Wek'èezhìi Land and Water Board

Box 32, Wekweètì, NT X0E 1W0
Tel: 867-713-2500 Fax: 867-713-2502

#1-4905 48th Street, Yellowknife, NT X1A 3S3
Tel: 867-765-4592 Fax: 867-765-4593
www.wlwb.ca

December 17, 2018 File: W2015L2-0001

Mr. Gord Macdonald
Diavik Diamond Mines (2012) Inc.
P.O. Box 2498, 300-5201, 50th Ave
Yellowknife, NT X1A 2P8

Dear Mr. Macdonald,

The Wek'èezhìi Land and Water Board (WLWB or the Board) met on December 7, 2018 to consider Diavik Diamond Mines (2012) Inc.'s (DDMI's) interim Closure and Reclamation Plan (CRP), Version 4.0. The Board did not approve the Plan and requires substantial revisions, for the reasons described in the attached Reasons for Decision. DDMI must submit Version 4.1 of the interim CRP by June 18, 2019. DDMI must submit a conformance table showing how all requirements for interim CRP Version 4.1 have been addressed.

The Board acknowledges that DDMI has accomplished several important closure planning tasks since approval of Version 3.2 of the interim CRP. However, the Board is concerned that DDMI's closure planning schedule may not be on track to complete all engagement and reclamation research (scientific and traditional knowledge) to support timely submission of a final CRP, which must include proposed final designs, closure criteria, and more. There are risks for all parties if the closure planning schedule falls behind. For example, if a final CRP is not approved by the time mining and milling ends, there could be costly delays in implementing the plan. Also, the Board could be in a situation where decisions need to be made with insufficient evidence to support the company's proposed plans. If work on closure criteria is not complete or is insufficiently robust, difficulties refunding the security deposit may arise. A final CRP that is incomplete or not well-founded in engagement and research may jeopardize future use of the site. These concerns apply to progressive reclamation as well, which also calls for research and engagement to support final or near final plans. With this in mind, the Board has required revisions to the interim CRP in order to gain more confidence that closure planning is on track (e.g., Revisions #7, 8, 13, 53, etc.). However, these requirements alone cannot achieve the necessary level of planning, which can only be accomplished if DDMI is dedicated to and fully resources closure planning.

For similar reasons, the Board strongly encourages DDMI to meet the June 18, 2019 deadline for interim CRP Version 4.1. Before submitting interim CRP Version 4, DDMI requested and was granted two deadline extensions and ultimately did not meet the March 31, 2017 deadline (see Section 2.0 of the Reasons for Decision for more detail). The Board has allowed a substantial amount of time (6 months) to prepare interim CRP Version 4.1. The Board places great importance on DDMI's closure plan and expects that DDMI will employ the necessary resources and expertise to meet the requirements within six months and that an extension request will not be needed. Should DDMI for some reason decide to request an extension, the Board expects a strong rationale, a detailed description of DDMI's closure planning activities since the interim CRP Version 4 was submitted, a list of the resources employed to address the Board's requirements for Version 4.1, and an updated engagement record.

For clarity, the Board expects that DDMI has continued its reclamation research, engagement, and closure planning while the Board has been reviewing Version 4 of the interim CRP and will continue to do so before and after submission of interim CRP Version 4.1. Likewise, DDMI should ensure closure planning for the PKC Facility is on track, despite the uncertainty related to whether the Board will approve underground disposal of processed kimberlite,[1] as discussed in more detail in section 3.2 of the Reasons for Decision.

The Board would also like to emphasize the need for DDMI to prioritize the development of closure criteria and employ the necessary resources and expertise in this regard. The Board attempted to guide DDMI previously on this matter, for example in its August 19, 2015 directive to submit a Closure Criteria Report.[2] In its decision, the Board emphasized that a lot of work on closure criteria remained, and that "it is critical that criteria be approved before closure, and for some criteria, possibly before progressive reclamation takes place." Despite this, much work remains on the closure criteria, as described in detail in section 3.6 of the Reasons for Decision. It is crucial that DDMI take the initiative to ensure all engagement, reclamation research, and analysis be completed such that DDMI can propose a robust and comprehensive set of closure criteria in the final CRP, or sooner for progressive reclamation work.

Finally, the Board would like to clarify that, although the Board has identified revisions that will improve site-specific risk-based closure criteria (SSRBCs), these revisions (see Appendix D for SSRBC Revisions #1 through 9) are not necessarily required at this stage. The Board identified these revisions to capitalize on the substantial resources dedicated by DDMI and reviewers on this topic. Before the Board further considers SSRBCs, DDMI must demonstrate that a comprehensive and appropriate list of chemical closure criteria is being proposed and that SSRBCC are being applied only where appropriate (as required in SSRBC Revisions #27-29). If after completing this exercise, DDMI wishes to advance some of the SSRBCs, DDMI must address SSRBC Revisions #1 through 9 to the extent that they apply. This issue is discussed in greater detail in the Reasons for Decision.

[1] This is in reference to the ongoing water licence amendment proceeding.

[2] See WLWB Online Registry for W2007L2-0003 - Diavik - ICRP - 2014 Progress Report - V 1.1 - Board Directive and Reasons for Decision - Aug 19_15.pdf

Should you have any questions, please contact Ryan Fequet, Executive Director at rfequet@wlwb.ca or 867-765-4589.
Sincerely,

Joe Mackenzie
Chair, Wek'èezhìi Land and Water Board

Copied: Diavik Distribution List

Box 32, Wekweètì, NT X0E 1W0
Tel: 867-713-2500 Fax: 867-713-2502

#1-4905 48th Street, Yellowknife, NT X1A 3S3
Tel: 867-765-4592 Fax: 867-765-4593
www.wlwb.ca

Reasons Decision

Reference/File Number:	W2015L2-0001 (Type "A" Water Licence)
Licensee:	Diavik Diamond Mines (2012) Inc. (DDMI)
Subject:	Interim Closure and Reclamation Plan (CRP) Version 4.0

Decision from the Wek'èezhìi Land and Water Board
Meeting of December 7, 2018

Table of Contents

1.0 Decision

At the Wek'èezhìi Land and Water Board's (WLWB or the Board) December 7, 2018 meeting, the Board met to consider the interim Closure and Reclamation Plan (CRP) Version 4[1] submitted by Diavik Diamond Mines (2012) Inc. (DDMI) on April 20, 2017 as required by its Water Licence (W2015L2-0001) under Part K, Condition 3 and Schedule 9, Condition 1.

The Board has made the following decisions:

A. The Board has not approved the interim CRP Version 4.0 and requires DDMI to re-submit the interim CRP as Version 4.1 within six months of informing DDMI of the Board's decision. The interim CRP Version 4.1 must incorporate Revisions #1 through 54 and the revisions in Appendix B.
B. DDMI is to engage on Engagement Requirements #1 through 8 and submit an engagement record that includes all of the elements in section 3.3. of the MVLWB Engagement Guidelines for Applicants and Holders of Water Licences and Land Use Permits in the interim CRP Version 4.1.
C. The Board advises DDMI that submitting research findings in an Annual CRP Progress Report is not, on its own, a means of obtaining reviewer input or Board approval on changes to a closure plan. DDMI must submit the research results, discuss how the results support DDMI's proposed closure activity, and provide a robust rationale in order for reviewers to provide input and the Board to consider approval.
D. DDMI is to incorporate or address SSRBCC Revisions #1 through 9, where applicable, when it submits Version 4.1 of the interim CRP.
E. DDMI is to submit an updated RECLAIM estimate with interim CRP Version 4.1 with Security Adjustments #1 through 15.
F. The Board advises DDMI that staggered submissions of final plans may be appropriate, and that proposed final designs must be submitted as part of a final CRP. The final CRP must demonstrate that research and engagement are complete and support the final design. DDMI should propose final criteria, and the final CRP should include the information identified in the Closure Planning Guidelines for a Final CRP.

2.0 Background

The Mackenzie Valley Land and Water Board (MVLWB) first approved the Diavik Mine interim CRP in 2001. DDMI submitted several versions of an updated interim CRP between 2006 and 2011, until the WLWB approved Version 3.2 on September 21, 2011.[2]

As required by Part K, Condition 3 of DDMI's Water Licence (W2015L2-0001), DDMI must submit a CRP upon the request of the Board (Part K, Condition 3 of the Licence and Schedule 9).

[1] See WLWB (www.wlwb.ca) Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Apr 20_17.pdf

[2] See WLWB Online Registry for W2007L2-0003 - Diavik - ICRP - Version 3.2 - Reasons for Decision - Nov 7_11.pdf

On August 15, 2015, the Board set the interim CRP Version 4.0 deadline at October 31, 2016.[3] The deadline for interim CRP Version 4.0 was adjusted several times:

- On August 15, 2016, DDMI requested an extension to December 31, 2016. The Board granted the request to allow DDMI to address issues that were raised with the CRP Progress Report.[4]
- On October 25, 2016, the Board informed DDMI that the deadline was extended to February 24, 2017 to allow time for a closure criteria workshop and for DDMI to prepare a RECLAIM estimate for interim CRP Version 4.0.[5]
- On January 18, 2017 DDMI requested that the deadline for interim CRP Version 4.0 be extended from February 24, 2017 until 45 days after the Board approves the Waste Rock Storage Area (WRSA) Final Closure Plan.[6] The Board extended the interim CRP Version 4.0 deadline to March 31, 2017, and stated that "Given that it has been a year and a half since the Board first set the original interim CRP Version 4.0 deadline, the Board expects DDMI has had sufficient time to produce a quality update to the ICRP."[7]
- On March 24, 2017, DDMI informed the Board that the company would not be able to meet this deadline.[8]

DDMI submitted Version 4.0 of the CRP on April 20, 2017. A conformity check was completed which identified missing components related to Schedule 9 requirements and revisions identified in Section 10 of the 2015 CRP Progress Report.[9] DDMI provided a response to the conformity check on May 17, 2017.[10] See Section 3.8 for more discussion on some outstanding issues from the conformity check.

Version 4.0 was distributed for public review on May 19, 2017. A technical workshop was held on November 20 and 21, 2017 to provide a forum where parties discussed their concerns and asked questions about Version 4.0.[11] Included on the agenda for the workshop was a list of outstanding public comments from the Board's consideration of Version 1.1 of Diavik's WRSA CRP.[12] Parties were requested to review their original comments in consideration of the proponent responses provided and discussions/clarifications that took place during the workshop. In addition, reviewers were asked to indicate which comments, if any, no longer apply. For those that still applied, reviewers were asked to update the comment and recommendation to reflect proponent responses and workshop discussions. To provide parties the opportunity to refine comments and recommendations following the workshop, the review comment deadline was extended to December 22, 2017.

