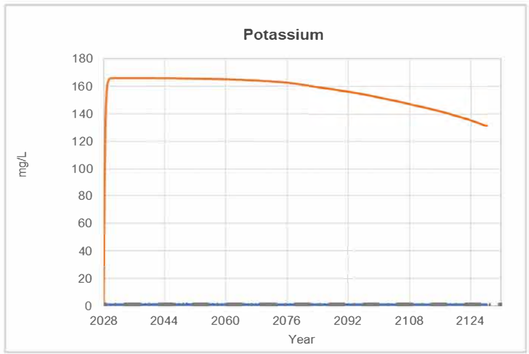
Figure A-5: Predicted time Series of A154 Pit Lake Constituent Concentrations – Sensitivity Scenario 1

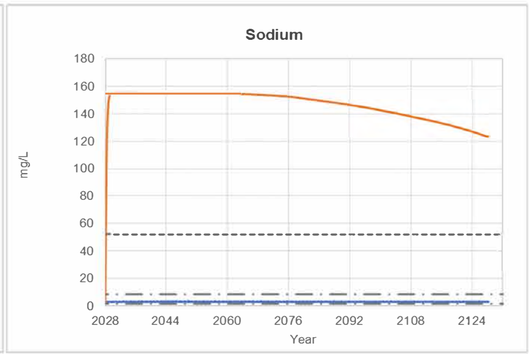


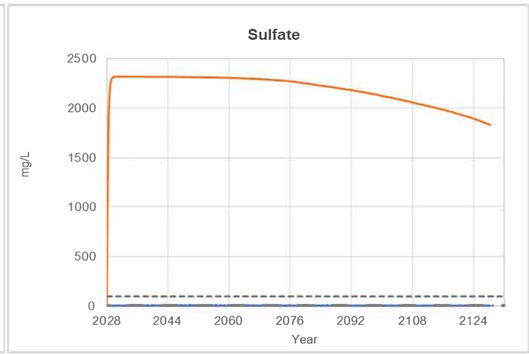


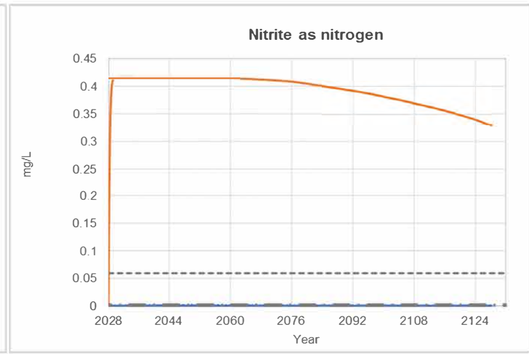


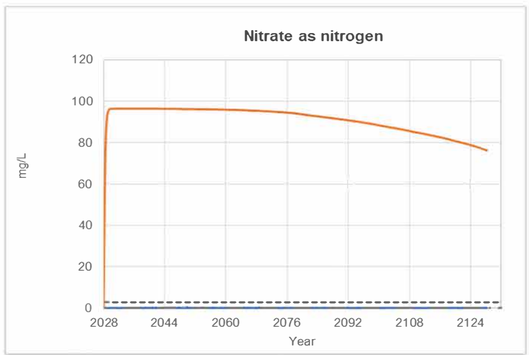


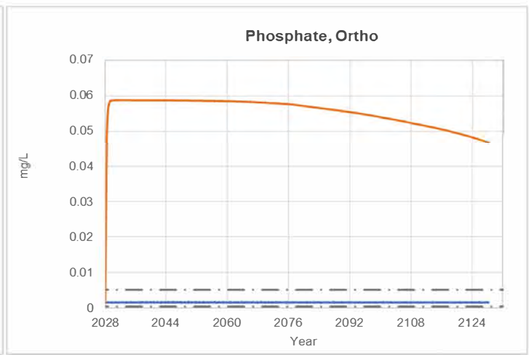


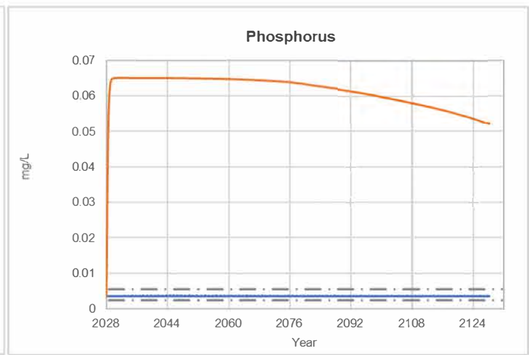


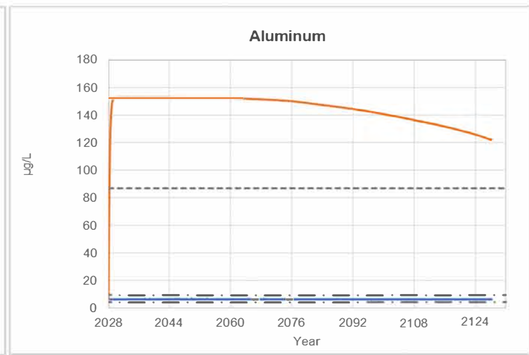


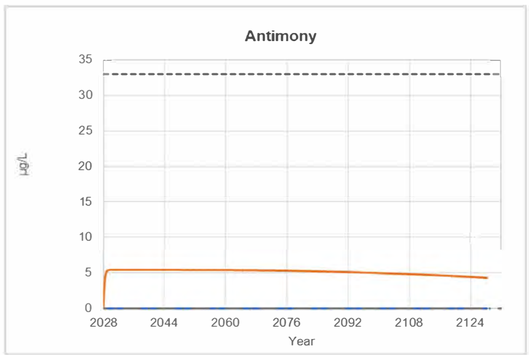


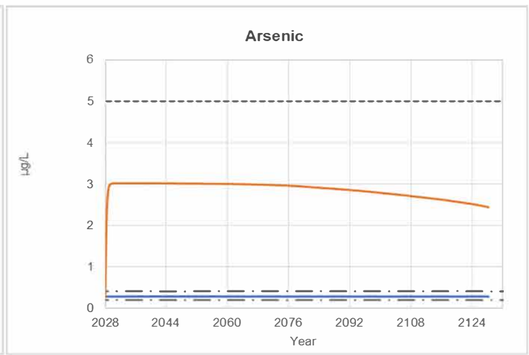


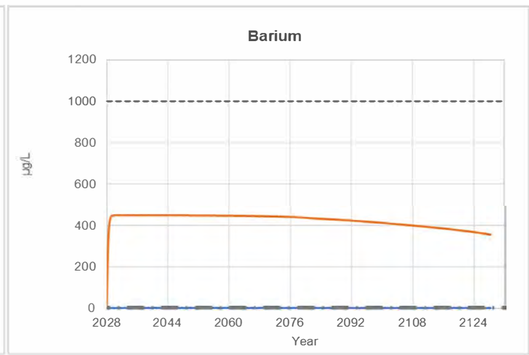












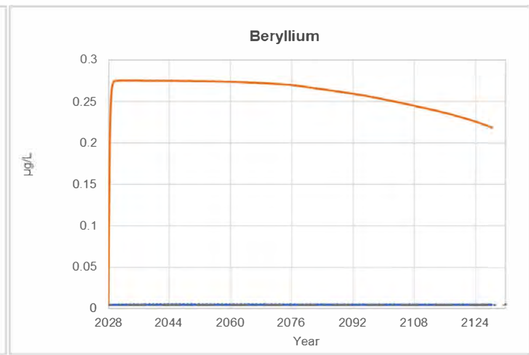
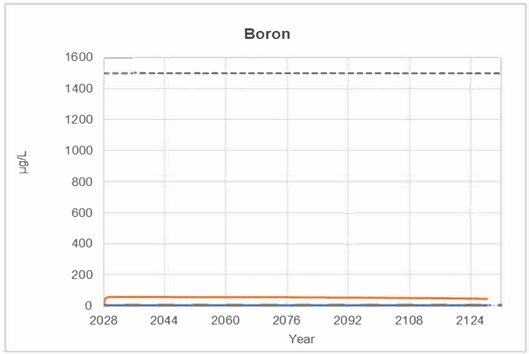
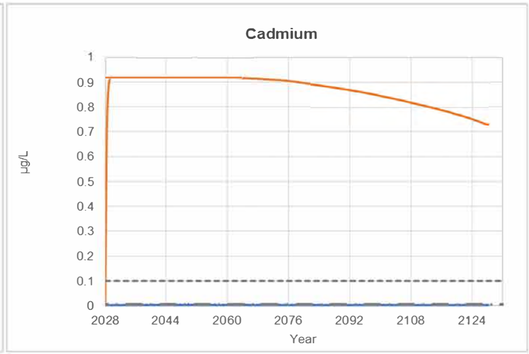
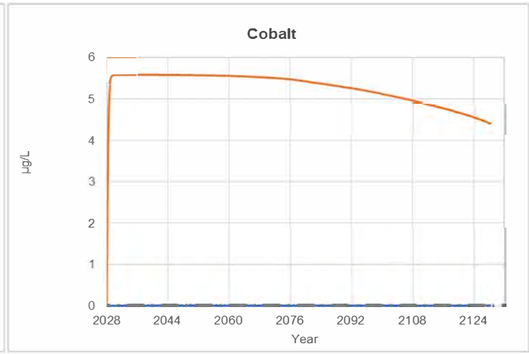
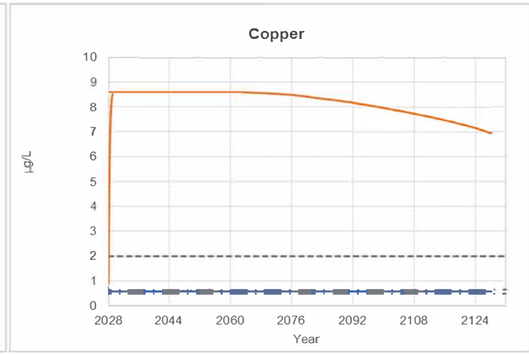


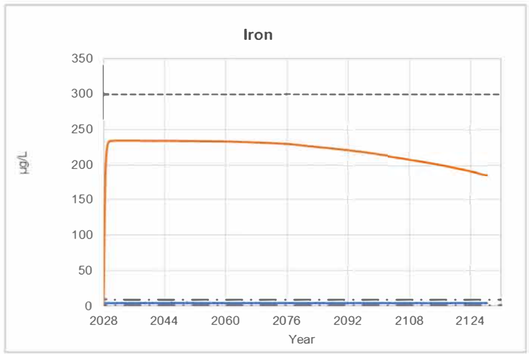
Figure A-5: Predicted time Series of A154 Pit Lake Constituent Concentrations – Sensitivity Scenario 1 (continued)

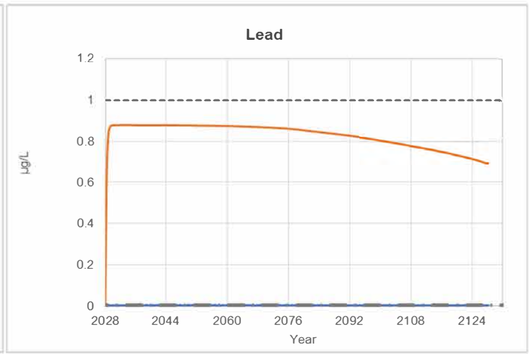


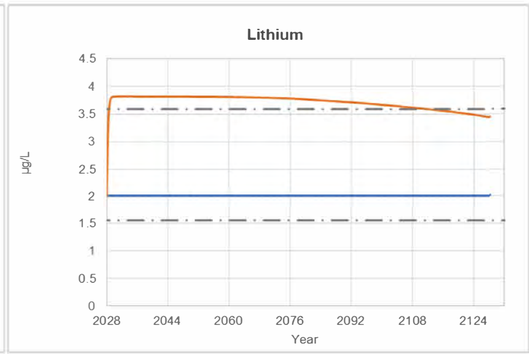


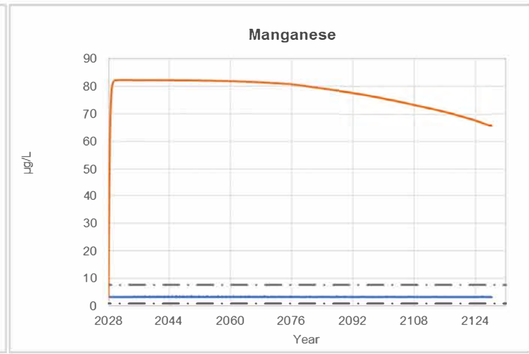


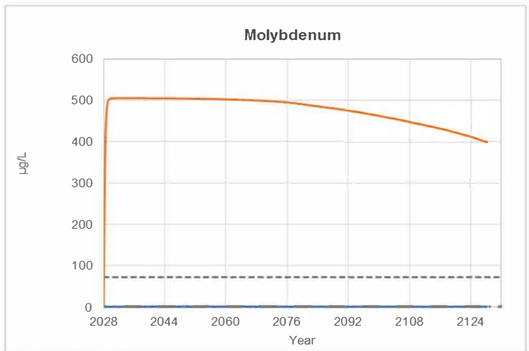


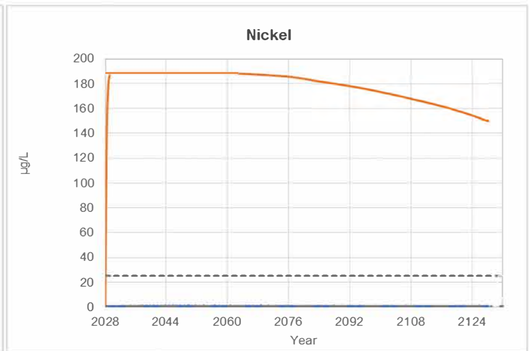


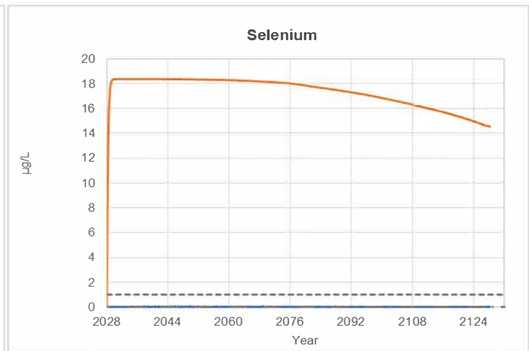


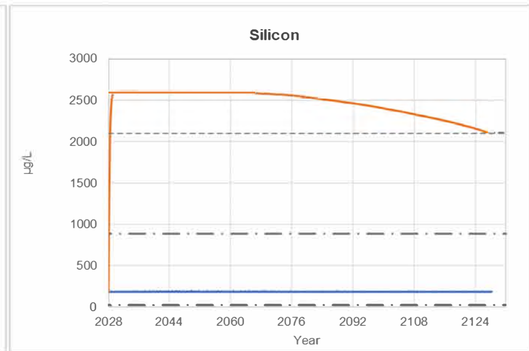


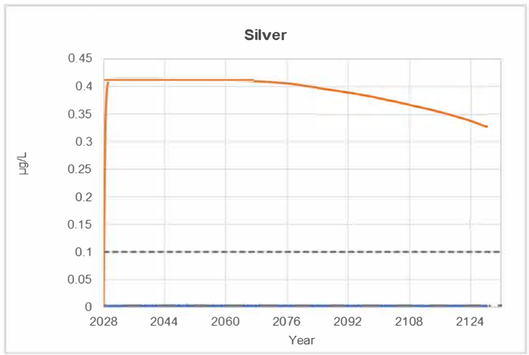


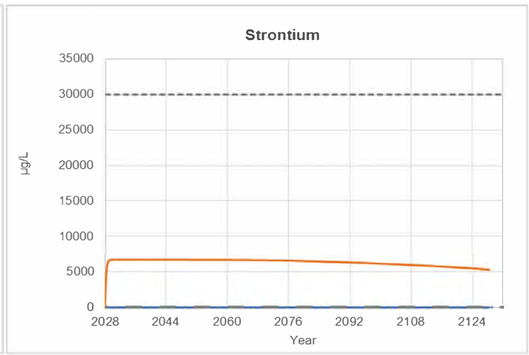


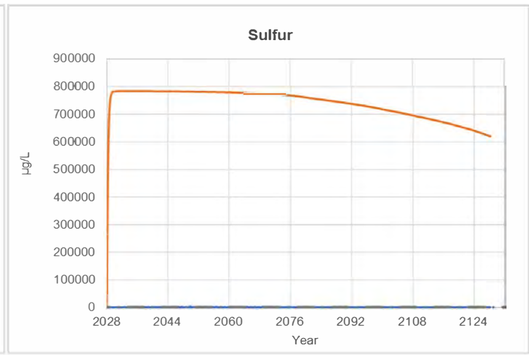












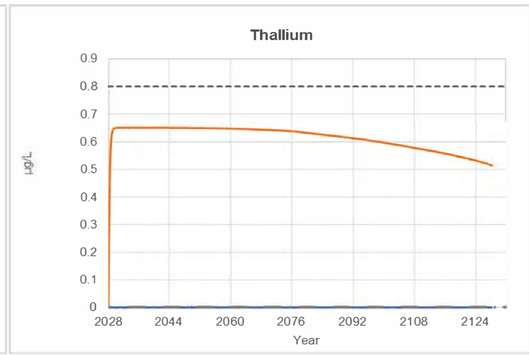
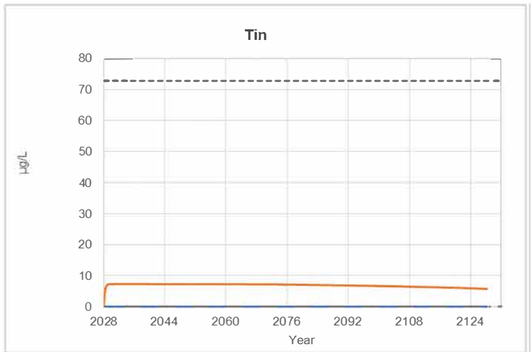
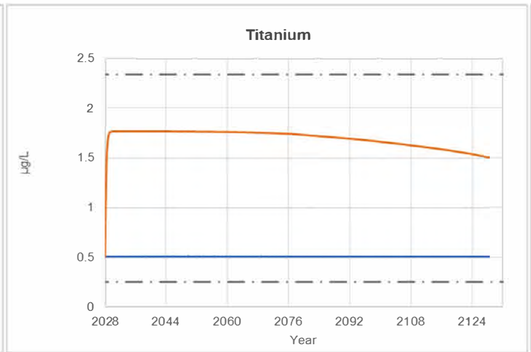
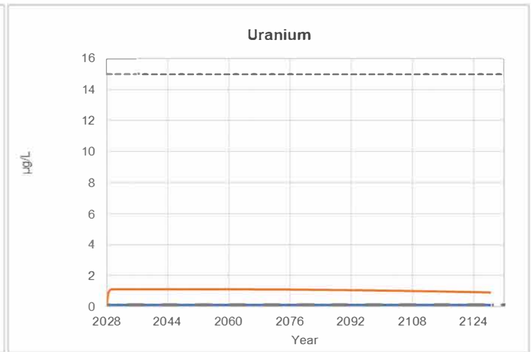
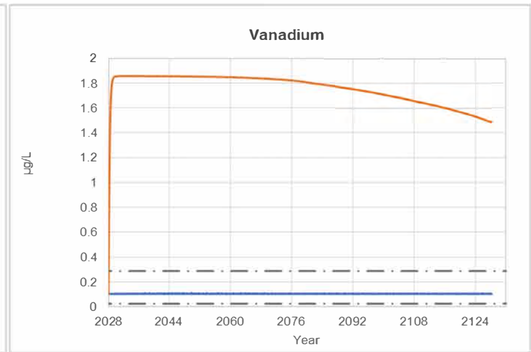


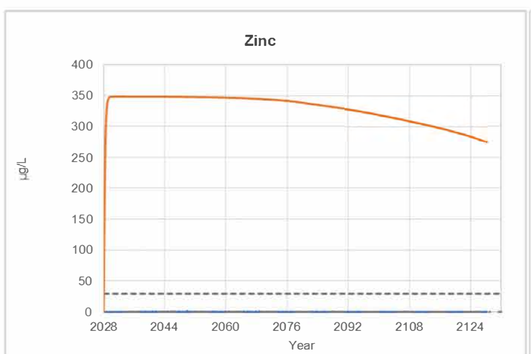
Figure A-5: Predicted time Series of A154 Pit Lake Constituent Concentrations – Sensitivity Scenario 1 (continued)











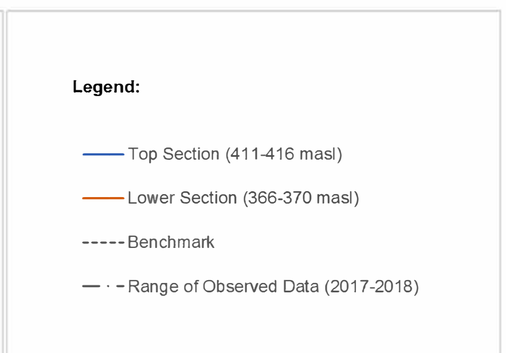


Figure A-6: Predicted time Series of A154 Pit Lake Constituent Concentrations – Sensitivity Scenario 2

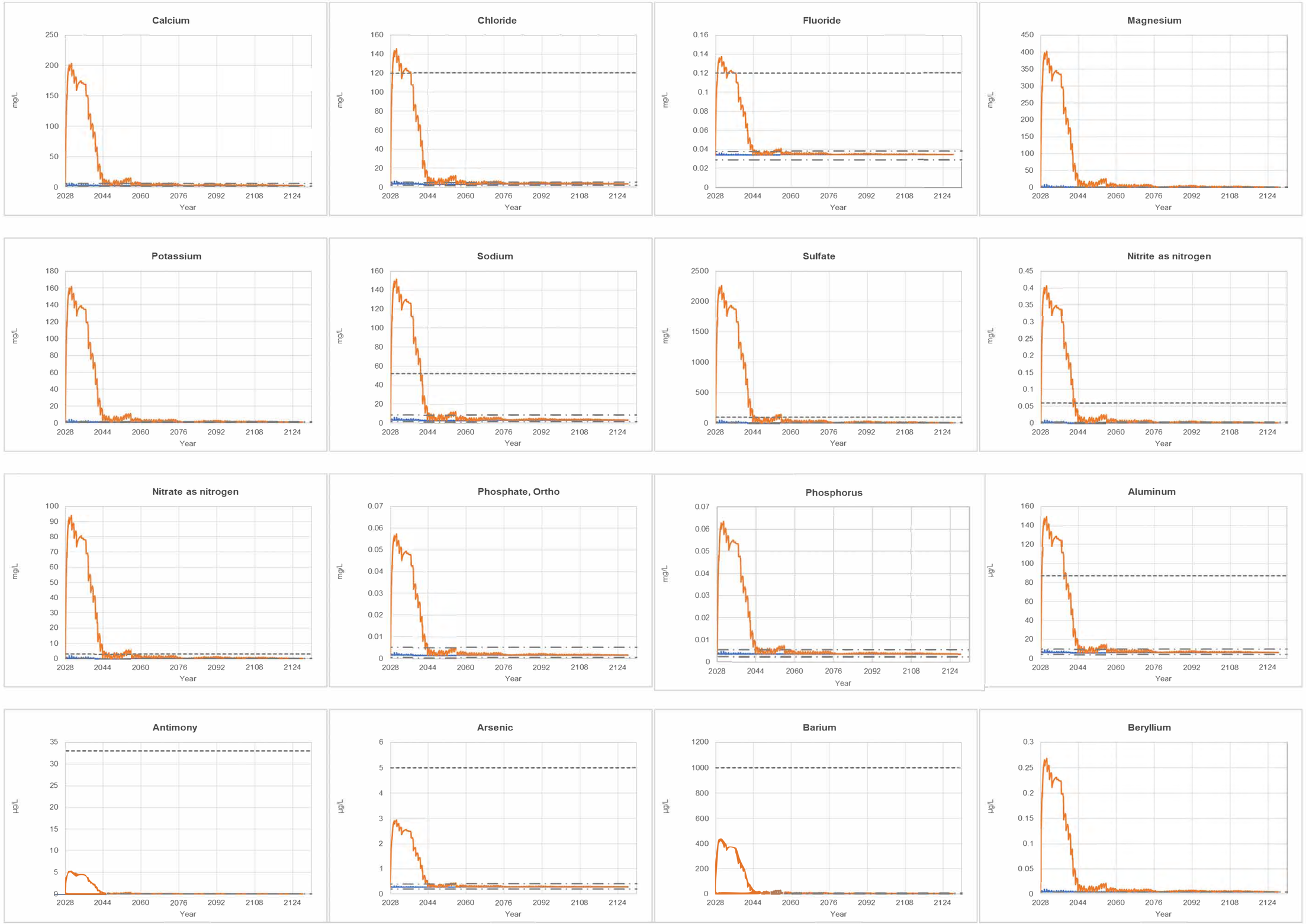


Figure A-6: Predicted time Series of A154 Pit Lake Constituent Concentrations – Sensitivity Scenario 2 (continued)

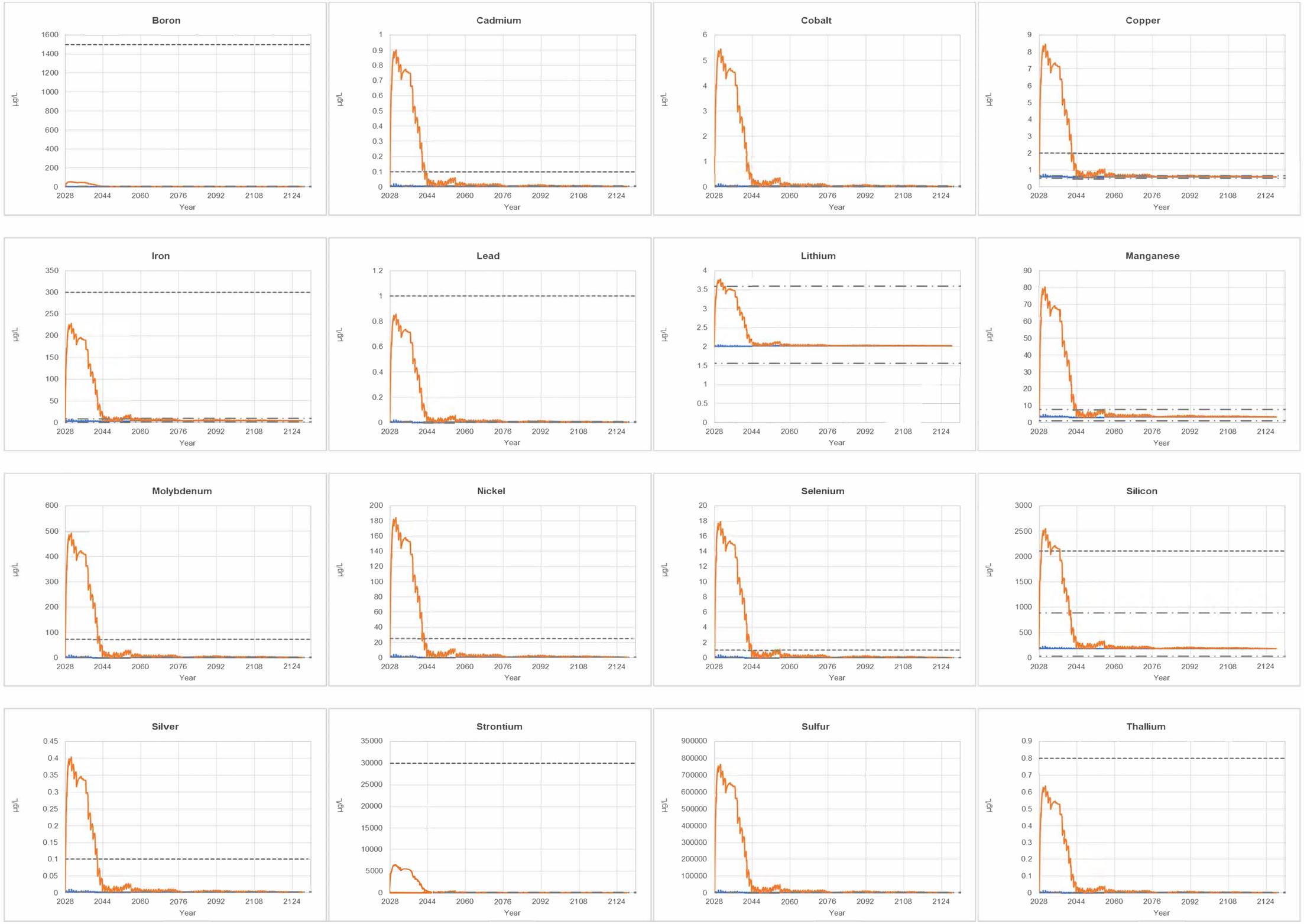


Figure A-6: Predicted time Series of A154 Pit Lake Constituent Concentrations – Sensitivity Scenario 2 (continued)

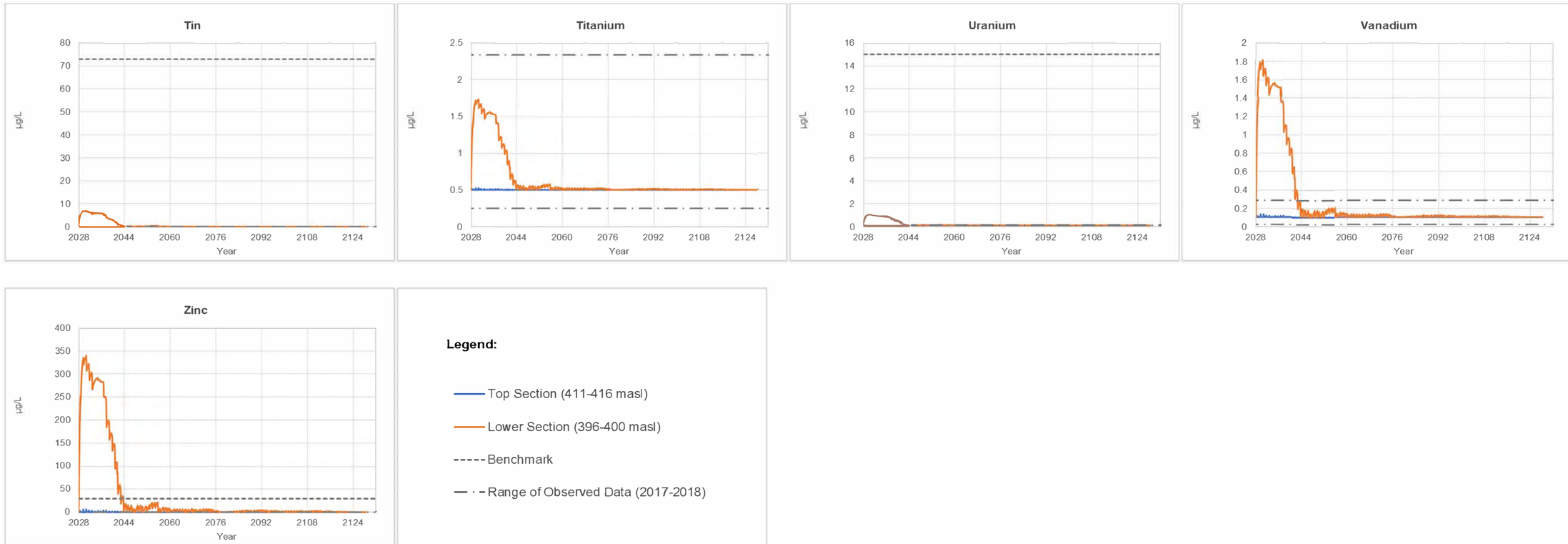
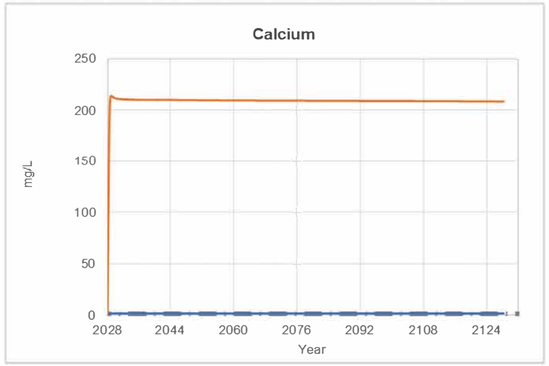
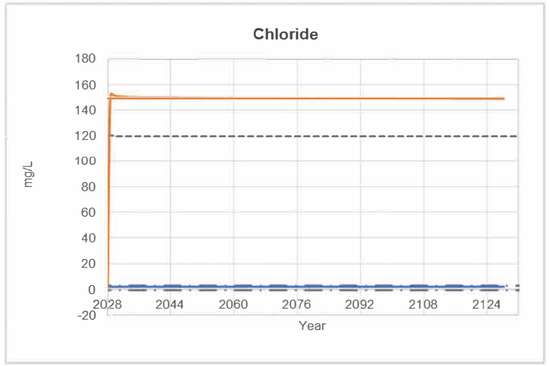
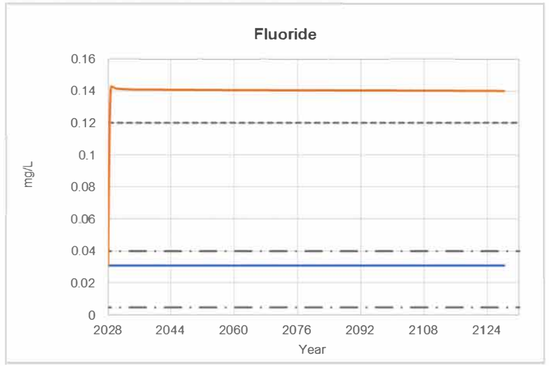
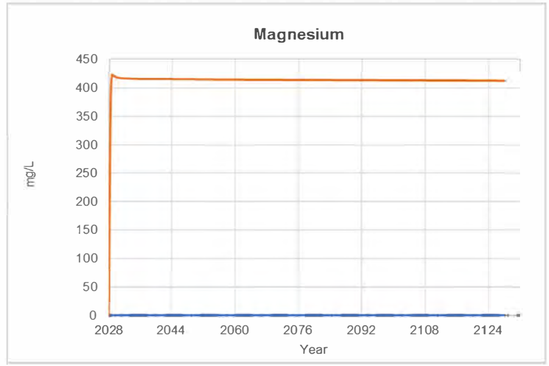


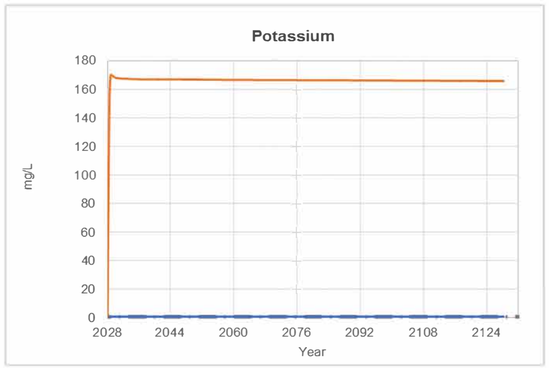
Figure A-7: Predicted time Series of A21 Pit Lake Constituent Concentrations – Development Case Scenario

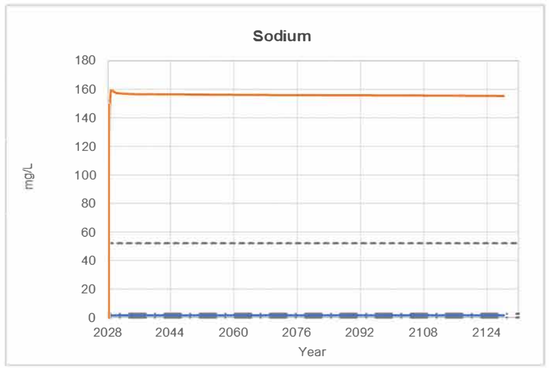


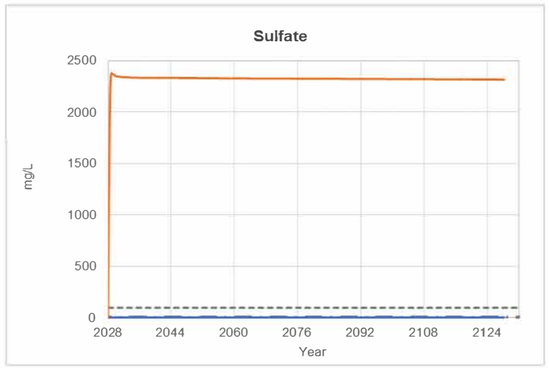


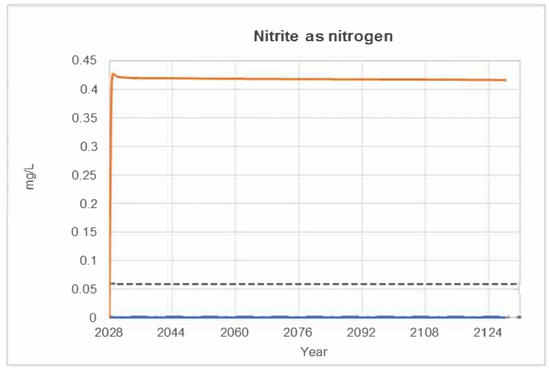


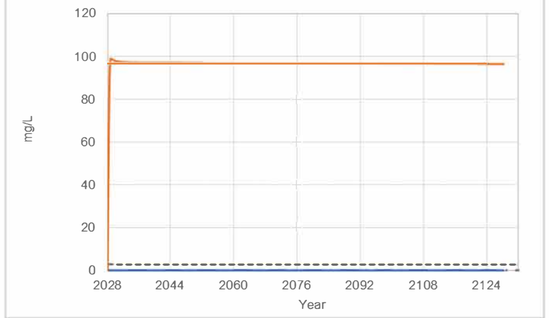


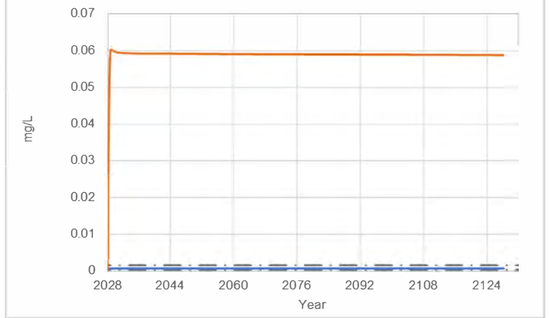


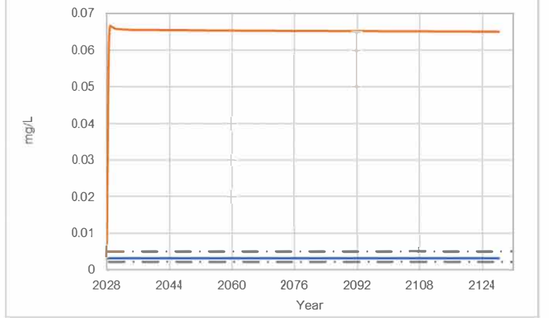


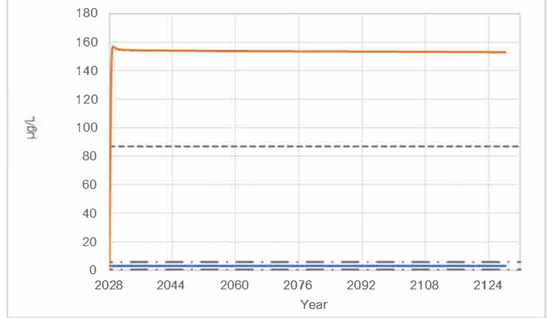


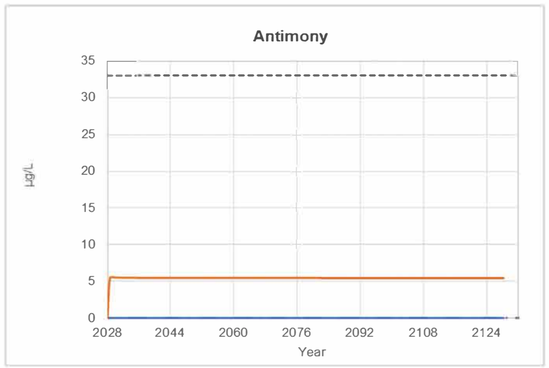


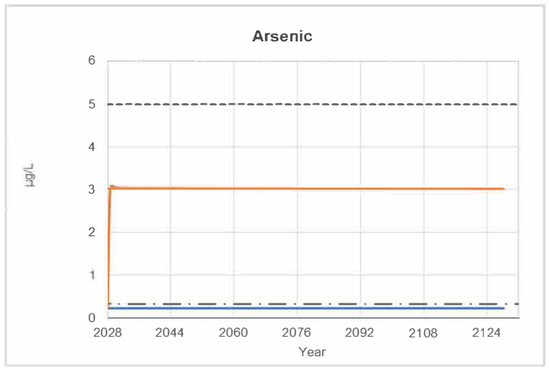


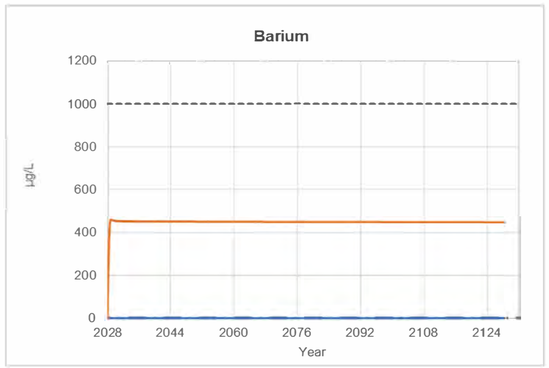












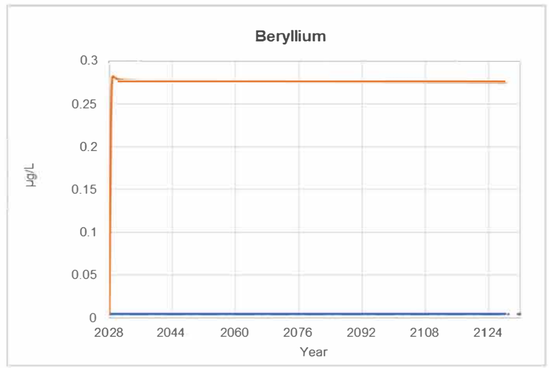
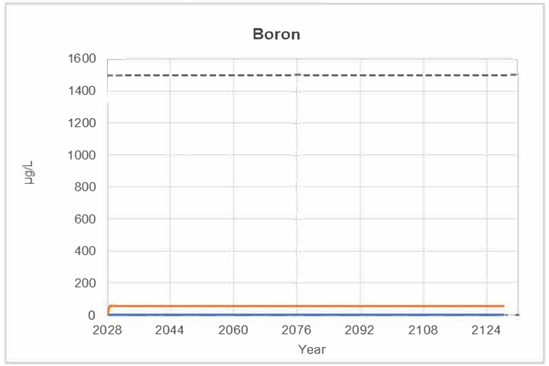
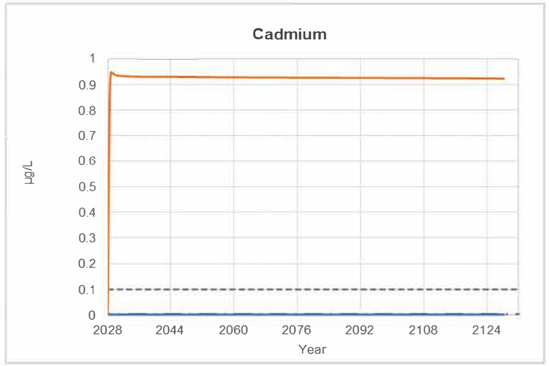
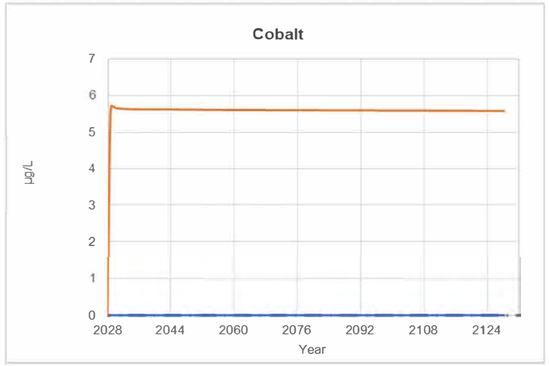
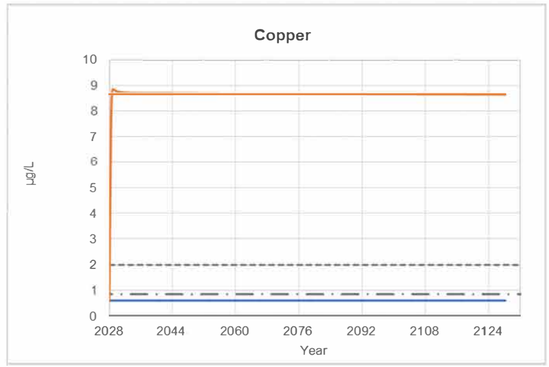


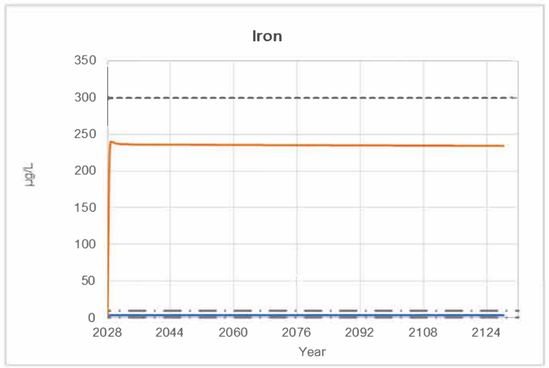
Figure A-7: Predicted time Series of A21 Pit Lake Constituent Concentrations – Development Case Scenario (continued)

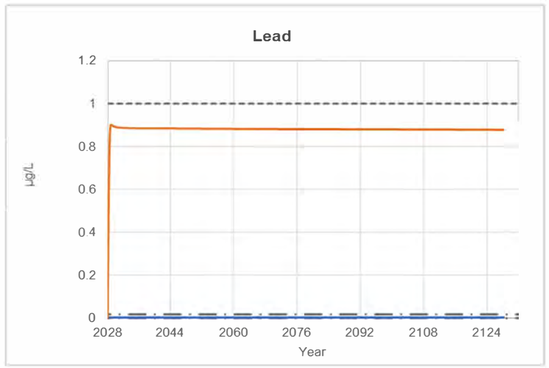


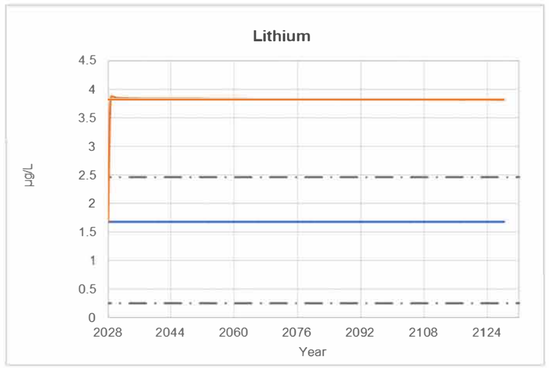


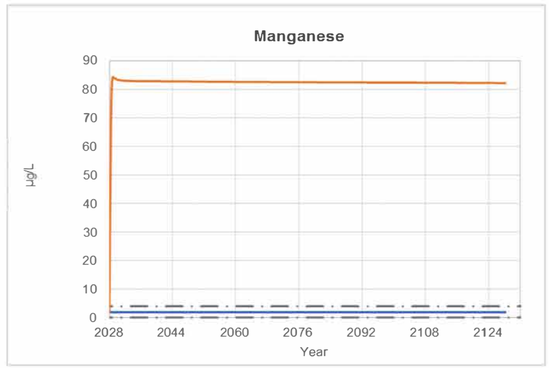


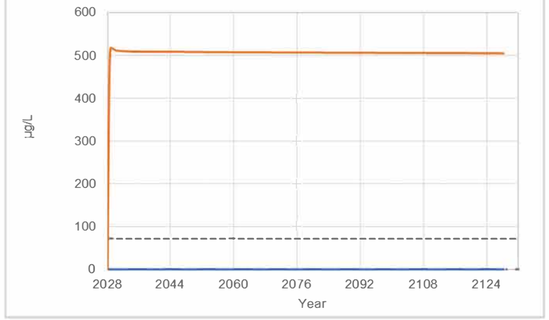


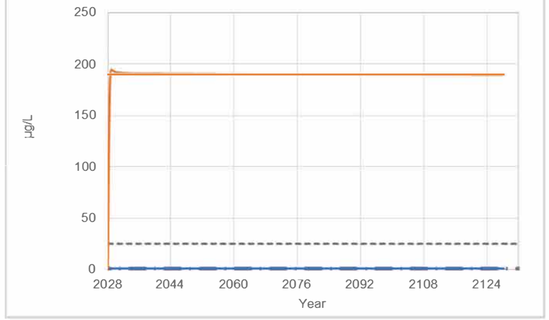


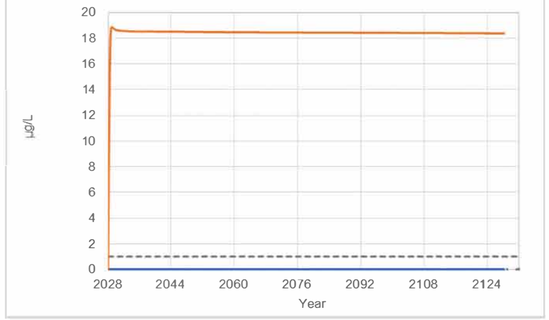


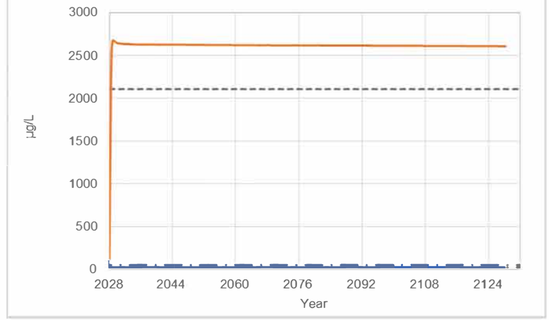


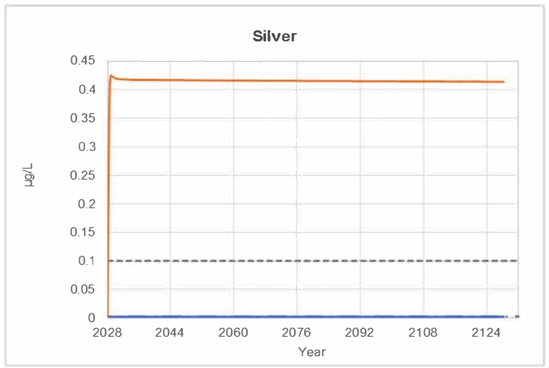


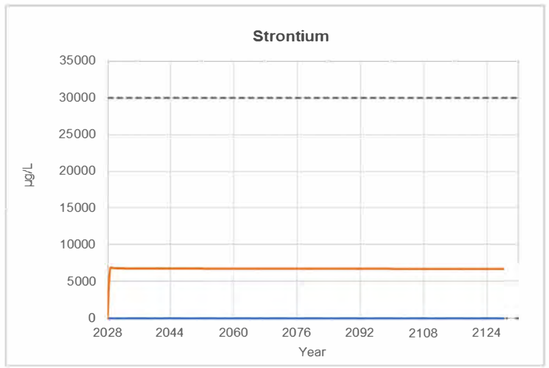


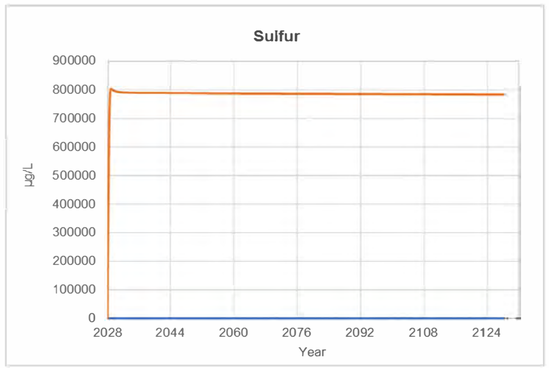












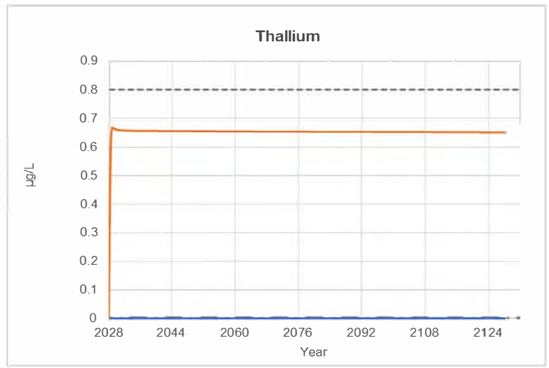
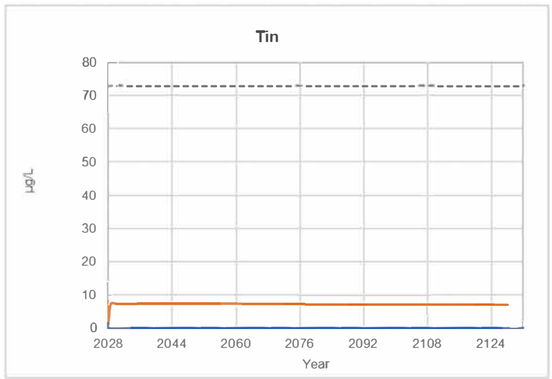
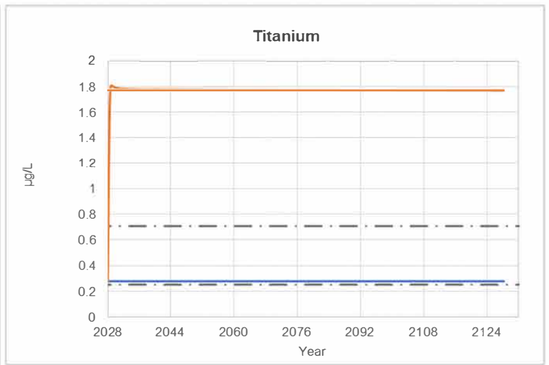
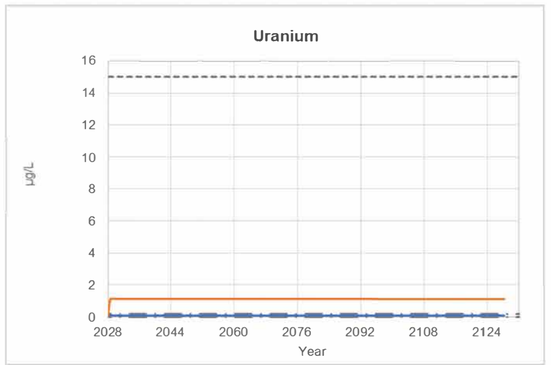
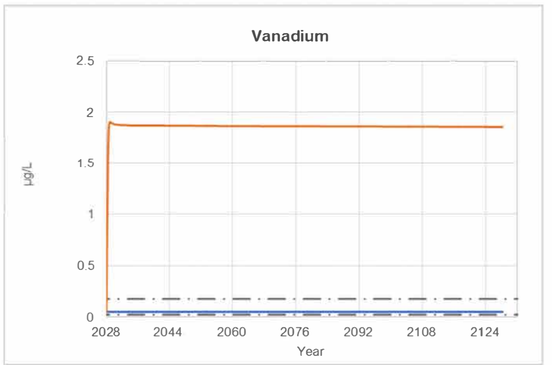


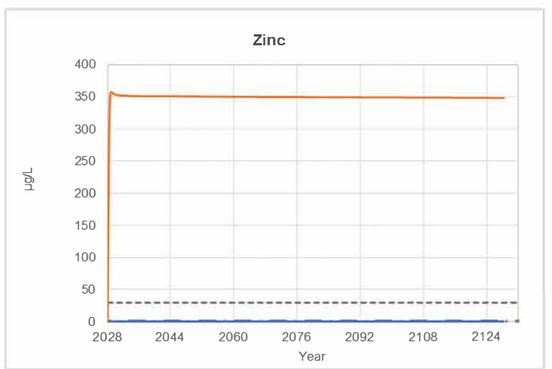
Figure A-7: Predicted time Series of A21 Pit Lake Constituent Concentrations – Development Case Scenario (continued)











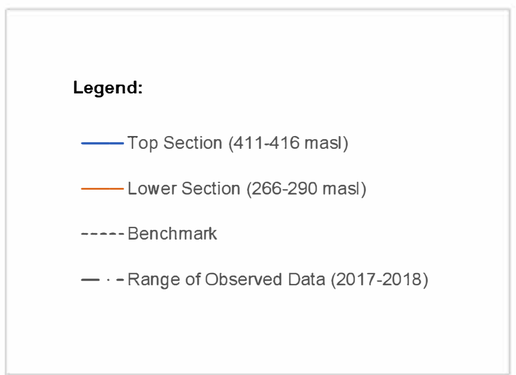
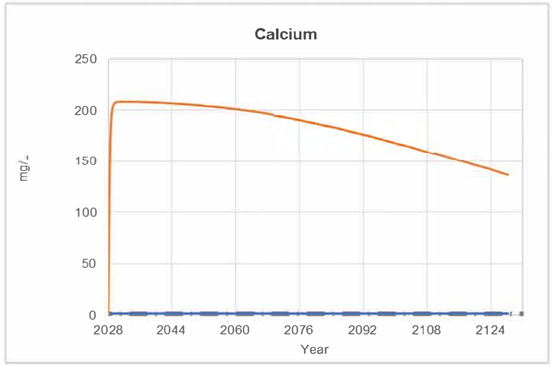
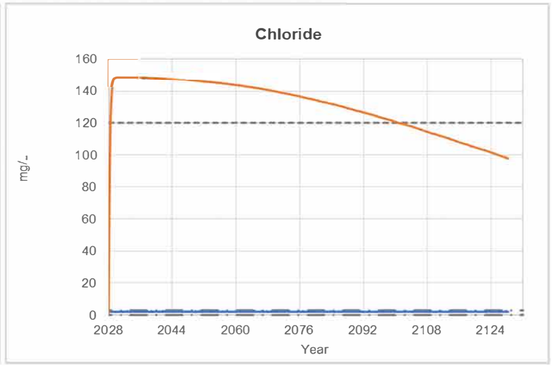
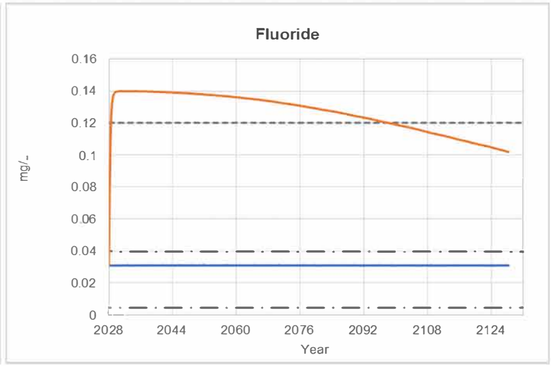
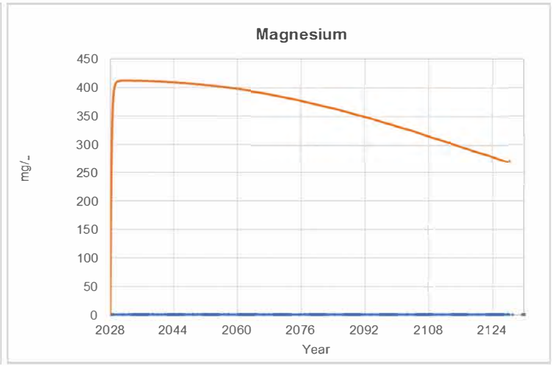


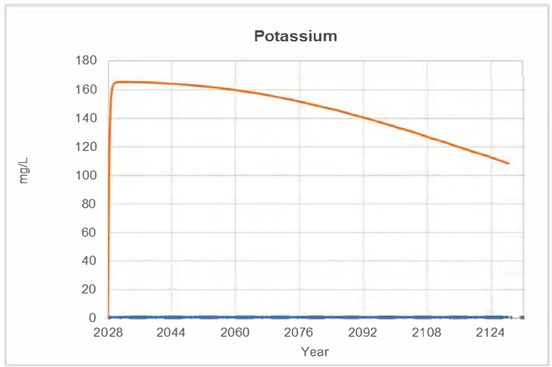
Figure A-8: Predicted time Series of A21 Pit Lake Constituent Concentrations – Sensitivity Scenario 1

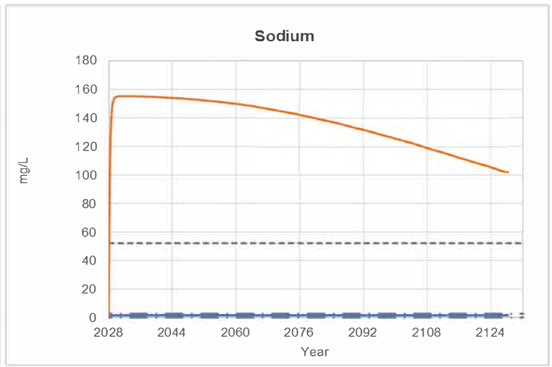


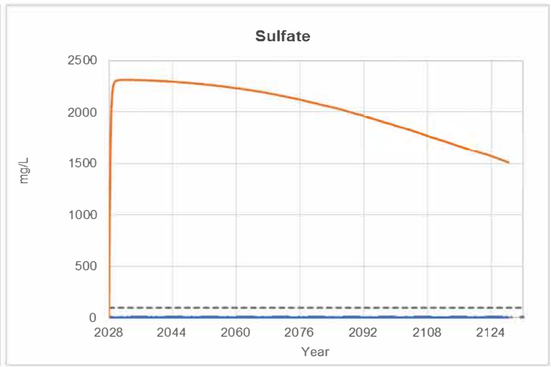


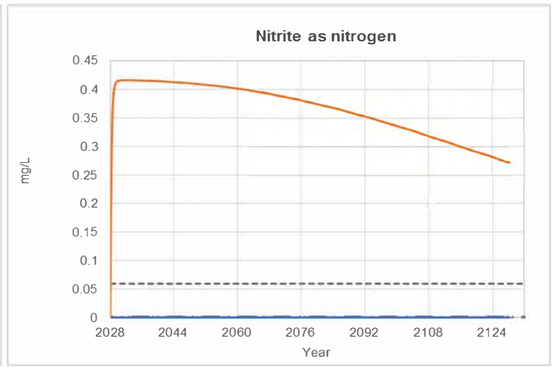


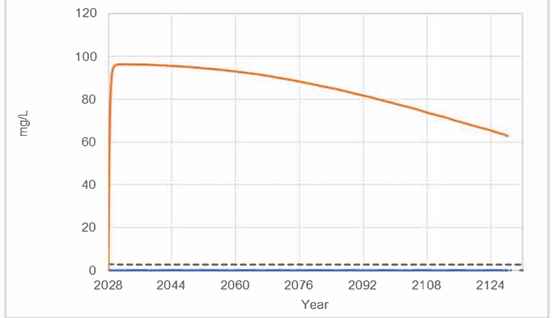


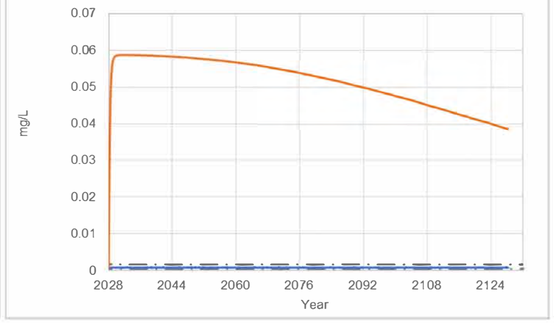


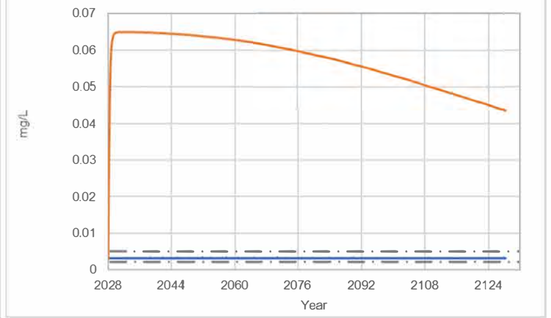


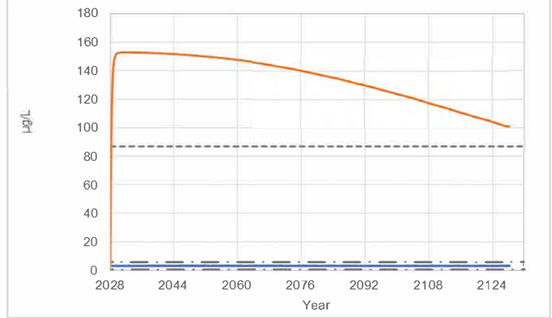


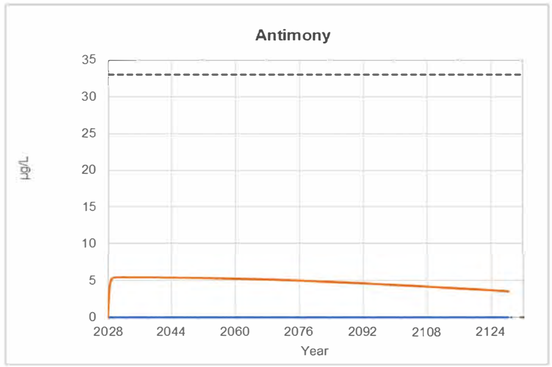


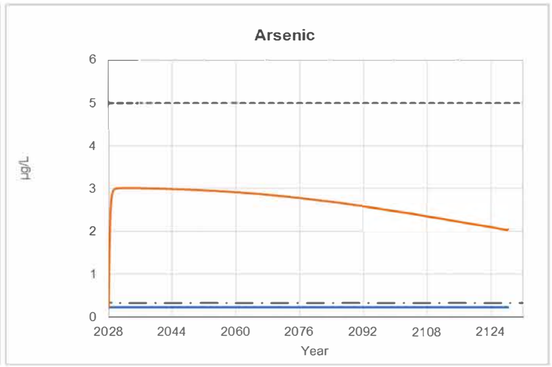


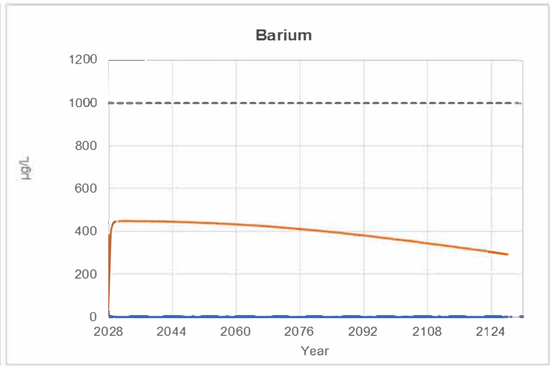












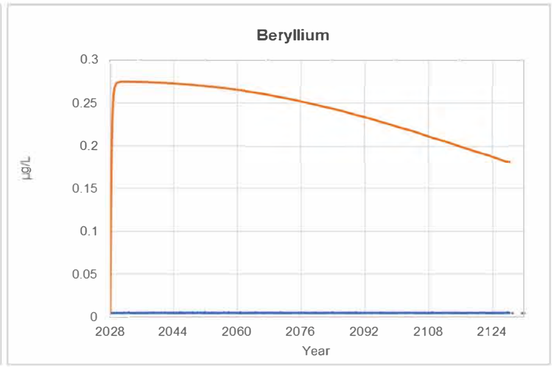
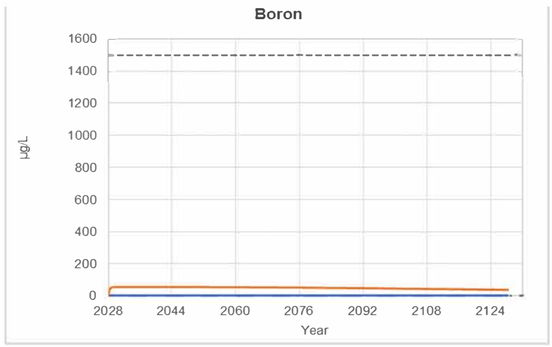
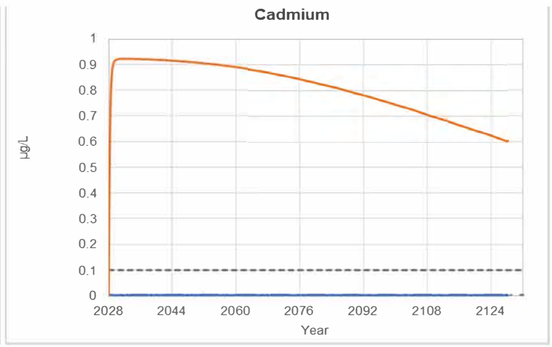
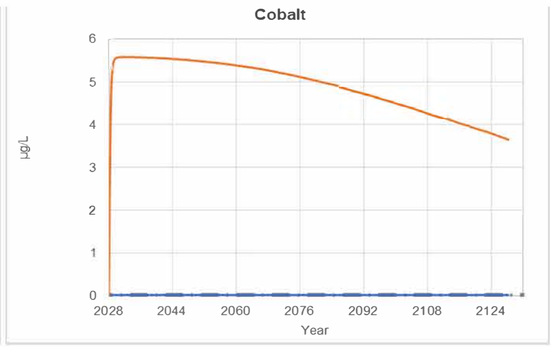
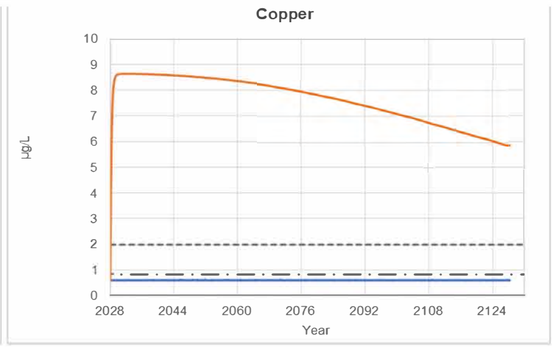


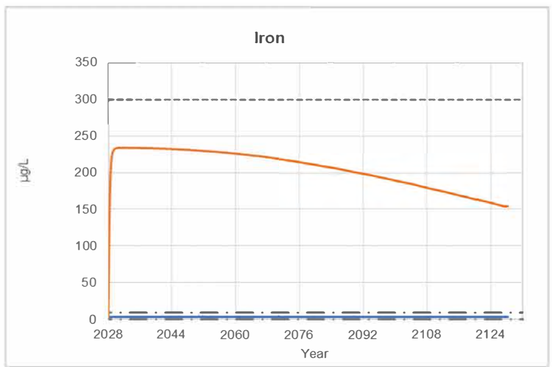
Figure A-8: Predicted time Series of A21 Pit Lake Constituent Concentrations – Sensitivity Scenario 1 (continued)

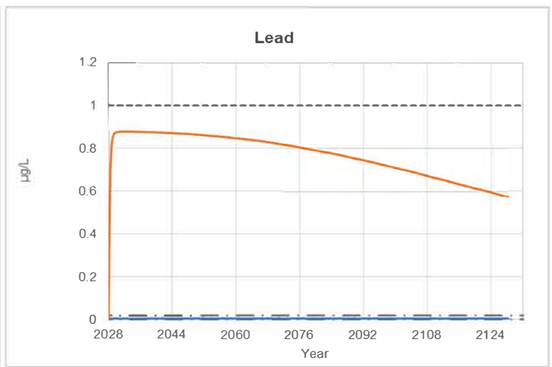


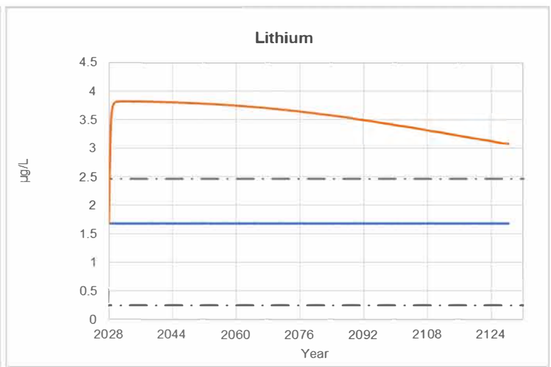


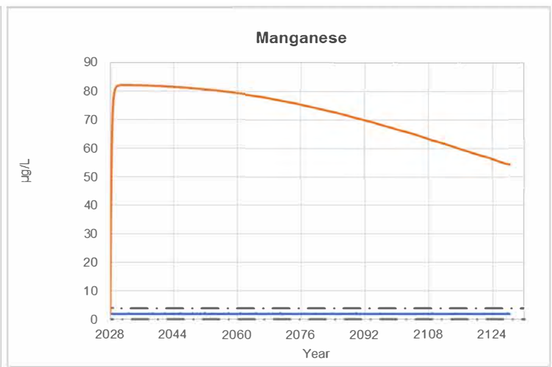


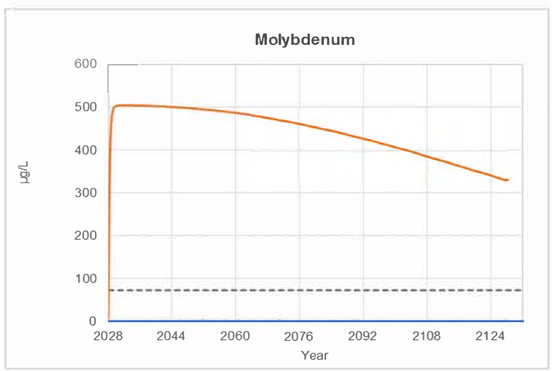


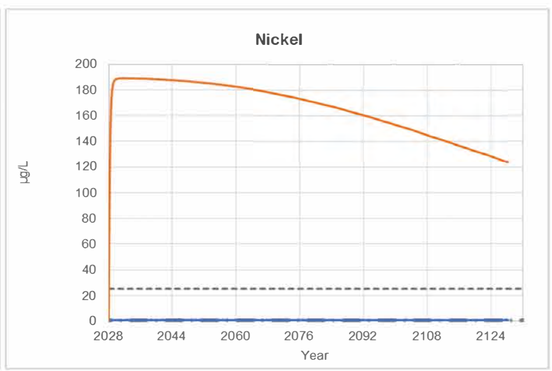


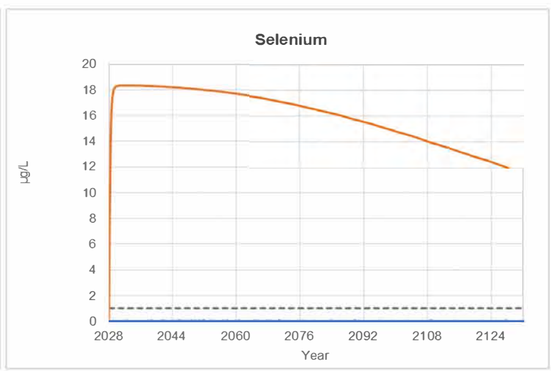


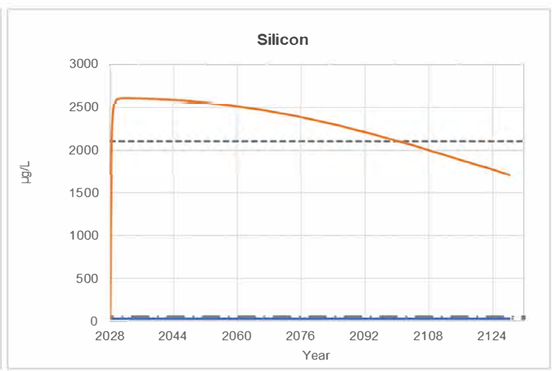


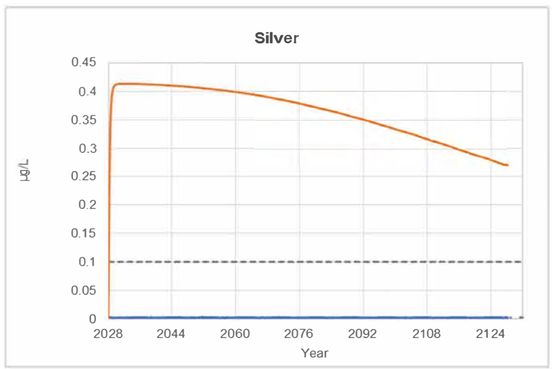


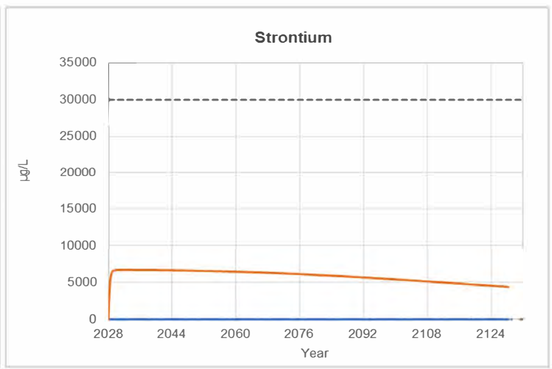


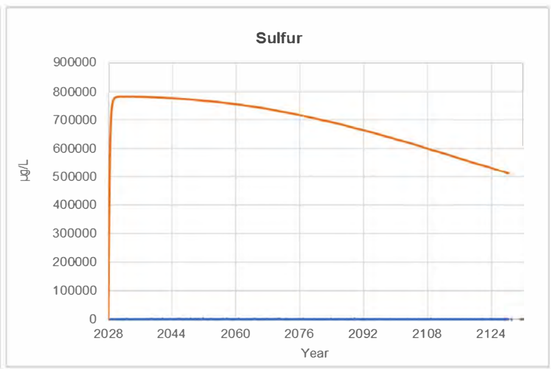












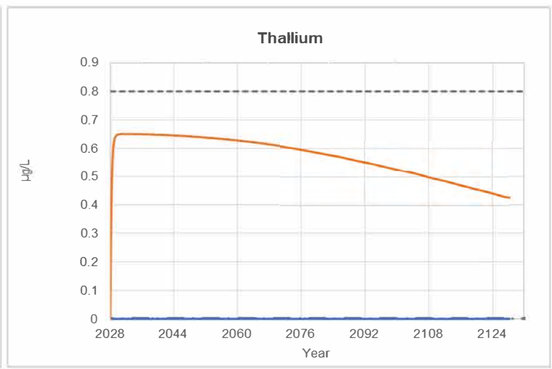
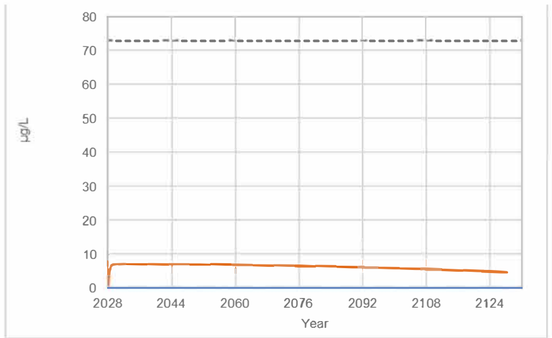
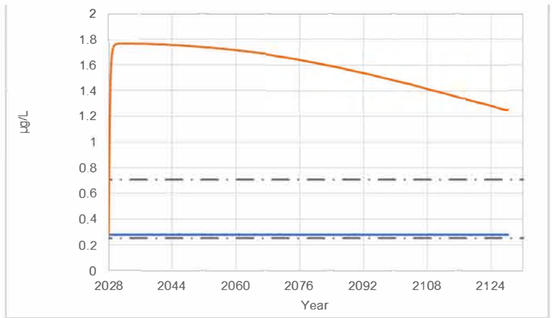
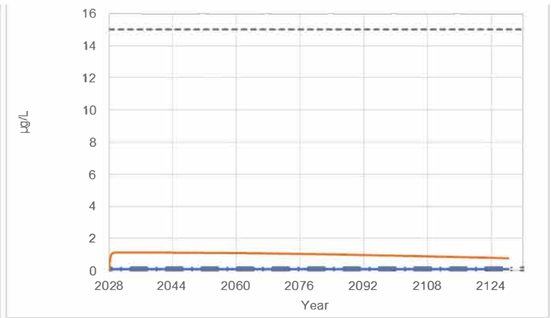
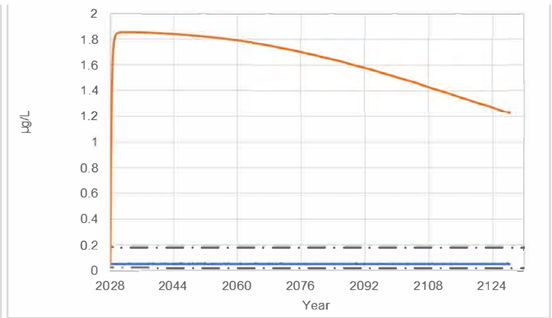


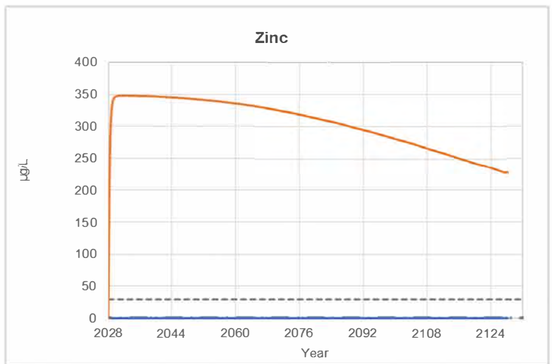
Figure A-8: Predicted time Series of A21 Pit Lake Constituent Concentrations – Sensitivity Scenario 1 (continued)











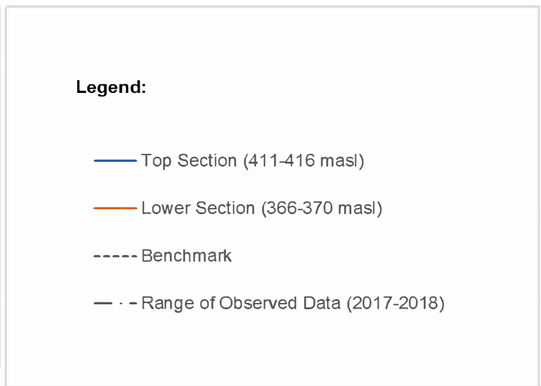


Figure A-9: Predicted time Series of A21 Pit Lake Constituent Concentrations – Sensitivity Scenario 2