---

[3] See WLWB Online Registry for W2007L2-0003 - Diavik - ICRP - 2014 Progress Report - V 1.1 - Board Directive and Reasons for Decision - Aug 19_15.pdf

[4] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Board Approval of DDMI's Request to Change Submission Date - Aug 30_16.pdf

[5] See WLWB Online Registry for Diavik - 2015 CRP Progress Report - Directive - Oct 25_16.pdf

[6] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - DDMI Request to Amend Submission Date - Jan 18_17.pdf

[7] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Submission Date - Board Directive - Feb 15_17.pdf

[8] See WLWB Online Registry for Diavik - DDMI Notification - CRP Version 4.0 Submission Delayed - Mar 24_17.pdf

[9] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Conformity Check - May 16_17.pdf

[10] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - DDMI Response Re Conformity Check - May 17_17.pdf

[11] See WLWB Online Registry for Diavik - CRP Version 4 - Technical Workshop Agenda - Nov 9_17.pdf

[12] See WLWB Online Registry for Diavik - Final Closure and Reclamation Plan - WRSA - Version 1.1 - Board Directive and RFD - Aug 23_17.pdf

The following reviewers submitted comments:

- Environment and Climate Change Canada (ECCC);
- The Environmental Monitoring Advisory Board (EMAB);
- The Government of Northwest Territories – Environment and Natural Resources (GNWT-ENR);
- North Slave Metis Alliance (NSMA); and
- WLWB staff.

The Department of Fisheries and Oceans (DFO) commented that they reviewed Version 4.0 in accordance with the department's mandate and had no recommendations. Proponent responses were submitted prior to the deadline on February 6, 2018. Reviewer comments and recommendations, as well as Proponent responses are available on the WLWB Online Registry.[13]

3.0 Reasons for Decision

- ***Decision A: The Board has not approved the interim CRP Version 4.0 and requires DDMI to re-submit the interim CRP as Version 4.1 within six months of informing DDMI of the Board's decision. The interim CRP Version 4.1 must incorporate Revisions #1 through 54 and the revisions in Appendix B***

The reasons for this decision are:

- DDMI has already committed to revising and re-submitting interim CRP Version 4.1;
- There are many outstanding issues that should be resolved before approving the interim CRP as discussed throughout the remainder of this document; and
- In addition to the revisions that DDMI agreed to, the Board has required many additional revisions. The reasons for these are explained below.

Revisions #1 through 54 are discussed in these Reasons for Decision and are listed in Appendix A.

In addition to the required revisions identified in the sections above, there are many revisions that are straightforward and are not discussed in these Reasons for Decision. These revisions are presented in Appendix B and captured in Decision A above. In general, the reason for the revisions in Appendix B are that the Board believes the reviewer provided a reasonable rationale and/or DDMI agreed to the revision.

As discussed through these Reasons for Decision, the Board has determined DDMI's closure planning requires further discussion, and that DDMI should engage on specific issues and attempt to build consensus.

- ***Decision B: DDMI is to engage on Engagement Requirements #1 through 8 and submit an engagement record that includes all of the elements in section 3.3. of the MVLWB Engagement Guidelines for Applicants and Holders of Water Licences and Land Use Permits in the interim CRP Version 4.1.***

Engagement Requirements #1 through 8 are described in these Reasons for Decision and are listed in Appendix C.

[13] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Review Summary and Attachments - Aug 13_18.pdf

This Reasons for Decision is organized by the following main themes that emerged during the review of the interim CRP:

- Waste Rock Storage Area (WRSA) Facility (section 3.1)
- Processed Kimberlite Containment (PKC) Facility (section 3.2)
- North Inlet (section 3.3)
- Buildings and infrastructure (section 3.4)
- Closure Objectives (section 3.5)
- Closure Criteria (section 3.6)
- Security (section 3.7)
- Remaining Issues (section 3.8)

3.1 Waste Rock Storage Area Closure Plan

The Board approved DDMI's WRSA Interim CRP Version 1.2 after DDMI submitted the interim CRP Version 4.0. The WRSA Interim CRP addressed the closure of the North WRSA. To prevent confusion, DDMI did not include the closure plans for the WRSA in interim CRP Version 4.0. DDMI proposed that the WRSA Interim CRP be integrated into interim CRP Version 5 once both plans have been approved.[14]

In the Reasons for Decision for WRSA CRP Version 1.1, the Board identified several issues in the WRSA CRP that required additional work, namely monitoring plans, contingencies, final landscape, vegetation, and closure criteria. The Board determined these issues could be addressed as part of the review of interim CRP Version 4.0. The security deposit was initially included in this list, however, in the approval of the WRSA CRP (Version 1.2), the Board adjusted the security deposit.

In their review of interim CRP Version 4.0, reviewers commented on some of these outstanding issues. Issues related to WRSA criteria are discussed in the criteria section (section 3.6). The following remaining issues related to the WRSA are discussed below:

1. Monitoring for physical stability
2. Closure plan for A154/418 Type I rock
3. Caribou safety
4. Raptor nest site enhancement
5. Revegetation

The Board has required revisions to the WRSA CRP to address these issues (below). As noted above, the WRSA CRP was not part of interim CRP Version 4.0 because the WRSA CRP was undergoing review, and has since been approved as an interim plan. To incorporate the required revisions, DDMI could either put the entire WRSA interim CRP into interim CRP Version 4.1, or add only the elements of the WRSA interim CRP that require revisions. The Board has selected the second option, because of the possible inefficiencies that could be created if reviewers commented on elements of the WRSA CRP that the Board recently approved.

- ***Revision #1: DDMI is to add only those aspects of the WRSA CRP into interim CRP Version 4.1 that require revision, and refer the reader to the approved WRSA Interim CRP Version 1.2 to read the main body of the plan.***

[14] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - DDMI Response Re Conformity Check - May 17_17; pg. 7.

WRSA Issue #1: Physical Stability Monitoring

The GNWT-ENR provided detailed geotechnical recommendations regarding physical stability monitoring for the WRSA (GNWT-ENR comment 11). The GNWT is concerned that DDMI plans to measure displacement of the WRSA cover at a resolution of 1 m, and recommends a resolution on the order of centimeters. The GNWT-ENR recommended that this resolution be used as one of the closure criteria for WRSA physical stability (see section 3.6 for more discussion numeric closure criteria for WRSA stability). DDMI responded that it will propose numeric criteria for physical stability in the interim CRP Version 4.1, but did not state whether the monitoring program would measure WRSA cover displacement at the resolution recommended by the GNWT-ENR.

- ***Revision #2: Add a description of a monitoring program that will demonstrate that closure criteria for physical stability have been met, and provide a rationale for DDMI's selected resolution in consideration of GNWT-ENR comment 11.***

WRSA Issue #2: Closure Plan for A154/418 Type I Rock

With the approval of the WRSA Interim CRP in February 2018, the Board identified that closure plans for the A154/A418 Type I rock in the WRSA are outstanding. The Board identified that there are concerning water quality issues with the A154/418 Type I rock. Although A154/418 and A21 Type I rock are both categorized as non-potentially acid generating (PAG), DDMI's extensive test pile research program revealed differences in the seepage quality from these two rock types. The research predicts that metal leaching from A154/418 Type I rock will be considerably higher than from A21 Type I rock. Concentrations of all parameters (with the exception of cadmium) are predicted to be lower for A21 rock than for A154/418 Type I rock. Concentrations from A154/A418 Type I rock are above Environmental Assessment (EA) predictions for most parameters, while only a small subset of parameters in A21 Type I rock are predicted to have concentrations above EA predictions.[15] Similarly, there are several more parameters predicted to exceed AEMP benchmarks in A154/418 Type I rock seepage compared to A21 Type I rock seepage.[16]

Because DDMI expected that A154/A418 Type I rock would not generate acidic drainage or metal leaching, DDMI used this rock around the site for Construction, as approved in their Waste Rock Management Plan. The closure plan for the Type I material is to leave it in place after mine closure; there are no plans to mitigate potential poor quality post-closure seepage from A154/418 Type I rock. Similarly, DDMI does not plan to cover the A154/418 Type I rock that was disposed in the WRSA.

During the public review of the Interim WRSA CRP Version 1.2, DDMI was asked to "discuss DDMI's views on whether the Type I (A154/418) rock should be covered (e.g., with till and A21 rock) to prevent poor quality seepage in the long-term."[17] DDMI responded as follows:

> If seepage/runoff from Type I A154/A418 waste rock was determined to be unacceptable for discharge to Lac de Gras then the most likely mitigation would be long-term active water treatment. Because all of the roads, airstrip, laydowns, dams, [dykes], etc. currently on the mine site have been constructed with Type I A154/A418 waste rock, long-term active water treatment would be a more practical/feasible alternative to the construction

[15] See WLWB Online Registry for Diavik - Closure and Reclamation Plan - WRSA - Version 1.2 - Appendices I to IX - Mar 1_18 - Refer to Table V1 of WRSA CRP Version 1.2, Appendix V; pg. 31

[16] Ibid

[17] WLWB comment 3 of the Review Summary for the WRSA CRP Version 1.2

> of a cover over all of the Type I waste rock on site. In fact, if long-term active water treatment is required for Type I waste rock, construction of cover over the Type III material likely would not be practical either because one purpose of the proposed cover is to avoid long-term active water treatment – one of DDMI's closure goals. This is a key decision point and why we believe it is important that closure water quality criteria be established now, so acceptable closure water quality for discharge to Lac de Gras can be defined.

The Board provided the following assessment of DDMI's response:

> It is premature to conclude that a water treatment plant is the only solution to this problem. For example, DDMI has not evaluated the potential for passive wetlands treatment or natural attenuation to reduce contaminant concentrations, nor has the company presented a thorough and transparent evaluation of closure options for this material. Further, it is not clear what the predicted seepage quality from A418/154 Type I rock used in construction is, once differences in thicknesses, as compared to the test piles, are accounted for. Potential refinements to criteria (e.g., the dilution factor) could also impact the Board's decisions on this issue. Also, it is not clear how the mixing of seepage from covered Type III and uncovered A418/154 Type I areas of the WRSA should be considered. Further, potential regulatory implications of selecting a water treatment plant as the preferred closure activity have not been explored. In summary, there is significant uncertainty regarding the implications of, and possible solutions to, A418/154 Type I rock seepage. On the other hand, there is solid evidence that an A21 cover on Type III rock in the WRSA will result in a significant improvement in long-term water quality, as discussed in Section 3.1.5. The issues with A418/154 Type I rock seepage quality can be further explored as part of ICRP Version 4 and/or future updates to the CRP.[18]

The Board noted that this aspect of the CRP would benefit from additional information and evaluation and required DDMI to "revise the WRSA CRP to note that closure plans for the Type I rock in the WRSA are outstanding."[19] DDMI included this statement in a revised WRSA CRP. In the interim CRP Version 4.0, DDMI maintains that no closure plan is needed for A154/418 Type I rock used in construction.