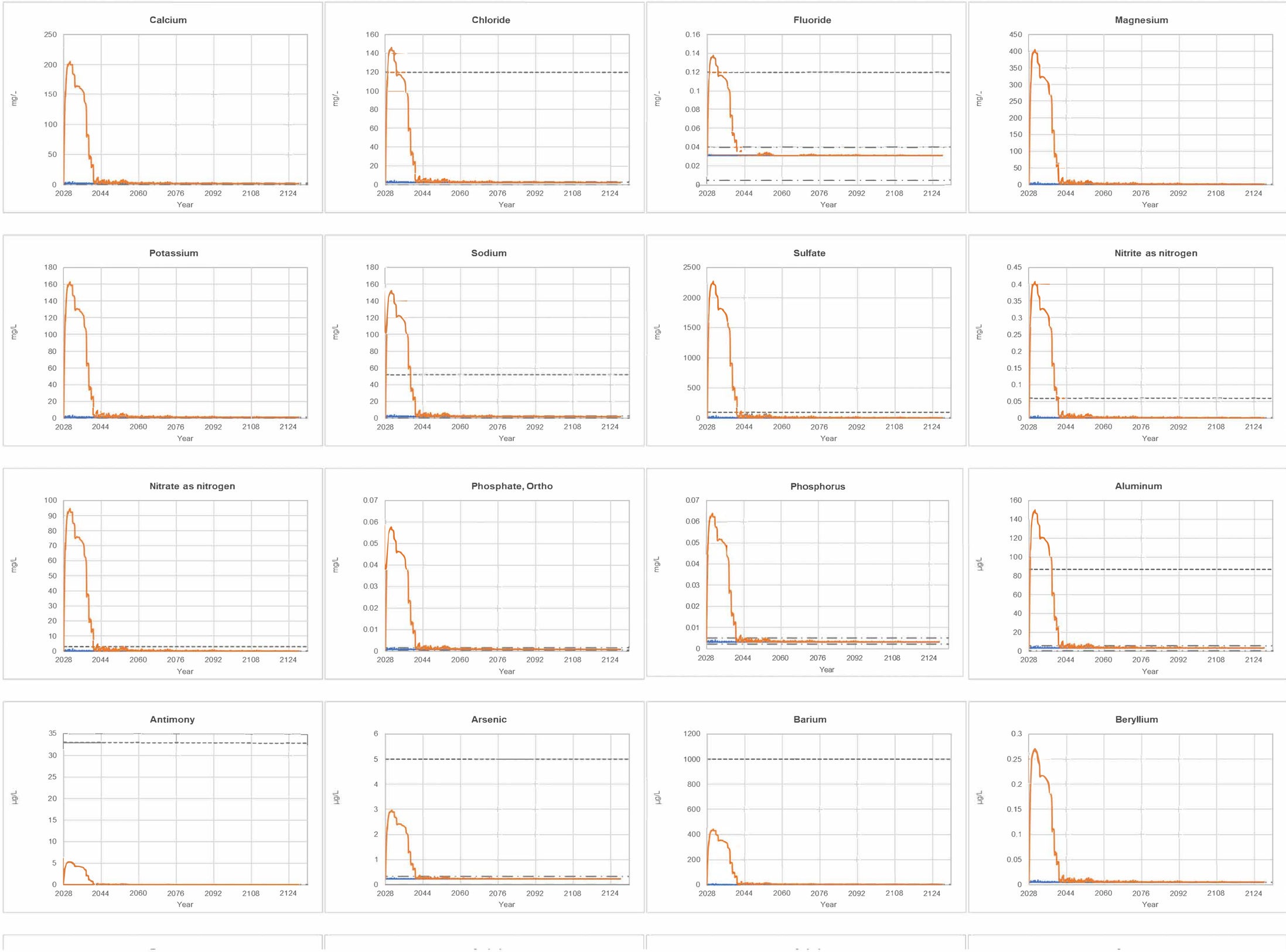
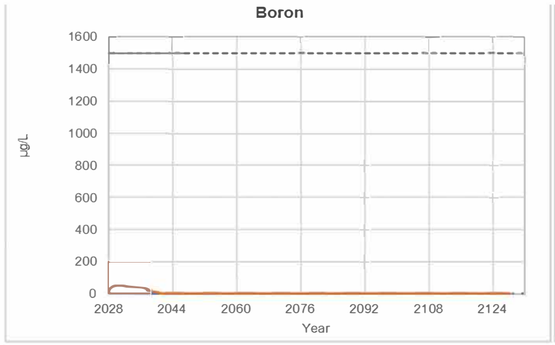
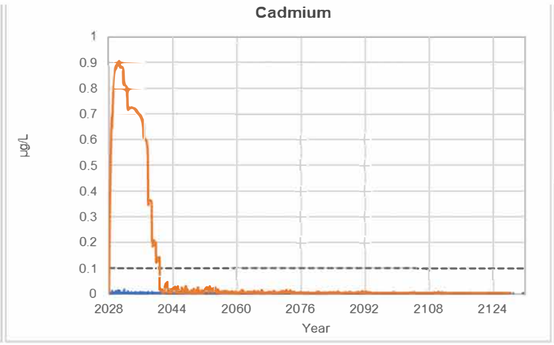
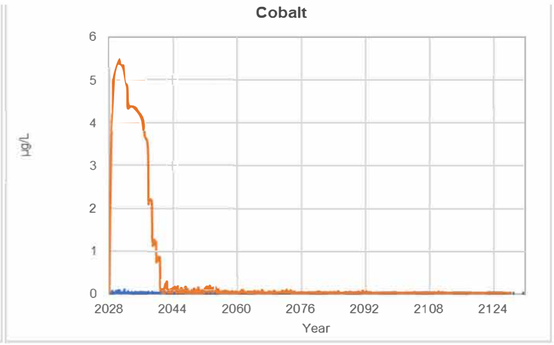
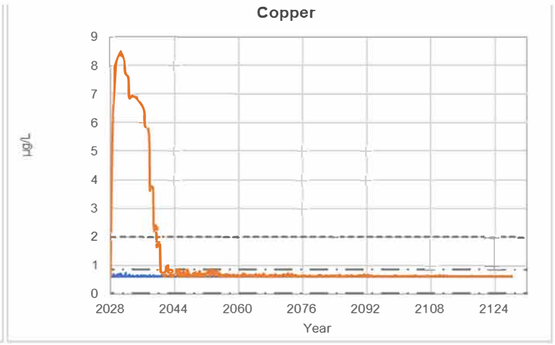


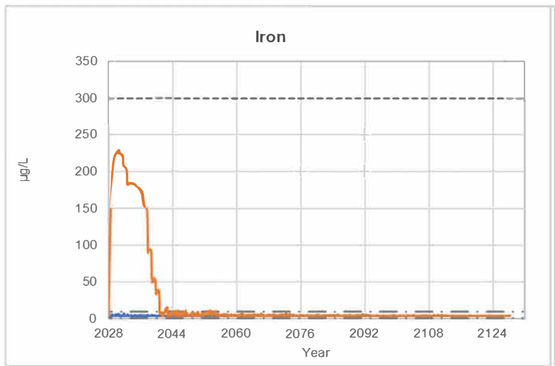
Figure A-9: Predicted time Series of A21 Pit Lake Constituent Concentrations – Sensitivity Scenario 2 (continued)

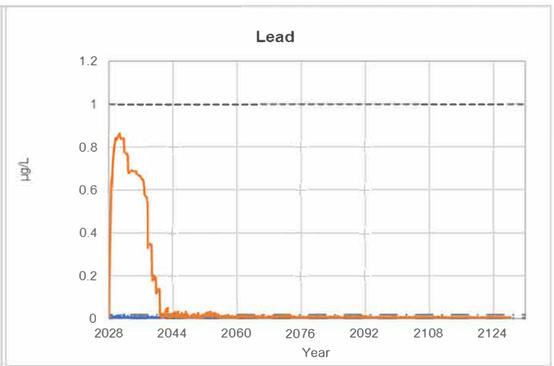


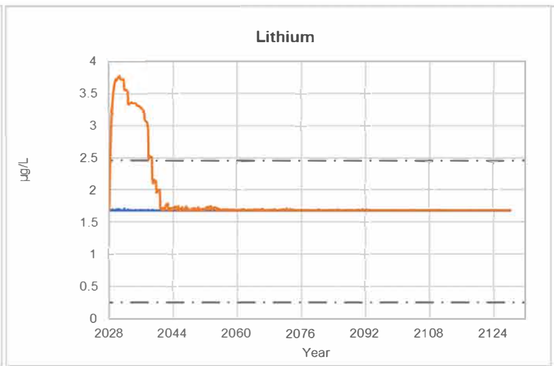


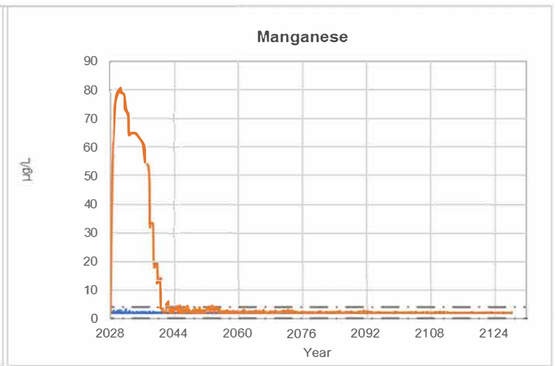


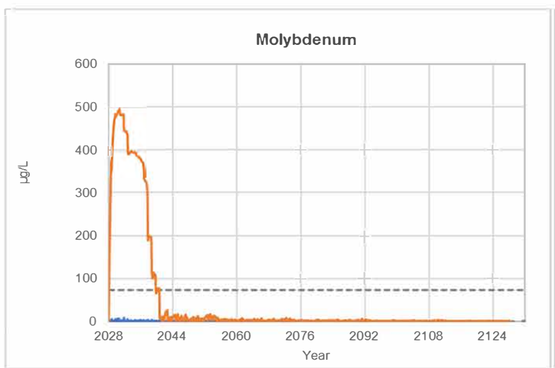


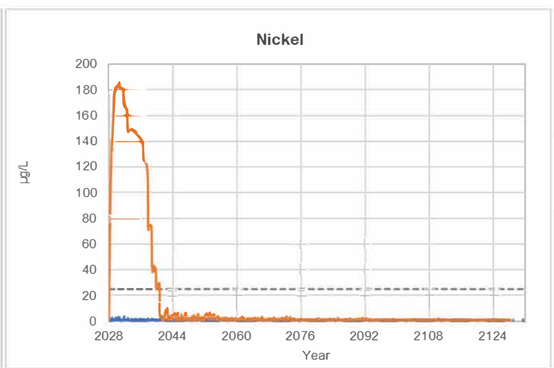


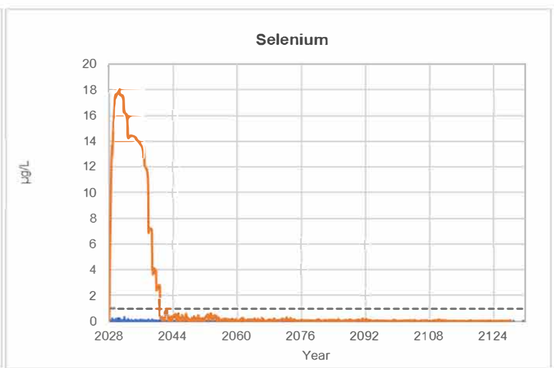


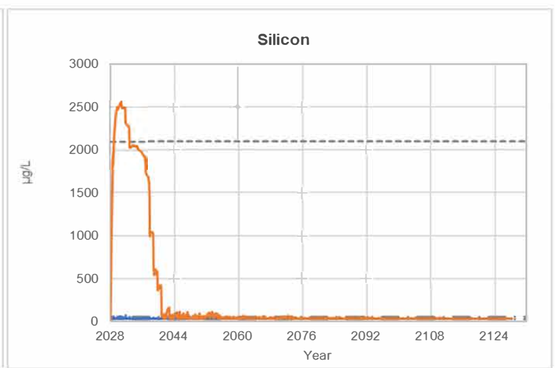


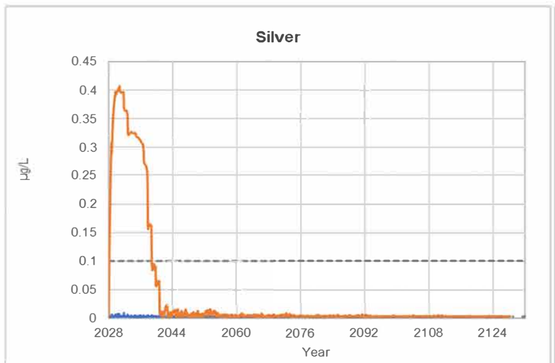


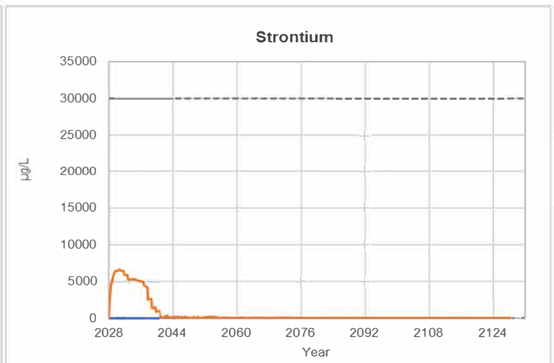


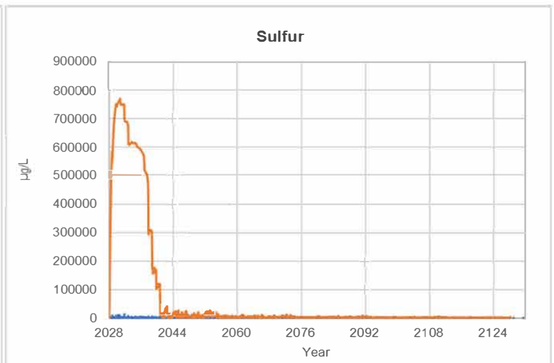












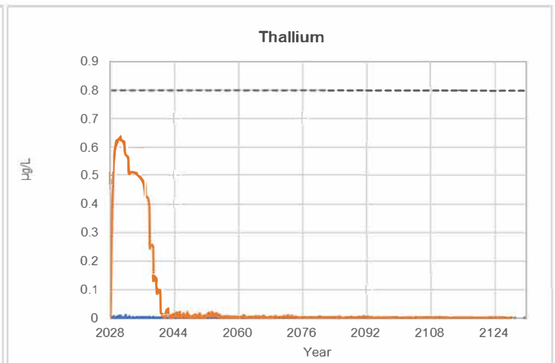
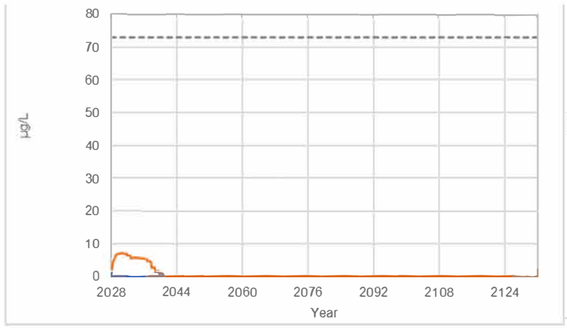
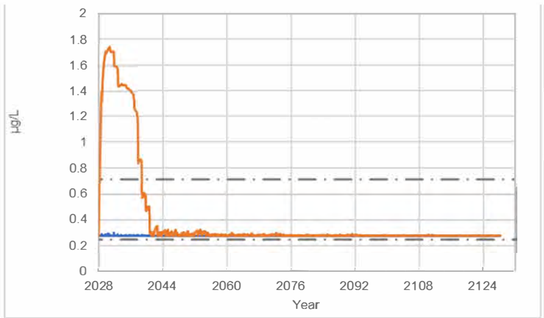
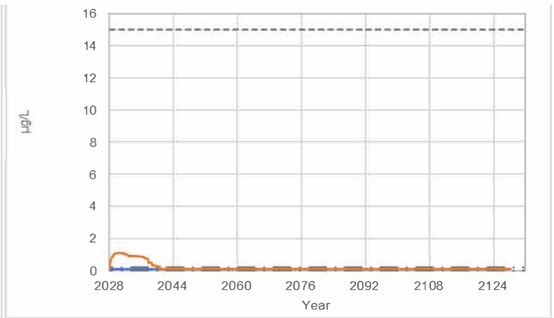
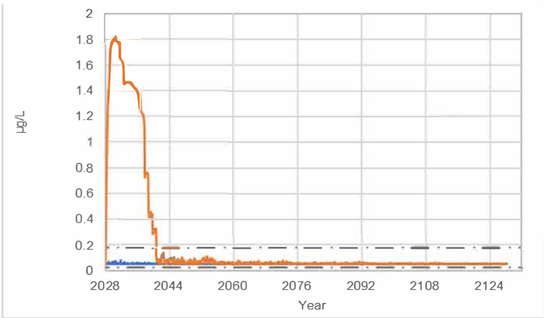


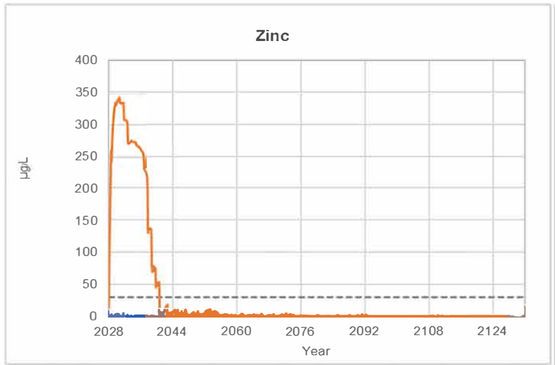
Figure A-9: Predicted time Series of A21 Pit Lake Constituent Concentrations – Sensitivity Scenario 2 (continued)











Legend:

- Top Section (411-416 masl)
- Lower Section (396-400 masl)
- Benchmark
- Range of Observed Data (2017-2018)

RioTinto

Appendix 3

Erratum to DDMI Response to WLWB Information Request #5 following the Technical Session as part of the Water Licence Amendment Process for the Processed Kimberlite to Mine Workings Proposal

RioTinto

IR #5 for DDMI

To provide the results of the following modeling scenarios for A418:

Scenario 2-a: Base Case as described below:

- Water Cap Depth = 150 m
- Deposited PK volume = 5 Mm3 (i.e., porewater volume from current consolidation model*0.17)
- Porewater chemistry = 350 mg/L TDS (with other parameters based on a representative statistic on saturated PKC samples as presented in Moncur and Smith, 2014)
- Reclaim pond size = based on a depth of 5 m (i.e., this is the depth of the pore water assumed to be sitting at the bottom of the pit before the filling period starts and which is expected to fully mix with the lake water used to fill the pit).

Results to be presented:

- Hydrodynamic results (presented for top section, 40m depth, and bottom section)
- Concentrations of water quality constituents (including ammonia) in the event of unanticipated mixing at year 100.

Scenario 3-a: Base Case described in Scenario 2-a, with the following changes:

- Add an additional volume of 5 Mm3 of PK slimes to the deposits (i.e., porewater volume from current consolidation model*0.34)
- Porewater chemistry = calculated based on the combined concentration of PK slimes and fine PK (50% of volume is fine PK and 50% of volume is PK slimes). The fine PK water TDS = 350 mg/L (with other parameters based on a representative statistic on saturated samples in Moncur and Smith 2014; PK slimes chemistry is to be extracted from representative porewater samples in Moncur and Smith, 2014).

Results to be presented:

- Hydrodynamic results (presented for top section, 40m depth, and bottom section)
- Concentrations of water quality constituents (including ammonia) in the event of unanticipated mixing (confirm depth of water ≤150m).

Scenario 4-a: Base Case described in Scenario 2-a, with the following change:

- Update initial conditions to include a reclaim pond size based on a depth 15 m (i.e., this is the depth of the pore water assumed to be sitting at the bottom of the pit before the filling period starts and which is expected to fully mix with the lake water used to fill the pit).

Results to be presented:

- Hydrodynamic results (presented for top section, 40m depth, and bottom section)
- Concentrations of water quality constituents (including ammonia) in the event of unanticipated mixing at year 100.

Scenario 5-a:

If scenario 2-a shows any exceedances under the unanticipated mixing conditions, DDMI is to model early closure based on a lower volume (2.5 Mm3) of deposited PK material.

If any water quality results from the above modeled scenarios show exceedances of any of the AEMP benchmarks, DDMI is to: (1) describe the likelihood of such occurrences, and (2) describe proposed mitigations.

DDMI Response to IR #5 (erratum May 9, 2019)

Model Assumptions

- Unless otherwise noted, the modelling assumptions are as described in Golder (2018) for the A418 Development Case (Scenario 1a).

- The A418 Development Case (Scenario 1a) was modified as per *IR #5 for DDMI* specifications listed above with the following exceptions/clarifications.

    1. Scenario 2a Pore Water Chemistry. During the Technical Session, WLWB Staff and Reviewers frequently referenced pore water from "fresh PK" as opposed to pore water from weathered in situ PK beaches in the PKC assumed in Golder (2018). The suggestion in *IR #5 for DDMI* was to use in situ beach pore water results only from saturated zones within the PKC. DDMI further reviewed the data presented in Moncur and Smith (2014) and recommend that a better representation of "fresh PK" pore water chemistry can be obtained from the results of the PK slurry at the point of discharge to the PKC. This would be the better representation of chemistry of water that would be released into the mine workings along with the PK. The "Fresh" PK slurry water chemistry is shown in Attachment-1 and compared with the in situ beach saturated zone results. "Fresh" PK slurry water chemistry was used to represent PK pore water chemistry in Scenario 2a. Actual pore water chemistry assumed in Scenario 2a is presented in Attachment-2.

    2. Scenario 3a Pore Water Chemistry. As requested, DDMI extracted results from in situ sampling of PKC slimes (extra fine processed kimberlite) from the PKC barge reported in Moncur and Smith (2014). These results are compared with other pore water results in Attachment-1. The PKC slimes water quality were assumed for modelling of pore water release from deposited PK slimes. Scenario 3a includes deposition of operational PK (deposited directly from the Process Plant) and slimes dredged from the PKC and re-deposited in the mine workings. For the modelling the pore water chemistry is assumed to be a 50:50 mix of measured PKC Slimes and "Fresh" PK pore water (described in 1 above). Please refer to Attachment-2 ~~3~~ for actual pore water chemistry assumed in Scenario 3a.

    3. Water chemistry for nitrogen forms were incomplete in Moncur and Smith (2018) as the focus of this investigation was PK geochemistry where the source of nitrogen is understood to be blasting residue rather than PK geochemistry. The importance of including all forms of nitrogen (ammonia, nitrate and nitrite) was expressed during the Technical Session and included as a requirement in *IR #5 for DDMI*. To remedy the short comings of the Moncur and Smith (2014) data with regard to nitrogen, DDMI reviewed Dominion Diamond Mine's Beartooth pit nitrogen monitoring results and concluded that these results for PK supernatant would be a reasonable analogue for PK pore water as they are expected to be driven primarily by blasting residue and therefore largely independent of the kimberlite ore body geochemistry. Beartooth monitoring

results were considered the best analog for these data and they have been used as the basis for nitrogen pore water chemistry in all Scenarios modelled as part of this IR response. Please refer to Attachment-2 for assumed pore water nitrogen chemistry for all modelled scenarios.

4. During the review of source data used to estimate model inputs for pore water quality, DDMI identified a possible issue with results for silver, particularly from the in situ sampling of PKC slimes and slurry. We have compared these results against measured data for supernatant water at Dominion Diamond Mine's Beartooth pit where silver concentrations are consistently below detection limits of 0.02 ug/L. DDMI is currently not confident in the in situ slimes/slurry results for silver. For all Scenarios modelled as part of this IR response, pore water silver concentrations have been assumed to be 0.24 ug/L silver based on results for the saturated zone of in situ PK. Please refer to Attachment-2 for assumed pore water nitrogen chemistry for all modelled scenarios.

5. Golder (2018) incorrectly reported the AEMP Benchmark for silver as 0.1 ug/L. The correct value should be 0.25 ug/L. The correct value is shown in Attachment-1.

6. Based on the remaining storage capacity after accounting for the requested material volumes in Scenario 3a, the water depth for Scenario 3a was assumed to be 111 m for the calculation of concentration under unanticipated mixing.

Prediction Results

Attachment-3 lists the predicted water quality results for each of the three (3) scenarios (2a, 3a and 4a). Results are presented for the top surface layer and at 40 m of depth. Also shown in Attachment-3 are the Aquatic Effects Monitoring Program (AEMP) benchmarks. Predicted surface water quality remains below AEMP benchmarks for all parameters at both surface and 40 m depth. Scenario 5a was not modelled as this scenario was only to run if AEMP benchmarks were exceeded in Scenario 2a, which they were not.

As also shown in the previous sensitivity analysis (DDMI response to EMAB-14), surface water quality is relatively insensitive to pore water quality under meromictic conditions because the upward flux of constituents is very small compared to the water exchange with Lac de Gras. Specifically, neither the addition of 5 Mm^3 of closure slimes (Scenario 3a) nor the addition of 10 m of initial decant water (Scenario 4a) materially changed the predicted surface water quality relative to results for the revised Development Base Case (Scenario 2a) initial conditions. The initial decant water volume influences the surface water quality at the start of the modelling as it assumed the decant water mixes completely with the freshwater used for infilling the pit lake. See for example TDS results for Scenario 3a in Attachment-5 and Tracer results for Scenario 3b in Attachment-6. The calculation of water chemistry based on the modelled tracer is thought to be highly conservative because the current model framework forces water upward rather than forming a deep pool of higher density water in the centre of the PK deposit over time, which is expected to occur over time.

Results are also provided graphically in:

- Contour plot of Total Dissolved Solids and Tracer (see Attachment-4)
- Time series plots of Total Dissolved Solids (top, 40 m, bottom; see Attachment-5)
- Time series plots of tracer concentrations (top, 40 m, bottom; see Attachment-6)

Unanticipated Mixing Scenario

At the Technical Session, DDMI's Geotechnical Engineer explained that filling the underground mine voids in A418 with PK material would improve pit wall stability in the lower sections of the mine and that filling the open-pit with water would eliminate wall pore-water pressure improving pit wall stability. A pit wall failure of sufficient magnitude to fully mix the A418 pit lake was described as very rare.

Regardless, *IR #5 for DDMI* requested that model results also be presented for an unanticipated mixing event. Attachment -7 ~~Table 4~~ presents these results for this unlikely scenario under each of the three (3) modelled Scenarios (2a, 3a and 4a). Predicted fully mixed water quality remained below AEMP Benchmarks in all Scenarios and for all parameters with the single exception of nitrite in Scenario 3a. The predicted fully mixed nitrite concentration under this unlikely scenario is 0.0756~~5~~ mg/L (see Attachment-7) compared with the AEMP Benchmark of 0.06 mg/L.

Further Discussion - Nitrite

In addition to the fully mixed scenario being very rare in the first place, there are two (2) other conservative aspects of the nitrite results that should be considered.

1. The AEMP Benchmark for nitrite of 0.06 mg/L is from the Canadian Council of Ministers of the Environment (CCME) (1987). Appropriately, the value is based on the most sensitive species – salmonids. Neither the CCME nor the AEMP Benchmark consider the modifying effect of the chloride ion (Nordin and Pommen 1986; EIFAC 1984; BC MOE 2009). With chloride in the 6-8 mg/L range (as predicted in Attachment-7) the AEMP Benchmark for nitrite would increase by about four-fold to 0.24 mg/L (BC MOE 2009). Predicted nitrite concentrations would not exceed a chloride adjusted AEMP benchmark in any of the unanticipated mixing cases.

2. Nitrite is an intermediate nitrogen form that would not remain for very long in an oxygenated environment where it would rapidly oxidize to a significantly less toxic nitrate form. The process of nitrite oxidation is well understood, and a numerical model has been developed for Snap Lake, which would have fairly similar environmental conditions as Lac de Gras and a fully overturned pit lake water column. The model was calibrated to northern environments to arrive at kinetic rates, and it was subsequently reviewed under the water license process and then peer-reviewed (Snow and Vandenberg 2015). The model indicates that the nitrite concentration in an overturned pit lake would have a half-life of less than one month.

Nitrite released from PK or Slimes pore water is very unlikely to cause a significant environmental impact because:

a) the unanticipated event itself is expected to be very rare;

b) the appropriate AEMP Benchmark with consideration of chloride toxicity modification would be 0.24 mg/L rather than 0.06 mg/L and no predicted surface concentrations are expected to exceed this value even with complete mixing; and

c) nitrite is expected to rapidly oxidize to nitrate in an oxygenated environment like the surface of a pit lake and no longer have the potential to cause toxicity to aquatic life.

Uncertainty with silver

As noted under exception/clarification #4, there is some uncertainty with measured in situ silver. DDMI expects that this uncertainty will eventually be resolved following the consolidation testing underway at the University of Alberta. DDMI conducted some additional calculations to assist Reviewers in considering the relevance of this uncertainty to the potential for significant environmental effects. Results reported here for Scenario 2a, 3a and 4a combined with the results and sensitivity analysis conducted in response to previous IRs demonstrate that predicted pit lake surface water quality under meromictic conditions is not sensitive to pore water concentrations and predicted concentrations of all water quality parameters, including silver, remain below AEMP benchmarks and well below concentrations that might result in significant adverse impacts. The only model scenario that was shown to be sensitive to the pore water concentration of silver was for the very rare "what if" case of unanticipated full mixing in Scenario 3a. If pore water concentrations were about 10 times greater than the upper 75th percentile of the in situ measured results (or 100 times greater than supernatant monitoring results from Dominion Diamond Mine's Beartooth pit) and a very rare event caused complete mixing of the water column, then predicted silver concentrations could approach the 0.25 ug/L AEMP Benchmark. While it will be important to better understand expected pore water chemistry for all parameters, including silver, any uncertainty is not expected to materially change the conclusion of no significant environmental impact.

References

BC MOE (British Columbia Ministry of Environment). 2009. Water quality guidelines for nitrogen (nitrate, nitrite and ammonia). Overview report update. Water Stewardship Division. Prepared by Nordin RN and Pommen LW. September 2009.

EIFAC (European Inland Fisheries Advisory Commission). 1984. Commission Working Party on Water Quality Criteria for European Freshwater Fish, water quality criteria for European freshwater fish. Report on Nitrite and freshwater fish. EIFAC Technical Paper 46: 19 p.

Nordin RN, Pommen LW. 1986. Water quality criteria for nitrogen (nitrate, nitrite and ammonia). Technical Appendix. Ministry of Environment and Parks. British Columbia. November 1986.

Snow, A., and J. Vandenberg. 2016. Simple but effective model calibration for nitrite in northern lakes. Integrated Environmental Assessment and Management 12:821–822.

ATTACHMENT-1

Comparison of water chemistry used as basis for assumption of future pore water chemistry from PK deposited to mine workings.

			In situ PKC Beach Pore Water[1]				In situ PKC Beach Pore Water[2] Saturated Only				In situ PKC Beach Pore Water[3] Un-saturated Only				"Fresh" PK Slurry[4]			In situ Slimes Sampled from PKC barge[5]			
Parameter	**Unit**	**Benchmark**	**Average**	**25th%tile of PK Pore Water Data**	**75th%tile of PK Pore Water Data**	**Number of Samples**	**Average**	**25th%tile of PK Pore Water Data**	**75th%tile of PK Pore Water Data**	**Number of Samples**	**Average**	**25th%tile of PK Pore Water Data**	**75th%tile of PK Pore Water Data**	**Number of Samples**	**Average**	**Data Range**	**Number of Samples**	**Average**	**25th%tile of PK Pore Water Data**	**75th%tile of PK Pore Water Data**	**Number of Samples**
Calcium	mg/L	-	209	15	413	55	133	12	150	27	282	87	437	28	12	1.6 - 21	3	11	8	13	23
Chloride	mg/L	120	149	89	156	53	148	92	127	25	145	84	186	29	63	33 - 86	3	39	31	43	23
Fluoride	mg/L	0.12	0.14	0.0	0.0	53	0.4	<0.4	<0.4	25	0.4	<0.4	<0.4	29	0.14	<0.1 - 0.17	2	0.059	0.056	0.063	6
Magnesium	mg/L	-	412	19	677	55	241	13	191	27	578	126	968	28	7.2	2.2 - 16	3	27	21	33	23
Potassium	mg/L	-	166	49	290	55	117	41	135	27	213	127	297	28	138	66 - 176	3	56	42	68	23
Sodium	mg/L	52	155	61	235	55	115	56	131	27	194	89	264	28	85	43 - 109	3	54	46	63	23
Sulfate	mg/L	100	2315	112	4283	53	1327	57	969	25	3088	679	4887	29	208	59 - 329	3	197	162	234	23
Phosphate, Ortho	mg/L-P	-	0.059	<0.065	<0.13	53	0.065	0.033	0.131	25	0.065	0.033	0.131	29	0.031	<0.1 - 0.09	2	0.032	0.06	0.13	23
Phosphorus	mg/L	-	0.065	< 0.01	< 0.035	55	0.035	<0.003	<0.035	27	0.10	<0.01	0.063	28	0.035	<0.035 - <0.035	2	0.039	<0.035	<0.035	18
Aluminum	µg/L	87	153	21	93	55	172	24	80	27	134	18	140	28	0.14	<0.2 - 0.0054	3	2.8	<0.2	1.7	23
Antimony	µg/L	33	5.4	4.6	6.5	55	5.8	5.0	6.9	27	5.1	4.2	6.1	28	18	5.2 - 28	3	2.7	0.9	4.3	23
Arsenic	µg/L	5	3.0	2.2	3.7	55	3.0	2.3	3.7	27	3.1	2.2	3.5	28	5.9	1.6 - 11	3	4.8	3.1	6.1	23
Barium	µg/L	1000	449	124	438	55	452	72	432	27	446	150	434	28	155	81 - 264	3	51	43	58	23
Beryllium	µg/L	-	0.27	< 0.02	< 0.08	55	0.24	<0.08	<0.08	27	0.25	<0.25	<0.25	28	0.59	<0.03 - 0.59	3	3.3	<0.03	0.2	23
Boron	µg/L	1500	56	44	73	55	51	38	70	27	61	47	74	28	71	48 - 105	3	30	<0.2	50	23
Cadmium	µg/L	0.1	0.92	0.28	1.18	55	0.78	0.2	1.18	27	1.06	0.62	1.1	28	0.2	0.082 - 0.3	3	0.51	0.13	0.72	23
Cobalt	µg/L	-	5.6	0.52	7.35	55	1.6	0.4	2.3	27	9.4	2.5	9.8	28	0.19	0.17 - 0.2	3	0.15	<0.01	0.16	23
Copper	µg/L	2	8.6	3.0	11.8	55	7.5	2.5	7.7	27	9.8	4.2	13.8	28	2.6	<0.07 - 3.8	3	1.0	0.4	1.1	23
Iron	µg/L	300	234	18	171	55	97	15	76	27	366	32	310	28	1.4	<0.2 - 3.8	3	63	2	31	23
Lead	µg/L	1	0.88	0.16	0.79	55	0.65	0.14	0.56	27	1.09	0.38	0.83	28	0.51	0.068 - 1	3	0.28	0.02	0.23	23
Lithium	µg/L	-	3.8	2.1	5.2	55	2.9	1.4	4.0	27	4.6	2.5	6.9	28	5.0	5 - 5	1	-	0	0	0
Manganese	µg/L	-	82	11	116	55	31	6	38	27	131	21	173	28	0.34	<0.07 - 0.92	3	6.1	1.9	7.9	23
Molybdenum	µg/L	73	504	213	679	55	452	155	562	27	555	320	683	28	242	189 - 278	3	385	330	430	23
Nickel	µg/L	25	189	8.8	267.1	55	78	5	90	27	296	69	380	28	2.5	1.4 - 4.3	3	10	6	13	23
Selenium	µg/L	1	18	1.8	27.5	55	5	<0.2	2	27	23	8	34	28	0.72	0.72 - 0.72	1	0.5	0.08	0.58	22
Silicon	µg/L	2100	2605	<700	3880	55	2000	<200	<2000	27	3245	2386	4432	28	2781	2300 - 2300	3	1626	864	1182	23
Silver	µg/L	0.25	0.41	<0.004	0.314	55	0.24	<0.05	0.27	27	0.55	0.0	0.38	28	Note 6			Note 6			
Strontium	µg/L	30000	6701	< 1000	12510	55	4306	500	5118	27	8753	2446	12705	28	298	0.56 - 840	3	349	284	389	23
Sulfur	µg/L	-	782981	43195	1382000	55	474037	30575	364900	27	1080890	255600	1691750	28	92090	78180 - 106000	2	54820	47730	66130	7
Thallium	µg/L	0.8	0.65	0.26	0.72	55	0.5	0.25	0.46	27	0.8	0.32	0.89	28	0.16	<0.006 - 0.25	3	0.11	<0.07	0.06	23
Tin	µg/L	73	7.3	3.1	9.4	55	5.2	1.7	5.7	27	9.3	4.9	11.0	28	4.1	0.38 - 11	3	1.6	0.0	2.1	23
Titanium	µg/L	-	1.8	< 0.2	< 2.0	55	2.0	<2	<2	27	2.0	<2	<2	28	0.25	<0.2 - 0.34	3	1.1	0.0	0.3	23
Uranium	µg/L	15	1.1	0.061	1.099	55	0.7	0.0	0.1	27	1.6	0.3	2.0	28	0.2	0.058 - 0.45	3	0.56	0.01	0.8	17
Vanadium	µg/L	-	1.9	0.64	2.34	55	1.1	0.5	1.5	27	2.6	1.5	3.0	28	1.4	<0.03 - 2.8	3	1.3	0.0	2.1	23
Zinc	µg/L	30	348	15	321	55	130	10	113	27	557	64	418	28	2.5	7.4 - 7.4	3	136	1	13	23

1 Data from Moncur and Smith (2014) - assumed as basis for modelling pore water quality in Golder (2018)
2 Results summary for only samples from (1) with saturated conditions
3 Results summary for only samples from (1) with un-saturated conditions
4 Results from direct sampling of PK slurry as discharged to the PKC - 1 sample from each of 2009, 2012, 2013.
5 *In situ* slimes samples were collectedin 2009, 2010 and 2011 from piezometers installed at depths from 10-75 ft beneath the water surface at the PKC Reclaim barge
6 DDMI is not confident in the in situ slimes/slurry results and for the current modelling have assumed a slimes/slurry pore water quality of 0.24ug/L based on results for the saturated zone of in situ PK.

ATTACHMENT-2

Pore water chemistry assumed for the Technical Session IR-5

Parameter	Unit	Benchmark	Chemistry assumed for PK Pore Water	Chemistry assumed for Slimes Pore Water
Calcium	mg/L	-	12	11
Chloride	mg/L	120	63	39
Fluoride	mg/L	0.12	0.14	0.059
Magnesium	mg/L	-	7.2	27
Potassium	mg/L	-	138	56
Sodium	mg/L	52	85	54
Sulfate	mg/L	100	208	197
Nitrite as nitrogen	mg/L	0.06	0.6	0.6
Nitrate as nitrogen	mg/L	3	16.8	16.8
Ammonia	mg/L	4.7	2.2	2.2
Phosphate, Ortho	mg/L-P	-	0.031	0.032
Phosphorus	mg/L	-	0.035	0.039
Aluminum	µg/L	87	0.14	2.8
Antimony	µg/L	33	18	2.7
Arsenic	µg/L	5	5.9	4.8
Barium	µg/L	1000	155	51
Beryllium	µg/L	-	0.59	3.3
Boron	µg/L	1500	71	30
Cadmium	µg/L	0.1	0.2	0.51
Cobalt	µg/L	-	0.19	0.15
Copper	µg/L	2	2.6	1.0
Iron	µg/L	300	1.4	63
Lead	µg/L	1	0.51	0.28
Lithium	µg/L	-	5.0	-
Manganese	µg/L	-	0.34	6.1
Molybdenum	µg/L	73	242	385
Nickel	µg/L	25	2.5	10
Selenium	µg/L	1	0.72	0.5
Silicon	µg/L	2100	2781	1626
Silver	µg/L	0.25	0.24	0.24
Strontium	µg/L	30000	298	349
Sulfur	µg/L	-	92090	54820
Thallium	µg/L	0.8	0.16	0.11
Tin	µg/L	73	4.1	1.6
Titanium	µg/L	-	0.25	1.1
Uranium	µg/L	15	0.2	0.56
Vanadium	µg/L	-	1.4	1.3
Zinc	µg/L	30	2.5	136

Attachment 3

Predicted Daily Maximum Concentrations in the A418 Pit Lake over 100-year Period after Closure

Parameters	Unit	Benchmark	Scenario 2-a (158 m Water Cap)		Scenario 3-a (105 m Water Cap)		Scenario 4-a (158 m Water Cap)	
			Top Section	at Depth of 40 m Below Surface	Top Section	at Depth of 40 m Below Surface	Top Section	at Depth of 40 m Below Surface
Calcium	mg/L	-	2.7	2.7	2.8	2.8	3.0	3.0
Chloride	mg/L	120	4.2	4.2	4.7	4.7	5.8	5.8
Fluoride	mg/L	0.12	0.035	0.035	0.036	0.036	0.038	0.038
Magnesium	mg/L	-	1.2	1.2	1.6	1.6	1.4	1.4
Potassium	mg/L	-	2.8	2.8	3.6	3.6	6.5	6.5
Sodium	mg/L	52	4.1	4.1	4.8	4.8	6.4	6.4
Sulfate	mg/L	100	6.5	6.5	9.1	9.1	12	12
Nitrite as nitrogen	mg/L	0.06	0.0081	0.0081	0.016	0.016	0.024	0.024
Nitrate as nitrogen	mg/L	3	0.26	0.26	0.5	0.5	0.72	0.72
Ammonia_N	mg/L	4.7	0.064	0.064	0.094	0.094	0.12	0.12
Phosphate, Ortho	mg/L	-	0.0019	0.0019	0.0024	0.0024	0.0028	0.0028
Phosphorus	mg/L	-	0.004	0.004	0.0044	0.0044	0.0048	0.0048
Aluminum	µg/L	87	6.3	6.3	6.3	6.3	6.3	6.3
Antimony	µg/L	33	0.25	0.25	0.3	0.3	0.74	0.74
Arsenic	µg/L	5	0.35	0.35	0.41	0.41	0.5	0.5
Barium	µg/L	1000	5.3	5.3	6.1	6.1	9.5	9.5
Beryllium	µg/L	-	0.012	0.012	0.056	0.056	0.028	0.028
Boron	µg/L	1500	3.8	3.8	4.2	4.2	5.6	5.6
Cadmium	µg/L	0.1	0.0053	0.0053	0.012	0.012	0.011	0.011
Cobalt	µg/L	-	0.019	0.019	0.021	0.021	0.024	0.024
Copper	µg/L	2	0.62	0.62	0.62	0.62	0.67	0.67
Iron	µg/L	300	4.1	4.1	4.9	4.9	4.1	4.1
Lead	µg/L	1	0.0096	0.0096	0.014	0.014	0.024	0.024
Lithium	µg/L	-	2.1	2.1	-	-	2.1	2.1
Manganese	µg/L	-	3.3	3.3	3.3	3.3	3.3	3.3
Molybdenum	µg/L	73	3.9	3.9	9.1	9.1	11	11
Nickel	µg/L	25	0.79	0.79	0.91	0.91	0.84	0.84
Selenium	µg/L	1	0.029	0.029	0.036	0.036	0.048	0.048
Silicon	µg/L	2100	218	218	239	239	289	289
Silver	µg/L	0.25	0.0055	0.0055	0.0087	0.0087	0.012	0.012
Strontium	µg/L	30000	38	38	43	43	45	45
Sulfur	µg/L	-	2698	2698	3461	3461	5183	5183
Thallium	µg/L	0.8	0.003	0.003	0.0046	0.0046	0.0073	0.0073
Tin	µg/L	73	0.061	0.061	0.084	0.084	0.17	0.17
Titanium	µg/L	-	0.51	0.51	0.52	0.52	0.51	0.51
Uranium	µg/L	15	0.12	0.12	0.12	0.12	0.12	0.12
Vanadium	µg/L	-	0.12	0.12	0.14	0.14	0.15	0.15
Zinc	µg/L	30	0.24	0.24	2.0	2.0	0.3	0.3

Bold indicates concentrations is exceeding benchmark

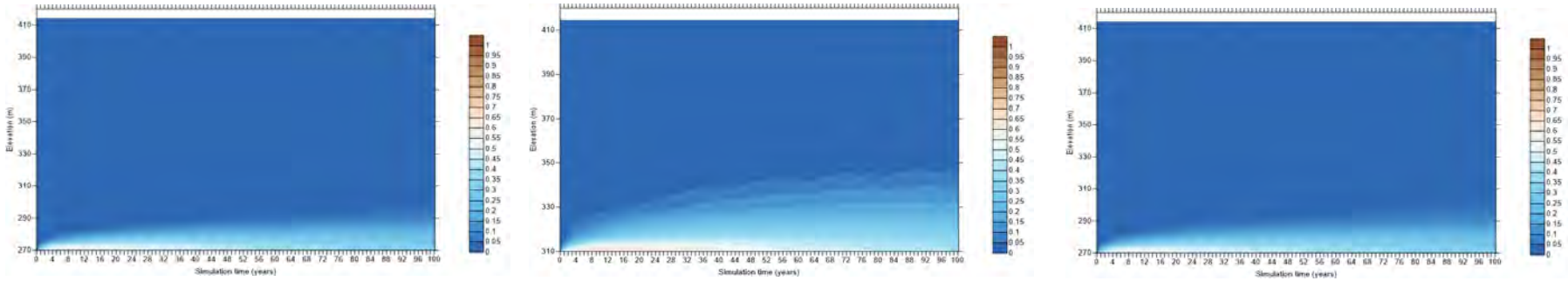
Attachment 4

Scenario 2-a (Development Case, 158 m Water Cap)

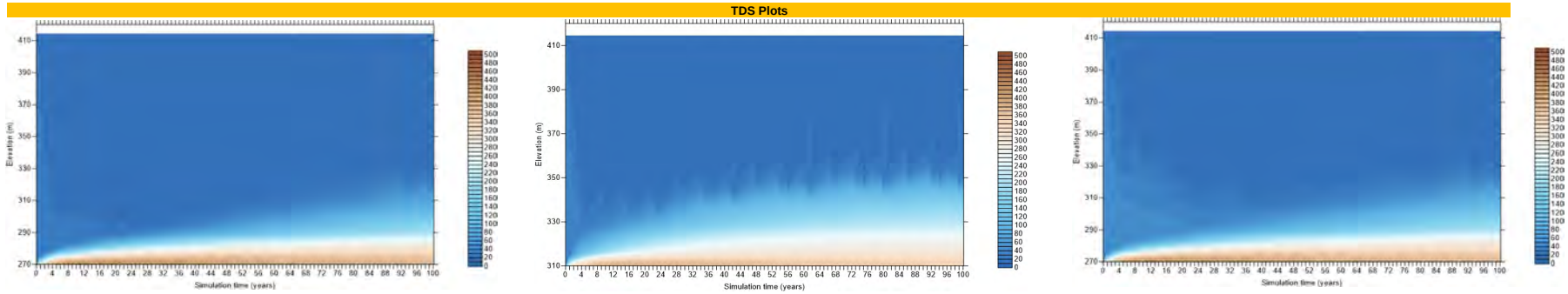
Scenario 3-a (105 m Water Cap)

Scenario 4-a (Development Case, 158 m Water Cap)

Tracer Plots

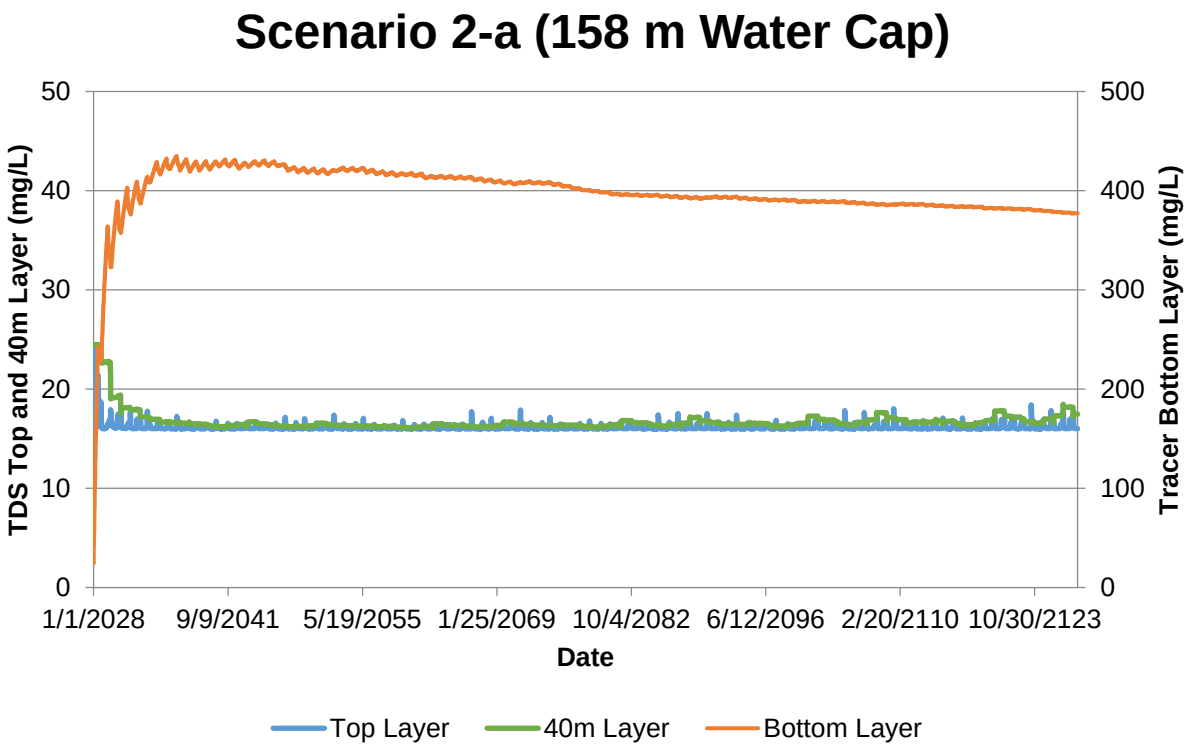


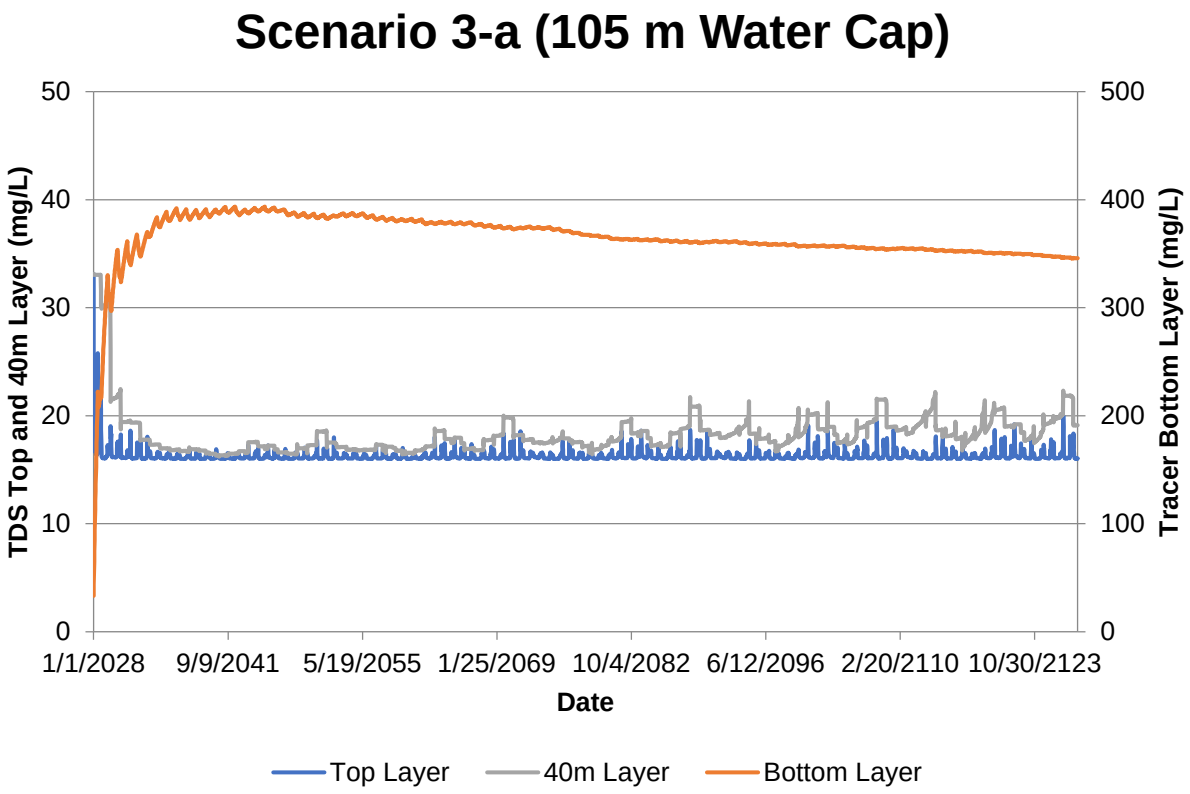
TDS Plots

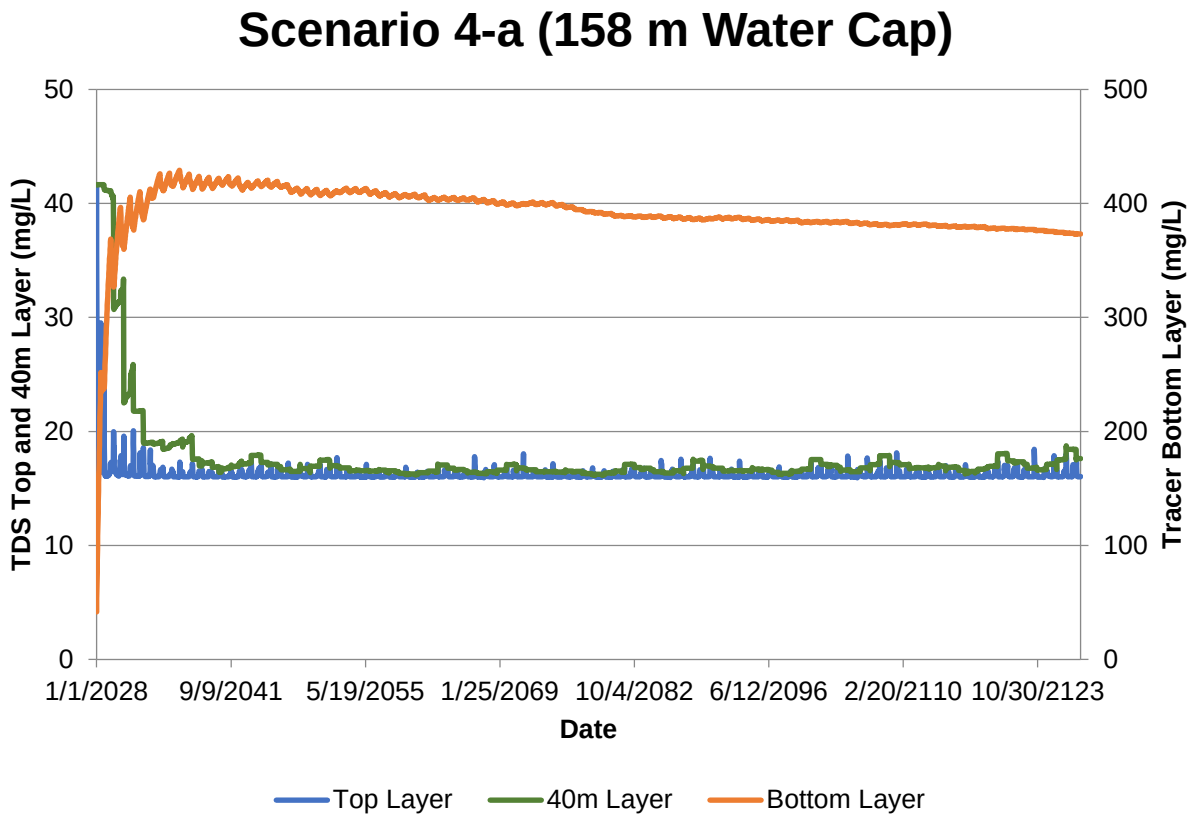


Attachment 5

Time Series Plots of Total Dissolved Solids (TDS)

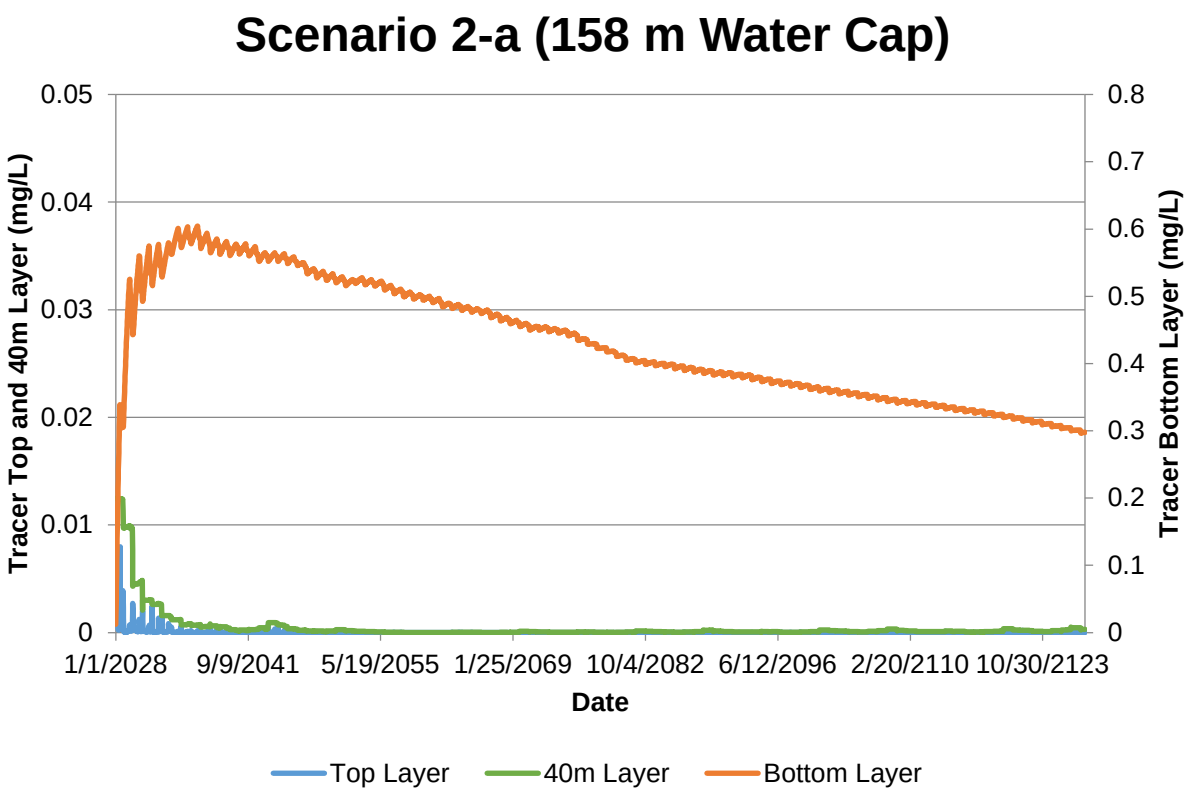


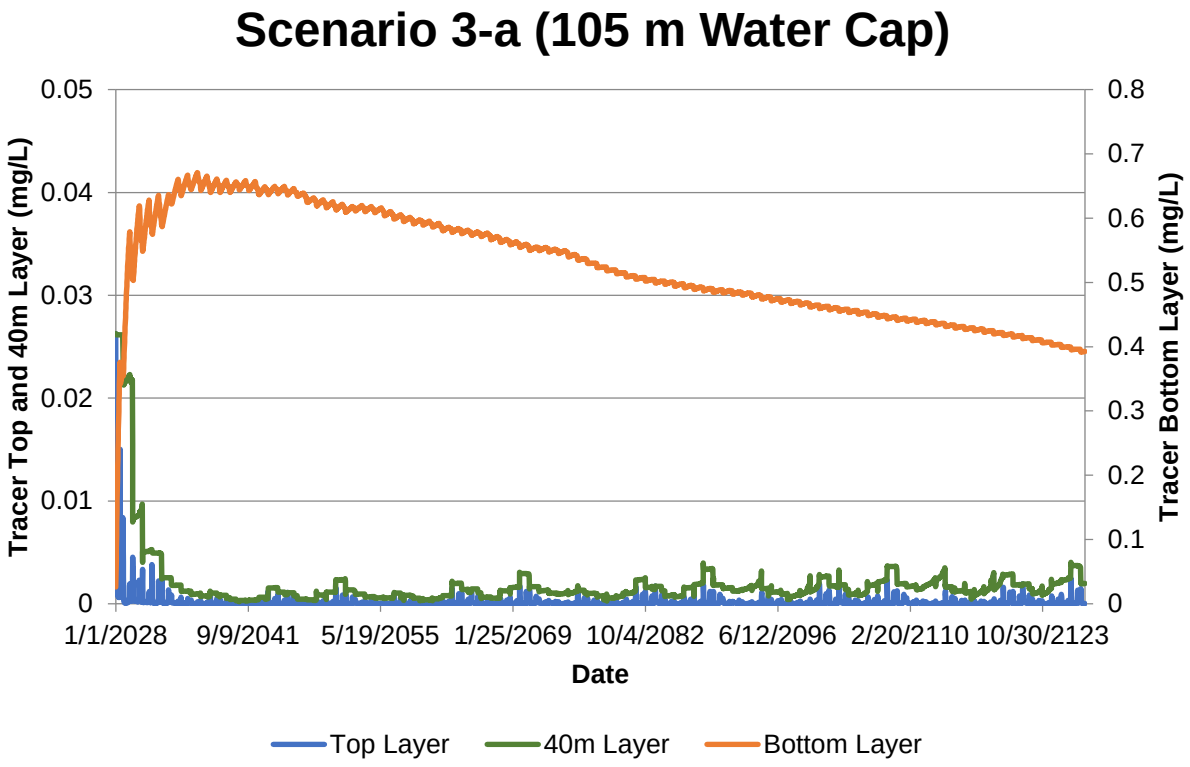


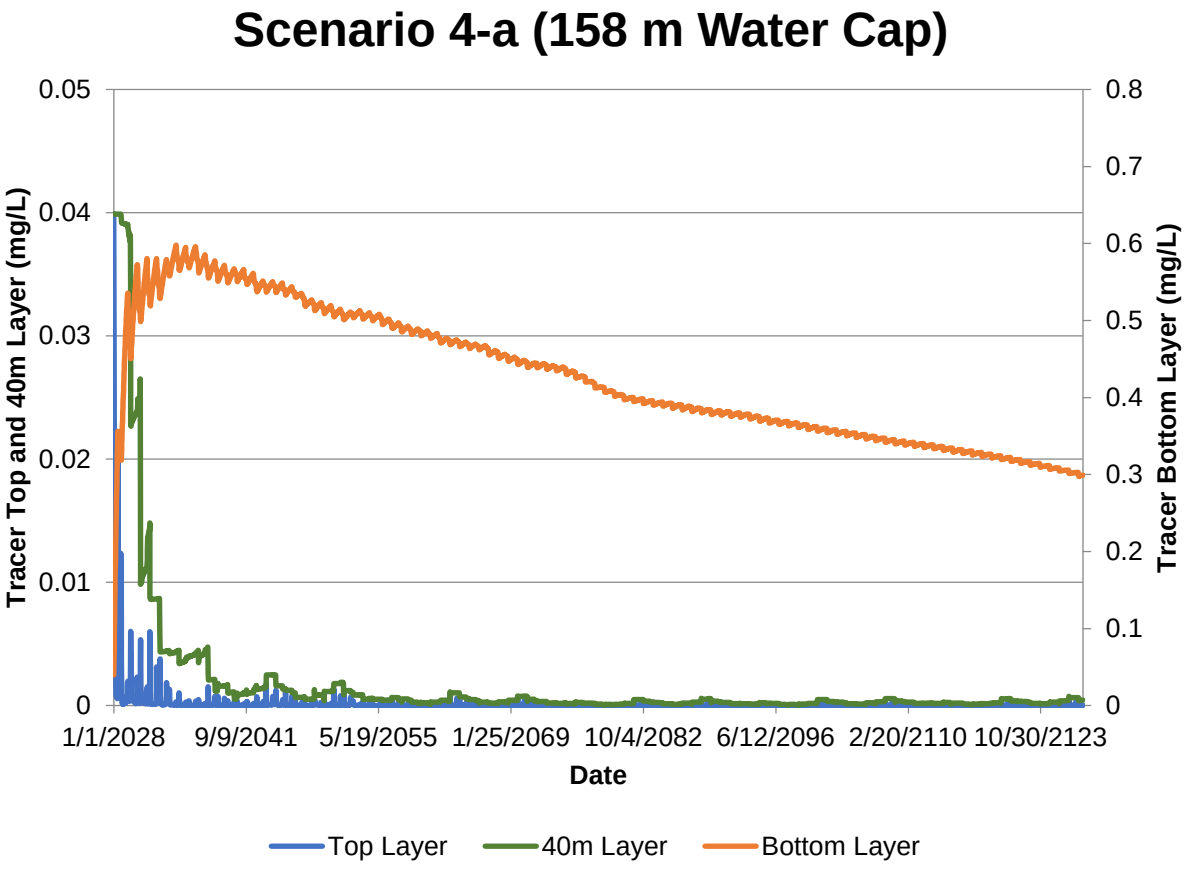

Scenario 4-a (158 m Water Cap)
TDS Top and 40m Layer (mg/L)
Tracer Bottom Layer (mg/L)
50
40
30
20
10
0
500
400
300
200
100
0
1/1/2028
9/9/2041
5/19/2055
1/25/2069
10/4/2082
6/12/2096
2/20/2110
10/30/2123
Date
Top Layer
40m Layer
Bottom Layer

Attachment-6

Time Series Plots of Tracer Concentrations






Scenario 4-a (158 m Water Cap)
Tracer Top and 40m Layer (mg/L)
Tracer Bottom Layer (mg/L)
0.05
0.04
0.03
0.02
0.01
0
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1/1/2028
9/9/2041
5/19/2055
1/25/2069
10/4/2082
6/12/2096
2/20/2110
10/30/2123
Date
Top Layer
40m Layer
Bottom Layer

Attachment 7

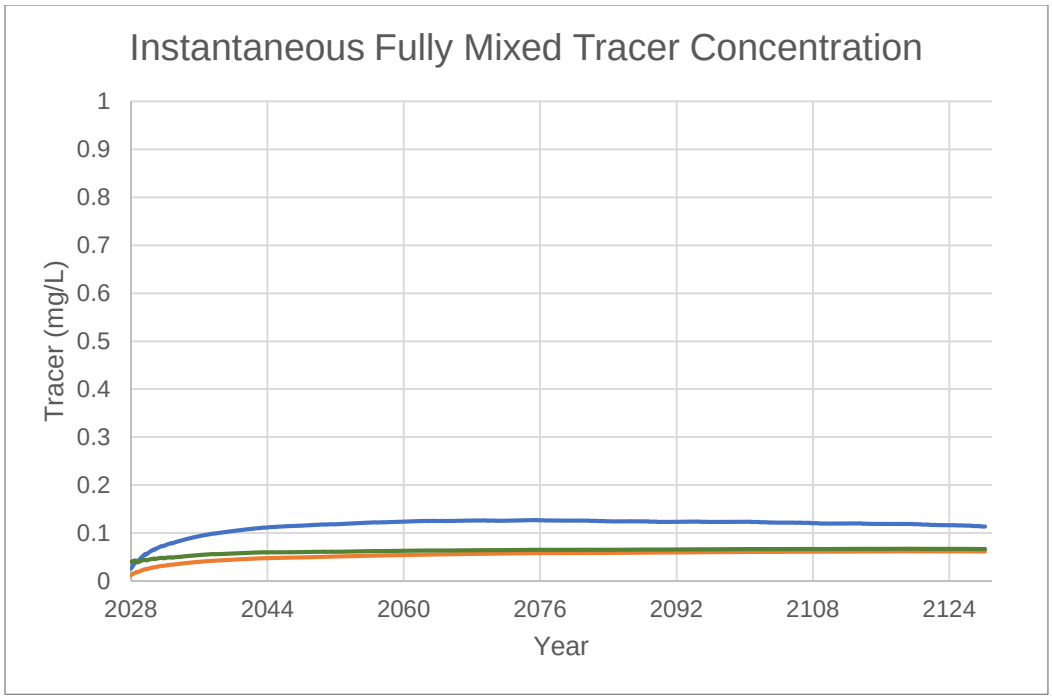
Table 1. Predicted Water Quality for an unanticipated event causing fully mixed conditions in A418 Pit Lake

			Scenario 2-a (158 m Water Cap)		Scenario 3-a (105 m Water Cap)		Scenario 4-a (158 m Water Cap)	
Parameters	**Unit**	**Benchmark**	**Maximum Concentration**	**Year of Max Concentration**	**Maximum Concentration**	**Year of Max Concentration**	**Maximum Concentration**	**Year of Max Concentration**
Calcium	mg/L	-	3.2	91	3.7	47	3.3	91
Chloride	mg/L	120	7.1	91	9.5	47	7.5	91
Fluoride	mg/L	0.12	0.04	91	0.042	47	0.041	91
Magnesium	mg/L	-	1.5	91	3.2	47	1.6	91
Potassium	mg/L	-	9.5	91	13	47	10.3	91
Sodium	mg/L	52	8.2	91	12	47	8.6	91
Sulfate	mg/L	100	17	91	29	47	18	91
Nitrite as nitrogen	mg/L	0.06	0.037	91	**0.076**	47	0.04	91
Nitrate as nitrogen	mg/L	3	1.1	91	2.2	47	1.2	91
Ammonia_N	mg/L	4.7	0.17	91	0.31	47	0.18	91
Phosphate, Ortho	mg/L	-	0.0034	91	0.0054	47	0.0036	91
Phosphorus	mg/L	-	0.0055	91	0.0078	47	0.0057	91
Aluminum	µg/L	87	6.3	0	6.2	0	6.1	0
Antimony	µg/L	33	1.1	91	1.3	47	1.2	91
Arsenic	µg/L	5	0.63	91	0.92	47	0.66	91
Barium	µg/L	1000	13	91	16	47	14	91
Beryllium	µg/L	-	0.041	91	0.25	47	0.044	91
Boron	µg/L	1500	7.1	91	9.0	47	7.5	91
Cadmium	µg/L	0.1	0.015	91	0.048	47	0.016	91
Cobalt	µg/L	-	0.027	91	0.036	47	0.028	91
Copper	µg/L	2	0.71	91	0.75	47	0.73	91
Iron	µg/L	300	4.1	0	7.7	47	4.0	0
Lead	µg/L	1	0.035	91	0.053	47	0.038	91
Lithium	µg/L	-	2.2	-	-	47	2.2	91
Manganese	µg/L	-	3.2	0	3.3	0	3.2	0
Molybdenum	µg/L	73	16	91	41	47	17	91
Nickel	µg/L	25	0.87	91	1.5	47	0.88	91
Selenium	µg/L	1	0.064	91	0.095	47	0.067	91
Silicon	µg/L	2100	347	91	442	47	361	91
Silver	µg/L	0.25	0.017	91	0.033	47	0.018	91
Strontium	µg/L	30000	51	91	72	47	53	91
Sulfur	µg/L	-	7176	91	10707	47	7663	91
Thallium	µg/L	0.8	0.011	91	0.018	47	0.012	91
Tin	µg/L	73	0.26	91	0.37	47	0.28	91
Titanium	µg/L	-	0.51	0	0.54	47	0.5	0
Uranium	µg/L	15	0.12	91	0.15	47	0.12	91
Vanadium	µg/L	-	0.18	91	0.26	47	0.19	91
Zinc	µg/L	30	0.35	91	9.0	47	0.36	91

Bold indicates concentrations is exceeding benchmark
Yeay 2028 = Year 0

These timeseries show predicted instantaneous fully mixed concentration of the water column that would be observed if the pit lake were to suddenly overturn at any time along this time ser

Predicted Water Quality for an unanticipated event causing fully mixed conditions in A418 Pit Lake



These timeseries show predicted instantaneous fully mixed concentration of the water column that would be observed if the pit lake were to suddenly overturn at any time along this time series

Rio Tinto

Health, Safety and Environment Department

Diavik Diamond Mine

Contingency Plan

September 2017 – Version 22

HSEQ Element 10, RT Standard E14
OPCO-022-0311 R22

DISTRIBUTION LIST

The following table provides the positions of the key personnel to whom a copy of this Contingency Plan has been distributed. The list will be updated if there are changes to organizational structure.

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1	DDMI	President	Electronic*
2	DDMI	Manager, HSE	Electronic*
3	DDMI	Head, Security	Electronic*
4	WLWB	Chairperson	Electronic*

* On DDMI Intranet under Element 3 Hazard Identification and Risk Management

Hard copies are also located at the Disaster Management Response stations: Kimberlite Board Room, Grizzly Board Room (Mine Site stations), and Yellowknife Corporate Office Main Board Room.

To request a copy of the Contingency Plan, please call 1-867-669-6500.

RECORD OF AMENDMENTS

Version	Nature of Amendment	Pertinent Sections	Date of Issue	By
A	Environmental Assessment		September 1998	
1	Class A Water License Application		August 1999	
2	Class A License Requirement		September 2000	
3	Annual Update		March 2001	
4	Annual Update (construction)		March 2002	
5	Operational Phase Contingency Plan		October 2002	
6	Updated		March 2003	
7	Annual Update		March 2004	CE/SM
8	Annual Update		March 2005	CE
9	Annual Update (Construction, Operations & Underground)		March 2006	CE
10	Annual Update (Construction, Operations & Underground)		March 2007	CE
11	Revised to address requirements in the NWT Guidelines for Spill Contingency Planning (INAC 2007)	Sections 1-5, Table 6.1, Section 8, Appendices A, B, C & D	March 2008	CE/SM
12	Annual Update		March 2009	SGB
13	Update to include WLWB comments dated June 12, 2009 titled *DDMI's 2008 proposed updates to the CP, HMMP, and WRMP*	Refer to WLWB letter dated June 12, 2009 for details.	July 2009	CE/SGB
14	Annual Update		March 2010	SGB
14.1	Update to include WLWB comments dated 20-Sept-2010	Refer to WLWB letter dated 20-Sept-2010	October 2010	SGB
15	Annual Update		March 2011	SGB
16	Annual Update		March 2012	DAW
17	Annual Update		March 2013	DAW
18	Annual Update Update to include WLWB Letter dated Feb 19, 2014.	Appendix E	March 2014	DAW
19	Annual Update		March 2015	DAW
20	Annual Update		March 2016	SS

Version	Nature of Amendment	Pertinent Sections	Date of Issue	By
21	Reformat to align with new Water License	Refer to page v for a complete list	December 2016	DAW
22	Updates to reflect A21 operations & WLWB letter of 28 July 2017	Refer to page v for a complete list	September 2017	DAW

The following table summarizes the changes made in V22, the September 2017 update:

Section	Change(s)	Rationale (if required)
Figure 1 (Section 1)	Updated to include A21 area	In accordance with 2(B) of the WLWB's 28 July 2017 Directive
Various (Sections 1.2.2, 3.1 and 3.1.1)	Updated to reference Safety Data Sheets (rather than Material Safety Data Sheets)	In accordance with 2(C) of the WLWB's 28 July 2017 Directive
Response Organization (Section 2.1)	Updated to include Water License requirements under Part I Item 3 re: spill response timelines	In accordance with 2(D) of the WLWB's 28 July 2017 Directive
DDMI (Section 2.1.1), External (Section 2.1.2) and Inspector (Section 2.1.3) Contacts	Contact phone numbers changed for DDMI President, DDMI HSE Manager and GNWT Inspector	Administrative updates to reflect recent staff changes
Spill Response Kits (Section 4.4.1)	Updated to include A21 area overview	In accordance with 2(B) of the WLWB's 28 July 2017 Directive
Spill Response Actions (Section 3.1.1) and Table 2 (Section 6.1)	Updated references to reflect changes in the revised Schedules 6 and 7.	In accordance with 2(E) of the WLWB's 28 July 2017 Directive. Reference to the AMP also remains in Table 2.
Appendices A and B	Updated to include the A21 area	In accordance with 2(B) of the WLWB's 28 July 2017 Directive

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1. INTRODUCTION, SCOPE AND PROJECT DETAILS

Diavik Diamond Mines (2012) Inc. (DDMI's) Contingency Plan (CP) for the Diavik mine designates lines of authority and responsibility, establishes proper reporting and communication procedures, and outlines action plans for employees and/or contractors to follow in the event of an unintended release of hazardous or toxic substances to the environment. This plan applies for the operational phase of the mine.

The mine is located at latitude 64° 31' N and longitude 110° 20' W, approximately 300 km NNE of Yellowknife. Figure 1 shows the project site layout for the operational phase. The mine is accessed primarily by aircraft, but a seasonal winter road also operates annually from January to March.

The principle objectives of this plan are to:

1. Provide readily accessible emergency information to responders, management, and government agencies in the event of any emergency situation;
2. Comply with federal and territorial regulations and guidelines pertaining to the preparation of contingency plans and notification requirements;
3. Comply with company environmental and safety policies, and water license requirements;
4. Promote safe and effective recovery of spilled materials; and
5. Minimize environmental impacts of spills to water or land.

The Contingency Plan is prepared in accordance with Indigenous and Northern Affairs Canada (INAC, formerly Indian and Northern Affairs Canada) Guidelines for Spill Contingency Planning (April 2007). It combines requirements for Spill Contingency and General Contingency planning. Contained within this document are the emergency contacts listed for DDMI, any applicable contractors, government agencies, private organizations and neighboring sites/operations.

The plan will be reviewed on an annual basis, or as required to reflect changes in the scope of operational activities, water license requirements, personnel or organizational structure and/or technological changes that may occur as the operation evolves.

1.1 Scope

The Contingency Plan is strongly linked to DDMI's internal *Business Resilience and Recovery Plan* (BRRP, Intranet> HSEQ>Business Resilience and Recovery Plan). The BRRP is supported by critical risk assessments for the operation, resulting in detailed evacuation, response, and asset re-instatement plans and checklists to address each high risk. It also outlines the sequence of actions, notifications and communications that would transpire for various types of operational incidents and emergencies, including

environmental incidents, which may occur at the site (e.g. dam failure, etc.). The document encompasses both surface and underground mining risks. Additionally, the document *Emergency Duty Cards for Underground Mining* specifically outlines detailed information about tasks required underground in the event of an emergency.

The Contingency Plan therefore provides an overview of site-specific operational requirements and considerations designed to reduce environmental incidents and be implemented by Supervisors in their work areas. It focuses on preventative measures that reduce the potential for an environmental incident occurring while also providing guidance on the initial steps to take in the event of an environmental incident. Should the incident become significant, the BRRP would then be activated and the detailed response procedures outlined therein would be followed.

Detailed information on items such as the hazardous substances stored on site and water management practices and infrastructure are contained within the most recently approved management plans. This document provides an overview of such items, as required but, as their content has a tendency to change more frequently, other plans are referenced as appropriate.

It should be noted that DDMI is one of the members of the Tibbitt to Contwoyto Winter Road Joint Venture. Therefore, information related to contingency planning for offsite transportation has been removed from this plan. A separate Spill Contingency Plan is managed by the Joint Venture.

1.2 Project and Site Description

The mine site layout is shown in Figure 1 for reference. At full development, the mine site will be 12.67 km^2. Diavik is an open pit and underground mine; operational activities in the open pits change throughout the years. Most infrastructure is located within two main areas: the south and north sides. The south side includes: process plant, sewage treatment plant, water intake, main and south camp accommodation buildings, powerhouses, south tank farm, warehouse and truck shop, lube storage building, A21 dike and open pit, the Diavik Operations Centre and underground dry, and various laydown areas. The north side includes: A154/418 pits and underground portal, fuel tank storage, underground truck shop, water treatment plant, batch plant, crusher and backfill plants and airport. The emulsion plant and ammonium nitrate storage buildings are located on the perimeter of the property to the west and south.

1.2.1 Potentially Impacted Areas

The Diavik Diamond Mine includes open pit and underground mining. It is located on East Island in Lac de Gras, which would likely be the receiving water for spills of a large magnitude, were they not contained on land. Local water quality is typical of pristine arctic

lakes and supports migrating waterfowl and a healthy fish population. The area frequently experiences high winds, which would be a catalyst for dispersal of any liquid product that could enter the lake and could potentially hamper response efforts. The waters of Lac de Gras are also the source for camp drinking water supply and general raw water use on the site, and are connected to the Coppermine River. The land on East Island supports a variety of wildlife including migratory birds and species at risk, but most animals simply pass through the area and do not reside on the island.

Figure 1

Site Layout

1.2.2 Hazardous Materials

Refer to the most recently approved Hazardous Materials Management Plan (HMMP) for a complete list and volumes of hazardous materials transported to and stored on site. The most common types of hazardous materials may include:

- Hydrocarbon liquids and waste, such as diesel fuel, gasoline, hydraulic oil;
- Soluble solids such as ammonium nitrate prill;
- Soluble liquids and waste, such as glycols, acids, and paints;
- Poor quality water (i.e. sediments, sewage and water treatment plant effluent & sludge); and
- Corrosive liquids such as sulfuric acid.

Included in Appendix A is a map showing hazardous material storage areas around site and likely drainage pathways that any released material may follow. Appendix A also contains a map showing the locations of spill response kits. Appendix B includes environmental sensitivity maps for the area of the mine.

Safety Data Sheets (SDS) and Product Guides for hazardous materials are available to personnel through DDMI's online database.

1.3 Prevention

Good house-keeping, diligent record keeping, regular maintenance, effective training, routine inspections and thorough risk assessments all contribute toward minimizing environmental incidents. The location of water bodies and drainage pathways were an important consideration in the design and location of storage sites, transfer sites, pipelines, incinerators and the sewage and wastewater treatment facility. The majority of this infrastructure is lined and bermed and situated away from water bodies.

Transport, transfer and storage of materials are performed by trained personnel and utilize designated and labeled storage areas, secondary containment where appropriate, well-maintained equipment, secure containers and product labels. Good housekeeping practices are used in areas such as storage facilities, loading and unloading zones. Site Supervisors document the existing condition of equipment/storage facilities, note any problems and request repairs. The volume and levels of materials stored are recorded and tracked. Any incidents that do occur are investigated and recommendations are developed to identify possible changes and improvements in procedures.

Periodic inspections will be carried out to verify the condition of work areas, and that resources and equipment, including those for emergency response, are available and in good working condition. During inspections, the service and repair records for equipment will be checked to verify it is current and complete. Inspections will also be carried out at

the facilities where handling or storage of hazardous materials or waste streams occurs. These area inspections assist with early identification and removal of possible hazards and include daily, weekly or monthly inspections, as appropriate, in the following areas: bulk fuel storage and fuel transfer, waste transfer (including incinerator inspections) and landfill, sewage and north inlet water treatment plants, containment facilities (dikes, dams, etc.) and emergency response equipment storage. Inspections will evaluate the condition of tanks, piping, valves, liners, electrical/cabling and road/airstrip access, among other area-specific considerations.

2. INCIDENT RESPONSE ORGANIZATION

This section addresses the organization and responsibilities of each individual during response to an incident.

2.1 Response Organization

As described in Part I Item 3 of Water Licence W20015L2-0001, the following is required for spills:

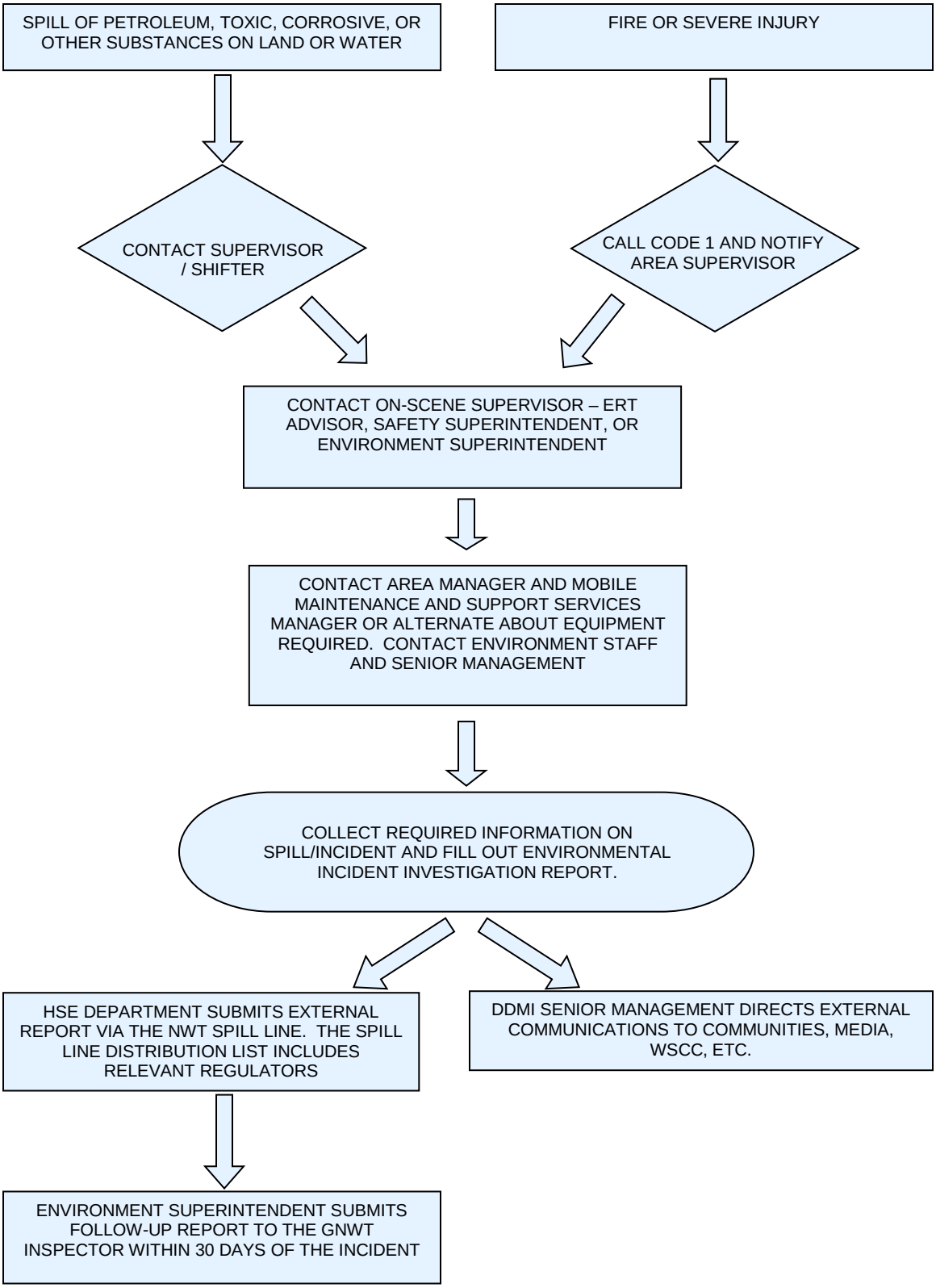
- Report the incident immediately via the 24 Hour Spill Report Line (867-920-8130) in accordance with the instructions contained in the NT-NU Spill Report form (NWT 1752/0593) (included in Appendix C to this Plan);
- Report each spill and Unauthorized Discharge to an Inspector within 24 hours; and,
- Within thirty (30) days of an Unauthorized Discharge or an incident reported under Part I, Item 3b, the Licensee shall submit a detailed report to the Board and an Inspector. The report shall include descriptions of causes, response actions, and any changes to procedures proposed to prevent similar occurrences in the future.

Figure 2 displays the lines of communication in the event of an incident or spill situation.

Onsite Environment personnel will complete a GNWT spill report form as information is compiled. After all information has been collected, DDMI Environment will submit a report to the NWT 24-hour Spill Line. A copy of the GNWT Spill Report form and a reference for spill report volumes for various substances is provided in Appendix C. Responsibilities such as informing communities, Workers' Safety and Compensation Commission (WSCC) and media, is the responsibility of Diavik Senior Management.