During the public review of interim CRP Version 4.0, DDMI was asked whether it had "considered closure options for Type I rock used around the site, to improve post-closure seepage" (WLWB staff comment 12). DDMI responded that "[t]he closure plans for these areas remain as described for roads and laydown areas within Section 5.2.8 of CRP V4." The section of the CRP DDMI refers to does not include any closure options to improve post-closure seepage or address the predicted poor quality seepage from A154/418 Type I rock. DDMI did not provide an explanation for their position. In addition, DDMI was asked whether it had plans to continue using A154/418 Type I rock (WLWB comment 3). DDMI explained that while the company has no plans to use this material for construction, it would consider using it when it was more practical than using A21 Type I rock.

Given the results from the test pile research, the Board has determined that DDMI's response is inadequate, and that DDMI should better defend its position that mitigations are not required for

[18] See WLWB Online Registry for Diavik - Closure and Reclamation Plan - WRSA - Directive and Reasons for Decision - Feb 9_18; pg. 13

[19] *Ibid*., pg. 7

A154/418 Type I seepage to prevent long-term post-closure water quality problems. DDMI could consider factors such as how the relative volume of seepage/runoff that may come from these areas compares to predicted volumes of seepage/runoff from other areas of the site (e.g., South WRSA, PKC Facility, covered areas of the North WRSA, etc.). Possible mitigations, for example, consolidation of A154/418 Type I rock followed by placement of cover made from A21 rock or other material or passive treatment, should also be discussed. Note that DDMI indicated in the interim CRP Version 4.1 that "passive wetland treatment in a northern climate is unlikely to be a significant mitigation for low quality seepage or outflow water and so has not been considered further." DDMI did not provide any evidence to support this statement. Given that other mines in the North plan to use constructed wetlands treatment systems,[20] DDMI may wish to obtain expert advice on the feasibility of passive treatment at the Diavik Mine site before eliminating this as an option.

- ***Revision #3: Include the following information related to A154/418 Type I rock disposed in the WRSA and used in construction on-site (laydown pads, roads, etc.):***
    - ***a. An assessment of the post-closure risk posed by poor quality seepage/runoff from A154/A418 Type I rock;***
    - ***b. An assessment of closure options for this material (regardless of DDMI's assessment in 3a), including consolidation of A154/418 Type I rock used in construction on-site followed by placement of cover made from A21 rock or other material, passive water treatment, and other any options identified by DDMI; and***
    - ***c. DDMI's preferred closure activity for A154/418 Type I rock, with rationale.***

WRSA Issue #3: Caribou Safety

EMAB expressed concerns about whether the surface of the WRSA will be safe for caribou, noting that quality control during construction is insufficient to prevent voids and spaces where caribou could injure their feet and legs. EMAB recommended that DDMI discuss in more detail the specifications and quality assurance programs that will ensure safe passage of caribou and other wildlife (EMAB comment 165), and that DDMI include placement of till on caribou ramps in the interim CRP (EMAB comment 27). DDMI responded that the TK panel recently inspected the WRSA slope and concluded it to be suitable for caribou. DDMI committed to continue working with the Panel and others on this issue. The Tlicho Government also commented on this issue in its comments on the WRSA CRP Version 1.1 (TG comment 1). In response, DDMI described its plans to involve elders and to work with the Traditional Knowledge (TK) Panel. DDMI stated that till placement is a contingency if post-closure monitoring indicates it is necessary.

- ***Revision #4: Add to the Traditional Knowledge and Community Participation Reclamation Research Plan a commitment to continue working with elders, the TK Panel, and communities to ensure the surface of the WRSA is safe for caribou and other wildlife, and add "till placement on caribous ramps" to the contingency section of the WRSA CRP.***

[20] See for example the Licence requirements regarding passive wetland treatment for Fortune Ltd.'s NICO Mine on the WLWB Online Registry: NICO Mine - Water Licence - Amendment and Security Adjustment - Jan 20_17.pdf.

WRSA Issue #4: Raptor Nest Site Enhancement

In the interim CRP Version 4.0, DDMI stated that: "Steep slopes and variable aspects could result from waste rock piles and, with the implementation of proven nest site enhancement techniques at these sites (e.g. ledge creation), raptor nest site potential could potentially be improved." The GNWT-ENR noted that the WRSA will have a 3-to-1 slope that is safe for wildlife, and questioned how this would provide nesting habitat (GNWT-ENR comment 13). The GNWT-ENR recommended that "DDMI clarify whether nest site enhancement techniques are still planned for various sites around the mine," particularly the WRSAs (GNWT-ENR comment 13). DDMI responded that the statement in interim CRP Version 4.0 regarding nest site enhancement is from the 1998 Environmental Assessment and that the enhancement techniques do not apply to the WRSAs.

The Comprehensive Study Report (CSR) from the environmental assessment notes that the Diavik Mine "would contribute to cumulative effects on raptor nesting habitat and could result in moderate magnitude and midterm cumulative effects on raptor populations".[21] The Report also states the following:

> Diavik predicted that the magnitude of effects would be reduced at post-closure due to removal of sensory disturbances and possible gains in habitat suitability due to reclamation. . . According to Diavik, the removal of sensory disturbance and restoration of nesting habitat suitability in the physically affected area at post-closure would more reasonably be expected to reverse the direction of effects to neutral, resulting in a post-closure assessment of no residual effects. Diavik stated that measures specified in the Environmental Management System will be implemented at closure, and project contributions to cumulative effects will be largely removed at that time. [22]

DDMI should clarify whether restoration of nesting habitat suitability (as identified in the CSR) will occur and if so where (e.g., WRSA) and explain any discrepancies between DDMI's plans and the CSR.

- ***Revision #5: Clarify whether restoration of nesting habitat suitability (as identified in the CSR) will occur and if so where (e.g., WRSA). If not, discuss whether this contradicts the statements in the CSR.***

WRSA Issue #5: Revegetation

In Version 4.0 of the interim CRP, DDMI stated that "the [North Country Rock Pile (NCRP)] WRSA is not to be actively re-vegetated but it is recognized that it will re-vegetate naturally in time".[23] For historical context, the closure concept during the environmental assessment was described in the CSR in a discussion regarding the WRSA:

> Subject to field experimentation during operations, the current plan for restoring soils and vegetation is to establish pioneer island communities of vegetation at closure. These islands would be created using the lake bottom till and vegetation/seed material taken from patches of undisturbed tundra within the mine area. The islands of vegetation could only be considered as a head start to the revegetation process. The remainder would occur naturally over time, as these islands of vegetation spread, although the rate of natural vegetation would be very slow.

[21] See WLWB Online Registry for N7L2-1645 - Diavik - Comprehensive Study Report - Jun 1999

[22] Ibid

[23] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Apr 20_17.pdf

However, the approved 2001 Abandonment and Restoration Plan stated that the WRSA would "remain barren and provide a different type of wildlife habitat." Similarly, interim CRP Version 3.2 stated that: "The waste rock area top surface would remain as a flattened surface and will not be a priority for re-vegetation efforts. This arrangement is expected to reduce snow accumulation and subsequent infiltration."

EMAB raised this issue during review of the WRSA CRP Version 1.1 (comment 62) to which DDMI responded: "[f]or the reasons described in the NCRP-WRSA Final Closure Plan, it is DDMI's intention to focus active re-vegetation efforts in the priority areas identified by the TK Panel".[24] In the Board's decision on the WRSA NCRP Version 1.1, the Board stated that outstanding issues such as re-vegetation can be addressed as part of the review of CRP Version 4.[25]

In its review of interim CRP Version 4.0, EMAB commented that "[t]he TK Panel, Tlicho Government, [Kitikmeot Inuit Association] KIA, [Lutsel K'e Dene First Nation] LKDFN, and [Yellowknives Dene First Nation] YKDFN feel that some re-vegetation should be planned for the WRSA" (EMAB comment 218). EMAB commented that statements made in the WRSA Closure Plan and in Version 4.0 of the interim CRP "seem to indicate that DDMI does not intend to achieve objective SW9 [Landscape features that match aesthetics and natural conditions of the surrounding natural area] with the NCRP closure design" (EMAB comments 72 and 203). EMAB recommended that "[a]ny revegetation proposal should be accompanied by a rationale that addresses the objective" (EMAB comment 203).

In response to a TK Panel recommendation for "some re-vegetation planned for the rock pile" DDMI states that "it is not practical to simulate the natural environment on the NCRP" but does not specifically provide rationale (Appendix IX-1.8 of Version 4).[26] DDMI states that "[t]he TK Panel and some communities recognize the diversity of landscapes in the Lac de Gras region and have likened the NCRP-WRSA to the concept of an esker, where vegetation is primarily present around the base and the top and sides are sand/rock" (DDMI response to EMAB comment 72).

EMAB also commented that "[r]evegetation of the WRSA would likely decrease infiltration, and subsequent runoff and potential impacts on water quality on East Island and in Lac De Gras, while helping to match the aesthetics of the surrounding area" (EMAB comment 169). DDMI response to EMAB's comment did not specifically address EMAB's assertion about infiltration.

The Board has determined that this issue requires further discussion, and that DDMI should engage on this issue and attempt to build consensus.

- ***Engagement Requirement #1: Engage on the issue of revegetation of the WRSA, with the aim of building consensus.***

- ***Revision #6: Include a discussion on the results of engagement on WRSA revegetation.***

[24] See WLWB Online Registry for Diavik - Final Closure and Reclamation Plan - WRSA - Version 1.1 - Review Summary and Attachments - Aug 2_17.pdf

[25] See WLWB Online Registry for Diavik - Final Closure and Reclamation Plan - WRSA - Version 1.1 - Board Directive and RFD - Aug 23_17.pdf

[26] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Appendices IX-1.8 to IX-4 - Apr 20_17.pdf

3.2 Processed Kimberlite Containment Facility Closure Plan

DDMI's plan for closing the PKC facility is to cover most of the tailings with non-PAG rock. The purpose of this rock cover is to prevent erosion of the processed kimberlite by wind and water, and to provide a stable surface for wildlife. DDMI plans to place rock during operations (i.e., progressive reclamation) over areas of processed kimberlite that are not semi-fluid. At closure, all of the semi-fluid processed kimberlite (i.e., slimes) will be in a low-lying central area of the PKC Facility, and a pond will cover the slimes. When the pond gets too high, a spillway would allow water to pass into a series of small ponds and streams that lead to Lac de Gras. Some seepage through the dams post-closure will also occur.