Note: Should an emergency situation occur that involves a major release of hazardous material, refer to the *Business Resilience and Recovery Plan (BRRP)* and the *Emergency Management Plan* for guidance in responsibility and control. These plans are found at the Site BRRP locations and the Yellowknife Corporate BRRP locations.

Figure 2: Incident/Spill Response Organization and Responsibilities



2.1.1 Key DDMI & Contractor Contacts*

Title	Office/Mobile	Fax/Radio
Diavik Switchboard	(867) 669-6500	(866) 251-5718
President	Ext. 7134 / (867) 443-2330	(866) 313-2754
Manager HSE	Ext. 5420 / (867) 444-7237	(866) 769-5940
Emergency Response Team Advisor	(867) 765-5462	(866) 769-5940
Environment Superintendent	Ext 5536 / (867) 445-4612	(866) 769-5940
Security Control	Ext. 5903	(866) 769-5940 / Zone 2 CH 25
Environment Supervisor	Ext. 5403	(866) 769-5940 / CH 6
Bouwa Whee – Camp Manager	Ext. 5913	CH 11
Medical Services	Ext. 5901	CH 6
Denesoline Western Explosives Ltd.	Ext. 5489 Ext. 5490	CH 7

*Contact numbers are subject to change; the DDMI phone directory should be referenced for the most recent contact information

2.1.2 External Contacts

1. Government of the Northwest Territories 24-hour Spill Report Line:

   PHONE # (867) 920-8130

   FAX # (867) 873-6924

   Email spills@gov.nt.ca

2. Worker's Safety and Compensation Commission (WSCC):

   PHONE # (867) 920-3888

   FAX# (867) 873-4596

Other external department contacts that may need to be notified include:

Title	Office
Chief Inspector of Mines, WSCC	(867) 669-4412
Regional Superintendent, Lands	(867) 767-9187 x 24185
GNWT Lands Inspector	(867) 767-9187 x 24188
Director, Water Resources Division (ENR)	(867) 767-9234 x 53105
Operations Manager Environment Canada	(867) 669-4730
DFO (Office Administrator)	(867) 669-4900
Hazardous Substance Specialist, Environmental Protection Service (ENR)	(867) 767-9236 x 53188
Regional Superintendent (ENR)	(867) 767-9238 x 53225
Office of the Fire Marshall	(867) 7679161 x 21026
RCMP (Yellowknife)	(867) 669-1111

2.1.3 GNWT Inspector Contacts*

Contact	Office	Cell
Manager, Diamond Resource Management	(867) 767-9187 x 24186	(867) 446-1841
Resource Management Officer III (Diavik Inspector)	(867) 767-9187 x 24188	(867) 447-0184

3. ACTION PLAN

3.1 Initial Actions for Spills

For all spill emergencies, it is essential that three initial response priority actions be undertaken. These are:

1. Respond Quickly
2. Respond Safely
3. Full Notification and Reporting

1. RESPOND QUICKLY
1. Identify the spilled material. 2. Ensure the safety of yourself and others; assess risk of fire, explosion, electrical current, personal injuries. 3. Shut off ignition sources – NO SMOKING. 4. Attend to the injured. 5. Call for assistance. 6. Assess the severity of the spill. 7. On-Scene Coordinator mobilizes Emergency Response Team.
2. RESPOND SAFELY
1. Consult SDS & Product Guides for further information on the substance. 2. Keep unnecessary people out of the area. 3. Wear impervious clothing, goggles, and gloves, as well as any other necessary PPE. 4. Approach spill from upwind, IF SAFE TO DO SO. 5. Stop product flow by shutting off valves or plugging leak, if safe to do so. 6. Do not contain gasoline/aviation fuel if vapors might ignite. 7. Allow gasoline or aviation fuel spills to evaporate. 8. Contain product using booms, berms, absorbent pads, absorb all or improvise with materials available at the scene, if possible and safe to do so. 9. Recover spill as soon as possible and dispose of material in an approved, contained area; ensure any equipment used is spark/explosive-proof.
3. OBTAIN AND REPORT SPILL DETAILS
A GNWT Spill Report Form is included as **Appendix C**. EXTERNAL REPORTABLE SPILLS MUST BE REPORTED TO THE NWT 24-HOUR SPILL REPORT LINE BY DIAVIK ENVIRONMENT STAFF: (867) 920-8130

3.1.1 Spill Response Actions

The feasibility of containing and recovering a spill will be largely determined by its location and the rate of the release, spreading, transport and evaporation. Each situation should be assessed to determine the most appropriate/effective resources (personnel, equipment, sorbent materials, skimming operations, etc.) that should be deployed. For

any spill where containment is a concern, best efforts should be made to minimize the volume of the spill (eliminate the source), contain as much of the spill as possible and minimize dispersion of the spilled material provided that it is safe to do so. It is important that every precaution be taken to ensure that spills do not enter a waterway. If there is any possibility of contamination to a nearby stream or lake, a berm or flume should be constructed near shore to prevent material from entering the water.

In general, when responding to a spill, the following steps should be taken.

- Determine whether or not it has entered a waterway. If so, determine if it is accessible by land or water to establish control points where booms, sorbent pads, skimmers or a vacuum truck can be used.

- Establish response priorities to optimize utilization of personnel and gear needed for all cleanup phases (containment, removal, storage, transfer and disposal) at selected sites.

- Consult with Environment department and/or Regulators to verify appropriate recovery and cleanup methods, as well as disposal or treatment options.

- Allow additional time for adverse weather conditions.

- Monitor spills throughout the response to ensure safety and to direct cleanup efforts. Monitoring activities may include: spill movement and behaviour, threats to people, property and the environment or gas concentrations.

General response strategies for spills on land, muskeg (tundra), water, ice and snow are summarized in **Table 1**.

Table 1: Spill Response Strategies by Location

Spill Location	Containment Options	Clean Up/ Recovery	Waste Management
Land	- Berm around source (earth, snow with water sprayed on top, sandbags with an impermeable liner) - Trench downstream/ downslope of source (0.5 m deep, use excavated material to berm behind the trench) - Pumps to cycle/move water or contaminant - Filter fencing for sediments	- Contaminated soil, snow or ice transported to WTA or other approved location or container - Vacuum truck to remove pooled product - Trash or other pump to transfer oil product to container - Adsorbent materials - Excavate contaminated soils	- Collect and label oil products and/or adsorbent materials for off-site disposal - Options to landfarm soils - Oil skimmers for small volumes of contaminated water
Muskeg	- Small spills may be best left in situ due to possible terrain damage - Larger spills contained with berms or trenches - Utilize booms if standing water - Filter fencing in drainage areas	- Adsorbent materials - In-situ addition of nutrients or peat moss - Vacuum truck to remove pooled product - Flush/saturate area with warm water - Excavate contaminated soils	- Collect and label oil products and/or adsorbent materials for off-site disposal - Options to landfarm soils
Water	- Floating booms; sorbent or non-sorbent - Temporary in-stream berm or weir (contact DFO before initiating) of earth, or rock with an impermeable barrier - Turbidity curtain or filter fencing for sediments	- Adsorbent materials - Vacuum truck, pumps or skimmer to remove floating product - Manual (e.g. shovels) shoreline cleanup - Pumps to transfer water	- Collect and label oil products and/or adsorbent materials for off-site disposal - In-situ burning may be possible - Pond(s) or PKC for sediment- laden water - Options to landfarm shoreline soils
Ice/Snow	- Snow or ice berm - Large holes or angled slots ~1 m wide (dependent on ice conditions) - Snow trench	- Vacuum truck, pumps or skimmer to remove floating product - Adsorbent materials - Pumps to transfer water	- Burning of snow or ice contaminated with oil may be possible - Collect and label oil products and/or adsorbent materials for off-site disposal - Pond(s) or PKC for sediment- laden snow/ ice/water - Re-visit area in spring to determine if residual contamination

Spill Location	Containment Options	Clean Up/ Recovery	Waste Management
Underground	- Adsorbent pads - Adsorbent boom - Dirt/rock trench with impermeable barrier	- Adsorbent materials - Manual clean-up - Vacuum truck - Pumps to transfer water	- Collect and label adsorbent materials for disposal in designated area outside C9060 shop - Collect and label oil products for off-site disposal - Pond(s) or PKC for sediment-laden water

Underground spill reporting procedures have improved and the following discussion outlines the reporting procedures, as required by Schedule 7 Item 1e. Spills are reported to dispatch, which captures the information in an electronic spill log. The following positions are responsible for assisting with and verifying the clean-up of spills:

- Equipment Operator (report, clean & verify): small spills of less than 10 litres (L);
- Equipment Operator (report, clean) and Shifter (verify): spills between 10 and 75 L; and,
- Equipment Operator (report), Shifter (co-ordinate clean-up), Mechanics (equipment assistance) and Mine Captain (verify): any spills larger than 75 L.

For any spills greater than 75 L, before and after photos are required and an incident report and investigation is completed.

Specific spill response considerations for materials transported and used on site are also provided in their respective Safety Data Sheet (SDS) and Product Guides, which are available online through Diavik's third party supplier.

These response strategies mostly pertain to larger spills, to provide guidance in areas of uncertainty. Given the chemicals stored on site, the worst probable case scenario would be a large release (millions of litres) of fuel or process water directly into Lac de Gras.

In the event of an emergency release (an event requiring dedicated resources to stop the release, minimize dispersion, recover the product, etc.), the GNWT Inspector would be notified immediately and status reports issued regularly. Clean up requirements would be determined in consultation with the GNWT Inspector. Monitoring of migratory birds and species at risk would be undertaken in consultation with ECCC.

4. RESOURCE INVENTORY

This section exclusively addresses the emergency response machinery, equipment, tools and other resources that will be made available on-site for spill counter measures.

4.1 Emergency Response Personnel

The organizational chart and lists of contacts presented in Section 2 outline the roles and telephone numbers of key internal emergency response positions.

4.2 Mobile Equipment & Emergency Transportation

Mobile equipment available to DDMI, that will be used for spill contingency include heavy equipment (e.g. grader, backhoe, bulldozer, forklift, etc.), light vehicles, boats, snowmachines, a vacuum truck, water truck, fire truck and various support equipment such as generators, pumps, hoses, heaters and light stands. Additional mobile equipment/machinery on site would be made available for use in an emergency situation.

Transportation options that may be available and used in an emergency situation/evacuation include aircraft (fixed wing or rotary), 4-wheel drive vehicles, snowmachines and boats.

4.3 Communication Equipment

Radios, telephones, faxes and other wireless communication systems/equipment will be used during an emergency response situation. In the event that the emergency is associated with a loss of power, satellite phones are available at: medic's office, IT, Duty Manager Kit and HSE departments.

4.4 Spill Response Equipment

4.4.1 Spill Response Kits

Spill response kits are strategically located around the mine site (see Figure A-2). Each department and work area is responsible for providing sufficient spill response kits in marked packages at visible and accessible locations in their respective work areas. These kits are located in areas such as fuel and chemical storage and transfer areas.

There will be no fuel or other hazardous materials stored at the A21 area. As such, no spill kits have been added to this area as heavy equipment carries their own kits (see below) and the emergency response vehicle would be called for spills on Lac de Gras.

Spill Response Kits (storage containers) shall contain the following:

- 45 gal, 16 gauge Open Top Drum, c/w Bolting Ring & Gasket
- 1-48”x1/16´ Neoprene Pad (drain stop)
- Plug N/ Dike TM Granular, 1-gal U. S. (3.8 litres)
- Splash Protective Goggles
- 2-PVC Oil Resistant Gloves
- 1-pkg Polyethylene Disposable Bags (5mil) 10 per Pack
- 1 Shovel (Spark Proof)
- 1-case T-12 3”x 12’ Mini Booms / case
- 1-bail HP-256 17”x 19” x1/2” Pads, 100 Pads/bail
- 1-bail of Sphag Sorb TM

The majority of the mobile heavy equipment onsite has the following spill kits:

- 1 Emergency Spill Kit Tote
- 1 Spill Response Jug (2.3Kg)
- 5 Land-only Absorbent pads
- 2 Large Disposable Bags

Underground mobile equipment onsite have the following spill kits:

- 1 Emergency Spill Kit
- 10 Land-only Absorbent pads
- 2 Large Disposable Bags

Spill kit caches are maintained at the C9060 Shop (contact: Shop Helper) and the A9290 Laydown (contact: Taxi Driver).

4.4.2 Temporary Containment Systems

A supply of temporary containment systems is also available and includes the following:

Booms	Drums
Tanks	Settling Ponds
Floating absorbent materials	Absorbent spill pads
Silt Fencing	Turbidity Curtain

4.4.3 Mobile HazMat Trailer

The trailer is portable and is stored adjacent to the Emergency Response Centre. The Mobile HazMat Trailer contains the following:

3 peat moss bags	10 chemical suits	6 bags of Sphagsorb
10 marine sorbent booms	31 spill kits, various	Acid neutralizer
4 bags + 2 rolls absorbent pads	2 fire extinguishers, 20 lb ABC-type	Various ropes, tarps, hose, blankets, etc.
2 bags absorbent pellets	31 universal booms	

4.5 External Resources

In the event of a major emergency that requires additional resources, equipment and manpower will be made available through members of the Tibbitt to Contwoyto Winter Road Joint Venture and with external organizations and work forces.

Contacts:

Organization	Contact Number
Dominion Diamond Ekati Corporation – Environment Department	(867) 669-6161
TCWRJV – Director	(867) 669-6500 ext 6561/ (867) 445-4604 (cell)

5. TRAINING AND EXERCISES

Diavik has a fully equipped Emergency Response Team (ERT) trained and ready to respond to emergency incidents, including environmental emergencies. The team has its own fire truck, airport response truck, ambulance (surface and underground), underground pumper truck, rescue truck and spill response trailer. The Diavik ERT also has access to additional equipment such as loaders and suction trucks, if required.

Active ERT members train for a total of 12 hours per 2-week rotation. Full day (12 hour) training sessions are held every week and special training sessions, which may include mock scenarios or desktop exercises, are scheduled periodically through the year.

Every employee at Diavik receives spill and waste management training during their initial site induction so they can respond to small spills and be familiar with the steps to follow if a larger response is required. ERT members receive more extensive HAZMAT training and learn how to respond while wearing protective clothing and a breathing apparatus. Diavik's Training Department manages and maintains employee training records.

6. RISK ASSESSMENT AND MANAGEMENT

6.1 Risk Assessment

Risk assessments identify potential problems, provide a determination of possible impacts to the environment, rank the probability of a problem occurring and provide preventative measures to minimize the possibility of such problems. A critical risk assessment is conducted for the site as part of Diavik's internal BRRP. Significant risks that are identified during this process are addressed through operational mitigation measures and the development of emergency response, trigger action response (TARP), asset reinstatement (ARP) and/or evacuation plans to be employed in the event of an incident.

Appendix B contains maps to identify environmentally sensitive areas associated with the mine site. Table 2 identifies and summarizes the significant environmental risks for the Diavik mine, identifies management actions to reduce the risk and lists potential contingency actions, which may include response plans that have been developed as part of the BRRP or Water License requirements. References to Management Plans refer to the most recently approved version of the plan. Specific triggers or thresholds at which a response plan is initiated (e.g. Schedule 7 Item 1b(iv)) are determined on a case-by-case basis and in consultation with area experts, as required. Contingency actions can range from something as simple as seasonal or long-term pumping, through to thermistor installation or liner repairs. Copies of the relevant response plans contained within the BRRP, which may also be listed in Table 2, are available here for all site employees (Intranet> HSEQ>Business Resilience and Recovery Plan).

Table 2: Summary of Environmental Risks, Management Actions & Contingencies

Risk and Water License Reference	Summary of Risk	Risk Management	Contingencies
Higher than expected pit or underground water flows, or dewatering volumes Schedule 7, Items 1a and 1b(i) and 1b(v)	Volume exceeds treatment or storage capacity; possible flooding scenarios for underground; pit stability	- Design of pits, underground sumps, pumping & pipeline systems and dewatering galleries - North Inlet (NI) design and capacity - North Inlet Water Treatment Plant (NIWTP) design - twinned and duplicate treatment systems, treat up to 90,000 m^3/day - Geotechnical monitoring programs and instrumentation - Water Management Plan - NIWTP Operations Plan - PKC Facility Plan - Construction Environmental Management Plan (CEMP)	- Rain storm TARP - Geotechnical TARP - Install grouting (pit) or cover grouting (underground), relief wells or inverted filters, as required - Pond 3 and PKC as back-up water storage and/or settling pond options - Portable, temporary pumps and pipelines available to collect/move water as required. - Evacuation Plans (underground, open pits) - BRRP/ARP
In-lake construction activities and pit lake destratification Schedule 7, Item 1b(iii)	Unplanned release of deleterious substances to Lac de Gras	- CEMP for dike construction activities - Full Risk Assessment and regulatory approvals and inspections for in-lake work - Secondary containment structure (turbidity curtain) during dike construction - Water quality monitoring (e.g. continuous turbidity monitors with alarms) - Water quality sampling, as required by SNP - On-site water quality analysis & confirmatory analysis by an independent laboratory	- CEMP (includes contingency actions) - TSS & Turbidity TARP - Spill response equipment stored in work area, including additional turbidity curtains - Emergency Response Team (ERT) trained in spill response with additional equipment - Reestablish dike if previously breached during PKMW

Risk and Water License Reference	Summary of Risk	Risk Management	Contingencies
Poor treatment performance at NIWTP/Sewage Treatment Plant (STP) malfunction Schedule 7, Items 1b(ii, viii)	EQC exceedance; Water volumes increase in NI due to inability to treat; potential release of non-compliant water to environment; inadequate diffuser performance; incorrectly treated sewage waste	- NI storage design and capacity - NIWTP design – twinned and duplicate treatment systems - Internal control limits (below EQC's) & continuous in-line water quality monitoring (turbidity, pH, conductivity) - Trained operators working 24/7 - On-line management system that can be monitored from numerous locations around site - Regular maintenance schedule for NIWTP & STP - Additional SNP sampling requirements if discharge PKC water through North Inlet, to account for sewage - Sewage waste solids stored in contained & approved areas on-site - Water quality sampling and internal & external laboratory analysis - SNP reporting & trend analysis - Water Management Plan - NIWTP Operations Plan - Ammonia Management Plan - STP Operations Plan	- Turbidity TARP - Alarm system provides notification of problems that may occur (NIWTP & STP) - Automatic shutdown of NIWTP effluent stream - Alternative storage available in Pond 3 (NIWTP) and PKC (NIWTP and STP) - Sulphuric acid dosing system - Water/sewage treatment experts and NIWTP/STP design team consultation - Confirmatory sampling and toxicity testing protocols

Risk and Water License Reference	Summary of Risk	Risk Management	Contingencies
Dam seepage; compromised or failure of containment area; spillway discharge; seepage control system/pond/pipeline failure (including those associated with Processed Kimberlite to Mine Workings) Schedule 7, Items 1b(iv, xi, x)	Uncontrolled discharge/release of untreated water and/or sediments to the environment; reduced storage capacity; erosion	- Dam and dike design and review process - Rigorous inspection, monitoring and maintenance programs - Onsite geotechnical team (continuous coverage) - PKC collection ponds actively pumped to manage water levels, i.e. maximize available secondary containment - Pipelines constructed within containment - Seepage collection wells in PKC dams - Water quality sampling & analysis - Seepage surveys - PKC deposition strategy - PKC Facility Plan - Monthly and annual reporting requirements	- Secondary containment ponds surrounding facility - Use or installation of sumps or pumps to collect seepage, as required - Dam repairs or instrumentation installations, as required - PKC Emergency Response Plan - Spill response equipment stored in work area - Emergency Response Team (ERT) trained in spill response with additional equipment - Engineer of Record and containment facility experts available for consultation
Hazardous Material Storage & Solid Waste Management Schedule 7, Items 1b(vi, xiii)	Release to environment; ingestion by wildlife; explosions; exposure to personnel; material interactions	- Waste Transfer Area design (lined, fenced, gated, bermed) - Gated landfill - Ammonia Nitrate (AN) storage & emulsion plant designs - Fuel/oil/lube storage area designs - Regular area inspections - Incineration on-site - Waste segregation program - Availability of approved storage and disposal containers - WHMIS/HazMat/TDG training & procedures - Designated & labeled storage locations - Waste management staff & disposal/recycling contractor - Expert explosives contractor - SDS & product guides to determine safe handling, storage & transport procedures - Waste Management Plan - Hazardous Materials Management Plan	- Secondary containment/double-walled tanks - Spill response equipment stored in work area to contain spills - Fire suppression systems - Emergency Response Team (ERT) trained in spill response with additional equipment - Vacuum truck/pumps, non-sparking equipment to collect product - Excavate contaminated soil & evaluate treatment or disposal options - Contingency Plan - AN Emergency Response Plan - BRRP/ARPs - Evacuation Plans (various)

Risk and Water License Reference	Summary of Risk	Risk Management	Contingencies
Poor quality water from site construction activities or inland lake development* Schedule 7, Items 1b(vii)	Release of untreated water and/or sediments to the environment *inland lake development is complete	- Risk assessments required for site construction projects - Consultation with Environment department (Figure B-3) - Identify & develop mitigation actions for hazards, e.g. collection ditch - Conduct site inspections - Collection ponds to capture site drainage - Water quality sampling, as required	- Secondary containment/double-walled tanks, if required - Spill response equipment stored in work area to contain spills - Emergency Response Team (ERT) trained in spill response with additional equipment - Vacuum truck/pumps/sumps to collect product - Excavate contaminated soil & evaluate treatment or disposal options - Silt fencing to capture sediments - Contingency Plan
Groundwater contamination Schedule 7, Items 1b(xii)	Seepage of contaminants from surface; potential to disperse below surface	Groundwater wells checked monthly; no to very little groundwater detected to date (insufficient for a sample)	- Pumps to collect product
Stability issues and poor quality drainage from waste rock Schedule 7, Item 1b(ix)	Localized slumping or rock slide; acidic runoff water	- Rock characterization and segregation practices - Waste rock storage area design intended to minimize long-term risks - Seepage monitoring - Temperature monitoring - Stability monitoring - Water quality sampling, as required - Test piles & modeling research to predict long-term performance - Waste Rock Management Plan - Water Management Plan	- Collection ponds for seepage/runoff water - Water treatment for seepage/runoff water - Closure plan designed to minimize long-term risks

Risk and Water License Reference	Summary of Risk	Risk Management	Contingencies
Hydrocarbon spills Schedule 7, Items 1d, 1e, 1f, 1g	Release of contaminants to the environment	- Daily vehicle/area/equipment inspections - Regular equipment maintenance program - Optimize hydraulic hose selections based on environmental considerations & equipment needs - Induction training for all employees includes spill clean-up & reporting procedures - NWT spill reporting requirements used to develop DDMI spill reporting procedures - Spill reporting program linked to department performance evaluations - Spill follow-ups by Environment & Inspector - Locking valves & transfer hoses, secondary containment on pipelines where possible - Fuel level inspections - Fuel/oil/lube storage area designs - Incident investigations to identify continuous improvement opportunities - WHMIS/HazMat training & procedures for material handling & storage - Hazardous Materials Management Plan - Waste Management Plan - Standard Operating Procedure (SOP) for Spill Response & Reporting	- Secondary containment in high risk areas or for high-risk equipment - Spill response equipment available in/on high risk areas/equipment - Fire suppression systems in high-risk areas - Emergency Response Team (ERT) trained in spill response with additional equipment - Vacuum truck/pumps to collect product - Excavate contaminated soil & evaluate treatment or disposal options - Contingency Plan
Ammonia Toxicity Schedule 6, Item 9b	Potential impacts to aquatic biota if elevated levels released in lake	- NIWTP design - Blast management/mitigation options - Water quality monitoring of effluent and internal & external laboratory analysis - Toxicity testing protocol - Established LC20 value - Ammonia Management Plan	- Established confirmatory sampling and Contingency Plan related to effluent toxicity due to ammonia (Appendix B of Ammonia Management Plan) - NI storage and/or PKC or Pond 3 additional storage - Sulphuric acid dosing system

7. REFERENCES

1. Indigenous (Indian) and Northern Affairs Canada (Water Resources Division), Guidelines for Spill Contingency Planning, Yellowknife, NT, April 2007.

2. Diavik Diamond Mines Inc., Environmental Assessment Submission, September, 1998.

3. Diavik Diamond Mines Inc., Business Resilience and Recovery Plan (BRRP).

4. Safety Data Sheets and Product Guides - online.

Appendix A

Hazardous Materials Storage Locations and Spill Response Equipment Locations

Figure A-1: Hazardous Material Storage Areas and Potential Drainage Paths

Figure A-2: Site Layout and Spill Kit Locations

Appendix B

Environmental Sensitivity Mapping

Environmental Sensitivity Mapping

Since the route to Lac De Gras is viable only in the winter, the seasonal concerns pertaining specifically to the winter period are shown. Sensitive wildlife areas and key species concerns in the project area are depicted in Figures B-1 and B-2. Sensitive fish habitat areas in the proximity of the project are shown in the event of a spill or other environmental incident, and provide some guidance as to the appropriate mitigation measures required.

Certain areas on East Island may require additional environmental controls than normal to provide adequate environmental protection. These sensitive areas (e.g. – areas outside of the DDMI drainage collection and control system or areas near water) are shown on Figure B-3. Work taking place in these areas requires that DDMI Environment personnel are consulted during the risk assessment (planning) stage of the project.

The project site is located in a transition zone between taiga forest and arctic tundra, typified by largely cryosolic soils, continuous permafrost with shallow active layers supporting dwarf shrubs, herbs and lichens. A variety of mammals, migratory birds, and species at risk live in the area. Lakes are numerous in the area, but are of low productivity (Reference: Integrated Environmental and Socio-economic Baseline Report, Diavik, 1998).

Figure B-1 - Sensitive Wildlife and Fish Habitat Areas

Figure B-2 – Waste Disposal and Storage Facilities, including hazardous wastes (Potential for Wildlife Attraction)

Figure B-3 – Sensitive Areas Requiring DDMI Environment Consultation during Risk Assessment

Appendix C

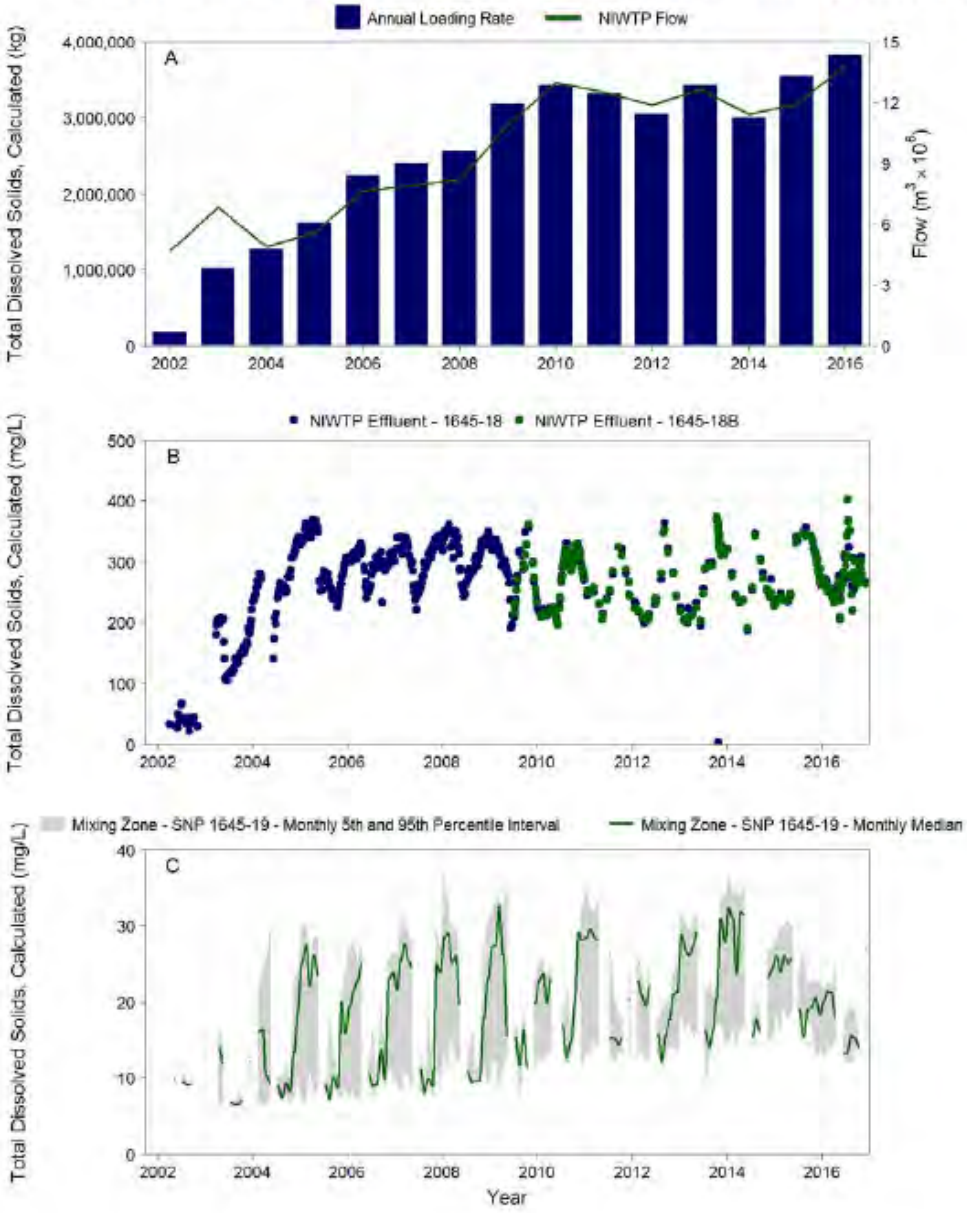
GNWT 24-hr Spill Line Report Form
GNWT List of Reportable Spill Volumes

Report Form

Report Quantities

Attachment #2

Figure 4-3 **Total Dissolved Solids, Calculated: A) Annual Loading Rate from the North Inlet Water Treatment Plant and B) Concentration in Effluent (SNP 1645-18 and SNP 1645-18B) and C) at the Mixing Zone Boundary (SNP 1645-19), 2002 to 2016**



Note: Effluent values represent concentrations in individual samples. Mixing zone values represent the monthly median concentration and 5th and 95th percentile interval at three stations (i.e., SNP 1645-19A, SNP 1645-19B/B2, SNP 1645-19C) and five depths (i.e., 2 m, 5 m, 10 m, 15 m, and 20 m). Gaps in the mixing zone dataset reflect times when samples could not be collected due to hazardous sampling conditions (e.g., ice-on and ice-off periods).

NIWTP = North Inlet Water Treatment Plant; SNP = Surveillance Network Program.

Attachment #3

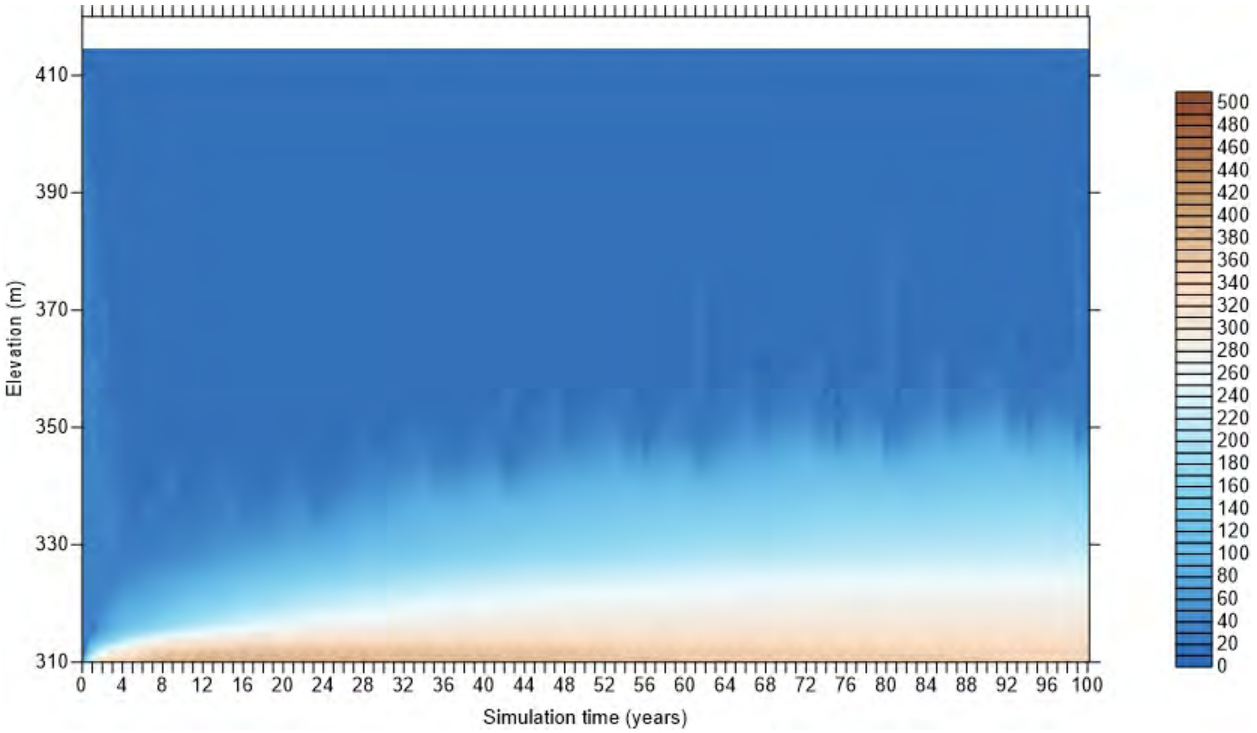


Figure 1 – Total dissolved Solids profiles over time in A418, scenario 3A

Attachment #4

Table 4-1: Revised Ecological Thresholds for Water Quality (Underlined; July 2019)

Variable	Units	AEMP Benchmark	Significance Threshold[1]
pH		6.5 to 9.0	6.4 to 9.1[2]
DO	mg/L	early life stages = 9.5	7.6
DO	mg/L	other life stages - 6.5	5.2
Total dissolved solids	mg/L	500	600
Total alkalinity	mg/L	n/a	NA[3]
total suspended solids	mg/L	+5 (24 h to 30 days)	+6 (24 h to 30 days)
total suspended solids	mg/L	+25 (24-h period)	+30 (24-h period)
Turbidity	NTU	2.2 (long-term, IC)	2.6 (long-term, IC)
Turbidity	NTU	2.3 (long-term, OW)	2.8 (long-term, OW)
Major ions			
Chloride	mg/L	120	144
Sodium	mg/L	52	62
Fluoride	mg/L	0.12	0.144
Sulphate[4]	mg/L	100	120
Nutrients			
Ammonia as nitrogen	mg/L	4.7	5.64
Nitrate as nitrogen	mg/L	3	3.6
Nitrite as nitrogen[5]	mg/L	0.06	0.072
Total Phosphorus[6]	mg/L	-	-
Total metals			
Aluminum (total)	µg/L	87	104
Arsenic	µg/L	5	6
Barium	µg/L	1000	1200
Boron	µg/L	1500	
Cadmium	µg/L	0.1	0.12
Copper	µg/L	2	2.4
Iron	µg/L	300	360
Lead	µg/L	1	1
Molybdenum	µg/L	73	88
Nickel	µg/L	25	30
Selenium	µg/L	1	1
Silicon	µg/L	2100	2,520

Attachment #4

Table 4-1: Revised Ecological Thresholds for Water Quality (Underlined; July 2019)

Variable	Units	AEMP Benchmark	Significance Threshold[1]
Silver	µg/L	0.25	0.30
Strontium	µg/L	30000	36000
Thallium	µg/L	0.8	0.96
Tin	µg/L	73	88
Uranium	µg/L	15	18
Zinc[7]	µg/L	30	36

NOTES:

1 Significance defined as 20% above the AEMP benchmark

2 Calculated based on logarithmic scale

3 NA – not applicable (modelling results did not include this parameter)

4 BCMOE (2013) water quality guideline for sulphate has been increased from 100 mg/L to 128 mg/L (hardness less than 30 mg/L) (BCMOECCS 2018); however, for consistency with the AEMP the threshold has been kept at 100 mg/L

5 The benchmark is the same as the CWQG PAL and does not recognize the toxicity modifying role of chloride. British Columbia water quality guidelines for protection of aquatic life (BCMOECCS 2019) provide a sliding scale for average concentrations from 0.02 mg/L nitrite as N (<2 mg/L chloride) to 0.08 mg/L nitrite (6 to 8 mg/L chloride. The range for maximum concentrations is 0.06 mg/L nitrite as N (<2 mg/L chloride) to 0.24 mg/L nitrite as N (6 to 8 mg/L chloride). Average chloride concentration in Lac de Gras in 2018 was 3 mg/L for which the maximum guideline is 0.12 mg/L nitrite as N and the average guideline is 0.04 mg/L nitrite as N.

6 AEMP has a phosphorus total annual loading threshold, not a concentration benchmark.

7 CWQG for zinc has been decreased from 30 µg/L to 7 µg/L; however, for consistency with AEMP the threshold has been kept at 30 µg/L.

Attachment #5: Table of Commitments from the Summary Impact Statement

The following table provides a listing of DDMI's commitments presented in the Summary Impact Statement for the Processed Kimberlite to Mine Workings Project Proposal.

No.	Subject	Commitment	Project Phase/Timing
Water Quality			
1	Follow-up and monitoring	Follow-up to verify the environmental effects predictions and effectiveness of mitigation is an important component of this Project and is summarized below: • Sample PK porewater to confirm constituent concentrations used in model • Monitor the chemocline development and stability prior to breaching dike (Surveillance Network Program). Include visual monitoring by Traditional Knowledge. • Monitor water quality in the flooded mine workings following dike breaching. • Monitor water quality in Lac de Gras following re-connection of pit lake(s) to Lac de Gras. • Adequately size breaches to optimize water circulation within the closure water cap to meet water quality objectives; and • Continue the AEMP in Lac de Gras (water quality, sediment, fish and invertebrates within the water and sediment).	▪ All phases.

No.	Subject	Commitment	Project Phase/Timing
2	Timing of breaching of dikes	Breach dikes following receipt of monitoring results that show acceptable water quality (i.e., below AEMP benchmarks) within the pit lake(s).	▪ Closure
3	Decision-making process to isolate pit lakes from Lac de Gras	Close the breaches or isolate the pit lake from Lac de Gras if water quality is later determined to pose a risk to water quality, fish and fish habitat, caribou, humans or cultural land uses.	▪ Closure and Post-closure
4	Community engagement	Report findings back to Indigenous communities.	▪ All phases
Fish and Fish Habitat			
5	Follow-up and monitoring	In addition to continuation of the ongoing Aquatic Effects Monitoring Program (AEMP), DDMI will: • Monitor water quality in the pit lakes after the mine workings are filled to determine when and if water quality parameters meet aquatic effects benchmarks. • Monitor water quality, particularly TSS and TDS, in Lac de Gras at near-field, mid-field, and far-field areas during the breaching of the mine workings dikes.	▪ All phases
6	Follow-up and monitoring	DDMI would also work with DFO and Indigenous Groups to identify any follow-up monitoring that may be necessary to adaptive manage water levels in Lac de Gras and flows in the Coppermine River during the pit infilling periods.	▪ All phases
7	Deposition method	Select a deposition scenario that predicts water quality in the pit lake(s) meets AEMP benchmarks in the top 40m.	▪ Operations

No.	Subject	Commitment	Project Phase/Timing
8	Fish interaction with pit lake(s)	Exclude fish from the pit lake(s) until the monitoring program shows that water quality in the top 40 m of the pit lake(s) meets AEMP benchmarks.	▪ Closure
9	Freshwater withdrawal for pit infilling	Work with DFO and Indigenous Groups to finalize water withdrawal rates that will not significantly affect fish habitat in Lac de Gras or the Coppermine River.	▪ Closure
Wildlife and Wildlife Habitat			
10	Follow-up monitoring	In addition to continuation of the on-going Wildlife Monitoring Program, DDMI will monitor: • Water quality in the pit lakes after the mine workings are filled to determine when and if water quality parameters meet aquatic effects benchmarks. • Water quality, particularly TSS and TDS, in Lac de Gras at near-field, mid-field, and far-field areas during the breaching of the mine workings dikes.	▪ Operations and Closure
11	Wildlife interactions with pits/mine workings	Any wildlife observed in the mine workings will be removed prior to pit lake infilling in accordance with applicable regulations. In the case of peregrine falcon nests on the pit walls, recommended minimum buffer distances in applicable guidelines will be followed until the birds have fledged and left the nests.	▪ Operations
12	Water quality monitoring	Water quality monitoring will be used to assess potential changes in water concentrations of chemical constituents.	▪ All phases
13	Wildlife monitoring	Wildlife monitoring to assess potential interactions of wildlife with potential contaminants.	▪ All phases

No.	Subject	Commitment	Project Phase/Timing
14	Wildlife deterrence	Wildlife deterrent techniques will be implemented as required to reduce interactions with contaminants, if necessary	▪ Construction, Operations, and Closure
Cultural Use			
15	Engagement with Indigenous groups	DDMI will continue its engagement with stakeholders, including with the Participation Agreement groups and communities and other Indigenous groups to inform project design and execution.	▪ All phases
16	Engagement with Indigenous groups	DDMI will continue to engage with potentially affected Indigenous groups through the TK Panel Sessions and other engagement activities to better understand Indigenous perceptions about the safety, quality, and health of Lac de Gras and identify practical strategies to address these concerns.	▪ All phases
17	Water quality monitoring	Water quality will be monitored to assess potential changes in concentrations of chemical constituents in comparison to acceptable criteria	▪ All phases
18	Wildlife monitoring	Wildlife monitoring will assess potential interactions of wildlife with potential contaminants.	▪ All phases
19	Water quality management	Cover the PK and porewater in each mine working with a freshwater cap such that water quality in the top 40 m meets AEMP benchmarks	▪ Operations and Closure
20	Water quality management	Breach dikes to connect the pit lakes to Lac de Gras once monitoring shows that water constituents in pit lakes are below Canadian Water Quality guidelines for the Protection of Aquatic Life (CCME 2019) and/or the Aquatic Environmental Monitoring Program (AEMP) Effects Benchmarks	▪ Closure

No.	Subject	Commitment	Project Phase/Timing
21	Wildlife management	Remove any observed wildlife from pit/dike areas before infilling in accordance with applicable guidelines / regulations	▪ Operations and Closure
22	Wildlife monitoring	Monitor area for approaching wildlife during infilling.	▪ Operations and Closure
23	Wildlife management	Employ deterrents as required to reduce risks to wildlife.	▪ Construction, Operations, and Closure

Attachment #6

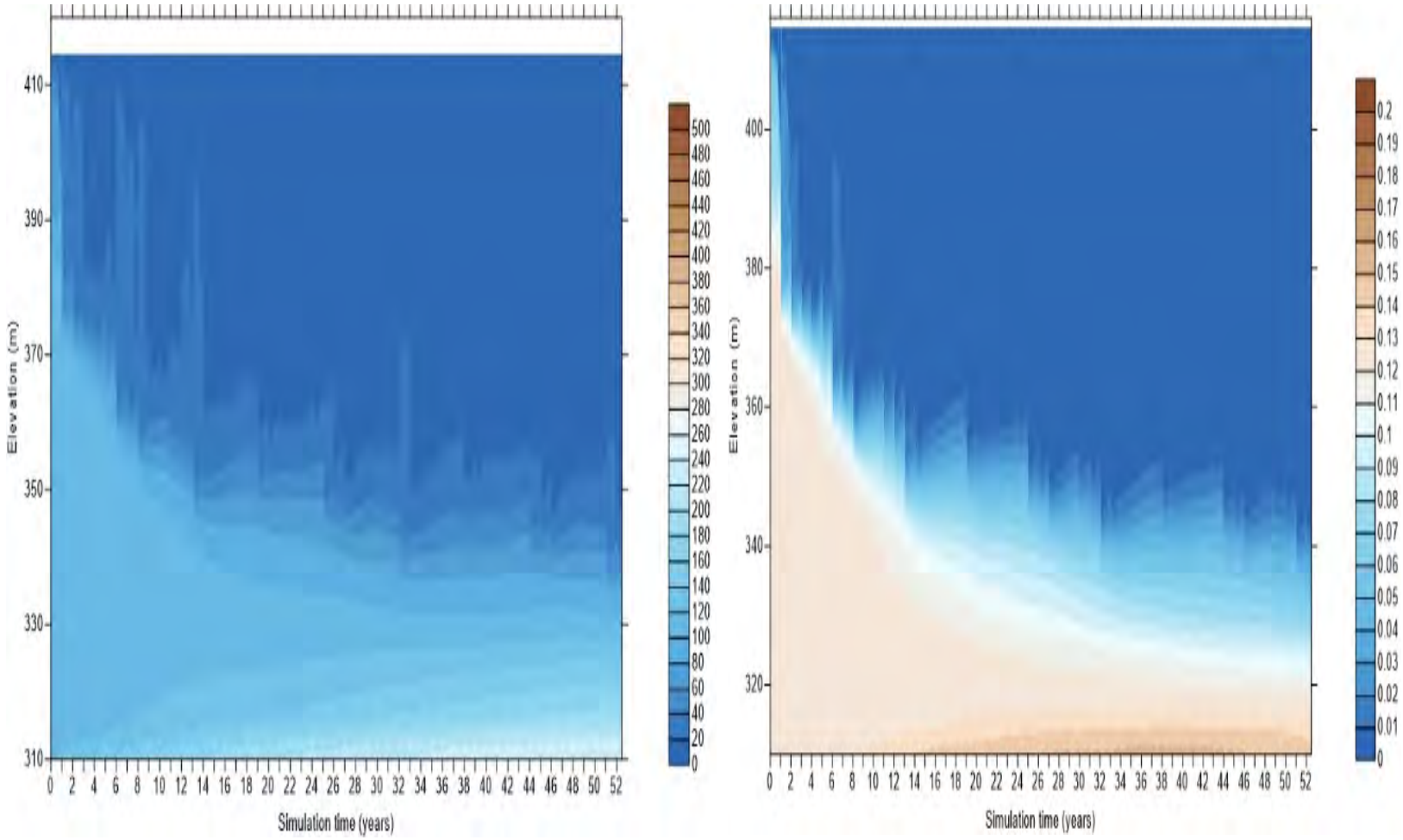


Figure 2 – Time contour plots for A418, Scenario 3A. Left: Total dissolved solids; Right: Tracer

Attachment #7

Table 1: List of calibration parameters

Calibrated Parameter	Unit	Calibrated Model (Dominion Diamond 2014)	Diavik
Sediment temperature	°C	2 (no PK)	5 (with PK)
Maximum vertical eddy viscosity	m^2/s	0.001	0.001
Reflection coefficient (albedo)	-	0.9	0.9
Coefficient of water-ice heat exchange	w/m^2 /°C	15	15
Wind Shielding Coefficient	-	0.8	0.8

W= watt; m= meter; ^oC= Degree Celsius; s= second

A WAY OF LIFE

Bridging Science and Aboriginal Knowledge in Caribou Monitoring at Diavik Diamond Mine

Technical Report
March 14-15, 2012 TK/IQ Panel Session

Presented by

The Traditional Knowledge and Inuit Qaujimajatuqangit Panel Environmental Monitoring Advisory Board (EMAB)

Bobby Algona, John Ivarluk & Mark Taletok (Kitikmeot Inuit Association)
August Enzoe, Alfred Lockhart & George Marlowe (Łutsel K'e Dene First Nation)
Ed Jones, Wayne Langenhan (North Slave Métis Alliance)
Pierre Beaverho and Louis Zoe (Tłı̨chǫ Nation)
Fred Sangris (Yellowknives Dene First Nation)
Michèle LeTourneau (EMAB)
Deborah Simmons and Shelagh Montgomery (SENES Consultants Ltd)
Natasha Thorpe (Thorpe Consulting Services)

Compiled by SENES Consultants Ltd.

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Released October 25, 2012

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Disclaimer

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No Prejudice

Section 2.1, *Environmental Agreement for the Diavik Diamond Project*

This Agreement is without prejudice to the positions of the Parties respecting any:

(a) existing Aboriginal or treaty rights of the Aboriginal Peoples;

(b) on-going or future land claims or self-government negotiations affecting Aboriginal Peoples;

(c) constitutional changes which may occur in the Northwest Territories;

(d) changes to legislation or regulations resulting from the settlement of land claims and self-government negotiations, or resulting from constitutional changes or devolution; or

(e) existing or future Participation Agreements.

Contact

Environmental Monitoring Advisory Board (for the Diavik mine)
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Report Summary

How can Aboriginal Traditional Knowledge/Inuit Qaujimajatuqangit (TK/IQ) be used to guide monitoring of caribou behaviour at Diavik? This is the question that TK/IQ Panel members were asked to explore during a two-day session on March 14-15, 2012.

This document includes four main sections reflecting the discussions at the March TK/IQ Panel session:

1. **People and Caribou in the ʔek'adı (Lac de Gras) Area.** A discussion of Aboriginal people's relationships with caribou since time immemorial. This is what scientists call the "baseline" for caribou monitoring.
2. **Aboriginal "Monitoring": A Way of Life.** Describes Aboriginal concepts and methodologies for the process that scientists call "monitoring."
3. **Recommendations for Action: Monitoring Across Cultures.** Recommendations for accommodating TK/IQ approaches in the Standard Operating Procedures for monitoring caribou behaviour, as well as other general recommend
4. **Introducing the TK/IQ Panel Team.** Session participants introduce themselves and talk about the experience and geographical knowledge base that they bring to the TK/IQ Panel.

Recommendations for Action

Recommendations for action are provided in this document related to the following topics:

Operating Procedures (SOP) for Monitoring Caribou Behaviour

- Capacity-building
- Methods
- Indicators (behaviours, herd composition, caribou health, environmental conditions)

General Caribou Monitoring and Management

- Managing caribou movement
- Using all the knowledge that we've shared
- Working with our future leaders

Conclusion

The TK/IQ Panel team together comprises a rich and varied body of knowledge and experience. In reviewing this document, panel members made it clear that the discussions over the two days of the March session represent only a small fraction of the knowledge they and knowledge holders in their communities have to share about the wildlife and landscape in the Diavik area. In particular, much work remains to be done in reviewing, assessing and adding to existing caribou TK/IQ documentation. As well, the TK/IQ Panel is eager to learn more about the totality of monitoring, management and research being conducted by Diavik about caribou. A full session focused on caribou in the future should include presentations about the Traditional Knowledge and scientific State of Knowledge about caribou in the Diavik area.

Contents

Figures

Appendices

Background: TK/IQ and Diavik Diamond Mine

How can Aboriginal Traditional Knowledge/Inuit Qaujimajatuqangit (TK/IQ) be used to guide caribou monitoring at Diavik? This is the question that TK/IQ Panel members were asked to explore during a two-day session on March 14 and 15, 2012.

This TK/IQ Panel session was a new effort to establish the panel as a standing body so as to strengthen the role of Aboriginal TK/IQ holders in mine monitoring. In previous years, TK/IQ Panel sessions had been one-off events related to single issues. The March session aimed to build on recommendations from a planning session on May 20, 2011. Because this TK/IQ Panel is new, the group also took time to learn about each other's knowledge and experiences.

EMAB and the Mine

The discovery of diamonds at Lac de Gras (Fat Lake in English, ʔek'atı in Yellowknives Dene Kwèka'tì in Tłı̨chǫ; "Tahikpak" in Inuinaqtun; Łuecho Kúé or Łuezáné in Dënesųłiné, and newly dubbed François Beaulieu Lake by Métis TK/IQ Panel member Ed Jones[1]) in 1991 led to the biggest diamond rush in Canadian history. Three years later, diamonds were found on a 20 kilometre square island, known in English as East Island. Diavik Diamond Mines Inc. was established in 1996. Five Aboriginal governments and organisations were identified as Parties affected by the mine. A year later, an Environmental Agreement (EA) was signed between the Parties. Canada, the Government of the Northwest Territories, the five Aboriginal Parties (Kitikmeot Inuit Association, Dogrib Treaty 11 Council, Łutsel K'e Dene Band, North Slave Métis Alliance, Yellowknives Dene First Nation), and Diavik. EMAB was established by the EA with the task of ensuring that all those responsible for protecting the Lac De Gras environment are doing their jobs. EMAB is unique in that it was the first such board to include as signatories the Aboriginal Parties, whose primary interest is protecting the land of their ancestors for future generations.

Figure 1: Celebrating the Participation Agreement. Source: www.businessweek.com

[1] For narratives related to these placenames, see 2012 TK/IQ Panel Technical Report 2 (June 2012).

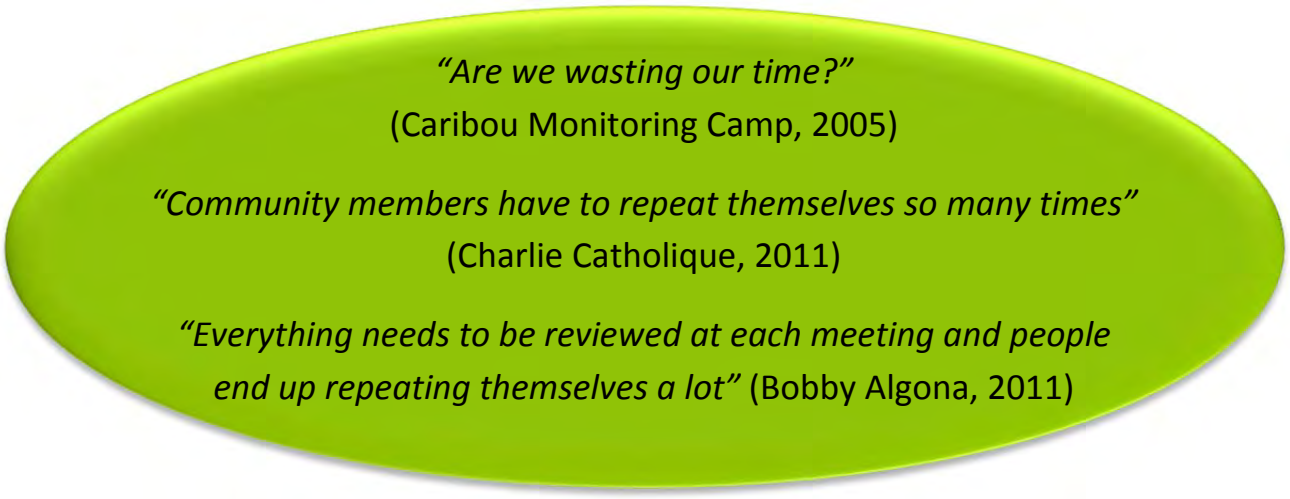
An Environmental Assessment was conducted including a TK/IQ Study. The necessary Access and Benefits Agreements and permits and licenses for the mine were in place by 1999. Two years later, construction of the mine began, and production began in 2003.

EMAB and the TK Panel

EMAB was mandated by the EA to serve as an independent public watchdog of Diavik. The EA supports the principle that Traditional Knowledge/Inuit Qaujimajatuqangit is fully considered and used along with science. The TK/IQ Panel is mandated to work with local communities and assist EMAB in ensuring that Aboriginal knowledge is appropriately and meaningfully incorporated into the planning and management of the mine.

Over the years, EMAB has convened a number of activities engaging with TK/IQ, including several on-the-land camps. Reports on some of these activities are available on the EMAB website at www.emab.ca. Not all of the events were TK/IQ Panel sessions. Two of the events were jointly convened by EMAB and the Independent Environmental Monitoring Agency (IEMA) for Ekati Diamond Mine.

Reports on the earlier events repeatedly mentioned people's frustration that it seemed they constantly had to repeat themselves at every meeting. They didn't see evidence of decisions or actions influenced by TK/IQ shared. The March 2012 session aimed to address this frustration by reviewing messages from previous work, and working toward realistic recommendations that could be used by Diavik right away.



TK/IQ Activities 1999-2012

Year	Workshop/Panel session	Monitoring Camp
1999		Diavik Science Camp, including TK teachings by Muriel Betsina
2001	Caribou Monitoring Workshop	
2002	Wildlife Effects Workshop	
2003	TK/IQ Monitoring Workshop (with IEMA)	Łutsel K'e youth-elder camps
2004	Fish (No Net Loss), and Fencing TK/IQ Panel sessions	Water, caribou, fish camps
2005		Water quality, fish tasting, caribou camp
2006		Water, dust, fish, caribou camp
2007	Environmental Monitoring Workshop (Behchokǫ̀)	
2008		Water
2009	Environmental Monitoring Workshop (Kugluktuk)	Łutsel K'e youth-elder camps
2010	Wildlife Monitoring and Environmental Agreement Workshops	
2011	TK/IQ Panel Workshop (with IEMA)	
2012	Caribou Monitoring and Closure and Reclamation TK/IQ Panels	

Figure 2: Muriel Betsina and students talking about TK, Diavik Science Camp #1, July 1999. Credit: Peter Hardy

The Caribou Monitoring Session

The TK/IQ Panel session on caribou monitoring on March 14-15 was facilitated by Deborah Simmons and Natasha Thorpe. The aims of the session were ambitious, including team-building and priority-setting, discussions of general approaches to TK/IQ monitoring, and a specific focus on developing recommendations for caribou monitoring.

> For the last year two years, we've talked about caribou. It's come out good. We're putting information together because we don't want to lose caribou. Number one thing, I don't want to lose caribou. Even when I'm six foot underground, I want the caribou in Canada and the Northwest Territories. If we accomplish that, everybody is happy. – *George Marlowe*

The TK/IQ Panel had a lot of independence. Although EMAB Chair Doug Crossley shared welcoming remarks via speaker phone, just one EMAB staff person (Michèle LeTourneau) joined the group to listen and provide support.

Colleen English and Diane Dul of Diavik were invited to give a presentation about their current Standard Operating Procedures (SOP) for caribou monitoring, but panel members decided that they needed to spend the remainder of the session working on their own. Discussions took place on the general themes of team-building and priority areas of work within the TK/IQ Panel, as well as caribou monitoring approaches.

Figure 3: Diane Dul on the job at Diavik. Source: Diane Dul, Diavik Diamond Mine Inc.

As a TK Panel, we should have a united voice when we meet with Diavik. We need to be well prepared. We're not ready yet. – *Ed Jones*

Recommendations for Diavik's Caribou Monitoring SOP from the workshop were approved by EMAB and delivered to Diavik in April, 2012. A short technical report on the workshop process was delivered in May. The *"Thinking Like a Caribou"* document with details about the session results was reviewed at a panel session on June 26-28, 2012.

Session Participants

Facilitation

Deborah Simmons, SENES Consultants Ltd. and Natasha Thorpe, Thorpe Consulting Services

Note Taker

Shelagh Montgomery, SENES Consultants Ltd.

TK/IQ Panel Delegates

Kitikmeot Inuit Association	John Ivarluk, Bobby Algona and Mark Taletok
Łutsel K'e Dene First Nation	George Marlowe, August Enzoe, Alfred Lockhart
North Slave Métis Alliance	Ed Jones, Wayne Langenhan, Sheryl Grieve (plain language interpreter)
Tłı̨chǫ Nation	Pierre Beaverho (Whati, Day 2), Louis Zoe (Gameti, Day 2), Jonas Lafferty (interpreter), James Rabesca (interpreter)
Yellowknives Dene First Nation	Fred Sangris, Randy Freeman (YKDFN staff)

Observers/Presenters

EMAB	Michelle LeTourneau, Doug Crossley (by phone, Day 1 opening)
Diavik Diamond Mine	Diane Dul, Colleen English (Day 1)

What's in this Document?

This document includes four main sections, briefly described here:

5. **People and Caribou in the ʔek'adı (Lac de Gras) Area.** A discussion of Aboriginal people's relationships with caribou since time immemorial. This is what scientists call the "baseline" for caribou monitoring.
6. **Aboriginal "Monitoring": A Way of Life.** Describes Aboriginal concepts and methodologies for the process that scientists call "monitoring."
7. **Recommendations for Action: Monitoring Across Cultures.** Recommendations for accommodating TK/IQ approaches in the Standard Operating Procedures for monitoring caribou behaviour, as well as other general recommend
8. **Introducing the TK/IQ Panel Team.** Session participants introduce themselves and talk about the experience and geographical knowledge base that they bring to the TK/IQ Panel.

The document includes a mixture of summaries of key messages along with quotes from session participants that give examples or bring alive the messages with a story. We've also included photos as a way of helping readers to get to know the TK Panel Team and our resource people. We hope that this will make the messages more meaningful and useful for both Aboriginal communities and Diavik decision-makers. We welcome feedback!

People and Caribou in the ʔek'adı (Lac de Gras) Area

An important aspect of caribou monitoring is documentation of what scientists call "baseline data." Aboriginal people know about this through their stories of their relationships with caribou from past to present. The past and present are the basis for learning about changes that are happening and will happen in the future. As George Marlowe puts it, "Us Dene people must love caribou. So that means monitoring caribou." Aboriginal people have a strong historical understanding of the whole huge landscape, our homeland and the homeland of the caribou. This is why our stories can't be limited to the scope of a single mine site.

Figure 4: George Marlowe

Sharing Stories

Bobby Algona

The elders are always talking about our ancient past how we came to be Inuit or how this world came to be, especially my grandmothers telling stories late into the evening or early morning. Sometimes they get tired. We want to hear more alright, but they say, "There's always tomorrow."

There came a time when the Ice Age took over and started to take over the land. They talk about some of us staying behind. It got cold over here on this continent and people from the Far East went off to find warmer climates. As Inuit, we stayed behind to be with our land and utilize the land. In my feeling, that's always been given to me by my grandmother's stories. That's my way of thinking how we came to be out here on the land long before other cultures started to come on this land. The whole story goes on and on forever, so I'm just keeping it short.

Figure 5: Bobby Algona

Grandparents are the Traditional Knowledge we have nowadays. All of our generation have kept that cultural experience out on the land, how to utilize the land. We were on the land for many, many thousands of years and living out on the land. Sometimes we go for gatherings and tell stories about where the caribou might be or where the hunting might be at times. We'd tell stories and then from that experience, we tend to help each other a lot through these stories.

When the World was New

Lisi Lafferty

Figure 6: Lisi Lafferty

A couple of years ago, probably in the early 1990s, there were a lot of Aboriginal educators. We got together and we were talking about how our culture needs to be taught to our children in the school. We didn't really have any documents. We had a lot of stories, but really nothing for us to follow. So we brought a lot of elders together.

They told us a story about when the world was new. That's how far back the caribou has been with us. At the time when the world was new, everything was formless, nothing had shapes yet. So all these beings came together and they chose their roles. "I'm going to be a bird." "I'm going to be a fish." "I'm going to be a caribou." All these animals were together and they became what they wanted to be.

After they all became what they wanted to be, then the caribou said we're going to be the food source for the people that live in this area. Fish is going to be the food source for people that live in the Tłı̨chǫ area. Then the bear got mad. The bear said I want to be the food source for those people. This was how consensus government was built. So they let the bear talk because they needed to let him talk. After he talked, they finally asked him, "What's going to happen to people when you hibernate? How are the people going to survive?" So the bear had to think. "Okay," he finally said, "If there's no caribou, if there's no fish, then people can use me for their food source."

When the world was new, the people and the animals were given a chance to talk, and they had a big celebration at the end. That's how Notah got his flat foot. He was one of the animals that came last. He was so tired, he fell asleep and this big tea dance was happening.

So our stories go all the way back from there. These animals were the first people. When they looked around, they saw this helpless, helpless being. When this helpless being had a baby, the baby had to live with the mother for a long, long time before it went and survived on its own. That was human beings.

The human beings are the ones that depend on their parents and other people to survive. But animals, as soon as they're born, they can survive. So the animals are the ones that looked after us. We were very, very helpless and we really needed to rely on them.

The one thing about caribou is they are really, really, really concerned about their feet. They are very, very sensitive about their feet. So one of the things they told us was you really, really need to make sure that the caribou, wherever it's travelling its trail, make sure that it's clean. Make sure that they can live out there and their feet are well taken care of.

Those are the kind of stories that the elders we worked with at the time, they told us these things that is very important. I think it's very important for us to remember that because the animals, the plants, the water, the land can survive without us, but we cannot survive without them. So that's the reason why we really need to take care of the land, the animals, because they're not dependent on us because they're going to be able to survive without us.

Monitoring Changes

George Marlowe

When Ekati first started operations in 1998 there were still lots of caribou. Towards the end of August, caribou used to come to Łutsel K'e. People go out by boat through August, September, October, and November. There were always caribou right there already. Lots, lots, lots. About this time of year, in the bay there at Łutsel K'e, right in the bay in the grass, caribou would just sleep there. Nobody cared, they would just look at them. Nobody cared to shoot them. Every year, it used to be like that.

Does anybody have an idea why caribou aren't coming back nowadays? For about five or six years now, there've been no caribou in our hometown, although this winter I shot two right by Star Lake. But for the most part we've lost that. I'm not going to blame the mine, maybe there's some other cause. In the old days, you had to be careful how you cut caribou or handle it. Maybe there's something that the caribou don't like that happened in Łutsel K'e, so they moved away.

Us Dene people must love caribou. So that means monitoring caribou. The hunters are the monitors. I'm a hunter. Every year I go there and even though I'm that old, I go to Artillery Lake every year. I know the caribou's movements, and their condition. Some years, the caribou have different fat. The hunters know that. Even my friends and relatives in Saskatchewan and Manitoba. They all phone me just about every second day to tell me the caribou are like this, the caribou are like that.

Gathering Place at Kǫ̀k’etì

Fred Sangris

Figure 7: Fred Sangris

I’ve heard a lot of stories about the Dene and Inuit people sharing at Koketi (Contwoyto Lake), north of ʔek’atı. They were trading. The Yellowknives Dene had access to the trading post there, and at Fort Resolution and Lake Athabasca in the old days. Koketi means “camp lake,” because that’s where the Inuit from the coast and the Dene people used to camp together and trade together. There was friendship and kinship there. In spring, they would depart and meet the next year again. The last gathering at Koketi was in 1950. There hasn’t been a Dene/Inuit gathering since. I’m still looking forward to a good gathering one day. It would be good to meet all the people that used to go there; the Akaitcho, the Tłı̨chǫ, the Sahtu Dene, and Inuit people. People used to travel before. Koketi was a gathering place. The muskox, char, the fish, caribou, everything was there. It was a beautiful place.

People have always travelled on the land, following the caribou herds. The caribou herds went north and that’s how they got into Koketi. They followed the caribou right to the calving grounds. Babies need soft caribou hair for clothing, diapers, parkas, the thin skin of caribou. The clothing on the young caribou was very important for children, especially babies. They had to be well looked after and the young caribou provided that soft material. Even the old people wanted young caribou for its tender meat, easy to eat when you’ve lost your teeth. That’s why the Dene people went up to the calving grounds to harvest them. At the same time, they went to harvest caribou antlers and many other things that the caribou left behind. Antlers are good medicine, and also make good tools.

The older bulls, they’re not going to move until late April or May. They are the very last ones to go. As some of the elders probably know, those last herds that leave the area is what we harvest. We harvest the bulls in the spring or in the fall. December, because it’s the rutting season, we hunt the cows. Then late season we hunt bulls again.

My grandfather lived to be over 107 years old. He was on the land with his family and when he was a kid, it would be the ancient past because there was only bows and arrows in those days.

No guns, nothing. Not even salt, tarps, nothing. Everything was made on the land and caribou hide. When they travelled, they didn't have anything. They went and wherever they caught caribou, they just made their tee-pees there out of caribou hides in the summer, spring and fall harvests. They followed the caribou. One year they followed the caribou up to Aylmer Lake. It's way passed Kennedy Lake and close to those mines. They spent the summer there and then came back this way again and followed the caribou coming back to the treeline.

In those days, that's how people depended so much on caribou is they just followed them. It was not just work, work on the land either. They'd finished harvesting and then they'd go competing with bows and arrows, sports. They'd compete for mostly caribou tongue and whatever they have.

The men were the hunters, trappers and fishermen. They had a big role, but the women too had a role in the communities and villages. The men and women worked together to move on the land and survive.

When my grandfather went out hunting, he would travel on snowshoes. He had a dog team, but he didn't use them. He went snowshoeing with a packsack and that's it, no blanket or nothing to carry. He went out and didn't come back until about close to Christmas. He was looking for caribou. He ended up close to Nonacho Lake, he says. That's where he found caribou. When he got those caribou, he cleaned and dried them, and put them up in a cache. Then he came back and got his dog team to pick up all the stuff, so the community knew where the caribou was and everybody went out to look.

They didn't have no guns, just bows and arrows. They used to hunt caribou with spears, and snares. You probably need a whole bunch of people to herd the animals.

We had a traditional management system. We managed the herds for thousands and thousands of years. It's only when the newcomers came here we started having problems with caribou.

It's been over 25 years since I've seen the Yellowknives Dene in this area harvest a lot of calves, unlike the old days. Today we don't hunt the calves anymore because we realize something is wrong with the herds today. We are slowing down on hunting the cows in spring too, because they are pregnant this time of year and they are going to give birth. It's given a bit of hardship to Yellowknives Dene hunters.

Now we have to hunt the young bulls. We have to work harder now. I have to climb this hill, go through the trees with snowshoes and get that bull. Now, mid-March, they are still in the treeline. The cows are pregnant. They put on a lot of fat right now, they are just working working, working at digging and putting on a lot of fat. In about ten days they'll start moving up

to the calving grounds. The cows know there is not much food there, so they are working really hard to put on enough to carry onto the calving grounds at this time of year.

We have a lot of ancient times information from thousands of years of generations, unwritten. It's all oral and we talk about it. We have big gatherings and we talk. We tell stories of the past, all the information that was passed onto us. But it's not recorded. It's not written in books anywhere. So for us Dene, it's a big challenge for us to capture all our histories.

Understanding the Whole Picture

Wayne Langenhan

We're in a unique situation in this present day where we have three mines on track – Ekati, Diavik and Snap Lake. Soon there is to be another one just south of Snap Lake they're working at putting in, Gahcho Kué Mine. So you're going to have a group of four mines right there in a very limited area. This could cause problems with the caribou in so much of a compacted area with these mines and these mines are a much greater scale than the ones in earlier times. These four mines grouped together cover quite a distance, and it might be just right on the migration of where the caribou go. And who knows what other mines are going to be built in the future.

So what we're looking at here now is different than anything that we've ever seen in the past. What we're working on here will be used in the future. We have to make sure that it's done right the first time, so that it can be used for the mines that are coming in later on. It's not right now that we're thinking of just one mine, or even the four mines. It's going to be about all the mines that are coming up down the line.

Figure 8: Wayne Langenhan

Caribou Monitoring at Diavik – Past and Present

Diavik has designed a science-based Standard Operating Procedure (SOP) for caribou monitoring that has been in place since 2003, with regular reviews and updates. The SOP is partly based on concerns that were expressed by communities about how caribou might be affected by the mine. The monitoring framework is shown in the diagram below. Diavik regularly approves the SOP. Monitoring takes place in spring, summer and autumn. If caribou are near the mine, monitoring is extended. When caribou are seen, observers check the caribou every eight minutes and fill out a form describing caribou behaviour. They do this at least for times, and up to eight times. Results are counted, and scientists use the numbers to learn how caribou are affected by the mine.

Caribou Impacts – Community Concerns

Haul trucks and traffic causing injury to wildlife and creating noise

Roads and berms injuring wildlife, injury/predation from rock piles

Dust from crushing and blasting contaminating vegetation and getting eaten by wildlife

Toxic waste harming animals

Wildlife drinking from or getting stuck in tailings ponds

Contaminated water that wildlife drinks

Smells from camp/cooking attracting animals (including predators)

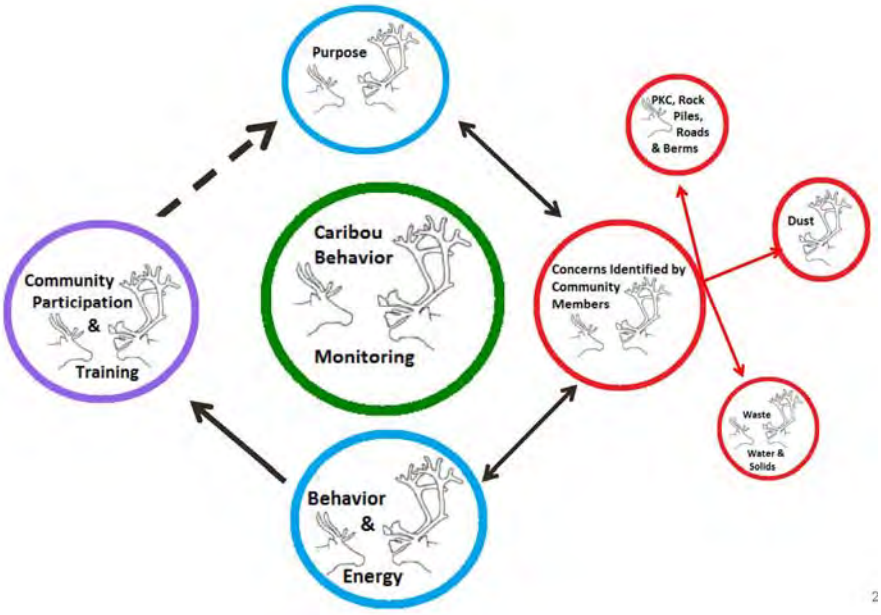


Figure 9: Caribou Monitoring Schema. Credit: Diavik Diamond Mine Inc.

Aboriginal Methods of "Monitoring" – A Way of Life

Aboriginal people have always "monitored" the land and animals and way of life and part of survival on the land. Each of the five cultures whose traditional territory encompasses the mine have our own way of monitoring. For some, it's not about watching or spying on animals, which might be considered very disrespectful. Watching animals may imply that it's possible to control or manage them, and this is against some people's laws.

In our different ways, our peoples learn about changes in the wildlife by maintaining our relationships with them, and with the landscape. We do that not by measuring, but by experiencing the land, remembering the stories that come with travel on the land, and practicing our spirituality. The animals are people too. They watch us, and they make decisions based on whether we can be trusted, whether ancient promises to treat them with respect have been kept. Our ancestors also watch us, and when we are travelling we pay respect to the gravesites that we pass on the land. It is because of them that we continue to survive as peoples.

Aboriginal peoples have a long term understanding of the animals, bearing knowledge of our homeland passed down through generations. In our different ways, we maintain our ancient and sacred relationships with the wildlife partly by travelling on the land, and partly by maintaining relationships and sharing knowledge with our families and communities. In harvesting, relationships among men and women are maintained, since they each have responsibilities in hunting and preparing meat. Relationships among generations are maintained, since all family members have roles to play as teachers and learners, leaders and followers on the land. Relationships across families and communities are maintained through sharing meat, and sharing knowledge about observations on the big landscape. This is why large gatherings are part of the harvesting cycle.

Aboriginal peoples have a special ability to understand what scientists call "cumulative impacts," impacts of all different activities on the land, because of our way of pooling knowledge from the past and present, and at different landscape scales.

Figure 10: Paul Omilgoitok with caribou. Source: Caribou Monitoring Workshoop Report (EMAB 2005)

Monitoring and Survival

Fred Sangris

We have changed, people have changed, but the wilderness is still out there, the caribou are still there. In the old days, the Dene followed the herds and went to the caribou, went to where the fishing areas were, went to the best hunting areas and spent many years over there.

For thousands of years Dene have lived on the land. We learned from our ancestors, but we also learned from our own experiences on the land, and passed that information down. We knew how the world worked and we passed that information on. When we went from to a new hunting area, we learned about that area through our own experiences and by learn from other people living in that area. So we did a lot of information gathering.

Now, we still go out on the land, but we don't spend as much time as we used to. Now we're dealing with industry, we're dealing with tourism, a lot of new things that never used to exist.

We long to be in the wilderness. We long to be out there. We miss something out there. We don't know what it is, but we miss it and we want to be there all the time. But our lifestyle has changed. Instead of living out there, we visit the area and check it to see if things are still intact, if things have changed. For example, burial sites and the migration routes. We want to go and check if the sand or gravel eroded at the caribou crossings, the migration routes, the spiritual places.

I call it visits, but it's much more a visit. It's a homeland that you miss. You experience it, and when you come home, you say, I've been there and this is what I saw. Boy, the place looks beautiful. There's more trees there, there's more wildlife. So you experience it and you gain knowledge from that. That's how you learn. I call it survival, but it's much more than survival. It's harvesting, travelling, seeing, experience.

When we're harvesting, we're observing. Has the caribou population gone up or gone down? Has the fox population gone up or gone down? People are there to see what's happening on the land because in the back of our minds, we still have that need to survive with the land. We want to be able to gather food, preserve food. Then we come back to communities and we share with other hunters and say I've been to this area, the habitat is still good, there's still lots of wildlife and people can go get the food when they need to.

Through ancient times, many customs and many laws were passed on, and one of them is we have to respect the wildlife, everything that's there, including caribou. In all our histories, caribou is the centre of our life. We have so many stories about caribou, caribou, caribou

because they are the only animal and species that the Aboriginal people have always relied on. It's a very close relationship, so they protect the animal.

In ancient times, they used to communicate with the animals. People wanted to know what the caribou thought about us, the people. The caribou monitors us. It has issues, concerns, about people. It doesn't like the way it's been harassed. It doesn't like the way it's been chased. It doesn't like the way it's been disrespected. So the elders would say "This is what the caribou are saying. We must do more to protect, we must do more to respect the animal."

Being Dene: Our Way of Seeing, Our Laws

Lisi Lafferty

What makes us Dene people? The elders said if you have a picture of a caribou and a lot of non-Aboriginal people, they come and look at the caribou, they're going to say it's such a beautiful animal. But if you show the elder the same picture, they're going to see caribou tongue, they're going to see dry meat, they're going to see blood soup, they're going to see tools, they're going to see clothing, they're going to see shelter. That's what they see when they see a caribou. That's the difference in the Dene way of learning. They told us these are the things you guys need to do to teach the children. Whatever you do in the school has to be authentic. It has to be something that is happening in the home, something that is happening in the community, something your people are still doing for your children to understand.

We also have laws. We have laws for how we treat caribou. We have laws for how we treat fish. According to those laws, you really, really have to watch the hunting gear of the hunters and the trappers and the fisherman. There are reasons for that. You also have to watch you don't step over blood. Way before contact with scientists, our people knew that if you cut your hand and you touch the blood of another animal, you're going to get sick. That's why they have rules around that. They also know that if another animal eats fish or meat, it's contaminated. You don't eat the meat that's been eaten by other animals.

Our people had laws about sharing and only killing what you need. Those are big laws that we need to teach our children. We have a whole generation of residential school victims who don't even know their stories, their histories. So even our own young children that are working at the mine, a lot of them miss out on all the Dene teachings. They need to know that. They need to be oriented about our culture, our way of life, the caribou and their migration and everything that's tied to the caribou.

The Tłı̨chǫ elders were very, very upset when there was a ban on caribou hunting, because there's a whole knowledge that goes with the caribou. There's the preparation when people are getting ready to hunt. They are talking about where they're going to go, what they're going to take, who used to live in that area, how they used to live in that area. So you educate the young people that are listening. Then the women are really excited. They are making moccasins because they can just taste the dry meat and the caribou tongue when their husband comes back with the caribou meat.

Recommendations for Action: Monitoring Across Cultures

Aboriginal people have always had our ways of knowing wildlife through harvesting. Recently scientists have come into our territory to learn about the wildlife, and they have a different way of doing their work. It is important that we have chances to continue practicing our different ways of knowing separately, perhaps inviting others to participate and learn on the land and at the mine site. The existence of the mine also makes it necessary to develop cross-cultural ways of learning and sharing knowledge. During our March 2012 Panel session, we concluded that it is not desirable or practical to try to implement a fully TK/IQ approach to monitoring in partnership with Diavik. Our seasonal way of life on the land must be fully governed and sponsored by us.

We can be creative in collaborating with Diavik in a cross-cultural monitoring program that includes observations and knowledge exchanges at the mine site and TK/IQ Camp, as well as

Figure 11: The TK/IQ Panel discusses monitoring on the land, in the community, and at the mine site

dialogue in the communities where harvesters share what they've been seeing on the land. A successful program will require good communication, and this is always challenging across cultures. Developing strong relationships will be key.

The TK/IQ Panel members are a very good group to lead this cross-cultural work, since we include people who grew up on the land, and people who have a lot of schooling with white people, and experience working at the mines. Many of us still have our languages, but we also are able to work in English. We're a group of Aboriginal people that bridge the two worlds, but there's still a lot of work to be done to develop our cross-cultural program with Diavik.

I've heard some people say that the caribou are not avoiding the mine, but some are saying they are avoiding the mine. There are two opposing views. There's nothing traditional anymore. The mines have changed that, and we have to start thinking that way. Don't try to brainwash the Aboriginals into thinking the mines are not affecting the caribou herd. Common sense tells me it is affecting the movement and the behaviour of the caribou. You may or not accept that view, but that's my opinion and I think it makes common sense. – *Ed Jones*

When I was seven years old, my Dad told me at least you should go to school a little bit and learn a little bit about the white folks so you can maybe teach the white folk how to do things on the land. A lot of times the elders take the white folk out on the land. Being a teacher, taking whit folk out on the land that's what it is. Gatherings like this, we are actually the teachers teaching the monitoring board how to think like a caribou. – *Bobby Algona*

If industry is going to monitor wildlife, at least they should learn about the customs and the laws of the Aboriginal people, how they look at wildlife. Maybe, in turn, they'll learn and learn how to respect the caribou the way we do it, not from an industry point of view. – *Fred Sangris*

One time there was a scientist that came in from Toronto. The community asked me to take him out on the land, so I did. We went out by skidoo to Nonacho Lake where the caribou were. He was using my son's skidoo, and he followed me. The scientist was travelling too slow so everybody else took off on us. So we ended up by ourselves.

When we got to Nonacho Lake we shot two caribou. We shot two, and then I cleaned it. The days were short then too, and it was dark by the time we got to the land. We made a fire and cooked ribs on the fire the traditional way, with no grill. Just on a stick poked up in the air over a big bonfire, the meat a little ways away from the fire.

We had that experience and came back to town at night. The next day he came to the house and said "I learned more in one afternoon that I learned in all my twenty years of teaching at the university." So he learned from experience. That's how people learn a lot of stuff. So in all those twenty years of teaching, he didn't know what was he was talking about, I guess. He lived through the books, you know? – *Alfred Lockhart*

Recommendations for Action on Diavik's Standard Operating Procedures (SOP) for Caribou Behaviour Monitoring

The revision of Diavik's SOP is one area where cross-cultural work can be done. The recommendations here were compiled through a review of the existing SOP as well as the TK/IQ Panel discussion. By permission of the TK/IQ Panel, the recommendations were delivered to Diavik in May 2012. The cross-cultural approach includes the use of what scientists call "indicators" that can be measured. TK/IQ Panel discussion showed that it is possible to use a more nuanced understanding of caribou populations and behaviours using Aboriginal harvester knowledge.

Involvement of Knowledgeable Aboriginal Observers and systematic communication with Aboriginal communities about the monitoring process and results will be important in ongoing assessments of the revised SOP. The panel expressed a lot of frustration about lack of involvement and communication to date.

Recommendations for Action on Capacity-Building

- During early July before the caribou migrate south, a regular training session should be planned for Diavik staff in ways of properly respecting caribou and other animals.
- When elders are brought to site for staff training exercises, youth delegates and harvesters should also be involved.
- The TK-Science camp (known as the CBM Camp) should be moved to a location north of Diavik on Lac du Sauvage closer to the caribou migration route for developing skills and capacity in cross-cultural caribou monitoring. The setup must be in the Aboriginal way, not in a square, so that it's not threatening to the caribou.
- Monitoring results should be reported back to the communities on a consistent basis.
- It will be valuable to "check nets" and synthesize what's already been done by Diavik to incorporate TK/IQ into its processes, and document/share lessons learned from these experiences in order to avoid repeating work already done.

Recommendations for Action on Methods

- Use pictures and/or other visual tools as part of the form for caribou behavioural scans.
- TK holders should be hired year–round to work with Diavik staff for general monitoring; additional TK holders should be hired seasonally for caribou monitoring.
- Community meetings are a good way to gather more information on how caribou are doing.
- Caribou observation logs can also be used by community members when they are on the land.
- Include more behaviours in the list for observation.
- Include more categories for herd composition (see detailed list below).
- Utilize Aboriginal terms/concepts as identifiers.
- Both ENR and Aboriginal harvesters should work together and assess animals that are injured.
- Scientists and TK holders analyze dead caribou together.

Recommendations for Action on Indicators

Key Monitoring Areas

The group identified four key areas for monitoring. Indicators or signs of herd condition were identified within each of these areas.

1. Behaviours
2. Herd composition
3. Caribou health
4. Environmental conditions

1. Stress Responses

- Be aware of what stressed behavior looks like with caribou
- Flight/freeze reaction to flies and mosquitos
- Jumping, nose in the air

Figure 12: Credit: Diane Dul, Diavik Diamond Mine Inc.