There will be a transition zone between uncovered processed kimberlite and the slimes covered by the pond. DDMI plans to allow freezing of this transition area, to the extent possible, following closure, so that rock can be placed on it. It is uncertain whether DDMI can place rock successfully over this transition area, because it is not known whether the semi-fluid processed kimberlite will consolidate and freeze enough to support the rock cover. Also, the length of time that it will take for semi-fluid processed kimberlite to freeze is unknown. Because of these and other uncertainties, DDMI has a contingency or backup plan:

> Removal of the semi-fluid FPK material is a contingency measure. The decision to remove the material will be made if construction of the waste rock cover into the closure pond area proves impractical, either during closure construction or during final constructability analysis. The ability of semi-fluid FPK transition area to freeze under the aforementioned conditions has been predicted by thermal modelling and will be confirmed through field tests.[27]

For DDMI to implement this contingency plan, the Board would need to approve underground processed kimberlite disposal (e.g. during the currently ongoing Water Licence amendment proceeding) or some other disposal location.

Reviewers raised several concerns with DDMI's PKC Facility closure plan, on the following topics:

1. Updated water quality predictions
2. Progressive reclamation
3. Missing reclamation research
4. Closure planning schedule
5. Other comments

In response to several of the comments on these issues, DDMI agreed to "consider how best to address expected PKC closure decision timelines, community engagement, closure criteria, completion of research plans and finalization of closure designs and we will make any necessary changes as part of the CRP V4.1 submission." While this is a positive response, DDMI was not very specific about what information it would provide. The Board has included direction below to clarify its expectations of what DDMI should submit in Version 4.1 to ensure that outstanding issues with the PKC Facility are addressed and closure planning stays on track.

[27] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Apr 20_17.pdf

PKC Facility Issue #1: Updated Water Quality Predictions

ECCC recommended that "modelling of water quality in the [PKC Facility] at closure be undertaken as soon as possible to ensure that the proposed closure concept is achievable and confirm that additional/ alternative mitigation measures will not be needed" (ECCC comment 7). ECCC stated that there is "a great level of uncertainty on whether this closure concept will be achievable in practice." ECCC also stated that "water quality modelling of the ponded water could inform whether investigations into other options need to be expedited."

DDMI responded that they will "provide an initial comparison of predicted PKC water quality to closure objectives, as well as a discussion of proposed key tasks and timelines for advancing the PKC options and modelling of PKC water quality" and indicated that the company "requires additional time to complete this task and will include the recommended discussion in the submission of CRP V4.1." It is not clear whether this discussion would include updated predictions.
EMAB also noted that the water quality prediction research task (and thermal and hydrologic modeling, which affect water chemistry) has not started, and is not scheduled to start in the next three years (EMAB comment 28). EMAB stated that this research is "critical to confirm the viability of the conceptual design". EMAB questioned how DDMI could plan to submit a final plan in 2020 without beginning research until the same year and noted that "There is extensive uncertainty that needs to be resolved before a final design is proposed". In its response, DDMI stated:

> the requirements to advance engineering designs for PKC closure activities is undefined at this time due to both the possibility of a change in the closure concept and ongoing design work related to long-term deposition planning and final dam raise designs.

Similarly, the GNWT-ENR recommended that DDMI update water quality predictions in 2018 and advised that the predictions "can then be refined with additional years of monitoring, and final closure configuration and design should it be different than what is currently approved" (GNWT-ENR comment 30). The GNWT-ENR commented that "DDMI continues to defer updates to water quality predictions, which are now scheduled for 2019" and that "there is a considerable amount of research results and monitoring already available". In response, DDMI stated that it would "continue with PKC geochemical work and provide updated water quality predictions in a future Annual CRP Progress Report".

The Board agrees with the GNWT-ENR, ECCC, and EMAB on this issue. In interim CRP Version 4.0, DDMI stated that one of the top risks for the PKC Facility is seepage and outlet water quality that is not adequate for release into Lac de Gras. DDMI stated that water quality predictions depend on the "closure configuration and design which have not yet been finalized and enhancement options are still under consideration. Once the closure configuration is defined geochemical performance can be better assessed and water quality predicted. Until then water quality will remain as a significant closure uncertainty." [28] In other words, DDMI's position is that once the company finalises the closure design, they can better assess water quality predictions. As noted above, reviewers recommended the reverse: that water quality predictions should be used to assist with confirming whether DDMI's preferred closure plan is the best option and is optimized with respect to long-term water quality.

[28] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Apr 20_17; pg. 123.

Research to date shows that water quality with a dry cover is likely worse than with a wet cover.[29] DDMI has not yet demonstrated that its preferred closure activity for the PKC Facility will result in acceptable post-closure water quality. Water quality predictions are also crucial for determining closure criteria (as discussed in section 3.6), which should ideally be finalized prior to commencement of progressive reclamation. The predictions may also be needed to prepare a more detailed design of the closure plan, for example, to determine the size of the pond, as recommended in EMAB comment 12. Work on predictions should not be delayed or DDMI may not be able to update the PKC Facility closure plan prior to beginning progressive reclamation of the facility.

- ***Revision #7: Update PKC Facility seepage and outlet predictions using all information that is currently available (including consideration of PKC interception well water monitoring results).***[30] ***To support these predictions, summarize the results of all research related to PKC water quality predictions and explain how the results were used to predict post-closure water quality. Compare the predictions to proposed closure criteria to provide context.***

- ***Revision #8: Clearly identify what tasks remain to refine water quality predictions, when each task will start, and when it will be completed.***

PKC Facility Issue #2: Progressive Reclamation

It is not clear in interim CRP Version 4.0 when progressive reclamation of the PKC Facility will start, as noted by EMAB (EMAB comment 13). DDMI responded that progressive reclamation would occur "as much as possible, but [is] challenging with ongoing PK deposition". DDMI was asked to clarify when progressive reclamation would begin (WLWB staff comment 19). DDMI did not provide the requested information, referring instead to the possibility of a change in the closure concept and ongoing design work related to long-term deposition planning and final dam raise designs.

DDMI's responses are inconsistent with the closure plan for the PKC Facility which states that the following would occur during operations:

> As portions of the FPK beach are completed to final grade, and the spigot (discharge) locations are advanced inwards, from the perimeter dams towards the center of the PKC Facility, the waste rock cover will be advanced. This is expected to be a straightforward operation, particularly if done in the winter months when the upper portion of the beach over which the rock is being placed is frozen.[31]

Despite this, progressive reclamation is not identified in the schedule for the PKC facility (Figure 5-15, section 5.2.6.4) or in the Progressive Reclamation section of the interim CRP (section 6.2.4).

- ***Revision #9: Identify the approximate timeline progressive reclamation of the PKC Facility will commence in, with rationale, and ensure this timeline is identified in a consistent manner throughout Version 4.1 of the interim CRP.***

---

[29] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Appendices X-5 to X-8 - Apr 20_17; pg. 1 - Appendix X-5.

[30] This was previously required by the Board, see WLWB Online Registry for Diavik - Water Management Plan V 14.1, Updates to Schedule 1, 6, and SNP - Directive and Reasons for Decision - Jun 13_18.pdf.

[31] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Appendices X-5 to X-8 - Apr 20_18; pg. 65.

PKC Facility Issue #3: Missing Reclamation Research

In the interim CRP Version 4.0, DDMI removed several of the PKC Facility research tasks that were in the interim CRP Version 3.2. Reviewers noted that DDMI's reclamation research plan for the PKC Facility does not include many key research tasks (GNWT-ENR comment 29, WLWB comments 19 to 21, EMAB comment 28 and 30).

As noted by the GNWT-ENR, the PKC Facility research objective and tasks in Version 4.0 address only geochemical performance. However, Section 5.2.6.6 of the interim CRP Version 4.0 identifies many uncertainties, including post-closure thermal conditions, water quality and quantity, shoreline stability, community preferences, long-term performance of a rock drain spillway, possible optimizations, and more. AMEC's PKC Facility Design (section 11.0 of Appendix X-5) includes a list of eight possible tasks that may be required to finalize the design (e.g., trials constructing the cover on fine processed kimberlite areas). DDMI did not commit to conducting these tasks. EMAB questioned how DDMI could finalize plans for the PKC Facility without adequate data to confirm the conceptual design (EMAB comment 28). The GNWT recommended that DDMI add these research areas to the reclamation research plan (GNWT-ENR comment 29).

DDMI responded to these comments by again noting that there may be a change in the closure concept and ongoing design work related to long-term deposition planning and final dam raise designs.

It is not clear what the "possibility of a change in the closure concept" is referring to (see below for more on this topic), or why ongoing design work would prevent DDMI from conducting research that will address uncertainties. Delaying research for the PKC Facility closure plan could jeopardize DDMI's ability to obtain Board approval of final designs prior to progressive reclamation. For clarity, DDMI does not require Board approval to begin research on its own initiative and should consider this approach in order to prevent delays with final approvals.

- ***Revision #10: Expand the PKC Facility reclamation research plan to address the uncertainties identified in section 5.2.6.6 of interim CRP Version 4.0, the trials and studies identified in section 11.0 of Appendix X-5, and outstanding issues identified in Table 1 (as necessary).***

PKC Facility Issue #4: Closure Planning Schedule

Collectively, the issues discussed above about updating predictions, progressive reclamation, and reclamation research point to an overarching concern with the closure planning schedule. DDMI has an approved closure plan for the PKC Facility, but appears to have put PKC closure planning and reclamation research on hold due to the possibility of underground PK deposition. Yet, the interim CRP Version 4.0 lists removal of slimes as a contingency option, and states that "[a] final decision on removal of the semi-fluid FPK material will be made with more information about the properties with respect to freezing and may not be made until closure construction when conditions can be verified".[32]

If DDMI obtains regulatory approval to deposit PK slimes underground, it is not clear whether removal of PK slimes would remain as a contingency or become the selected closure activity. This piece of information would assist the Board and reviewers in evaluating DDMI's closure planning schedule.

[32] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Appendices X-5 to X-8 - Apr 20_17; pg. 46.

- ***Revision #11: Clarify whether removal of PK slimes will remain as a contingency if DDMI obtains approval to place PK underground, or become the selected closure activity.***

Further, if DDMI waits to advance reclamation research and begin progressive reclamation until it receives regulatory approval for underground PK deposition and for a revised PKC Facility, there may not be enough time left to complete research and the window of opportunity for progressive reclamation may be shorter. Placement of the rock cover on stable areas of the PKC Facility appears to be possible whether the PK slimes are removed or not, and it is not clear why this activity should be delayed because the fate of the PK slimes is unknown. Similarly, research required for either option (dry or wet facility) may not be able to wait until the underground deposition decision is made. DDMI may need to advance reclamation research to support either option.

- ***Revision #12: Compare the PKC reclamation research required for a wet facility vs a dry facility, noting any overlap in research areas.***

DDMI should provide a schedule to demonstrate that closure planning for the PKC Facility will not fall behind and jeopardize timely reclamation research or progressive reclamation.