If we look at the same picture, we're going to have different views, for those of you who are not familiar with wildlife, their behaviour and what they're doing. Those of us who are hunters probably know what the herds are doing. The caribou are running in front of the helicopter. When a caribou gets scared or surprised or threatened, that's what they do. They put their nose up and sometimes they jump and then they go on a really fast gallop because they don't know what's going on and they're threatened.

If I was to walk over there and the caribou sees us, they are going to go slow and take their time and look at us. They are not threatened because we're not creating noise or surprising them or anything. They know we're there, so they won't act like that. When a caribou is stressed, they're going to run and run, and probably go a long distance moving because they're threatened. They are acting like a bully.

When a caribou gets scared and surprised, that's what they do. They get uptight and come together. If that helicopter comes, we'll both put our horns down and go after it. That's how a caribou looks like when they're threatened or surprised. – *Fred Sangris*

When I was hunting in Rankin Inlet, I noticed that if the bugs were bad the caribou would head for the sea. If they are down in a swampy area, they'll just go like a freight train, and all of a sudden they'll just drop down. Then when the flies catch up with them, they get up and they go right back to just about where they started off from. They'll keep doing this. If the flies are there, that's a lot of stress on them, the amount of black flies. – *Wayne Langenhan*

2. Herd composition and behaviour

Fred Sangris said that "caribou has a family," and this needs to be understood in the monitoring SOP. The different family members have Aboriginal names, and each has a different role in the herd.

- Balance of older/younger animals
- Balance of male/female
- Leaders and followers
- Caribou family behaviour
- Differences and changes in timing of migratory movements between bulls and cows
- Changes in migration route

Figure 13: Credit: Diane Dul, Diavik Diamond Mine Inc.

Caribou are very intelligent animals. I've worked as an outfitter and a guide in the past, and I see that. Thousands of caribou, but they would never come near the camp, never. Not even if the camp was right on the migration route. They avoid it. But as soon as you put up mine like BHP and Diavik, they just love being around people. They look at the mines as security. They know the people working at the mien are harmless and they know predators like wolves and grizzly bears are sometimes chased away. They never hang around that area, so it' s a safe haven for caribou. Bu at the outfitters camp, no grizzly bear, no wolves, no caribou, no nothing. They know exactly what that camp is and they learn how to avoid it. Think about that.

– Fred Sangris

I've been surveying caribou around BHP and Diavik. I did a lot of walking with the caribou biologist Anne Gunn. A lot of people from Rae were with me. The company was complaining that the caribou were going onto the island. We said we should have put a fence across the lake or the caribou trail. We should have blocked them there and that way you wouldn't see caribou on the island. If they had put stakes up there to draw caribou in a different direction, the caribou would still be doing good. But they never did that. They didn't listen to us.

Way back in the 1980s, we had all kinds of caribou come north. There were no mines. We had no complaints about caribou. Since the mines came up, we've had lots of complaints about caribou. I told those guys when I was in a meeting, you should be monitoring the caribou before they hit the mine when they're coming back from the calving grounds, about 10 or 15 miles out from the mine site. Then when they pass the mine and after they pass the mine, monitor them and see how they look. I used to see a lot of crippled caribou around the mine in the 1990s when I was working down there with Anne Gunn. But they never did it. They never listened to my suggestions. – *Alfred Lockhart*

There's no way you can keep an animal out of its migrating route when it's migrating somewhere. It's either going north or coming back south. There was always a different route they use. No matter if there is a tailings line, they'll go over it. Just like the mountains, they go over that mountain. They'll even cross a strong river. – *John Ivarluk*

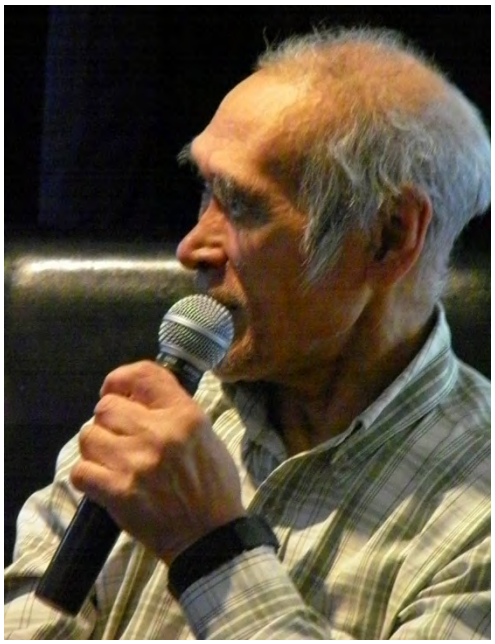


Figure 14: John Ivarluk

3. Caribou Health

- Appearance: fat or skinny (this fluctuates from year to year)
- Caribou crippling
- Caribou looks sick
- Hoof condition

4. Environmental conditions

- Noise
- Garbage impacts (eg. wire)
- Windmill impacts
- Presence of other animals (when caribou go away, other animals go away)
- Smells
- Climate change

You can silence the noise from the heavy equipment by putting what I call – it's not the proper name – a silencer, a catalytic converter or...(inaudible). – to put on heavy equipment including the power generating plants. That's one way of lessening the noise and you can do it. I've mentioned catalytic converters before but nobody pays any attention to it. They merely say it's too expensive. It is not expensive. – *Ed Jones*

Figure 15: Ed Jones

One time in Contwoyto Lake, me and my wife were watching caribou migrating north. It was a big herd. There must have been some exploration not too far from where the caribou went through. One big bull, you could see it tangled in yellow and black wire. I wish those exploration guys could collect whatever they do and not just leave it there. In the fall, when their velvet is coming off, caribou go against the bushes to take the velvet off. In doing so, it gets tangled with that wire that's lying on the ground. – *John Ivarluk*

I want not only me, but my family, everybody, to keep my land clean. I don't want garbage or anything. For the last three years now, when outsiders go hunting, we see whiskey bottles and cans, we don't want that. You go home, tell your communities, tell your people if you want to go out there to Łutsel K'e, respect the land and respect the people. You can drink at home, not over there. You don't know what's going to happen. You might end up in an accident, you don't know. – *George Marlowe*

You go hunting, you see fox, white fox, wolverine, wolves running, caribou, just running all over. We've got to monitor that, too not only at the mine site. The mine site is just around that area, but around our hunting area it's a big land too. So those kind of things we have to talk about. – *George Marlowe*

For 15 years, I've been hearing from First Nations that the weather is changing, the land is changing, it's unpredictable, we're seeing new things we don't see any more. What happens in the fall time is that you get snow and then it melts and then you get this layer of ice and then you get snow on top of that. That's one of the reasons the caribou are having so much trouble. Maybe that's why they are getting skinny. It's really hard to dig through that deep snow, that's one problem. The other is once they dig through, it's ice. – *Natasha Thorpe*

Figure 16: Natasha Thorpe

General Recommendations for Action on Caribou Monitoring and Management

Recommendation for Action on Managing Caribou Movement

In the old days, people used to use markers on the land to direct the movements of caribou for hunting. Those methods are still used today. People get on their snowshoes and guide the caribou where they want them to go. For example, Aboriginal people guided caribou away from the winter road last winter. Ed Jones noted that "the caribou need to be kept out of the Diavik zone of influence." There could be two deflection zones, 20 miles away from the mine and another zone closer to the mine. It's possible to use knowledge of migration routes to guide caribou movements.

Working with Aboriginal knowledge holders, spruce and other markers, such as coloured fencing, or a deterrent like wolf scat, should be experimented with to find the best way to direct the caribou away from the caribou crossing to the island where the mine site is so they won't encounter risks and undergo stress.

Recommendation for Action on Using All the Knowledge that We've Shared

The TK/IQ Panel feels that it is very important that all the knowledge that's been shared in the past is accounted for in future recommendations about caribou monitoring. The early work that was done for Diavik's Environmental Impact Statement and other planning processes included knowledge about caribou that should be reviewed and used.

Recommendation for Action on Working with Our Future Leaders

"Look around you. There are no youth around us. We should have youth with us," observed August Enzoe. At any meetings related to TK/IQ, people talk about youth. The time has come to include youth in our work. The youth are living in a changing and complex world now. They have skills that the elders don't have, and they can help us to see a way forward. Everywhere that the elders are called upon to share knowledge or observe changes, the youth should be with them.

Patience and Understanding

Bobby Algona

For myself, I'm thinking about my grandmother and my dad a lot. I travelled a lot with my dad ever since I started walking. I seldom stayed home. I never wanted to be at home with the ladies or with mom or my sisters. I'd rather be out hunting away from the camp or travelling with my dad.

The reality for the next generation is going to be very different from what we were used to with our parents and our elders, who gave us a whole lot of patience and understanding. We need to do a lot to help that next generation. We need to do more in communities and meetings like this. We're losing our next generation because we aren't teaching them our culture, who we are as Inuit.

Learning About the Mine

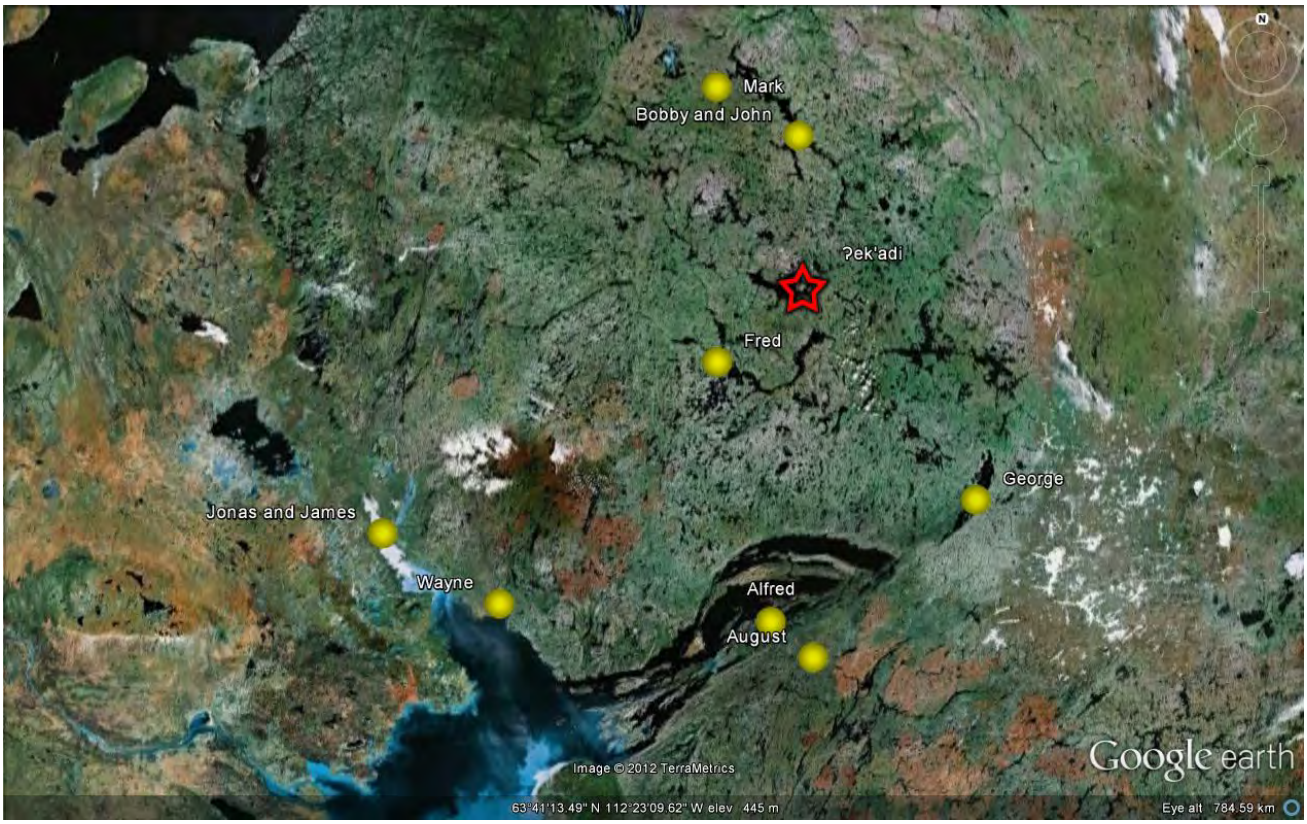
George Marlowe

I took a lot of kids out on the land, me and my wife and some elders. When we're out there, we only talk with the kids about the land, not much about the mine site. I teach the kids how to shoot caribou or skin caribou or make a fire, set up a tent. They like that. But there's got to be more done about the mine site with the youth.

Introducing the TK/IQ Panel Team

Many books and reports include reference or resource sections with lists of documents. The main resources for the TK/IQ Panel are the knowledge, experiences and stories of the panel members themselves. During the March, 2012 TK/IQ Panel session, participants shared some of their life experiences so that we could all get to know each other better, and learn about the knowledge that each person brings to the panel.

We learned that we bring together a lot of knowledge of the area surrounding Lac de Gras, as well as knowledge of development and mining in other places across Canada. The team also has a strong foundation in cross-cultural knowledge. There are elders who were born and grew up on the land and survived all their lives from subsistence harvesting. Others went to residential school and survived in part by working at mines and other jobs, but have at the same time managed to maintain their knowledge of the land. The resource people (Deb, Shelagh, Natasha and Michèle) all bring different experiences facilitating research with Aboriginal communities in various parts of northern and southern Canada.



"Where I'm From" Map – Aboriginal TK/IQ Panel Members

Kitikmeot Inuit Association Delegates

Bobby Algona

I live in Kugluktuk now, but I was born in Edmonton. I was born and raised around the Tahikyoak (Contwoyto Lake) and Pellet Lake area. My dad told me to go to school so I could speak English a little bit and get along with the white folk a little bit easier. He spoke very little English, and I guess what he wanted was some translation. I went to school in Fort Simpson for about seven years at the hostel there, the Alexander Mackenzie School. The very first time I went to school, I spoke not a word of English. I listened to my Dad and paid attention to my teachers, and did a lot of things that the white folks do. I started to learn a little more, and English caught on a little bit. After that, I went to school every year. At least some of us got to go home, not for Christmas, but for summer break at least we got to go home. That was hard alright.

When I was living at Pellet Lake, I tried to keep my family away from the community as long as I could. Just the same way my dad did for me. He kept us out there. Just being in the community, he says, you tend to lose your cultural experience on the land. Communities have a lot of distractions. Being distracted in the communities, they'd always say "palumuk, palumuk." You're not looking, not paying attention how you want to survive or do stuff on the land. You're not giving your total self sometimes. It's like covering your head and not looking at the land. That's why I tried to keep my children going out on the land as long as I can.

Being athletic and into a lot of sports, I played lots of hockey. It caught on really well. One day my skate got caught on a crack on the ice. I went flying and landed on the sideboard right on my back. I was almost paralyzed. I was at the hospital for about six months, tied to the bed, not even moving my head. My whole body including my head was strapped for almost six months. I've had this back problem ever since. Just ten years ago, I re-hurt my lower back and it's been giving me a whole lot of problems getting out on the land and carrying loads. I'm not really going out at all, though I've been really tempted. I'm mainly trying to heal from my surgery. Hopefully this spring I'll be able to go back out again, eating caribou and fishing on the land. Right up until ten years ago was going out on the land for most of the year and bringing my family out to my camp. The family misses that a lot. I'm having a hard time getting out there. Hopefully this spring, I'll be able to get out a little more. Quana.

John Ivarluk

I lived mostly in Tahikyoak (Contwoyto Lake) before I moved to Kugluktuk. I worked there in 1979 when Lupin gold mine started. I worked there two weeks in, two weeks out, on rotation as a heavy equipment operator. I've had five kids, but I've got only four left. I'm on my second wife. My first wife died when I was in Edmonton in the hospital. They were getting no more food back home. They put dog food in a forty-five gallon seal oil barrel, and my first wife was so hungry she ate from that meat and she got poisoned. That's how I lost my first wife. Today, I'm happily married and she's back home waiting for my return. We want to go back to Tahikyoak

when I'm finished with this meeting. We like to live on the land. It's my life. After I finished working at the gold mine, I went back to being a hunter and trapper. I am now retired and just doing anything I want. I live on the land, trap and hunt. That's about it. Thank you.

Mark Taletok

I had to go to a hospital in Edmonton. By 1988, I had no dog team. I'm having a hard time going back to my hometown Pinganatok (Concession Lake). Quana.

Łutsel K'e Dene First Nation Delegates

August Enzoe

I was born south of Łutsel K'e at a lake called Austen Lake. It's about thirty miles down the Snowdrift River near the mouth of the river where I have a cabin now.

I went to residential school in Fort Resolution in 1944, and I stayed at residential school until 1951. When I left that school in July 1951, I never saw my mom or my dad. They passed away when I was small, just a baby. My grandparents raised me. I told the story about how I was raised and what they were doing to me in Fort Resolution, so they told me never go back to school again. So I started learning the bush life, how to trap, how to fish, all those years. I learned from a lot of old-timers from way back, even from the 1800s. They were still with us from the 1950s until the 1970s. I've been travelling the south side of Łutsel K'e all my life, and north to the barren lands. In those days there were only dog teams. I had a good life.

I've got two boys and two girls, and I raised them mostly in the bush even though they went to school. So now the two boys know the bush life. I taught my grandsons how to work in the bush too. Now I'm retired so I don't go out hunting much. I've got a back problem. Most of my kids do hunting and fishing. I taught them good in the bush.

I worked for the government for twenty years, and retired in 1990. I had enough of government jobs. I wanted to do my bush life again. It's just like starting over again after all those years. I've always done pretty good in the bush. That's why we live out in Łutsel K'e right now. Thank you.

Alfred Lockhart

I was born in Łutsel K'e. At an early age, I went to residential school in Fort Resolution, and then Fort Smith. I also went here in Yellowknife at Sir John Franklin High School. I was done school in 1964. Then I went on to apprentice in building and construction, carpentry work. In 1965, I got my second year in building. Then I went out on the land with my parents. My dad took me out and showed me the bush life, how to survive and be safe on the land. The following year, I went out into the barrenlands with him. I learned quite a bit in the barrenlands around the Artillery Lake area and Sandy Lake and the Whitefish Lake area. It took me two years to learn everything I know now.

I've trapped a bit with white fox. For the year I was out in the barren land, I met Fred Sangris's dad there. A whole bunch of people came from Dettah that year, so I met and got to know those people and drove dog teams with them. In those days we used only teams, no skidoos.

I was going to go back to school in 1968 and pick up a trade, but I never did. I never got a chance. I ended up in the States with an all-native band called Chief Tones. I toured the whole USA in 1968 and 1969. So I met lots of artists out there, country singers, George Jones. We were young then.

After that, I came back and went to school at SAIT [Southern Alberta Institute of Technology] in Calgary. There I finished my trade, and then I came back to work here. I worked on most of the high-rises here because that's my trade, big buildings. I've been here for 14 years. Later on, I went back to my community. All I do now is hunt. I'm also employed by NorthwesTel as a technician. I'm semi-retired, but I'm getting paid.

I go out on the land quite a bit, out on the barren lands around the Artillery Lake area. That's where my parents taught me how to survive, so I'm quite confident going out by myself. I built myself a komatik. It's good for the barren lands. I take everything in there. I take a generator and lights. I carry two tents. One is a four season dome tent. That's for a quick setup in the barren lands when you're stuck and caught in a blizzard. I also carry a propane heater, and a satellite phone. I've got everything you need, so you don't need to fear nothing. Just go out and enjoy. Thank you.

George Marlowe

I was born in Łutsel K'e, that little town by the river, back in 1938 or 39, and I lived at Rocher River. No one lives at Rocher River any more. There are lots of houses, they've all fallen down but they're still there. It shows that people used to live there. It's just like a town. Lots of white trappers used go through there, they would stay with Dene people. I must have been about four or five, pretty small. I remember a little bit though. While I was growing up, I remember I used to go out with my grandfather and my dad hunting.

Then in about 1948 or 47, I went to residential school in Fort Resolution. My mother put me there. My dad took me out after my mom passed away at Rocher River. She died on March 31, 1949 and I didn't even know. The priest never told me nothing. The nuns never told me nothing. I didn't know until my dad came back and said, "Jesus took your mom." I was wondering what he meant. All this time he meant my mom passed away. I cried a little bit right there and he took me out.

I got my first job in 1955 or 56, commercial fishing. There was a lot of commercial fishing close to Łutsel K'e. I went there. I went in the boat with a young person who told me, "I'll pay you $150 a month." I was happy. A hundred and fifty a month was so much for me. So I started working with him. The next year, 1957, they started cutting brush for that highway in

Providence. I worked with them for two years. I survived like that, little jobs. Me, all my life, I worked too. I worked for forestry too. I went training for about four years and I just about crashed in a chopper, so I quit. Then I went to heavy equipment operator training in Fort Smith. Even when I worked at the mine, I could drive anything.

I'd do a lot of hunting too. Right now, every year I go out to Artillery Lake where the caribou is right now. Now I'm old. I'm close to 74, but I still go on the land. I like it. If I don't go there for eight to five years, I'll forget the spot on the land. Every time I travel by skidoo, the memories come back. Hey, we used to have a fire there. Little trees, maybe six or seven trees there, I remember we had a fire there. Things like that remind me of everything. Sometimes I feel like crying, remembering my parents, my grandparents. But it's good to be on the land.

I have six girls and one boy and sixteen grandsons, three girls and four great ones, boys. Every one of them, I love them just the same. My grandkids have never seen me drink alcohol yet. They've never seen me smoking cigarettes yet. That's how much I love my grandkids. This spring I'm going to send them out, six of them. We'll take three skidoos, tents, stoves. I've shown them already how to hunt. We'll go up there at night, set up a tent, cut wood. It's not like the old days now. We have a chainsaw. Some people carry generators, gas stoves everything today. When I was a young kid, no gas stove, no gas lamp, a little candle, that's it.

I love dancing too. When I was a little kid, August Enzoe's grandfather told me go dance. He used to be a good dancer. He called square dance. I was too small, I was shy. One day I just got in there dancing. I danced a lot of places from Fairbanks, Alaska to Moose Factory, Manitoba, Kugluktuk, Saskatchewan. I won a lot of jigging contests. I used to have a lot of trophies.

North Slave Métis Alliance Delegates

Ed Jones

I've worked as a prospector for many years. I started out in northern Saskatchewan prospecting for radioactive minerals, and then spent five full seasons here in the Northwest Territories, looking for uranium. I believe uranium is the fuel of the future. I worked up at Nanisivik for four-and-a-half years as a diamond driller underground, and I worked at various DEW line sites for a construction company. I've worked underground. I was in the air force five years. I've been all over Canada for PEI to Vancouver Island, Herschel Island, Baffin Island, believe it or not.

I've spent a lot of time in the bush, though I don't have the knowledge of caribou that others do because I spent so much time working. I guess you could say I'm a product of seven years of residential school at Fort Resolution. But I love the bush life. That's probably the reason I got into prospecting. I'm 80 years old now, but I will be going back to the bush whenever I can accumulate enough cash and time. I don't think of myself as an old man. I don't think that way. I think we're young.

Wayne Langenhan

I was born and raised in Yellowknife except for about ten years when I moved away with my parents at the age of one. I came back when I was just about 11. I've spent most of my life in this area around Yellowknife. I've hunted the area quite extensively for about the last 45 years, in a radius of say about 100 miles out from Yellowknife. I've also hunted other places, like in the barrenlands when I lived in Rankin Inlet for a couple of brief periods. Down towards Whale Cove, the Black Hills, the Copper Needle River, Ferguson River, that area. I've also hunted up around McKay Lake, Great Bear Lake and over in the Yukon.

These places give you different challenges because of the terrain and the people that you pick up for hunting partners also have better knowledge of their area, because they're there and they teach you how to tie different knots, how to hook up a load differently, how to pack a sleigh. Sometimes it's faster to use a combination of loading and packing from both the Inuit and Dene cultures. So I don't use just one method, I incorporate them all for what my preference is. I'm not saying that it's better than anybody else's, but it's handier for me personally.

I've worked in this area, up at Great Bear Lake, in the Yukon, over in the Keewatin area doing different things; staking, prospecting and in some of the mines like Port Radium, Echo Bay Silver, and at one little mine in the Yukon. I've worked down in British Columbia, and Thompson, Manitoba and, of course, Con and Giant gold mines here underground. I've done some carpentry work. I've worked with many of the Dene people and the Inuit people. I know a lot of their working habits. They still get the job done as well as anyone.

Sheryl Grieve (plain language interpreter)

I was born in New Brunswick in a little town called Harvey, which is where both of my parents were raised. That was an accident because my family was actually living in Toronto. We were military family, so we moved every three years. I met Bill Enge in Calgary, and he talked me into coming to Yellowknife in 1981.

I worked on the Norman Wells pipeline. Then I went to college in Fort Smith for two years, 1985 to 1987, in the Natural Resources Training Program (NRTP). Then I went to Yellowknife. I worked for the Canadian Wildlife Service, I worked at the jail. People in Yellowknife probably even remember me from a long time ago waitressing in bars. I worked painting houses, as a construction worker, pipeline labourer, truck driver. I worked for Robinson's. I got a job as a Renewable Resource Officer for the Government of the NWT. They sent me to Clyde River on Baffin Island. From there I lived in many different places, and now I've settled in Victoria, British Columbia. If you put a caribou collar on me, it would go a lot of places. That's not including all the travel.

It was through the pipeline work that I started to learn about Aboriginal people in the North. I had received my education in Ontario where they taught us about Aboriginal people in Canada as

an historical artifact. They didn't mention to us that there were still Aboriginal communities existing. So it was a big surprise to see actual communities of Aboriginal people when I got here and I've been getting educated about that ever since.

Tłı̨cho̱ Nation Delegates

The Tłı̨chǫ delegates, Pierre Beaverho and Louis Zoe, were not able to share their stories because they were delayed in arriving at the panel session due to a snowstorm. We were fortunate that Lisi Lafferty and interpreter Jonas Lafferty were willing to participate in their place for the first day!

Jonas Lafferty

I was born and raised in Behchokǫ̀. In 1963, I can recall going to residential school for a number of years. Later I became the Language and Cultural Coordinator of the Chief Jimmy Bruneau School. Every fall we had the fall hunt. We went to Courageous Lake, Jolly Lake, and Mohawk Lake to learn how to properly handle the caribou, how to sneak up on a caribou, how to care for a caribou, how to do a very good job. Traditionally, this tradition was passed on. You just take a knife and twine, that's all you have. You didn't have a backpack. You used to pack the caribou in a caribou hide. I used to love doing these things. Because of my health the last few years, I have not been out on the land.

Lisi Lafferty

I'm a daughter of Harry and Liza Koyina. I was born on Hislop Lake out on the land. I was also raised out on the land when I was really young. When there was a shortage of caribou and fish, my family moved to Ray Rock. That's where my dad and my brothers worked for many years. I was picked up from there and sent to residential school. I went to residential school in Fort Smith, then Fort Simpson, and then I went to Akaitcho Hall here in Yellowknife.

Mainly I'm an educator. I became a teacher in 1982 and got my teaching degree at the University of Saskatchewan. I worked as a teacher for many years. Then I became a principal. Then I worked as a curriculum developer. I produce material for our Tłı̨chǫ teachers to teach our children their language and culture. I can read and write in my language. That's why when people are writing things in our language, I'm very critical of them. If you write something in English and there's a spelling mistake, you're not going to put it up. But we see a lot of our language written and there's a lot of spelling mistakes and it really bothers me a lot.

My current position right now is with the Tłı̨chǫ Government. They have a land claim and self-government. They have an Intergovernmental Services agreement and in there they have a position for the Cultural Coordinator. That's the position that I have right now. So I make sure the Tłı̨chǫ Government, the Territorial government and the Federal government are not doing something that's going to impact our language, our culture and our way of life.

My main issue is communication. You have to have proper communication to be able to have an effective meeting, and make sure that our people and people working for the government are understanding one another so they can make the right decisions.

I have six children and twelve grandchildren. Mahsi.

Yellowknives Dene Delegates

Fred Sangris (Nogache)

I was born here in this town of Yellowknife before it became a city in 1957. I was born to a nomadic family. Both my parents were hunters and trappers. They lived the land. They didn't speak English at all. They used their own indigenous language, which I picked up very quickly at a young age. I remember travelling with sled dogs on the land. My mother would cover me in a blanket, and I would throw the blanket over so I could see where we were headed. My mother allowed me to see the country at five and six years old. Today I travel through the same country and I still see the same hills, the exact same hills. Maybe trees change over time, but the hills and the valleys are still there. Sometimes I stop and look at it and I say, "Oh yeah, this is where I went through with my parents years ago. The very same places we used to camp." I'm still happy to see that.

I had a brother named Fred Sangris who was a year older than me. He passed away around 1956. He was only two months old. I didn't have a name when I was born, so my parents gave me my brother's name, which I still carry. I have to carry that name with a lot of respect because it's not really my name. It's a name for my brother and I carry it for him.

My real Dene name is Nogache. Noyacha in Chipewyan is Wolverine Tail. So when he was a young man, 15 years old, Nogache went into the greater barrenlands. One day I was going to school and I really enjoyed it. But the next thing I know, I was yanked out of school and I was told by y grandfathers that I have to have my feet in both worlds in order to survive. I had my foot planted on ancient times, the history and I lived that time too. I was taken out on the land and I lived the way of the past.

I travelled and learned from elders. They lived with the caribou, they monitored the caribou and they followed them, just like the Tłı̨chǫ in the olden days. When the caribou were quite a distance away, you'd take your dog team, you'd take your children, grandma and grandpa and just go. That's how we were.

My father said "I want you to travel past the treeline where there's no wood. Your grandfather did that already, and I'd like you to travel on your grandfather's trail." So that's what I did. I went all the way to McKay Lake, Courageous Lake and Lac De Gras. In the winter of 1977 and 78, I went right to Lac Du Sauvage, right beyond Lac De Gras. At that time, white fox were $25.

Altogether I spent about ten years living up there. Everything was based on custom, traditional laws. Everything we did was by season.

I spent most of my time in the barren lands because my father wanted me to learn about using the resources. When I was 12 and 13, I was cutting a lot of firewood and my father noticed that I loved to cut trees at a young age. I still do it to this day. I cut firewood this morning too. I just love cutting firewood for the woodstove. My father noticed, that so one day he said, "We're going to move into the barrenlands and show you how to use the resources wisely." There are very few trees up there. That's I learned to use the resources. I only made a fire when I needed to cook. If I didn't need to cook, I wouldn't build a fire at all. Most of the time I was sitting in the cold. Thank God I didn't have a girlfriend at that time. She probably would have froze on me. It was cold. We would leave early in November and spend the whole winter there. About March 15th or 20th, we'd all come back to the community.

I was a competitive dog musher in the 1970s too. My father and I owned about 40-something dogs. All our uncles and our cousins, we were all in racing. That's part of the reason my father brought me up in the barren lands, so I could travel longer distances with sled dogs, and at the same time they were getting the exercise they needed. So it was a good life. There was plenty of white fox, plenty of caribou, lots of wildlife out there.

Randy Freeman (staff)

For the past year-and-a-half, I've been the director of lands for the Yellowknives Dene. I'm fairly new to Yellowknife. I think it's about 27 years. I still feel like I'm a new-timer coming here. Prior to that I worked in archaeology. My first foray into the North was in 1973, and I vowed never to return. I just couldn't stand the mosquitoes. Now I've gotten quite used to them. I just let them bite me in the beginning of each season.

I was born and raised in Medicine Hat, which I guess would explain my love of traditional placenames. The name Medicine Hat has a very interesting story. About 100 years ago, a bunch of businessmen in Medicine Hat got together and made up a story about it which people believe to still be true about some sort of Indian maiden and a medicine man's headdress and war with the Cree or someone. It's just all BS. The people that really still know about it say it's the name of some cliffs that look like a medicine man's headdress in the proper light when the sun shines on it at the right angle. It was a very important crossing of the river, and that's why they named it. It was about 1912 that businessmen got together to make up the big story about it.

Most of my career in the NWT has involved working with various communities on traditional placenames. Nowadays people may give the English name of a place or places where they are from, but qualify that by giving it the real name, the proper Aboriginal name. That's the way that I've looked at it for all these years. There are imposed names by explorers, geologists and anthropologists and then there are the real names. It's been my work over many years to try to make sure that those names are still used, still known, put on the maps where they can be. That's

one of the projects I hope to get into with the Yellowknives Dene, because they have traditional names that have been in use for many hundreds if not thousands of years.

Resource People

Michèle LeTourneau (EMAB)

I'm from a small town south of Winnipeg. It's a French town called St. Jean Baptiste. I didn't speak English until I was about six or seven. My family moved all over Canada when I was growing up. In 1998, I went to Rankin Inlet for a three-week contract. I fell in love with the North. The newspaper hired me and sent me to Yellowknife. I was surprised when I got off the plane, because it didn't look at all like Rankin Inlet. I worked at the paper for four years, and for the government for a year. I wasn't happy, so I got a job with EMAB and it's been an amazing experience. This is my favourite part; when people get together and try to get something going. It's my pleasure to be here and listen.

Shelagh Montgomery (SENES Consultants Ltd)

My introduction to the Northwest Territories was moving to Délı̨nę in 2000 after finishing university in Montreal. I lived in Délı̨nę just over two years, working with the Délı̨nę Uranium Team on issues that the community had with Port Radium, the former uranium mine. So I've spent lots of time as well in the Sahtu area.

When I moved to Yellowknife, I worked for an environmental non-governmental organisation, Canadian Arctic Resources Committee. We were involved in some cumulative effects work in what's known as the Slave Geologic Province. It's that area where we're looking at now where the diamond mines are located, stretching from the Yellowknife area or Great Slave Lake up to the Arctic coast. I did some work related to the Bathurst caribou herd.

For the last seven or eight years, I've been working for SENES Consultants, primarily in the Northwest Territories. We do a lot of mine site contamination or remediation work. I've done work with Łutsel K'e and in the Dehcho workıng with different Aboriginal groups.

Deborah Simmons (SENES Consultants Ltd)

My starting point is in Arizona, that's where I was born. My dad was studying mountain sheep, big horn sheep, wild mountain sheep down there. He got a job in the Northwest Territories and he didn't even know where it was on the map. But we got into a yellow Ford station wagon and travelled up to Fort Smith. He was studying Dall's sheep, and he worked mostly with Shúhtagot'ı̨nę people in Shúhtagot'ı̨nę Nę́nę́, the land of the mountain Dene who mostly now live in Tulít'a. So that's where part of my growing up was. As a wildlife biologist, my Dad realized that he was learning more about mountain sheep and mountain caribou from the Dene who lived with those animals than he ever could at university. Now I'm fulfilling one of his lifelong dreams, working on TK/IQ with knowledgeable Aboriginal people.

Natasha Thorpe (Thorpe Consulting Services)

I feel lucky to have worked on TK/IQ projects probably for about 15 years, mainly in the North.

I grew up on the coast in and around the Vancouver area. I was brought up in a very scientific family, and I ended up pursuing a science degree. My first job out of university was working up at BHP. At that time I remember my boss saying, "We have these elders coming in from Kugluktuk. Can you take them around in the helicopter and write down what they tell you about Traditional Knowledge?" I was just out of university and thought I knew everything. I had things to do, and this was going to mess up my whole day.

I spent the whole day flying around with these elders. They spent the whole day telling me there's a wolf den over here and there's going to be caribou over here. Every single time they were right. It was like your whole life you thought the world was square and then all of a sudden, someone tells you it's round. It really changed the way I started to think about the world and about the environment as a scientist. That was the beginning of my second education, which was primarily working with Inuit and having an on-the-land experiential education.

I spent most of my early twenties back and forth from the North. I can't seem to ever really leave. It's in my blood. Thank you.

Introducing the Diavik Team

Diane Dul

I was born in Fort Smith. My father was an RCMP officer. He married my mom, who is an Aboriginal lady and he got a dishonourable discharge from the force back in those days because they couldn't get married until they'd been in the force for at least five years, had a certain amount of money in the bank, etcetera etcetera, and my dad had none of those. He loved my mom dearly. They are still together, and they are going on their 57th year of marriage.

When I was very little, we moved out of Fort Smith and we moved down south. So I wasn't raised traditionally in the North. I really feel badly about that. I moved back up North in 1992, and I love the North. It's my home. It's where I belong. I came home.

I was very fortunate to end up working in the Environment Department at Diavik. I started working for Diavik in 2005 through the process plant operator's course. I was selected as one of the people to go through the course. I went up to the mine, did a six-week practicum and ended up with a full-time job working in the recovery plant. When we were in the recovery plant in 2009 when they had the shutdown, I was asked if I would like to go and work in the Environment Department for six months doing the Water Monitoring Program. They decided instead of laying off their Aboriginal workers, that they would transfer people from the process plant into the environment department to do the Water Monitoring Program, if they were

interested. They hired me, and later they asked me to stay in the Environment Department. They told me I'm going to fly around in helicopters and be out in the boats and run around on skidoos and monitor all the wildlife and do all these cool things.

I'm really excited about where this can go, bringing in the TK/IQ into it, sharing knowledge both ways.

Colleen English

I was born and raised in Winnipeg. I studied the environment and wildlife at university because I had grown up outside. I loved the outdoors, and it seemed a natural fit. While I was at university, we were out on a waterfowl reserve in Manitoba, and my professor saw a goose. The goose had been injured, it had been shot. But it was just its wing that had been damaged. It was running on the ground and trying to flap its wings and lift up. My professor stopped the vehicle, got out, ran after the goose, grabbed it, rung its neck, and put it in the back of the truck with all his students sitting in the back of the truck. We were all shocked. He just said, "Well, it wasn't going to survive anyway, so it might as well be dinner for somebody. I thought, "This is a whole new approach."

His wife taught Native Studies at the university, and he taught northern ecology. He put a very different twist on northern ecology, and he was focused on the people and the landscape. That really influenced me. One of the pivotal classes that I took a course with him and his wife in Churchill and it was an outdoor survival and education course. It was a week long and we built quinzis and igloos, we built trenches, we hunted, we trapped, we did everything and it was hard. It was cold. It was a long week, but it was amazing. We had help all along the way from local people in the community teaching us all the different aspects of living on the land.

Then I started to change some of the courses I was taking, started to look at life a little bit differently and started to think about where I wanted to live and what I wanted to do after that. I went to the High Arctic and started working up in the Resolute area and Prince Patrick Island. I passed through Yellowknife when I was going up there and loved Yellowknife. I started living here about 15 or 16 years ago.

Then I started working for Diavik. It was a very interesting job. It was getting to do all those little pieces that I loved. Getting to work with people in the communities and on the land. I really enjoyed all of those experiences. Now my newer job is melding those a little bit more. Before, it was strictly a lot of the environment work. Now I'm starting to get into working with TK/IQ, and help make some changes in how we do things.

Conclusion

The TK/IQ Panel members comprise a rich and varied body of knowledge and experience. In reviewing this document, panel members made it clear the discussions over the two days of the March session represent only a small fraction of the knowledge they and knowledge holders in their communities have to share about the wildlife and landscape in the Diavik area. In particular, much work remains to be done in reviewing, assessing and adding to existing caribou TK/IQ documentation. As well, the TK/IQ Panel is eager to learn more about the totality of monitoring, management and research being conducted by Diavik about caribou. A full session focused on caribou in the future should include presentations about the Traditional Knowledge/Inuit Qaujimajatuqangit and scientific states of knowledge about caribou in the Diavik area.

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RENEWING OUR LANDSCAPE

Envisioning Mine Closure and Reclamation of the North Country Rock Pile, Diavik Diamond Mine

Technical Report
June 26-28, 2012 TK/IQ Panel Session

Presented by

The Traditional Knowledge/ Inuit Qaujimajatuqangit Panel Environmental Monitoring Advisory Board (EMAB)

Bobby Algona, Mark Taletok, Mona Hiniak & Randy Hinaniak (Kitikmeot Inuit Association)

August Enzoe, Alfred Lockhart, George Marlowe, Darnian Marlowe & Helena Marlowe (Łutsel K'e Dene First Nation)

Ed Jones, Wayne Langenhan, Nicole Enge, Jackie Strong & Susan Enge (North Slave Métis Alliance)

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Compiled by SENES Consultants Ltd.

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No Prejudice

Section 2.1, *Environmental Agreement for the Diavik Diamond Project*

This Agreement is without prejudice to the positions of the Parties respecting any:

(a) existing Aboriginal or treaty rights of the Aboriginal Peoples;

(b) on-going or future land claims or self-government negotiations affecting Aboriginal Peoples;

(c) constitutional changes which may occur in the Northwest Territories;

(d) changes to legislation or regulations resulting from the settlement of land claims and self-government negotiations, or resulting from constitutional changes or devolution; or

(e) existing or future Participation Agreements.

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Report Summary

The Environmental Monitoring Advisory Board (EMAB) and Diavik are working collaboratively to develop an approach to Traditional Knowledge (TK) and Inuit Qaujimajatuqangit (IQ) processes required along with scientific research as the basis for sound planning related to closure and reclamation of the mine.

The TK/IQ Panel was asked to provide input on a vision for closure and reclamation of the North Country Rock Pile, and a process for community engagement and TK/IQ studies. Accordingly, a three day TK/IQ Panel session was convened June 26-28, 2012. The session added a new workshop component, providing opportunities for learning about some of the technical aspects of rock pile closure, as well as experiences and approaches to mine closure elsewhere.

The three sections of the report are as follows:

1. **How We Did the Work.** A discussion of the Aboriginal knowledge and cross-cultural learning approaches that informed design of the session and workshop.
2. **Results: Reclaiming the North Country Rock Pile.** Key messages from the session and workshop, as well as linkages with relevant previous studies and Diavik's May and August 2009 closure planning workshops. This section provides a window into the social and natural history of the mine site and the landscape; a scoping of values and concerns; and an indication of areas where there are opportunities for TK/IQ input.
3. **Recommendations for Action.** The consensus perspective of the TK/IQ Panel on reclamation and closure planning, and the panel mandate and approach.

Recommendations for Action

Reclamation and Closure Planning

The June TK/IQ Panel session provided direction on a series of three recommended focal points for cross-cultural dialogue during upcoming sessions:

1. Baseline studies: previous TK/IQ studies and archaeological findings in the ʔek'atı area.
2. Reference condition options for the rock pile.
3. Planning for biodiversity in revegetation, wildlife habitat, and capping options for the rock pile (differences from the target reference condition)

TK/IQ Panel Mandate and Approach

The panel made progress in clarifying its role in the broader framework for planning, management and monitoring at Diavik. Discussions gave rise to recommendations regarding clarification of the panel mandate; the need for State of Knowledge reporting on TK/IQ in the Diavik area; best practices in TK/IQ research; the role of the panel in community engagement; and the need for a system to measure success in TK/IQ processes.

Conclusion

This document expands on the proceedings of the June 2012 panel session and workshop toward providing a foundation for future panel work, specifically in providing inputs on closure and reclamation planning at Diavik; and more broadly in contributing to the purpose of the Environmental Agreement "*to respect and protect air, land, water, aquatic resources, wildlife, archaeological and cultural resources, and the land-based economy that are essential to the way of life and well-being of the Aboriginal Peoples"* (S1.1[d]).

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Introduction

The Environmental Monitoring Advisory Board (EMAB) and Diavik are working collaboratively to develop an approach to Traditional Knowledge (TK) and Inuit Qaujimajatuqangit (IQ) processes required along with scientific research as the basis for sound planning related to closure and reclamation of the mine.

Diavik is preparing a revised *Interim Closure and Reclamation Plan* for submission in 2016, with a final plan due in 2020. This must be approved by the Wek'èezhìı Land and Water Board (WLWB). The revised Interim Plan would incorporate findings from TK/IQ research and community engagements, including specific tasks outlined in the "Traditional Knowledge and Community Participation" section of the current Interim Plan (Appendix VII-1 [2011]). Diavik is required to submit an annual progress report to the WLWB.

Two of the goals identified in the current Interim Plan (Version 3.2, 2011) are "land and water that allows for traditional use," and "final landscape guided by traditional knowledge." Interim Plan 3.2 notes that "Diavik accepts future traditional knowledge considerations may influence or change the final landscape, in particular wildlife movement routes, final contours and surface textures."

The "Traditional Knowledge and Community Participation" Appendix identifies the need for community inputs in a number of areas, including wildlife routes, target areas for revegetation[1], and landform shapes. A particular focus identified by Diavik for 2012 is closure of the North Country Rock Pile.

The TK/IQ Panel was asked to provide input on a vision for the rock pile, and a process for community engagement and TK/IQ studies. Accordingly, EMAB convened a three-day TK/IQ Panel session June 26-28, 2012. Through a financial partnership with Diavik, EMAB was able to include youth representatives. The session added a new workshop component, providing opportunities for learning about some of the technical aspects of rock pile closure, as well as experiences and approaches to mine closure elsewhere.

[1] Although the approved closure design concept does not include revegetation of the rock pile.

Diavik Closure Planning Process and Goals

Diavik's closure planning began in 1996-1998, before the mine opened, and the Initial Abandonment and Restoration Plan (1999) was issued in 1999. Subsequent versions were published in 2001 and 2006. The current Version 3.2 was submitted in July 2011, and identifies the following eight goals:

1. Land and water that is physically and chemically stable and safe for people, water and aquatic life.
2. Land and water that allows for traditional use.
3. Final landscape guided by traditional knowledge.
4. Final landscape guided by pre-development conditions.
5. Final landscape that is neutral to wildlife – being neither a significant attractant nor a significant deterrent relative to pre-development conditions.
6. Maximize northern business opportunities during operations and closure.
7. Develop northern capacities during operations and closure for the benefit of the north, post-closure.
8. Final site conditions that do not require a continuous presence of Mine Staff.

EMAB and the TK/IQ Panel

EMAB has established a Traditional Knowledge/ Inuit Qaujimajatuqangit (TK/IQ) Panel with a mandate to assist EMAB in facilitating appropriate and meaningful accommodation of Traditional Knowledge/Inuit Qaujimajatuqangit (TK/IQ) in the planning and review of environmental monitoring at Diavik. The TK/IQ Panel consists of knowledgeable individuals appointed by each of the five Aboriginal Parties to the Environmental Agreement.

Prior to 2012, EMAB convened several TK/IQ Panel sessions on an issue-by-issue basis. In May 2011, EMAB held a workshop to explore how best to implement its mandate regarding TK/IQ. A first of a series of TK/IQ Panel session was held on caribou monitoring at the Diavik mine site March 14-15, 2012. Following a strategic planning session on May 20, 2012, EMAB decided to continue working toward establishing the TK/IQ Panel as a standing body. The current report is based on proceedings of the second TK/IQ Panel session, which took place June 26-28, 2012 with a focus on closure and reclamation of the North Country Rock Pile. A third panel session is planned for February 2013.

Who Are We?

The TK/IQ Panel is a standing body of knowledge-holders appointed by the five Aboriginal Parties to the Environmental Agreement related to Diavik. As often as is feasible, the TK/IQ Panel works with a youth delegation, also appointed by the Aboriginal Parties.

We have learned that the diversity of our cultures and experiences needs to be accounted for in our work together. At the same time, we share common interests as peoples who have survived from the land across generations. We work with a small team of resource people to ensure that our knowledge can be applied to the new conditions presented by the existence of the mine in our shared traditional territories.

Facilitation

Deborah Simmons, SENES Consultants Ltd.

Note Taker

Shelagh Montgomery, SENES Consultants Ltd.

TK/IQ Panel Delegates

Kitikmeot Inuit Association	Bobby Algona, Mark Taletok *Youth:* Mona Hiniak, Randy Hinaniak
Łutsel K'e Dene First Nation	August Enzoe, Alfred Lockhart, George Marlowe *Youth:* Darnian Marlowe, Helena Marlowe
North Slave Métis Alliance	Ed Jones, Wayne Langenhan, Susan Enge *Youth:* Jackie Strong, Nicole Enge
Tłı̨chǫ Nation	Pierre Beaverho and Louis Zoe
Yellowknives Dene First Nation	Fred Sangris, Phillip Liske

Observers/Presenters

EMAB	Michèle LeTourneau
Diavik	Colleen English, Gordon Macdonald & Seth Bohnet
Integral Ecology Group Ltd.	Ann Garibaldi
Dialectic Research Services	Kathryn Scott

What's in this Document?

This document reflects on three days of work together in June 2012, and is supplemented by a limited review of relevant literature. The three sections of the report are as follows:

4. **How We Did the Work.** A discussion of the Aboriginal knowledge and cross-cultural learning approaches that informed design of the session and workshop.
5. **Results: Reclaiming the North Country Rock Pile.** Key messages from the session and workshop, as well as linkages with relevant previous studies and Diavik's May and August 2009 closure planning workshops. Provides a window into the social and natural history of the mine site and the landscape; a scoping of values and concerns; and an indication of areas where there are opportunities for TK/IQ input.
6. **Recommendations for Action.** The consensus perspective of the TK/IQ Panel on our mandate and lessons learned about approaches to our work and measures of success.

The report weaves together summaries with background information and key messages from the TK/IQ Panel session, along with quotes from session transcripts, shared with the knowledge and approval of the speakers following review at the panel session on October 23-25, 2012. We share the quotes because these contain more of the full meaning of what was said. In some cases, the original narratives were spoken in an Aboriginal language. Unfortunately we are not able to provide the Aboriginal languages texts here, but have to rely on the transcripts of the English language interpretations.

Figure 1: TK/IQ Panel talking circle

How We Did the Work

Aboriginal Ways of Knowing

There are very few examples of this kind of work being done by a group of Aboriginal knowledge holders in Canada, or even the world. We are trying to use our traditional ways of knowing as five different nations working together, and addressing issues that are new to us as Aboriginal peoples in Canada. This is not easy. As Aboriginal peoples have always done, we are learning as quickly as we can so that we can address our responsibilities in a way that bridges the past with the present and future. Here we describe some of the processes that we've been developing for our sessions. The session agenda can be found in Appendix A.

Prayer

Aboriginal research might be understood as a form of ceremony (Shawn White 2008). The TK/IQ Panel indicates the spiritual dimension of our work by starting and ending our meetings with a prayer.

> It's only proper that we pray. Our elders always remind us to say an opening prayer and closing prayer whenever we meet, no matter what the size of the assembly. The reason why we pray in the morning is to thank the Creator, who united us together. The only guidance we depend on to do our daily work is the Creator's. That's the reason we pray. Thank you.
>
> *– Pierre Beaverho*

Talking Circle

Because of the cross-cultural context of our mandate and activities, we take a very flexible approach to our sessions. One of the methods that we rely on is the talking circle, which puts everyone on an even playing field as knowledge holders collaboratively working to create new knowledge. In the talking circle, we are all learning from each other. This requires that we practice the Aboriginal discipline of being respectful listeners.

> I like the way the chairs are set up in a circle. In the past, years ago, this is how the old timers used to sit. This is how they used to share stories and conduct their meetings in the past. This is how they had prayed. They sat in a circle. So it's just like doing what the elders have done. As a kid, I used to see them sharing stories. So I just like the way it's set up now to have a workshop and a meeting with the chairs in a circle. I don't mind at all. – *Pierre Beaverho*

I think this word "expert" is used a little bit loosely. To start off with, this is all new. It's never been done before and we're sort of stumbling in the dark. We're trying to do a good job the best we can, but we're by no means experts because this has never been done before. What we're trying to do here is get all our heads together and come up with the best solutions possible, but that doesn't really make us experts. – *Wayne Langenhan*

Youth Delegation

Elders have said many times that youth need to be involved in TK/IQ processes. Knowledge sharing is more meaningful when knowledge holders are able to address the future leaders and stewards of the land. Young people bring to the processes their unique knowledge of the cross-cultural circumstances for interpreting and applying the knowledge of their ancestors.

Figure 2: L-R Top Randy Hinaniak, Helena Marlowe, Jackie Strong; Bottom Mona Hiniak, Damian Marlowe, Nicole Enge

Participants in the March 2012 TK/IQ Panel session made it clear that they consider youth involvement to be essential. In response to this recommendation from the panel, EMAB invited each Aboriginal Party to delegate two youth to participate in the June meeting. Youth delegates from three of the five Parties attended the session. Over time, it is hoped that full representation will be possible, and the youth delegation might achieve a life of its own.

It is a challenge to support meaningful participation by youth delegates. Aboriginal youth are familiar with educational methods introduced in schools. However, many of these are also fortunate to have grown up with traditional methods of teaching in their families and communities. This involves disciplines of learning through listening, watching, and practicing.

During this first TK/IQ Panel involving youth, a gradual approach was taken to involving the youth delegates. This was an opportunity to become comfortable sitting in the talking circle, and to listen to the discussions in order to begin to become familiar with the role of the TK/IQ Panel and the objectives of the session. When they spoke, knowledge holders often specifically referred to the youth and the importance of their learning and contributions. As the microphone travelled around the talking circle, youth had opportunities to speak. They made it clear that they were absorbing and reflecting on the knowledge that was being shared. However, as was pointed out by Susan Enge, as the TK/IQ Panel evolves it will be useful to consider a variety of different ways to involve youth, including cross-cultural methods.

The final day of this panel session coincided with a graduation ceremony in Yellowknife, and became an ideal occasion for reflecting on the potential for involving youth in the TK/IQ Panel, in EMAB, and at the mine – continuing the thread of discussion started in the March panel session. The large number of references to the role of youth (eight references by different speakers were coded in the transcripts) is an indicator of the value placed on their participation by panel members, as well as the need to be conscious of how to achieve success in engaging youth at this early, experimental stage.

> We need youth. Even the youth in Rae Lakes, when we have meetings, we're leaving them out. It's their future that we're talking about. They need to be involved, so they can know what's happening in the community, on the land. So I would like to bring the youth from our region next time I attend a meeting like this. – *Louis Zoe*

> I think about young people all the time. When we talk like that for the young people, they are the ones who are going to speak for the next 10 years. Those are the ones who have to put a lot of things in there after us. They are going to take over. I'm happy I've got my grandson with me here and also my niece. Those kinds of people like that, it's very important. For that, I'll say thank you and we're still not over yet. Thank you very much. – *George Marlowe*

I know the youth is critical and I'm really personally glad to see them here today because they are going to carry the torch. We can incorporate youth by making our meetings more interactive. – *Susan Enge*

It's a good recommendation that the panel have more youth with them all the time. As Elders, we're not going to be here forever. The youth are going to be taking over what we're doing today. We want our wording to represent our youth also. Some thoughts may be changing in the future. The youth may have better access to how they put their wording down also. Thank you. – *Bobby Algona*

Myself too, at one time I was youth. All of us were once babies. And as young people, we were learning by listening. We didn't say a lot. We're learning. Even though we didn't talk, we learned a lot. Years later when I got older, all that listening helped me to learn to speak publicly. – *Fred Sangris*

Today I think we have a lot of youth graduating in our communities, in every region. We should pay our compliments to them. The Tłı̨chǫ Nation consists of five communities including Yellowknife and Dettah, so we make up a lot of the population. The future generation is growing and healthy. I would like to see students who have graduated work closely with the EMAB office and maybe doing some studies at the mine site, monitoring the water, the environment and the plants out there on the land. The Elders can't do this anymore. As an Elder, I'd like to see that. It's always good to have youth involved with us. The youth are the ones that will have to live through closure. I sure don't want to see them getting a good education and not doing anything with it. Along with education, you need Traditional Knowledge. That's where we as Elders come in. We can all benefit from working hand-in-hand with our youth and industry into the future. I sure hope that you'll be able to encourage youth to work with you in every region. They are the ones who we will have to depend on, and who will manage our destiny into the future. Thank you. – *Pierre Beaverho*

I'd like to say thanks to everybody here, all the youth, elders, board staff. This is the first time I've been to one of these meetings. It's a fun process learning and trying to get youth's input into it as well. I've had so much fun here. I definitely am looking forward to coming back to more of these meetings. Thank you very much. – *Randy Hinaniak (youth delegate)*

Site Visit

TK/IQ Panel members felt strongly that in order to speak knowledgeably about the North Country Rock Pile, it would be necessary to see it in person. There was extensive discussion about the reasons a site visit would be important (14 references by different speakers were coded in the transcripts). This speaks to a fundamental principle in TK/IQ, that "being knowledgeable" requires that knowledge from the past be properly situated in the experiential context being discussed[2]. As Louis Zoe put it, it's not considered appropriate to "speculate or assume."

There was consensus among TK/IQ Panel members that it would be impossible to talk knowledgeably about the rock pile as a feature on a map, narrative description, photos, video, or clay model – or all of the above – as was proposed at this panel session, in large part because it was a completely new feature for TK/IQ knowledge holders. There was no clear reference point that could be drawn from people's knowledge of the natural landscape. Colleen English noted

Figure 3: Diavik Site Visit, August 20, 2012. L-R Peter Huskey, Ed Jones, Louis Zoe, Pierre Beaverho, Bobby Algona, Mark Taletok

[2] Allice Legat (2012) discusses this principle at length based on her collaborative research with Tłı̨chǫ elders over more than two decades.

that in the past, Diavik had received similar feedback in discussing closure with Aboriginal stakeholders. A closure workshop was held at the mine site in 2009.

While requesting a site visit for the TK/IQ Panel, the group understood that it would not be feasible for everyone in the communities to see the site – for this reason, it was suggested that the site visit be videotaped. Although dreams for a visit the traditional way, through an on-the-land camp, were put forward, it was understood that this would not be possible within Diavik's safety policy.

Diavik staff responded quickly to the proposal for a site visit with an invitation for a day trip followed by a debriefing meeting. This invitation was welcomed. Speakers engaged in a detailed discussion about the timing of the visit, noting that the weather would be unpredictable and potentially very unpleasant during the originally proposed date for the visit in September. August was suggested as the preferred timing.

Several speakers proposed that youth should be included in the mine site visit, so that they too would have an experiential reference point for participating in closure discussions. At the same time it was understood that a small group might be preferable.

The site visit following from this TK/IQ Panel session was sponsored by Diavik and took place on August 21, with a debriefing session at the Yellowknife Inn on August 22. The mine site tour was conducted by Colleen English. Unfortunately, due to mechanical problems with one of the planes, it was not possible for Seth Bohnet, Michèle LeTourneau or Wayne Langenhan to travel with the group. Panel members on the tour were Deborah Simmons, Ed Jones, Bobby Algona, John Ivarluk, and Pierre Beaverho, Louis Zoe, as well as Peter Husky (interpreter). George Marlowe and Mel Enge joined the group at the debrief.

Figure 4: Site Visit Debriefing session, August 21, 2012. L-R Peter Huskey, Deborah Simmons, Bobby Algona, Pierre Beaverho, Mark Taletok, Louis Zoe, George Marlowe, Mel Enge, Ed Jones, Wayne Langenhan

We've seen just a few pictures there. I don't understand. The last time I was there was ten years ago. Today it's probably changed a lot. So it would be good if we all go down there and check around the mine, walk around and look at pile and the pit that you're talking about now. We should go down and see the mine twice a year, winter and summer. Just to see how the mine is working. We all have to work together. Thank you. – *August Enzoe*

It's hard to make a recommendation without seeing with your own eyes what type of rock pile you're talking about. I, for one, would like to go back to the mine site again before I make any decisions or recommendations. I need to see where all the waste rock piles are and where all the tailings ponds are, how that's going to be treated down the road, and how those things will be reclaimed.

We need to do our traditional knowledge work properly. Traditionally that's how we did it. You have to visualize and see for yourself and know where you're going and what you're talking about. The last time I was at the Diavik mine site, it was back at the early exploration stage. There was no airstrip at the time. That's when I was there last. – *Pierre Beaverho*

A lot of our elders don't know how to read and write, but I agree with what they said in the past. In order to do a proper job, you have to go and visit the site and make your own decisions, not to speculate or assume. A lot of the elders that travelled that area in the past knew exactly what land they were crossing, where they were going, what direction the prevailing winds were, where the eskers and caribou crossings were. That's how they used to travel. They had a natural instinct for navigating in the area. Thank you. – *Louis Zoe*

It's really hard to come up with a plan or even a really informed discussion about the rock pile and how we're going to design this man-made plateau. There are some Elders here who haven't been to the mine site for a long time. There are others who haven't been there at all. There are youth who haven't visited there. They don't know the scale of these things, what kind of undertaking it would be to have the material to cover something that huge. They are just guessing. They have nothing to go on.

The people that haven't been there, they don't know what they're dealing with. So it's pretty hard to discuss things when you don't know what you're dealing with. – *Wayne Langenhan*

What that photograph doesn't tell you is the boulders there are about the size of this table. They are huge boulders all broken up on the side of the hill. You don't see that on the photograph. You can't go and make suggestions on that model and say "Do it this way, do it that way." You're likely to make a mistake. You have to go see that site. You have to go and look at that rock, the size of that rock before you make suggestions and recommendations. We can't really work with the model because we haven't seen the type of rock that's there or the size of rocks. We don't know. – *Fred Sangris*

Learning from Others

Other ways of learning and sharing knowledge were incorporated into the TK/IQ Panel session in a "workshop" format to complement and inform the talking circle process. Presentations were made by Diavik staff (Colleen English, Gordon Macdonald and Seth Bohnet) and visiting resource people (Ann Garibaldi and Kathryn Scott), who provided examples of Aboriginal inputs into closure and reclamation planning from other places. Slide presentations are in Appendix B.

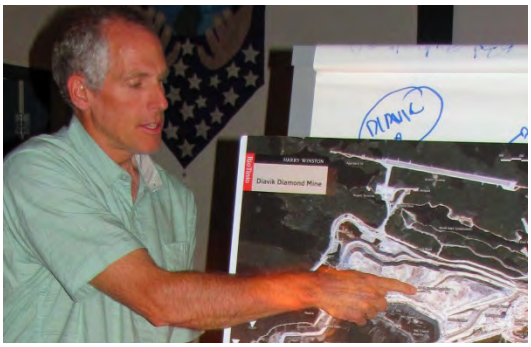

Figure 5: Clockwise from top left Gordon Macdonald, Ann Garibaldi, Colleen English

Diavik staff also offered opportunities to experience the rock pile by way of maps, short video clips, photographs at various scales, as well as a clay model. The possibility was offered of using computer modelling tools to reshape the rock pile during community consultations. In addition, Diavik staff prepared a demonstration including samples of different materials that could be used to cap the rock pile.

Workshop Presentations

- Gordon Macdonald, Colleen English and Seth Bohnet: "Diavik: Closure and Reclamation Planning"
- Ann Garibaldi: "Aboriginal Values and Reclamation"
- Kathryn Scott: "Examples of TK Integration"

Reflecting on Our Process

During the June 2012 TK/IQ Panel session, the second in the series, the session process expanded beyond the experience of the March session by including youth, as well as a workshop approach to some of the activities. Several lessons were learned in the process:

- The presence of youth significantly enhanced the proceedings; it may be possible to progressively develop mixed methods for engaging youth over future sessions.
- There needs to be coherence in the format of TK/IQ Panel sessions so that participants understand the flow of discussions as they relate to the session purpose.
- Cross-cultural learning processes can be very effective in providing knowledge holders with necessary context for providing meaningful input.
- TK/IQ holders are not comfortable speculating about situations that they have not experienced; a "reference condition" approach that refers to ecological features that resemble new scenarios may help to address this challenge.
- Site visits are invaluable as a means of educating TK/IQ Panel members about the closure process, and as a basis for developing process design for community engagement and TK/IQ studies.

Results: Reclaiming the North Country Rock Pile

The TK/IQ Panel session provided an opportunity for panel members to get an overview of Diavik's closure and reclamation plan, and to begin scoping options for closure and reclamation of the North Country Rock Pile. Presentations by Diavik staff and visiting resource people provided the context needed for the panel to understand their role and contributions in relation to larger processes underway. Panel members described their knowledge about the history of the landscape, identified concerns about the future of the rock pile, shared their values, and began to explore options.

What is Closure?

When mining activities end, the owner is required to close it down or "decommission" it through a formal process. A mine begins to close the day it opens. Closure planning needs to happen before the mine opens, since decisions made in construction and operation of the mine will affect the closure process and reclamation of the landscape. Diavik is required to regularly review and revise its Interim Closure and Reclamation Plan. Since Aboriginal people will live with the post-mine landscape in the future, it is important that they be involved in closure planning.

Figure 7: Diavik and the North Country Rock Pile (outlined in orange) and till stockpile (outlined in green)

Figure 7: Depiction of currently approved closure plan with flooded pits, waste rock pile and PKC pond.

What is Reclamation?

The mine has changed the land. It is not possible to restore all the land to exactly the way it was before the development. But reclamation projects attempt to establish ecosystems that serve the needs of society and the environment. People's visions for the land are the basis for planning reclamation projects.

Wildlife, People and Landscape

During the March TK/IQ Panel session, panel members were invited to introduce themselves by way of talking about where they were born and grew up. The June panel session provided an opportunity for members to share their historical knowledge of the landscape encompassing and surrounding the Diavik mine site. The richness of Aboriginal histories and knowledge of the area was remarkable. At the same time, it was mentioned a number of times that considerable documentation of traditional knowledge had already taken place through the Environmental Assessment process – and a number of the knowledge holders involved at that time are no longer with us. The panel sent a clear message about the value of past and present TK/IQ work as a baseline for understanding closure and reclamation values and goals.

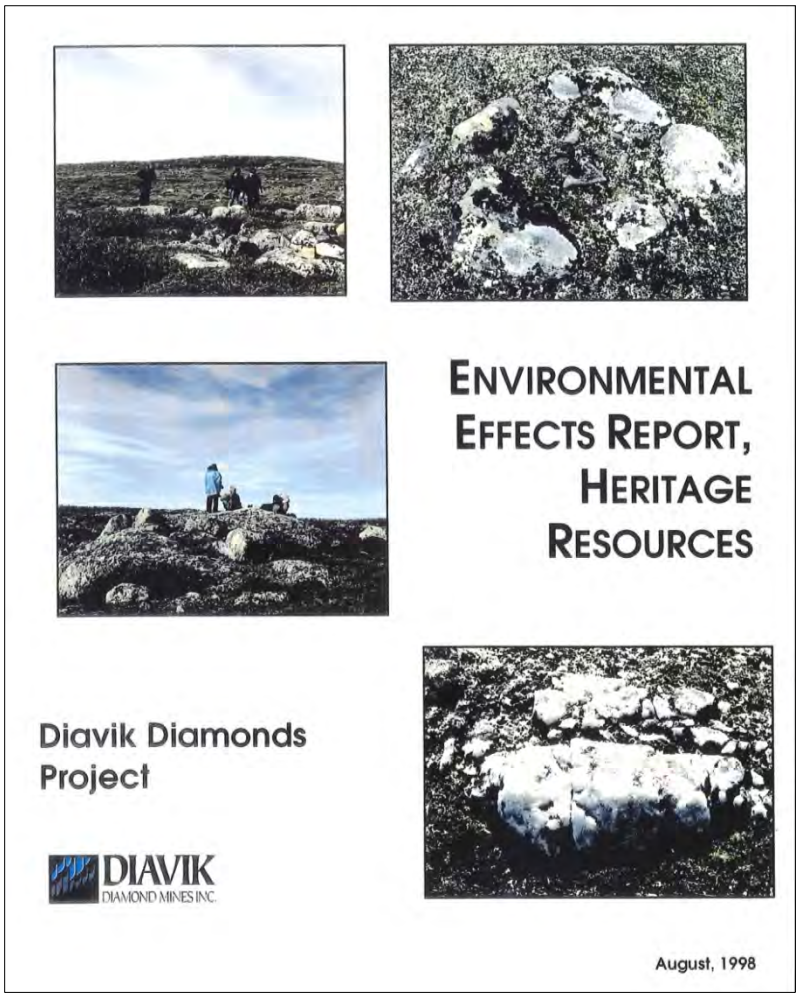

Figure 8: Cover page, Diavik Environmental Effects Report, Heritage Resources, August 1998

A History of Research

A comprehensive review of previous TK/IQ research about the landscape now occupied by Diavik is not within the scope of this report. However, it is important to highlight several processes that are especially important in collectively serving as a foundation for present and future TK/IQ research, as follows:

- Interviews conducted as part of the Committee for Original Peoples Entitlement (COPE) program established in 1970 to resolve the Inuvialuit land claim agreement.
- The Dene Nation Mapping project undertaken during 1974-1983 as part of the research for the Denendeh Dene and Métis comprehensive land claims process, including interviews with approximately 600 trappers in the Mackenzie Valley.
- TK/IQ research as part of the Environmental Assessment process prior to mine development.
- A number of projects related to the West Kitikmeot/Slave Study (WKSS) program during 1996-2001 that centred or included TK/IQ research, under the oversight of the Traditional Knowledge Steering Committee, including representatives of the five Aboriginal partners in the WKSS program.
- TK/IQ research programs and projects independently initiated by the five Aboriginal Parties since 1983.
- The State of Knowledge Report of the West Kitikmeot/Slave Study Area (SENES Consultants Ltd 2006).

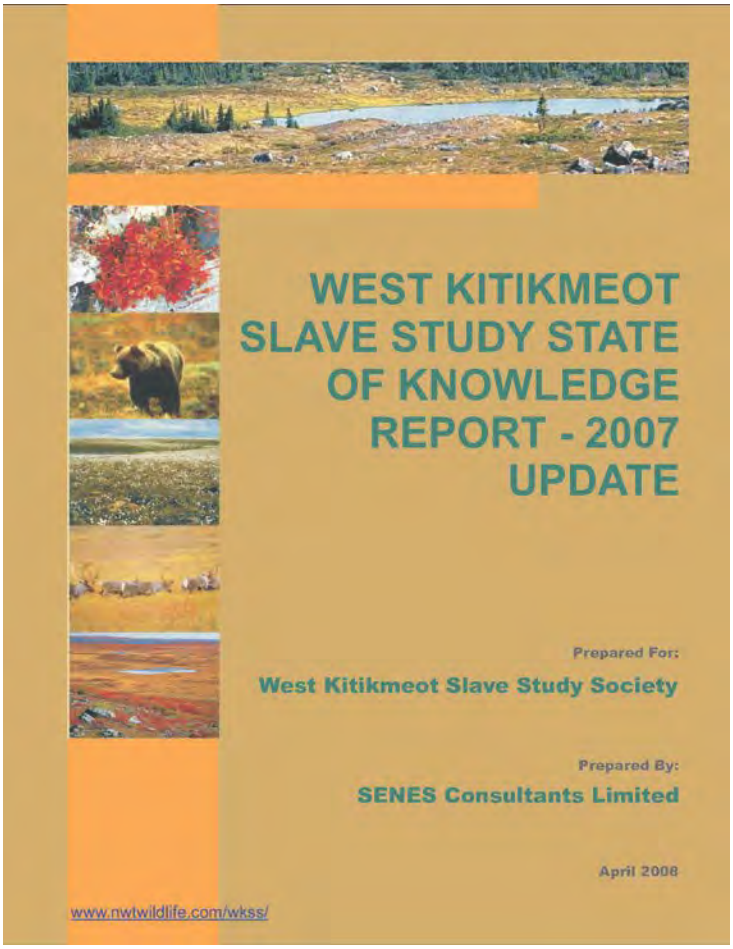

Figure 9: Cover page, West Kitikmeot Slave Study State of Knowledge Report - 2007 Update, April 2008

Back in 1996 or 1997 we visited the mine site, and at that time we did mention the caribou crossing there, and we recommended that we should do something about it. We should do this or that. We could put a fence on the side of the shore and see if it works or not. If it's not working, they could take it down. We talked about those things. At that time, there were lots of caribou on that island. It was August when we were there. Some of them were sleeping on hills. Other ones were sleeping under a TV dish. There was a whole bunch of them. It's not like that anymore.

So we did put a lot of words in there, but nothing was done. Now they are going to start to work on it after all these years. I wonder what they did with the data that they wrote down back then? I'm confused. I don't know why we didn't work on it.

I've been to the Diavik mine site how many times now? Since way back when it started opening. We put a lot of work in related to the mine and how it should be designed. I look around and realize that a lot of the people I worked with from Behchokǫ̀ and elsewhere are not with us anymore. They are all gone. It's only me sitting here now. There were books written on that, way back in the 1990s, how to deal with caribou around the island. But there doesn't seem to be anything happening. Now we are just starting over again. The same words are coming up again. Thank you. – *August Enzoe*

Figure 10: Louis Zoe

Homeland: Placenames and Cultural Landscapes

The five Aboriginal nations represented on the TK/IQ Panel each have distinct languages and histories. Each of the nations, as well as each individual, brings a distinct overlay to the cultural and historical landscape of the mine, providing their own nuance to the socio-ecological knowledge of the area. This diversity is indicated in the placenames and stories that panel members have shared – including the new Métis name for the lake suggested by Ed Jones – that demonstrated the intimacy of their relationships with that place, as well as the ecological, cultural and spiritual values accorded to it. At the same time, the panel members shared a common interest in renewing the health of the land.

We came to learn that more work will be needed to fully understand the baseline for closure and reclamation planning – the meaning of homeland.

In Yellowknives Dene language, that whole island that Diavik Diamond Mine is on [East Island] is called ʔek'adı. ʔek'atı is the name of the lake. So ʔek'adı is an island, ʔek'atı is the name of the big lake.

There are five groups here, and we all have different traditional names of that lake. Every one of us probably has different names for that lake. We all use the same area, but we have different names for the same area. Bobby Algona and his people used to trap way out at Pellet Lake north of ʔek'atı in the 1970s. I used to trap just south of ʔek'atı, but we used traditional placenames that our grandfathers have used in the past.

The land is very important to us. Back in 1865, my grandpa was born on the land at the Coppermine River called Sahdezeh. People used to travel out there to go hunting for muskox and caribou. My grandpa has a lot of stories. He lived to be about 105. His son, Morris Sangris, was with him out there on the land when he was about three years old. At that time, an epidemic came around, so they went further up to the barrenland because of the sickness.

In 1976, when I was a child, I used to go out by dog team to the barrenlands. We had to travel, so we used a dog team. At that time, they had about five dogs for each team. If you have less dogs, you can travel further because it's a lot of work to feed the dogs. So I travelled on my grandpa's trail and my dad's trail. I followed where they went and listened to the stories they were telling me about life on the barrenlands and right down to Yellowknife. There are a lot of gravesites along this route.

The most important island on ʔek'atı is ʔek'adı where Diavik Diamond Mine sits. That's where the food source is for the caribou. It's also a shelter for caribou when they get injured. It's a shelter for small calves. That country is mostly esker and muskeg, and the island is good for young caribou. After the long migration, they just swim right along the channel. It's not a long

channel, but it's a safe place for caribou where they can hole out and gain some weight with a lot of good feeding areas. South of ʔek'atı is really jagged rock country. It's a place where caribou could get injured. There's a lot of rock. On the eastern side of ʔek'atı is sandbar, muskeg and rocks, but it's a good place for caribou migration. The island itself, ʔek'adı, is well known for caribou habitat. Caribou just love this island. – *Fred Sangris*

Traditionally, when we wanted to go meet the caribou further south from where we lived because migration is a little bit slow coming slow this year, sometimes we go down and meet them even down past McKay Lake sometimes. We called the lake that Diavik Diamond Mine is on Hivogakhialok, referring to the big lake that is the southern part of our huntıng territory. – *Bobby Algona*

We used to trap in that area. In our language we would call that Łuecho Kúé or Łuezáné (Big Trout Lake). That's what we call it all the time, that's what we've always called it. We don't change what we call it. – *George Marlowe*

I have a name for that lake, François Beaulieu. He was one of the first Métis in the North. In fact, it was François Beaulieu who brought a priest to Salt River just out of Fort Smith, and he helped introduce Christianity to the natives and Métis. – *Ed Jones*

When I first went and visited the island, it was some time ago with some other elders. The elders are not living with us today, but when I first walked over to the site before the construction started, the land looked the way it's always been. Today, there's a huge rock pile over there, a waste rock pile. In the early days, Dene people used to use that island. That's where they used to hunt caribou and that's where most of the caribou used to cross the water. That's where they used to kill caribou to get some meat out of it.

I'm an old-timer. I'm over 80. The kinds of stories I want to tell you are about how our ancestors and elders survived in the past. It was a real hardship in those days. The ancestors travelled by dog team and canoe. They trapped for furs and set nets. Today we have everything that we need to survive. When I was young, I never saw white man's food. We survived on the animals of the land. We went hunting for caribou, hunting for moose.

All those things they did a woman would do, we had men doing those things too because we didn't have no women along with us. It was only the men who would go. How women worked, we had to work the same way, fixing meat and making drymeat. We would fix all the caribou hides, and we would scrape them and everything.

Those animals gave us shelter and meat. I never bought clothes from stores. We had them made through animal fur and hides. Our elders would go out and get furs – beaver, muskrat. In fall, they'd go out on the land until the spring comes. They would hunt and trap.

Then at this time of year they would gather in Behchokǫ̀. They'd make a big ceremony, a big feast. About July, during Treaty Days, they would gather again for the big event. They would come in with a boat from the outlying communities. That's when they would bring in all the furs that they caught through the winter. They would trade them for goods. They had a Hudson's Bay in Behchokǫ̀. People would all gather there. At that time, the Hudson Bay don't have money. Whatever we'd bring in, he'd give us some kind of ration and write down what the fur was worth on paper. We didn't get no money. Sometimes we traded for goods. That paper that they gave you, it was similar to getting an income from the government. He would keep the paper too.

The supplies would come in at this time of year by boat. There was only one shipment a year, so over the rest of the year there would be nothing in the store. After that, a boat comes in, a lot of stuff comes in. So when they'd give you that paper for the fur, you could get things out of it when that big shipment came in. So everyone would come in, and the store would empty out.

When people travel to the barren lands, they used to start out in August. The caribou are out there on the land during that month. The people know it, and they try to get there before the caribou migrate down. We would go there by canoe. We could see the caribou crossing and the caribou swimming. It's still warm at that time in August.

Figure 11: Pierre Beaverho

It was kind of hard at that time too. I witnessed that myself. That's why I'm telling the story. It was hard in those days. We didn't know no white people. There were no white people on our land. We didn't know no government agencies. At the time when Monfwi took the treaty, there were RCMP stationed in Behchokǫ̀, and one store, the Hudson Bay, and the priest. That's all. We survived without government and without white people. We survived without them. It wasn't until after I got

married that white people were starting come into our region.

In those days, our land was beautiful and healthy. We had fresh water, healthy animals, and good dog teams. Even the small animals were healthy. We had a beautiful landscape. When we went out on the land, we felt happy. We felt fresh. Elders love the land, they love the animals. We are protective of things. The land should be protected.

But today, since white people have come on the land, they have started doing development and they are destroying the land. We didn't do the damage, because we care for the land. The mines are getting all the licences now and opening all the mines and they are making big disturbances on the land.

The government has destroyed our land. They are giving the permits and licences to the companies. To think about it, we never did get any benefit from this. Now we are starting to negotiate, we are trying to get something. But it seems we are suffering more. We should get some kind of benefit.

If I look at it today, there's a huge waste rock pile, what benefit is it to us? Probably all we're getting is the damage that's already done and we're not too happy with it. But here, somebody has to do some work that we're doing. That's the reason why we're here.

I've got a lot of stories. I just want to share this story with you. Thank you. – *Pierre Beaverho*

For thousands of years, the Dene people lived on this land, slept on it, hunted on it, and they never damaged the land or polluted the land. Before the white man came, everything they used for tools and for food sources came from the land and water. They lived off the land well. Through the generations it was passed onto them how to live off the land through the spirits.

A long time ago, when people were surviving out on the land, they had spiritual power. They used to turn themselves into animals. If you wanted to be a caribou, you could be a caribou. If you wanted to be a wolf, you'd be a wolf. They would talk to one another at the time because they had the power to do so at that time. They say the grizzly bear have arms like a human being. A lot of them don't eat bears because of that.

The caribou and other fur-bearing animals used to have meetings. They'd gather themselves and say, "This is what I am, and this is what I'll do for my fellow human beings. They put me here for that reason."

There are a lot of stories like that. I just wanted you to be aware of it.

The First Nations people respect the land and they respect the animals, and even the fish. When we are done with the bones or the hides, we don't just throw them anyplace. We don't just throw the fish bones back into the water. We place them underneath the branches or the trees. It's Dene law to do that and respect the bones. It's a custom. In the long run, if you don't do this you'll get bad luck. If you look after and respect the animals and the fish, the animal will return and respect you and provide you with your food sources. Thank you. – *Phillip Liske*

Landscape and the North Country Rock Pile

In reflecting on the task at hand, providing guidance on closure and reclamation of the North Country Rock Pile, TK/IQ Panel members spoke about the ecology of the landscape encompassing the mine site. There was discussion of the differences and similarities between the rock pile and eskers or boulder assemblages – and the group began to consider what the options might be for reclaiming the rock pile in relation to those landscape features and the needs of people and wildlife.

I've been on the barren land a lot of times hunting in August and September. There are lots of sandflies when it's hot, and the caribou like to stand on a hill that's blowing. Think about that too. Eskers shouldn't be touched. There are lots of foxholes and dens for wolves and grizzlies, that's where they sleep. And maybe that rock pile should be left there, or put more black dirt so the plants will grow on it again. – *George Marlowe*

When we were young, in the 1940s and 1950s, we used to travel down to the barrenlands. We would see a lot of outcrops of rocks and mountains. It was good scenery. The waste rock pile itself is just like a manmade island, or some sort of a pyramid. So to us, it's kind of an eyesore. Yes, on the barrenlands we would see a lot of good soil out there that you can find on the eskers. – *Pierre Beaverho*

In the summertime, sometimes they would put graves on top of the hills. I keep travelling in the sand areas, and I've seen a lot of things out there. There are a lot of good sand areas with gravesites. So I questioned the elders a long time ago. They said that when people used to work out on the land, they couldn't bury a person because of permafrost. So it was best place to bury them was where the sands are. When I see sand, I go there and I go on top of the hill, and I know I will find a gravesite there.

I work for the Yellowknives Dene First Nation and help with their mapping projects. The elders have told us where the gravesites are, who the living relatives are. We've talked to them and questioned them. We went out there hunting in the fall-time. And the relatives to the ancestors in those gravesites came along with us because they want to visit the graves.

There are stories to them too, how far they travelled and how far they walked. There are trails they were travelling on. I hope the sand on the barrenlands is never removed We don't know the rest of the gravesites out there, so it's really important that the sand never is touched.

In 1995, BHP visited the community and they wanted to use the sand. But we as the Yellowknives Dene First Nation said no, not to touch the sand. So they're not using them.

The Yellowknives Dene First Nation have three gravesites in the ʔek'atı area. They are our relatives. We are monitoring that area so it's not disturbed.

The animals are also important. Grizzlies make a den towards the sun on a hill. When the snow is melting, they know inside the den will dry right away. The animals know where is a good place for a den, towards the sun.

The caribou love their calves. When they travel, they don't want to go on a rocky place. They go on the eskers and sandy places. Sometimes they will go on the hills. Caribou and muskox know where the good places to travel are. But the sand is really important.

A long time ago when there was a war, non-Aboriginal people killed a lot of muskox to use. Today we have a big population of muskox coming down this way. So we're monitoring those things too.

If you see sand, there would be a gravesite there, and animals would use that place. Those are kinds of things that we need to monitor. So those kinds of things should be left alone. – *Fred Sangris*

Figure 12: Fred Sangris

I consider the rock pile to be just a boulder field. It's just a big, black hill compared to the colour of the eskers, it's totally different.

On eskers, there's permafrost under the sand. When you get up on top, it's always cold. Any little pond or lake or anything that gets on there, it's super cold all the time. Very few plants grow on there. Try swimming in the little ponds on the eskers. You think most ponds are warm, but these little ponds are super cold. You don't see little bugs that can survive in there.

Eskers are cool in the summertime. Wolves, foxes and grizzly bears tend to dig in that esker and keep cool in the summer time. The grizzly bears tend to stay close to the berry patches, where the blueberries, blackberries, cranberries grow.

When we walk around an esker, we know that there's going to be a natural foundation of super cold water flowing out of the eskers. That's permafrost flowing out of these eskers. In summertime, you feel the urge to go for a few berries. Sometimes we tend to get hot, and we want to find some cold, cold water, we need a cold drink as we're walking from here to there, and we look for these natural foundations. We drink a couple of gulps, that's all we can manage, just a couple of gulps of this super cold water until your throat gets frozen.

This rock pile is going to have some super cold spots inside, just like an esker. It's going to have natural fountains building up as years go on. – *Bobby Algona*

But if you make the rock pile walkable for caribou, then they'll probably go onto it. If that's the case, then have you made observations of caribou and other eskers or hills? If so, what have you found? I don't have firsthand knowledge, but I can consult the elders to see how they interact with hills and eskers.

– Susan Enge

Figure 13: Susan Enge

Learning about the Rock Pile

The North Country Rock Pile is a major new feature on the landscape, 500 m (1/3 mile) wide, 2.24 km (1.3 miles) long, and 70 m (230 feet) wide. At the east end of the rock pile there is a pile of "till" that is 500 m (1/3 mile) in size. This is material that's being saved for use in reclamation.

Right now, the rock pile is composed of large boulders from the mine pits, and within the rock pile is a landfill site for storing other kinds of waste from the mine operations.

Surrounding the rock pile are collection ponds (similar to what Bobby Algona described as a castle "moat"). Water collected in those ponds is pumped into the treatment plant before it flows into the lake.

The rock pile will not grow any more, since Diavik has stopped open pit mining, and there is very little rock that comes from the current underground mining. So the timing is now good for Diavik to start closure and reclamation of the rock pile.

Diavik has eight goals for closure and reclamation that were listed in the introduction to this report. Related to those goals, there are three main objectives that need to guide plans for the rock pile:

1. The slopes on the sides of the rock pile need to be stable and safe for people and wildlife.
2. Rock and till pile features (shape and appearance) should match the look of the surrounding natural area as much as possible.
3. Contaminated soils and waste disposal areas must not contaminate the land and water, so must be "capped" so that they are contained.

Within these objectives, there are a number of aspects of reclamation to be considered, including the shape of the pile, the kind of material that should cover the pile, how the water should flow off the pile, the kind of vegetation that should be supported (if any), and whether wildlife and people should be encouraged to go on the pile or be kept away from it.

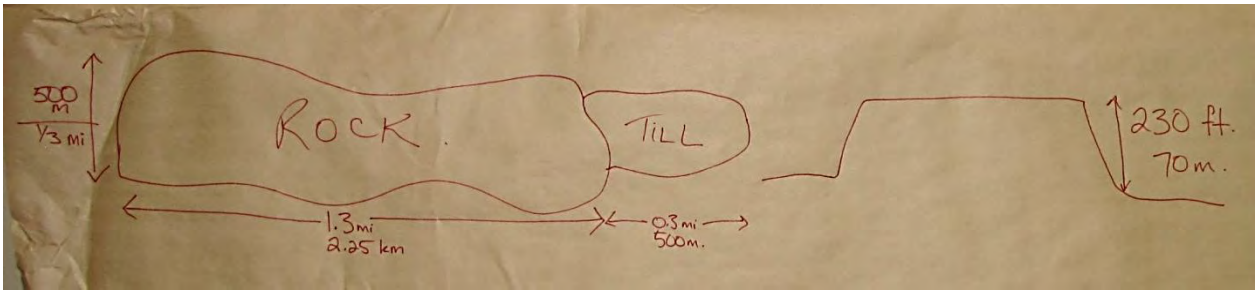

Figure 14: North Country Rock Pile shape and dimensions drawn by Colleen English, site visit debriefing session, June 21, 2012

Identifying Concerns

A variety of concerns were discussed by TK/IQ Panel members for consideration in rock pile closure and reclamation planning. Panel members recognized that some of the concerns are the result of limitations of their own knowledge of rock pile conditions, and several times there were requests for more information from scientific experts as a basis for consideration from TK/IQ perspectives. The following are the seven key areas of concern that were identified, with a series of quotes to illustrate these. There were also concerns expressed about other aspects of the mine, including in particular the dyke and plans for flooding the pits, but these are not within the scope of this report. Careful consideration of these concerns is useful in developing risk management and communication plans.

- Contamination and water flow
- Caribou health and safety
- Future land use
- Waste materials
- Invasive species
- Global warming
- Accountability and follow-up

Contamination and Water Flow

Understanding the risks of contamination caused by exposure of waste rock to air and water led TK/IQ Panel members to articulate concerns about risks that seepage from the waste rock would lead to contamination that could affect wildlife, vegetation, fish, lake water and, consequently, people.

Figure 15: Waste rock pile. Photo credit: Diavik Diamond Mine Inc.

The rock pile itself, it must have a lot of materials in there, toxins for animals and maybe it's a toxin for any plants and might affect their growth. – *Pierre Beaverho*

We don't really know too much about what's in the waste rock in terms of toxins. It would be good to know what's in the waste rock. Once we understand this, then we can help. We need to know what the harmful effects are. – *Fred Sangris*

I was thinking about not only about the vegetation, the water, the fish and the air. All the elements from the waste rock are going to wash down to the lake sooner or later, because the water is beyond our control. You get high winds, lots of slush, and sometimes it rains. From slush, they get lots of wet water coming down onto the ground and it goes into the lakes.

My concern is for caribou, fish, and water. When people do go up hunting in that area after the mine closure, are they going to get sick from it or are they going to get cancer? We've got to watch those things. – *Phillip Liske*

The people who are expert in that should talk to us about it because I'm pretty sure there's lots of metal in that waste rock. When it rains, it's going to go onto the lake. That rock pile is too high, and it's really packed now. It's been nine years, and it's really packed underneath. The bottom must be really hard. I don't think water will go right through now, but it will run off. – *George Marlowe*

We don't want to see a pool of water on top of a rock pile. Once a pool of water forms up, it gets bigger and it becomes a little lake. That's when the animals are using it. – *Pierre Beaverho*

I'm wondering whether Diavik is going to be monitoring this rock pile. At the bottom part of the rock pile there is going to be a lot of water seepage and water flowing out of there into streams and into the lake. Wouldn't it be feasible that this water be contained in the castle, I call the Rock PIle a castle, around the mine itself until everything is all clean and safe to open and let the water go through? That's been one of my big concerns.

I was thinking you see in those pictures of people with castles that have moats around them. Looking at the rock pile as a castle, maybe it would be possible to build some kind of moat or something to contain and monitor the water that's coming out of the castle. Thank you. – *Bobby Algona*

Caribou Health and Safety

Caribou safety was a core concern discussed by the TK/IQ Panel. The focus on caribou in part is related to the value of caribou for survival and spiritual and cultural well-being, and as sensitive beings that need to be treated respectfully. Caribou were also on the minds of the panel since they had just completed review of a report on their previous session on caribou monitoring. TK/IQ Panel members were most concerned to talk about risks to caribou during mine operations, and there were suggestions made about ways and means of keeping caribou away from the mine site.

All mines in the North all have an impact on wildlife as well as cultural and traditional people who make a living on the land. Years ago, we tried to come up with traditional methods of driving the caribou away from the mines. There's probably a good, old, traditional way of doing it.

Diavik Diamond Mine sits right in the middle of the great caribou migration path, right in the centre. There's no doubt about it. They don't migrate further east or further west. It migrates in the centre of it. That's why the caribou always up at Lac de Gras during the summer, sometime in early or late July. They always seem to go there. Even in late September, the caribou are still hanging around there until freeze-up. The caribou are aware of their natural surroundings and where the main herd is headed and where the other herds are scattered. They have a sense of where they are.

So I think Diavik and other companies have to understand when they put the mine there, they put the mine in the path of the migration. That's why it had such a big impact. Many Aboriginal people here spoke in defence of the caribou because we don't want the caribou to be harmed in any way.

Caribou feet are really soft, so they don't want to go through the rough country to get around the mine. For them, the safest places are the soft ground near the

mines. One time, I think it was in 1996, we tried to get the caribou to go at the crossing at Lac du Sauvage. But when we went there with the elders, we found two drowned caribou, one calf and one older caribou that had their hooves caught in the rocks in the river at the crossing, and couldn't get out.

So we told Diavik Diamond Mine that they should put some padding or something there so caribou can cross that little river. It's not a big river, probably three or four feet, but the caribou get caught there and they drown. So we have to find a method to make their crossing much safer. The calves who are just weeks old are making their way to Lac de Gras as well. Lac de Gras where Diavik is used to be a haven for young calves to catch up, feed and rest because they are tired after a long journey. Of course, the wolves are right behind them. So they have to rely on the island for security.

But we have to try to find other ways to help the herds get around the mine safely so they can get to other lakes further south. Those other lakes have islands as well. That's where you'll find some of the smaller herds and injured caribou. Injured caribou find a way to heal themselves. When a caribou is injured, he leaves the herd and goes to an island on his own. He'll stay on the island for weeks on his own until he heals. When he's ready, he'll try to find the main herd. When a caribou is injured, they don't go with the main herd. They move away from the main herd because the wolves can spot them out pretty quick.

We told Diavik many years ago to try to take some of the soft sand and cover all the jagged rocks at that crossing so the caribou can get in the water safely and come out the other side safely. That's one of the recommendations we made.

We have to make the other crossings safer before we do that before we put up traditional rocks or traditional ways of driving the caribou away from the mine. We can probably talk about finding different way for caribou to travel. Through our panel we can probably share all these ideas and try to come up with a good recommendation, a good solution, on how we can do that. The more we talk, we'll get closer to the idea. – *Fred Sangris*

We should share really good stories about the caribou that we're talking about. In the ʔek'atı area, at Diavik Mine, we know from our stories that the caribou would swim to that East Island, as long as we can remember. Our elders used to go by birch bark canoe out to the tundra. They would paddle all the way up to the East Island on ʔek'atı. That's how they used to harvest and kill caribou. Our elders used to live there. It was a good area for caribou to eat, with good lichen. They should fence that area because I know for a fact that the caribou would swim to

the island. If we fence that whole island, maybe the caribou won't go to the mine site. We can fence off that whole area on East Island. – *Pierre Beaverho*

The caribou should not be negatively impacted. I think they underestimate the importance of caribou. We're in court right now over caribou. It's important to us. So we need to do it right and we need to take the time to do it right. – *Susan Enge*

Future Land Use

The TK/IQ Panel discussions about the future of Aboriginal land use in the area of the rock pile were inconclusive. This is consistent with some Aboriginal cultures, where it is considered to be inappropriate and even bad luck to make predictions, since "nature is the boss."

There was pessimism expressed that the rock pile could in the foreseeable future be a desirable place to visit. However, Pierre Beaverho provided an alternative perspective, paralleling comments to the effect that if the rock pile were made accessible and safe, caribou would want to travel across it after closure. Historical narratives in this report and elsewhere indicate that as they always have done, the Aboriginal harvesters with roots in this territory will travel where the caribou go. Phillip Liske's comment that the land encompassing the mine site is a homeland points to the prospect that the five Aboriginal peoples will renew and maintain their relationships with that area for generations to come.

Most of the people are still using the land, all the impacted groups that are here today are reusing it. My ancestors, they used it in the past. It's not to say the future generations aren't going to use it. For sure they will be using it. We have to beautify our land as much as possible. – *Pierre Beaverho*

The Aboriginal people have the homeland. This is our land here, our land base. Some have treaty land and some don't, but it's still our homeland. – *Phillip Liske*

Waste Materials

Diavik has a regulator-approved landfill in the rock pile that is designed to be used throughout the life of the mine. Wherever feasible, items are recycled, burned or backhauled for reuse elsewhere. Input is being sought about what should and should not be dumped in the landfill. The landfill is inspected by INAC, and an update on the landfill is included in Diavik annual reports. TK/IQ Panel members directed a number of questions to Diavik staff about the landfill site, and expressed a lack of awareness about the landfill and the provisions under which it was approved. A number of concerns were expressed by reference to experiences with other abandoned mines.

I know there's lots of metal in the rock pile that's been crushed. Lots of metal. What's going to happen in the future after thirty years or forty years? The metal under the ground will be rusted. I'm pretty sure the water from under there will go into the lake. It's the time to talk about those things. – *George Marlowe*

There are lots of things that have gone wrong in the past that we couldn't do nothing about it. We couldn't even speak against it. Today, we have the opportunity to be able to communicate with the Diavik company that is hurting the land. I see that we have some abandoned mines in our area, the Beaver Lodge area. They left a big airplane, a big Bristol airplane parked right on the shore of the lake. Not only that, they just left Terra Mine as it is and all the debris is sitting there. It still requires a cleanup.

I don't know what you guys do about recycling, but I'd like to see every material possible be recycled. I don't know about just leaving it there in the land because it wasn't like that before. I don't know how the caribou and whatever will react to everything. Thank you. – *Jackie Strong*

Invasive Species

Fred Sangris pointed out that invasive plant species brought into the mine could be a real danger to the natural biodiversity of the landscape.

The other danger too is opening up new areas. If you look at the highway from here to United States all along the highways on both sides, and the highway across Canada as well, there are foxtail plants. They are not native to this area. A lot of the plants and seeds fall off the trucks that haul supplies up here to the mine site. I've seen it at Lupin Mine. I was kind of terrified because once foxtail plants start growing, they just take over. The native plants will die off. That's a danger to this area.

If Diavik wants to do some planting, they need to get rid of the foxtail plants. Once they flourish and grow, they are going to go across the mainland and go all over the land. They are one vegetation plant that we are really going to have a problem with. Once they grow, they grow quite a bit. So you must come up with a plant that can fight back and get rid of it. Otherwise we're going to have the barren lands full of foxtails growing all over the place an it's going to be really bad for caribou, lichen and everything else. That's one plant we have to try to understand and try to combat.

You can plant some real good native plants here, but the introduced plants will probably overtake them. One thing they have to do is study the non-native plants and see if they are a threat. If they are a threat, then they should somehow be removed or minimized. You need to keep pushing the native plants. They can really grow fast and cover that whole area. Nature can come back. It will take its time, but doing the right thing will probably help speed it up real quick. Thank you. – *Fred Sangris*

Global Warming

Susan Enge raised a question about the effects of global warming on the rock pile. Colleen English pointed out that the rock pile has been modelled for global warming over the next hundred years to see what might happen as annual temperatures rise. There are instruments that are in the pile that can give us the information needed.

Accountability and Follow-Up

TK/IQ Panel members want to know about the kind of follow-up that will take place to address issues raised at their sessions. It was clarified that all concerns are documented, and EMAB makes decisions with input from the TK/IQ Panel about recommendations to be forwarded to Diavik. There has been an effort since the caribou monitoring TK/IQ Panel in March to make progress on TK/IQ recommendations related to caribou monitoring. It is expected that there will be similar follow-up and reporting to the panel following the current session.

Exploring Options

Diavik staff presented three options for rock pile closure that had been identified at an on-site workshop with Aboriginal delegates in 2009. However, these options emerged from a focused discussion about caribou movements, and did not account for the full range of values and socio-ecological components to be considered.

TK/IQ Panel members were unwilling to discuss their vision for the rock pile prior to a site visit. However, in dialogue with resource people they did scope out issues related to key areas of discussion, informed in part by the presentations provided by Gordon Macdonald, Colleen English and Kathryn Scott. The site visit allowed for a more detailed discussion of issues, also reflected in this section. In order to provide greater insight on the meaning and implications of these discussions, some background on technical considerations drawing from Diavik's Interim Closure and Reclamation Plan and other sources are provided.

The key issues addressed are as follows:

- Baseline and goals: "rebooting nature?"
- Shape of the rock pile
- Capping the rock pile
- Water flows
- Plants for life
- Wildlife habitat
- Renewing homeland

Biodiversity: Values in Reclamation

One starting point for Aboriginal people to provide input into mine reclamation has been to develop an understanding of the cultural values that can shape reclamation goals and objectives. Anne Garibaldi and Kathryn Scott were invited to join this TK/IQ Panel so they could share some experiences in doing this kind of work from other places. Anne Garibaldi focused on her work with Fort McKay in the Alberta oil sands. Kathryn looked at the examples of Colomac Mine in the Northwest Territories, Faro Mine in the Yukon, Whistle Lake mine in Ontario, and a number of other examples.

Aboriginal peoples have always made it clear that reclamation needs to address environmental, cultural and spiritual components. The stories from other places inspired TK/IQ Panel members

to talk about their values. They named some key elements in the landscape, always returning to the idea that it's the whole environment together that is valued: the land, water, air and all the animals, plants and Aboriginal peoples that live in the landscape. The word that scientists use for this is "biodiversity." Article 8(j) of the United Nations Convention on Biodiversity recognizes both the cultural practices and knowledge of Indigenous peoples. The relationships between ecological values and the practices of living in homeland were well expressed by George Marlowe and Fred Sangris.

What is Biodiversity?

Biodiversity is a scientific word that brings together two words – "biological," which refers to living things, and "diversity," meaning lots of variety. The word was invented in 1968, and showed new scientific knowledge that the natural world needs many different forms of life in order to be healthy. This (biodiversity) is something Aboriginal people know a lot about because we have survived by harvesting a lot of different animals, birds, fish, plants and berries, and trees. Aboriginal harvesters are very knowledgeable about the things they harvest – it's a matter of life or death.

Usually scientists are just thinking about the land, water and animals when they talk about biodiversity. But as Aboriginal people, we consider people, culture, way of life and spirituality as part of biodiversity as well. Our traditional knowledge offers a different way of understanding what it takes to make a healthy environment. – *excerpted from Two Roads Research Team (SENES Consultants Ltd) 2011*

They say, diamonds are the best, and we've got diamonds here. Think about that. I don't know what to say sometimes. Me too, I love the land. I love the caribou. I love the fish in Lac de Gras. I still remember when I used to go there. We used to get fish there. The tourists would get fish and I'd fry them for everybody, nice golden brown. Everybody loves it. When I said before the pit, we'd fish from a little dock that was there. We'd catch three fish and brought them to the kitchen and fry them. I don't think I'd do that now.

Every time we say something it's the youth. We've got to put those youth on the right track, in the right frame of mind. My value is something like every winter, every summer, at Artillery Lake, I can portage all the way to French Lake. That's my value. That's my goal. I go to Artillery Lake. The first thing I do is watch a beaver lodge over there. I'm really happy. That's my value.

If the mine is going to start around there, we'll tell the company not to destroy our values too much. Try to help them as much as you can. If I go to Artillery Lake right now, I know where to cast right away for fish, a nice little trout. I love that. And in August, I'll go right behind a muskrat lodge. I know where there's lots of blueberries. I'll go there right away. That's my value. We have to tell the company, you can work on it but let's try to make it as clean as possible for the next 10 or 20 years. We have to tell them that all the time. – *George Marlowe*

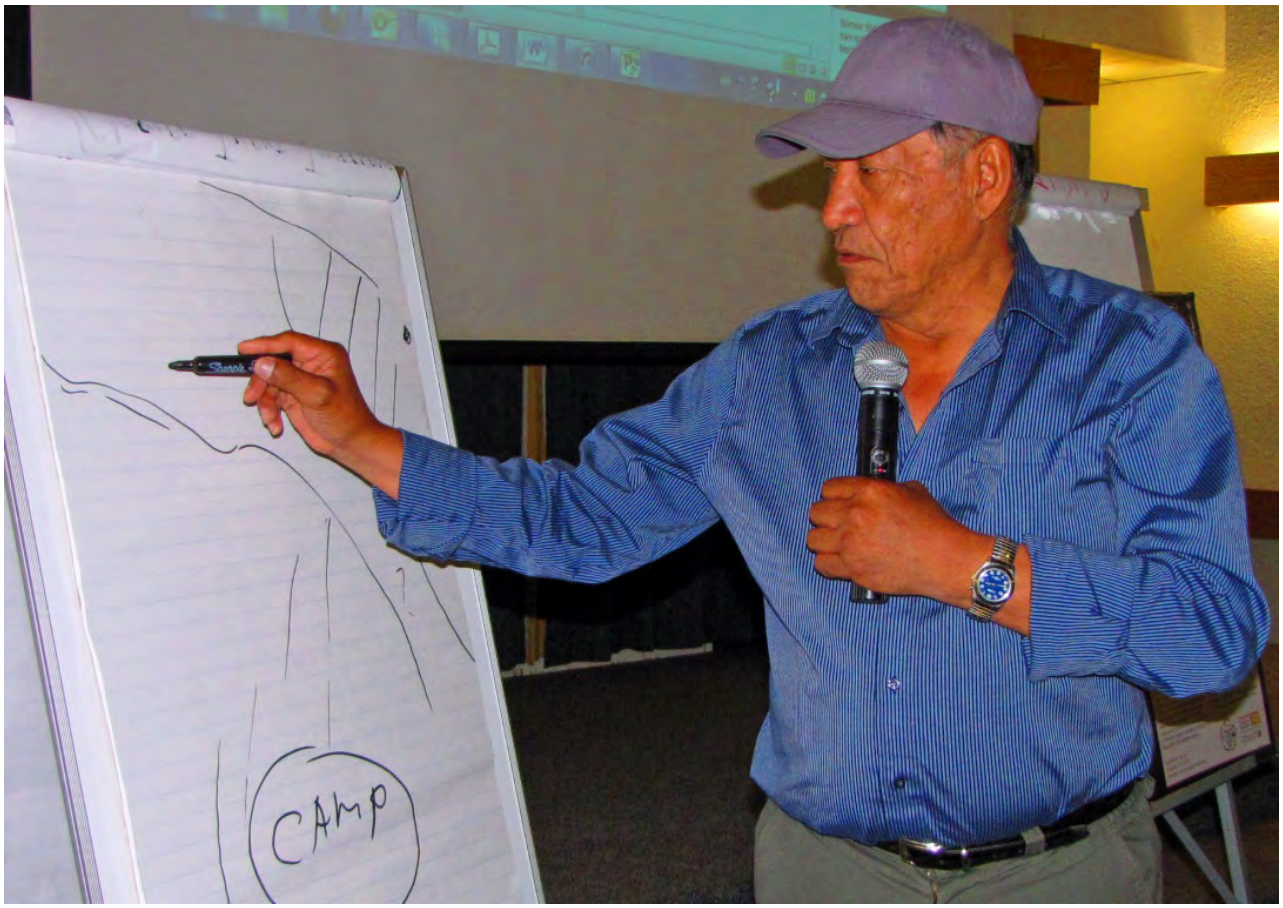

Figure 16: George Marlowe

I think the three key areas to Aboriginal people that we should pay attention to are the land, water and air. Those are the three important things. What we don't see on the land, what we cannot see in the water, it will be in the air. Those are things that we need. Like I said, we don't know what Diavik buried, so we don't know what's going to come up in the atmosphere. We have no idea what's there under their big stockpile.

So those three areas are key that we monitor. Traditional knowledge is also important in four different areas; fall, winter, spring and summer. Those are the four different areas that we should monitor. During the winter you have the caribou migration and then you have the Arctic hare, the foxes, they are all visible. They can be seen. They all have different behaviour patterns.

During the spring and caribou migration, we monitor the herds too to see how they interact with the mines. If there's a smell there or something they don't like, they'll avoid it. But if their food is there, they'll come around to their food chain.

Caribou are very important to Aboriginal people. The caribou are still here with us, and there are other wildlife too that are moving into the land. Muskox are important as well.

Then we have fish in the summer. People go to the camp every summer, fry fish any way they can to taste the fish to see if the water changed over time because of the dust fallout from the mines on windy days. It gets into the water and into the food chain with the fish. So we're monitoring the fish to see if the fish changes over time. We monitor to see if the water has changed over time. These are important. Any change will tell us that there is something going on.

Muskeg is important to us. There are a number of berries that grow in muskeg as well. Just south of it, there are cloudberries that grow. There are a number of blueberries in the surrounding areas, as well as medicinal plants. These have values for us too. In the olden days, you couldn't go to a pharmacy. There was none around, it didn't exist. So they went and got it themselves. A person in a community who would be a medicine man or a traditional doctor would find the right plants and treat people. That's how they did it in the past.

We don't eat all the berries. We share it. Baby seagulls and all those other animals also feed on berries. So it's important that those berries are monitored as well wherever they are so we know what's in it, they're not contaminated or anything.

So those are the values. For Aboriginal people, all wildlife that live on the land are important to us. All the species that live in the water are valued by us. The air is a value to us too because it blows for hundreds of miles around. Does anybody know how far the dust from this mine

blows? It goes quite a ways. Some people probably think a kilometre, maybe two kilometres, but you'd be surprised how far the dust can go, and it gets into everything.

So if there is acid rock or any toxins in the dust, it could affect the spawning areas or the growth of berries. If you consume enough berries or fish, it could be harmful. Not too harmful, but it could get into your food chain as well. So all wildlife, fish, everything else that's there, it's all of value to us.

The places of our ancestors on the barrenlands are of value to us. Many archaeologists who go on the land find arrowheads on the hills and in the sand. They think the native people were here, and they dropped this and left it behind. They don't understand the spiritualty and religion of Dene people.

Religion was a big part of Aboriginal life in the past. There are arrowheads at old campsites that were buried there for protection, for spirituality. In the olden days, there were shamans or medicine men. In my language we call them holy men because these are the people who protected us from harm. These are the people who protected us from disasters. These are the people who went looking for caribou in the spirit world and told us where the herds were so we could survive. They told us where the best fishing areas were. They were connected to the natural world.

So many of the archaeologists who walk the land have no idea. They think native people camped here and forgot their arrowheads and left a lot of their artifacts. They don't understand the spirituality component that is still practiced today by different Aboriginal peoples in the north. We were told never to bother those arrowheads when we see them. They were left there for a purpose, and they're still there. There may be places in the barrenlands that have a spiritual connection. A person that's buried as well, and all his things are buried with him.

So we have spiritual sites and religious sites on the land too that we value above everything else. Archaeologists, Diavik and BHP find arrowheads and collect them. They bag them and collect them, not realizing those locations might be a temple or prayer sites and people place them for offerings and protection. They live in a different world. They don't understand. Thank you. – *Fred Sangris*

Baseline and Goals: "Rebooting the Landscape"

In imagining a future for the rock pile, the TK/IQ Panel is considering whether this new landscape feature is a "dead zone" that just needs to be contained and isolated, or whether it should be "rebooted" to become reintegrated with its natural surroundings in some way. In looking at the options, it's useful to know a bit more about the building blocks that can be worked with in terms of land formations and materials in the surrounding ecosystems.

Aboriginal peoples have stories about how the earth in the Diavik area was formed that the TK/IQ Panel has not yet had a chance to review. There is a lot of scientific research about the historical formation of the landscape that can be a useful starting point for discussion and interpretation by the panel.

Rocks of the Diavik area are very old, relative to the age of the Earth – the most ancient part of the Canadian Shield. Geologists call this the "Slave Geological Province." They think the rock in this area was formed in the *Archean* era, before 2.5 billion years ago when the earth was a lot hotter. The earth's crust from this era is composed of *metamorphic* rock that was transformed by the earth's heat, and *igneous* rocks that were formed by the frequent volcanic activity of the era. Some of the land formations in the Slave Geological Province were formed by plates of the earth's crust pulling apart and colliding. The kimberlite pipes that are associated with diamonds tend to be only in areas that are older than 1.5 billion years and where the earth's crust is thick.

The surface of the landscape is largely shaped by the glaciers that covered the area110,000-10,000 years ago. This was an era marked by strong and periodic changes in global climate. As the glaciers melted a huge lake was formed, and sea levels rose.

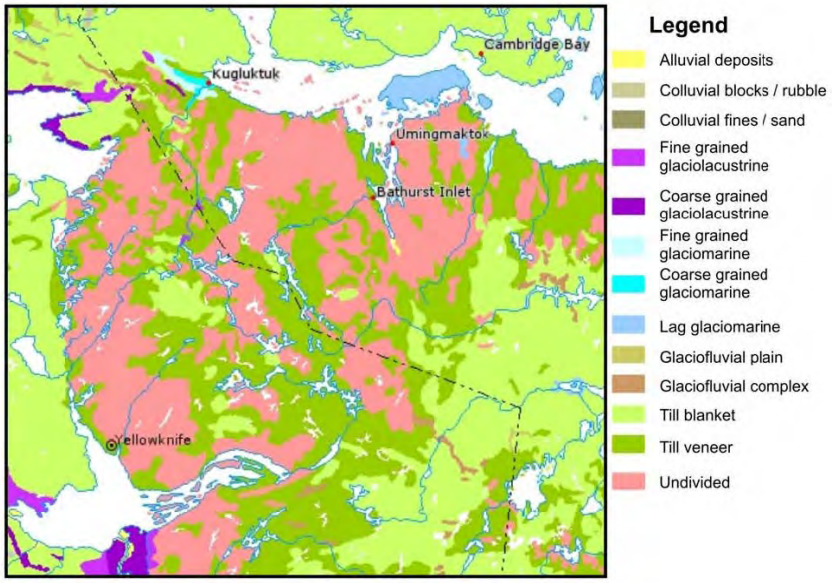

Figure 17: Glacial deposits in the West Kitikmeot Slave area. Source: Surficial Materials Map, Digital Atlas of Canada. http://atlas.nrcan.gc.ca.

What was left behind as the lake shrank and sea receded were lake sediments, raised sand and gravel beaches, and glacial grooves and deposits on the landscape. *Glacial till veneer* is an unsorted mixture of gravel, sand, silt and clay that has thin and patchy distribution across the Slave Geological Province. Till areas tend to be poorly drained. Most remarkable are the patterns of gravel and sand *eskers* and

kames formed by streams and ponds under the glaciers. These are well drained areas. *Boulder associations* are deposits of larger rock fragments from glaciers on the bedrock surface. Different kinds of plant and wildlife communities are adapted to the conditions on each kind of landform.

> The terrain on East Island is characterized by steep-sided bedrock ridges, undulating to strongly rolling slopes consisting of glacial till, ridged eskers and level to depressional glaciolacustrine [glacial sediment] and organic deposits. – Diavik Diamond Mine, Inc. 2011

Shape of the Rock Pile

It is important that the shape of the rock pile is visually pleasing, and supports objectives for wildlife, people and plants. The "baseline" discussion above provided a glimpse of the kinds of land forms that are in the larger landscape of the Lac de Gras area.

Bobby Algona noted that the rock pile currently looks like a human construction alien to the natural landscape, a "big castle" with a colouration "totally different from the landscape around." The TK/IQ Panel discussed the pros and cons of leaving the rock pile the way it is and "letting nature take its course" (Ed Jones), or finding ways and means of reshaping it.

It was agreed that in its current form with steep sides and large boulders perhaps closest resembling a glacial boulder association, the rock pile would remain a "dead zone" for a very long time, uninviting to plants, animals and people. Scientists have found that boulder associations support very little plant life, but a variety of lichens grow on the boulders (Matthews et al 2001). According to TK/IQ and scientific research conducted for the Interim Closure and Reclamation Plan, caribou tend to avoid boulder associations (Diavik 2010, Appendix VIII-1, 4.1).

The overall height and shape of the rock pile may also resemble an esker. Eskers are the opposite of boulder associations in that they are very attractive to a variety of wildlife, since they are well drained and exposed to the wind, providing a welcome escape from insects in summer. The mixed sand and gravel composition of eskers makes them good places for wolves, grizzlies and foxes to den. They are also good places for people as sites for camping and burial grounds.

Options for the shape of the rock pile were explored at a Closure Options and Criteria Workshop on May 12-13, 2009 including representatives of EMAB, the Federal and Territorial governments, the Wek'èezhìı Land and Water Board, the Kitikmeot Inuit Association and the Yellowknives Dene First Nation. Pros and cons of gradual "flat" slopes versus steep slopes were discussed. There were linkages to concerns discussed elsewhere in this report. The following table is adapted from the workshop report, linked to key TK/IQ Panel concerns. Because the positive or negative values assigned during the workshop may vary depending on objectives, the plus/minus coding is removed in the table.

Table 1: Options for side slopes on North Country Rock Pile (adapted from Closure Options and Criteria Workshop, May 12-13, 2009)

TK/IQ Panel Concerns/Values	Flat slopes	Steep slopes
Contamination and water flow	Better stability Greater water erosion Increased snow accumulation	Enhanced freezing Smaller footprint More opportunities for natural drainage patterns Larger buffer from Lac de Gras
Caribou health and safety	Safe passage for caribou Caribou access to top of pile to get away from bugs	Prohibits caribou access
Revegetation	Greater opportunity for revegetation	
Other	Could cover adjacent roads	

Maybe you should flatten the rock pile a little bit just for the animals. In the future, if anybody goes there again they can walk on that site to look around. Make it better than the way it looks now maybe. That's what I'm saying. – *George Marlowe*

Put some gravel back in the open pit, not to cover the whole pit, just to cover maybe less than half. That's what we're suggesting. The mountain will shrink that way. Then we have a passageway for the caribou to migrate onto the rock pile. That's my thought by observing what we've said here. Thank you. – *Phillip Liske*

The rock pile looks like a big castle from fifty miles away, where my place is. You see Ekati's rock pile. The rock piles are sprouting up everywhere. They truly are eyesores. It's not natural anymore when you go up on a hill and you see a big, black thing over there. The colouration is totally different from the landscape around. – *Bobby Algona*

Rock Pile Capping and Water Flows

The rock pile consists of rock that has been broken up through the mining process. When broken up and exposed to air and water, the natural metals in rock with lots of sulfur in it will undergo a chemical reaction that causes acidic water and metals to leach out. This can lead to contamination of the water and land. This is called acid rock drainage, ARD.

When a pit is blasted, the broken up rock is tested for sulfur content, and depending on the amount of sulfur present, the rock is identified as *Type I* ("clean"), *Type II* (moderate acid and metals leaching potential) or *Type III* (high acid and metals leaching potential). The three categories of rock are stored separately. Type I rock is used for roads and the airstrip. There is very little Type II rock, and it is currently stored as an outer layer on the North Country Rock pile.

In closing up the rock pile, water seepage through the rock pile needs to be contained and enclosed so that there will be no contamination. The assumption is that seepage will be limited by permafrost conditions (assuming predictions for climate change over the next 100 years). Glacial till is considered to be a good material for covering the rock pile and keeping water out of the Type III rock. The currently approved plan is for a till cap of 1.5 meters to be put on the pile. A second layer of Type I "clean" rock 3 meters thick will be added on top of the till to keep it from eroding. So the total covering of the rock pile would be 4.5 meters.

Figure 18: Seth Bohnet demonstrates Rock Pile capping

Another possible material that can be used is processed kimberlite (PK). This the rock that the diamonds are found in, and it gets crushed in order to take out the diamonds. This PK could maybe be mixed with something else to use for reclamation, but it is more likely to leach contaminants than till or Type I rock.

Diavik is now reviewing the kind of capping that should be used for the rock pile for its revised Interim Closure and Reclamation Plan. The kind and thickness of materials that should be used for the outside layer can be reconsidered depending on the goals for revegetation and wildlife access on the rock pile. It's likely not a good idea to get soil from other places, since this would just damage another part of the landscape. Other possibilities include crushing the Type I rock to a finer size, using more glacial till for topsoil, and mixing in sewage sludge as a fertilizer.

The Closure Workshop on May 12-14, 2009 reviewed three options for capping the rock pile, with a focus on the till cap. Table 2 outlines the options linked to key TK/IQ Panel concerns. As in Table 1, the plus/minus coding is removed. There was no discussion of the additional Type I rock layer included in the 2009 workshop report.

Table 2: Options for Till Cap on Country Rock Pile (adapted from Closure Options and Criteria Workshop, May 12-13, 2009)

TK/IQ Panel Concerns/Values	Option 1: Till Cap on Top and Sides	Option 2: Till Cap on Top	Option 3: No Till Cap
Contamination and water flow	Reduces oxygen into piles Reduces freezing Reduces infiltration [water] Shortage of till material Difficulty in sorting usable till	Better freezing Vegetation on surface holds snow, increases infiltration amounts	Enhanced freezing
Caribou health and safety	No discussion	No discussion	No discussion
Revegetation	Good for revegetation	Good for vegetation	

The TK/IQ Panel members asked a number of questions about the options being considered for capping the rock pile. There was a lot to learn about the rock pile, since it's very new to people and not a part of the natural homeland; the main source of information is scientific research. There was some discussion about ways of ensuring that seepage from the rock pile does not lead to contamination of the surrounding land and water. The discussion about the best capping approach was also closely linked to the topics of revegetation and wildlife, areas that more easily tapped into the knowledge base of panel members.

We asked Diavik at the hearings to pile the rocks where it is away from the water because that island is so small. One of the plans they had was to make a break to the mainland, but the community didn't support that. They wanted everything piled in the middle, so that there is no danger of any leak into the lake. Also, that centre area is probably the proper place. – *Fred Sangris*

There is going to be a lot of water seepage and water flowing out of the bottom part of the rock pile. I'm wondering whether this water could also be monitored as time goes by? This water that's coming from that rock pile is going to seep into the streams and into the lake also. Wouldn't it be feasible that this water be contained in the castle, I call it a castle, around the mine itself until it's safe and the water is all clean?

You see in those pictures of people with castles, they have moats around the castle. If you look at the rock pile as a castle, maybe build some kind of moat or something so you can contain and monitor this water that's seeping out of this rock pile. Thank you. – *Bobby Algona*

Plants for Life

According to the scientific assessment in the Interim Closure and Reclamation Plan 3.2 (Diavik Diamond Mine Inc. 2011), there are a variety of vegetation types on ʔek'adı. The main kind is called *heath tundra.* This is also the type of vegetation most affected by the mine footprint. There are also six other types of vegetation related to the different land forms on the island. The kinds that are most related to the rock pile landform are *esker complexes* and *boulder associations.*

Table 3: Vegetation Types on ʔek'adı (from Matthews et al 2001)

Vegetation Type	Plant Community
Heath tundra	Mainly herbs and shrubs in the "heath" family. Common plants include dwarf birch, Labrador tea, cranberry, crowberry, alpine milkvetch, and alpine azalea. Plants form a mat on the ground.
Boulder associations	Support very little plan growth. A variety of lichens on boulders.
Sedge associations	Sedges look like grasses or rushes. The sedges grow in tussocks (bunches), and form hummocks (humps) invaded by a variety of other plants including bog rosemary, cloudberry, Labrador tea, blueberry, and cranberry. Moss lives in the troughs between the hummocks. Dwarf birch and willow grow on the old hummocks.
Esker complexes	Vegetation on eskers varies depending on exposure to sun, wind and snow. Esker tops are windswept and dry, and as a result vegetation is sparse and in low mats, including three-toothed saxifrage, moss campion, sandwort, blueberry, crowberry, cranberry, bearberry, and alpine azalea. The areas away from the prevailing winds support dwarf birch, willow,

	shrubs and grasses. Low heath plants and some dwarf shrubs grow on windward slopes.
Bedrock associations	Dry and windswept areas. Lichens on the bedrock, and variable vegetation in protected crevasses and depressions in the rock.
Riparian tall shrub	Birch, willow, alder and occasionally black spruce. Understory includes include dwarf raspberry, dwarf marsh violet, cloudberry, grasses, sedges, club mosses and common horsetail.
Lichen veneer	Windswept and dry areas including esker tops may have a mat of different kinds of lichen. Where there's some shelter and moisture, some heath shrubs and saxifrages may grow.

The approved Interim Closure and Reclamation Plan for the rock pile does not include revegetation – but Diavik has conducted research on revegetation at the mine site that may shed light on options for rock pile closure. The May 12-13, 2009 Closure Workshop included a discussion about pros and cons of revegetating the rock pile. Vegetation will hold snow and thus increase seepage through the pile, but on the other hand it will help with dust control. Vegetation will attract wildlife, which depending on objectives may or may not be a good thing.

The August 20, 2012 mine site visit included a short tour of a revegetation plot, as well as a look at volunteer revegetation that's taken place on the "test pile" and elsewhere. A more detailed review of revegetation study results would be needed in combination with TK/IQ research to assess options. Pierre Beaverho made an interesting analogy with the community garden in Whatì that has recently been introduced. Like gardening, revegetation is not a traditional practice – but there is strong Aboriginal interest in renewing plant life on the landscape, and learning what works through experimentation.

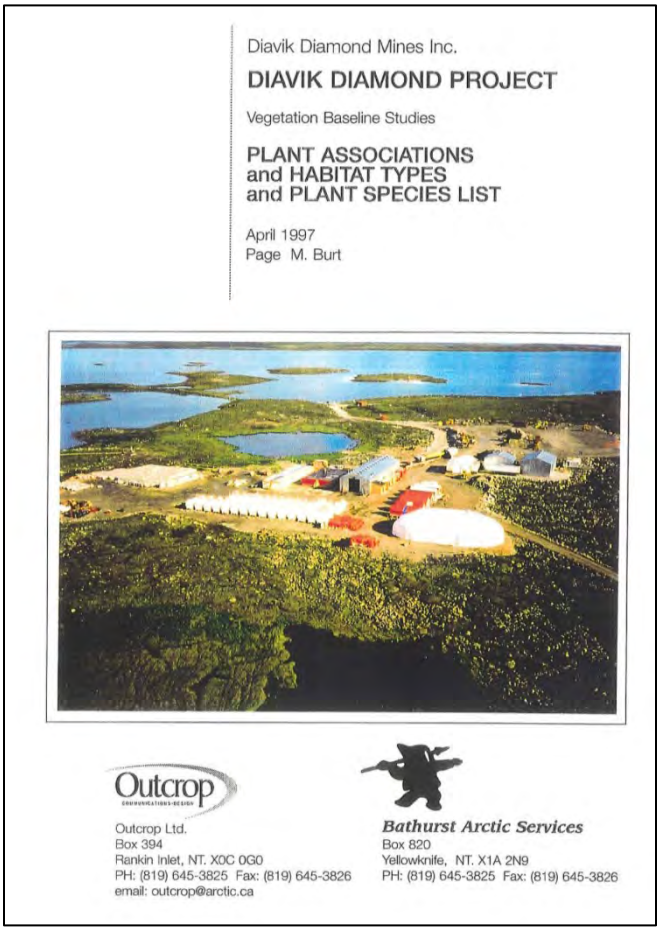

Figure 19: Report cover, Diavik Plant Associations and Habitat Types and Plant Species List, April 1997

Figure 20: Heath tundra (August 20, 2012 site visit)

Figure 21: Volunteer revegetation at Test rock pile August 20, 2012 site visit

Figure 22: Tour of a revegetation test plot August 20, 2012 site visit

That whole area needs to be studied. At one time, it used to be a beautiful island with a lot of food sources. It's not like that anymore. You are going to have to try to recreate it, but you can't bring in anything from the outside. You have to use what's there, the local plants.

I used to bring the elders to the south side and there used to be all kind of cloudberries, blueberries, everything that grows. They were telling me there were some native traditional medicine plants as well. I think plants are an important part of the whole ecosystem. It will take a very long time to bring plants back to life, but eventually it will come back. Once they come back, they'll take over.

You need to keep pushing the native plants. They can really grow fast and cover that whole area so nature can come back. It will take its time but doing the right thing will probably help speed it up. Thank you. – *Fred Sangris*

The Métis for sure would like revegetation on that rock pile. – *Susan Enge*

We see a lot of good soil out there on the eskers. I would use that to put on the rock pile so proper vegetation will grow back. The reason is we're really concerned about the Diavik island. That's a traditional area where the caribou roam, and it's a good feeding area and resting area. Even our area where I come from, Whatì, some of the community residents have a little garden and they planted some vegetables such as potato plants. People have a lot of interest in vegetation and replanting nowadays. Forty-five years back, those things weren't even thought of. We know the land. We're not farmers, but we have an idea how we can have good proper growth on the land, no matter the size. – *Pierre Beaverho*

The vegetation for caribou is the lichen. It takes a long time to grow, 80 years so that caribou can eat it. I'd like to go back to the natural vegetation as close as possible to the way it was before the mine started. If it's going to come back as natural, it's going to take 80 years and we won't be here. – *Phillip Liske*

If there is a waste rock pile that is finished now on the Diavik site, maybe we could put something on it, to grow some plants and see what happens. – *George Marlowe*

Wildlife Health and Safety

Comments made by TK/IQ Panel members made it clear that the diversity of wildlife on the landscape is valued as essential to maintaining overall biodiversity. However, the focus of discussions about terrestrial wildlife has been on caribou. A workshop with Aboriginal community delegates was held at the mine site August 17-18, 2009, with a focus on post-closure caribou movements (a second on-site workshop was held on fish palatability immediately afterward, on August 19-21). The TK/IQ Panel session on March 14-15, 2012 was focused on caribou monitoring. Further work would be required to gain a full picture of wildlife values, concerns and solutions in relation to closure and reclamation.

During the August 2009 workshop, participants toured ʔek'adı and Diavik by helicopter, including caribou trails on the island and surrounding areas, as well as the North Country rock pile. The workshop report reflected on previous research by Ann Gunn (1998) noting that caribou may use the rock pile as a vantage point for seeing predators, and for keeping away from mosquitos and flies in summer. On the other hand, if the rock pile is understood to be similar to boulder associations as described earlier, it's likely that caribou will avoid it.

When thinking about caribou, 2009 workshop participants talked about a number of variables for consideration in closing down the rock pile. These are reproduced below with links to aspects of reclamation identified during the June 2012 TK/IQ Panel session.

Table 4: Caribou and North Country Rock Pile Closure (adapted from August 17-18, 2009 Closure Workshop report)

Issue	Consideration
Shape of the rock pile and access	• Concerns regarding caribou crossing very high rock piles. • Smooth the sides of the rock pile so that wildlife can go over it if they want to. • Smooth crossing/access areas so caribou feet don't get hurt. • Contouring the waste pile so it is similar to natural topography. • Find traditional paths and plan access/crossing areas around these. • East Island is now dead due to mine development, and caribou may naturally avoid this area in the future for this reason. • Ramps have been used along the Misery Road to facilitate caribou crossing.
Contamination	• Restricting caribou access to the pile so they don't eat any vegetation growing up there. • A fence around the PKC; concerns that caribou will sink down into the PKC area.

A number of comments were made during the June 2012 TK/IQ Panel session to the effect that that caribou should be kept away from the mine during operations (see the section above on "Identifying Concerns"). It was not always clear whether the panel members felt that this should also be the case post-closure, or whether conditions should be created for safe caribou travel at

the mine site, and on the rock pile in particular. Colleen English mentioned that caribou have been observed walking on the test rock pile, which is capped with smoother material and with slopes reshaped to be less steep.

Now that Diavik has made some disturbances on that island, we have to try to bring it back as close as we can to the way it was, so that the calves and caribou maybe one day want to come back to their secure island. If there's concern, we could probably find traditional methods to get them to avoid that island somehow. Thank you. Máhsı. – *Fred Sangris*

We're not going to be here all the time. The young people are the ones who are going to take over. So today is a chance to talk to them and say, "Think like a caribou." We've got to talk about not disturbing caribou, or not wasting meat.

Caribou is a very smart animal. After the closure, sure, they could go back there again. We'll make some kind of a trail again and they'll go back to their old trail, the one they used to walk on before, twenty years from now maybe. When everything's gone, the building, the trucks, the roads are gone, guaranteed the caribou will be there on the rock pile. But right now, I don't want the caribou to go to the mine site. – *George Marlowe*

After closure, everybody's gone, the caribou will come back and swim across again and I'm pretty sure they'll go to that hill where there are no flies. I know there are lots of flies in August and September, too much. You guys know that too; everybody knows it.

Some time in the not too distant future, Diavik will be finished their job. They will be leaving. Us, our children, our children's children and their children will be here for a long time. Mahsi cho. – *George Marlowe*

The mine is right on the caribou migration route. The caribou will eventually go back to this landscape if the mine does a good job with closure. So the caribou will go back onto the same migration route. So we have to make a recommendation on caribou to make sure the closure is good so the caribou comes back. – *Phillip Liske*

Homeland or "Dead Zone"?

As discussed above, biodiversity was identified as a core value for TK/IQ Panel members. Linked to this, panel members had many stories to share about the value of the ʔek'atı area as a part of their traditional homelands – a place for living, burying their family members, and harvesting. However, the future of the mine site area was considered as an open question. More work is required to clarify whether Diavik should plan for closure as renewal of a homeland, or as a "dead zone" that needs to be closed off from wildlife, people, and the surrounding landscape.

Recommendations for Action

Recommendation for Action: Future TK/IQ Panel Work in Closure and Reclamation Planning

The TK/IQ Panel developed a series of three resolutions following from the June 2012 workshop, related to: the need for a site visit; the role of panel members in communicating with communities; and the communication of TK/IQ Panel processes to the other environmental monitoring boards, such as the Independent Environmental Monitoring Board (IEMA) and the Snap Lake Environmental Monitoring Board (SLEMA). These recommendations were approved by consensus, and are provided in full in Appendix C. Further to the formal recommendations by the panel, a number of action items can be extrapolated from the proceedings of the session, briefly described as follows:

Panel members shared much baseline knowledge about the landscape encompassing Diavik. This knowledge sharing suggested that a "reference condition" approach (including ecological and cultural landscape aspects) be used in TK/IQ studies related to closure and reclamation. This underscored the value and importance of reviewing earlier TK/IQ studies as part of the context for planned community-based TK/IQ studies.

Panel members also pointed to a number of linked technical issues related to closure and reclamation of the rock pile that would provide critical context for further development of TK/IQ inputs, including questions about which landscape form should be considered as the "reference condition," what surface capping options might best support revegetation (if revegetation is desired), and what wildlife habitat conditions might be supported (including species other than caribou). These questions point to the usefulness of a cross-cultural learning approach to TK/IQ processes in closure and reclamation planning.

The June TK/IQ Panel session provided direction on a series of three recommended focal points for cross-cultural dialogue during upcoming sessions:

1. Baseline studies: previous TK/IQ studies and archaeological findings in the ʔek'atı area.

2. Reference condition options for the rock pile.
3. Planning for biodiversity in revegetation, wildlife habitat, and capping options for the rock pile (differences from the target reference condition)

Recommendation for Action: TK/IQ Panel Mandate and Approach

The second TK/IQ Panel session in the 2012-2013 series has provided a number of general insights into the mandate of the panel, the knowledge base that can be used a starting point for TK/IQ processes, best practices in new TK/IQ research, best practices in Aboriginal engagement, and criteria for assessing successful use of TK/IQ in mine planning and monitoring, particularly as it relates to mine closure.

Revisiting Our Mandate

EMAB is currently considering a revised draft Terms of Reference for the TK/IQ Panel. At the same time, the implementation of the Panel mandate is being developed in practice. In part, the panel is learning through experience about who it is not answerable to, and what it is not mandated to do. These boundaries provide clarity about the panel's role in relation to the Parties to the Environmental Agreement.

The panel is not directly answerable to Aboriginal Parties/communities or to Diavik – rather, it was established to provide advice to EMAB. The Panel does carry out TK/IQ studies or consultation; this is Diavik's responsibility, working in partnership with the Aboriginal Parties.

As a regional body of knowledge holders, the TK/IQ Panel is well positioned to review existing and ongoing community-based TK/IQ studies and consultation processes, identify best practices and guidelines for these processes, and develop initial scoping and methods for new community-based processes around mine closure.

There is bound to be some level of TK/IQ knowledge sharing in activities of a panel of TK/IQ knowledge holders. However, such knowledge sharing should be considered as issues scoping and piloting of methods, as well as a basis for assessing and synthesizing community inputs. It is also in keeping with respecting Elders and knowledge holders as a key tenet of Aboriginal ways. The regional scale of the TK/IQ Panel limits the level of detail possible in TK/IQ research, but at the same time the cross-community level provides an opportunity for learning about method through best practices or comparative reflection, and identifying regional patterns and priorities emergent from community-based study and consultation results.

TK/IQ State of Knowledge

An update to the State of Knowledge Report for the West Kitikmeot Slave Study Region was published in 2007. The report notes that it was not within the scope of the update project to complete a full review of TK/IQ in the region, and recommends that a separate TK/IQ State of Knowledge Report be completed as a follow-up to the 2007 update. This work might be

combined with development of a secure, web-based system for accessing TK/IQ materials for use in new TK/IQ studies.

Best Practices in TK/IQ Research

The TK/IQ Panel is learning through experience that Indigenous methodologies need to be adapted to the specific conditions of addressing monitoring objectives related to mine operations, closure, and reclamation. The cross-cultural learning approach allows for productive dialogue with scientists so that TK/IQ knowledge holders fully understand the context for their work, and the specific ways in which they can meaningfully contribute to planning and monitoring. A reference condition approach allows knowledge holders to bridge their understanding of the baseline social-ecological landscape with the reality of the mine in operation and post-closure.

The TK/IQ Panel would be well situated over time to lead development of TK/IQ Research Guidelines specific to the West Kitikmeot Slave Region that can be used to establish best practices for new studies with stakeholding communities.

Aboriginal Engagement

In some cases, individual Aboriginal Parties may have established their own guidelines for consultation and engagement, as well as TK/IQ research. However, the TK/IQ Panel is a regional body that can synthesize experiences among the communities in order to crystallize best practices.

Measuring Success

Community-based TK/IQ studies and community engagement processes need to be monitored, validated, and assessed in terms of their success in having been accommodated for in planning and monitoring processes. Although the Parties are in part responsible for this, the TK/IQ Panel is in a unique position in being able to assess these processes from a standpoint of expertise in relation to Aboriginal inputs.

Figure 23: L-R Back ???, Louis Zoe, Pierre Beaverho, James Rabesca, George Marlowe, Phillip Liske, Susan Enge, Fred Sangris, August Enzoe, Wayne Langenham, Alfred Lockhart, Shelagh Montgomery, Bobby Algona, Kathryn Scott, Randy Hinaniak, Ed Jones, Ann Garibaldi; Front Jackie Strong, Nicole Enge, Helena Marlowe, Helena Marlowe, Darnian Marlowe, Mona Hiniak, Michèle LeTourneau

Conclusion

The second TK/IQ Panel session of 2012 represented significant progress in the twofold objectives of providing input on the Terms of Reference and procedures for establishing the panel as a standing body, and providing a preliminary scoping of TK/IQ processes in closure and reclamation planning, with specific reference to the North Country Rock Pile. Panel members took strong ownership of their mandate and process. They insisted on being provided with information necessary to fully understand the context for questions that they were being asked to address. The panel requested, firstly, clarification about the decision-making framework within which the TK/IQ Panel is situated. Secondly, they made it clear that it would be necessary to ground their inputs on closure and reclamation planning in direct experience of the mine site, as well as full information about the technical context for planning.

This document expands on the proceedings of the June 2012 Panel session and workshop toward providing a foundation for future panel work, specifically in providing inputs on closure and reclamation planning at Diavik; and more broadly in contributing to the purpose of the Environmental Agreement *"to respect and protect air, land, water, aquatic resources, wildlife, archaeological and cultural resources, and the land-based economy that are essential to the way of life and well-being of the Aboriginal Peoples"* (S1.1[d]).

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TK/IQ Panel Session

Environmental Monitoring Advisory Board

Technical Report 2,

2012 Series

RENEWING OUR LANDSCAPE

Envisioning Mine Closure and Reclamation of the North Country Rock Pile

Diavik Diamond Mine

VOLUME II—APPENDICES

October 2012

PRESENTED BY

The Traditional Knowledge & Inuit Qaujimajatuqangit Panel

COMPILED BY

SENES Consultants Ltd.

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List of Appendices

Appendix A

Tk/IQ Panel Session and Workshop Agenda

June 26-28, 2012

EMAB Traditional Knowledge Panel

Caribou Monitoring, and Mine Closure and Reclamation
Workshop and Session

Northern United Place, 5403 Franklin Avenue
June 26-28, 2012

Facilitation and Recording

Deborah Simmons, SENES Consultants Ltd.
Shelagh Montgomery, SENES Consultants Ltd.

Confirmed Participants to Date

**Two youth for each delegation TBA*

Kitikmeot Inuit Association	John Ivarluk, Bobby Algona and Mark Taletok
Łutsel K'e Dene First Nation	George Marlowe, August Enzoe, Alfred Lockhart
North Slave Métis Alliance	Ed Jones, Wayne Langenham
Tłı̨chǫ Nation	Pierre Beaverho (Whati), Louis Zoe (Gameti), Jonas Lafferty (interpreter), James Rabesca (interpreter)
Yellowknives Dene First Nation	Fred Sangris

Observers/Presenters

EMAB	Michèle LeTourneau
Diavik Diamond Mine	Colleen English, Kathryn Scott
Integral Ecology Group Ltd.	Ann Garibaldi, specialist in Aboriginal Values and Reclamation

Background and Purpose

EMAB TK/IQ Panels are mandated to work with local communities and assist EMAB in facilitating appropriate and meaningful accommodation of Traditional Knowledge/Inuit Qaujimajatuqangit (TK/IQ) in the planning and review of environmental monitoring at Diavik Diamond Mine. This event is part of a series of TK/IQ Panel workshops and sessions for 2012/2013 to address key questions.

This Workshop and Session will include a review of our work and progress to date on caribou monitoring, as well as a start to activities related to mine closure planning. This gathering will include youth delegates, ensuring that they have opportunities to both learn and share their ideas for the future of the mine site.

Session: Caribou Monitoring Review

On March 14-15, the TK/IQ Panel met to review the current Standard Operating Procedure (SOP) for monitoring caribou behaviour, and lay the groundwork for developing a traditional knowledge caribou monitoring plan. In April, a Briefing Note on the approved TK/IQ Panel recommendations for the SOP was submitted to Diavik. Our half-day session on June 26 will include an update on the status of the recommendations, and review of the full report on the TK/IQ Panel session.

Workshop and Session: Closure and Reclamation Planning

Every three years, Diavik is required to revise the closure plan for the mine site, which includes the rock pile. The TK/IQ Panel now has an opportunity to provide input on the vision for the rockpile, and the approach to working with communities in the coming years. Activities will include a 1.5 day Workshop on closure planning, and a one day Session to develop recommendations, including next steps for the planning process.

What is Closure?

When mining activities end, the owner is required to close it down or "decommission" it through a formal process. A mine begins to close the day it opens. Closure planning needs to happen before the mine opens, since decisions made in construction and operation of the mine will affect the closure process and reclamation of the landscape. Diavik is required to review and revise its Closure and Reclamation Plan every three years. Since aboriginal people will live with the post-mine landscape in the future, it is important that they be involved in closure planning.

What is Reclamation?

The mine has changed the land. It is not possible to restore all the land to exactly the way it was before the development. But reclamation projects attempt to establish ecosystems that serve the needs of society and the environment. People's visions for the land are the basis for planning reclamation projects.

Talking Circle Approach

The TK/IQ Panel often shares knowledge within a Talking Circle format that ensures everyone has equal opportunities to speak. The main principle of the Talking Circle is respect. The microphone serves as the Talking Stick, and is also important because we are recording the proceedings. The person holding the Talking Stick is not interrupted – but the group gives the facilitator permission to ensure that our time constraints are respected by signalling to the speaker when it's time to wrap up. If the Talking Stick comes to you, you can choose not to speak, or you can request that what you say not be recorded.

This gathering includes a Workshop with resource people who are knowledgeable about closure and can share examples of other indigenous experiences in working on closure plans – the Workshop will include presentations and back-and-forth discussion so that people can have their questions and concerns addressed by the resource people.

The first and last parts of this gathering are a TK/IQ Panel Session, which is a forum for TK/IQ Panel members to talk among each other and make recommendations. TK/IQ Panel members can decide whether they wish to have Diavik representatives or other resource people present for their Session discussions.

It may at times be useful for elders and youth to work separately so they can develop their own perspectives and then share these with each other. The group can decide when and whether group work is a good idea – the facilitator will have suggestions!

The recording will be transcribed, and used as the basis for the report on the Workshop and Session. The report will not be shared without review and approval by the TK/IQ Panel (at the October meeting). The TK/IQ Panel can decide to approve some recommendations for immediate sharing with EMAB and Diavik, as we did with the Caribou Monitoring SOP recommendations.

AGENDA

Tuesday, June 26 – Caribou Monitoring Session Review and Closure Planning Workshop 1

Note: There will be at least one short break with refreshments during each morning and afternoon.

9:00	Opening prayer, introductions, welcoming remarks
	Review and discussion of Workshop and Session purpose, agenda, roles of TK/IQ Panel, EMAB and Diavik
	Caribou Monitoring Session Review – *TK/IQ Panel Members only* • Update on Caribou Monitoring SOP recommendations (Michèle) • Review and approval of TK/IQ Panel Session report
Noon	LUNCH PROVIDED
1:00	**Closure Planning Workshop Part 1: Background** • Introduction and background on EMAB involvement in Closure Planning (Michèle) • Presentation on the site and the closure process – what are the possibilities? (Colleen, Kathryn)
1:30	***Talking Circle:*** What does closure mean to you?
3:30	Review workshop agenda for Day 2.

Wednesday, June 27 – Closure Planning Workshop

9:00	Opening and agenda for the day
	Checking In: Key messages from Day 1
	Closure Planning Workshop Part 2: Reclaiming the Rock Pile • Introduction to the rock pile (Colleen, Kathryn) • Discussion
	Small Group Work Envisioning a future for the landscape at the rock pile site.
	Small Group reportbacks
Noon	LUNCH PROVIDED
1:00	**Closure Planning Workshop Part 3: Aboriginal Values and Reclamation** • Presentation by Ann Garibaldi • Discussion
	Talking Circle or Small Group Work • What are the most important values in reclamation planning? What would successful reclamation look like?
	Analysis of key messages or small group reportbacks
3:45	Review workshop agenda for Day 2.

Thursday, June 28 –TK/IQ Panel Session on Closure Planning

9:00	Opening and agenda for the day
	Checking In: Overview of key messages from Closure Planning Workshop
	Closure Planning Recommendations ***Talking Circle*** What are the key messages to be shared on closure planning?
	Review and approval of key messages
Noon	LUNCH PROVIDED
1:00	**Next Steps for Community Involvement in Closure Planning** ***Small Group Work or Talking Circle*** How should the TK/IQ Panel continue to be involved? How should communities be involved?
	Analysis of key messages or small group reportbacks
	Workshop and Session Reporting • Reporting and review schedule • Approval of any immediate recommendations for interim report
	Group Photo
	Concluding Talking Circle What were the highlights of this Workshop? What should be different at the October event?
3:45	Closing remarks, prayer.

Appendix B

Workshop Presentations

Presentation 1: Diavik Diamond Mines Inc,"Closure and Reclamation Planning"

Presentation 2: Integral Ecology Group, "Aboriginal Values and Reclamation Planning"

Presentation 3: Dialectic Research Services, "Examples of TK Integration"

Rio Tinto

Diavik Diamond Mines Inc.

Closure and Reclamation Planning

27 & 28 June 2012

Doc# ENVI-204-0512 R0

Rio Tinto

Diavik closure and reclamation planning

- Diavik closure concept – then and now
- Diavik closure goals
- Diavik closure process & timelines
- Diavik closure plan overview – by mine area
- Waste rock pile closure objectives
- Rock pile closure process & considerations
- Review of ideas from 2009 community consultations
- Questions to consider for the rock pile

RioTinto

Closure design – then and now

3

RioTinto

Diavik closure goals

- Land and water that is physically and chemically stable and safe for people, wildlife and aquatic life
- Land and water that allows for traditional use
- Final landscape guided by Traditional Knowledge
- Final landscape guided by pre-development conditions
- Final landscape that is neutral to wildlife – being neither a significant attractant nor deterrent relative to pre-development conditions
- Maximize northern business opportunities during operations and closure
- Develop northern capacities during operations and closure for the benefit of the north, post-closure
- Final site conditions that do not require a continuous presence of mine staff

DOC# ENVI-204-0512 R0

4

RioTinto

Closure process & timing

- Interim closure & reclamation plan (ICRP), v3.2
  - Approved through WLWB review process
  - Further work to be done on closure criteria & reclamation research
  - Annual progress reports required
- 2016 – next version of ICRP due
  - 3 year window for community review & input
    - Many different aspects that each require discussion & recommendations
  - Some closure work can start soon, e.g. rock pile

ICRP, v3.2 (2012) → Community Input (2012-2015) → ICRP, v4 (2016) → Community Input (2016-2019) → Final Closure Plan (2020)

5

RioTinto

Overview of closure plans, by area

DOC# ENVI-204-0512 R0

6

RioTinto

Diavik waste rock pile closure objectives

- Physically stable slopes to limit risk of failure that would impact the safety of people or wildlife
- Rock and till pile features (shape and appearance) that match the look of the surrounding natural area, as much as possible
- Contaminated soils and waste disposal areas that cannot contaminate land and water

RioTinto

Rock pile

- Opportunity to begin the closure process - no more rock added after open pit mining is complete later this year
- One of the most important areas for community input and TEK – landform considerations, waste disposal, wildlife movement/use
- Key focus area over the next year; began discussions with communities in 2009

RioTinto

Wildlife movement – post-closure

- Closure design for wildlife movement is current focus
- Communities workshop at site 17-21 August 2009
- Outcome was three main options:

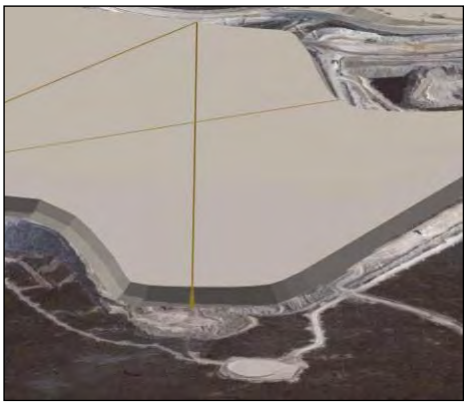
1 Leave rock pile as is – little to no access to rock piles

October 12 9

RioTinto

Wildlife movement – post-closure

2 Use traditional caribou trails to develop defined paths - controlled access to rock piles



October 12 10

RioTinto

Wildlife movement – post-closure

3 Contour the pile - full access to rock piles

October 12 11

RioTinto

Rock pile technical considerations

- The rock in the pile would not go back in to the pits
- Water has to run off the pile without causing too much erosion or pooling in various areas
- The rock may release metals if it is not covered effectively
- Burying basic waste on site is a common practice and is currently done for operations – it can be the more environmentally friendly option for disposal at remote mines
- There may be an opportunity to use clean rock from A21 pit development to cover the pile

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RioTinto

Rock pile

- Purpose of discussion today is to continue developing some of the ideas we've already heard from communities
- What would you recommend the rock pile look like after the mine is done?
- How would you recommend wildlife use the rock pile?
- In order to make that happen, what would you recommend the pile look like?
  - Is there vegetation?
  - Are the sides steep or more of a gradual slope?
- What can we continue to discard waste into the pile?
- How are we best to discuss these questions & get feedback from community members?
- Timeline: want to start work on closing the rock pile in early 2013

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RioTinto

Discussion

DOC# ENVI-204-0512 R0

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Aboriginal Values and Reclamation

EMAB Traditional Knowledge Panel
June 26-28, 2012

Integral Ecology Group

Thank you!

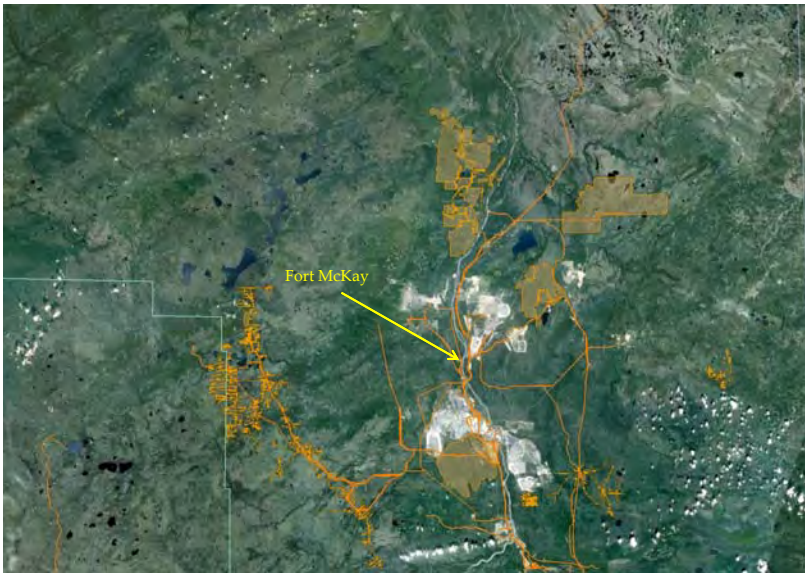
TEK Project Team
Andrew Boucher, Rena Boucher, Mary Bouchier, Gary Cooper, Flora Grandjambe, James Grandjambe, Wilfred Grandjambe, Celina Harpe, Dorothy McDonald, Fred McDonald, Victoria McDonald, Francis Orr, Walter Orr, Elsie Rolland, Elizabeth Stokes, Mary Tourangeau, Clara Wilson

The community of Fort McKay – this truly is their project

Fort McKay summer students
Brittany Cardinal, Lori Lei Mercredi, Katrina Delisle and Shawne Courtorielle


Fort McKay

Fort McKay



Initial key messages

- "Put it back the way it was as fast as possible"
- Reclamation needs to address environmental, cultural and spiritual issues
- Wanted to feel that they were a part of the process
- Need to involve multiple generations, particularly youth
- Traditional knowledge should be included in reclamation decisions
- Everything is related – you can't put back one piece at a time
- Lack of trust that reclamation would work (hadn't seen any done yet after decades of mining)

Fort McKay's Key Species

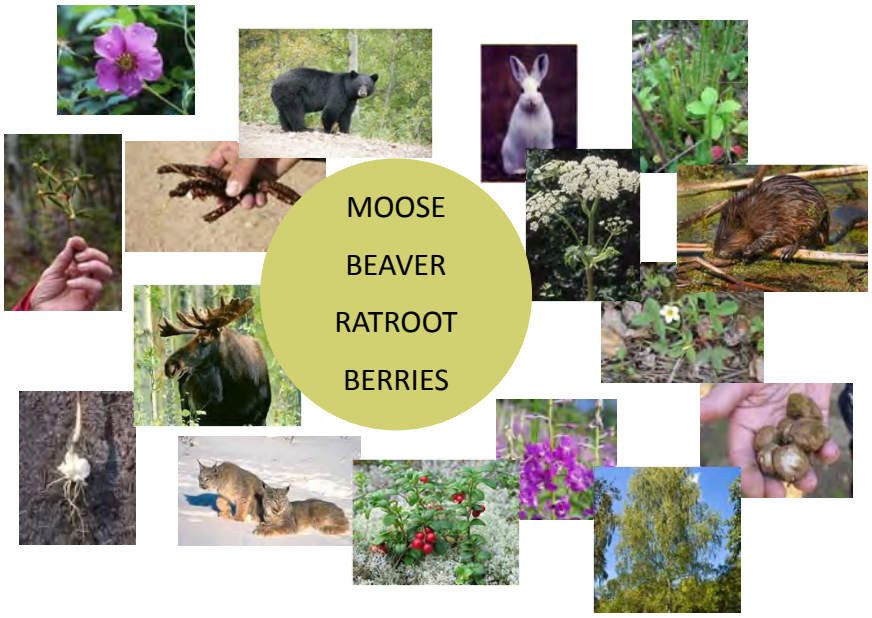
Beaver help shape and build the land.

Moose are an important source of food and provide material for moccasins, clothing, and tools.

Ratroot is a highly valued medicinal plant.

Berries are a prized seasonal food and contain medicinal properties.

Project Approach



We we did

- Established a project focus group
- Visiting sites before they were disturbed (or adjacent sites if necessary)
- Identified reclamation values (e.g., importance of muskeg)
- Youth and elder TU field camps (pre- and post-disturbance where possible)
- Reclamation site visits
- Reviewed existing information

Learnings – More time on the land

More time focusing on species relevant to *community members* has encouraged sharing of traditional knowledge with direct implications for reclamation.


BEPPSCO

Learnings - Communication

When industry come I listen good, [but] the half of it I don't understand what he's talking about. And if I talk to you, and if you don't understand me…you don't understand four or five words in between, you're out. You're out of what you're listening [to].

Learnings – planning for the future

Focusing on plants and animals that are important to community members support more meaningful conversations between the current state of the developed landscape and the long-term goals for the land following reclamation

Learnings – Muskeg

My father would tell you that our body is like the earth. We need a heart to live. And he would tell you that the muskeg is your heart, and that the mountains are your brain, and the creeks and rivers are your blood vessels…Muskeg is very important to rivers and creeks and everything in them. Muskeg is connected through water to the rest of the earth. With that comes our spiritual values and how we are connected and respect the earth

(Cecelia Fitzpatrick, Fort McKay)

Learnings – Muskeg

Learnings – Spirituality

It was most challenging to find ways to support spirituality in the reclamation process. The focus group determined that people need to be on the land to sustain their spiritual connection.

If you fly them [children] to an area (rather than have them walk or sled there) that is:

"*like dropping them in a bowl. What have they learned? Nothing. They have to walk* [in order] *to learn.*"

James Grandjambe
Cree Elder, Fort McKay

Current structure

- Community Advisory Groups that meet ~4 times per year (more than 16 companies)
- Advisory Group meets on their own (when possible); they have internal technical experts that participate when requested (e.g., dust concerns)
- Intense focus on one key issue per year (though all issues of concern are discussed)
- Ongoing reclamation tours
- Companies required to demonstrate reclamation of key species identified by the community
- (Potential) joint community-industry projects
- Much still needs to be done – still not much demonstrable reclamation (and people are very cautious about possibility of success)

Next Steps

- Need additional internal staffing to manage the many Community Advisory Groups
- More community involvement (even more youth participating)
- Explore alternative places to have discussions (reclamation field camps) – no powerpoint ☺
- Develop aboriginal criteria for reclamation certification
- Conduct (ethnobotanical) inventories of adjacent areas
- Establish community-based monitoring of traditional territory and reclaimed sites
- Fort McKay to establish their own reclamation company

Thank you!

- How would you like the reclaimed landscape to look?
- How would you (or animals) like to use the reclaimed and adjacent areas?

- How will you know reclamation is successful?
- What do you need to have (see/smell/test) to trust that reclamation is successful?

Animals they've got a spirit, everything. The trees. The earth. That's why we have to respect it…according to my elders, they told me, don't play with everything. Don't. Have respect for everything.

Learnings – Muskeg

So if you don't put everything [back] the same…if you don't put anything underneath, like muskeg…it is no good. 'cause a lot of spruce grows [naturally] and there's always a muskeg dip someplace close by. That's kind of a bank. That's a bank for all the trees now. And it rains, all that moss and everything holds that water. And it they have a dry spell, the trees suck all that water now from that muskeg. They survive on that.

The path forward

- Establish joint land use objectives between communities and Diavik

EXAMPLES OF TK INTEGRATION

EMAB Closure Workshop (June 26-28, 2012)

Outline

- Case Studies of TK Integration in Closure (Colomac, Faro, Whistle Lake)
- Other Examples of TK Integration
- Esker/Hill Analogy
- Suggestions from Previous Closure Workshop and TK Panel
- Questions for Discussion

Colomac Mine (NWT)

- Based on discussions with Tłı̨cho and evaluation process, the following options were explored and the preferred option selected in 2003
- **Reclamation Options:**
  - Flatten tops and partially revegetate
  - Contour tops and partially revegetate
  - Construct wildlife access ramps onto rock pile
  - Re-establish natural drainage and enhance stream fish habitat
  - Clear vegetation to create wildlife trails around waste rock piles
  - Ensure long-term care and maintenance are minimized or eliminated;
  - Identify activities required to return site to aesthetically acceptable condition
- Both Tłı̨cho and INAC chose dry cover option based on different values/input

Colomac Option Evaluation Process

- Tłı̨cho participated in evaluation of closure options for abandoned Colomac Mine with INAC
- Tłı̨cho gave scores to 6 tailings closure options based on Aboriginal values
- 6 tailings closure options:
  - Move tailings: to another tailings or to pit
  - Cover tailings: wet rock cover, dry cover, plant (no cover)

Colomac Option Evaluation Process

- Tłı̨cho selected criteria to rate how closure options would do:
  - Safety to people and wildlife
  - No dust
  - No new sites disturbed
  - Walk-away effect
  - Restores natural conditions
  - Gets rid of contaminated sites
- Tłı̨cho rated each criteria based on 3-point scale →1) low = poor job; 2) medium = acceptable job; 3) high=good job

Colomac Option Evaluation Process

	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Safety	2	3	2	2	1	2
Dust	3	3	3	3	2	3
Disturbance	3	3	3	3	3	2
Walk-away	3	3	2	3	1	1
Natural Conditions	3	4	1	2	2	2
Con. Sites	1	2	1	1	1	1
Average Score	2.5	3	2	2.3	1.67	1.83

Idea for Process

- Aboriginal groups could create their own values to measure each closure option; framework for organizing and presenting what's important
- Each group, EMAB and DDMI could do their own scoring and weighting based on values most important to them
- Get together and compare results of everyone's scoring to determine which option is preferred and what is behind preference

Faro Mine (Yukon)

- Selkirk First Nation & Ross River Dena Council
- Consensus-based 15-year closure plan with Yukon Gov't
- Aboriginal groups collected TK to inform closure planning, including current/future use of Faro Mine site by groups
- Involved in selection of closure options based on TK, including:
  - Soil cover to prevent human and wildlife contact
  - Uncompacted top growing layer of soil for revegetation of cover (improve habitat for birds/wildlife)
  - Waste rock reshaped to look like natural environment
- Learning from other Aboriginal experience: Collaboration with Intertribal Nursery Council (INC) based in Albuquerque, NM to consider re-vegetation options

Whistle Lake Mine (Ontario)

- Inco and Wahnapitae signed MOU in 1999 for greater participation in closure planning
- Treated mine water released to Post Creek which went through Wahnapitae reserve
- Meet quarterly to discuss closure planning
- TK informed closure of open pit
- Capacity bldg: Contracts and training in closure processes

Other Examples of TK Integration

- **Red Dog Mine Airstrip** – TK of prevailing winds changed design of airstrip in Alaska
- Using traditional Inuit methods of corralling caribou to divert them away from mine components
- Elders involvement in problem solving: Vegetative species not thriving; suggested adding particular nutrient–rich soil to encourage vegetation growth

Esker/Hill Analogy

- Use Aboriginal esker knowledge links to closing rock pile
- Importance of direction of esker related to meltwater flow
- Important wildlife habitat (esp wolf denning)
- Travel routes for humans and caribou
- Vegetation patterns on eskers → more vegetation on sides than top due to wind
- Steep slopes → good drainage
- Top of eskers good for temporary camp due to drainage
- Visibility: Ability to see surrounding areas on top of esker

Closure Objectives from Previous Workshop

- Safe for wildlife/people
- No dust
- Stability
- No erosion
- Survivability in case of an earthquake
- Perpetual frozen core
- Promotion of vegetation (monitoring for metal uptake)
- No ARD
- Elimination of run-off/seepage
- Construct gradual slopes along the edge of the waste rock pile
- Leave the steep slope to discourage use by animals
- Noted: Could potentially be used by wolves and fox to hunt caribou trying to climb the pile

Suggestions/Input from TK Panel

- Move rock pile to pit →DDMI response: geochemical and cost reasons not feasible
- Caribou seek hills for relief from bugs (related to wind), esp in August and September
- Metis in favour of caribou access to pile with vegetated PK/soil cover

Questions for Discussion

- How have you and/or ancestors taken care of the land?
- How have you and/or your ancestors used rocks / elevated areas on land? What do eskers/hills mean in your culture?
- What have you observed or how have you taken part of reclaiming natural/traditional disturbances (e.g., caribou highways, camp clean-up, snowmobile tracks)?
- How can these practices be used in managing the land after the closure of the mine?

Questions for Discussion

- What have you observed on the land about migrating caribou when they encounter esker/hill? What do they do? Do they go around it? Do they climb over it?
- What have you observed on the land about wolves and foxes and their use of eskers/hills? How do they interact it?
- What have you observed on the land related to plants and berries growing on hills or rock piles? What makes them strong in some years? Why are they weak or die in some years? Water, nutrients, and/or weather?
- What on the land will tell you that the rock pile is done being reclaimed? Return of caribou? Taste of berries? Taste of fish in nearby water? Use by people?

Key Questions to Consider

- Caribou/wildlife on rock pile? Yes / No
- Vegetation on rock pile? Yes / No (If yes, where?)
- Sloping of rock pile? Yes / No (If yes, where?)
- Contouring of rock pile? Yes / No (If yes, where?)
- Trails for wildlife? Yes / No (If yes, where?)

Examples of Traditional Land Management

- There are many forms of Aboriginal land management, including:
  - **Active manipulation of landscape**: Burning berry patches to encourage growth of bigger and better berries.
  - **Avoidance**: Non-hunting areas where group leaves certain valleys alone to allow for wildlife breeding and/or rearing.
  - **Selective harvesting**: Using a fish weir to catch fish, but sorting out and releasing female fish back into water.
  - Focusing wildlife hunts on males rather than females to encourage the viability and sustainability of species

Appendix C

Tk/IQ Panel Recommendation:Closure and Reclamation Planning

Closure and Reclamation Planning

June-28-12

The following recommendation was approved by consensus of the TK/IQ Panel at 1:15 pm on June 28, 2012.

Background

1. The TK/IQ Panel is provided for under the Environmental Agreement as a panel of experts to *"assist in the application and consideration of traditional knowledge."*

2. The TK/IQ Panel is a standing body of knowledge holders appointed by each of the five Aboriginal Parties.

3. TK/IQ Panel members are responsible for providing expertise and recommendations to the Environmental Monitoring Advisory Board (EMAB), Diavik Diamond Mine Inc. (DDMI), the Aboriginal Parties and their respective leaderships and communities.

4. The TK/IQ Panel is assisting in developing options for closure and reclamation planning at Diavik Diamond Mine through a series of activities including the June 26-28 Panel Session and Workshop.

5. DDMI is required to educate and seek input from communities with respect to TK/IQ aspects of closure and reclamation.

6. DDMI is required through the terms of their water licence and through the Environmental Agreement to include TK/IQ in their monitoring plans and programs.

It is Therefore Recommended That

1. EMAB work with DDMI to plan a site visit by the TK/IQ Panel to learn firsthand about the North Country Rock Pile, with follow-up activities to prepare recommendations on rock pile closure and reclamation planning; the site visit should include an overnight stay at the Community-Based Monitoring Camp.

2. EMAB request funding support from DDMI for TK/IQ Panel members to play a leading role in reporting back to their respective communities, to inform the communities about the role they are playing in closure and reclamation planning, working with DDMI and EMAB as needed.

3. Due to the fact that Diavik, Ekati and Snap Lake diamond mines all share the same landscape, EMAB should facilitate sharing the TK/IQ Panel's work with the Independent EMA and the Snap Lake EMA so that our work can be used to inform closure and reclamation planning at the other diamond mines, per Section 1.1(b) of the Environmental Agreement, in order *"to respect and protect air, land, water, aquatic resources, wildlife, archaeological and cultural resources, and the land-based economy that are essential to the way of life and well- being of the Aboriginal Peoples."*

Appendix D

Site Visit Debriefing Presentation and Discussion Notes

August 21, 2012

DIAVIK DIAMOND MINE SITE VISIT – DEBRIEFING MEETING

YELLOWKNIFE INN, AUGUST 21, 2012

PARTICIPANTS

Diavik Diamond Mine Inc.	Colleen English
SENES Consultants Ltd	Deborah Simmons
North Slave Métis Alliance	Mel Enge, Wayne Langenhan, Ed Jones
Łutsel K'e Dene First Nation	George Marlowe
Kitikmeot Inuit Association	Bobby Algona, John Ivarluk
Tłı̨chǫ First Nation	Pierre Beaverho, Louis Zoe, Peter Husky (interpreter)

CLOSURE OBJECTIVES

- Physically stable slopes to limit risk of failure that would impact the safety of people or wildlife
- Rock and till pile features (shape and appearance) that match the look of the surrounding natural area, as much as possible

DIAVIK REQUIREMENTS

- Capping to contain contaminants within the pile
- Maintain the temperature of the rockpile

HOW DIAVIK WILL USE TK PANEL RECOMMENDATIONS?

- 3 year window before next submission of closure plan – 2016.
- Diavik wants community input.
- There will be conflicting views, but some of the best ideas that work with technical considerations will be used.
- Diavik will report back on what input was used.
- The rockpile is just under 200m (about 190m or 700 ft)
- The more ideas, the better.

HERITAGE (RENEWING HISTORY)

- Hunting and fishing
- Campsite
- Berries

Goal

Future generations will want to visit!

TEST ROCK PILE

SHAPING THE LANDSCAPE

- Simulate an esker
- Slope the top edges so they're rounded
- Slope the sides so less steep, like the test pile
- Remove big boulders
- Rock from piles back into the pit
- Flatten the top to that there are no berms and caribou can easily walk – there are fewer places for predators to hide.

SHAPING THE ROCKPILE

- Less than 8 miles NE of Diavik that might be good to look at as an example – it's sandy.
- In winter NE or NW (prevailing) wind will shape the snow, so that it's smoothed over and cuts straight down at the lee side – people from Kugluktuk know this. People who travel on the land with skidoo know that you have to watch this when you get to an esker.
- There are a lot of sandflies in August, so the caribou will want to go up on the slope to catch the wind, sleep, and get away from the flies. There needs to be something for them to eat up there.
- Caribou ramp? The caribou will come across from the northwest side to the east side, and swim across the lake – that's what they used to do before. And coming back, from southwest again.
- Use waste rock to slope the pile.

REVEGETATION

- Options: Use soil from tundra; cover with rock and till from pit A21
- Natural revegetation
- Plant shrubs near bottom in the soil being placed there (dwarf birch and willow)
- Visit old archaeological sites to view regrowth
- Place soil near the bottom
- On the tundra, there's black soil – if they create an esker and put that soil, there might be more regrowth. Eskers are usually just rocky and sand, so they need soil added for regrowth.

REVEGETATION ISSUES

- Soil nutrients
- Erosion from water and/or wind
- Disturbing another area by moving materials

WATER CHANNELS

- Water can be diverted onto the tundra, or go directly into the water.
- Water will find its natural channels as well.
- Channel to a pond contained geotextile, deep enough so water will seep into ponds in four different areas
- Let nature take its course

Issue

Contaminants are or are not a concern.

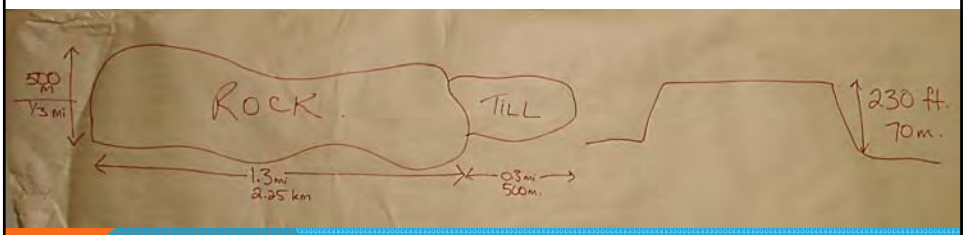
ROCKPILE DIMENSIONS

1/3 mile or 500m wide

1.3 miles or 2.24 km long

Till pile 500m or 0.3 miles

Height 230 feet or 70 metres.