- ***Revision #13: Include a schedule of major PKC Facility closure planning and implementation milestones, including at a minimum (not necessarily in this order) timelines for the following:***
    - ***a) Completion of each reclamation research task in the expanded Reclamation Research Plan (see Revision #10);***
    - ***b) Engagement;***
    - ***c) Submission of an updated PKC Facility interim CRP (or final CRP) for Board approval prior to starting progressive reclamation;***
    - ***d) Submission of Final Design Reports for PKC Closure Cover;***
    - ***e) Submission of final closure criteria for PKC Facility;***
    - ***f) A determination on whether PK slimes will be removed from the PKC Facility;***
    - ***g) Start of Progressive Reclamation; and***
    - ***h) Other Construction milestones for the PKC closure cover and spillway construction.***

PKC Facility Issue #5: Other Comments

Reviewers raised several other issues that the Board has determined require additional revisions in interim CRP Version 4.1, as described in Table 1.

Table 1. Other PKC Facility Issues and Revisions for the interim CRP Version 4.1

Issue	Required Revision (in Interim CRP Version 4.1)
EMAB recommended that DDMI complete a risk/failure analysis on the proposed PKC design (EMAB comment 31). DDMI responded that this would not be completed until the engineering design phase, after the closure option is selected. However, EMAB's recommendation was that the risk analysis would inform the selection of the preferred closure activity. DDMI did not explain why a risk analysis wouldn't inform the selection process.	***Revision #14: Include a risk/failure analysis for the PKC closure plan or identify when this will be submitted such that it can verify the PKC selected closure activity, in which case the task should be added to the Reclamation Research Plan. Alternately, DDMI can provide a rationale for why this is not needed until the design phase.***

Issue	Required Revision (in Interim CRP Version 4.1)
EMAB noted that DDMI plans to use geotextile under the PKC Facility rock cover in areas covered by the pond, to prevent piping of processed kimberlite up through the rock cover (EMAB comment 14). EMAB recommended that DDMI address how the company will prevent piping of fine processed kimberlite in other areas of the rock cover. DDMI responded that "the current concept includes geotextile below the rock cover towards the pond". This answer does not adequately address EMAB's concern, since it is not clear to what extent geotextile will be used above the fine processed kimberlite.	***Revision #15: Identify where geotextile will be used under the rock cover. If geotextile will not be used over all fine processed kimberlite, provide a rationale.***
The GNWT expressed concerns about the risks to wildlife that may be posed by the PKC pond, post-closure (GNWT-ENR comment 27). The GNWT recommended DDMI provide additional information on pond characteristics (size, depth, etc.) and evaluate whether these characteristics could pose a significant risk to wildlife. DDMI indicated that this information will not be available until the PKC closure activity is finalized and engineering designs are advanced. However, this information is useful for confirming that DDMI's closure plan is sound.	***Revision #16: Provide additional information on pond characteristics (size, depth, etc.) and evaluate whether these characteristics could pose a significant risk to wildlife, or identify when DDMI will provide this information. Include in the PKC Facility Reclamation Research Plan if appropriate.***
The GNWT-ENR raised concerns with the effects of seepage from the PKC Facility on the performance of the WRSA Cover (GNWT-ENR comment 26). In response, DDMI agreed to provide additional information in the interim CRP Version 4.1.	***Revision #17: Provide a summary of results from the monitoring and inspection of PKC seepage to the WRSA, and discuss the concerns raised by the GNWT-ENR (comment 26).***
In response to the GNWT-ENR's questions regarding the pathway from the PKC Facility outlet to Lac de Gras (via the spillway), DDMI agreed that "once the location of an outlet for the PKC is finalized that the routing of water from the PKC to Lac de Gras should also be finalized" (GNWT-ENR comment 17). The GNWT-ENR also enquired about whether there is aquatic life along the path from the PKC Facility to Lac de Gras. DDMI did not explicitly answer this question.	***Revision #18: Identify that routing of water from the PKC to Lac de Gras is an outstanding issue and discuss how and when it will be resolved. Include in the Reclamation Research Plan if appropriate. Describe whether there is aquatic life in the path from the PKC Facility to Lac de Gras.***
EMAB recommended that DDMI assess the effects of pond size on water quality, since a drier facility is expected to result in worse water quality (EMAB comment 12). DDMI responded that "[i]f the conclusion is a wet-cover vs dry-cover then optimum size of wet-cover pond would be considered design phase." DDMI's response is inconsistent with DDMI's PKC Facility closure plan in interim CRP Version 4.1, which includes a permanent pond and a dry cover only as a contingency plan.	***Revision #19: Assess the effects of pond size on water quality or discuss how and when DDMI will perform this task. Include in the Reclamation Research Plan if appropriate.***

Issue	Required Revision (in Interim CRP Version 4.1)
Similarly, EMAB recommended that DDMI "revisit the water balance for [the PKC Facility] over the long term and assure the WLWB that indeed the PKC pond will be maintained and fine PK will not be exposed" (EMAB comment 29). DDMI did not commit to resolving this issue.	***Revision #20: In order to confirm that the PKC pond will be maintained in the long-term and fine PK will not be exposed, revisit the water balance for the PKC Facility or identify how and when DDMI will perform this task. Include in the Reclamation Research Plan if appropriate.***

3.3 North Inlet

Reviewers raised issues related to the reconnection of the North Inlet to Lac de Gras and the timing of the North Inlet sediment characterization study, as discussed below.

North Inlet Issue #1: Reconnection of the North Inlet to Lac de Gras

Whether or not the North Inlet can be reconnected to Lac de Gras after the mine closes has been outstanding since the environmental assessment. At that time the Responsible Authorities stated: "The fate of the North Inlet at closure has not yet been established. Diavik's closure options will depend on the quality and quantity of sediments in the inlet at that time."[33] As described in interim CRP Version 4.0, DDMI predicts water quality will be safe at closure, but sediment is toxic. This was also the case when the Board approved interim CRP Version 3.2.[34]

DDMI's preferred closure option in the interim CRP Version 4.0 is to create a rock barrier that allows water, but not fish, to pass between Lac de Gras and the North Inlet. This would not be a full reconnection because fish would not be able to enter the North Inlet. DDMI presented this as its preferred option in the 2001 and 2011 approved ICRPs. Approvals of both of those documents were tied to requirements to resolve the outstanding issues related to the fate of the North Inlet. In the case of the 2001 ICRP, the MVLWB made approval of the ICRP conditional on DDMI addressing issues related to sludge disposal impacts and alternatives.35 In the case of interim CRP Version 3.2, the Board concluded that more work is needed on this issue and required quarterly investigation reports to address related issues, for example, whether there is a feasible mitigation that would allow reconnection, should the water and/or sediment be unsuitable for aquatic life.[36] The Board was also clear in the 2015 Water Licence Renewal Reasons for Decision that "[r]egardless of whether toxicity in the North Inlet sediment is reduced or eliminated, the post-closure fate of the North Inlet has yet to be determined."

Since DDMI submitted interim CRP Version 3.2, the Board has required the following to resolve this issue:

- Quarterly investigation reports[37]
- Updating the Operational Phase Contingency Plan (OPCP)[38]

[33] See WLWB Online Registry for N7L2-1645 - Diavik - Comprehensive Study Report - Jun 1999

[34] See WLWB Online Registry for W2007L2-0003 - Diavik - ICRP - Version 3.2 - Reasons for Decision - Nov 7_11.pdf

[35] See WLWB Online Registry for W2007L2-0003 - Diavik - ICRP - Board Decision Package - May 20_10.pdf

[36] See WLWB Online Registry for W2007L2-0003 - Diavik - ICRP - Version 3.2 - Reasons for Decision - Nov 7_11.pdf

[37] See WLWB Online Registry for W2007L2-0003 - Diavik - ICRP - Version 3.2 - Reasons for Decision - Nov 7_11.pdf

[38] See WLWB Online Registry for W2007L2-0003 - Diavik - ICRP - North Inlet Quarterly Status Report - Q3 2013 - Board Decision Package - Feb 19_14.pdf

- Additional monitoring and reporting under the SNP and Annual Water Licence Report[39]
- Repeat the North Inlet Sediment Investigation[40]
- North Inlet Hydrocarbon Investigation Report (W2015L2-0001; Part H Condition 18)
- North Inlet Sludge Management Report (W2015L2-0001; Part H Condition 19)

While these submissions have advanced discussions and informed the issue of reconnection, it remains outstanding. The most recent development in the effort to determine the fate of the North Inlet was a Board requirement resulting from the Board's review and approval of the North Inlet Sludge Management Report. The Board required DDMI to provide a detailed evaluation and comparison of closure options, including a cost benefit analysis, in interim CRP Version 4.0.[41] DDMI hired Golder to conduct the evaluation. The results of Golder's evaluation are in Table 2.[42]

Table 2. Evaluation of North Inlet Closure Options

Closure Option for North Inlet (with estimated cost)	Golder Conclusions
"Option 1: install flow-through structure in East Dam (i.e., permanent use of a permeable fish barrier)" ($250,000)	"Much less expensive than any of the options that involve remediation and full reconnection to Lac de Gras (Options 2 to 4). Option 1 also has relatively low uncertainty but does not provide for fish habitat in North Inlet (i.e., does not satisfy objective NI3)."
"Option 2: dredge contaminated sediment/sludge from North Inlet and breach East Dam" ($4,000,000)	"Option 2 to dredge North Inlet is the least expensive of the intrusive remediation options, but residual sludge left behind after dredging will at best result in impaired fish habitat relative to Lac de Gras, and at worst may result in North Inlet remaining unsuitable to reconnect with Lac de Gras."
"Option 3: cover contaminated sediment/sludge in North Inlet and breach East Dam" ($24,000,000)	"Option 3 is not considered to be worth further consideration due to the very high cost and uncertainty in the technical feasibility and remediation success."
"Option 4: combine dredge and cover (i.e., hybrid of Options 2 and 3)" ($16,000,000)	"Option 4 to dredge and cover is the best option for meeting environmental objectives and is expected to result in higher quality fish habitat than the other remediation options, but it has a significant cost."

In the interim CRP Version 4.0, DDMI indicated its agreement with Golder's conclusions (in Table 2)and identified Option 1 as its selected closure activity for the North Inlet. However, Golder nor DDMI provided a rationale for why the other options, in particular Option 4 (dredge and cover remaining sediment) were eliminated. Option 4 has the "highest technical feasibility for reconnection of North Inlet to Lac de Gras" and has no risk of failure of the fish barrier, since it the barrier would be removed.