SIMULATED ESKER

- Caribou will have easier access to the hill when the hill is reshaped, from all different directions.
- There's a lot of seepage from the bottom of esker.
- Esker material compared with gravel from rockpile.
- Gravel holds nutrients in the ground that makes the baby birch grow easy.
- Under the topsoil is natural till from long ago.
- A little bit of gravel from an esker or even crushed rock will hold more nutrients for plant life.

PROCESSED KIMBERLITE POND

- What we do with one part of the pile, we don't necessarily need to do with the whole pile.
- Could shape the landscape to prevent caribou from accessing a certain area like the PKC area.
- Option to cover the PKC area – the material isn't as solid, so there might be more movement, and could become unstable.
- There may need to be an open water area for catching water from the rock pile.

ISSUES IN SHAPING PILE

- Caribou travel (but caribou travel anywhere! Can be injured with steep slope; safety is a key consideration)
- Channeling water to ensure contaminants don't reach Lac de Gras
- Snow drifting

WATER/CONTAMINANTS

- Don't bury metals in the pile
- Use geotextile in drainage areas d/s of pile and revegetate these areas.
- There may be seepage from PKC pond. They drain that pond back from water plant, cleaning the water in that way?
- Use esker materials nearby as cover materials
- There is a dump for inert materials in the pile, including metals, rubber, styrofoam, machine parts (but not vehicles).
- Can metal be backhauled? But there's a short window on winter road, it's costly, and there's no storage space. Don't want to bury things on our ancestors' island. Our ancestors used to clean up after themselves when they left that island.

PKC POND

- The PKC pond will be drained but there's a mud, and water will come out of the mud as it gets compacted. There may need to be a pond for the water to escape. Any contaminants may be more concentrated after closure and draining the pond.
- What will the water quality be? It will be tested for a lot of years. Currently tested monthly.

OPTIONS FOR PKC

- Should caribou be kept away from PKC pond until it's certain that the water is safe?
- Options for keeping caribou away could be:
  - steep sides to rockpile to keep caribou away
  - Options for keeping caribou away from the other side of the pond?
- Option B could be to shape rockpile for safe caribou access all around and let nature take its course. The landscape will definitely change and won't be the same as it once was. Work with what we have.

INFRASTRUCTURE

- Current plan to reclaim airstrip; suggestion to keep airstrip as an emergency landing site (Wayne) – but this would not be maintained. Needed for long term monitoring of the site (Pierre). It won't go back to a pristine state anyway.
- Keep some small buildings for hunting/fishing parties – but someone would have to own/lease the building and the land
- Debate about whether people would want to use that place – but there are cabins elsewhere on the lake.
- If Diavik leaves materials behind, all the other mines will do the same thing.

PLANTS THAT ARE GOOD FOR REVEGETATION?

- What's a good way to speed up the revegetation process?
- Look at an esker that's lined up the same way as the rock pile to see what grows there naturally in different areas (shade, leeward, side, top).
- Take materials from the natural eskers and spread it on the rockpile to revegetate.
- We have the opportunity to have our plan ready so that the closure of the pile can start when the A21 pit is being dug.

A21

- This pit was always part of Diavik's mine plan – and was approved during the initial Environmental Assessment.
- The rock from this pit will be used to close the rockpile etc.
- If there's any left over waste rock, it will be down near the pit.

LOOKING BACK

- Comprehensive Study Report – brought together all the studies (1998-1999) – completed by the government.
- Problem that we're asking some of the same questions over and over, because different people are involved.
- Need to include youth more.

PREFERRED "LOOK" WITH CONTOURS FOR WATER FLOW

TEST PILE AT DIAVIK

Appendix E

TK/IQ Panel Update to EMAB Board

September 25, 2012

TK/IQ Panel Update

Presentation to EMAB
SENES Consultants Ltd.
September 25, 2012

Focus

Review and assess TK/IQ Panel objectives, lessons learned, and approach.

TK/IQ Panel Purpose

Established under Section 4.9 of the EA

EMAB TK/IQ Panels are mandated to work with local communities and assist EMAB in facilitating appropriate and meaningful accommodation of TK/IQ in the planning and review of environmental monitoring at Diavik Diamond Mine.

Timeline

March 2010	Report on Environmental Agreement Implementation Review
May 20, 2011	TK/IQ Panel Workshop
July 19, 2011	Literature review – TEK in the resource sector (Diavik/Golder)
March 14-15, 2012	TK/IQ Panel Session – Caribou Monitoring
June 26-28, 2012	TK/IQ Panel Workshop/Session - Closure
August 20, 2012	Diavik Site Visit and Debriefing
October 23-25, 2012	TK/IQ Panel Session - Closure

Objectives

1. Establish TK/IQ Panel as a standing body
2. Pilot partnership approach with Diavik
3. Provide input on key monitoring issues
   a) Caribou Monitoring SOP
   b) Provide input on rock pile closure
4. Develop general approach to TK/IQ Panel processes

1. Establish TK/IQ Panel as a standing body

- Relationship-building
- Educate about mandate
- Build trust and confidence

2. Partnership approach with Diavik

- Co-facilitation
- Work with Diavik timelines and objectives
- Diavik presentations
- Learn from community engagement activities
- Independent knowledge processes
- Accountability framework

3. Inputs on key monitoring issues

- Recommendations on caribou monitoring SOP
- Three preliminary recommendations on closure planning
  - Site visit
  - Communicating with communities
  - Knowledge sharing with other EMAs

4. Develop General Approach to TK/IQ Panel Processes

- Indigenous knowledge methodology
- Youth involvement
- Sessions vs. workshops
- Balance of EMAB leadership and independent knowledge creation/sharing
- Cross-cultural learning approach
- Research vs. consultation

TK Research History

1. Social science approach
2. Indigenous methodologies
3. Cross-cultural learning approach

1. Social Science Approach

Questions/objectives	Science-driven
Methods	Structured, quantitative, extractive
Accountability	"Integration" or "incorporation" into science-based processes
Benefit	Easy to interpret
Challenge	Knowledge holders lose control Quality/meaning suffers

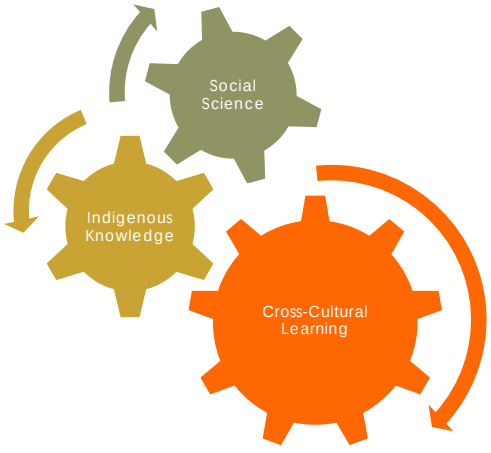
2. Indigenous Methodologies

Questions/objectives	Arise from TK/IQ holders
Methods	Indigenous knowledge creation processes – "research as ceremony," talking circles, on the land, story-based
Accountability	Embodied knowledge mobilization (community and external)
Benefit	Knowledge holder ownership, quality control
Challenge	Difficult to validate and accommodate in external decision-making

3. Cross-Cultural Learning Approach

Questions/objectives	Jointly agreed to, accounting for new scenarios
Methods	Mixed, involving two-way learning
Accountability	Dual
Benefit	Contextual; "everyday"; easier to validate and accommodate in decision-making
Challenge	Complex, new

TK/IQ Approaches




ON THE LAND
LAWS
Hunting
Fishing
Gathering
Sharing
Spirituality
Language
Stories
Songs
Ceremonies
Medicines
Sacred Sites
Water
Air
Land
Plants
Animals
Family
Community
Elders
Children
Youth
Women
Men
Leadership
Governance
Economy
Education
Health
Housing
Culture
Traditions
Protocols
Territory
Boundaries
Resources
Rights
Responsibilities
Relationships
Kinship
Clans
Moieties
Totems
Crests
Regalia
Dances
Songs
Drums
Rattles
Feasts
Potlatches
Trade
Barter
Money
Banking
Credit
Debt
Taxation
Property
Ownership
Inheritance
Wills
Estates
Trusts
Corporations
Partnerships
Contracts
Agreements
Treaties
Negotiations
Litigation
Arbitration
Mediation
Courts
Judges
Lawyers
Police
Prisons
Corrections
Probation
Parole
Rehabilitation
Restorative Justice
Traditional Justice
Customary Law
Common Law
Civil Law
Criminal Law
Family Law
Child Welfare
Adoption
Foster Care
Guardianship
Custody
Access
Support
Divorce
Separation
Marriage
Common-law
Same-sex
Polygamy
Monogamy
Celibacy
Abstinence
Contraception
Abortion
Adoption
Surrogacy
Fertility
Infertility
Pregnancy
Childbirth
Midwifery
Doulas
Lactation
Breastfeeding
Formula
Nutrition
Diet
Exercise
Fitness
Sports
Recreation
Leisure
Hobbies
Arts
Crafts
Music
Dance
Theatre
Film
Television
Radio
Print
Media
Journalism
Publishing
Libraries
Archives
Museums
Galleries
Tourism
Hospitality
Food
Beverage
Accommodation
Transportation
Roads
Bridges
Tunnels
Airports
Seaports
Railways
Public Transit
Taxis
Ride-sharing
Car-sharing
Bike-sharing
Walking
Cycling
Driving
Parking
Traffic
Signals
Signs
Lights
Cameras
Surveillance
Security
Privacy
Data
Information
Technology
Internet
Broadband
Wireless
Satellite
Telephone
Mobile
Smartphones
Tablets
Computers
Software
Hardware
Networks
Servers
Cloud
Storage
Backup
Recovery
Disaster
Emergency
Fire
Flood
Earthquake
Tsunami
Hurricane
Tornado
Drought
Famine
Epidemic
Pandemic
Quarantine
Vaccination
Immunization
Public Health
Mental Health
Addiction
Substance Abuse
Tobacco
Alcohol
Drugs
Gambling
Prostitution
Sex Work
Human Trafficking
Slavery
Forced Labour
Child Labour
Exploitation
Abuse
Violence
Domestic Violence
Sexual Assault
Rape
Harassment
Bullying
Discrimination
Racism
Sexism
Homophobia
Transphobia
Ableism
Ageism
Classism
Xenophobia
Islamophobia
Anti-Semitism
Hate Crimes
Genocide
Colonialism
Imperialism
Capitalism
Socialism
Communism
Democracy
Dictatorship
Monarchy
Republic
Federalism
Provincialism
Municipalism
Local Government
Regional Government
National Government
International Government
United Nations
European Union
NATO
G8
G20
World Bank
International Monetary Fund
World Trade Organization
North American Free Trade Agreement
Kyoto Protocol
Paris Agreement
Climate Change
Global Warming
Greenhouse Gases
Carbon Dioxide
Methane
Nitrous Oxide
Ozone
Pollution
Air Pollution
Water Pollution
Soil Pollution
Noise Pollution
Light Pollution
Waste
Recycling
Composting
Landfill
Incineration
Hazardous Waste
Nuclear Waste
Radioactive Waste
Toxic Waste
Biohazard
Contamination
Remediation
Conservation
Preservation
Restoration
Sustainability
Renewable Energy
Solar Power
Wind Power
Hydroelectric Power
Geothermal Energy
Biomass
Biofuels
Fossil Fuels
Coal
Oil
Natural Gas
Petroleum
Refining
Pipelines
Tankers
Spills
Accidents
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Workers' Compensation
Occupational Health and Safety
Workplace Safety
Harassment
Bullying
Discrimination
Equity
Diversity
Inclusion
Accessibility
Human Rights
Civil Rights
Freedom of Speech
Freedom of Assembly
Freedom of Religion
Freedom of the Press
Freedom of Information
Privacy
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Terrorism
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Accommodation
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Bridges
Tunnels
Airports
Seaports
Railways
Public Transit
Taxis
Ride-sharing
Car-sharing
Bike-sharing
Walking
Cycling
Driving
Parking
Traffic
Signals
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Backup
Recovery
Disaster
Emergency
Fire
Flood
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Tornado
Drought
Famine
Epidemic
Pandemic
Quarantine
Vaccination
Immunization
Public Health
Mental Health
Addiction
Substance Abuse
Tobacco
Alcohol
Drugs
Gambling
Prostitution
Sex Work
Human Trafficking
Slavery
Forced Labour
Child Labour
Exploitation
Abuse
Violence
Domestic Violence
Sexual Assault
Rape
Harassment
Bullying
Discrimination
Racism
Sexism
Homophobia
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Communications


CAMP

Preferred Rock Pile "Look"

DDMI Traditional Knowledge Panel Session #8

FOCUS ON REEFS AND MONITORING WATER

Yellowknife, NT
December 2–4, 2015

Thorpe Consulting Services

Diavik Diamond Mines (2012) Inc.
Traditional Knowledge Panel Report

Session #8: *Focus on Reefs and Monitoring Water*

Yellowknife, NT
December 2-4, 2015

Facilitation

Joanne Barnaby, Joanne Barnaby Consulting
Natasha Thorpe, Thorpe Consulting Services (TCS)

Participants

Kitikmeot Inuit Association	Bobby Algona, Nancy Kadlun, Ethan Kadlun (youth)
Łutsel K'e Dene First Nation	August Enzoe, Bertha Catholique, Lucas Enzoe (youth)
North Slave Métis Alliance	Ed Jones, Kathy Arden
Tłı̨chǫ Government	Dora Migwi, Louie Zoe, Janelle Nitsiza (youth), James Rabesca (interpreter)
Yellowknives Dene First Nation	Mike Francis, Fred Sangris, Mary Louise Black (youth), Berna Martin (interpreter)

Observers/Presenters/Visitors

Fisheries and Oceans Canada	Julie Marentette and Georgina Williston (presenters)
Environmental Monitoring Advisory Board	John McCullum
North Slave Métis Alliance	Chloe Dragon Smith
Tłı̨chǫ Government Lands Department	Phoebe Rabesca
Diavik Diamond Mines Inc.	Gord Macdonald
C&E Consulting	Colleen English
Thorpe Consulting Services	Janet Murray (transcriber)

Interpreting equipment provided by Pido Productions.

Background

The TK Panel is mandated to assist Diavik Diamond Mines (2012) Inc. (Diavik) and work with local communities in facilitating appropriate and meaningful accommodation of Traditional Knowledge (TK). The TK Panel provides guidance in environmental management and monitoring as well as in closure planning at the Diavik Diamond Mine. From 2011 through early 2013, TK Panels were assembled by the Environmental Monitoring Advisory Board (EMAB) to discuss select concerns related to the Diavik Diamond Mine. The most recent session was held in Yellowknife, NT from December 2–4, 2015 and was the fourth in a series of TK Panel sessions now administered under Diavik rather than EMAB, but the eighth in the series of TK Panel sessions.

Session Purpose

This eighth session focused on Diavik's closure plans in relation to water monitoring and the dike, including reef construction and shoreline design options. Both small scale and landscape level considerations for the immediate mine site (e.g., East Island) and broader Lac de Gras area were discussed (Figure 1).

The TK Panel drew upon their knowledge of fish and water, as well as observations made during previous site visits and the 2015 AEMP TK Camp, ultimately elaborating further on concepts, values, understandings, and complexities offered in earlier TK Panel sessions (e.g., advising that undisturbed areas within the dike should not be disturbed when the reefs are constructed). The TK Panel developed recommendations and commented on future sessions for review and consideration by Diavik.

Session Goals and Activities

The TK Panel reviews closure plans for various areas of the mine, shares their knowledge in relation to each topic and presents recommendations to Diavik at the end of each session. In this way, they are continually increasing their understanding of the mine site and its closure challenges, while also directly influencing Diavik's closure plans. The goals for Session 8 were to:

1. Provide an opportunity for TK Panel members to determine priorities and methods for managing and monitoring water post-closure.
2. Review the results of the 2015 AEMP TK Study.
3. Consider fisheries habitat upon closure, specifically the proposed reefs within the dikes.
4. Learn how recommendations provided to Diavik in the past session are being considered presently.

Figure 1 Diavik Diamond Mine 2015

This three day TK Panel Session was held in Yellowknife and structured according to these key goals. At the outset of the session, the group reviewed the proposed format, scheduling and agenda. An evaluation process held at the end of the session helps to improve future sessions.

> We are talking about the importance of the water. This is our land. That our land won't be so disturbed that we'll have it forever and we are not talking for ourselves we are talking for our future, that we would always have the water clean. – Louie Zoe, December 2, 2015

Report Overview

This report first outlines key themes around water and fish related to closure planning that were discussed during the session and closes with recommendations made by the TK Panel. Appendix A includes some photos from the session. Appendix B includes the session agenda while Appendix C contains a blank copy of the informed consent form that was signed by participants new to the TK Panel. Since it was not possible for the participants to review the session transcripts, these are included in draft form only in Appendix D.

Bobby Algona and August Enzoe gave a detailed update of the AEMP TK Study (see Appendix D [Day One] and Appendix E) highlighting the summer camp, recent verification session, review the related draft video-documentary [https://vimeo.com/artlesscollective/wefishtodayforfishtomorrow] and report conclusion [available through Diavik public registry: http://www.mvlwb.ca/Boards/WLWB/SitePages/registry.aspx after March 2016]. Diavik provided an update of the closure plan (Appendix F) and reported back on TK Panel Session 7 recommendations on vegetation (Appendix G). Diavik also reported on water quality (Appendix H) and presented an informative / educational presentation on fisheries habitat, with a focus on reefs (Appendix I). The Department of Fisheries and Oceans Canada gave a presentation on reefs/ shoals (Appendix J).

On the morning of the last day, the youth collaboratively presented the work of the TK Panel to Gord Macdonald through a presentation outlining key observations and comments as well as recommendations on reefs and monitoring water (Appendix K). A short presentation delivered on the next steps is included (Appendix L), followed by a summary of participant evaluations (Appendix M).

Proceedings: Key Themes

The key themes discussed throughout the session included:

1. It is important to continually monitor water quality and quantity after closure using both TK and western science.
2. With slight modifications, the current Aquatic Effects Monitoring Program (AEMP) TK Study is strongly supported and should continue at the current location until at least 2018.
3. Fish need to be respected and have different habitat considerations for different life-stages.
4. Youth need to be involved, both now and in the future.
5. Diavik and the TK Panel is a model for collaboration between western science and TK.
6. The future is uncertain and efforts to increase energy efficiency and monitor for climate change are important.

1. Continually Monitor Water Quality and Quantity after Closure

The TK Panel was unwavering in advising that water and fish continue to be monitored long after closure, both at the present site (e.g., East Island) within the dike and in surrounding waterbodies (e.g., Lac de Gras, the Narrows, Lac du Sauvage, outflow to Coppermine River). Discussions started with the current AEMP and included how a monitoring program should continue in the near future and post-closure. As part of these discussions, issues around water levels, flow and monitoring capacity of communities were frequently mentioned.

> It's got to be monitored even after Diavik is gone. It's got to be Aboriginal people because it's our land. We don't want anything to happen, we don't want just anybody to walk away and leave it. So it's got to be monitored for the next generations, the next generations that are coming. It's got to be ongoing. Because it's water, it's the only thing that gives life. – Bertha Catholique, December 2, 2015

> We do need to monitor an ongoing program for after the mine is closed, we've already heard that. Until we are satisfied - that is a strong phrase there - until we are satisfied. I think that speaks for itself, after the mine life is done. – Bobby Algona, December 2, 2015

Throughout the three days of discussions, the TK Panel considered which areas they would like to sample and why; how, where and whether to interweave TK and western science in water monitoring and specific features of the land that might clean or heal water.

The TK Panel expressed that Diavik has an ongoing responsibility to make sure that "all is well" and "people's minds are at ease" but that community members want to help and ultimately take the lead today, tomorrow and long into the future.

2. Aquatic Effects Monitoring Program

The TK Panel voted to keep the current location of the AEMP camp until at least 2018. After closure, participants asked that Diavik consider options to donate camp facilities to people traveling to Lac de Gras and, if it is not possible to keep the current camp intact, that at least the tent frames remain.

The financial, logistical and capacity challenges of community members to continue AEMP activities (both the scientific and traditional knowledge elements) were raised multiple times. The Panel recognized that monitoring is costly and advised that Aboriginal groups should start working with governments and industry today to plan for closure tomorrow. A monitoring program similar to the AEMP could be administered through the Environmental Monitoring Advisory Board or another independent agency that could pull together the five Aboriginal groups and governments.

One suggestion was to use the bond posted by Diavik as a possible funding source to support monitoring post-closure. However, Diavik clarified that the bond is considered a "safety net" which is not meant to be used unless something extreme were to happen (e.g., company bailouts, bankruptcies).

Discussions of monitoring post-closure helped the TK Panel realize that current community capacity is not at a level where Aboriginal communities could take-over monitoring in the same way as is done presently. The importance of supporting monitoring training today thus becomes even more critical. Further, participants strongly advised that people start monitoring training now so that youth today can carry through to monitoring post-closure, equipped with *personal knowledge and experience* (i.e., the foundations of TK) of decisions and activities today. One suggestion was to build a school in the north specifically for monitoring; however, the TK Panel recognized that there are several existing monitoring programs to help build monitoring capacity:

- *LKDFN Watchers of the Land* (www.landoftheancestors.ca/team/ni-hatni-dene-program.html)
- Aurora College Environmental Monitor Training Program (www.auroracollege.nt.ca/_live/pages/wpPages/ProgramInfoDisplay.aspx?id=64&tp=PRG) or Environment and Natural Resources Technology Program (www.auroracollege.nt.ca/_live/pages/wppages/ProgramInfoDisplay.aspx?id=117&tp=PRG)
- BEAHR Environmental Monitoring Coordinator, etc. (http://www.eco.ca/beahr/program-options/)
- Programs such as CIMP that are supported by the territorial and federal governments

Aboriginal groups must continue to monitor fish and water long after closure in a coordinated and well-funded program that integrates TK and western science.

During the update of the 2015 AEMP TK Study, Bobby Algona and August Enzoe mentioned that a few changes to the methods were suggested for next time, including tasting water in its pure form rather than as tea. The TK Panel discussed and supported this suggestion.

Figure 2 shows sampling locations for the scientific components of the AEMP that were developed with community input and are still supported by both 2015 AEMP TK Study camp participants and members of the TK Panel. However, given the importance of the Narrows to wildlife, fish and people, the TK Panel members advised that both fish and water should be sampled from this area henceforth for the TK component of the AEMP.

Water Quality Monitoring [Lac de Gras]

During this session, many indicators of good water quality from the TK perspective were shared. One example was that "bugs" within the lake have long been an indicator of good water for drinking.

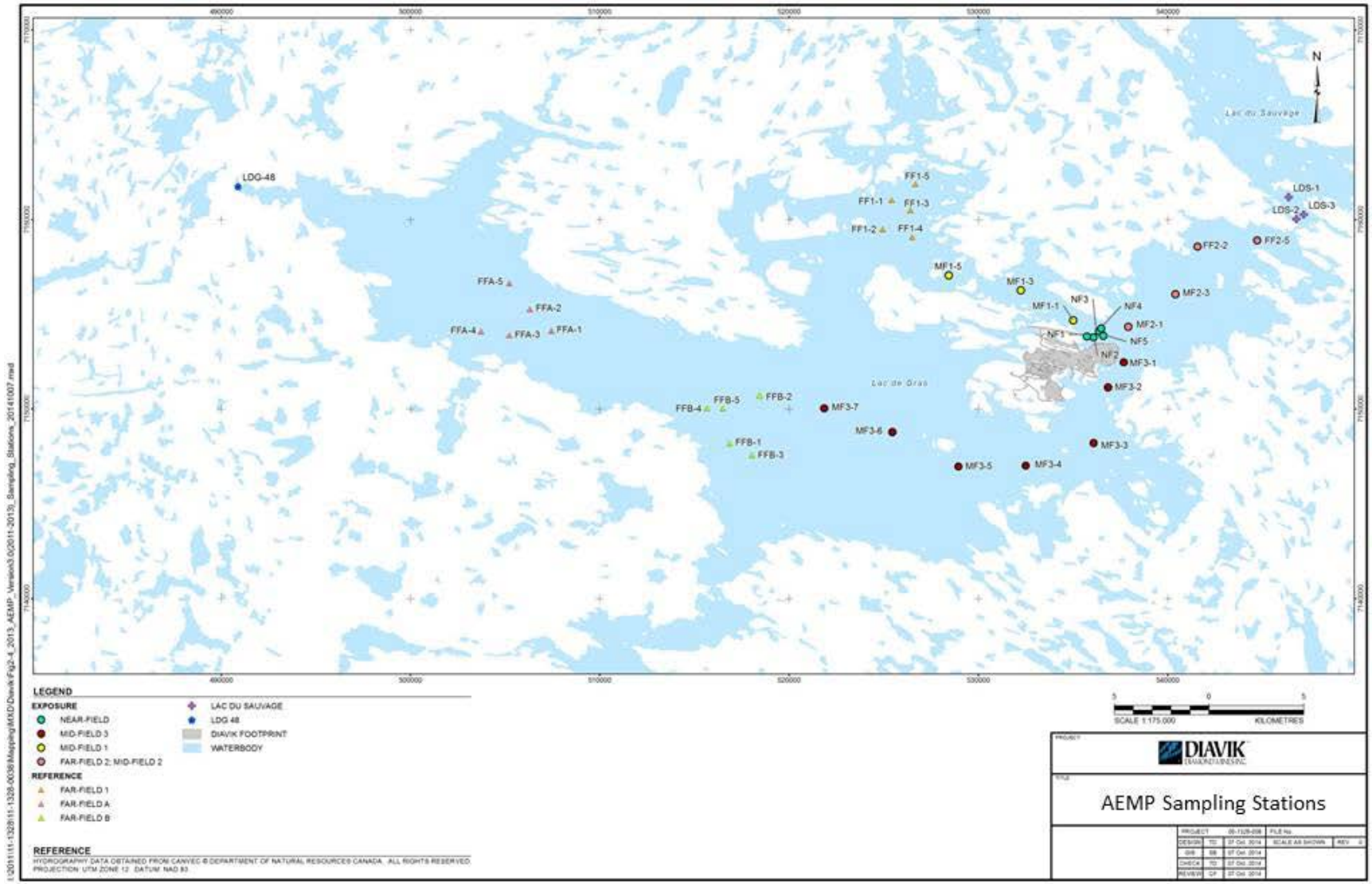


Figure 2 AEMP Sampling Stations

> Even without water or tea testing, which I saw this summer when we did water sampling from underneath the lake. When the lake bottom comes up, we saw all kinds of little bugs and that makes me happy because I know the water is healthy because all those little bugs wouldn't be living if it was contaminated. They are so tiny and there were lots of kinds I was happy to see that. They are so tiny they couldn't live with the contamination. – Nancy Kadlun, December 2, 2015

Another example was that animals could be monitored to see if they drink from particular water sources. If they hesitate to drink or come near a water source, this might mean that the water quality is compromised.

TK Panel members spoke to the importance of continuing to taste lake water to evaluate quality. Lessons from TK suggest that the best drinking water comes from deeper areas, below the surface. One must look for scum on the surface of the water as well since this can be an indicator of poor or altered water quality.

> When the water changes, there is a scum around the cup, – Fred Sangris, December 2, 2015

Fish tasting is also an important indicator of water quality. The TK Panel explained that when the water quality changes, the fish can taste different.

Water Quality Monitoring [Water flow in/around site]

In addition to the AEMP sampling locations, the TK Panel discussed in detail how water should be monitored in and around the current site, within the dike on the East Island and within the context of the current surveillance network program (SNP) as shown in Figure 3. After much consideration, dialogue with Diavik and review of current maps showing pit location, undisturbed areas and landscape, the TK Panel decided that when the pits are refilled and the dikes breached, the natural lands between the pits and dikes should be left alone to facilitate natural regrowth, and reefs of various heights and composition should be constructed away from existing vegetative growth and lake bottom sediments.

Participants emphasized that the land can heal itself and that vegetation and mosses are known to filter water. Placing mosses or encouraging certain types of vegetation to grow in key aquatic areas such as channels and shorelines should be considered as part of the closure plan and included in post-closure monitoring.

Given concerns about possible water contamination in the areas within the dikes, TK Panel members suggested that water quality monitoring on East Island post-closure should be done through scientific analysis and visual inspection led by the communities (i.e., not by tasting). However, tasting water in Lac de Gras and other areas farther from the immediate mine site would continue as part of any monitoring program such as the AEMP TK Study.

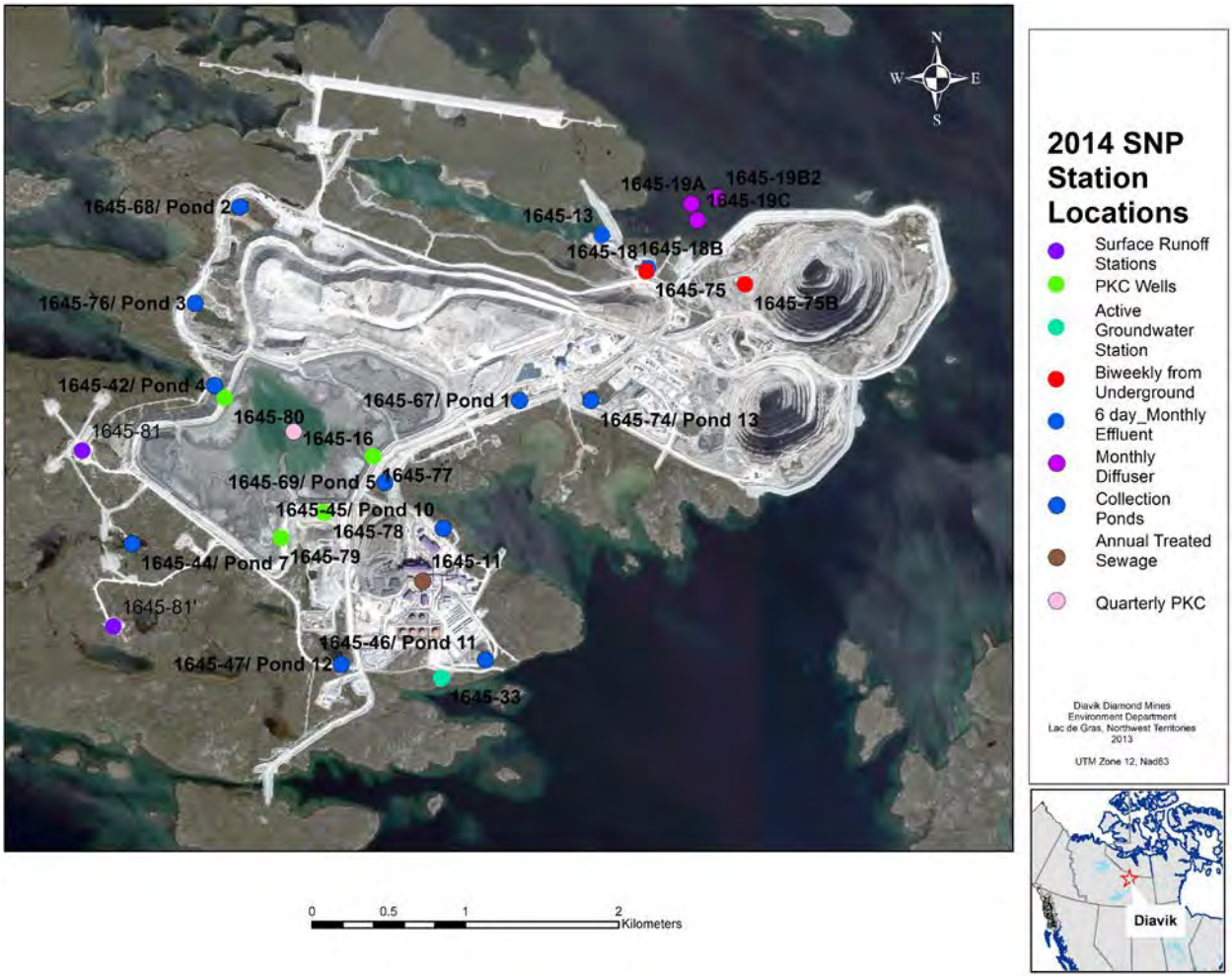


Figure 3 2014 Surveillance Network Program Station Locations

I know that the Elders don't want to drink the water there because there is still residue from the dynamite on the walls of the open pits, ammonia and so on, so I wouldn't want to drink it anyways but I think the idea of getting samples or continued study on that would probably be good. The pits themselves have to be studied, get the water, get it studied to check that the water is still the same or if there are any changes happening to it we need to know. But I think a lot of us here are not going to continue to be involved; most of us will probably move on but I think it's important to bring our youth, get them involved, educate them, they need to continue to be involved so that the monitoring can continue and the reports can come out and they can understand the reports so that 2030 maybe continue into the future, we don't know when is the end. – Fred Sangris, December 2, 2015

TK Panel members expressed concern about groundwater and how tunnels extending under the pits may lead to contamination. Diavik explained that they plan to remove any items from the pits and underground tunnels that would lead to water contamination. Given that water is saltier deeper under the earth's surface, water will be monitored within the pits as they are refilled. Extensive testing and monitoring of water is required before, during and after the dikes are breached.

3. Fish Need to be Respected and have Different Habitat Considerations for Different Life-stages

The third key theme that emerged from the session is that fish need to be respected and that they have different habitat considerations for different life-stages. Fish need special considerations: they can hear and feel what you are doing on the ice, they need shorelines that provide sources of oxygen, and pressure ridges or open water are well known areas that attract fish because of the oxygen. Presence of too much algal growth on shorelines can be an indicator that there is less oxygen for fish, so this should be monitored.

In future AEMP TK studies, the TK Panel advised that nets be set on both sides of East Island and that both fish and water be monitored.

The TK Panel discussed at length how artificial reefs, shorelines, and pits should be handled post-closure to maximize fish habitat. Participants outlined what makes habitat "good" for spawning, nursing, rearing, and resting with a focus on water movement, substrates and slopes. They considered potential reef shapes and sizes, the type and size of rock to use, and how deep underneath the surface of the water they should be. The TK Panel also considered the shorelines around the dike and pits, thinking about how they should be best modified for fish, wildlife and vegetation.

Reefs

After both Diavik and DFO gave presentations on how reefs are constructed to maximize fish habitat, TK Panel members advised that the current approach sounds reasonable and that efforts should be made not to interfere with undisturbed areas on East Island, within the dike and when constructing reefs. It was agreed that the areas within the dikes should not be constructed to encourage spawning, but focus more on rearing and resting.

> They like to lay their eggs in a very sandy area, maybe not sandy but gravel, and it has to have a slope. The current can't be really strong but it has to be moving. . . . When the fish are born, they like that shallow area with a little bit of gravel. They don't like the sand, and most areas in the east where there is a lot of fine sand you always find dead minnows floating around. They have no protection to hide from the waves so the waves just wash them up and that's why we find

> lots of minnows on those sandy beaches. After they are born they want to go into the shallow areas, so through the islands you will find lots of minnows. But they are not going to go in the pits. – Fred Sangris, December 3, 2015

Participants also clarified that a variety of shapes and sizes should be considered for reefs, but that they should not pose a safety hazard for travelers. Specifically, it was advised that the reefs remain low enough under the water that the ice still freezes solid. Reefs can affect currents and lead to open water if they are too close to the surface. If the reefs extend out of the water (i.e., become islands), snow and ice can accumulate such that the ice is not as thick in the middle of the lake due to insulation effects. Bobby Algona cautioned:

> I have come across a lot of shoals . . . where I grew up and lived all my life and there are many, many shoals on this lake and I have to be really, really careful around those areas. . . . That was my big concern, for safety. Am I going to be safe coming to this place when there is a shoal there that I didn't know about, and it's keeping the ice thin. – Bobby Algona, December 3, 2015

Participants advised that in addition to substrate, currents are a determining factor in spawning site selection and successful spawning. Fish are known to lay eggs in shallow areas where there is current. After much discussion, it was suggested that there was good spawning habitat elsewhere in Lac de Gras and that this needn't be a focus for the reefs, shorelines, dikes or pits.

Shorelines and Pits

The TK Panel reviewed satellite photos of the current mine site (Figure 1) and drew from their experiences "seeing with their own eyes" while onsite to conclude that the shorelines on the dikes can be left largely as-is. The group agreed that upon closure, the roads leading down into the pits could be left as-is, but the approximately 1 km cliff along the shoreline of Pit A418 should be modified such that caribou and other animals can have easy and safe passage. Session participants thought that the caribou might fall or be chased off the cliff in Pit A418.

> Yes I understand there is a drop about 10 feet which is dangerous for the caribou and the wolves and the foxes. So before the water is pumped back in there, I suggest maybe you put some sort of a slope. – Louie Zoe, December 3, 2015

Further discussion clarified what modifications might work:

> What if you left pieces of it as a cliff but add pieces of gradual slope for the caribou? – Gord Macdonald
>
> Yes, that would work. – Bobby Algona, December 4, 2015

Participants agreed that the shoreline around Pit A154 can stay as-is and didn't pose any hazards. Given the challenges of providing guidance without seeing the pits and shorelines at the site, the TK Panel members asked that they be given the chance to visit these areas to see for themselves and provide specific in-the-field guidance on the shoreline to Diavik at a later date.

During closure and when building reefs or making modifications to shorelines, the stages in the moon cycles should be considered as they are well known to affect water flow and currents.

> You can use a fish line as an indicator of current and watch how it changes; it is important to understand currents in Lac de Gras and Lac du Sauvage when thinking about reefs, shorelines and pits. – Bobby Algona, December 3, 2015

Pits

As in previous sessions, members of the TK Panel shared their concerns that the pits were not going to be re-filled with rock and that the pits would be too deep for fish habitat. People also discussed concerns about water quality in the pits once they are filled with water, as discussed above. Diavik reviewed the current closure plan and explained how the pits would be filled with water and tested for approximately five years before the dikes were breached. From that point, it was suggested that it would take "just a few short years" before the fish would return to the area.

4. Youth Must be Engaged

Although current efforts were recognized, better ways to engage youth by community members need to be explored. Accordingly, two youth from each Aboriginal group should be attending camps and meetings. It was recognized that elder panel members could help ensure that Aboriginal governments select appropriate youth in a timely manner. Both the importance of, and challenges with youth engagement have been discussed at every TK Panel session.

5. Diavik and the TK Panel Demonstrate a Collaborative Model

Collaboration between different groups, disciplines, and generations strengthens the nature and quality of the work that is carried out by TK Panel members as well as the resulting actions taken by Diavik (for example, see responses to recommendations from Session 7 in Appendix C). While the membership of the TK Panel has shifted slightly to become more gender balanced, many members have been participating since the TK Panel began in 2011. Such commitment levels are indicators of the success of the TK Panel and enable the members to move through a series of related topics with each session, building on their knowledge from one year to the next.

As Bobby Algona summarized:

> I think there is a whole lot more things that we can learn from this as well and certainly as TK holders we have come to appreciate what scientists have brought as well. I think we need to work much more closely with the scientists as well so that scientists can learn from us as well as to how we came to learn these things. – Bobby Algona, December 2, 2015

Early in the session, one participant asked Diavik how they could help advise Diavik regarding planning fish habitat when the pits were reconnected, given that TK Panel members had never seen this "problem" before. Yet the very point of the TK Panel is to facilitate interweaving TK expertise that simply may not have been applied in the same setting before, but nonetheless, is integral to a fulsome understanding by DDMI, scientists, TK holders, regulators, and northerners alike. Indeed, it is the commitment of TK Panel members and Diavik staff alike to respect one another's perspectives and to see value in learning from each way of knowing that is at the core of this successful collaborative model.

> . . . give a little insight about what the dangers might be and to get them to think a little bit about what your future might be with what the mining industry is doing and how the mining industry as well can help the youth with a program or what they might be doing in the future. That's a most wonderful thing that we can do as Elders. We can have these that we can bring home and it makes it a whole lot easier to explain to the young generation with these tools. – Bobby Algona, December 2, 2015

> One thing that we can probably use is, we all come from different communities, maybe there is something we can bring back to the community to show them what we are doing and they can see the progress we have made. So our community people have an idea, you were involved, we are helping with the recommendations, this is how closure is going to work and this is how we are going to be monitoring. We need to show something to the community so they know the mines are not being abandoned and you are not walking away. So there is progress and there are people thinking about the future. And safe guards are there. – Fred Sangris, December 3, 2015

Given the success of this collaborative model, the TK Panel members emphasized that materials that reflect this collaboration in monitoring and planning should be shared publicly and widely. Educational "tools" such as videos (DVDs), books, photos, should be given to TK Panel members as well as more widely distributed. Reports and video-documentaries developed for the AEMP TK Studies of 2012 and 2015 are examples of such materials.

6. Increase Energy Efficiency and Monitor Climate Change

This particular TK Panel Session took place the week after the *COP 21: UN Climate Change Conference* such that environmental issues, in general, and climate change impacts, in particular, were on people's minds. Throughout the session and during the breaks, TK Panel members spoke of the importance of this global conference. It was as if the conference provided a certain level of urgency and responsibility as well as empowerment to the work of the TK Panel. Such discussions provided opportunity for Elders and youth to come together to talk about the mining industry, climate change and the accompanying responsibilities held by Indigenous peoples in monitoring their lands.

> I notice everything around us here, when I look at things, how many ounces to make this one tool that we use. How many ounces to make this one microphone that we use as a tool? . . . Looking at all that, we need to think a whole lot more about the mining industry itself. We can't get away from the mining itself, I see very far into the future the mines are going to be ongoing all the time now, we cannot get away from it. I think even though I have a lot of qualms about the mining industry itself, then I start to look at a lot of other good tools that they make alright but I always think of something that we should be doing. – Bobby Algona, December 2, 2015

> I like that Bobby touched base on the environment. I think what Diavik and all these mines really need to take into consideration is doing things more energy efficient now, not in the future, not when we are closing but now. Work on the little things, it's the little things that count; they make big things one day. So any little thing that we can do to help the environment because climate change is here, it's in our face, we need to deal with it now otherwise none of us will be here and its really serious. – Janelle Nitsiza, December 2, 2015

Youth Lucas Enzoe asked the group: "Are we going to find an alternative way to make better tools for a greener place to help out the earth, or keep destroying the earth?"

Concerns about lower water levels across the North were also shared along with the concept that water is life-giving and precious:

> Okay well I want to make a point, too. Water across the world is very precious. I think it's more precious than the diamonds that we are digging up because are you going to drink diamonds when the world runs out of fresh water? I don't think so. – Janelle Nitsiza, December 3, 2015

The TK Panel spoke to the importance of planning for climate change through closure and post-closure:

> My concern is the volume of water that we have right now. We know lakes are becoming very low now. Global warming has an effect on this, too. Are we going to have rain coming down in the future? Looking at it in the future we are not getting much rain right now that's what I have been really worried about. Are the natural levels going to come back to Lac de Gras due to climate change as well? And having that volume going back into the pit was my concern; taking that little bit along with global warming and not much precipitation over the last few years, that is my concern. – Bobby Algona, December 3, 2015

Outcomes: Recommendations

The TK Panel collectively developed 33 unanimous recommendations related to reefs and monitoring water at closure (Appendix K). These recommendations flowed from a common vision expressed during previous TK Panel sessions that the mine site be returned to the most natural state humanly possible and that monitoring efforts continue, in part, to support fish and wildlife.

Following observations and comments about fish, water, the AEMP, reefs (shoals), shorelines, and other general issues, the recommendations are divided by the following themes:

- AEMP TK Study
- On-Island
- Reefs
- Shoreline
- General

Recommendations are numbered to reflect the TK Panel session identification (i.e., Session 8) and to subsequently identify each specific recommendation (i.e., 8.1–8.33).

TK Panel Next Steps

Following from planning carried out at previous sessions, Diavik gave an overview of the next TK Panel topics and schedule suggestions (Appendix L). The TK Panel supported the following suggestions: TK Panel Session #9 will focus on post-closure wildlife monitoring and be held on-site at Diavik in either May/June of 2016; and TK Panel Session #10 will focus on a closure plan update and landscape overview and similarly be held on-site. The TK Panel reiterated that they would like to visit the North Country Rock Pile to view the current height, the pit shorelines, areas planned for reef construction within the dikes, as well as the sewage treatment plant.

Appendix A

TK Panel #8 Session Photos

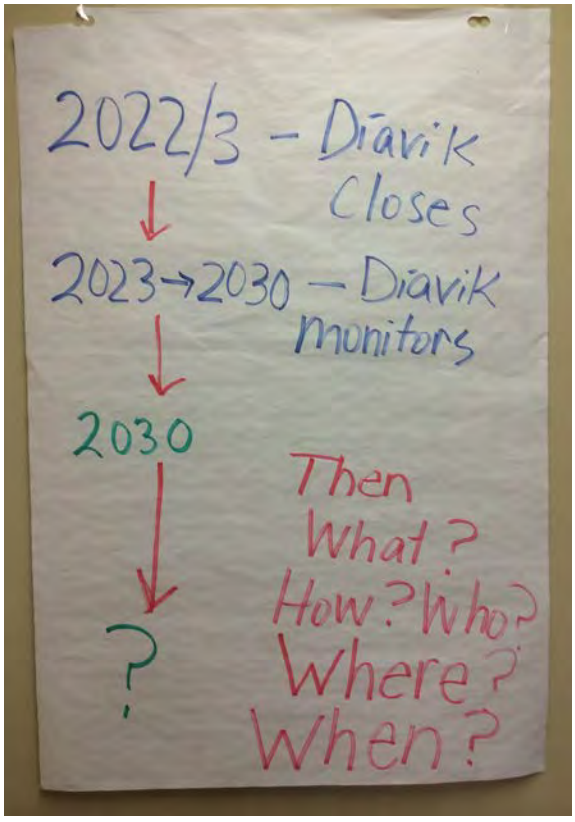
Dora Migwi

Mike Francis

Janelle Nitsiza shares a laugh with Elder Louie Zoe. Janelle recommends humour as a way of connecting and bridging language differences with Elders.

Ed Jones and Kathy Arden participate in discussion (foreground); Chloe Dragon Smith and August Enzoe remember the AEMP TK Camp of 2015 together.

The Panel puts forth ideas for water quality monitoring [Nancy Kadlun; Bobby Algona; Ed Jones; Kathy Arden; Joanne Barnaby (L-R)].



The TK Panel provided guidance on post-closure monitoring, using flip charts, sticky notes and session recordings to capture their ideas.

Gord Macdonald of Diavik provides a diagram of the dike for discussion purposes.

Elder August Enzoe and Lucas Enzoe (foreground); Janet Murray and Mary Louise Black (background).

Fred Sangris reflects on his experience with the AEMP TK Camp to provide guidance on how water and fish should be monitored in the future.

Appendix B

TK Panel #8 Session Agenda

Agenda

Diavik Diamond Mines Inc.
Traditional Knowledge Panel
Session #8: Aquatic Systems
Yellowknife, NT
December 2 - 4, 2015

Wednesday, December 2

8:30 am	Opening Prayer
	Welcome, Round Table Introductions, Review Draft Agenda, Workshop Purpose Overview
	DDMI Closure Overview & Session Focus
	Break
10:30 am	Aquatic Effects Monitoring Program 2015 TK Study Update
	Group Discussion: *Monitoring fish health and lake water in the future*
12:00 pm	Provided Lunch [Play AEMP Video from 2015]
1:00 pm	Group Discussion: Cont'd
	Break
3:30 pm	Recommendations Table Update Review
	Group Discussion: Recommendations
5:00 pm	Close

Thursday, December 3

8:30 am	Overview of Day 1
	Diavik Presentation: Water Quality Monitoring [water flow on/around site]

	Break
	Group Discussion: *Monitoring water quality on East Island after closure*
12:00 pm	Provided Lunch
1:00 pm	Shorelines & Fish Habitat in Lac de Gras after closure (Presentations by Diavik & DFO)
	Group Discussion: *Shoreline and fish habitat design in Lac de Gras*
4:00 pm	Review of Days Key Messages / Recommendations / Notes
5:00 pm	Close

Friday, December 4

8:30 am	Compile and Review TK Panel Recommendations for DDMI
	Group Discussion
	Break
	Group Discussion
Noon	Lunch
1:00 pm	Present TK Panel Recommendations to DDMI
2:00 pm	DDMI Preliminary Response to Panel Recommendations
	Next Steps – plan for 2016 meetings
	Break
3:30 pm	Round-table
5:00 pm	Closing Prayer

Appendix C

Informed Consent Form

Diavik Diamond Mines Inc. Traditional Knowledge Panel

Informed Consent Form

I (name) _____ _____on _____, 2015 give permission for Diavik Diamond Mines Inc. and its contractors to take notes, photographs and / or audio and video recordings related to my participation in meetings, workshops and events related to the Traditional Knowledge Panel established for the Diavik Diamond Mine. I understand that my participation includes meetings and workshops held throughout each year either in communities in the NWT or NU or at the Diavik Diamond Mine.

Through my signature below, I understand that:

1. I consent to have my words, activities and responses regarding and related to my knowledge recorded on maps, in notes and photographs, and using audio- and video-recording equipment (collectively referred to as Traditional Knowledge Data);
2. I am free to choose not to respond to any questions asked or participate in any discussions without prejudice or penalty;
3. I can choose to be anonymous in my participation without penalty;
4. My representative Aboriginal Organization, DDMI and / or its contractors may use the information collected to contribute to operations and closure planning at the Diavik Diamond Mine;
5. DDMI and its contractors may share my information which I have verified and given permission to share in either reports and/or photographs and provide such information to my Aboriginal organization and other regulators:
6. I agree that my contributions may also be used for future educational, cultural, heritage, and environmental purposes that are outside the scope of the TK Panel and that my representative Aboriginal organization, DDMI and/or its contractors will make all reasonable efforts to consult me, or my descendants, before using my information for purposes not indicated above;

7. I will receive financial compensation for my participation in accordance with DDMI policy;
8. I am free to request that any information I share is removed, erased or deleted and that I will have the opportunity to verify draft video-documentaries, reports and maps to make edits before I sign them off and that final copies will be provided to me;
9. I also understand that DDMI cannot ensure the protection of the Traditional Knowledge from public release once the reports are released (e.g., via youtube.com, Facebook, other social media, or Aboriginal group websites);
10. The Traditional Knowledge Data will be summarized and integrated with scientific data into a report, which will be publicly available.

Signed this_____ day of_____ 2015, in _____ Northwest Territories,

Signatures:

_____ _____

Participant Aboriginal Organization

_____ _____

Diavik Diamond Mines Inc. DDMI Contractor

Appendix D

Draft Session Notes

Appendix D

Diavik Diamond Mines TK Panel Session #8 – Water Monitoring & Fish Habitat

Wednesday, December 2nd, 2015

Joanne Barnaby: Mike Francis will offer the opening prayer.

Mike Francis: Opening prayer

Natasha Thorpe: Welcome everybody it's good to see familiar faces around the table. I am hoping everybody has an agenda. I am going to take a moment to walk us through the next few days, planning for mine closure. Bobby and August are going to give you an update on the AEMP, the fish and water testing camp, that was held out at Lac de Gras this past summer.

We've got a video to show you at lunch time.

Before lunch we are going to talk a little bit about monitoring fish heath and lake water into the future.

At the end of the day Colleen will be presenting the response that came back from Diavik to the last set of recommendations that you made in Session 7 regarding re-vegetation.

Looking forward to having a discussion about what the AEMP TK study might look like after closure. 2022-2023.

Lunch is provided. DFO is coming in to talk about reefs and planning construction for after closure and talking about how Diavik might do this and what they can do today to plan that into the future.

So at the end of session we will review what we have talked about so far. Give any specific feedback or recommendations. And then Gord from Diavik will be here to listen to those and provide an initial response. And we will discuss plans for 2016.

Questions, comments??

We have a few new faces at the table so I am just going to pass the mic around so you can introduce yourself, your community and maybe tell us how long you have been involved with the TK Panel for Diavik.

Gord Macdonald: I have worked for Diavik for almost 20 years now and always in the environment department and currently my focus in on closure planning but while it is currently my focus it was also my focus back in 1996 when we were designing the mine and so a lot of those ideas that we had then and we got from

the communities then are in the closure plan. And now we are coming back to it after 20 years verifying where it is and working on the details of that, that I will present to you later this morning. I have been involved with the TK Panel from the beginning and some of its precursors and again I am looking forward to working with you and hearing recommendations from you on Friday.

Lucas Enzoe: Hi my name is Lucas Enzoe and I am new for this TK Panel and I am from Łutsel K'e.

August Enzoe: My name is August Enzoe and I sit on the wildlife management board for Łutsel K'e.

Bertha Catholique: I am Bertha Catholique. Originally I am interpreter/translator and I have been involved since before the Diavik mine had started and now they put me as participant and I don't feel right sitting here at the table. I am supposed to be back there (points to interpreter booth).

Janet Murray: Transcriptionist and I have been with the TK Panel for 2 years.

Colleen English: I worked for Diavik for about 10 years and I now do some consulting back to them. I have been involved with the TK Panel since the start and environment is also my back ground, similar to Gord, so I am here to sort of help with the Panel and do a lot of the behind the scenes work.

Mike Francis: Mike Francis from N'dilo.

Louie Zoe: My name is Louie Zoe, I have been with the TK Panel for quite a while so I am just trying to catch up and be able to have a good closure plan. And talk to what the elders are looking for into the future.

Janelle Nitsiza: Janelle Nitsiza. I am from Whatì was with the Panel in 2013 when we went to visit the site.

Dora Migwi: Hi my name is Dora Migwi and I am an elder from Behchokǫ̀. I have been participating as an elder regarding the closure plan and the TK Panel. And although I was scheduled to go to the fish study this past summer, there was a problem with the community so I stayed behind but I am happy to be back.

Phoebe Rabesca: I work for the Tłı̨chǫ government, and I am just new on the Lands department. I was in finance for 10 years it is my first time here.

Nancy Kadlun: My name is Nancy Kadlun, I work with the visitor's heritage center and I am so happy I made it to Lac de Gras this summer.

Ethan Kadlun: My name is Ethan Kadlun from Kugluktuk and I am new to this TK Panel.

Bobby Algona: My name is Bobby Algona. I am from Kugluktuk and I have been with Diavik ever since they started up right from the beginning doing environmental work and then from there I've done a lot of group sessions like this right from the beginning. Closure programs, ongoing programs, I do a lot of those and hoping that this will be a more communicative part that we have always been working together and trying to come up with ways of helping Diavik with their ongoing programs and closure programs. Thank you.

Ed Jones: My name is Ed Jones. I am a North Slave Métis Alliance elder I have been involved with this since the beginning but missed one or two meetings that were held on site.

Kathy Arden: Hello my name is Kathy Arden I am with the North Slave Métis Alliance and I am new to the TK panel although over the years when Diavik first started I was sort of on the other side of the table taking the notes and so it's going to be nice to see how far the TK Panel has gone and hopefully I can put in some input with you guys too.

Joanne Barnaby: I am one of the facilitators, I have been involved with Diavik in different ways. First of all helping communities prepare for the meetings and the hearings in the early days and I did some cross-cultural training work for them. I have been with the Panel about 4 or 5 years now.

Natasha Thorpe: I am Natasha Thorpe and like Joanne I have been involved with the TK Panel since it started. It was first run through EMAB then through Diavik, and my personal goal is trying to bridge western science and Traditional Knowledge.

House keeping issues, bathrooms are down the hall, keys are on the table.

Colleen English: Just if we did hear a fire alarm just go up the stairs and meet at the back parking lot.

Natasha Thorpe: Gord will talk first.

Presentation – DDMI Closure Overview (Appendix F)

Gord Macdonald: So what I wanted to do is to give a presentation at the beginning of every TK Panel. How many people have not seen the site? And how many people have not seen the closure plan?

As we go through the next few days I am not going to be here the whole time but I am across the street so I can come back.

PKC is where the waste kimberlite goes and we spent a lot of time talking about the North Country Rock Pile where the big boulders go. We talked about re-vegetation, you made some helpful maps and the women won. That was the best example the TK Panel has done so far because it's something we can use now.

Back to the focus of what we want to look at today. We have heard the water is equally important and we need to have a landscape where the water is in a condition that doesn't affect the fish and wildlife. We have been monitoring and in the future when the operations have stopped, we need to figure out how that may change. And how we would monitor into the future so from a time perspective, 2015 is almost over and I keep thinking that 2024 is a long time away but it comes so quickly. So that's when commercial production would stop. Then it would be 2025 when we would really want to start monitoring how this closed system would affect the wildlife and fish.

Presentation on screen

How we got here. What it looks like right now. I have been involved with Diavik 20 years this is the slide we took to the communities back then. Then a slide that shows what it looks like now. They are largely the same. One of the main reasons it didn't change is because it is on an island. But again just the main pieces of it, the pits, then the rock pile. In the very middle of these (pits) is where the kimberlite is. North inlet used to be part of the lake but is now part of the island and is where all the water is stored before it is treated.

Closure goals.

-Land and water that is physically and chemically stable and safe for people, wildlife and aquatic life

-land and water that allows for traditional use

-final landscape guided by Traditional Knowledge

-final landscape guided by pre-development conditions

-Final landscape that's neutral to wildlife-being neither a significant attractant nor deterrent relative to pre-development conditions

-maximize northern business opportunities during the operations and closure

-develop northern capacities during operations and closure for the benefit of the north, post-closure

-final site conditions that do not require a continuous presence of mine staff

Overview of closure plan by area

-North Country Rock Pile

-PKC - consistency of toothpaste, wanted to know the chemistry of that material, has been sent to a company in Saskatchewan and I will update later on this week.

-North inlet- built a dam across so we could use the pond as part of our treatment plant. Material has settled on the bottom of the north inlet.

-Buildings need to go somewhere – off site or into landfill, Wind towers?? Will they still have value in 10 years?

-The pits and the underground – the road around it is actually a dam, the brown part used to be the bottom of the lake, want to fill the pit with water for shut down. The deep portion is not usable as it is too deep for freshwater fish but the edges are usable.

Kathy Arden: What was the discussion about possibly partially filling that hole so it wasn't so deep??

Gord Macdonald: You mean filling it with rock?

Kathy Arden: Yes from the North Country Rock Pile.

Gord Macdonald: We have had that discussion many times and the answers are it's not something we could do practically. It would be prohibited expensive to do and it was discussed from the very beginning that, that isn't an option for us. The only way it might have worked, and it wouldn't work at this site, is if the sequence of mining is that you're finished in one before you dig the next one

and you can directly fill it that way. But all of our pits are still working because we've got underground mining underneath them so you can't fill them back in while you've got all of the mining going on underneath it, so it doesn't work at this site.

Kathy Arden: So now your North Country rock pile there, are you going to reform that to the land? Is that what the plan was?

Gord Macdonald: Yes we are going to soften the slopes so that caribou can get up them and people can get up them but mostly so that it's chemically safe, so that any water that lands on it will stay in it and not come out.

Kathy Arden: So it will be a big hill. Okay, because you were talking about melting the ice and all that because right now we have a lot of this environmental warming things going on and is that a factor that you have in your formula?

Gord Macdonald: Yes it is, good questions. So the pits will be filled back in with lake water.

Natasha Thorpe: The water will sit in there 5 years.

Gord Macdonald: We will fill it but the dikes will still be fully in place so we can do all the testing before we reconnect it to the lake. Build fish reefs but no fish could go there until everyone is comfortable.

So that is just an overview for you.

Ed Jones: Gordy I am just wondering at this point, well your plans look pretty good and what I want to say is, how can the TK Panel help you because we have never had this problem before?

Gord Macdonald: Yes that is true but you also don't know what information that you do have that you can share with us that will help us. Honestly take what a good fish habitat is like. That's something you know you have, you've just never applied it to this kind of a problem before. Same thing when you evaluate water and say it is good or bad, how do you do that? How do you evaluate something in a natural landscape, and can you use that to do this?

Colleen English: With water quality as well - with water on the island and also the water in the lake - you can help in terms of where you would sample and why, and what you are looking at based on what you would normally see.

Gord Macdonald: Also I am very happy to have the Panel say that you want science information on something like water chemistry and that's the information you need. Then we will make sure that we provide and explain that.

Nancy Kadlun: Just wondering about if you have to fill it with water and it's going to be very contaminated from the man-made dike and all the birds get in there and have that water that would be bad. Or can we just leave it the way it is?

Gord Macdonald: All of the information we have is that it won't be bad water. It will actually be very good water. But that is the question that everybody has and we will talk a bit more about the studies we have done to test what the water is going to look like. That's why we want to fill it before we connect it. If we just left it, it will fill up with water, but it will just take a long time for it to fill, and it also won't be as good of water. It will be from deep in the ground, not like the water in Lac de Gras, so we would like to fill it up quickly with good water.

Louie Zoe: I'm concerned about not only the open pit that we see right there. I can see that the company has gone underground and how they got there and then the water is going to connect to all the tunnels under there. So what type of materials have been left behind like air pressures, connecting to the underground steel pipe and all that stuff that might be left behind that might be causing some contaminations. And so these are things we've thought of before.

Gord Macdonald: Under both of the pits there is substantial underground workings that would get filled and we would be leaving materials behind exactly like you said - pipelines, ventilation - which we don't think would be a problem for contamination. What we do need to remove is all of the motors or anything with hydraulics, fuels, or lubricants that could get into the water. What we would be removing is anything that could contribute to contamination. Once we have approval, again maybe we need to have you come walk through the tunnels and see that what we have left behind is okay to leave. Then we would fill it up with water.

Phoebe Rabesca: If it's not filled with water then you say bad water is going to come up. I just want to know where is the bad water coming from and where is the contamination from and what kind of contamination is going to be in it and from where?

Gord Macdonald: The deeper you go into the ground, the saltier the water gets. Its natural but not what we see regularly, more like ocean water. We are a fair ways down in the ground now and we measure water down there and that is much saltier

then what Lac de Gras is. So if we leave the pits they will fill up with that saltier water, that's the bad water.

Natasha Thorpe: Any other questions?

Bertha Catholique: When was the whole discussion on the open pit because I remember when it was first started when you guys were going to go underwater and make a dike and make an open pit. Then a lot of people in Łutsel K'e didn't want that because what they are saying is that you guys are digging a hole in the ground making it like a big scab on your arm and then you are going to fill it up with water and the concern was to fill it back up, leave it the way it was. Is it too expensive to do that or is it expensive to take the rocks out and leave it like that? So that is my main question: is there any discussion around how we can heal that sore that you guys made?

Gord Macdonald: The discussion about putting the rock back into the pit comes up every time we have a discussion about closure. Yes, the answer is it is too expensive and we said that right from the beginning, back in 1996, 1998 that we couldn't heal that hole once we did this.

Joanne Barnaby: If there are no other questions.

Fred Sangris: I just walked in. I wasn't here early in the morning but I heard about this reclamation and heard about the water being filled in years ago but the water quality on that lake is very good, Bobby and I drank water from that lake, we ate fish from that lake. But the surface of the ground is all natural but once the grinded rock and materials is disturbed this is also a chance for salt and acid runoff. So I just want to know if that's filled in with water and the fish come around to spawn, is that going to affect the spawning area or is that going to affect the fish? What kind of contaminates is on that rock because I am sure it has some sort of effect.

Gord Macdonald: Our biggest worries are the pit walls themselves, the chemical reactions that have been happening on the rock walls being exposed that will get washed into the water when we fill it up. So we did a washing experiment, washed the walls then tested the water, is that water still good for the fish. There is lots of good water coming in, and not a lot of chemicals are going in it. What we found from our water studies is that it will still be very good water because there is so much Lac de Gras water going in with so little material coming off of the wall. It was also raised about hydrocarbons what happens? The last thing

I want to do is fill this up then find out its bad water so we don't want to do that either.

August Enzoe: We have been working on this closing part from the start and we did have a lot of input in there on how it should be done and that's really good. The sample of water there and rain goes in and out you didn't mention that, rain and snow water.

Gord Macdonald: We measure the amount of rain water and how much snow falls; we measure snow chemistry but not rain water chemistry.

August Enzoe: The snow and rain once it's in the water I mean.

Gord Macdonald: Yes, we do test that.

Bobby Algona: I am hearing again how these pits are going to be reclamated, living downstream from all of this mine fall out that we are experiencing. Hearing the chemicals that are going to be staying under that water for many many years and I am wondering if you are thinking about leaving that dike for several years and studying that water quality. And you're telling me that what if this water when it's filled up very soon, it might become a problem, that would become a problem for us, too, downstream and you are telling me that it is very expensive to process it to clean that how you want it. That might be expensive for you but what if that water gets all contaminated and runs downstream into Kugluktuk - isn't that going to be more expensive then what the mine is proposing to do?

Gord Macdonald: That's exactly why when we fill it up with water we won't be putting holes in the dike until we know that that water is good. So you can take Kugluktuk as the best example; we don't want to release that water into Lac de Gras until we are confident that it is good. What if we are wrong what if we fill it all up with water and the water isn't good, and then we have to run it through a treatment plant and replace it with clean water until we can get it to that point? So I think Kugluktuk should feel safe. Bobby you are going to be the guy that we are going to be asking, "can we put a hole in it?'

Bobby Algona: In the mean time when you fill these pits with water and it comes to the top that the level is what you want or the level that is stable what about those animals that want to go though the dike and like caribou or wolves that want to drink that water. Are people going to be monitoring on a full time basis until its good water?

Gord Macdonald: That sounds like a very good recommendation. Absolutely during that period particularly if the water is poor for some reason and if it's bad enough that it would be a problem for wildlife we would definitely have to have that.

Nancy Kadlun: I am just wondering when you said if it just fills up over time and just leave will it over flow? And if you can't do anything about it then who will clean the lake?

Gord Macdonald: It won't over flow, the water will only come up to the same level the lake is at now so it won't over flow. And who's responsible for cleaning up the water in the pit? We are.

Break 10 mins

Joanne Barnaby: For the past two days some of us have been meeting, those that went to the fish camp have been meeting. We have also been reviewing the report that we've been writing up and we also have been reviewing the video that is still a work in progress that you will see later on today.

Bobby and August have agreed to present.

Presentation – 2015 AEMP TK Camp Overview (Appendix E)

Bobby Algona: We have been going to the TK Camp for the last few years and it's good to have the ongoing program with TK. I am pretty sure we are coming up with something new and doing some things that we are learning as TK holders. As TK holders we can only do so much as to say that all our traditional knowledge that we have come to know out on the land is being kept alive and well. And all of what Gord has been explaining over the last few years, especially the water seepage and air quality, and what the mine has been doing to keep our minds at ease as TK Holders over the years. This is one of the good things we have been doing the last few years, is testing the water, the quality of the water, testing the water, testing the fish and doing a lot of traditional knowledge stuff as well. Some of us have been doing a little bit of plant life as well. Madeline and the ladies have been doing berry picking and its really good to see and a lot of the things we have come to appreciate what Diavik has been doing for us keeping the TK camp going. Over last couple of months we have been doing the same thing we did in 2012.

In June we had a pre-program session about what we were going to be doing at camp and all the different ways we would be testing at Lac de Gras and from that we had a good insight on how we wanted to keep this camp going and

what changes we might do in August. Come August we have been doing a lot of things we wanted to look at in June. Comparing it to 2012, there was not much different [in 2012] from what we saw this summer. But it's a good program, we need to do this water testing and look at the fish and the fish habitat and what the water is doing to the fish habitat. From that we look at the mine as when we come into the camp, we look at the dust from this camp and a lot of that dust goes into the lake because Diavik is on an island and most of that dust is falling into the lake. And we have been listening to all the scientific work that Diavik has been doing and we have all evaluated that as TK Holders and everything seems to be very well and the fish that we tasted was really no different from the last session in 2012 so that was really good and the water quality was no different from 2012. So that was good to see not many changes due to the activity from the mine and a lot of these programs that we have been doing is almost the same parameters from 2012 looking at fish and all the different ways that we have been preserving and putting our minds at ease with the scientific program. I think it's really good to work right alongside the scientific people as well. As TK Holders we've been out on the land and we learned a lot from our elders to keep the waters as clean as possible for today and tomorrow for our youth. And these discussions over the last few days like last time I think all this dedicating these programs to the youth and making the film and a copy of what we have been doing and dedicating all the hard work we have been doing over the last few years to the young people of today for tomorrow.

That is a really good thing that Diavik has been doing for us as traditional knowledge holders even though I have lived out on the land a lot we still forget to mention some things. A few new things can be learned through this program. I think there is a whole lot more things that we can learn from this as well and certainly as TK holders we have come to appreciated what scientists have brought as well. I think we need to work much more closely with the scientists as well so that scientists can learn from us as well as to how we came to learn these things. As TK holders we've come to appreciate all the helpful insights that our elders have been giving us for many thousands of years and to this day I think that in the future, hopefully in the future and all this water and the air and plant life and everything around the camp can be kept as clean as possible for all of us to share. As a TK Holder, I have come to appreciate a lot of people that I have come to know and come to work alongside with over the years and there is still a whole lot of things that we need to do as well, not only with the water but there are something's that we could really be looking at as well. I mentioned earlier that the ladies have been doing their part picking berries and

looking at the plant life as well and maybe in the future or through these sessions we have been working on I think there are some ways that we can truly think about, maybe there are some things that we need to look at more closely. And that's what we have been doing over the last few years and if August wants to say a few more words.

August Enzoe: I don't know what I can add in, you almost said everything. This was my first year this year; I wasn't there 3 years ago. But I was there this year and they did pretty good. From my side [for a similar program in Łutsel K'e] in the spring time we asked for 2 youth and to me it didn't happen. I asked for 2 youth, 1 girl, 1 boy and that didn't happen because of money. [At the Diavik camp] I had lots of fish. One whole week of it - lots of fish, boil it, fry it, cook on the fire, fish eggs we all had that for samples. It tasted good and the water we made tea and coffee and that tastes the same to me. You should taste just the water because if you have tea and coffee you can't taste it the same. Like Bobby said there's lots of dust going into the lake. I went up the hill and I touched the rock and my hand was just white from all the dust from the mine. So how far is it about 500 feet across or more I don't know.

We made a movie and the movie is really good [*We Fish Today, For Fish Tomorrow* available at: https://vimeo.com/artlesscollective/wefishtodayforfishtomorrow]

When we were fixing the fish that's a problem we all had because I couldn't hear what I was saying to the reporter. For the camp it's a good camp, I really enjoyed myself eating fish every day plus a good meal at night and breakfast. For the next time I did mention yesterday when we were in the other meeting we should try for one night to have nets on both sides of that island, just for one night, just for a sample of the fish that are closer to the mine.

Joanne Barnaby: Thank you August. I was just looking around the room to see who else was at the camp.

Ed Jones: I wasn't allowed to go because I have macular degeneration; I am slowly going blind so they didn't want me on the property.

Joanne Barnaby: Yes I guess they were worried about your safety.

Nancy Kadlun: I couldn't wait to go to Lac de Gras after hearing about it so many years, especially when the mine was there for so long. I tried the water it was

so good, pure water but again when the river goes down to Kugluktuk from all that mud, it's kind of thickened back at home you know from all the mud going down. But in that lake when you have water from the lake, the middle of the lake from the top, that's very yummy water. I like when camps like this happen because lots of our youth they don't know, they are not experienced, so when we have more youth that come to stuff like this they will learn more and they will want to do more.

Joanne Barnaby: It was really unfortunate that we didn't have as many youth as we wanted then but I am really glad we have more youth here today.

Any questions or comments regarding the 2015 camp? Fred did you have any questions or comments?

Fred Sangris: Last time I ate fish there I am still full from it, that's how good it is. I think over time in that area we have water quality that is coming down from Contwoyto right through to Lac du Sauvage and right onto this lake [Lac de Gras] and it drains on through to Coppermine River. We were there at one time and we wanted to try everything out including water quality to make sure the water didn't change at the time of the operation of the mines and we wanted to see if there were any changes in the fish as well. Because when water quality changes in lakes, the taste of the fish changes to. We know that because of our own experience here in Yellowknife Bay. There are lots of rubber boots in the bay here, they don't taste that good. When the water quality is good, its good and we don't want to make changes to it because there's life in the water. The aquatic life, the fish, and there is little critters that the fish depend on, it's underwater too. Those are the food for the fish and it's very important. If the food is not there then the fish aren't going to be there. So I think when you are studying fish and you are eating fish and you are looking at the texture and the quality of fish you also want to make sure the food source of the fish is not in any way affected or impacted from the mines. We want to make sure that the fish continue long after the mines are gone and we want to make sure the water quality doesn't change. And that's why we are involved; to make sure that it happens. But like any other mines in this country, mines can have some impact and affect to water and land and we are concerned with the reclamation with all the rock pile, the acid run off and it could be as well from the blasting and the ammonia I forgot to mention that on the walls of the open pit. We need to do more studying on it to decide if the ammonia and the dynamite blast is still staying on the walls so we need to know that so it doesn't have an effect on future spawning. Because long after the mines leave the fish are going to

continue to live there and continue to spawn and if the spawning areas is not impacted the fish will be there long after we are gone and that's what we want, the quality of life for the fish that was there when the mines first came in. After the mines leave we want to make sure those things are still the same, not changes to it. So I think for us and the scientists and the mines that we are working together to make sure that we understand that not too many changes are taking place. That is what we want and I think that is what we did in 2012 we tasted a lot of different fish, all different sizes, we tried cooking it different and we tried to get the taste of the fish and made some tea.

When the water changes there is a scum around the cup, you know when you go camping and you go to little ponds and you have to make tea and you see the scum after drinking then you know there is something there, there are changes in the water and that's what we try to watch for at Lac de Gras when we make tea. But we didn't see a lot of that so to me it means that even though the mines are operating across, there hasn't been too many changes but it's always important to continue to monitor and keep doing this kind of work so that when the mines close down and the reclamation happens you want to make sure you leave that place in a good way so that you know you walk away from something that didn't have too much impact. You want to make sure the continuation of life and wildlife quality is going to be there forever. We are on a mission looking for truth, that's what we are trying to find out, we are probably in the middle of it probably beyond it, because there is going to be an end life to that mine and we are working with it to make sure that these things are studied and that we understand it.

Joanne Barnaby: Thank you Fred, that is actually a really good lead in because we are looking at what kind of monitoring should take place once the mine closes and we have this program that runs every three years that we should look at how that might continue after the mine is closed. We need to look at issues like where should a camp be set up, how would we maintain that camp, how would we pay for going out there to do this fish and water tasting and testing. Should it continue to be both TK and science and these are the longer term issues that we need to figure out we should look at where there should be sampling sites, we can look at where they are now and where they should be after the mine closes and there are some questions in the air about the future and how do we continue and what is it that our own organizations from home want to do and all the different Aboriginal peoples and how do we maintain the collaboration. These are the issues we want to focus on this week. The closure and post

closure and how to make sure that someone is keeping an eye on the fish and the water.

Ed Jones: After the mine closure I believe that the monitoring of the water quality should be done by the government who are independent of Diavik; they can periodically check the water quality and report back to the public. I don't think they should allow Diavik to do this, because I really don't trust mining companies, to be truthful, I don't.

August Enzoe: I was at the table way back since the mine was started, 1997 or 1998. Albert was still with me, Eddie Jones is still with me. All those words we've been saying towards the mine, the Elders, how it should be done for the record. Way back me and Eddie found out that the mine at Diavik wasn't doing what it said it would in those days. The Elders that were with us from Rae and Yellowknife and Łutsel K'e and not one of them is with us now, well Eddie is with us. We put a lot of work into the mine about how it should be done in the future. Like right now the round table is all new ones, newcomers for me and they don't know too much about what we said way back. That's how it sounds for me. That is what I would like to mention that to you people.

Colleen English: I just want to respond to Ed's comment. Mostly Diavik staff - employees, some from the communities and some from Yellowknife - they do the actual samples. We bring up guys like Bobby sometimes to help us out with different programs and they take the samples and then we give that information to independent consultants who then make that into a document that basically says to the people like the Land and Water Board, and that is given back to communities as well, this is what the water quality is like. At the same time, the government does come up to the mine. Inspectors come to the mine site and they take their own independent samples as well. I get your concern, but there is definitely overlap.

Natasha Thorpe: I would add that the community based monitoring that you will continue to do is a big part about how Diavik decides to do things. One suggestion from here, from Ed, is that we should be monitoring in the future, so do you mean Aboriginal governments? If so, how do we move forward once Diavik is gone?

Ed Jones: I did not fully explain myself, what I wanted to say is that the government holds a bond for the cleanup and Diavik shouldn't have to monitor after the closure because the government holds a bond and does have the money to do that.

Joanne Barnaby: Perhaps Colleen in answering that question you can also outline Diavik's commitments in terms of monitoring after closure.

Colleen English: The bond is actually for instances like Giant Mine where the company walks away. The bond, ideally, Diavik does not want to cash in on that bond. They don't want to hand over that money and have the government do everything. Diavik wants to be doing that work until the mine is done and closed. So the bond is there as a safety net and it's only really a safety net. It's not meant to be used unless something dire happens with the company and you get bailouts and bankruptcies and that sort of thing. With Diavik's mine plan right now, the mine closes around 2023 and the current plans have monitoring that extends another 5-7 years beyond that to make sure that everything is functioning properly before the company is completely done. And then the reality that we don't really know yet, I think, is what happens beyond those 7 years. No one knows what the obligations would be, do you come back a couple times a year? Do you come back yearly? The governments here haven't had a mine close properly so it's a tough question. What is the point where we can say, 'yes, we are all happy and we are done?' These discussions help with defining that.

Mike Francis: The water in that hole, samples and everything, I just want to know if they are going to change the water later or stay there forever.

Colleen English: Do you mean once they put the water back in the pit, are they reconnecting??

Mike Francis: Are they going to change the water if it's contaminated.

Colleen English: The way that Diavik is planning to do it now is to bring the lake water in to fill up the pits. They'd keep it in there for about 5 years and it should be good. They wouldn't need to change that water again. What Gord was talking about is if they saw something that they didn't expect, something that was not good, then they would need to look at taking that water out, treating it, then putting it back. So that's why they want to fill the pit and leave it to see how it goes for a few years, and monitor to see how it's responding. Because you can plan all you want, but things can happen, so you want to have protection and a buffer before anything goes back into the lake.

Natasha Thorpe: Tomorrow our discussions are supposed to focus on really getting down to it in terms of exactly how and where Diavik should be monitoring water quality around East Island post closure, once things are covered up and things

are reclaimed. Then in the afternoon I am going to get down into the details around when the waters are reconnected; what should the shoals look like.

Who, what, where, when, how 2022/23 Diaviks closes, 2023→2030 Diavik monitors 2030→ Then, what, how, who, where, when????

Some have said they don't want to taste the water after they are reconnected, they would rather the scientists monitor the water.

Nancy Kadlun: It would really help to let people still go because who do we trust?

Natasha Thorpe: Your organization, yourselves.

Nancy Kadlun: They still have the same things that we did so continue camps like that so people and the youth would really understand if our water is still good or is it not good anymore.

Natasha Thorpe: If you still want to do that camp and Diavik wasn't doing it anymore, how would your organizations work together? Any suggestions to make that happen?

Louie Zoe: We are talking about the importance of the water, this is our land. That our land won't be so disturbed that we'll have it forever and we are not talking for ourselves we are talking for our future, that we would always have the water clean. And the company and the development and how they use the water, we don't know, and once the water gets into the open pit and it gets over flowed and all the water gets into the big lake again and then water will be traveling into our lakes and ponds. When there is rain and snow that goes all over the place once the water gets contaminated it would be hard to get fresh water again. We know from the examples from other mines that I have been traveling with other people and this one mine there are some people and other places they said that once you contaminate that water it's not going to get clean and fresh again. That is what we are being told by other people from other areas.

Fred Sangris: It's true what we say about the open pit how it can be monitored. For a number of years we have been working on this project and we go to the site. Our concern has been that in the beginning of the mines is that there will be less impact and we want to be involved and that is what we are doing, we are involved. Once the reclamation, the mine closes and the reclamation begins, then the mines will be gone. So we have to find a way where we can continue working on this project long after they are gone. But there should be some dollars so that our communities can continue that work. Coordination would be

kind of difficult but if someone was to send us a letter saying get some elders and youth up there, then we will make that trip. I think it's possible because we need to still be involved long after the mine closes, we need to continue to make sure that the water quality and all the plans is doing what it is suppose to be doing. I know that the Elders don't want to drink the water there because there is still residue from the dynamite on the walls of the open pits, ammonia and so on, so I wouldn't want to drink it anyways but I think the idea of getting samples or continued study on that would probably be good. The pits themselves have to be studied, get the water, get it studied to check that the water is still the same or if there are any changes happening to it we need to know. But I think a lot of us here are not going to continue to be involved; most of us will probably move on but I think it's important to bring our youth, get them involved, educate them, they need to continue to be involved so that the monitoring can continue and the reports can come out and they can understand the reports so that 2030 maybe continue into the future, we don't know when is the end.

We have Mary here who is a youth with the Yellowknives Dene and I think people like her are very important. Every organization should have an Elder and maybe two youth so that you know when we kind of disappear and fade out, they'll be the people to continue and ensure that water monitoring and quality is there. The plans are doing what it is supposed to be doing. If we don't get the young generations involved then they'll have no idea of the diamond mines that have had an effect on the past. What we are trying to do is work with the industry to make sure what they leave behind is going to be good in the future, and it's not going to have so much impact. But it's the generations that have to be involved to make sure that those things are done properly. For how long, I don't know, but I think maybe 2030 could be a target date, maybe 8 years after the mine closes. Continue that work but Mr Jones said that the Federal government's got the bond so my question would be whose going to pay for it after. Who will bring up the dollars to continue to pay for this kind of work?

Joanne Barnaby: Thank you Fred. We have the Environment Monitoring Advisory Board that is set up through Diavik and this Panel worked under for a few years until it started working under Diavik. EMAB or an organization like EMAB might be the tool that we need to continue past closure. I know everyone has their own experience with EMAB but the whole idea of an organization like that - that does represent or has representation from the communities and that has the mandate to monitor and that brings all of the different cultural groups together -

that might be the kind of tool that we could use into the future. The question is who would fund this. Currently all its funding comes from Diavik, so we'd have to look at that and we would have to look at whether Diavik is prepared to make longer term finding commitments to an organization like that, or whether it needs to shift to a partners funding model where a mix of public governments or Aboriginal governments and perhaps Diavik, in a smaller way, contributes to the work.

Bertha Catholique: The concern I have is who is going to monitor after the mine is all gone. So what I would recommend is we should start training our youth today to be the monitors and the keepers of our land. That's the only way that we could teach them how to look after the land so it can be a continuing thing and we could sort of build a big school or something in the north here where we could teach all this monitoring. Because they are monitoring stuff and they are analyzing it, like the fish, they have to take it out to wherever they are looking at the fish for contamination. Maybe they should have a building like that here in the North where it won't be so expensive and then our youth and our communities will all be under one roof so we won't get stuck. Like where the money is going to come from if something is contaminated and everybody walks away. Like right now what they are cleaning up after the first mine that came to the North. They made all these messes now they are cleaning it up. We don't want that to happen. So we need to come up with ways to teach our youth right now or even in schools, make curriculum. But they have to see, the Elders are always saying when you are teaching someone on paper if you don't really know how to read and write you can't understand it and you are shy. I was one of them. Because I was always told don't ask too many questions. So I was that person and then I became an interpreter so I would talk all I want but it's not coming from me. I think a big school would be good.

Natasha Thorpe: I think any of us who has worked with youth gets that feeling of the responsibility of making sure that they are inspired and have a passion for something, whether it's interpreting or fish analysis, because that's what keeps the future moving forward. You'll see in the video that we play that one youth in particular talks about making this realization or connection of how interested he is after spending a few days out on the land. It's very true that's how we are going to make people, youth, inspired to monitor long into the future.

Dora Migwi: I've been attending a few meetings like this. I have heard clearly what you guys said that we love our land and to protect our land and our environment, animals, that everything will be safe. We all come from each region in the

community and something is contaminated and the water - what about the animal, it will affect the animal. Today we have all kinds of scientists and these doctors and they work along with the TK people. Into the future the young people sitting here today, and there are not much Elders in the community, there are only young people today in the community. That's all it is in my community, there's times that if there is a meeting going on we have two youth coming to the meeting so they can learn from the meeting. I am very thankful. I have a lot of grandkids so I couldn't go but I feel really comfortable and a lot of information is coming from the communities and we care for our land and water. I can't sit back and say nothing.

Janelle Nitsiza: I am really thankful for what Dora just said. The bond between Elders and youth is really important. I know from experience because I was raised by my mom but I was also raised by my grandparents and I just lost my grandma last week. So you really need to love your grandparents because they are a textbook of knowledge for us. Any questions that I ever had for my grandma she always knew the answer. I am grateful for what she taught me. And I am grateful that these Elders really want to incorporate youth because, as a youth, I really want to be involved and I really want to learn more. I am not the greatest with landscape or navigation but I am only 21 so I have lots of time to learn. I am just collecting stories from these Elders; I have collected so many stories from my grandma. I have traveled the Tłı̨chǫ region for work so I was fortunate enough to gather lots of stories. Even though there is a language barrier I always find a connection to them and the recommendation for youth is laughter; laughing with elders and making them happy, because when you laugh you build that connection and that's how I built my connection with my grandma was by laughing and telling stories.