Similarly, in the interim CRP Version 4.0, DDMI eliminated the closure objective to reconnect the North Inlet to Lac de Gras (objective NI1). DDMI explained its rationale as follows:

> It is DDMI's view that this closure objective should have properly been included as a closure option. That is to say, it is one closure approach that could be used to achieve the

[39] Ibid

[40] Ibid

[41] See WLWB Online Registry for Diavik - North Inlet Hydrocarbon Investigation and Sludge Management Reports - V1.1 - Board Directive and RFD - Jul 25_16.pdf; pg. 17

[42] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Apr 20_17.pdf, Appendix X-6

> closure objective. Removing objective NI1 is consistent with MVLWB (2013). The closure option of reconnecting the [North Inlet] I with Lac de Gras is a closure option considered in Section 5.2.7.

There was general consensus amongst reviewers that the preferred outcome for the North Inlet is to reconnect it with Lac de Gras (NSMA comment 4; GNWT-ENR comment 20; EMAB comments 5 and 88). The NSMA and EMAB proposed another option for achieving this: natural degradation of hydrocarbons in the sediment, and recommended a study to determine feasibility. EMAB recommended that if natural degradation does not appear to be viable, then DDMI should dredge the sediment. DDMI agreed to add a literature review on natural hydrocarbon degradation to the North Inlet reclamation research plan (Appendix VIII), in response to EMAB comment 5, but maintained its preference to build a fish barrier rather than dredge the North Inlet.

- ***Revision #21: Add a literature review on natural degradation of hydrocarbons in north inlet sediments to the North Inlet Reclamation Research Plan.***

Although EMAB expressed some urgency regarding the timing of a decision to dredge the North Inlet, DDMI has previously submitted evidence that there is no rush to make this decision:

> . . . if dredging is the closure remediation method selected for the North Inlet, the most substantial part of the cost will be the mobilization/demobilization of the dredge to site. The difference in volume of sediments requiring dredging would unlikely have much influence on the cost. The rental costs associated with the dredging equipment would likely be based on the time period between winter road access to mobilize and demobilize the equipment to site. Dredging of the North Inlet is not expected to take longer than this period of time even if NIWTP sludge disposal continues in the North Inlet.[43]

ECCC pointed out that if a fish barrier is needed because sediment quality is poor, the closure objective that "water quality and sediment quality in the North Inlet that is safe for aquatic life, wildlife, and people" (objective NI2) will not be met (ECCC comment 8).

DDMI responded to reviewer comments in part by stating that the company would "consider recent discussions around NI Closure Objectives and revise them as part of the CRP V4.1 submission" (response to comments GNWT-ENR 20 and EMAB 88). DDMI also committed to re-phrasing the NI-1 objective in Version 4.1 (response to EMAB comment 5).

In light of the background information presented above, reviewer comments, and proponent responses, the Board concludes the following:

- All parties including DDMI agree that if the sediment and water quality is safe, the North Inlet should be reconnected. The issue is what the closure activity should be if the sediment is not safe.
- Notwithstanding the resources that DDMI has expended on this issue (e.g., studies, consultant fees, etc.), the review and approval process for the many submissions related to the North Inlet closure plan has been a significant effort for the Board and reviewers over the years. A more proactive effort by DDMI to resolve this issue and attempt to bring parties to consensus would improve efficiency and increase the likelihood that a solution agreeable to all parties can be found.

[43] See WLWB Online Registry for Diavik - North Inlet Hydrocarbon Investigation and Sludge Management Reports - V1.1 - Board Directive and RFD - Jul 25_16.pdf; pg. 17

- Although DDMI and the GNWT-ENR have indicated that reconnection to Lac de Gras is a closure option not an objective,[44] this is not necessarily the case. Although a closure activity is typically not an appropriate closure objective, if the closure activity (e.g., reconnection to Lac de Gras) in and of itself is the desired outcome it could reasonably become the objective, as noted by EMAB (EMAB comment 88). Regardless, the important issue is what DDMI should do if sediment quality remains unsafe.
- DDMI has not properly explained why the other options, particularly Option 4 (dredge and cover) should be excluded. Given the controversy and importance of this issue, and the benefits of improved understanding and consensus building, DDMI should engage parties on this topic.

➢ ***Engagement Requirement #2: Engage and build consensus on the North Inlet closure objectives and the fate of the North Inlet, including the Options in the Golder evaluation.***

➢ ***Revision #22: Incorporate the results of engagement required by Engagement Requirement #2 and include a more detailed rationale for DDMI's selected closure option and why it rejected the other options in the Golder evaluation.***

North Inlet Issue #2: Sediment Characterization Study

In the interim CRP Version 4.0, DDMI indicated that "[a] final sediment investigation is planned for as a final check to determine if hydrocarbon contamination has been sufficiently improved to enable fish use of the [North Inlet]." DDMI proposes to implement Option 1, unless the sediment quality has improved enough to allow reconnection to Lac de Gras. In the interim CRP Version 4.0, DDMI proposed to submit the Final North Inlet Sediment Investigation in 2025, after the Final CRP has been submitted in 2020 (Figure 8-1).[45] The GNWT-ENR questioned the timing of this investigation (GNWT-ENR comment 22), however the Board believes that until the closure activity (e.g., Option 1 vs Option 4, natural degradation, etc.) is resolved, the timing of the investigation cannot be determined.

➢ ***Revision #23: Based on the results of the engagement required by Engagement Requirement #2, provide a rationale for the proposed timing of the final sediment investigation(s).***

The July 25, 2016 Board Directive related to the North Inlet Sludge Management Report required DDMI to "include a study design and proposed timeline for the next North Inlet Sediment and Sludge Characterization Study." DDMI was asked why the interim CRP Version 4.0 did not include the study design and DDMI responded that there is a reference to the design in the interim CRP Version 4.0 (WLWB staff comment 8). A reference is not a replacement for the study design. A summary of the design in a reclamation research plan or elsewhere as appropriate, would better enable reviewers to understand the study design, and allow for better tracking of the progress of the next study.

➢ ***Revision #24: Include a summary of the study design for the North Inlet Sediment Investigation in the North Inlet Reclamation Research Plan.***

Finally, there are several other issues regarding the North Inlet that don't relate directly to reconnection and/or are very straightforward. These are identified in Appendix B – Additional Revisions.

[44] See GNWT-ENR comment 20 for GNWT and WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Apr 20_17.pdf

[45] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Figures 3-28 to 9-4 - Apr 20_17.pdf

3.4 Buildings and Infrastructure

Relative to other topics, there were fewer issues raised on closure and reclamation of buildings and infrastructure. The issues raised were:

1. Hydrocarbon-contaminated soils
2. Airstrip

Revegetation is also relevant to buildings and infrastructure, but is addressed in section 3.5 below.

Buildings and Infrastructure Issue #1: Hydrocarbon-contaminated Soil

In the interim CRP Version 4.0, DDMI noted that there will be hydrocarbon-contaminated soil that will require remediation or management at closure. DDMI stated that landfarming can reduce concentrations to levels acceptable for disposal on-site, and indicated its preference for the "the subsurface/deep placement management option within either the PKC and/or the landfill".[46] This is a newly proposed plan for hydrocarbon-contaminated soils. In the interim CRP Version 3.2, DDMI had not yet selected an option for this material, and indicated that on-site remediation, on-site disposal, and off-site removal were options, and identified that "significant amounts of hydrocarbon material that must be hauled off-site" was a risk.

DDMI's preferred option identified in the interim CRP Version 4.0 (deep subsurface disposal) comes from a report prepared by Golder Associates Ltd (Golder) and submitted with DDMI's 2012 Annual Closure Progress Report.[47] Golder assessed three options for disposal on-site: surface placement in the upper 1 meter, subsurface/active zone placement at a depth greater than 1 meter but above permafrost, and subsurface/deep placement at a depth where permafrost is expected to form and persist. In all three options, the on-site disposal locations under consideration were the Type III area of the WRSA, the inert waste landfill, or the PKC Facility. Golder concluded that the third option (deep placement) is the safest. The report's objective was to determine whether hydrocarbon-contaminated soil can be left on-site in a manner that would be safe for human and ecological receptors, and whether some form of remediation/risk management be required to make this possible. Golder concluded that Option 3 (deep placement) is the safest. The option of off-site disposal was not considered in the Golder report.
EMAB commented that "[b]ased on comments made at EMAB's closure workshop, and during community consultations, we expect that there would be significant public concern about burying contaminated soils at site" (EMAB comment 42). EMAB recommended that DDMI "should treat all contaminated soil to meet soil quality criteria" and "Any soil that does not meet these criteria should be taken off site to a place where it can be reclaimed" (EMAB comment 42). DDMI replied that it "maintains that the options presented in interim CRP V4 with regard to hydrocarbon management and disposal are valid and supported with evidence". DDMI also identified that research on closure options for contaminated soils was presented in the 2012 Annual Closure Progress Report (response to EMAB comment 42).

In its review of the 2012 Annual Closure Progress Report, Environment Canada requested DDMI "provide evidence that that the placement of hydrocarbon contaminated soil below the active layer represents the best available technique" (Environment Canada comment 2).[48] DDMI responded that the referenced assessment was "preliminary and intended to consider broad approaches using a risk-based approach as

[46] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Apr 20_17.pdf

[47] See WLWB Online Registry for W2007L2-0003 - Diavik - ICRP - 2012 Annual Progress Report - Dec 10_12

[48] See WLWB Online Registry for W2007L2-0003 - Diavik - ICRP - 2012 Annual Progress Report - Board Decision Package - Feb 28_13.pdf

described".[49] In Version 4, no new information beyond the Golder report submitted with the 2012 Progress Report was provided on this topic. Given EMAB's opposition to this option, and the fact that DDMI did not provide its assessment of the pros and cons of off-site disposal or explain why this option has been eliminated, and that the Golder report was intended as preliminary information, DDMI should provide additional information to support its selected option for hydrocarbon-contaminated soils, and engage with parties prior to submitting interim CRP Version 4.1.

- ***Engagement Requirement #3: Engage with parties on the closure options for hydrocarbon-contaminated soil.***

- ***Revision #25: Provide DDMI's assessment (including cost-benefit analysis) of the pros and cons of off-site disposal of hydrocarbon-contaminated soil compared to on-site disposal, report on the results of engagement required by Engagement Requirement #3, and provide DDMI's preferred option with rationale.***

In DDMI's response to EMAB's comment, DDMI stated that "EMAB submitted no comments or recommendations with regard to [the 2012 Annual Closure Progress Report] findings and WLWB did not issue any directives for follow-up in their March 6, 2013 Notice of Decision". Submitting research findings is useful for updating the Board and all parties on DDMI's research progress, but in no way constitutes a request to change the closure plan. Further, DDMI submitted the Golder Report without indicating the company's views, and should not expect any Board direction in this situation. It is DDMI's responsibility to submit proposed CRP changes with rationale, which reviewers would then have an opportunity to comment on.

- ***Decision C: The Board advises DDMI that submitting research findings in an Annual CRP Progress Report is not, on its own, a means of obtaining reviewer input or Board approval on changes to a closure plan. DDMI must submit the research results, discuss how the results support DDMI's proposed closure activity, and provide a robust rationale in order for reviewers to provide input and the Board to consider approval.***

Buildings and Infrastructure Issue #2: Airstrip

In Version 4. of the interim CRP, DDMI states that "[t]he plant site, roads, airstrip and laydown areas will be contoured, original drainage channels restored, and surfaces scarified and targeted for re-vegetation" (as also described in Version 3.2[50]). EMAB commented that "[t]he airstrip may be the only future access for heavy equipment in the future if ice roads are not available" and that "communities and the TK Panel appear to support the retention of the airstrip" (EMAB comment 34). EMAB recommended that "future retention, ownership and maintenance issues need to be addressed between GNWT, Diavik and Communities". DDMI responded that "DDMI suggests that this matter is beyond the scope of CRP V4.0" but it "is willing to participate in discussions with government and other interested parties to assess the fate of the airstrip, recognizing that DDMI would not retain ownership, liability or associated maintenance costs for such infrastructure post-closure" (response to EMAB comment 34). DDMI should acknowledge the possibility of the airstrip being retained since this would change DDMI's closure plans for the airstrip, even if DDMI did not retain ownership, liability, or associated maintenance costs.

[49] *Ibid*., pg. 16

[50] See WLWB Online Registry for W2007L2-0003 - Diavik - ICRP - Version 3.2 - Jul 27_11.pdf

- ***Revision #26: Add a discussion about the possibility that other parties may wish the airstrip to be retained, a statement that DDMI is willing to participate in discussions with government and other interested parties to assess the fate of the airstrip, and a plan and approximate schedule for resolving this issue.***

3.5 Closure Objectives

The closure objectives for the Diavik Mine were approved via the Board's Decision on Version 3.2 of the CRP in November 2011.[51] At that time, the Board explained that approval of the CRP means that the closure objectives are approved and that supporting evidence would be required before the Board would approve changes. It was acknowledged that objectives may need to be modified, but that parties' input would be required for any changes. It was stated that DDMI or any other party could propose a change to the objectives.

The substantive issues related to closure objectives raised during the public review of the interim CRP Version 4.0 are discussed in the sub-sections below. Comments on the closure objective regarding the fate of the North Inlet are discussed in section 3.3.

Closure Objective Issue #1: Scope of SW1

Site-wide closure objective #1 (SW1) states: "Surface runoff and seepage water quality that is safe for humans and wildlife". The GNWT-ENR recommended that SW1 be amended to include that it "will not cause adverse effects to aquatic life" because this runoff will fill East Island lakes, which may contain fish or other aquatic life (GNWT-ENR comment 19). DDMI responded that no change is required because East Island lakes "are either non-fish bearing or are included within Diavik's Section 35 Fisheries Authorization." In a follow-up clarification from DFO, it was explained that "Diavik's Fisheries Act Authorization No.SC980001 (under section 35 (2)) of the Fisheries Act is valid for the period of August 2, 2000 to December 31, 2025 for harmful alteration, disruption or destruction of fish habitat (HADD) from works and undertakings."[52] In other words, the *Fisheries Act* Authorization applies to operations, not closure. Regardless, the comment from the GNWT-ENR recommends that SW1 be amended to apply to all aquatic life, not just fish (e.g., plankton and benthic invertebrates) and closure criteria for "wildlife" do not currently encompass aquatic life, they are focussed on mammals and birds.

As addressed in the CSR, it appears that during the environmental assessment for the Diavik Mine, effects at closure to East Island lakes were discussed and expected to be reflected in the closure plan. For example:

- Section 8.5.1 of the CSR states: "Aquatic life in two fish-bearing East Island lakes could be affected during post-closure. Diavik predicted that East Island post-closure runoff will produce high magnitude, long-term local changes in water quality in these lakes…These changes in water quality could decrease the abundance and reproductive success of sensitive aquatic organisms."
- Section 8.5.1 of the CSR states: "Diavik further predicted that phosphorus could change the trophic level of two East Island lakes (E3 and E21) from ultra-oligotrophic to eutrophic with a resultant increase in productivity, variety and abundance of aquatic life."

[51] See WLWB Online Registry for W2007L2-0003 - Diavik - ICRP - Version 3.2 - Reasons for Decision - Nov 7_11.pdf

[52] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Review Summary and Attachments - Aug 13_18.pdf

- Section 8.5.3 of the CSR states: "At post closure, metal concentrations in fish flesh in some of East Island lakes are predicted to exceed consumption guidelines…The RAs [responsible authorities] agree that Diavik should monitor metal concentrations post-closure and agree with KIA's [Kitikmeot Inuit Association] recommendation that a plan be developed to warn people fishing these lakes (e.g. posting signs), if the predictions are correct."
- In the Executive Summary of the CSR, the following was stated with respect to surface runoff: "…construction, operation, closure and abandonment/reclamation of the proposed Diavik Diamonds Project will affect the surface water drainage patterns on East Island. The RAs conclude that potential acid rock drainage and other water quality issues can be mitigated by the options proposed by Diavik. The RAs further conclude that follow-up by Diavik is required to verify predictions and to ensure that the appropriate water quality criteria are met in Lac de Gras and East Island lakes."

The GNWT-ENR comment 19 appears to have identified a potential gap in the closure objectives. Based on the above, it appears reasonable that the protection of aquatic life in East Island lakes should be reflected within the closure objectives for the Diavik Mine. It is not clear whether this would be best addressed by a revision to SW1 or by the addition of a separate objective for the protection of aquatic life in East Island lakes. The Board has determined that this be considered and addressed, with rationale, by DDMI in Version 4.1 of the interim CRP.

- ***Engagement Requirement #4: Engage with parties on this potential gap in closure objective SW1 and consider, with rationale, the inclusion of a revised, or new, closure objective to specifically address the protection of aquatic life in East Island lakes.***

Closure Objective Issue #2: Scope of SW5

The objective for SW5 is "[r]e-vegetation targeted to priority areas".[53] The GNWT-ENR recommended that DDMI "clarify what the goal of re-vegetation is" (GNWT-ENR comment 32). In addition, EMAB recommended that "WLWB and DDMI should reconsider the effectiveness of the current Objective SW5" (EMAB comments 64, 65, and 66). EMAB also commented that "the priority should be to revegetate to the maximum extent possible compared to pre-development conditions" (EMAB comment 23). This was "EMAB's interpretation, based on comments and recommendations made by community members at the February 2017 EMAB Closure Workshop and reinforced at EMAB's November 2017 community update in Lutsel K'e".

DDMI stated that EMAB's recommendation to re-vegetate all terrestrial areas to the maximum extent possible "is inconsistent with the approved Closure Objective SW5, as well as the approved closure concepts for the PKC and NCRP-WRSA and our understanding of the TK Panel's recommendations". DDMI also stated that it "has considered input from others over many years as described in CRP V4.0 and approved in CRP V3.2" (DDMI response to EMAB comment 64).

In Section 5.2.8.3.3 of the interim CRP Version 4.0, DDMI stated that the TK Panel "initially struggled with the concept of re-vegetation, preferring a traditional approach of letting Mother Nature take its course".[54] DDMI also stated that it had "identified site roads, plant site, laydowns and the airstrip as target areas for

[53] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Apr 20_17.pdf

[54] Ibid.

re-vegetation". DDMI committed to providing a map detailing proposed areas for re-vegetation, as reflected in revisions in Appendix B).[55] DDMI stated that the TK Panel preferred that "areas of site where chemical or waste storage occurs" and the airstrip be excluded from the target areas for re-vegetation.[56] In Appendix IX-1.6 of the interim CRP Version 4.0, the Revegetation at Closure Report states that the TK Panel recommendations "flowed from a common vision to have the mine site returned to the most natural state humanly possible" and that "nature can heal itself".[57]

It appears that EMAB and DDMI disagree on what parties would prefer for re-vegetation at the site. EMAB has identified that there are some parties that want the site returned to pre-development conditions as much as possible. EMAB also commented that the "TK Panel has stated it is not representative of the communities" (EMAB comment 21). DDMI argues that "[s]ection 5.2.8.3 of CRP V4.0 is in our opinion an accurate description of community input received to date by DDMI" (response to EMAB comment 22).

Since there seems to be a difference between what EMAB and DDMI have reported, additional engagement on objective SW5 is warranted. DDMI should engage parties on a discussion of SW5 and provide a clearer understanding of what areas and to what extent (e.g., percent cover) DDMI is proposing to target for re-vegetation. From this engagement, objective SW5 may require updating in Version 4.1. The criteria related to SW5 may change as well; DDMI has committed to reconsidering the criteria for SW5 in Version 4.1 (DDMI response to NSMA comment 1; GNWT-ENR comment 32; and EMAB comment 67) as reflected in the revisions in Appendix B.

- ***Engagement Requirement #5: Engage with parties on closure objective SW5 and consider revising closure objective SW5 and its associated closure criteria in light of engagement. If revisions to the objective or criteria are made, including a rationale.***

3.6 Closure Criteria

Broadly speaking, closure criteria fall into two categories: chemical (e.g., water quality of seepage and sediment quality in the North Inlet) and non-chemical (e.g., physical stability of structures and re-vegetation targets). Objectives and associated criteria are either site-wide or specific to each of the five different mine components (e.g., North Inlet Area and Processed Kimberlite Containment Area). Closure criteria have been the subject of much discussion since first proposed in Version 3.0 of the interim CRP. In Board direction from May 2010, DDMI was to advance criteria as part of Version 3.1 of the interim CRP and develop a work plan for completing the criteria. [58]

In Version 3.1 of the interim CRP, DDMI revised the descriptions of the proposed closure criteria and included research plans for the further development of some of the closure criteria.[59] In the May 2011 Board Decision Package for Version 3.1 of the interim CRP, it was identified that not all parties agreed with the risk assessment approach proposed by DDMI for the finalization of chemical criteria.[60] It was suggested that a workshop could be held to discuss this and the WLWB hosted a risk assessment workshop in November 2011 to help advance discussion on chemical closure criteria. In Version 3.2 of the interim CRP, DDMI proposed some preliminary criteria for each of the closure objectives and recognized that the

[55] Ibid.