Bobby Algona: It's really wonderful that some of our youth can really speak up. That's what we are here to do and when we are coming to meetings just ourselves as Elders it gives us ideas on what we want to do in our communities to help our children and our children's future as well. When I come to these meetings I often think of ways . . . we're not going to get away from the mining industry in the near future. I am always coming up with ways of teaching our younger generation back home and these are the things that we need to teach our young generation. It's really wonderful that we have come up with water quality monitoring programs and have CD's and books that we come up with. Sometimes, just on my own, I go to the school and talk to young students. And sometimes I get asked to go to the school or get asked to come to a meeting in the community and I give a little insight about what the mining industry is

doing and how our organizations and the Elders that we work alongside with, with the mining industry itself, we give a little insight to our young students. In the future having these CDs would be a really good tool. I have these tools now, these CDs, that I can work with to show a classroom what we are doing for our children when we come to the mining discussions groups/workshops in our communities. And give a little insight about what the dangers might be and to get them to think a little bit about what your future might be with what the mining industry is doing and how the mining industry as well can help the youth with a program or what they might be doing in the future. That's a most wonderful thing that we can do as Elders. We can have these tools that we can bring home and it makes it a whole lot easier to explain to the young generation with these tools. And I myself have my own CD I put together myself of an outpost camp. I have an outpost camp that my family go to every year. Even though our family portraits are just family portraits I tend to use these as tools now that I bring to these workshops. Sometimes I get to show it a little bit to the group sessions that we have here, what the land means to me and my family. I use this as a tool to present to the mining personnel as well. I've been working with the mining personnel for a very long time; sometimes it's hard to tell them how I do things out on the land. My pictures start to come in handy when I start to try and explain things that I do with my family, what I need to do, what I need to teach my family out on the land. But I've come to use these tools that I came up with, these family portraits, to show the mining personnel about what I do and what I do out on the land and what the land means to me.

Natasha Thorpe: Thank you Bobby. So maybe when you are thinking about monitoring fish and water down the road it may be important to have those tools.

Joanne Barnaby: I've been involved in some work in the Dehcho region so that they could be involved in the monitoring. They have actually set up a program and its building slowly because they need to raise money and they need equipment and they need support to carry out the work they want to do. Łutsel K'e is involved in something similar - Keepers of the Land - and they came to the Dehcho and presented information on their program and shared their approach, which is something similar. The work is coordinated by the First Nation and the Elders committee and the Lands and Resources Committee that August sits on and they over see that and they train their young people with scientific techniques as well as TK. The young people go out by boat in Łutsel K'e and they are reminding people to be respectful. If they are noticing problems, they are reporting the problems to their community or to ENR if needed. And I was

thinking that because we are all from different regions, an organization like EMAB that coordinates can maybe run that program.

August Enzoe: I was just thinking we are starting to get kids with us, the youth, and we should continue for their future. If we are gone they'll be saying behind us Grandpa was here once and they'll remember for their future. Because we won't be sitting along with them, we don't know how many years yet so I am really happy that we got the youth. Diavik could put more money, put a million dollars, towards the kids.

Colleen English: Just further to what Joanne was talking about, there are some really great programs that already exist in the North, and that Aurora College has organized as well. They had a BEAHR program where they would go out on the land, its environmental monitoring for youth that includes TK and also the scientific side of it. And it's amazing. We had gone and helped them out when I used to work for Diavik. I would go and do sessions with the kids and teach them about water quality sampling and then they would have Elders there. Also something that is very unique to the North is that you can get a certification as an environmental monitor based on hours working, even if you didn't go to school but you start working at one of the mines as an environmental technician or whatever. There's a program you can do through the college, you get a work book, you have to log your hours; you do all that and you become a certified monitor. That's pretty cool, and you can't really get that anywhere else in Canada that I know of.

Natasha Thorpe: I think August has spoken and let's take a break to eat.

Lunch Break.

Video of AEMP TK Camp (25 minutes)

Joanne Barnaby: As we explained earlier, the video is not quite final. There is more editing to do and the title, which hasn't been determined yet, hasn't been selected. We were brainstorming some ideas for the title for the video and for the written report from the camp this year. We have lots of ideas but no consensus yet. So we are working on that. Some ideas also for distributing the video as well. Perhaps offering it to APTN, asking North Beat to do a story on it and of course getting it into our communities as well, hopefully to inspire young people to turn out for the next camp.

Natasha Thorpe: You are the first official non-participant screening group here, so we are really interested if you have any comments or thoughts about the film that you just saw. Anybody want to say anything? Any suggestions for future activities?

Dora Migwi: Look at the lake itself, the Lac de Gras area. My dad used to trap around that area for white fox. My dad had travelled by dog team on the barren lands and my dad had lived with the Inuit people, people from back then what used to be Coppermine. While my dad was out trapping white fox before Christmas on the barren land, my mom and us were living in a tent on the tree line and we were young at the time. My mom was expecting a child and apparently it died there and he is buried out there on the tree line somewhere. So that's what happened while my dad was out on the land hunting. I am not saying my dad was the only one but there were a lot of people who were harvesting the white fox back then. I guess how those people trap the white fox is they use the caribou meat as bait, and back then, before my dad's time, I guess the people used to harvest the caribou hides for clothing and even to make tents out of it. So that's how they were raised and then they were using the firewood, they were using the small willows and small birch willows and that I guess throws a lot of heat and you cut them in bundles. So the days when my dad used to harvest a lot of caribou, all the families would use the hides to make mitts, mukluks and caribou meat. But nowadays things have changed and a lot of hunters that used to live on the barren land, especially the Dogrib tribe, they used to go out in July to the barren land to harvest dry meat and specifically to get the caribou calves when the hair is really thin enough to make a caribou hide parka. So remembering all that I guess brought back a lot of memories and the places my dad has traveled. I was too young to remember when my younger sibling died on the barren land.

Joanne Barnaby: Thanks so much Dora. Any other comments from people who haven't been out there, any suggestions for how we might do future camps?

Bertha Catholique: I was just thinking about us having one youth from each community and it was kind of hard for that youth to speak because they don't have another person from the same community. And to make friends it's kind of, they are kind of shy. So I would suggest that we bring 2 youth and 2 elders so they aren't so shy. I would suggest that.

Joanne Barnaby: In the planning meeting that we had in June before we went out, we talked about different things that the Elders could teach the youth but also things the youth could teach the Elders. So if you could think about that, too,

that would be great. Over the last couple of days we talked about the people that went out, we talked about any changes that they might want to make and I think that there was a consensus that instead of boiling the water for tea and coffee, instead they want to taste it as pure water straight from the lake. So that is one change. Any other questions, comments? How did you feel about the video?

Bobby Algona: Once in a while, if not every other day now, I can't help but look at the TV and I look at all the things that are happening around the world and just last week or so we have come to learn that other companies are working on a climate change conference in Paris. And I am just hoping that they get things right now and start to realize that the industry itself sometimes really contributes to natural climate change itself. And when you look at things around us, I notice everything around us here, when I look at things, how many ounces to make this one tool that we use. How many ounces to make this one microphone that we use as a tool? And when you look at mining ounces per tonne. That's what I look at. How many ounces does it take to destroy tonnes of other ground and the natural ground that they are looking at. And when you look at Diavik and all the other mines, you look at all of that waste rock, how many ounces or carats do they get out of that rock. You look at how much rock is being moved and how much water is being used. I look at all that myself. I am just learning in my residential school days sometimes we get into a little discussion ourselves and in those days you look at all of the things you have all around us not just in this room alone. How many tonnes of rock or waste rock is being used to make this one tool or all the tools that we are using here to work with as tools we have. And there's another thing we've got going. Going to Toronto a couple of years ago I looked at the city, how many ounces, how many tonnes of waste rock to make that city. And how many cities are in the world right now? You look at that and you see what climate change is doing now maybe it is from the industry itself, we have to look at those things. I look at all of those things. Learning just from the TV that I have at home. I look at what is being done all over the world; people are destroying each other for the industry or what they do to make their country a little bit better for themselves. I look at the TV a lot. I learn from the TV by seeing what everyone is doing to each other in the world and I try to teach my children. Looking at all that, we need to think a whole lot more about the mining industry itself. We can't get away from the mining itself, I see very far into the future the mines are going to be ongoing all the time now, we cannot get away from it. I think even though I have a lot of qualms about the mining industry itself, then I start to look at a lot of other good tools that they make alright but I always think of something that

we should be doing. And just from that TV at home alone or just from the school that I've come to work with in my residential school days, how many ounces does it take to make this tool and how much land has to be destroyed just to make this one little piece of tool that we use. Those are the things that I look at most every other day now.

Joanne Barnaby: Do the youth have any suggestions or would a program like this interest you in the future?

Lucas Enzoe: I think the things that he said is true - that we destroy the world for all the technology we use and take for granted and it's still happening to this day. How many times will we destroy this earth just to get the tools that we want? Are we going to find an alternative way to make better tools for a greener place to help out the earth, or keep destroying the earth?

Joanne Barnaby: Thank you Lucas. Pretty big questions. Ethan did you want to say anything? Janelle?

Janelle Nitsiza: I like that Bobby touched base on the environment. I think what Diavik and all these mines really need to take into consideration is doing things more energy efficient now, not in the future, not when we are closing but now. Work on the little things, it's the little things that count; they make big things one day. So any little thing that we can do to help the environment because climate change is here, it's in our face, we need to deal with it now otherwise none of us will be here and its really serious. It's that serious that we could be the last generation to live on this earth and we need to take that into consideration. Even Justin Trudeau brought up that the world needs to learn from Indigenous people because we are still reliant on the land. We may be strong like two people, we live in both worlds, we live in the traditional world and we live in the modern world, but we need to come back and live more in the traditional world then we do in the modern world. I mean, I have said it before, I think post secondary education is very important but I think you need a PhD on the land before you go on and do that. Because when all else fails, the world fails you, what's this document going to prove to the world, nothing really. But if I can start a fire on my own, if I can cut up dry fish on my own, if I can live on my own that's real survival for me. That is a better education. So 4 years ago I went off to post secondary, I quit, I quit the first year because I realized there were still things I needed to learn back home. So I went back home and I learned from my grandma. She passed away last week and she was still teaching me. She was sewing right up until the day she passed away and she was working with hides, and she was putting together gloves. My aunty and my

mom didn't know how to put together gloves so she spent that week teaching them how to put together gloves. That's a real skill I think right there. I would rather take a course on how to put together gloves then to take a course on native studies. I would rather hear the stories while I am learning a new skill.

Charlie Apple, I know Charlie Apple, and he is a really, really kind Elder. I got a chance to work with him and he is right [in the video]: I am kind of embarrassed as a young person, I went to Marion Lake with Louie and he could work way harder than me and he could do things that I couldn't do. What am I going to do if this old man can survive and I can barely survive? He kept me going and he was very encouraging but when Charlie said young people are too distracted by material things, he is right. When Charlie was young it was all about survival and it's like that now but we're lost. We don't know where the caribou are, most young people don't know how to set a net, they don't know how to do a lot of these things. And I'm not saying I am top, that I am number one, but I've taken it upon myself to learn from whoever will teach me. So I have made lots of friends with Elders and I am grateful for that because that's the kind of knowledge I want to grab before they all disappear. We are losing our Elders every day. Like last week there were two elderly women that passed away, my grandma and another lady. That's a lot of knowledge, that's a lot of grandchildren who don't have somebody to turn to. My grandma's message to me before she passed away, she gave me raw sinew before we took off to Edmonton for radiation, and she said put this in your room and keep it good because one day you are going to need it, one day you are going to teach all your babies. I was the only grandchild that took the time to learn from her. Every day of my life, I am so grateful for that.

Joanne Barnaby: Just one last check with Mary, we would love to hear about the program you mentioned just after we broke for lunch. It's very relevant.

Mary Louise Black: I recently took an environmental monitoring course in Fort Smith. Which was a six week course. It's a really short course that you can get hours, when you get up to 100 hours you are a certified monitor. I took another workshop last month where ENR and the Government of Canada sat together to try and pull youth together from all the different communities so they can have their own monitors in our own areas that you were speaking about earlier. So they are working on that and I think they are going to take in 13 youth per summer from each community - which is a lot - and they will teach you until you are able to do it up to Terex standards and then you will be eligible monitors. So that's there, so eventually we'll have more youth being about to

go out and sample our own waters and soils or whatever the community has concerns about. We can get together and go out there and try to answer some of these questions for Elders and people who don't understand just reading the data and all the stuff that comes back.

Joanne Barnaby: Thank you very much. I just had a vision of our youth coming out with the Elders and the youth doing the science portion of the program and with the Elders doing the traditional part of the program. So it will be all Aboriginal people doing the monitoring in the future and that would be wonderful. Especially when those youth are so committed to learning traditional knowledge as well.

Natasha Thorpe: I was just going to follow up with what you were saying about monitoring. We wanted to check with the TK Panel here today about whether the idea of changing the water sampling process that we have been doing up at Lac de Gras makes sense. Just to give you a little more background, the program that we just watched has several different parts to it. One is going out setting nets, collecting the fish, opening then, examining them, and looking at their color, smell, feel, according to science and TK. There are the fisheries biologists as well as the TK holders. And then there is tasting the fish to make sure the fish still tastes right, as it should, as you are used to tasting. Second part is testing the water and the scientists go out and collect water samples, the locations that they select are determined in part by science but also by community members. In August there was a recommendation from participants that next time we should sample on both sides of the island. You know what kind of recommendation is really helpful for planning for the future. Once the water samples are collected they come back to camp and we make tea and people taste the tea to make sure again it's what they expect good tea to taste like and the water is okay. This program was suggested by Elders - by your ancestors - back over 10 years ago and Diavik has generally followed that model. But this year there were questions on whether it made sense to drink tea from the water or whether it just made more sense to drink water by itself without the tea. So we had the discussion yesterday with the Aquatic Effects Monitoring Program participants and asked what they think and…Nancy is going to interject here.

Nancy Kadlun: Even without water or tea testing, which I saw this summer when we did water sampling from underneath the lake. When the lake bottom comes up, we saw all kinds of little bugs and that makes me happy because I know the water is healthy because all those little bugs wouldn't be living if it was

contaminated. They are so tiny and there were lots of kinds I was happy to see that. They are so tiny they couldn't live with the contamination.

Natasha Thorpe: So Nancy that's a wonderful example of how you tell whether the water is good to drink, whether the water is still healthy. The scientists might take that same water and send it to a laboratory and test it for various contaminants, but that's an excellent example of water quality based on Inuit Qaujimajatuqangit (IQ).

Ed Jones: I know you are going to laugh at this but I would test the water not through making tea because I will tell you, the brand of tea will change the taste.

Natasha Thorpe: Ed, you are exactly right and we had this big discussion - do we have Red Rose, do we have herbal, do we have Tetley. So that you know, that's exactly the discussion we had out on the tundra. So I want to bring this up to this group of Elders and experts, when thinking about 3 years from now when we run the program again and three years after that, and we are wondering what you think, should we continue to test the water by tasting it in tea or is there a better way?

Kathy Arden: I think just tasting it as water would be the best thing. I think it was Fred Sangris that said this morning sometimes you can make tea with water and it will leave a scum. So obviously you know that something is wrong with that water. If you drank it, it might even taste a bit off. So water is water whether it's grey, clear, got bugs in it, no bugs in it you'll know when you taste it if it's good water or not. And so I would say do that water test but then after drink your tea, have a cup of tea and use your Tetley tea bag or green tea but I think that's the best way to do the water test.

Natasha Thorpe: What do other people think?

August Enzoe: Tea comes from water. I noticed the lake water and the tap water is different. I make tea from the tap water. It's not like the lake water you make tea. It's a different color, it shows on the cup, it's darker. That's how it is right now. We drink more water, or either tea doesn't matter, coffee because coffee is always black so we don't know.

There is just one thing I would like to say about the movie. It looks good right now but it will be better later next time you see it. Like us, the way we clean the fish, how we did it, you are going to hear us speaking when we are cleaning the fish.

Natasha Thorpe: Thank you August. You reminded me to tell the TK Panel that yesterday we spent the whole morning, stopping and starting the video so that people could make their recommendations on how to change it. Whether they wanted it expanded or altered or changed in anyway. That was a good suggestion of yours August. So I am hearing at least two voices that seem to be okay with changing the way we do things out there to taste just plain water, cold water, as well as boiling it to look for the scum or the slime. Does anybody else have anything, any opinion or thought? We would like your input whether that's something we should change for next time.

Louie Zoe: We were talking about the water before in Rae area, Point Lake. We used to travel there when there was no caribou and we would get water from all the little streams and ponds, we didn't know if the water wasn't good. Now that we are using choppers and prospectors and Elder prospectors and mine people they use the monitoring and all these kinds of equipment there that we know how the water is. They are doing fish tasting and sampling and we had travel quite a ways from Rae. Even I used to travel with my dad with the dog team, use the water, the snow to make tea. The water was good and the snow was good to eat but nowadays all the chemicals people are using and all the fumes and so today there's a lot of variable things that goes on there.

Natasha Thorpe: Thank you for sharing.

Kathy Arden: There was something mentioned earlier about dust coming from the rock pile and of course it's going to land in the lake and I don't know if they test the water. Or if there is a prevalent wind that blows in a certain direction and that dust lands on that part of the lake, if you took a water sample from that portion of the lake that receives more dust and then took that water and either let it sit on the side when you first go there and see if there's any settling of dust on the bottom of the pail or a clean beaker or something like that, or if you boil it is there a difference in the color or the clarity of the water. I don't know if anyone has done any testing like that but I think if my memory serves me that had been mentioned many years ago about the dust in the water. Not just Diavik mine but the other mines, too that are surrounded by small creeks and ponds and other lakes. Probably something like Snap Lake because they are right next to a waterbody there so that's a suggestion that I am thinking of.

Joanne Barnaby: Are there suggestions for – again, as we look into the future, and past the operating phase of Diavik, and once they are closed - are there ideas for what should be monitored and how that can be done after Diavik is gone? Are

people going to be satisfied with Diavik demonstrating that everything's okay or are you going to want to go back and check on it after they are gone?

Bertha Catholique: What I think is that it's got to be monitored even after Diavik is gone. It's got to be Aboriginal people because it's our land. We don't want anything to happen, we don't want just anybody to walk away and leave it. So it's got to be monitored for the next generations, the next generations that are coming. It's got to be ongoing. Because its water it's the only thing that gives life. If we don't have any water we're not going to be here. And already parts of the world, on the other side, the waters all contaminated and this is the last little cup of water that we have that's pristine and how do we watch that doesn't get contaminated. And now with the climate changing, it's warmer. So now if we are going to have to survive I think we are going to be the last Aboriginal people that would survive and it's really scaring me to think like that. So I think its Aboriginal people have to make these strong recommendations. I always remember what Pierre Catholique said, an Elder, when they first made him chief and then they wanted that park to go ahead. At that time they were just picking people, the chiefs and leaders. They'd say, we are going to put a park there and yeah, yeah, yeah…and the parks just went up like that. Then when it came to Łutsel K'e, he said "No" you guys never planned to have a park on my land, it was never planned and all this time you took me and my wife to Ottawa to sign, to get a park going, no he said. I got to wait, us Dene people we don't just jump into something and take it, we think about it, we really analyze it first, so it's like monitoring. So for me that monitoring has to go on forever. That's my strongest recommendation, it's got to go on forever as long as we're the last Aboriginal people in this world.

Natasha Thorpe: Thank you Bertha those are all really important points and I appreciate you emphasizing and raising them.

Another really important question that came up yesterday and also at the camp was once Diavik is closed and into post closure and the water is connected again and not behind a dike, are people going to want to taste the water then? Is that still going to be part of the study? Right now we taste it: you collect water from Lac de Gras and taste it. Are you going to want to continue to do that after Diavik closes? Are you going to want to continue to taste the fish or would you rather just science be the storyteller of how the fish are doing in their tissues and how the water quality is?

Nancy Kadlun: Yeah, it would be good because I don't think Diavik will be the last mine. I am pretty sure that somebody's going to jump in right after Diavik

goes. This is not going to be the last mine in that area. There will be some people jumping right away as soon as they know nobody is there, so we would like to still go there and monitor the area.

Bobby Algona: You read my mind Nancy. I have often said it before who is going to monitor the water and the animals after the mine. I am hearing they will be monitoring it for a period of time until everybody is satisfied that the water and the area is clean for all animals to use again after the mine is closed. I think we need to do a whole lot more and let's think a whole lot more about the things we need to do. These are some really good recommendations, sessions that we go to. We do need to monitor an ongoing program for after the mine is closed, we've already heard that. Until we are satisfied - that is a strong phrase there - until we are satisfied. I think that speaks for itself, after the mine life is done for that mine.

Colleen English: I think those are two really good points. I just have a couple of questions around that. One that I hear you saying is that to be comfortable with the fish quality or the water quality, you would still want to be tasting them. So one of the questions I had was that back in 2009, I remember I was at the camp with a few people - I don't think that anyone here was there then - but one of the Elders who was there, before we got there we'd had a couple of meetings and he was like, "I am not eating this fish. I am not eating it, it's on a lake that has a mine on it and I am not eating it." And so we had said that was okay, and that they could still come to the camp, can still hang out and do whatever you want to do, and we understand it's everybody's choice and you don't have to eat the fish when you come there. So we got there and we did some fishing and we pulled the fish in and we started cutting up the fish and then he saw the fish. And then he tried the fish, because he was comfortable with what he saw, with the discussions that everybody was having and the talks that they had. And I thought that was a really great example of some of the things that you talked about earlier, Bobby, about being a little bit uncomfortable with that lake being reconnected to the pits. Does this program then become that the number one thing that we do is we look at the fish. It's a visual inspection that we are doing before we eat anything. We have the intention of tasting, that option is always there, and we will always have the science people there, but do we make it a multistep process where we want to look, we want to see, we want to be comfortable with what we see, and then we taste if we are comfortable with what we see. So I think that's one of the questions that I would have in terms of that comfort level with everyone, once everything is reconnected again.

The other thing that Nancy brought up in a roundabout way that I think is an important question, too, is right now, for example, we have the Ekati mine that is very close to Diavik and they're going through permitting for Jay Pipe at the moment. That is upstream of Lac de Gras, in Lac du Sauvage. It's not far, it's a few kilometers, so do we start saying that we want to test fish from Lac de Sauvage? August mentioned expanding the area within Lac de Gras a little bit. Does the Narrows become a more important site to get fish from every time we go to that camp? So do we add that to the list of the places we want to go, and the fish that we want to test and taste? I think those are two really important questions that you guys touched on in your comments.

Joanne Barnaby: I just wanted to mention that in fact at this last camp we failed to follow through and understand Madeline when she would look at the fish and discard a fish. She would say, 'no, I don't want to work with that one' and what we didn't do, and should have done, was question her as to why she rejected a fish. So I think that's something that we definitely need to pay attention to and address if it happens again.

So are people comfortable with identifying areas that you want to sample water from and to take fish from?

August Enzoe: Yeah I mentioned down there, there is one place there, they call it the gap [the Narrows], it's a caribou route right across there. We should sample fish there. We didn't go this year because of the weather. Take samples of the water because the reason I am saying this is there's another big mine going way up there, Jay Pipe you call it, and they are going to build a big dam around it, bigger than the other ones you see. They are going to start work in probably another 5 years. Before that we have to watch that lake, the gap there; they should have a station there.

Natasha Thorpe: August do you mean the narrows between Las de Sauvage and Lac de Gras. [nodding yes] Colleen, do you want to speak to the current monitoring?

Colleen English: We will go over this a bit tomorrow too but this is a good map to try to explain some of those concerns. [Figure 2 and 3]. We have a water quality site at the base of the Narrows and then we basically sweep our way across the lake. This is the outflow that heads to Kugluktuk so there is a sample point that's at the outflow of Lac de Gras as well. Once you get past there it gets complicated, as Diavik is not the only one out there. There are other exploration groups, there's other mines and so you start having a river system with a lot of different natural and human inputs and it becomes very difficult to

distinguish what might be Diavik's and what might be somebody else's. So that's the reason for this sample location. And, right now, Ekati actually has some outflow up here, too, but that last point of control is the main reason for that sample location. So that's where Diavik can last check, at the outflow from Lac de Gras, that Lac de Gras water is okay before it goes into the Coppermine River. And it's not just water that they sample. Nancy, Bobby and Berna you guys came out with us. There were a few people at the camp this summer who came water quality sampling with us and saw everything Diavik does when they go out there. Its taking sediments, its taking the bugs off the bottom of the lake, it's the water itself, it's the bugs that float in the water, it's the fish, it's a very extensive program for testing all different kinds of things that could be happening in the lake.

Natasha Thorpe: In the future I am wondering where you might consider testing water. Same places or different places?

Bobby Algona: Water sampling the very first time, we all said as a group we all agreed on a place that we wanted to test each and every time we went. And it didn't happen this time for some of the places that we wanted to sample because of weather. We couldn't get around to the other side of the island itself. In my mind I think it would be a good idea to sample every time we go out there. We had to change our sampling place. We sampled a place a few years ago, we wanted to keep sampling from that same spot, and in my mind the water is always moving especially in the big lakes. In my mind it doesn't really matter where we sample from, the water is moving all around the lake. I think it would be a good idea if we sample and we agree in this workshop let's do it in that one spot we didn't do this time. Because the water is always moving and the pressure itself is, the tides and the moon do a lot to move water.

Colleen English: I wanted to follow up with everybody and show everybody where the samples that they took at the camp site were. In 2012, of the two samples they were taking, one was taken at the discharge line and the second was over in the bay where Diavik takes in drinking water for the camp. This year we had some weather issues and so we took them where the fish nets were set.

Joanne Barnaby: So we have been talking about whether or not there are changes we want to make to the program and a lot of people have said they are okay with sampling water, boiling it without making tea or coffee out of it. So I just wanted to check in.

August Enzoe: Testing water we could still boil it, but don't make tea. Let it sit over night then taste it.

Joanne Barnaby: Would you want to taste some before its boiled and then taste it after its boiled?

August Enzoe: You would still have to taste it before its boiled but also boil it and check it the next day.

Joanne Barnaby: How do other people feel about that approach? Good? I think we have a consensus on doing that next time. Show your hands please.

Phoebe Rabesca: I don't know, I am new at this and so I am not sure if this was done before, but have they ever tested the water before its boiled? Do they do sampling of water before its boiled and after it's boiled? And what's the result of that?

Natasha Thorpe: Do you mean to taste or scientific testing?

Phoebe Rabesca: Scientific testing.

Colleen English: We don't do science samples on boiled water; it's only just the cold water out of the lake. There's a way that you can analyze water to look at the dissolved chemicals in it, which is kind of the same idea as if you were to use boiled water and get rid of some of the total particulates and stuff in there. They do that through an extraction method in the lab. Its called 'digesting' and they put it through a microwave digester and then it removes the floating, suspended 'total' particles and just gives you the dissolved fraction. So it's kind of a similar method as boiling to break out those two types of metals that you would be concerned about, the totals and dissolved. That's the closest thing they can do to boiling.

Natasha Thorpe: Boiling water would kill some of the things they were looking for, like the bugs which Nancy said is an indicator of healthy water.

Phoebe Rabesca: The chemicals in the water and I'm not sure, I'm not a scientist, my mind is going, when you take a sample of water and they do testing on it, do you know what kind of chemicals is in it and all that? Let's say in one spot you take water and you take two samples: one just regular water to see what kind of chemicals are in there, and then what if after you boil the water from the same spot to see before and after, is there any difference, regarding chemicals or anything?

Colleen English: Boiling water does change water. Diavik wouldn't have any samples from the mine on boiled water, because they don't boil their samples, but they do a very thorough analysis, in a different way, that get at the same questions, like what I was talking about before.

Phoebe Rabesca: So what you are saying is the water is not boiled but it would show more stuff in that when you look at it.

Colleen English: Yes, it's just looking at it in a different way.

Natasha Thorpe: Alright I can see that we are ready for a break. We have fresh coffee and hot water and snacks there.

Break

Colleen English: So we had one last question in relation to this fish and water camp and it comes down to more logistics. This is about where the camp currently is and what the future plans for the camp may be. The current location of the camp is separate from Diavik so it's on the other side of the lake, the south side of Lac de Gras. It's on a land use permit area, so Diavik has a completely separate land use permit for the camp. That land use permit is going to expire within the next year or two, so there needs to be a decision made as to whether Diavik should re-apply for a land use permit, which would give us another 5 years at that current site, or we can talk about changing the location of the camp. It's not wide open. If any changes were made, it would be to scale back, as opposed to a change a location. Diavik doesn't want to go and make a new foot print for a camp somewhere, they would rather just move it onto the mine site. So it would be on East Island as opposed to being out on the land. Those are basically the two options: do we keep the camp where it's at, even if it's just for a few more years (up to about 5), or do we move to the mine site? I would say, this is just my gut instinct as I don't think anyone at Diavik has ever confirmed this, but that we would have a maximum of 5 years at the current location and then that would kind of be it, because they would be starting to close and shrink their overall foot print by that time. They wouldn't want to be holding on to another land use permit for a place where they would need to go clean up and remove everything.

Joanne Barnaby: If the renewal is scheduled for next year, would we have use of the current camp two more times?

Colleen English: No, it would be one more time and then they'd be near the end of the permit.

One of the things that I thought of in terms of the future, in my view, I think 2018 is realistic. I would probably want to keep the camp where it is for the next time, 2018. After that, the mine site is going to get a lot quieter so the mine won't be as busy. You aren't going to have all of the people that are there now and all of the equipment; it's going to be a lot quieter in 2021 as they approach closure. I think that there's been a lot of discussion we have had in this Panel around healing the land at the mine site and I think that there could be some pretty cool opportunities to do that if we used the mine site as a base and maybe had a tent, a gathering tent set up somewhere sort of onsite, but in a nice quiet area where there is some natural tundra that's a little away from the buildings. So you can still go out and you can still fish and you can still go take water samples and stay at the mine and then use this tent as the meeting place, gathering place, where you would cut your fish, where you would do all of that. But you can also be on the land at the mine site to get a better feel for how things are changing, because they will be changing a lot at that point in time. And we have had a lot of feedback saying that people at the camp also want to see the mine site. The camp can change, the camp can evolve. It can move location, but it's really a choice between where it is now or being based on site.

Joanne Barnaby: Thoughts on the location and whether we should recommend staying at the current camp for the next time or moving before then?

Ed Jones: Colleen mentioned there are quiet areas on that island, I don't believe that. First of all why move? That's my question.

Joanne Barnaby: As Colleen explained, they won't have a land use permit for where the camp is currently. After a certain amount of time, it will expire. If they don't have a land use permit, yes they have to move. Yes they can renew but, as she explained, if they did renew next year, it gives them 5 more years. But after that Colleen doesn't think that Diavik will be interested in renewing again because they will be focused on closure and taking things away. Are you suggesting that you want them to renew again after the next renewal, so for another 10 years, they would have that camp? If that's the case are you also asking them to leave all of the buildings and tent frames and such? If they don't have a land use permit that stuff has to be moved. Any other thoughts on this.

Bobby Algona: The land use permit for that camp expires and if you do get to where you have to move equipment, these tents and stoves and stuff that you have

there, I think if we could. Each group here would like to say a few things maybe. I myself as a hunter and trapper I have often come to Lac de Gras and if there's a way that the communities can say we would like to keep those tent frames there at least. They aren't going to go rotten, they can leave those tent frames there, they are still fairly new and can be use by the different communities for another 20 years from now. I think it would be a good recommendation to Diavik.

Joanne Barnaby: So the option of selling the tents to the communities at say $1 each. What would that mean in terms of land use permits because community people don't need land use permits to set up on the land camps.

Colleen English: Yeah and I think one of the challenges is that Diavik does need a permit and to get out of the land use permit we need to clean it up. So it would either have to be something that we explore outside of the box with the government where it's a sign off, the communities would rather keep it here as oppose to it being cleaned up and then someone coming back in to re-establish in the same area. So that would have to be flagged pretty early on for a discussion with them. The other option is to dismantle the camp where it is and give all of those materials to everybody and you can set up wherever you want after that. Then Diavik gets that close off piece with the land use permit and liability, and you guys get the gear and equipment and can set up a camp wherever you want to be.

Bobby Algona: As an elder and as a hunter trapper all my life, I think I would like to use the camp in the future. Maybe if my health were to come back I would like to go up there again and I think that's something. If you are going to lose that land use permit anyway I think handing it off to a community or maybe an organization or maybe to all the communities around the table we could use those in the future. I have no qualms about leaving such good lumber there. I could always use that as camp, instead of having to move it away.

Colleen English: Yeah I know for the government it always comes back to how long is that going to sit there, are people just going to leave it and forget about it and walk away. That's the big concern and if it's got the Diavik name on it, you can bet that they are concerned about it may come back to them later. Something would need to be signed off somehow.

Natasha Thorpe: Do you know how the original camp location was selected?

Colleen English: It was done back in 2002 with support of the communities but I don't know the exact process. I know everybody sat down with a map and picked a spot and it had to be close enough that Diavik could support it but quiet enough to have some space away from the mine and have a camp feel.

Natasha Thorpe: I think that's important to know that there was community input in the beginning in selecting the location.

So for 2018 what would the TK Panel like to recommend? Staying where the camp is, or move to the island.

Bertha Catholique: I don't want to move away because there are a lot of cloud berries there.

Natasha Thorpe: We were lucky this year to see a bear and a wolf. Lots of ground squirrels. Is there agreement to keep it where it is or do we want to think about moving?

Keep it where it is: Yes, majority.

We are going to switch channels here to talk about the recommendations that you as the Panel delivered to Diavik at our last session when we were at camp.

Presentation – DDMI Response to Session 7 Recommendations (Appendix G)

Colleen English: Very early on we got a lot of feedback that you wanted to hear back on your recommendations. So that is what this is. One of the commitments that we made very early on was to respond to every recommendation that the Panel brings forward to Diavik. Usually, at the end of every session, you guys will present to Diavik, and Diavik will give an initial response, a best guess of their initial take on things. But then they also take it away and have some time to think about it and figure out what works and what doesn't in relation to the closure plan, or whatever topic we are discussing. Then, someone presents the official responses from the last session at the beginning of the next session. So that's what we want to do today. Last time we talked about plants and re-vegetation, re-planting at the mine site and trying to rejuvenate the land after the mine is done. So today I am going to walk through some of those recommendations and give you the response from Diavik. If there are any questions I can't answer we will park those and make sure that Gord answers those when he comes back tomorrow.

1. Those [recommendations] that are supported (16 recommendations)

Kathy Arden: Before Diavik started mining on the island did they have a group of environmentalists that went on there and took pictures and samples of the vegetation? And then do sort of a mapping of it? Because on there you said studying the vegetation on the north and east side of the island. And I am sure the vegetation in those areas would run throughout the island. But if I remember correctly, many years ago, like in 1998 when all the mines were starting up, they had asked the mines to start taking samples of the vegetation right away. So they have done that?

Colleen English: Yes, and there are two sides to that question, from a TK perspective and from a science perspective. From a science perspective we've got all that. We have the vegetation based maps that show us exactly what types of vegetation are present all around the area. And Diavik has done studies since day 1 about what types of vegetation have been seen, is it growing faster, are species changing? Those are all questions from the science perspective that have been looked at. And also dust on vegetation, particularly lichen in relation to caribou. That's been another study that has been done in relation to plants. On the TK side of things, Natasha and Joanne probably want to speak to that from your literature review. I don't know which one of you wants to speak.

Joanne Barnaby: Let me just say that what struck me about that work was how well our TK holders in our communities knew that area. You know the full variety of plants that they identified, in some cases they identified how they were used for food or medicine or for fire. And what they knew was critical vegetation for animals and in particular the caribou and what they knew about how long it takes that vegetation to grow once it's disturbed. So it was very rich information and its there, it's available to us.

Kathy Arden: With that in mind, you have a length of time that this vegetation would take to come back on that mine site. So it might be 10 years before the lichen would come back. Because I was just thinking that we (the TK Panel) and Diavik are going to make the paths back for the caribou to roam through but the mine is going to be done and gone but not much of the vegetation is going to be there yet to eat. So I guess what you are thinking of is that they will probably pass through and go to areas where they can feed because I don't know how long it would take them to go through the site.

Colleen English: Yeah it doesn't take any time, it's a pretty small site. But one of the things that a couple people raised that I found really interesting, Joanne and I were talking about it after our site visit last time, is we have vegetation plots, a research plot that was 10 years old when we were there last. It has big, tall grasses on it. But its grasses, so a lot of people were like, 'well that's different, that doesn't look like the tundra that is all around'. It was really important for people to see that, because it's a staged approach.

Even when you plant and you encourage growth for different species, the first type of plant that can take to anywhere is either fireweed, as August observed, or grasses. Then those grasses die and you start getting some nutrients in the soil and that's when you start to see your willows and your berries and those types of things coming up. So those will be even longer before you are going to see that type of change to similar to a truly natural landscape. So you may see swaying grasses on the tundra for a little bit before you are going to start to see what looks natural to your eyes, for those who are used to being on that land.

Nancy Kadlun: I was wondering what are you going to do with all those huge buildings?

Colleen English: The buildings will come down. What happens to them will depend on the state of the building, if it's in good condition. We have done some studies but will probably have to re-evaluate this as we get closer to closure in terms of which ones have value to keep using or sell or donate. Those that don't will be buried in the on-site landfill.

2. Those that Diavik wants to modify (5 recommendations)

Joanne Barnaby: One of the things that we found in the literature review was you could really see the specialized knowledge of the women, and it was quite different from the knowledge that men had. So that's why we wanted the specific women's session, so that we didn't miss the deeper knowledge that women have about plants. And I haven't given up pushing for that one for the vegetation, because we don't want to miss out on their knowledge.

Joanne Barnaby: So you are saying the Panel could meet three times a year?

Colleen English: It could be 1, 2, 3 times a year, but based on the information that can be shared and what is relevant at the time. Especially when a large part of the Panel's focus is on closure and there's aspects to the closure plan that Diavik doesn't even have all the right information yet. They are still doing research in order to know what that closure plan piece is going to look like. So to have a discussion before they know that is sort of futile. They can't share enough information with you so it puts the Panel in a tough position to be able to make useful recommendations back to them as well. So we just want to make sure that it's relevant.

Natasha Thorpe: So I just want to check in with the TK Panel to summarize that the slide that Colleen showed you before, these are all the recommendations that came from you last time that have been supported. Then there are these ones that they would like to modify. They are not saying no but they would like something slightly different. So

based on what Colleen has just shared, I want to check in with the Panel to see if there is a response or comment on these 4 that they are wanting to revise.

Kathy Arden: Earlier when we were talking about the PKC pit, I haven't seen it but I have a picture in my head that it's something very eerie and scary and green and stuff like that. And like you were showing us on the map that sort of natural barrier between the rock pile and the slope that goes down into PKC. What is preventing the caribou, if they decided to migrate lower and come across, is there something blocking it all the way around that PKC pit or are you just more concerned that they are going to actually cross over this nice little walk way we are going to make them. I mean caribou change their mind and have gone different directions over the years for various reasons of course, but what about the bottom end.

Colleen English: Yes that's a good question. There is a very big dam, very tall, that goes all the way around the PKC.

Kathy Arden: So now I can see why your concerned and your concentration is on that rock pile and the barrier there, because it's not as high.

Colleen English: Right so it's easier for them to get down.

Natasha Thorpe: I want to add that it's really tough to come in to the TK Panel because we have been going a few years and you also weren't at the last session. Not just you, but we have some members that are not here all the time and we are so excited that there are new members, especially more female representation, which is what you recommended as a panel before. If anybody is interested in reviewing, taking home with them previous Panel reports, these recommendations, I think it will all make a little bit more sense and I am thinking Phoebe for you, too. Because it's really tough to be parachuted into a process so thank you all.

The other thing I wanted to mention is that Colleen is presenting and it's a lot of words and thank you for being patient. This is just what you came up with last time so just to give you an idea, this is how hard you are working and how many recommendations came out. There were 22 or 23 recommendations from last time and we will probably add the same number around that on Friday after we figure out all the comments you have made today, tomorrow. So this is the 8th session of the TK Panel so we have 8 sessions times 10, 20, 30 recommendations and they are all in a huge table. It shows here is the recommendation, here is how Diavik is responding and here's the action. This was something that I got involved in when I started working for this TK Panel. I advised Diavik, I said people need to know exactly where their recommendations are leading to action. You make these recommendations and then sometimes in other

situations you don't hear back and it's frustrating. So this is an example of you hearing back how Diavik is responding to your recommendations. You have made over 100 recommendations at this point.

This is you hearing back from Diavik about your recommendations.

3. Those that are unsupported (2 recommendations)

Ed Jones: I just want to remind you that human waste is used as a fertilizer in China and they have been using it for years and I believe that is what keeps them slim.

Nancy Kadlun: I don't think that we will need seeds because it will do it itself.

Colleen English: There has been a lot of discussion around people thinking that the land will do it itself. August was saying that he really noticed when we went through the mine site to camp this summer. He noticed that there was fireweed everywhere, growing on the sides of the rock piles, growing beside the roads. Mary Rose Sundburg said it best, that nature will heal itself but it is a big scar that has been put on to the land. So for nature to heal itself, it would take a lot more effort than it normally would. So if we can help and we can try to encourage that growth then that may be a good thing in this case.

Joanne Barnaby: I just want to make a suggestion that we visit the treated sewage area next time so that maybe you all know better what it is and maybe you will feel better about it. You know our people used nature in the past always without even treating sewer and a lot of times that sewer that we produced, human waste that we produced, went into the water ways and nature healed it and kept out waters clean and we do have experience with that.

Bobby Algona: I would like to remind you again, I have said this one time before, when we want to reclaim and replenish the mine site and get the prospective on how to do that we should go and see old camp sites nearby. There was a lot of human activity in those camp sites and they haven't been used in many years because people long ago found one spot that they could use which had a lot of human activity because of a lot of animals around and plant life and the animals around the area. And just a couple of years ago Ekati went up to my camp on their caribou surveys and they landed on my campsite and they told me and showed me pictures of my camp and all the grass and everything is all over my camp now. I think if we are going to reclaim and replenish I think we need to go visit my camp to get a perspective on how we can reclaim the mine site. As a TK holder I see this all the time. I find old camp sites on my travels. I don't know who's ones they are and if its' my people, the Dene people and it looks

like the explorers from the past. And those grasses and shrubs have really grown fast in those areas.

Natasha Thorpe: I have added that as a recommendation. I don't want to put you on the spot Lucas but we do have someone around the table with quite a bit of experience with vegetation. Lucas has worked on a mine site before in a vegetation program. Are there any words of wisdom you have for us?

Lucas Enzoe: I did work at Ekati Diamond Mine replenishing and seeding, and testing the Canadian geese, that go up there and feed on the grass and test if it's okay to eat. We test the soil. It does have chemicals in there but it's not too much, so it's not harmful. But it's actually growing.

Natasha Thorpe: So do you think moving these tundra mats might work?

Lucas Enzoe: You don't need the tundra mats you just need to give it time and it does work.

Natasha Thorpe: Thank you Lucas. Any other questions and comments?

Louie Zoe: You're talking about things that will be important that the country rock that is up really high. I don't think the animals can climb up high, they can lower it down so animals can go up other rocks and further down this side. They are going to be making another rock pile in the process of making the new dike. We once told Diavik the rocks piled up like that is too high for the animal.

Natasha Thorpe: So we will put that down again as a concern. Can I put that down as something we can talk about with Gord when he comes back? So thank you very much. I know that everybody is tired, so let's call it a day. If we can meet here, we would like to get started about 8:30 a.m., if that works for you guys? And tomorrow we've got Diavik going through a presentation about monitoring water quality right on East Island. So before you go home or to the hotel we are going to be talking tomorrow about monitoring water quality on site, and putting together some recommendations. And in the afternoon, that's when we will be hearing from both Diavik and DFO and focusing on shorelines and fish habitat, and making recommendations.

Louie Zoe: I had mentioned in the past that the sewage is being treated and with the PKC are the putting that back into the lake? This is an additional question.

Natasha Thorpe: He was asking earlier and suggesting that the height of the Rock Pile is too high for animals.

Gord Macdonald: I can't answer the question if it's too high for caribou or not - you would probably know a lot more about that than me. So it is as high as it is. It's not going to be any bigger, but it also is not going to be any smaller. It will be capped. So when A21 rock comes out, that rock is going to go somewhere in here [southwest side of Island, on Figure 1]. I haven't decided exactly how or where yet, and it is something that I think we talked about at the last Panel session. Do we make it large and flat or smaller and higher? Those are the options that we have, so those are decisions you can help us with. Because once we put it out there, whichever way we build it is the way it will be forever. Other than what we will used to cover the north country rock pile, all the rock [from A21] is going down here.

I think you asked a question about whether the sewage is treated.

Colleen English: Does the PKC go to the lake and is the sewage treated?

Gord Macdonald: The liquid sewage is treated and it goes into here [PKC], and if there is too much water in here [PKC] we send it to the north inlet to be treated before it goes back into the lake.

Colleen English: That's the sewage water, then there are the solids too.

Gord Macdonald: Then the solids come out and right now a lot of them are being placed up on this till pile. We saw that when we were doing the re-vegetation session. We've got options, but we would like to be able to use it as part of the re-vegetation process. I know there were some concerns from this group about using that for re-vegetation. Any other questions?

Joanne Barnaby: I think everybody is tired, we have absorbed a lot today. If you can think about what Diavik said and if you have any other comments bring them in the morning.

Louie Zoe: Closing prayer

Appendix D

Diavik Diamond Mines TK Panel Session #8 - Water Monitoring & Fish Habitat

Thursday December 3rd, 2015

Nancy Kadlun: Opening prayer

Joanne Barnaby: So when we finished off yesterday we were focused on Diavik's response to your recommendations from the last session on plants and re-vegetation. Everyone was tired and we agreed to come back to it this morning and give you a chance to comment on it, especially if you had any questions to Diavik about any of the recommendations that they don't support. So just to remind you, I believe there are 2. This first one was in relation to the use of tundra mats to re-vegetate certain areas. Colleen explained that the timing was really challenging to do this and they don't see that it can be done. They have tried and it didn't work.

The second one was the use of treated human sewage as fertilizer. If you remember, some Panel members were uncomfortable with using human waste as fertilizer and Diavik feels that it's a very effective fertilizer and it's there, its treated and its safe for use.

In terms of recommendations they would modify, there were 4. The one recommendation related to using the small crushed rock similar to what's on the air strip. Diavik explained that a very specific crusher was brought in specifically to construct the air strip to produce that really fine rock and it would not be feasible to bring that back. They feel that it's not necessary, that the test slope that we saw seemed to be satisfactory to the Panel and it would be at that level of crush.

The idea of creating a barrier between the rock pile and the PKC slime area, there's still a need to explore options there on how to do that.

And the idea of having a special women's session on vegetation, their preference is to incorporate women into all the meetings and not have a special session.

Also in terms of meetings per year they are basically saying they would rather approach it on an as needed basis so that's if there's something that needs to be addressed in terms of planning for closure that needs some direction they would rather approach it that way.

Any comments on the recommendations that they suggest either modifying or rejecting?

Janelle Nitsiza: Good morning. The third modification incorporating women in the vegetation. I think it's actually more important if we do have our own women's sessions. I mean I don't have to be incorporated but I would love the opportunity

because we could use that time for Elderly women to teach about traditional vegetation, like how to collect moss and what's good for this and what's good for that. I know my grandma taught me lots just from around our area and it would be interesting to see what's growing in the Lac de Gras area. I know a long time ago when they had meetings the men went, it was mostly men who were incorporated and they got to see the caribou stuff and all the things that affect the caribou. But women use the land and we need to see it ourselves and we need to learn because not many Elderly women are around now, so I would be very grateful just to see what the vegetation is like there and just to see what we can do to help, from both sides, the scientific side and the traditional side.

Joanne Barnaby: Any other comments?

Bobby Algona: When we look at the fine crush rock I agree that we don't really need that really fine crushed rock. When we go to the mine you see lots of crushed rock all over the camp site itself, you see them under the culverts or the pipeline, the water line. You see growth underneath the buildings as well and near the water pipelines especially. There was this one person that we were working with, he was wondering, we did not put any additives to any crush rock. I told him when you crush rock there are ingredients in that rock sometimes, it's not always acidic or anything that can really deter plant life. Sometimes you see that on the water pipelines. There are natural ingredients in that crushed rock as well. It all comes from the rock, you see all the plant life on the tundra, that all comes from the rock.

Joanne Barnaby: Any questions or comments about any of the responses from Diavik?

Natasha Thorpe: I am just going to speak to the Women's session on vegetation. During the Aquatic Effects Monitoring Traditional Knowledge program when we are out at the camp there was some work that we did with the vegetation, particularly with the women. But we also had some of the men comment that they would rather more fish related lessons be taught at the camp than vegetation related. So I think the idea with this if I am remembering is that it was sort of something that would happen once, not on a regular basis, but that it would capture the specific knowledge of women.

Ed Jones: I just want to say that I don't know why they keep harping on this re-vegetation thing because I have said many times that you can allow nature to take its course, they don't need to do that. You take the risk of introducing something that shouldn't be there. You can allow nature to take its course and there is no danger in that. If you are introducing new plants they could be harmful. I think it's a

waste of time talking about this, should we or should we not re-vegetate, but it doesn't seem to get through that you can allow nature to take its course and there is no danger in that.

Joanne Barnaby: Just to be clear Ed, everyone is in agreement that no new plants will be introduced. It would only be local plants.

Kathy Arden: I think I had asked yesterday and I fail to remember what the answer was, has someone from Diavik already done a collection of seeds in that area or are they waiting until closure?

Colleen English: They do have the University of Alberta that is on site and doing re-vegetation research. As part of that work they are also collecting seeds and shrubs. Diavik has also tried to source northern seed supplies, one example is Aurora Resource Institute. Two summers ago they did a NWT wide seed collection program and we've sourced seed from them. There's also a supplier in the Yukon that have NWT species, so we also source from them. Between those three that's where we get all of our seed from for the programs that we are doing.

Joanne Barnaby: No other questions or comments?

Bobby Algona: That fourth one that the TK Panel meet two times per year? Why was that not accepted? Is it for once per year or three times per year?

Gord Macdonald: Its not that it wasn't accepted. We said we shouldn't fix the number of sessions, it should be based on what is needed to be done.

Joanne Barnaby: Okay, last chance for comments or questions.

Kathy Arden: Forgive me for harping on the seed thing but going to the women's session on vegetation and the identity of the plants in the Diavik mine site area. It's been commented that women have used plants for medicine to treat their families and even consume so I think that a women's session on vegetation using the identity of plants in that area would good because then they, those people that are knowledgeable in the consumption or use of those plants for medicine, would be good. Then we could ensure that those plants manage to re-grow in that area so that in the future our youth who will learn the use of these plants would be able to go there and use them and consume them and know what they are for. So perhaps a women's session with lady Elders that know of these plants would be a good thing because then it would be ensured that these plants have come back in that area. I know Eddie has mentioned that we are always talking about re-vegetation

and let nature takes its course and I am sure it will, but identifying those plants and making sure they come back would be good.

Joanne Barnaby: Any other comments or questions?

Louie Zoe: Yesterday talking about plants and vegetation is a very important question and the plan and the gravel that we talked about. I am concerned about the height of the waste rock pile and then the big boulders and think maybe we would try to reduce the size of it and then eventually, but it's hard to know how long, for the vegetation to come back. It's going to take years for sure, none the less if you had some fine dirt scattered all over on top maybe that way the wind would take over and nature would take its course.

Dora Migwi: Taking the vegetation back and the re-growth is very important because it's seasonal and every spring I guess when all the plants that come back to life and all the shrubs are all out there. I agree that we should just leave it up to nature to take its course. The animals really depending on it and we don't have to put new species of plants in there that maybe the animals that are using the land might change their diet. It will change the whole landscape. It looks grey brown because everything is dried up and leave it up to nature to run its course.

Joanne Barnaby: Any other questions or comments?

August Enzoe: Good morning this program we are working on I have been working on this for 3 years now. We work on it for three years what should be done and what should not be done. And I was looking at it and it looks pretty good. The rock pile we want them to make it level so the caribou could come back and be able to go on top of it. And for other things we did a lot of talk about what should be done but now the mine is going to be going another 5 or 6 years again so what we are doing now is for the future of the mine. Mother Nature will do her part with the flowers and stuff.

Short story. Rush River way back in the 1920's there was a lot of people living there, a school everything, church, Hudson Bay. 1960 it closed and everyone moved out. And I was there after 10 years and all the houses were gone and the land was really growing again. I used to travel around there and it was really growing back, everything is growing even where the houses were.

What's going on with the Jello, or slimes?

Gord Macdonald: We call it slimes but I think we should change it to jello, it would be a good idea. Since the last time we talked, we said we would get back to you and

we will do that tomorrow about them. Pails of the stuff went to the University to have toxicity testing done on it. Nothing has changed in terms of what we are going to do with it.

Joanne Barnaby: Ed you wanted to say something.

Ed Jones: I just want to mention that we do a lot of talking about what the mines are doing, environmental damage, but you know this is not the time for me to say it but I am going to. The biggest threat to our environment is the Tar Sands at Fort MacMurray. I don't hear our government representatives talking about it or even the average Yellowknifer. They tend to ignore that, why I don't really understand. Fort Chipewyan and Fort Mackay have shut their mouths, they don't criticize the Tar Sands anymore, I suspect because they have been paid under the table and I am wondering if our government is also being paid under the table to keep their mouth shut. I know this is not the time or place, but I just want to remind people the biggest threat is not the diamond mines, but the tar sands.

Joanne Barnaby: Thank you Ed. No more questions then we should move on. I believe Gord has a presentation.

Presentation - Post-Closure Water Management and Water Quality Monitoring (Appendix H)

Questions from Diavik

1. What areas would you want to sample and why? (eg. Migration routes, caribou crossings, ponds, etc.)
2. Would you want to do any type of TK monitoring of water quality on the island?
3. Are there features that would help clean/heal water draining from the land?

Fred Sangris: I know when they operate the mines the rocks are stockpiles and the most harmful rocks are normally stockpiled somewhere else. Can you tell us where the harmful country rocks are? And what's in the surrounding area?

Gord Macdonald: The more harmful type rocks, they are what we call type 3 rocks, and they are located in the middle, the core, of the North Country Rock Pile. So we put it in the middle of the North Country Rock Pile and it is sitting over top of the old quarry that was initially dug to build the dikes. So it's in the heart of this pile and the plan we have for that is to put a cap on the top of it that is made up of a layer of till, some gravel and a layer of rock. The idea is that it's going to make a cap over top of it to keep the core of the pile frozen so that, as much as possible, we

can keep that type 3 rock away from any snow melt or rain fall. So the design is to have everything run off of it, not in to it.

Mike Francis: The big pile of waste rock. Once the closure of the mine are they going to put it somewhere else? Or put in the open pit? I am concerned for the waste rock once the closure of the mine and that water.

Gord Macdonald: I think that there was a question about whether the rock is going to stay here and the answer is it is going to stay here. It's not going anywhere. We are using the good rock for on-going construction, type 1 rock. The Type 3 rock, the bad rock, is in the place it is intended to be.

Bobby Algona: As you I know we are in the heart of global warming and everything is melting all around us and hunters are finding these sink holes out on the tundra and especially around these esker areas and where there's a lot of permafrost, its melting. When you talk about that harmful rock and you want to put a cap on it and you think it's going to stay frozen. I am thinking how is that going to happen when everything is melting. It's eventually going to melt if global warming doesn't stop what it's doing now. It's not going to stay frozen with all the global warming going on.

Gord Macdonald: That's a very good question Bobby and that is exactly why we are doing this the way we are.

This is a picture of the rock pile and all of this would be frozen, but every year in the summer and you get a depth of thaw, about 1.5 meters of annual thaw in the ground. The thaw back on the rock pile is 15-20 meters every year. Global warming would likely increase that, if we left it the way it is today.

Natasha Thorpe: The math geniuses would play around with a few different cases, like if climate change went really crazy. What if it was small, what if it was somewhere in the middle, where would that thaw go?

Gord Macdonald: There are a range of scenarios looking at the paper these days about what's going on in Paris. There's a whole range of views that people have about what the world is but just like in any other engineering communities, the regulatory communities come up with reasonable scenarios and they ask every development, particularly developments in the North, to evaluate your designs against those global warming scenarios. So that is exactly what we have done is to evaluate all of our engineering, even back when we were doing the mine design, all of the engineering was done with global warming scenarios. The scenarios have changed plus or minus but when the average temperature at site is still like -

11C, you'd have to go 11 degrees of average temperature before you'd end up in a thawed environment. But regardless, global warming is not working in our favor for the mine site. So we want to make the rock pile act like the ground with regards to the annual thaw back. And the difference between what happens on the ground and what happens in the pile is that this [pile] is all big rocks with big air spaces in between, so the thaw can move faster down the column. What happens in here [ground] is its more compacted, it's more solid, so the annual thaw back is less. So the way we are doing this is to add 1 meter of the till [lake bottom material] out of the new pit and put it on to the rock pile. Then we top that with a 3 meter thick layer of rock, which will protect the till from thawing. So even with the annual thaw back, it [type 3 rock] still stays in the frozen zone.

This isn't something that we are going to do in 2023 or 2025. This is something that we actually have to start next year; we have to start re-sloping this pile because 2018 is when we will start mining A21 and we want to bring that material straight out of A21 and put it straight onto this pile so that we can start this process of developing this cap.

And I say all that because, in order to do this, next year we come back to the Panel with what we have been working on for the shape and the slope and caribou access on the North Country Rock Pile. It is because we have to make these decisions about what that final slope is going to look like next year, so that we can have it set and we can start building on top of it. Because what we don't want to do is build this cap on top of it and then, you know, have the Panel come back and say, you know, we would really like a caribou ramp over here. That gets a lot harder then.

Natasha Thorpe: Are there any more questions for Gord?

Fred Sangris: Here in Yellowknife, about the last 30 years, over the last many years we don't get a lot of rain. Have you been monitoring the rain season? Has the rainy season been diminishing or have you been getting more rain?

Gord Macdonald: It seems to come in more storms. So we have been getting the same amount, more or less, every year. We have had a couple of dry years but the storms seem to be bigger. The global warming prediction for the North is more rain, which we haven't seen yet, but that's what all our scenarios are designed for.

Fred Sangris: Is the rain going to help or is it going to be a problem?

Gord Macdonald: It's harder not so much for this, but for the PKC where it's a pond and so we have to design to those higher volumes. We can design to it properly but the

bigger problem is if we didn't see rain. Then those slimes on the bottom end up getting exposed. Dry would be good for the North Country Rock Pile, not so good for the PKC.

Natasha Thorpe: Thank you Gord I think that gives us a good start to our discussions. We have three questions to think about.

1. What areas would you want to sample and why? (eg. Migration routes, caribou crossings, ponds, etc.)
2. Would you want to do any type of TK monitoring of WQ on the island?
3. Are there features that would help clean/heal water draining from the land?

Louie Zoe: Definitely I think the mining company wanted to work with the Elders and now that we have that component in there I would like to help the best possible way. The Elders are concerned mostly about the land, the wildlife. Another concern is the way the company is looking at putting the waste rock back in the pit. As far as the filling it back up with water, I think the open pit will be cleaned out with the water any given day the water would be so deep that the fish might not want to use it. There's the dike itself at the water front do you see any vegetation that might be growing back in that area and if we could make the landscape more pleasant.

Fred Sangris: I feel the same was as the Elder from Gameti. We have learned from the past the mining companies just walked away so we want to see the best closure possible.

Natasha Thorpe: You are giving early guidance to Diavik so they can meaningfully and respectfully bring in TK into how they are planning closure. And when I hear that closure is planned for 2022-2023, its exciting that you have the chance now to guide them according to your experience and your wisdom.

Break

Natasha Thorpe: I am going to put up the map of East Island at closure. Our focus is to look at East Island. This island. What areas on east island would you want to sample and why? The blue lines are where Diavik thinks there will be water flow, that's where there will be cuts in the dike, that's what they are planning for. Are there places on the land, in some of these water bodies, maybe where the two pits are? We are free to take a marker and mark the map as well if you have ideas as to where you want monitoring to happen after closure. We could also break up into small groups. Colleen is getting you smaller maps. Let's look at the second question until the maps get here.

Would you want to do any type of TK monitoring of water quality on the island after closure? Right now you are monitoring by tasting it, tea test, boiling it, looking for scum.

Fred Sangris: I know in the past before the mine was developed that whole island was a spawning area for fish. It's a very important area. The water drainage I am a little concerned about for the fish. I am concerned about the water quality on the one area of the bay (south west of the two pipes or east of the PKC) we seem to have a lot of breaks of water coming into that one little bay. That area seems shallow and would probably be a spawning area? So maybe we can talk about that part maybe we can make it a cell with slow drainage or we can take a look at the flow of water, how much water is going in. And that might be an area that sampling would take place for a very long time.

Natasha Thorpe: Fred that is great suggestions, I wonder how would you suggest to monitor science or TK?

Fred Sangris: TK alone can't tell you, science alone can't tell you but I think, combined, I think you could get the best information for long term, and that could be an area where we want to go. But along with that the mine is going to close in 2023 and also there was a mention of bond, the dollars that's there but long after Diavik leaves the property I'm not sure if the bond money is going to be there for a very long time or who is going to use it or are we going to use it as part of this committee. This kind of committee needs to continue the work long after the mine leaves because we need to continue working and monitoring this place here, providing the best TK recommendations as possible but along with that I think there has to be dollars put aside for this committee so that other people involved and sampling and the information and reporting is done. I think the money might be an issue, if the money is not available then we can't go any further.

Natasha Thorpe: That sounds to me like a recommendation. That money be set aside to continue and whether that's from the bond, whether that's from the government it may involve asking or having the TK Panel put together a letter or formal recommendation to the government.

Fred Sangris: I agree, I'm not sure of the amount. But I think for the long term monitoring, there might be a long term impact we don't know, but I think it would need to be a substantial amount of money set aside so that monitoring continues with this. At the end we all want to see a beautiful thriving island again. The little critters that were on the island before maybe they could be returned.

Natasha Thorpe: I am wondering if anyone has ideas if you imagined the youth or Elders going back out to monitor East Island using TK, what would that look like?

Fred Sangris: I think it's important to because many Aboriginal people have TK since this is the very first of the mines that are working this way, it could be a model that could be built for the future for the other mines. I think for many of us we could pass on the traditional knowledge and then the youth need to continue that roll. I think it's important for the young people to learn about the TK and how it works and we are going to be partners with mine industry in the future, there is no way we are going to walk away from it because we all need the jobs, we need the economy we need, the young people are looking for a future. But I think we can work with that but also passing on our information and passing on our TK so that these things are taken care of long after the mines are gone and the healing process continues, so that there is no big impact. We want the herds of caribou to come back and some people may not agree with me but I hunt caribou a lot and I know the caribou will come back to this island. This island was an important caribou habitat at one time and we have to make that island, design it so that the animals will come back, the caribou will come back to it and other animals as well and use the island again.

We also have youth that are trained in the environmental fields they could be scientists. A partnership should be struck with the First Nations community and the governments. This could be a model the way we design this.

Bobby Algona: Looking at the water currents around the lake I've had a little discussion earlier on the panel even over the summer. I have asked this question and I didn't really get the full answer, of all the monitoring of water currents around the lake, I am wondering have the currents been monitored around the little bays? I was really wondering if there was any monitoring in those areas and as a hunter and trapper trying to find fish and coming to know these little bays. Fish need water currents to move around on the lake and coming to know these little bays no matter how small they are, I see the water currents when I am fishing you set your fish line down in the water, you see the curve on the line all the time, that's the water currents in those areas. And if you put it down later it's going in a different direction. As you know the moon has something to do with this water currents even out on the ocean you see these water currents moving back and forth all along the ocean. I was wondering if there was any water currents in these areas? When you look at that fish and land you know there are currents in these lakes and no matter how small the lake is there is still the current, its still there. I always find no matter how small the bay is there is a current. Those would be the places to monitor because of the . . . (stops).

I recommend that those dikes not be open for many years after the mine closes, same as those blue lines. Until we can monitor the seepage spots that the mine has. If they are not drastically changing then when we are all comfortable and we can monitor these as well. Don't break any dikes or channels for a number of years after the mine is closed.

Natasha Thorpe: I wonder two things Bobby, one when you say monitor the seepage so that you are satisfied how exactly would you monitor it by tasting, by looking.

Bobby Algona: We can be working along with the scientists as well. We don't really want to be tasting it or do anything with it. I think we will be working closely with the scientists after closure. I think science can help us a lot in those ways too.

Natasha Thorpe: So I am hearing you wouldn't want to taste the water on East Island? Is that a general feeling? Right, we taste it at the camp from the big lake, but right now we are talking specifically on East Island.

Everybody agrees? (Yes.) Okay.

Phoebe Rabesca: I do agree with Bobby not to open up the dikes. If you look at the map right now you see the big two giant holes and once the water's covering it, it's there forever. 200 years, 300 hundred years. And also with the North Country where there is contamination in the rock, chemicals. That is there forever. Then if you look at the PK that to, there's slime inside and that too is contaminated and this land is not reversible 100% because, and I'm sure Diavik doesn't want to be accountable after they leave, they want to make sure everything is done. That's the reason why they created the TK Panel to get the Elders perspective, to get the peoples perspective and for me this Panel right now, this day and age, while we are making the decisions if we make one or two mistakes and we didn't do nothing right, 150 years from now they are going to say the TK Panel didn't do it right. Diavik can say the TK Panel didn't do it right because they created this committee because they don't want to be accountable and then with the bond, Fred is talking about the bond because he wants money there, its true. Diavik came into our traditional area, a hunting area and they did all that, they got the money they want, they got the diamonds they want and now, if you think about it, they don't want to be accountable for it. And now they say well let's ask the government for money. You can't just look at the government, Diavik has to be accountable. I know that Diavik and Rio Tinto don't want to be accountable. It's not like Giant Mine. And if we think about it the water is going to be there. It's flowing through Kugluktuk, 50 years from now what is it going to be like when you are not there. 50 years ago by this time it use to be -50 out on the trap line,

now it's -12, we are 40 degrees above normal if we think about it. My mom when she was growing up in the bush it was -60 in the month of December. Global warming is not going to be reversible for a very long time. Tar sands is flowing this way, ray rock is flowing this way, the j-pipe is eventually going to flow into your area.

Natasha Thorpe: Thank you very much for those thoughtful comments. It's not easy for anyone to plan for these types of events. One thing you mentioned about the bond to clarify, the bond is not government money, the bond is Diavik's money that they have to put aside. I understand they put aside 4 million dollars a year. The government requires that Diavik has 150 million dollar bond set aside and to have that available. Its not government money that funds the bond.

I wonder about different times in the moon cycle or the different moons over the 12 moons of the year. Are there ways that your knowledge of moon phases and how they affect water quality or water quantity? I am wondering if that expertise that TK holders have about the moon might affect how you monitor the water based on the moon.

August Enzoe: Can you please repeat what you said about the moon?

Natasha Thorpe: I was listening to Bobby talk about the moon and about how it affects water currents and it made me wonder if that TK that you have about how the moon affects water - quality, quantity, how it tastes, how it moves, how deep or shallow it is - whether there is anything that could be applied to how you want to monitor water in the future on the island?

August Enzoe: The moon you are talking about what it does to the land, to the world the way the creator made it, it's no different there is nothing changed for me same as the sun. Now we are talking about the mine and that island and are there any small mice and ground squirrels around? Because I have been in there a lot of times and when I get there it's just like I am in jail. They don't let me out to walk around (laughing) they all know it so are there any small creatures like mice and ground squirrels? Yes okay, well that creature and rabbit they will do their part we know there will be wolves and caribou.

Mike Francis: Airstrip what is going to happen with that?

Colleen English: We have had some feedback from the panel on that in the past in that the preference is to leave it for an emergency airstrip. The thing that Diavik would need to look into with that, that we have talked about before too, is that it is a liability. So if that airstrip is left and it's not signed off as an uncontrolled airstrip

that's there 'just in case', its too much of a liability for Diavik. Because the reality is that airstrip is going to deteriorate over time, when Diavik's not maintaining it. So it wouldn't be that nice smooth perfect airstrip, and a plane could come in and try to land and then end up crashing because it is bumpy and it has had some permafrost heaving. If it were to be left intact, again coming back to the closure scenario and working with the governments, we would need to get that as an agreement from everyone. Everyone would need to sign it off that it is okay to be left as is and only as an emergency landing strip, including government.

Natasha Thorpe: The 3rd question we have is what features or types of landscape that would help to heal the water draining from the land? What I have heard from you in the past is that you often get drinking water from where a muskeg or wet land filters the water and you get it from the other side, because you know from your expertise that the wet land helps to clean the water so I am wondering if there is any features or types of landscape or plants that would help to clean or heal the water that drains from the land after closure?

Nancy Kadlun; I am worried about the pits, they are really, really big and if the water sits there for a long time and its going to be very contaminated to go back to the lake.

Natasha Thorpe: So how would you like to monitor that water, how would you know its ok? Bobby always says ease in your mind and ease in your heart, that water is healthy.

Nancy Kadlun: Maybe do samples again in about 30-40 years from after it sits there for a while because it's not going to be the same as soon as they close it. They might think it's clean but in about 40-50 years time that water is going to be very bad.

August Enzoe: You are talking about sampling water after its all closed. I know they are going to do it but after its closed they should take samples around the island that year, and a year later do it again to be on the safe side. Saying 30 years is too long for them.

Natasha Thorpe: Did you mean every year for 30 years?

Nancy Kadlun: I was saying if the water sits in that area for a long time it's going to be contaminated in the big pit and how would that get cleaned.

Natasha Thorpe: I think what I heard from Gord yesterday is that the contaminant is that the water is saltier the deeper you go. So Diavik's concern is that salty water that comes out of the deeper part of the ground would mix with the water in the pit.

But as I understand there is not a concern for a chemical contamination. Colleen did you want to speak, did I get that right? Yes.

Ed Jones: Water lies in various layers and salt water is heavy and it will sink to the bottom. I don't think we should be too concerned about salt. It's the ammonium nitrate that they use for blasting, but it is also a fertilizer so my only worry is that the ammonium nitrate is a fertilizer and you are maybe going to get a lot of algae and plants because of that but the salt itself, that type of salt I wouldn't be concerned about.

Natasha Thorpe: Thanks for clarifying that Ed.

Phoebe Rabesca: For the open pit, what if they just do a slow seepage and see what is coming out of there.

Colleen English: Phoebe, do you mean when you are filling the pits a slow seepage? Or what do you mean.

Phoebe Rabesca: No after both pits are filled doing slow seepage from it. Then monitor what is coming from it.

Colleen English: The question is how are you going to fill it? It is the reverse to how we emptied it. We will have a pipe from the lake to fill the pits. The ground water in the bottom of the pits will also be seeping in. So the idea is that you fill it quickly, so you reduce the amount of salt water and it stays at the bottom.

So when we talked about filling the pits, they will be full and sitting with that water mixture, so there will be the ground water in there and they will have probably that 5 year period to make sure that water is okay. When the breaches are put into the dyke the only thing it is doing is re-connecting the pit water. By then they will know it's good to connect with the lake, which is just more good water. So there wouldn't be a big change.

Phoebe Rabesca: I was listening to Nancy about not opening, you know, to leave it as it is. But then I thought about it that if we just leave it as it is, what if there is contamination in there that's what they are talking about. But if they just open it slowly. So for 5 years you will be monitoring it before they open it up, that's what you are saying?

Colleen English: Diavik is estimating at least 5 years. The way Diavik sees it is that if they can't connect the pits to the lake then Diavik has failed. If that water is not good enough to reconnect then they have failed.

Kathy Arden: I believe Gord said too, before they fill the pits they will wash the pits down first and then pump that water out and test it. And then over the period of 5 years they will be testing it.

Colleen English: Mostly correct. The pit wall washing has already been tested and have that in the presentation this afternoon. At this point, washing the walls doesn't make a significant change to the water quality so I don't think that they are planning on washing at the end.

August Enzoe: Are they going to fill up the pit before or after the mine closes?

Colleen English: It would be after. The reason we can't fill the pits with the rock or water is because there are people working under those pits.

Natasha Thorpe: We have smaller versions of these maps and I am wondering if you feel ready to break into smaller groups and talk about perhaps where monitoring could take place, how monitoring could take place. What sort of features Diavik might consider constructing or creating that would help protect water quality.

Working with the maps

Fred Sangris: We still got time until noon. What we are doing is trying to educate each other. The pit that we are talking about right now, those pits are dead pits, there is no life in that pit. I think what might help in the future would be to make those pits lively. The beavers on land they work very good and they make life. I think the pit needs some critters to bring life back to the pit. The little critters will bring life back to the pits. I think for this one here [A154] you just need to put something in there. Put some live things in there, bugs. Sometimes I take my caribou hide and put it in the lake and then a week later I go back and it's cleaned; the bugs cleaned the hide.

The beaver can do a lot of wonderful work, but you can't put the beaver there because there's no trees there. What you can do to drain and filter the water, you want to filter it using moss and such but there are different ways to make things live. And by the time it reaches the lake its filtered. And maybe that's how we do it; find those beaches and it will filter it and in a few years it will have a filter system of its own.

Natasha Thorpe: Fred I just changed the slide up there to show you that I think, from your TK and the science, that you are both agreeing. Remember how Gord said this was the preferred route [for water flow from the PKC]? My understanding is that

its because it allows for that longer route and that filtering through here [long drainage channel from PKC pond to LDG].

Kathy Arden: With regards to question 1 after the closure, maybe I missed something, is it referring to after those dikes are breached? Because I know that Diavik is going to monitor the water for 5 years within those dikes, so the question of what areas would you sample and why, is that after the breach?

Joanne Barnaby: Before and after.

Louie Zoe: Concerned about the water seepage and the water drainage from the rock pile and the drainage that goes through the ditches - somehow they should be monitored. Just one area that I am concerned about is if the dike is too deep and water might not move and so maybe contamination will develop in the future.

Joanne Barnaby: I believe that Louie was just stating his agreement with regards to continuous monitoring after the dikes have been breached and beyond the 5-7 year period?

Phoebe Rabesca: I think what Louie is trying to say is about once the pits are filled with the water. When a river is flowing, it is always replacing the water, but in the dike there will not be continuous change in the water. So he wants to know about that. There is going to be no river flowing through it, so no fresh water circulating in there.

Joanne Barnaby: The concern is that you are not going to create a continuous flow of water because the dikes will still be in the way. There were natural currents before the dikes were built and he is concerned we will not get those back.

Colleen English: The cuts in the dikes are where they are because Transport Canada regulates water ways and dictates where the cuts go because of line of sight. So if you came across this and you went into them you could see a way out from where you are.

Back to Louie's question, it will be different here then it use to be. This is going to be very sheltered and protected, there won't be as much wind and wave and current action as there was when this was a completely open lake.

Joanne Barnaby: Almost like creating a new bay.

Natasha Thorpe: The blue lines [on site map], why are they there?

Colleen English: The blue lines are where we have existing collections ponds or where we have broken off where natural flow has been in the past and we would be

reconnecting that natural flow after we are not trying to contain all of that water that comes off the mine site anymore. When I look at the SNP Program that Gord was talking about, and I look at some of these points, I think about things that the communities have said that I have heard over the years. You've said within the Panel that you want to know where water is going, you want to know what that water looks like. And I think that the SNP program that exists right now very much aligns with that concern. It's looking at all of those points where you can lose water off of the mine site into the natural environment and making sure that, that water is contained from a management perspective or sampled from a monitoring perspective. I think that's where you want to get to with closure is identifying those places of concern where water is going to come back into the environment and making sure that those are being watched.

And if there are ideas about how to help that water along the way, with moss or plants or whatever it is, then making sure that's incorporated into the design. So I think those are the two biggest things that you can probably contribute with this piece.

Joanne Barnaby: So the blue lines that are up there now, do they reflect where the natural flow was before the mine?

Colleen English: Yes, most if not all of them are natural drainage spots that were blocked for mining purposes.

Joanne Barnaby: Any other questions, concerns, ideas.

Phoebe Rabesca: She was talking about drainage and they are going to do it again. Does Diavik have anything in place about what is going to be done say in 20 years if contaminants are found?

Joanne Barnaby: Can you address what commitments would Diavik have 20 years after closure.

Colleen English: I talked a little bit yesterday about the process for closure, with governments and the mine and we talked about the security deposit, the bond. There are a lot of unknowns about that final tick in the box for the mine and what the governments will want and what we end up doing with security deposits and that sort of thing. So it would be a best guess, just my best guess, that it's likely the government is going to come back at the end - when we they are wrapping up and the mine is clean and they have given Diavik the okay to walk away - it's probably likely that they are still going to ask for a little pot of money that's available for things like that. And when I say little, it's probably still millions of

dollars. So that would be their back pocket protection in the case that something unexpected came up in the future. So that is a likely scenario, in my opinion, but we don't know that for sure. We don't know what that's going to look like in terms of that final agreement between all of the parties that are interested in this. It's something to keep on the radar, it's something to think about for the future and start having those conversations.

Joanne Barnaby: Any further questions, comments or recommendations? Do you want to spend some time on the maps to start identifying locations for either monitoring or action to ensure that some kind of natural filtering system is supported or developed?

Spend 15 minutes looking at the maps and writing on them, then come back and explain what you are proposing.

Lunch Break until 1PM

Joanne Barnaby: So what we would like to have everybody do is present their ideas that they came up with when they were reviewing their maps and any recommendations that you have.

Kathy Arden: So we came up with what areas would you sample and why. Lac du Sauvage entry and exit because of the j-pipe, and even though it's not Diaivk's responsibility to find out what happens there, there still could be contaminants coming through so we would like to see that one continue to be sampled.

Going on the other side of the lake, is the exit to Coppermine river as well all around the shore line of the [East] island to check for any new algae growth. Even though we can somewhat predict the drainage, there may still be drainage places that may change after they are done their reclamation work. Check all the breached drainage areas too. We would like to see this happen in May and June when the spring runoff happens, this will give a better indication of what is coming off the island.

Bobby had mentioned the North Inlet containment which has a lot of heavy metals in it and, even though Diavik would be cleaning that out and ensuring that the water is going to be cleaned before they breach that dam to have it flow back in with Lac de Gras, we would like it monitored for contaminants continuously to make sure the metals are cleaned up.

How wide and deep is the pit breaches going to be??

Colleen English: Each breach is going to be about 30 meters (90 feet) wide and the depth would be variable, ~10 meters [note: later corrected to 2-3 m below low water depth, as per ICRP]

Phoebe Rabesca: Diavik should provide a list of chemicals in the type 3 rock and in the slime so the TK Panel know what they are dealing with.

Diavik should provide bonds for future use for studying, monitoring and testing.

Diavik should reseed the land and use dirt and human waste so the land can grow faster. And they should provide a report of the water and the fish sampling every year after the mine closes to see what's going on and to see what's in it.

Janelle Nitsiza: Where the PKC is, so the bodies of the water around it, there should be lots of sampling in that area because we don't know what that slime is, you can't define the slimes to the Elders. So I agree with Phoebe that we need to know what these chemicals are and we need proper translations of chemicals so they [Elders] can understand.

Fred Sangris: What we did with the two open pits, we were talking about putting little insects in there and the red surrounding it is moss. So if the water flow is going back and forth, then anything bad will be caught in the moss.

PKC area there are two streams coming out and what we did is the red area is just for when the water starts to flow. We want to put a filtering system and/or moss; we talked about possibly two different systems, one industrial one and then the Traditional method of moss. Line them up along the stream that goes on to the lake and work hard at the lake so it is clean water at the lake.

Mary Louise Black: North Country Rock pile and the PKC should be monitored and sampled due to chemicals, all run offs from the mine should also be sampled.

Monitor and sample the north inlet containment and its run off continuously.

Continuing to use TK and scientists together.

Lucas Enzoe: The dust on the North Country rock pile, does it have any chemicals that can affect the air quality and lake?

Joanne Barnaby: We will return to the discussion around recommendations for monitoring and fish habitat or action that can be taken to rebuild fish habitat on the shoreline and with shoals later on today.

Right now we are going to hear from Diavik

Presentation – Open Pit Closure: Fish Habitat and Shoreline Construction (Appendix I)

*****This was not recorded. Sound system did not turn back on until DFO was talking.*****

Colleen English: Water depth in shoal area would be approximately 15 feet.

The plan is not to wash the pit walls because Lac de Gras water 'wins' in that the amount and quality of good water beats out the amount of chemical.

Fish use some reefs more why is that? Is it because it is shallower, closer to the bay, more moss or more plants? What is your experience?

What should the finished reef look like? How big should the boulders be? What is going to encourage the fish to use it most?

Should the first part of the roads [that currently go into the pits] get left for easy passage for animals in and out of the water? And the shoreline, what should it look like?

Questions?

Bobby Algona: This is concerning the breach. I am thinking you are going to be breaching the channels to the same levels as the original lake bottom?

Colleen English: The width is 30 meters. I think the depth is based on the bottom so it would vary. [note: later corrected to 2-3 m below low water depth, as per ICRP]

Bobby Algona: Because it's a pit that is very, very deep already. When you open that or breach it I think there will be more water going in and out because of the depth of the pit itself. There are some islands that have shoals and you can see the water going in some directions because of the shoals. Right in the middle of the lake its always moving, the water is always moving under the ice so the ice is thinner there. There is going to be movement there too. So it's something to think about too.

Colleen English: Are there any other questions or do we want to get DFO's information first?

Presentation - Artificial Reefs as Offsetting in the North (DFO, Julie Marentette) (Appendix J)

*****Recording started again*****

Fred Sangris: As fisherman when we are ready to set a net we know what to look for, we are looking for the right place where fish are going to be. We know where there are going to be spawning areas, we don't want to fish in spawning areas because the

fish have a different texture and taste different. The last picture where you see a lot of boulders and you said the current is strong, that's where I would set a net to catch a big fish, 6lb to 10 lb. The fish will go back and forth. They like that deep area and they go right through and they are not going to lay their eggs there. It's too cold and too deep. And the waves play a big role in it. They like to lay their eggs in a very sandy area, maybe not sandy but gravel, and it has to have a slope. The current can't be really strong but it has to be moving.

Where they built the dike, I was fishing there and the gravel was beautiful there and it looked like a beautiful area for spawning fish. So I threw a couple of hooks in and I caught some fish there and I noticed that the water was moving slowing. When the fish are born they like that shallow area with a little bit of gravel. They don't like the sand, and most areas in the east where there is a lot of fine sand you always find dead minnows floating around. They have no protection to hide from the waves so the waves just wash them up and that's why we find lots of minnows on those sandy beaches. After they are born they want to go into the shallow areas, so through the islands you will find lots of minnows. But they are not going to go in the pits.

I have a camp just outside the city here. Every spring I have graylings coming in, it's a small little bay and maybe from here to the stairs and 6-8 feet where the water comes in it's a little bay. And the graylings come in every June and they are only there for about a week. Shallow, big boulders and if there are other big fish that come around they can't get into the shallow areas where the minnows are. The current is the important part.

Joanne Barnaby: Are there other comments, observations, questions?

Bobby Algona: Fred was talking about the fish. I agree I find a lot of these fish beds when you are out fishing. There is another concern I want to talk about. Sometimes we come across a lake we don't know about the shoals and we don't know how thick the ice is because of the movement of the lake. And depending on how deep the shoal is from the top, it's going to be moving all the time from side to side whichever way the water is moving. Traveling in Lac de Gras I have come to know where all these shoals are in the winter and they can be really shallow and the ice can be really thin in those areas. I am wondering how deep are the artificial shoals going to be that Diavik is going to be putting in? I have come to know these in my travels and I agree these fish tend to come to the shoals, because of these shoals the water movement is more pronounced in these areas; you need the water movement for the spawning. But I have come across a lot of shoals especially around my lake on Pellet Lake where I grew up and lived all my

life and there are many, many shoals on this lake and I have to be really, really careful around those areas.

And living right next to the river, the river doesn't freeze at 40 below. The river does not freeze year round, depending on how the moon is moving, one way now and then a few hours later it's moving a different direction. I have come to know a lot of these types of water.

So I want to know about the shoals so I can be safe when coming back to this lake.

Gord Macdonald: That is a good thing for you to tell us: how deep they should be so you don't fall through? Just picking up with what you said about currents, and what Fred said, it fits with this story as to why there may not be eggs there. I wanted to bring you back to the reefs that we are talking about are on the inside of the dikes.

We are not setting this up to be a high current or spawning area, but to be more of a nursing or rearing habitat.

We need to look at what we are targeting.

Colleen English: Further to answer your question, like Gord said, some of the feedback we are looking for is what should those shoals look like, how big or how small should they be? This [referring to diagram] is what is in the closure plan right now:

Water will be 15-30 feet deep and the shoals will be 6-9 feet high.

The cuts in the dike will be 9 feet below the low water level. I was wrong earlier when I said they would be variable based on bottom depth, so my apologies for that.

Bobby Algona: When mining companies say they want it to look as pristine and as natural as it was before. Why do we want to do this? The mine wants to put everything back to as natural as it was before it started, why do we want to put these natural fish shoals there?

I am having a hard time with this because it's not as natural and pristine as it was before the mine started. Artificial reefs do bring fish alright but I am having a hard time agreeing to this because it's not as natural and pristine as it was before the mine started in the first place. That's what I am having a hard time with, thinking about it myself. The mines said they want to bring it back as natural as we can after the mine closure has been set in place.

Julie (DFO): When the Fisheries Act authorization was issued for this project, this type of rehabilitation project was built into that authorization to try and bring it back to a more natural state. So that's why we are talking about this now, is that it was built into the authorization that Diavik received about 20 years ago. There is also the pit that's still lost habitat, so we are trying to add a little bit more then what was permanently lost.

Natasha Thorpe: Bobby what is your concern about them creating shoals?

Bobby Algona: My concern is that, depending on how thick the ice is and how deep the shoal is going to be from the top, towards the end of the year I noticed some places as the ice starts to get thicker and closer to the bottom of the lake you see in those shoals the water currents being more pronounced. That was my big concern, for safety. Am I going to be safe coming to this place when there is a shoal there that I didn't know about, and it's keeping the ice thin.

Joanne Barnaby: Is there any plans to mark these areas somehow?

Colleen English: Not as of yet but the dike will still largely be there so that should be a bit of a marker.

Bobby Algona: I am thinking about some people that didn't come to this group and maybe there are going to be people traveling in this area. And they may travel into that dike. I think it's really something to think about that they didn't know that these shoals would be there.

Gord Macdonald: We should definitely design the shoals to be safe. So if the shoals should only be 3 meters under, then we need to know that.

Natasha Thorpe: So maybe there is an approximate water depth that should be above the shoal in order for your minds to be at ease for traveling?

Ed Jones: I think the answer is to build the shoals high enough to be viewed above the water level.

Natasha Thorpe: Its one option.

Gord Macdonald: So that is more like an island then a shoal, which is fine, it is just different. But then this could work.

Fred Sangris: I agree it might be good to create piles of sands almost similar to the way it was in the beginning and the water runs through it with a bit of current, in some areas its deep and in some areas its shallow. There are some areas that we avoid, we go out to the middle where it is deeper. And that way is better if it is underwater it will

freeze over, the ice will be really thick if you use sand and rocks it will be good because that's the way it was in the beginning and the fish will come back.

Outside the dike is where it will be perfect for bigger fish and other fish to swim along, but not good for spawning. It might be good to create some areas for fish to come up back and forth. Graylings love shallow water.

Natasha Thorpe: So what I am understanding, Colleen was saying right over here [shoal area inside dike], that's one area that Diavik is proposing to put those finger shoals. You are saying throw some sand or throw some gravel on these areas, but don't throw so much that those areas would become islands?

Fred Sangris: You need a little bit of sand and gravel so the eggs can float around.

Gord Macdonald: It sounds like we are kind of talking about the same thing. We would have these fingers of rock, but the fingers of rock are just to break up the sand beds that are in between. If you just piled the sand there with nothing to break it up, they would probably all just flatten out, so the idea was to separate them with fingers of rock. The key thing was making it shallow, something like 8 meters deep.

Fred Sangris: You should try all different levels. I will tell you how I found gold. Just north of Gordon Lake on the south side my dad asked me to go down to the get some water. I see all these yellow things so I ran back and told my dad I found gold and I brought him back to the water. But it wasn't gold, it was fish eggs.

Gord Macdonald: But other than islands, we were thinking everything else needed to be at least 6 feet or deeper so that the ice wouldn't freeze right to it, and for it to be more useful fish habitat in this lake.

Fred Sangris: I think that would help, having some deeper and some shallower. We are trying to get bigger fisher so we will go on the outside where it's deep.

Gord Macdonald: You might not want to go fishing in here, but the fish that you are catching on the outside may have come from inside, so they may have been raised there or go to feed there certain times a year. But that's not where you are going to go to catch them, you would stay out where there was more current.

Natasha Thorpe: Any questions for DFO??

August Enzoe: Look way out over there, it's a big lake. It [map] shows how big the lake is and its only part of it. You guys are working to put a reef in a little spot there for spawning. It doesn't make sense. Because with that big lake, all the fish will go back there, but there is a different spot for spawning. It's like a city for fish.

Julie (DFO): I like the idea of it being a city for fish. I think if at least some of the fish in the lake are happy there, that will make us happy too.

Fred Sangris: I know we are trying to create something and trying to bring something back. A good example is the Giant Mine and the Yellowknife Bay. There was a lot of underground blasting shock and it drove a lot of fish out into the lake. It's been over seventy years, but now they are returning. We have been monitoring the fish and we have been telling DFO they are coming back, but the only person that listened to us was a guy named [Paul] Vecsei. So we brought him out there and said there are exciting things happening, they are coming home. So now we are waiting for the conies to run the river now after many, many years. But the same example might happen here because there has been a lot of blasting here and dynamite, so the fish might avoid this area for a while, As soon as the area is silent they will start making their way back slowly.

There was a federal election not too long ago, is there any DFO legislation changed now that Harper is out?

Julie (DFO): I don't think there has been enough time or if there are going to be any changes. I don't know, we will have to wait and see.

Natasha Thorpe: How long might it take for the fish to come home?

Fred Sangris: I think it won't take long, just a short few years. There are no jet boats, I'm not there to bug them, so once it's quiet they will come back.

Natasha Thorpe: We have some youth here who have been out monitoring; do you have any questions or comments?

Gord Macdonald: Julie, one thing we never thought about when we were first doing this design was the amount of terrestrial vegetation that would grow in dike in the interim. It's just so visible now in these pictures, but now we are wondering what should we do with it before we flood it? I kind of think it's a good thing to have that much organics left there when you flood it, that it might make a decent substrate. But I don't know that we thought about flooding something that's vegetated versus trying to cut it out before. What do we do with it before we flood it? Do we just leave it?

Julie (DFO): That's a good question. I am definitely not a plant expert and it has not occurred to me. I haven't heard of any other files that have had to think about this issue so we will have to look into it.

Natasha Thorpe: I wonder if any of the TK holders have any ideas on that.

Fred Sangris: I am trying to help so I can fish there one day. Those two pits are dead pits. You can start putting vegetation on the side as the water is coming back. If you just fill it, it will stay dead for a long time but if you add the bugs and put little critters and plants, it will come back much faster. Bring the critters back. I was just showing Colleen about this one bug that the fish don't try to eat, those are the bugs that you want to bring in there with the plants and the mud and the sediment.

Break

Natasha Thorpe: Thank you for such a productive discussion on the shoals. This won't be the only time that the TK Panel will have a chance to discuss this.

We spent most of our time talking about reefs before the break and we still have the discussion around shore lines. Same three questions for the shoreline.

Gord can you clarify that we are talking about around East Island?

Colleen English: No not really. Most of the shore around East Island is actually intact so a lot of it, if you look [at the satellite image] you can see a lot of the areas of the mine don't extend right to the shore. So primarily we are talking about these areas in here [open pit access areas], because this will become a shoreline again, as well as over at A21.

Gord Macdonald: This is almost original shoreline. But this has a distinct shape because that is the edge of the pit. So is that okay if it's going to be a sheer rock wall? There are roads into each of the pits, is it okay to leave them?

Joanne Barnaby: So are we talking about the outside of the dikes, too?

Gord Macdonald: We aren't because, just like the discussions this morning, it's pretty useful habitat the way it is. It's a steep, rocky shoal.

Bobby Algona: Leaving the outside of the dike the way it is, is fine. Even the inside would be something to look at. We are going to be looking at it for a number of years and if something should come up that we are not happy with, we can bring it up then. I think just looking at it maybe we leave it for a year or so.

Joanne Barnaby: I think we need to keep in mind that Diavik is updating their closure plan this coming year and so deciding to wait and see what happens and then trying to introduce some action for perhaps changing the shoreline at a later point might be more difficult if we don't try to start planning for that now. So there are two very different scenarios. One pit is very steep with a big cliff, the other is not, it is more gradual. Is there any problem that anyone sees with either of these?

Fred Sangris: How steep is the wall?

Gord Macdonald: About 45 feet from the top to the bottom, but the water level would be part way along it. So let's say around 30 feet deep in the water and about 10 feet out of the water. It's not a huge cliff.

Joanne Barnaby: Thoughts, concerns, ideas?

Fred Sangris: I am not sure what the high ground is there. I am just wondering if the wall is too high for caribou or is it going to go to the water level? I ask because I see caribou falling onto the ice.

Gord Macdonald: If the water level was the floor the land would be the ceiling. So if a caribou walked off that into the water it wouldn't be able to get back up. It would have to go sideways until it found somewhere to get out.

August Enzoe: I was just looking at the wall and you are going to make a shore and we don't know how it looks so I was just wondering if a few of us goes down to look at it then we would have more ideas.

Joanne Barnaby: If we looked at it now, we wouldn't be seeing what it would look like after the water is brought back in. That's the problem with trying to see it now; you still have to picture that water there.

August Enzoe: When we get there the working guy would tell us where the water would be and then we would look at it and then look at the cliff.

Natasha Thorpe: It sounds like it's more of a caribou problem than fish habitat concern and I know that we have a session on caribou coming up.

Fred Sangris: August is right it's really hard to tell without being there. It is a concern for caribou but it is also a fish habitat too. If he says 45 feet then we need to know how far from the wall to the other edge. So if we were to advise that you fill it in with gravel or materials then we need to know how far it's going to go. So it's really difficult to say without looking at it. You could create a good fish habitat around the edge but you need to see because as the pit goes it's like stairs so you need to see what's there.

Gord Macdonald: We're asking about shoreline here but we are not talking about building any reefs or anything on these shores. That's mostly why we are putting it out in these bigger benches because we know we have that area to work with. Because you are right, these stairs are pretty narrow, really, going down into the pit. The whole distance of the cliff is about 1 km.

Fred Sangris: Sometimes when the migration is happening the lead caribou could lead. But sometimes they go on the run and at night time they are not going to see what's in front of them. I have seen caribou go over cliffs in the past chased by wolves. But anyways let's think about it.

Kathy Arden: How long would it take the fish to discover the opening in the dike?

Natasha Thorpe: Any ideas?

Louie Zoe: Yes I understand there is a drop about 10 feet which is dangerous for the caribou and the wolves and the foxes. So before the water is pumped back in there, I suggest maybe you put some sort of a slope. Or if you want to leave it as it is, I suggest you put some sort of skirting on it or fence of some sort.

Natasha Thorpe: A while ago I remember when Ekati mine had a fish diversion channel which was a cliff area that the community members were worried about, and they build *inuksuk* / *inuksuit* along the side. Is that what you mean?

Louie Zoe: Even though sometimes there's a wolf pack that chases the caribou around and we just want to make it easier for the animals to get on top of the land not so much steep down around. Once the animal falls over the cliff it's not going to come out again.

Natasha Thorpe: Colleen also mentioned the road that is presently the pit road that would be a gradual slope going into the pit. Does anyone have any thoughts on that in terms of shoreline?

Gord Macdonald: There is a ramp in both pits; it's just like a boat ramp in each pit.

August Enzoe: Which pit is that one?

Gord Macdonald: The small one. In the other one its more natural shoreline.

Natasha Thorpe: So the ramp would be a gradual ramp in. Should there be changes or can it stay as is?

August Enzoe: I don't mind the way it is, the ramp. I am just wondering about the cliff. I would like to walk there before they put water there.

Joanne Barnaby: Okay so leaving that road in might act as a ramp that would allow caribou to get out if they get into that pit.

Bobby Algona: We have talked a lot about the North Country Rock Pile and slopes there so that caribou have an easier access to it to get away from bugs. I think if we

were to look at it like that we all want them to have easier access to land. I think that at the cliff we should have a gradual slope where they might make it look like the NCR pile and they can get in or out. And if caribou did get in then we want them to be able to get out.

Gord Macdonald: What if you left pieces of it as a cliff but add pieces of gradual slope for the caribou?

Bobby Algona: Yes, that would work.

Joanne Barnaby: Any other comments? Are there other ideas for addressing the shoreline, for address fish and fish habitat?

Natasha Thorpe: What kind of shoreline are fish attracted to?

Bobby Algona: Fish tend to look for spots where oxygen is coming in to the water. I have come to know a lot of lakes along my travels and there are some places that there are fish but no oxygen. Fish can also hear and feel the ice chisel and they come there because they need the oxygen. There were some places where I have fished and you don't jig because when the oxygen starts going down that hole the fish come wanting the oxygen, and sometimes there are so many fish that you just put your hook in and pull it out and you have a fish, and if you keep doing it you will have a fish every time.

They need oxygen year round.

Joanne Barnaby: Other comments, other suggestions?

Nancy Kadlun: These pits are really huge and they are going to be filled to the top and this lake wow a lot of the water from the lake and then our river will be slow because these pits will take most of the water.

Joanne Barnaby: Does Diavik have an idea about what the difference in the lake depth would be once the pits are filled?

Gord Macdonald: I can't remember the numbers but it would be centimeters (cm) in difference in the lake; it is hard to measure exactly. You won't be able to see the difference and we would have a tough time measuring the difference. It looks like a lot of water going into those pits but the lake is very big.

It was looked at in the environmental assessment and it's continually asked. In particular it's asked about when we're filling up the pit if Ekati and the J project or any other pits will be filling at the same time. We have them all scheduled so it doesn't happen at the same time. The real worry would be if you were trying to

fill all the pits up at the same time, that's when you would have an effect on the lake level.

Joanne Barnaby: Do you have an idea on how long it would take to fill up one pit and would you be doing the two together or separately?

Gord Macdonald: The A154 and A418 are actually linked. They are joined underground, so if you start filling one you will fill up the other one. So both of those would be filled up at the same time, but A21 is separate and it would be filled up at a separate time. We are still talking about which ones to do first. There was originally a plan to do A21 first, it's a little smaller, learn from it, then apply it to the big pits. Lots of the decision is going to be about which one is available when.

With respect to how quickly or how slowly, it's a matter of how many pipes we want to put in. We want to fill it up quickly, and I mean in the order of 6 months to fill it up, with the idea that the quicker we get the good Lac de Gras water in there, the better the quality of the water. We can be slower about it but it would not be as good of water quality in there. So it's just how many pipes and how big.

Kathy Arden: I would assume also that the water level would come back up because it is being fed from other places and the spring runoff. I don't think it's going to be affected that much, it'll just sort of come back on its own, right?

Gord Macdonald: That's exactly right. It will go down for that period of time but it will refresh by the spring.

Ed Jones: I don't think that you will see much of a drop because the water is coming in to the lake all the time.

Louie Zoe: So I think that the huge hole in the ground here, the depth of the area is too deep and I am concerned. So I would like to try one pit at a time, rather than two at a time, because we might sacrifice something else for what are we going to do for both pits. I know there are schedules that you have to do this in because there is a very short summer season.

Joanne Barnaby: Thank you. Any other comments, recommendations, suggestions, concerns?

Bobby Algona: My other concern is you take out all this rock from these pits and you look at the original bottom of the lake. With all that water going back in to the pits, how is it going to affect the big lake itself when you fill the pits after removing all that rock and piling it up on the hill. My biggest concern is how much water is going to be put in these pits because of how much ore has come out. And the

water is going to be used a lot for these pits with how far down the mine is. Including BHP [Ekati mine] and all the mines around the area itself because I live in Kugluktuk and our river is becoming really, really low and the water level is becoming really, really low and we have a brand new shoreline in Kugluktuk. All that water that goes to Kugluktuk is having an effect on the river itself. We are having to divert the channels around the river because of the water level in this river.

Joanne Barnaby: The calculations that Gord described about how much impact it would have on the water levels is that the difference would be in centimeters, very small.

Gord Macdonald: It would go down when you did it but then it would come back up. You wouldn't see any difference in Kugluktuk other than when we were filling. I challenge you to be able measure the difference when we are filling.

Joanne Barnaby: Questions, suggestions?

Dora Migwi: I listen to everything, everyone's comments that everyone shared. We are doing things for into the future. I would like to thank everyone one that is sitting here. The water that's going to be put down into the pit, I don't think there is going to be any difference. My father had said when the water goes down it won't come back up again. But once you guys put the water in that open pit and maybe in time you can keep putting water inside that pit and make it safe for wild animals again.

Phoebe Rabesca: Before they put water in the open pit, what if they measure the river first. Then, when they put the water in, re-measure it. Yeah, measure it before and after.

Joanne Barnaby: I know there is a general concern about water levels in the north going down so this would probably add to those overall concerns.

Ed Jones: The low water levels is right across the territories and its probably due to climate change, not to mining. Filling a small pit like that would not make much difference like he said. 10 cm is only 4 inches; we shouldn't be concerned about that.

Janelle Nitsiza: No offence to Ed but I think it is a big deal. 10 cm of water over the whole lake is a big deal.

Ed Jones: As I was saying that will be replaced, every lake has an inlet, Lac du Sauvage and Lac de Gras has water coming in from other lakes.

Gord Macdonald: Its not 10 cm, it's actually 1-2 cm. If that makes a difference to you.

Ed Jones: No, it doesn't, I just wanted to make a point.

Janelle Nitsiza: Okay well I want to make a point, too. Water across the world is very precious. I think it's more precious than the diamonds that we are digging up because are you going to drink diamonds when the world runs out of fresh water? I don't think so.

Ed Jones: Yes, I do, but there is nothing I can do at this point. Not many people listen to me, you are the only one.

Joanne Barnaby: I think that is an important message that we all need to hear. There is an issue with water levels across the north and across the world.

Natasha Thorpe: These are issues that are very close to our hearts so I am very grateful for the passion that I am feeling in the room right now. All of our voices are equal and we will carry that message into tomorrow as well.

I know you are all anxious to get out of here but Joanne has the job of trying to pull together everything that you have shared the last few days into some recommendations that you can then present to Diavik tomorrow.

Louie Zoe: Just a short speech that the water is going to go in to the open pit and it's not going to be in time that the water is going raise up to the top of the pit and its going to rain and snow and everything is going to go on. So in time there will be water back in the open pit.

Joanne Barnaby: And hopefully it comes back up to normal levels, but the idea of monitoring that and measuring that, as Phoebe suggested the pre-filling levels of Lac de Gras and then the measurements after the pits are filled, would be good to have.

Mike Francis: I just wonder if we put water back into the open pit, maybe half fill it for now maybe.

Gord Macdonald: Half first then half later? Why?

Mike Francis: Too much water going in at once.

Gord Macdonald: You are saying do it that way so that there is less of an effect on the water level?

Mike Francis: Yes.

Gord Macdonald: Yes, if that was a big enough concern from everyone then yes, it could be done like that.

Joanne Barnaby: There was also the concern about leaving it because the groundwater coming up would be saltier, so that if you only fill it half with water from Lac de Gras you might not get the pressure that you need to keep the salt water at the bottom.

Kathy Arden: Just to touch on what Phoebe was saying about measuring before and after, it would be kind of neat to know the 6 months or maybe the following spring to measure that again, just see if it went back up to normal.

Fred Sangris: Ed says only Janelle listens, I am listening, too. I'll listen to you. I think Lac de Gras is a huge lake and there is a large volume of water coming in from Lac du Sauvage and if you used the amount coming in then it wouldn't affect the lake at all. If you use too much water then it might have an effect on the spawning up river, so if you use the volume of what comes in.

Gord Macdonald: Limit the rate to equal the same rate that is coming through the narrows?

Fred Sangris: Yes.

Bobby Algona: My concern is the volume of water that we have right now. We know lakes are becoming very low now. Global warming has an effect on this, too. Are we going to have rain coming down in the future. Looking at it in the future we are not getting much rain right now that's what I have been really worried about. Are the natural levels going to come back to Lac de Gras due to climate change as well? And having that volume going back into the pit was my concern; taking that little bit along with global warming and not much precipitation over the last few years, that is my concern.

Gord Macdonald: It is interesting that everyone has commented on the low water levels but Lac de Gras water levels aren't low this year, or last year. They do go up and down but they've remained quite constant. But you definitely see it elsewhere in the NWT.

Joanne Barnaby: All right, are people getting near the end of their rope? One more question.

Fred Sangris: In order for us to make a good decision on the water for the pits, we should try to find out how much water is going into Lac de Gras. If we have a better idea of all the streams coming in, we will have a better idea on how it will affect it.

August Enzoe: When you started draining the water out of the pits, do you have a record of how much water was in there before you drained it?

Gord Macdonald: We do know how much water came out but that's not the same as how much is going back in, because now we also have the big hole. But we do have an estimate on how much water it will take to fill up, I just can't remember what the numbers are though.

August Enzoe: That lake is big. Like Fred was saying, its running from a big lake up there, too. Like the concern in Kugluktuk and the water is all going down to them, lets cross our fingers that the water goes back up again.

Natasha Thorpe: I am sensing that everyone is starting to fade here. As I started to say, Joanne and I will be working tonight to try to pull together, you must have 50 pages of notes now to pull together recommendations from those notes, from these post-its. And tomorrow morning we will go over them, make sure they are in your words and that we don't miss anything. I want to, in 5 minutes, quickly read through what I have jotted down. If there is something that comes up where you think, no you totally got it wrong, let me know. And if you think we've missed something big time, likewise let me know. Okay?

Yesterday we talked about monitoring fish health and lake water in the future and the key themes that I had recorded is that certainly for 2018 you want to continue at the current camp site for the AEMP TK program, recognize that funding and administration of it will be difficult in the future [after the mine closes], science and TK work together, 2 Elders and 2 youth, monitoring should be done by Aboriginal people, maybe by Watchers of the Land. Change that you support testing the water by drinking, but not making tea.

Fred Sangris: One thing that we can probably use is, we all come from different communities, maybe there is something we can bring back to the community to show them what we are doing and they can see the progress we have made. So our community people have an idea, you were involved, we are helping with the recommendations, this is how closure is going to work and this is how we are going to be monitoring. We need to show something to the community so they know the mines are not being abandoned and you are not walking away. So there is progress and there are people thinking about the future. And safe guards are there.

Natasha Thorpe: Thank you, good point. I know that Diavik is required to, but also recognizes the importance of going into the communities regularly and talking about closure planning. But this may be one other way.

We have another video from this summer, its 22 minutes.

We talked more about monitoring water quality on East Island. I have here that you want to continue monitoring; you know that nature has a way of filtering and cleaning itself, making longer channels so the land has time to heal the water. Stock the water with bugs because bugs tell you the water is healthy.

Reefs and shorelines: currents are really important for spawning success and there is general support for creating the reef habitats but not clear on how deep, due to human safety. Possibly come up higher, like an island. The moon? Oxygen is important and the vegetation that has already grown back should be left and how that will effect.

Caribou health and safety on the cliff, so that it is not a solid kilometer long.

Would like to visit the sewage site.

Visit the pits to see the shoreline and cliff.

Better sense of the height of the NCR Pile.

The responsibility to make sure that all is well or that your minds are at ease: I heard that you still see that as Diavik's responsibility but that you're wanting to help and that you see yourselves doing the monitoring today, tomorrow and long into the future.

Not only the water quality, but also the water quantity.

Kathy Arden: To touch on the moon part you didn't know, Bobby was talking about how the moon affects the currents in the water.

Ed Jones: I think you and Natasha both missed something and that's the islands, rather than shoals and reefs, so that you won't have to worry about safety.

Joanne Barnaby: We got it.

Joanne Barnaby: Yes, we can start at 9am tomorrow morning.

Appendix D

Diavik Diamond Mines TK Panel Session #8 – Water Monitoring & Fish Habitat

Friday December 4th, 2015

Dora Migwi: Opening prayer

Joanne Barnaby: As we said today we are going to focus on the recommendations for Diavik. We want to make sure they are clear and everyone is comfortable with them and in agreement with them.

Last night Natasha and I went through all of the notes on the wall and the notes that Janet has provided us and we came up with a presentation that we will walk through this morning with you. So the first part of the presentation sets out some of the main comments, some of the main concerns, some of your insights. As we go through those, we may decide that one of those, or more of those, need to become recommendations so keep that in the back of your mind. But let's walk through that, and then we will walk through the actual recommendations that we heard and see if there is anything missing in there. And we can go back up and move things around or change things as we need.

Natasha Thorpe: Just a reminder that we will have this morning to do this and then Diavik will be here this afternoon, assuming we are ready to present to them. Also EMAB, who as you know is the independent monitoring agency for Diavik, asked if they could come this afternoon so I wanted to confirm with everybody that, that's okay? They are just going to sit and observe. (Yes)

Presentation – Draft TK Panel Session 8 Recommendations to Diavik (Appendix K)

Observations and Comments FISH

Observations and Comments WATER

Observations and Comments AEMP TK study (Aquatic Effects Monitoring Program)

Natasha Thorpe: Nancy was just asking if she could get a copy of this to take home, if you would like copies of this to take home we will get them to you.

Observations and Comments REEFS or SHOALS

Observations and Comments SHORELINE

A418 - Cliffs are a concern for animals

A154 – Shoreline looks okay

Observations and Comments GENERAL

AEMP Recommendations

August Enzoe: Can you go back to the reefs or shoals, it says reefs can shift?

Joanne Barnaby: I believe that was a comment that Bobby said, that reefs can shift. Did you want to explain that to August, what you have seen in the past?

Bobby Algona: The reefs don't shift; it's the water currents around the reefs that shift.

Joanne Barnaby: Any other concerns, comments?

Mike Francis: Yeah about the fish. When we are on the water, you can hear the motor going up to about 400 feet under the water. And the fish would be the same, they can hear the motor. I don't know about winter, but when you are walking on top of snow and freeze they can hear you. And then they get up. It should be the same underwater.

Joanne Barnaby: Are you concerned about activity on top of the ice disturbing the fish?

Mike Francis: Yes, because after Christmas, they freeze the top of the ice and when you are walking on top of the ice they can hear you. Same with the ski doo, they can hear you.

Natasha Thorpe: I just had another comment to me that ice can shift or alter the shoreline.

Louie Zoe: The TK camp where we are doing water study and fish study and there are some dangers and there are some things happening in our land. And people fall through the ice and arctic divers or the RCMP bring in a dive team to find the body. And the ice is sometimes unsafe because of the current. So the mine site happens to be right on the island and all of the debris that comes off the island goes to the lake. And 24 hours a day on the ice, the vehicles create a lot of dust and the airplane landing and taking off. But, none the less, all the dust, the rest goes back to the land and the rest goes in the lake. I hope that next time we can do some fish study right around the island, not far away.

Joanne Barnaby: We have added dust as a concern that should be monitored on the land, in the water and the air.

Lucas Enzoe: If there in too much algae it lets you know there is not enough oxygen for the fish. If it's balanced its fine, but if there is too much it shows there is something wrong.

Joanne Barnaby: What about some minimal algae growth? Do we want to have someone assessing whether it's balanced?

Lucas Enzoe: Yeah, you can ask someone to check the algae growth annually to see if the growth is going up or down.

Joanne Barnaby: So once a year.

On Island recommendations

Natasha Thorpe: There are two different things we are talking about: one is the vegetation inside the dikes, between the dike and the pit wall, but Bobby was also talking about the outside of the dikes and fishing in that deep water. I think it would be good to give Diavik advice on what to do with the outside of the dikes. I am wondering if you want to be able to set nets in that deep water beside the dike.

How do people feel about the slopes and such on the outside of the dikes, do we leave it?

August Enzoe: Yes, it is good.

Nancy Kadlun: Do not disturb it because it was already disturbed before. Leave it alone now.

August Enzoe: I want to let you guys know a lot of us have never been around that pit. But I have been around there and I think it is just fine. Leave it alone.

Joanne Barnaby: So we are going to clarify this by making two different recommendations. One relates to leaving the outside of the dike the way it is. And then inside the dike leaving the natural vegetation that has grown there in place, and do not disturb it to encourage ongoing natural re-vegetation.

REEFS Recommendations

Natasha Thorpe: Are there specific reef depths you would like to suggest? And why? How deep should those reefs be?

August Enzoe; It's not the reef you are talking about inside of the dike. For me, if you are going to make a reef it doesn't make sense for me because it is just small. It's going to be really deep when you fill up that dike, you would have to make a really high reef. You don't need the reefs, look around the island at the reefs - what more do you want.

Joanne Barnaby: No we are not talking about putting the reefs in the pits.

August Enzoe: Where are you going to put it?

Joanne Barnaby: Around the edges outside of the pit, but inside of the dike.

Joanne Barnaby: When we put the breaches in the dike it will fill up automatically. Currently there is the vegetation and we are not going to touch that, but it will be covered with water once we fill the pits.

Natasha Thorpe: I really appreciate you asking that question August because this can be confusing. So DFO explained yesterday the reason to make these finger like reefs is to create habitat for fish. When the mine was built, they took away fish habitat so they are required to put fish habitat back to help heal the land. Right now the recommendation is to build those at different heights or depths below the surface of the water and I am wondering if you want to be even more specific around how deep or how high those reefs should be.

Bobby Algona: Yeah just looking at this picture it distracted me. I thought they were doing this on the main lake, not inside the dike. That was my concern. I thought they were doing similar things out on the lake.

Natasha Thorpe: Yesterday you raised a concern about safety but now that you know they are inside the pits are you still concerned about safety?

Bobby Algona: I feel a little differently now I get the real picture. There isn't going to be much movement. Putting these little reefs inside the pit might promote growth. I think in my mind if we could leave that whole bottom, that whole natural bottom that you have there as is and maybe just for reference, just to see. You don't have to put as many shoals in there. It doesn't have to be as drastic, maybe just one on each corner.

Colleen English: I understand your point. Unfortunately DFO requires us to make those reefs, we have to compensate for the habitat that was lost because of the construction of the mine. We have pushed back on some of DFO's requirements. We do have to do this. Its more just a matter of those areas that are green. Most of A154 especially is pretty done for the fish habitat. These pockets that you see that are natural, will stay natural. Some of those fingers will still be put there, but there were all those blue zones, that were on that drawing I showed you, that would stay natural. Also, most of this is the original bottom of the lake. Anywhere that is not, we have talked about adding in that till to connect those reefs so that you have the type of habitat that Fred was talking about with the small gravel that is better, less sand, less dirt. Unfortunately we cannot do nothing, but hopefully we can find a middle ground for what you guys are looking for and what we need to do from a DFO perspective.

Bobby Algona: Looking at it a little differently now from yesterday, I think not all have to be real shoals. It might need to be just a couple on either side and if you can make

little islands along the way. Putting an island in there promotes re-vegetating naturally. The island would be a collection point, for the wind is always blowing leaves and the ground vegetation no matter how far. The vegetation grows way into the middle of the lake right from the shoreline creating a middle ground or from the surrounding areas and the leaves and grasses blowing. I think putting in a little island is a good idea.

Colleen English: I have one question. When I look at it from a scientific view, the reefs are beneficial because they are long and provide a lot of habitat for a fairly small footprint. For an island you need a lot more material to build up an island, all for a smaller area for fish to use. One thing I think you need to think about, too, is that the whole dike structure is kind of like an island, and that's still going to be there. That is going to be like an island, above the water level and its going to run almost all the way around. So how much effort do we put into making islands inside here when we have this dike which, when the pits are flooded again, is kind of like an island.

Joanne Barnaby: Is there something we can do on top of the dike to view them like islands, to encourage the very things that Bobby was talking about?

Ed Jones: I am a bit confused, are you [Colleen] an independent advisor, or are you representing Diavik?

Colleen English: I don't work for Diavik, but I contract to Diavik. Gord pays me to be here to answer some of these questions.

Ed Jones: What's your role? A consultant you say, but sometimes you are advising and sometimes you sound like you are Diavik staff. That's where I am confused.

Colleen English: I use to be, but I am not Diavik staff anymore. I may say 'we' a lot because I worked for them for too long!

Ed Jones: But my question is who are you and what are doing? You are an advisor, yes or no?

Colleen English: I am a consultant but I wouldn't call myself an advisor.

Ed Jones: You confuse me because a lot of the times you sound like Diavik staff. I know you were with Diavik at one time.

Colleen English: I haven't been with Diavik for 3½ years. I know it can be confusing.

Kathy Arden: I think it's because you know so much about the mine and what their plan is for closure.

Colleen English: That is part of the reason I am here. I have that knowledge and I've been involved with it for 10 years when I was with the company. That's why Gord wanted to keep me involved with this Panel.

Kathy Arden: I wanted to speak on the island but I think Bobby is talking about raising it more so it's a little warmer for the minnows and such, not so much to make a big island.

Nancy Kadlun: I was just wondering what about the very bottom of the pit what is there?

Colleen English: Right at the bottom of the pit is the underground mining. They do what's called open sky mining so that bottom of the pit connects to the underground. That's where you get into all of those little tunnels. Then it's largely rocks but some tunnels.

August Enzoe: For the future, the Diavik company doesn't know what is going to happen. They are going to fill it up with water. They should leave it, testing it for a few years. They might not break it, or they might. So we got two options after they close the mine. If the water is good, everything is going the way it is.

Natasha Thorpe: One thing about the reefs being above water versus being below water, the higher you are going to build something the bigger the base has to be. So if you are building reefs above water you are going to be taking up more of the bottom with rocks. So would you say half of the reefs should be above water and half under or maybe just 1 in 10 should be above water?

Kathy Arden: The land around the pit is not exactly flat so when you are putting in the shoals or reefs I would say use the high points in the land to make a higher reef and use the low points to make the low ones. Use the layout of the land to plan the reefs.

Bobby Algona: I did see that for a bit, too, the dike itself as a collection point for the natural wind-blown material from the land itself. I do agree. I see it now. You don't really have to have an island now. I keep thinking about the main lake itself, putting an island there, and I keep getting distracted. If you have to put those shoals and reefs, it doesn't really matter how deep they are, as long as you can see the shoreline. If you put some reefs out in the natural lake sometimes you see them, and some you don't. Some of those natural reefs are out in a larger area. In a small area, like in the dike, there is not going to be much movement. The space in between the ice and the shoal itself has a lot of movement and it will be more pronounced versus how thick the ice gets in the winter time.

Joanne Barnaby: I just wanted to check my assumptions with Colleen. Right now what we see around the pit, am I correct in saying what we see around the pit is old lake bottom?

Colleen English: Yes, the only thing is they have added some rock in there to build up some of those base areas for reefs.

Joanne Barnaby: We are actually going to be covering natural old lake bottom with water.

Louie Zoe: Flooding the open pit with the amount of water has been taken out. The vegetation that has already grown back on the dry land and once the water is back to normal, up to lake level, they are going to kill all the vegetation that's on the dry land. I don't know if the dry plant will come back to life.

Joanne Barnaby: So perhaps the concern that we are going to be killing the new vegetation on the old lake bottom. Maybe there is something to consider moving some of the bottom on to the tops of the dikes.

Bobby Algona: Just another observation, seeing the dike right now its sort of a slow accumulation place for the snow. I am wondering when all that snow has accumulated on there, and looking at it right now, that dike is there it is going to be a collection place for snow. It's going to be much deeper in that pit and it will be insulation for the water inside the dike. If the snow starts to accumulate inside the dike, the ice won't be as thick as it is out on the main lake where the ice is going to be thicker. It doesn't really matter how deep the shoals are; when you have less or more snow in one area, you have more or less insulation so the ice will vary.

Natasha Thorpe: Am I hearing that it doesn't matter if some of them come above the water?

Bobby Algona: Yes, I think being inside that dike is going to be less movement, just like in small bays. It will be breached in some corners. There will still be a little movement, depending on how deep the dike is going to be breached.

You are creating a little river channel now, when you breach these dikes, a little channel in these dikes, it's something to look at as well.

Joanne Barnaby: So new currents are being created through the breaches.

Natasha Thorpe: So maybe over break think about inside of the dike. I am hearing you don't want any islands inside the dike.

Break

Ed Jones: I believe the area within the dike walls is too small in comparison to the lake to put shoals, reefs in there.

Kathy Arden: I wanted to speak to the existing vegetation that's around the pit. Those plants are meant to grow on the land, so when we flood that area those plants are definitely going to die. Now they are growing there because of the rich silt from the bottom of the lake but it is also going to help sustain and grow new water plants and food for the fish. So removing it now and putting it up on the dike or something to try and build plant life on the dike I think is not a good idea. We are destroying something that is already there that's meant to be in water. I think on the dike itself plant life will come back from, you know, the seedlings that will be flying around through the wind. I think we should just let the plants be and get flooded and use that as part of the re-growth for the fish.

Joanne Barnaby: Ed just to remember Diavik has no choice; they are required by the Government of Canada to build the reefs around the pits.

Ed Jones: Joanne when you say around the dike do you mean inside or outside.

Joanne Barnaby: Inside the dike, outside the pit.

Nancy Kadlun: I won't be concerned about putting the reefs in as long as it's not harmful for any living animal.

Natasha Thorpe: It sounds to me that maybe we should get rid of 21-ensure built reefs have a portion above and below water and 23-put sand and gravel on top of built reefs.

Mary Louise Black: No body wants to disturb the land that is there and that is already re-growing but then there is the area that isn't and maybe to build the reefs there.

Natasha Thorpe: So the idea is don't disturb new growth and build on something that is already disturbed.

Show of hands to cut 21 and 23-Yes.

Change 22

I have a general question about the area inside the dikes. Do people want to fish inside that area, long into the future? Should we building for that? Do you want to set nets in there sometime, or would you set them out side of the dike?

August Enzoe: For that place around there, once the mine is gone? We know how to set nets. We are working for the future.

Natasha Thorpe: Anybody else have a question?

Nancy Kadlun: We don't usually put fish nets in really deep parts so we don't have to worry about that.

Kathy Arden: I was, forgive me if I am wrong, but I thought we were building this as a spawning area for the fish so they can go out to the big lake later, where we would fish. Putting nets on the outside of the dike was a really good place for the bigger fish. You wouldn't want to eat fish that is spawning so I am sure that when the fish go there they will be able to find the exit so that we can catch them in the net.

Joanne Barnaby: Its one of the questions that we have, do we design this for spawning, do we design it for feeding, resting or rearing because each is a little different. Which should it be designed for?

Ed Jones: Joanne I think we will let the fish decide that.

Natasha Thorpe: There is feeding, spawning, rearing and resting so of these different types of habitat, the fisheries biologists would make slight changes depending on which of those 4 you wanted to build for. Is there any guidance you can give Diavik or the fisheries biologist based on what you want to see? I hear that we don't want to build to set nets inside the dike but how can we plan for feeding, spawning, rearing and resting?

August Enzoe: I have been working for government for many years and they want us. They are sitting in the office a lot of them and they have never been on the land. They might change their mind if they go on the land.

Colleen English: A good point August. I just want to add a little bit to what Natasha was saying about how we want to design the habitat. We also need to think about what is going to be there when we are saying that. So Bobby I think you and Fred were talking yesterday that big fish need the currents for spawning, they like to put eggs on the rocks with some current. So this area is going to be pretty closed, so we need to think about the limitations that exist because of the structure [dike] that will be there.

Bobby Algona: If we were going to think about re-vegetating and having a spawning area, I am thinking to myself again that these little breaches will create some movement because most part of that lake on both sides. If we are going to think about re-vegetating fish habitat to be moving, the lake itself will be moving either way. Maybe if we were to breach one of the areas a little bigger so we could get some more movement because of the sediments we need to come in from the lake.

Joanne Barnaby: Do we know if there was spawning around the island before the mine was build?

Colleen English: Not for certain. There were rocks and islands that were probably used, but we don't have a definitive answer.

Natasha Thorpe: The location and size of the breaches are non-negotiable right?

Colleen English: Location yes, size I don't know. I am waiting to hear back from Gord.

Joanne Barnaby: So let's go back to our recommendations and continue going through them, we may need to come back to these ideas after we have time to get more information or when we think about it more.

Colleen English: It looks like maybe you and fishers disagree. Yes they could be bigger but it would increase the currents, something that goes against the fisheries objectives.

Joanne Barnaby: So DFO wants this area on the inside of the dike to be designed for rearing fish, not for spawning fish. Are you okay with that?

August Enzoe: Yes, for now.

Kathy Arden: We don't know if they spawned in that area before anyway.

Nancy Kadlun: What he said earlier, we don't decide for the fish.

August Enzoe: The two pits that are open now on the north side, after they fill it up and they test it, they should break it at the top and the bottom only, to make a stream across the pit.

Joanne Barnaby: So Lucas and August have proposed where the breaches should be located and what they want to achieve with those locations is a stream running south and north through both pits.

Lucas Enzoe: I am proposing that if you fill up the two pit with water, then make a breach on the north side and south side of the pits, and put the breaches to use the natural currents already there. (i.e. north of the big pit A154, south of the small pit A418 and a connector in between the two pits.)

Mary Louise Black: Why don't you want breaches on the side?

Lucas Enzoe: No breaks along the side because it would disrupt the natural flow.

Joanne Barnaby: So that objective is to keep the current strong? So keeping the current strong by limiting the breaches along the side.

How do other people feel about the idea?

August Enzoe: We are talking for the future so it sounds good.

Joanne Barnaby: August and Lucas, is this something we want Diavik to consider as an option and ask them for feedback on what issues they see with it so we can consider it as an option?

Lucas Enzoe: Absolutely.

Joanne Barnaby: Alright so this will give us another option to consider.

August Enzoe: Is fisheries going to come back today? It would be good if they did.

Natasha Thorpe: It might be possible, we can certainly ask, you never know what their schedule is like.

If I were to add this in observations and comments: general that we have a proposed solution for consideration or research to breach the dikes at the north end of A154 between the two pits A154 and A418 and at the south end of A418 to support strong current running through. Why do we want a strong current running through the pits?

Lucas Enzoe: It will make like a river from the north to the south and the fish will sense the current. They will think it's the perfect place for spawning. It's like a tiny lake, and around the edges its shallow and you could make reefs so it could be like a fish habitat. And at the same time you can keep all of the outside vegetation that is growing.

Natasha Thorpe: So you are thinking that you would only flood the pits and not the surrounding vegetation?

Bobby Algona: We want so much to re-vegetate these dikes, we want natural growth to go back in there. Creating these currents inside these dikes would be something that the big lake itself has all of these natural sediments and we wants parts of that lake to be moving and all the sediments and anything that is coming off of the big lake. It would encourage the natural sediments from the lake to go into the pits. We want the growth to go back in there so I think in my mind these breaches are going to bring back the natural growth and sediments from the bottom of the lake. The natural windblown leaves branches is something to think about as well.

Natasha Thorpe: So Bobby I added encourage the natural sediments of the lake to come back into the pits. Is everybody okay with the way this is written or added? Would we like this as a proposed solution, or an option to consider?

Our artist has given us a diagram, is that what you were thinking August and Lucas?

Kathy Arden: So the red is the vegetation and blue is the water? So what happened to the Fisheries idea of rearing and resting, it's gone? So it's going to be a big deep hole of water? It will be like a big river, no spawning, no resting, no nothing?

Lucas Enzoe: It will be like a big river and it will be up to the fish if they want to spawn. Think about the part between the two pits as where the fish may spawn.

Joanne Barnaby: My question to Diavik given Fisheries requirements is this an option that you can actually consider?

Colleen English: This small area in between the pits is likely not enough so it will be a challenge from a fisheries perspective. And then there is also A21 we need to think about it in the same manner. Ask Gord to look at it later today.

SHORELINE Recommendations

August Enzoe: Is that shoreline only inside the pit or around the island? Just the shoreline inside the pits.

Natasha Thorpe: We are not talking about outside, we are talking about the shorelines of the pits. Then the ramps, we need some closure on that one.

Joanne Barnaby: We want a recommendation on keeping that road way, which acts as a ramp.

August Enzoe: The first pit is okay around the shoreline, the second one with the cliff down to the lake is the one we are worrying about now.

Natasha Thorpe: Does the TK Panel support the two recommendations? One on leaving the shoreline on the pit A154, the bigger pit? Yes.

Kathy Arden: On 27, break up the 1km cliff on pit A418 with slopes because its too long for caribou. Wasn't it that it was dangerous, not that it was too long?

Joanne Barnaby: Break up the 1km cliff with slopes (poses a danger for caribou)

Joanne Barnaby: Natasha has added number 28. Leave current roads leading into the pit so they would act as ramps that animals can climb out if need to. Are people okay with that?

Louie Zoe: Discussed a lot of issues for recommendations, things that we are discussing today and maybe next visit to the mine in spring. We need to take a look at some of the areas and maybe we don't try to re-vegetate and let it naturally go. The mine people, they hear the people from the TK and I hope they take our recommendations seriously.

Joanne Barnaby: We did have a recommendation that the TK Panel visit the areas again in the spring or summer so that we can see it again.

Mike Francis: How are they going to put the water in the hole?

Colleen English: With siphons and pumps into the pit.

Joanne Barnaby: They are using pumps because they want to get the water in there fast and test it over a period of time before they open it.

Mike Francis: If you use a channel, fish are going to fall in and then they starve, but the pump is good.

Colleen English: There are screens on the pumps so the fish don't get sucked in.

Joanne Barnaby: Diavik wants to monitor for 7 years, TK Panel wants longer. So #28 is looking at how to do that. See what the options are and explore funding options, using a portion of the bond if possible.

Re-seed land and use dirt and human waste to facilitate re-growth.

Natasha Thorpe: We had a written recommendation from yesterday that this take place and I would like to take a few moments to talk about this idea. I don't think that we got closure on the whole concept of using human waste on site. This showed up on one of the maps, one group did recommend this.

Bobby Algona: Re-seed land and use dirt and human waste to facilitate re-growth. How are we going to do that as the human waste has already been chemically stabilized? I wonder how many chemicals are being used to treat the waste?

Colleen English: I am not 100% sure of all the chemicals that are used to treat the waste but I know the purpose of the treatment is to make the end produce stable, safe. It is stored on site in the environment anyway. It will stay on site even if it's not used as a fertilizer. But I will get back to you on the chemicals they use.

Natasha Thorpe: If the waste doesn't get put back in areas where people have identified where they want vegetation to re-grow, where would it go?

Colleen English: There are two places where it is stored and it would just stay where it was and then some may be buried in the rock pile.

Natasha Thorpe: If you don't use the waste for areas of re-vegetation then would you have to truck fertilizer up from down south?

Nancy Kadlun: As long as it is un-harmful, make sure its checked and everything because its human waste, and we also have so much chemicals going into the same area.

Mary Louise Black: I think that all the waste should be used if it is treated, and if it's there they don't have to bring anything in and if it would promote growth I think that is a good thing.

Bobby Algona: In my mind we are not only getting the fallout from the mines we are also getting it from the trucking companies that are coming up and are bringing lots up with them. They bring a lot of mud and everything under the wheels and we are having a lot of things come up from these trucking companies and when it falls, it falls out on the road. What they are bringing up from the south as well and all the containers is coming up from the south and these crates and we're having to see all these bugs as well and replanting themselves out on the tundra that we don't know about. Down along the arctic coast we never had grasshoppers before, now we have thousands of them. It's because of the crates and ships that come up. Some of these freighters that are coming from all parts of the world we have long known that these cruise ships are bringing all kinds of bugs and sediments up to us.

Natasha Thorpe: Okay so do we have some final direction about using waste as fertilizer? Can I have a show of hands? Yes, all are good.

We forgot to ask this morning if there is a volunteer to present these recommendations to Gord this afternoon.

Joanne Barnaby: We still have more to review after lunch but we really do need to think about a presenter. Perhaps the 4 youth could team up and present the recommendations to Diavik? Yes, okay good.

Okay I guess we don't have any further recommendations.

Natasha Thorpe: Gord has preliminary results for the slimes. He wants to know if you want him to present preliminary information, or wait until next time and have a better

presentation with all the information and maybe one of the researchers to present and answer questions.

Bobby Algona: It is good if we could have it next time, but maybe give us a little bit to think about this time, too.

Natasha Thorpe: I am super excited of what you have pulled together so I just want to say that I am going to put on the video again over lunch because we have Chloe here. She was one of the youth from the AEMP TK camp this past summer.

Lunch Break

Presentation – Recommendations for Diavik

Janelle, Mary and Ethan as the youth of the Panel are presenting to Diavik

Observations and Comments: FISH

Observations and Comments: WATER

Observations and Comments: AEMP

Observations and Comments: REEFS OR SHOALS

Observations and Comments: SHORELINES

Observations and Comments: GENERAL

AEMP Recommendations

On Island Recommendations

Reefs Recommendations

Shoreline Recommendations

General Recommendations

Questions for Diavik

Questions addressed by Diavik

Joanne Barnaby: Thank you to the youth. John McCullum has arrived from EMAB.

Gord Macdonald: Thank you, youth, for your presentation. I don't know why they keep bullying you to make the presentation, you should push back sometimes, but you did very well, thank you.

On the pressure ridges, is it something we should be looking at? Is there an intent with that or is it just an observation?

Bobby Algona: It is an observation from something that has been around for many, many years and they are caused by the weather and as you know the weather has fluctuations all season long. Winter time you have long spells of really warm weather in the fall and this creates pressure ridges in the lakes, the warmer the winter the more pressure ridges you have. The colder weather may not bring any pressure ridges. The moon effect and the sun and the rotation has an effect on weather and this causes fluctuations on weather, and the warm spells and the cold spells and how this affects in our season. The long warm weather is what causes the pressure ridges and the spells is not thickening the ice, maybe a week or two weeks because the ice is not thickening.

Natasha Thorpe: Pressure ridges being important in terms of oxygen and open water and fish, and that being why fish were attracted to those areas.

Gord Macdonald: But I am not sure there is anything we could do to create one. It's an observation, and I agree, I just don't think there is anything we can do.

Nancy Kadlun: How many pressure ridges do you see in Lac de Gras?

Gord Macdonald: Bobby would probably know more, he has snowmobiled on that lake way more then me.

Bobby Algona: Like I said before, the longer warm weather in the winter time creates more pressure ridges on the lakes. The longer colder spell in the winter time will not create pressure ridges. In my mind to create something like a pressure ridge I think another recommendation that I am coming up with again is to make an example if we want something to look like a pressure ridge maybe make holes on the ice inside the dike where the ice is to make it look like a pressure ridge. Every time you make a hole in the ice fish are going to be looking for that oxygen.

Gord Macdonald: I think you could do that initially to try and attract fish in the area but you wouldn't want to go back every year to do it.

Natasha Thorpe: I think, Gord, all of these observations and comments are understandings that are grounded in TK and part of your challenge is to see and track how those ultimately flow into operations or planning.

Gord Macdonald: Yeah, I was just curious what that was.

I like the animals drinking from the pit as an indicator, that's a good one that we could build into that monitoring of the pit before we breach it.

This one [north-south stream across the pits] makes it sound like all of this would have to be at a lower elevation than the lake. The only way to stop it from flooding into the shores, you can't do that and have the water at the same elevation. I like the idea but I just don't know how. Physics isn't helping you in this one.

What I understand Lucas is that you are suggesting to only flood the pits and not flood the edges, and leave a hole here [north] and here [between A154 and A418] and here [south] so the water could flow through and gradually add sediments and natural materials into the lake. But the problem is that the edge here [pit] would be 30-40 feet lower than the lake. If you put a hole in here [dike] you are going to fill the area all the way up to the lake level. You couldn't do it as a breach. You could control it with pipes but then you wouldn't get the currents going through there.

Why can't you do the same thing but with flooding the vegetation?

August Enzoe: That's because we don't want the water to spoil the vegetation that is growing now.

Gord Macdonald: I see.

Mary Louise Black: Another thing we had in there was flooding the whole inside and having the breaches where you said. I think one of the things we spoke about was where the reefs would go, and they didn't want to ruin the natural vegetation because it was originally the bottom of the water; so just using where you had already developed the land and poured the rock for reefs.

Gord Macdonald: That's exactly what we were thinking. We don't want to put any reefs where there is already natural lake bottom and, in fact, now vegetation. So we wanted to put it in areas, like up here, where we have intentionally put rock. But I think it would be hard not to flood it all.

Ed Jones: Gordie what I want to suggest is this. Instead of opening the north or east side of the pit walls, pump the water in there to the level that you want and leave it there and don't open the walls at all.

Gord Macdonald: Yeah we could do that. And then introduce fish in there, or just leave it?

Ed Jones: Leave it. Until such time that it's been tested and is suitable for fish habitat.

Gord Macdonald: Yes, that is exactly what we are doing.

For the TK Camp, I understand why you want it to stay but it is really difficult legally to own a camp and allow anybody to use it. We could sell it, give it away, but it would be difficult for us to hold on to it and take all the legal responsibility that comes with it. But I understand the intent. And why destroy it if it is of use to someone.

I am interested in the why of number 7 of AEMP Recommendations. Why are you interested in sampling there [the Narrows]? We sample water from there so we understand what's coming from our competitor's property to protect our interests, but why would you guys be interested in monitoring those fish?

August Enzoe: That is for the future because when they start working up there we want to be able to test the fish. For the future.

Gord Macdonald: That's something we should be recommending to Dominion, not to Diavik?

Natasha Thorpe: In LDS or LDG?

August Enzoe: Both sides, and in the narrows, because that is where the fish are going to go through.

Gord Macdonald: In the narrows is a very unique fish habitat. It seems more of something to understand the effects from J [pipe] then to help understand the effects from closure or operations at Diavik. Not that it isn't a good idea, but we might not want to do it if it seems to have other reasons.

Number nine is exactly what Ed was saying but being very specific, we should seek the approval of the Panel before doing that. I think that is a nice recommendation.

I am glad you picked up on 10. We think that is the most important for water quality as well.

11 and I think 22 seem to be about building some sort of wetland treatment or natural treatment particularly for the PKC to try and naturally clean the water. I have never thought of mosses, it's a good one as well; moss is on our list of things to research. I think it is one we need to bring forward. I wish I knew what the industry filtering system was.

Kathy Arden: Leave it the way it is when you flood it. The land plants are going to die but water plants are going to grow.

Gord Macdonald: 24 seems to be the main question that we all have to get at. I think if we put our minds to it we could design a fish habitat for any one or all of those fish habitat types, maybe the bigger question is what habitat types do we want in there. We had excluded spawning because we wanted to replace habitat that is in short supply in LDG, which is rearing and feeding and resting.

I like 26, the importance of us walking that in the field before and after we've created that habitat to see what the bottom of the lake looks like.

29 is an interesting one that we need to look at, and if you could be clear on this recommendation. If we are using 2030, which is what we are saying right now for when we think we will be done monitoring, whether there should be some sort of trust fund for ongoing monitoring is what I understand you are saying.

30 is very appropriate. I am just trying to get money as we speak to do that. So we have had a large group of scientists working on those test piles and it's done with 3 different Universities and they are interested in continuing the program and instrumenting the main pile.

Joanne Barnaby: Can you give us an idea when you are looking at long term monitoring the NCRP for stability of the frozen state. What kind of time frame do you have in mind? For monitoring?

Gord Macdonald: Same as everything else, 2030. If things all go as planned it would be 2030. If not, it could be longer. It's hard because it depends what we see.

Joanne Barnaby: That gives us a framework.

Gord Macdonald: The scenarios we look at now are 100 years because it's hard enough for 100 years.

There is a key word in 33 I'm taking and that is 'safe', the key word for all. We want it to be safe as well and we will have to demonstrate to you why we think it is safe.

Thank you very much.

Joanne Barnaby: Any questions or comments from the Panel?

August Enzoe: Do you agree with most for now?

Gord Macdonald: I don't think I disagree with anything. I agree to most. There are some very solid recommendations in there and things that I have never even thought of, like introducing bugs are a good one. And hearing that you view that healthy

environment at a bug level is the same place where science goes, so that is very useful.

Joanne Barnaby: Further thoughts. Everybody is good.

Gord Macdonald: Questions for Diavik number 1 is a really hard one. It can't get to that point, we have to have monitoring and control systems in place way before Kugluktuk. That's why we are monitoring on the island right now. The first test is, is it acceptable in the water right next to LDG because once it gets there its too late. I don't think we can even think of that. We have to have monitoring and controls in place at the island. It just can't get to there, because it's too late once it gets there. The most we could do once that happened would be to compensate, financially compensate Kugluktuk, which is not going to solve anything. It might help but it is not going to solve anything and it's certainly not where we want to go.

Bobby Algona: We have always had this ongoing thought in there that what if all the contaminants start to flow to Kugluktuk as well. We are not just looking at Diavik, we are looking at the other mines as well. Even though they are all related and are diamond mines, what if something else comes in. Where are we going to move Kugluktuk if ever this was going to happen, how would we present this to the community?

Gord Macdonald: Number 2 is what we have to do this year, making an inventory as to what is actually down there. Nothing really in the pits, it's the underground. So making an inventory of what is underground and what do we think has to come out and what do we think we can leave in there. That is what we think would be the start of the discussions with yourselves and with regulators; is our list okay so we can start planning. We won't be the first ones who have done it. Dominion has flooded an underground, they left stuff behind, don't know what it was but there is some precedent, Snap Lake might be doing the same inventory right now.

Number 3 we do know how many streams and rivers flow into LDG and about how much water comes with each of those but I can't tell you off the top of my head. I can certainly get the information for you.

Nancy Kadlun: I am concerned about the rock pile here but once everything settles what will happen then. The earth is very strong and can break man-made things no matter how good and thick. We are worried about this from spring and rain, it's still going to contaminate the areas.

Gord Macdonald: That long term settlement and moving is a valid concern and we share those concerns.

Natasha Thorpe: That's it in terms of questions for Diavik. Does anyone have any general comments, thoughts, concerns? Gord do you have any more questions.

Gord Macdonald: Thank you again for your time and effort.

Natasha Thorpe: I am going to walk through the changes, then we are going to go on to planning for 2016.

Kathy Arden: We had put in that one comment about testing fish in LDS and LDG. It might serve as a warning bell for the other diamond mine. I don't know what the communication is like between the two mines, but if they pulled a fish from there that was slightly contaminated with something they could say to Dominion, we have pulled this contaminated fish from the narrows and obviously the flow is coming from J-pipe. So I was thinking of that as more of an alarm bell.

Natasha Thorpe: I forgot this last suggested change in number 27. There was a suggestion to change the part in brackets so that it reads, break up the 1 km cliff on pit A418 with slopes to make it safe for caribou.

Presentation – TK Panel Process: Next Steps (Appendix L)

Colleen English: The next update for Diavik's closure plan is due at the end of 2016. That is going to include a number of the suggestions from the last few Panel sessions so we would like to have the time to include any changes that might come up in the August session.

Diavik prefers to have the summer session in August so they have time to change the closure plan if need be.

Natasha Thorpe: In April or May for the wildlife monitoring there would likely still be snow and ice so wouldn't it be harder to have a look at the shoreline and or the sewage treatment pile.

Colleen English: Yes, in April there would still be snow and ice but mid to end of May the snow would be melting. So if we did it mid to late May. The sewage piles, the one that is on top of the till pile is pretty exposed to wind so it doesn't get a tonne of snow on it and there is always fresh stuff being added.

Kathy Arden: We had mentioned earlier for water testing to happen in May and June when water runoff is at it's highest.

Colleen English: Around May long weekend is probably the best to see the water flowing and moving around the site. Freshet is usually the very start of June, end of May.

Kathy Arden: It's been very warm now so it's possible it may be early.

Colleen English: Yes, that is true. One of the reasons April was in there was because the northern migration can be happening then. But it is touch and go, and it's a really fast migration, as you well know, so it's really just the luck of the draw.

Bobby Algona: As an Elder out on the land for most of my life and my observations of caribou, the way the caribou migrate either way they are coming. North it's always the cows and calves that come first and the bulls always come later. It's always the same way going south. The cows are always making a trail for the bulls. Sometimes late March can be when the caribou come through. Working in Ekati late fall there was no caribou coming through those areas this year. The usual migration route comes through I am wondering if Diavik can keep the communities posted on when the caribou are coming through the mine.

Joanne Barnaby: Any other comments regarding timing of the sessions and the location of the sessions. Is there a preference for April, May or June. Do you prefer April, May or June?

Bobby Algona: I like the idea of what Kathy said, May or June, when the water is flowing at site. We are monitoring water a lot in our sessions so we want to look at the water. I am in agreement for that.

Joanne Barnaby: So you would want that session at site then.

August Enzoe: Plan a visit for after snow when everything is melting.

Mary Louise Black: I think this was for wildlife monitoring. I went to Ekati in June and there were lots of caribou, so I think June.

August Enzoe: Caribou is not like before, there would be a lot and in years coming now you probably won't see caribou there. In the spring time you are lucky if seeing them at Ekati.

Louie Zoe: I guess during the spring runoff is the time to go. Maybe early in spring as long as the eggs are hatching and the leaves are turning up and maybe the end of June when the leaves are coming out. The hunting season closes about that time.

Joanne Barnaby: We have had some consensus to look at June.

For the second session, August was suggested. Is that okay or not?

Natasha Thorpe: Also would you like it on site or in YK. So we will be there in May or June but the suggestion is to have the next one in Yellowknife, but we'd like your feedback. The discussion at that proposed session would be closure plan, the updates that they are working on now and reviewing that before it goes for licensing.

Joanne Barnaby: In terms of the stage of revision, I am wondering if delaying that August to the fall might give us a disadvantage affecting any change to the plan.

Colleen English: The August date was suggest because it gives Diavik enough time to have the report ready to share with you, but also take anything back that would come from the Panel and still incorporate that before we would be submitting it in December.

Natasha Thorpe: If we end up with the session in June, August might be a little close.

Bobby Algona: I am thinking about the youth. Some youth are going to school early August so we may want to think about that.

In Kugluktuk some kids start in early August.

Nancy Kadlun: Taking youth out of school for a week is not a problem. I have my son here who is in grade 10 and I talked to the principal. This makes them stronger, even one little trip like this can help the youth for a long, long time. They feel stronger and do more in school. You can still pull them out of school because these trips make them stronger and help them want to stay in school.

Natasha Thorpe: That's a good point Nancy. Some of it Colleen might depend on what's going on at the Diavik site as well, or as long as we are early we can book it.

Colleen English: Weekends, Travel Thursday and then come home on Monday. The best time is still weekends at the mine site.

Natasha Thorpe: Do you want to be at the mine in August/September or in YK?

August Enzoe: At site because you see the land. I look at it, if I see it with my eyes.

Natasha Thorpe: That's what we have heard all week, seeing with my own eyes. One last question. We talked a lot about how we could have ensured more youth come out to the camp, 1 youth from each group, and there was suppose to be an alternate in case they got sick or something. In the end we only had 3 youth come and I am thrilled we have 4 youth for this session. But planning into the future I am wondering if the Panel would be open to the idea that we always try to have 5 youth, or the designated number of youth. So if, for example, one group's youth

aren't available at the last minute, then the youth from another group could come. That we just keep moving down the list. It doesn't matter which group the youth are from, it's more important to have the youth here. I am putting it out to the Panel as a suggestion.

August Enzoe: It sounds good for the youth, they learn a lot from us to sitting with them in the meetings like this. You should think about the future of your youth. Depends on the money but we need to think of the youth.

Natasha Thorpe: To clarify, the youth right now are selected by your groups and for those that weren't here Monday and Tuesday when we talked about the Aquatic Effects Monitoring Program, there was a lot of discussion around the Elders getting involved with your schools, trying to encourage as much participation as possible.

Bobby Algona: I've touched a little bit on this earlier, sometimes the schools ask me to come and do a session at the school and as an Elder I certainly do. There are going to be more white folk coming to these parts so learn the language so you can be a part of it. I was pretty intimidated in the beginning. Everything my dad taught out on the land made it really easy for me to teach my children out on the land. If only I could get my health back I would be there. I am not going to go there with my health the way it is. So with the youth, having the youth around our Panel here is really nice to have.

Joanne Barnaby: I would encourage the youth that are here to tell your groups that sent you, tell them how you feel about being here, if you want to continue participation make sure that they hear that from you and they hear it from the Elders as well.

Colleen English: Just another logistical thing for when we hold meetings at the site, the youth have to be 18 years or older.

August Enzoe: I want the youth to say something about how they feel right now.

Lucas Enzoe: I feel that I have been enlightened by my grandpa and the western science and the importance. There are not a lot of people in the communities and some don't want to be involved. Our Elders won't be here long enough to keep this going. So I think it's important.

Mary Louise Black: I really enjoy doing all of this, I don't have a lot of knowledge or answers or info or anything like that and I don't say much, but I am observing and I am taking it all in. I like listening to Elders from all over. I am taking it in and I like this kind of stuff, it's where I plan to be hopefully, environmental monitoring.

Janelle Nitsiza: I am very grateful for the opportunity to be here. Learning about all this stuff is interesting and taking in culture everywhere and coming together is really amazing for me because we do have so many similarities and I think our duty as youth is to train to be an Elder one day. That is something that my grandmother engraved in me. One day you might be a grandma so what kind of stories are you going to give your grandchildren, are you going to give them bad stories or give them stories where you sat around the table and you learned from your Elders or learned stories. When I make decisions in life I normally have my grandmother on my shoulder saying are you doing the right thing or the bad thing.

I hang out with the young people and the Elders. Anytime I have gone to a meeting I have told the youth what I learned so that one day they can, too. We are Elders in training.

Ethan Kadlun: I feel pretty happy that I participated in this meeting because this is my first meeting. I have learned a lot even if I didn't talk much. I listened to the Elders talk a lot.

Joanne Barnaby: Before we break I just want to give you a chance to ask John McCullum any questions. Do you want to make a few comments John?

John McCullum: First thank you very much for letting me sitting in on your meeting. I have really enjoyed it so far and I can tell you our Board met just in the last few days. Part of the reason I am here is they are asking what is happening with the Panel. They really appreciate your work and the attempt that Diavik is making to hear what this TK Panel says and incorporate it in to closure. Our job is to be a watch dog and so the way the Board is looking at this is to see what kind of questions are you answering , are they the right questions, what do you think about what Diavik is doing with the information.

Great opportunity, great to meet you folks and to see your deliberations. Glad to be here. We are talking about maybe next time that you guys meet, trying to coordinate a Board meeting around the same time, so that maybe there is some overlap where our Board can actually come and talk with you, and you with them.

Joanne Barnaby: Question or comments for John, messages to their Board.

Nancy Kadlun: Thank you for what you said. We are always willing to go if we are invited because we learn a lot and we want to continue to have our air and water clean for our future. No matter if its 100 years, there will always be people here.

Joanne Barnaby: Thank you, Nancy. Anyone else.

Joanne Barnaby: People are ready for a break and then we will have a final round table for your final comments for today.

Break

Joanne Barnaby: We would like to give you the opportunity to share anything that you wish to and we have as usual your evaluation forms for you to fill out.

August Enzoe: What have we been doing since that time I was sitting on this Panel, the way it sounds like, is it is getting more input now in the last two years. We did all the information what should be done for when the mine closes. It sounds really good with how it will be done. What we are doing right now I hope the government will tell us we did a good job. We did a good job and getting the youth involved is really good.

Mary Louise Black: In the last three days I learned a lot, a lot of insight to what's happening, a lot of things I wasn't aware of. I think its good you are taking our recommendations and keeping us up to date.

Louie Zoe: The thing is its going to be very memorable in a way because a lot of the things we have done over the year. I didn't participate in activities there are some differences in the communities and I hope I will be able to participate in future activities. None the less we have a lot of Elders in the community and I hope to continue to participate but none the less I will encourage the Elders and the youth to participate.

Janelle Nitsiza: I learned a lot in the last 3 days. I remember in 2013 when we went to Diavik I think I made the recommendations to add the female Elders because there had to be a balance male and female, they both play such important rolls. I think that should go along with the youth, too. We can learn our rolls as men and women from the Elders. I really do see, I feel like Diavik could be a model for other diamond mines when it comes to closure because they are incorporating the TK and the science side.

Dora Migwi: Yes its quite a learning experience for me, too because it's quite a cross cultural experience. I do always listen to my Elders and respect them for that they are our main leaders. Today the youth are looking at us as leaders now and the possibility and we still carry the same notion of safety and preserving our land, despite losing Elders every year we are still here to help you. It's always good to have the majority of Elders, more ladies and more youth.

Appendix D

Diavik Diamond Mines TK Panel Session #8 – Water Monitoring & Fish Habitat

Mike Francis: Thank you for everything everybody, we had a good meeting. The baking it was good and we have people that come from a long ways, plane, truck everything. God bless you guys, thank you.

Ethan Kadlun: As I said before I am happy to be here, I am happy to a participant of this TK Panel, this is a great way of bringing Elders and youth together.

Nancy Kadlun: I am happy about being on the TK Panel, hearing Elders since I was young child they were always saying without the water one day the earth will burn because there will be no more water. There are so many people, some people, some day before there were scientists before we had TV and news there was no radio and they always said one day there will be no water left and we have to try and protect it any way we can. I am so happy I am part of these meetings, it's really helped me to come to these meetings.

Bobby Algona: The other day, when was it again, Janelle said it all for me and my people: water is really precious, not so much the diamonds, water is more precious then diamonds. No matter who it is, people are suffering all over the world because of water. I touched a little on this in the past, we cannot go without our water and our air; two most important ingredients, what we need the most. We cannot find another way to make our water so we have to keep it as clean as we can. Climate change is all around us. We can't get around whatever comes from that. We cannot only depend on land based animals we have to depend on water animals as well. For me my grandmothers stories were the most important, I traveled everywhere with my dad on his trap line.

I asked my dad many thousands of questions and my father never turned me away. Unlike some of the people I have heard before they said those things to me, you're important, you're my future, it made me appreciate how I interact with my family and be out on the land. Some of you might know I have an outpost camp on Pellet Lake which I grew up on for many years. I couldn't just leave it out there. I have been really blessed with the help of my Elders along the way.

I will use it in the future. I am going to be an Elder some day from my dad living out on the land really helped me to learn. I could never be doing this without him and their wonderful answers. I have come to learn a lot over the years through generation to generation. I have become an Elder and I try to do the things my father did for me and any questions my children pose to me I try to answer the best that I can.

Ed Jones: I am happy with most of the recommendations to Diavik. I have learned a lot this session and thank you for contributing their knowledge.

Kathy Arden: I have found it a real pleasure working with all of you the last few days and in listening to everyone speaking it awakened old memories of me being a child going out on the land with my parents, things I had forgotten about when you get involved in the modern world. So to be asked to come sit on this Panel with you and share our ideas and recommendations to close the mine that has scarred mother earth is a pleasure to work with you to help in that healing process. Thank you very much.

Joanne Barnaby: I wanted to tell you that it was a long week for some of you. It was a very long week and I really appreciate your commitment, your energy and insights. I am always amazed and this time in particular I was impressed the insights that you shared and the ideas that you brought forward and the honesty that you brought and your commitment to taking care of the land and your struggles to understand the mining process and the closure process and the science that we hear about and to come to terms with how you can bring your knowledge to this and make a positive change. Your patience and willingness to ask questions is fantastic. *Mahsi*.

Kathy Arden: I think on behalf of us we would like to thank our facilitators who have done a beautiful job getting us through this session. A big thank you to Joanne Barnaby, Natasha. I know you have worked late at night to put things together for us to review the next day and I am sure you are as tired as we are. Thank you John for coming.

Natasha Thorpe: I think Joanne said everything I was going to say. I want to echo my appreciation. Thank you for making the journey, the 3 and 5 days that you were here. The idea of this continuity and back and forth between youth and Elders and TK and science and as we continue in this TK Panel; we continue to respect one another, respect the land, the process and your passion and your stories are at the core of that. I think that the fact that we see such continuity in the faces around the table, honestly in an Indigenous setting as well as a non-Aboriginal setting, for this many years to have so many of the same faces is really, really exciting and it makes it much easier for this Panel to be effective because you've got the history.

I am also grateful that we have more women on the Panel now and I really hope that you are here and there is that continuity with you as well. I think we have a wonderful strong group. Likewise with the youth, you bring something to the table here that is really magical and a passion from the others.

Appendix D

Diavik Diamond Mines TK Panel Session #8 – Water Monitoring & Fish Habitat

Lucas Enzoe: My reflection for the last 3 days shows me how all these things are very important in all that we do. I am grateful that I took the time to participate and come to the TK Panel. I didn't think that I would enjoy it but I did and it feels good to be here.

Natasha Thorpe: It's hard to compete with all the things in your life.

Colleen English: I just want to say thank you to all who have been here all week. I really appreciate your patience and I was saying to Gord earlier today I feel like when I talk to this Panel, I feel like you know more about the site then some people that work there.

I think that the new additions are great. Thank you to everyone and I look forward to our next session.

Berna Martin: I would just like to thank every one of you until we meet in the New Year, thinking about your wellness, of your health and happiness and everyone have a good Christmas Holiday.

James Rabesca: I have been involved for many years and of course the Dene nation and the reason why they built it and as well as I did interpreter. I have been with them since day one so but now I am not involved in politics so I just interpret and I think I worked well and I enjoyed it. Thank you.

August Enzoe: Closing prayer

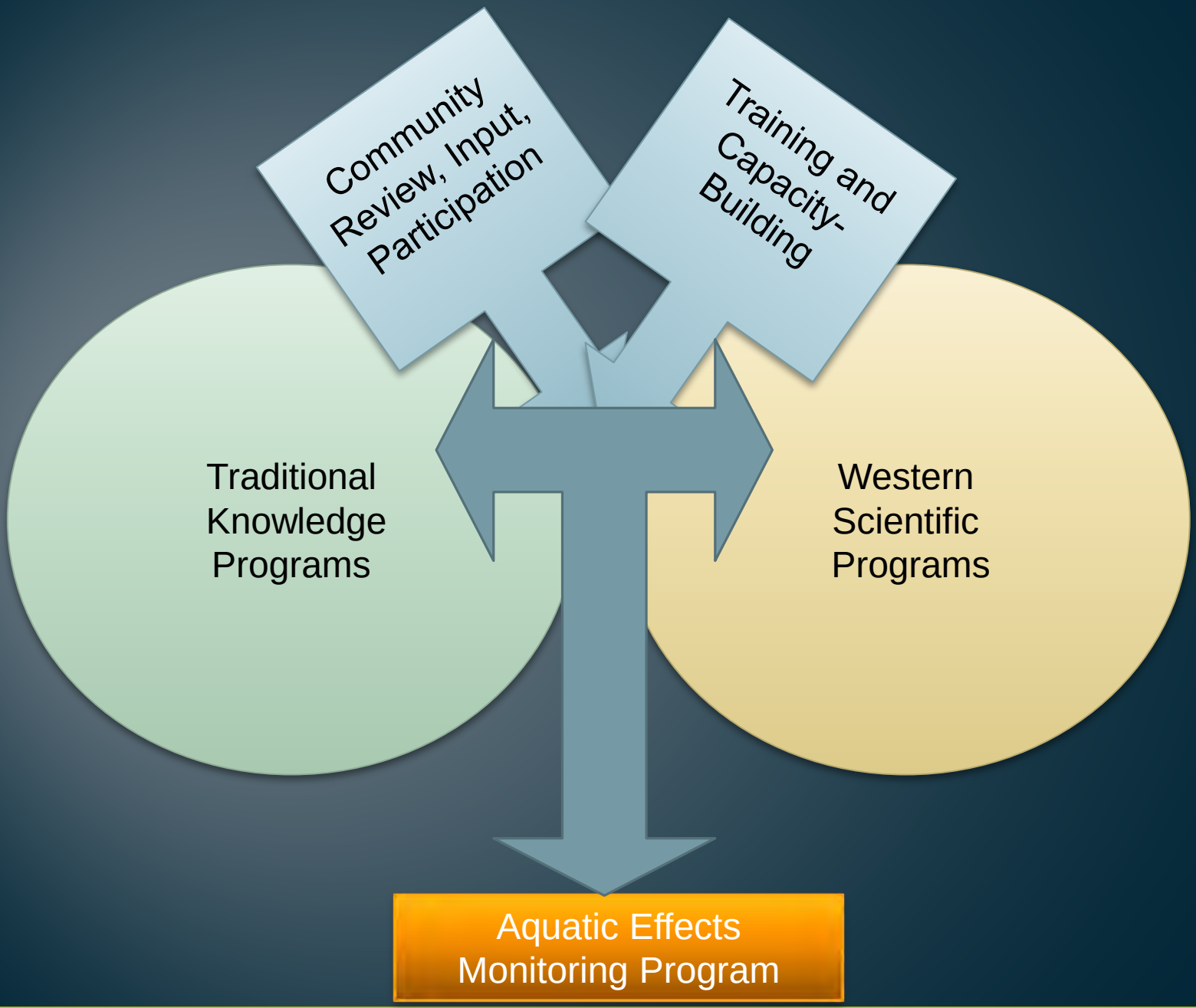
Appendix E

Post Camp Presentation

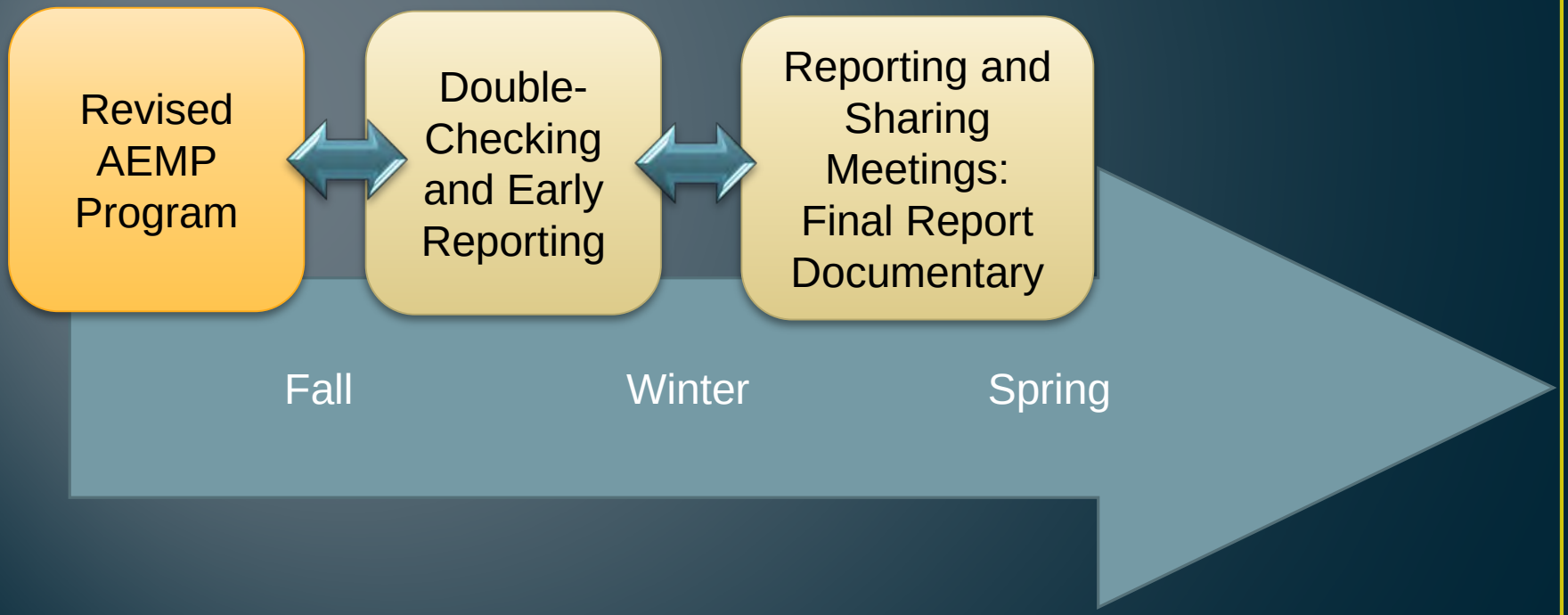
Diavik Diamond Mine
Aquatic Effects Monitoring Program: Report Update (2015)

November, 2015

Thorpe Consulting Services


Community Review, Input, Participation
Training and Capacity-Building
Traditional Knowledge Programs
Western Scientific Programs
Aquatic Effects Monitoring Program

Outcomes of 2015 AEMP



Report Over-view

Introduction

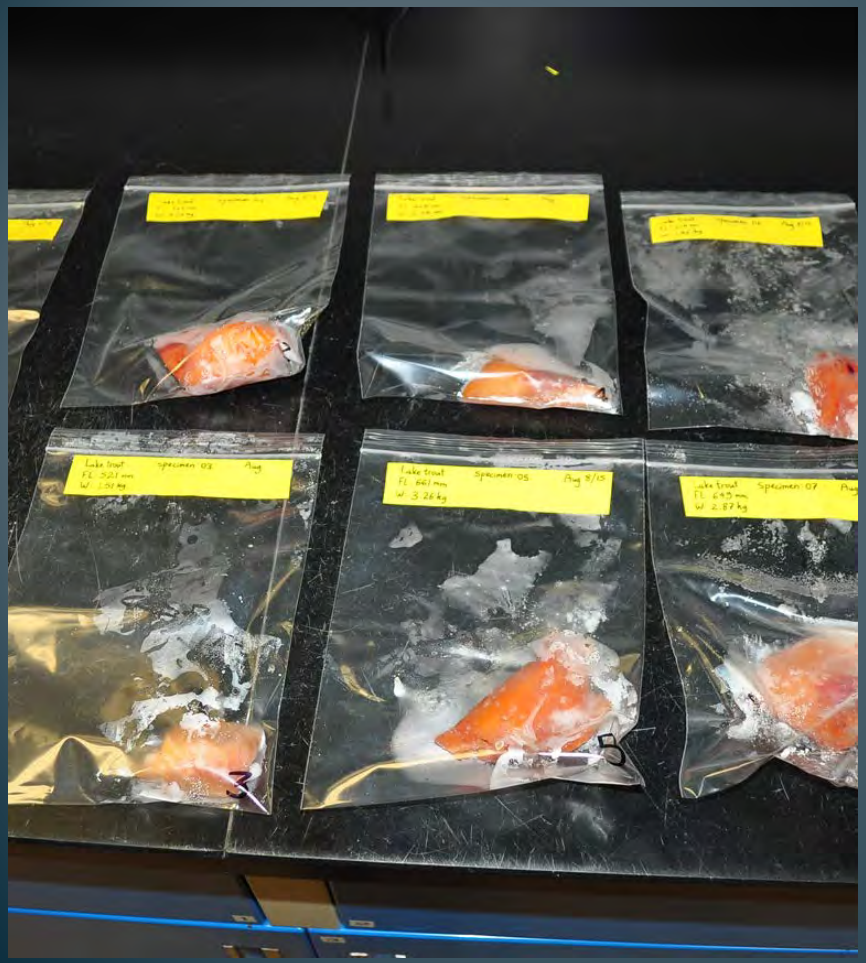
Approach and Methods

Observations, Learnings, Outcomes

Recommendations

Observations…

Fish


Lake trout Specimen: 03 Aug
Lake trout Specimen: 05 Aug 8/15
FL: 661 mm
W: 3.26kg
Lake trout Specimen: 07
FL: 643 mm
W: 2.87kg

Water

Fish Palatability Study Questions

- 1) this fish tastes excellent for eating and looks better than fish we usually catch;
- 2) this fish tastes good for eating and looks similar to fish we usually catch;
- 3) this fish tastes okay for eating but does not look as good as fish we usually catch;
- 4) this fish does not look good for eating and looks much worse than fish we usually catch; and
- 5) we would not eat this fish.

Recommendations from 2015

Appendix F

Closure Overview Presentation

Diavik Diamond Mines

Diavik Closure Planning Overview
TK/IQ Panel – December 2015

Closure Planning

Content

Closure Plan – How we got here

Water and Fish – the focus for TK Panel Session 8

1998 Pre-feasibility

Closure Goals

- Land and water that is physically and chemically stable and safe for people, wildlife and aquatic life
- Land and water that allows for traditional use
- Final landscape guided by Traditional Knowledge
- Final landscape guided by pre-development conditions
- Final landscape that is neutral to wildlife – being neither a significant attractant nor deterrent relative to pre-development conditions
- Maximize northern business opportunities during operations and closure
- Develop northern capacities during operations and closure for the benefit of the north, post-closure
- Final site conditions that do not require a continuous presence of mine staff

Overview of Closure Plan by Area

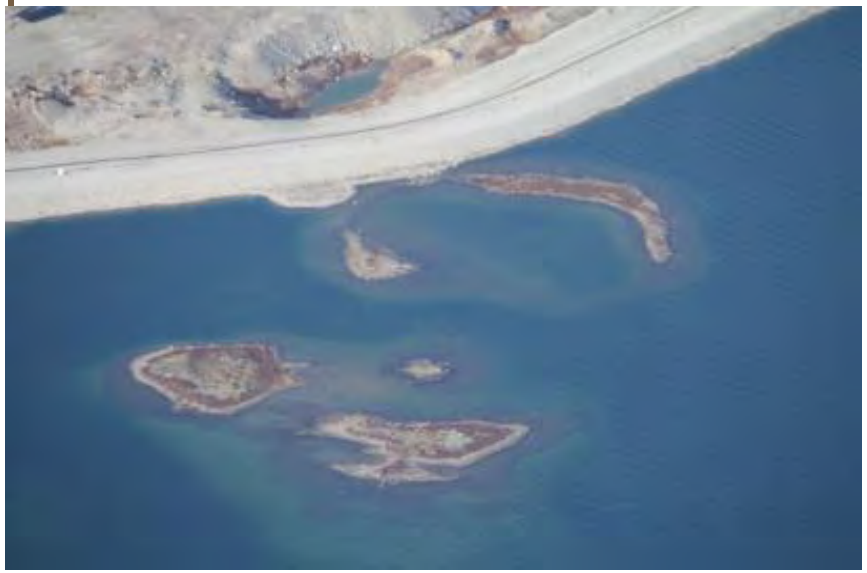
North Country Rock Pile

PKC

North Inlet

Infrastructure

Open Pits & Underground



Fish Habitat Design & Water Quality