[56] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Apr 20_17.pdf

[57] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Appendices IX-1.6 to IX-1.7 - Apr 20_17.pdf

[58] See WLWB Online Registry for W2007L2-0003 - Diavik - ICRP - Board Decision Package - May 20_10.pdf

[59] See WLWB Online Registry for W2007L2-0003 - Diavik - ICRP - Version 3.1 - Part 1 - Main Report - Dec 22_10.pdf

[60] See WLWB Online Registry for W2007L2-0003 - Diavik - ICRP - Version 3.1 - Board Decision Package - May 10_11.pdf

"the criteria are works in progress that will evolve along with the closure plan."[61] Version 3.2 was approved on September 21, 2011 and it was reiterated that the closure criteria are a "work in progress".[62]

On August 19, 2015, the WLWB directed DDMI to submit a Closure Criteria Report with its 2015 Annual Report.[63] Specifically, it was stated that: "The Board has not approved DDMI's proposed closure criteria and a lot of work remains. It is critical that criteria be approved before closure, and for some criteria, possibly before progressive reclamation takes place." It was also explained that this submission "would not be for approval, but would be for the purpose of discussion and public review, so that DDMI would be in a better position to submit final criteria with ICRP Version 4.0." The Board did not specify the contents of the Report, but stated that "DDMI should work with Board staff to determine a useful format for the Closure Criteria Report." On March 17, 2016, DDMI submitted a Site-Specific Risk-Based Closure Criteria Report (SSRBCC Report), which addressed the subset of closure criteria that DDMI was proposing to define using a risk-based approach.[64] These chemical closure criteria would apply to some of the chemical closure objectives. This Report differed from the one that was expected based on discussions prior to its submission.[65] The expectation was to have a more complete Criteria Report for all criteria, not just risk-based ones, and a discussion on how the risk-based criteria relate to DDMI's approach for developing criteria in CRP Version 3.2. Considerations included discussion of mixing zones and dilution rates, describing what work remained to be done on criteria, and when this work would be completed. While the report received did not include the expected level of information, it was not for Board approval thus was distributed for review for the purpose of discussion.

Shortly after the submission of the SSRBCC Report in mid-March 2016, DDMI submitted the 2015 CRP Progress Report on March 31, 2016.[66] The 2015 CRP Progress Report included a proposed Final CRP for the Waste Rock Storage Area (WRSA), which included proposed closure criteria relevant to the WRSA.[67] On October 25, 2016, the Board provided DDMI with some preliminary direction on closure criteria, prior to making its decision on the Final CRP for the WRSA – this preliminary direction was to help DDMI "proactively address concerns that may potentially delay approval of the [CRP for the WRSA]."[68] Key points from the Board's October 25, 2016 decision are summarized in the following bullet points:

- With respect to DDMI's proposed water quality closure criteria, the Board concluded that *Metal Mining Effluent Regulations* (MMER) limits are not appropriate closure criteria;
- Also, with respect to water quality closure criteria, the Board noted a number of topics that had not been discussed between DDMI and reviewers (e.g., use of mixing zones and how to consider EA predictions of post-closure water quality);
- With respect to the use of SSRBCC, the Board noted outstanding issues raised in review of the SSRBCC Report; and

[61] See WLWB Online Registry for W2007L2-0003 - Diavik - ICRP - Version 3.2 - Main Report - Jul 27_11.pdf

[62] See WLWB Online Registry for W2007L2-0003 - Diavik - ICRP - Version 3.2 - Board Decision Package - Sep 21_11.pdf; W2007L2-0003 - Diavik - ICRP - Version 3.2 - Reasons for Decision - Nov 7_11.pdf

[63] See WLWB Online Registry for W2007L2-0003 - Diavik - ICRP - 2014 Progress Report - V 1.1 - Board Directive and Reasons for Decision - Aug 19_15.pdf

[64] See WLWB Online Registry for Diavik - Risk Based Closure Criteria Report - Mar 17_16.pdf

[65] See WLWB Online Registry for Diavik - Risk Based Closure Criteria Report - Correspondence re Submission - Mar 30_16.pdf

[66] See WLWB Online Registry for Diavik - Annual Closure and Reclamation Progress Report - 2015 - Version 1.1 - Mar 31_16.pdf

[67] See WLWB Online Registry for Diavik - Annual Closure and Reclamation Progress Report - 2015 - Version 1.1 - Appendix IV - Mar 31_16.pdf

[68] See WLWB Online Registry for Diavik - 2015 CRP Progress Report - Directive - Oct 25_16.pdf

- The Board noted a number of comments on non-chemical closure criteria for the WRSA that would benefit from further discussion.

In the end, the Board determined that a closure workshop was needed; DDMI could use feedback from the workshop to revise and re-submit the closure criteria for the WRSA Final CRP and to inform closure criteria for the interim CRP Version 4.0. A closure workshop was held on December 12, 2016. In its December 16, 2016 decision for the WRSA Final CRP, the Board stated that "DDMI must ensure the revised closure criteria are developed in consideration of the discussions that took place at the workshop and the public comments provided to DDMI to date on criteria."[69]

DDMI submitted Version 1.1 of the Final WRSA CRP on April 18, 2017.[70] Additional information, identified as missing during a conformity check, was submitted on May 9, 2017.[71] The submission of Version 1.1 of the Final WRSA CRP included revisions to the closure criteria. The Board did not approve the Final CRP for the WRSA and provided a summary of some of the key unresolved issues related to closure criteria and stated that "more discussion on some or all of these issues, in the form of a workshop and through comments on ICRP Version 4 would be beneficial."[72] The Board approved WRSA CRP Version 1.2 as an interim plan and noted that criteria were not approved.[73,74] Specifically, the Board stated that:

> The closure criteria submitted with Version 1.0 and to some extent Version 1.1, required significant work to improve them, and work remains before criteria could be approved. There are important aspects of the closure criteria that remain outstanding, including the mixing zone, dilution factor, and DDMI's 20% "effects magnitude"….Approval of the WRSA CRP as an interim plan (rather than final) will enable additional work on the closure criteria. For clarity, public comments (including staff comments) on closure criteria submitted during review of the WRSA CRP may be considered in review of ICRP Version 4, since the Board has not made decisions on those comments.[75]

The interim CRP Version 4.0 was submitted on April 20, 2017; Appendix V included a tabulation of closure objectives and proposed closure criteria.[76] A technical workshop, which included discussion of closure criteria, was held on November 20 and 21, 2017.[77] A large proportion of the comments submitted during the public review of interim CRP Version 4.0 were related to closure criteria. There are several outstanding, unresolved issues related to the proposed closure criteria. DDMI has acknowledged that these are a "work in progress", which is re-iterated in Version 4 of the CRP.[78] Because of the number of unresolved issues, and the potential linkages between criteria for different closure objectives, the Board has not approved any closure criteria at this time. The issues related to the closure criteria are discussed

[69] See WLWB Online Registry for Diavik - Final Closure and Reclamation Plan - WRSA - Directive and Reasons for Decision - Dec 16_16.pdf

[70] See WLWB Online Registry for Diavik - Final Closure and Reclamation Plan - WRSA - Version 1.1 - April 18_17.pdf

[71] See WLWB Online Registry for Diavik - Final Closure and Reclamation Plan - WRSA - Version 1.1 - May 9_17.pdf

[72] See WLWB Online Registry for Diavik - Final Closure and Reclamation Plan - WRSA - Version 1.1 - Board Directive and RFD - Aug 23_17.pdf

[73] See WLWB Online Registry for Diavik - Closure and Reclamation Plan - WRSA - Directive and Reasons for Decision - Feb 9_18.pdf

[74] See WLWB Online Registry for Diavik - Closure and Reclamation Plan - WRSA - Version 1.2 - Board Directive - Apr 13_18.pdf

[75] See WLWB Online Registry for Diavik - Closure and Reclamation Plan - WRSA - Directive and Reasons for Decision - Feb 9_18.pdf

[76] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Apr 20_17.pdf

[77] See WLWB Online Registry for Diavik - CRP Version 4 - Technical Workshop Agenda - Nov 9_17.pdf

[78] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Apr 20_17.pdf, pg. 94

in the sub-sections below, with revisions required to help further advance their development and refinement.

3.6.1 Chemical Criteria

Chemical criteria have been proposed for the following closure objectives: SW1, SW2, M1, M2, P1, NI2, NI3, NI5, I2, and I3. The proposed chemical criteria are based on SSRBCC, back-calculated values based on achieving the Aquatic Effects Monitoring Program (AEMP) Benchmarks in the Receiving Environment, or AEMP Benchmarks.

Chemical Closure Criteria Issue #1: Site-Specific Risk Based Closure Criteria (SSRBCC)

DDMI has proposed the use of SSRBCC for a number of closure objectives. Closure criteria based on SSRBCC include water quality that is safe for humans and wildlife. For humans, these include drinking water criteria applicable to where water could be consumed by people, including direct consumption of seepage/runoff water or of Lac de Gras water in proximity to where seepage/runoff is released. For birds and mammals, these include water quality criteria applicable to where birds and mammals would be exposed to water, including direct exposure to seepage/runoff or to Lac de Gras water in proximity to where seepage/runoff is released. Closure criteria based on SSRBCC also include soil and sediment closure criteria for humans, mammals, birds, and aquatic life, and are applicable to where humans or wildlife could be exposed to surface material or sediment. Subsets of these criteria apply to the following closure objectives: SW1, P1, NI2, NI3, I2, and I3.

The basis and derivation of the SSRBCC were provided in Appendices X-8.1 and X-8.2 of the interim CRP Version 4.0. As discussed in section 3.6, an earlier version of these appendices (i.e., the SSRBCC Report) was distributed for public review for the purpose of discussion and to help inform criteria to be submitted with Version 4.0 of the interim CRP. A substantial number of comments (approximately 100) were received from reviewers during this initial review.[79] DDMI responded to those comments and generally indicated how it would address reviewer concerns in Version 4.0 of the interim CRP. On September 8, 2017, DDMI submitted a revision to interim CRP Version 4.0, which included an update to the SSRBCC Report (i.e., Appendices X-8.1 and X-8.2); the revision was provided following recognition by DDMI that the incorrect versions of these appendices were mistakenly included in the original submission of interim CRP Version 4.0. The updated version was added to the WLWB Online Registry and added to the Item for Review. The revision included an excel table indicating how and where the appendices had been updated in response to reviewer comments obtained during the earlier public review of the SSRBCC Report. In a follow-up email, it was confirmed that no other changes were made; the only changes were those identified in the excel table submitted by DDMI.[80]

SSRBCC were developed in two phases and are described in Appendices X-8.1 and X-8.2 (i.e., Phase I and II, respectively). The Phase I Report identified Receptors of Concern (ROCs)[81] and selected Contaminants of Potential Concern (COPCs)[82] for which SSRBCC should be developed.

---

[79] See WLWB Online Registry for Diavik - Risk Based Closure Criteria Report - Review Summary and Attachments - Jun 10_16.pdf

[80] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Review Summary and Attachments - Aug 13_18.pdf

[81] Selecting ROCs involves identifying the specific receptors that are to be protected. These could include species, a community, or an ecosystem. In this case, DDMI selected representative aquatic and terrestrial wildlife species as ecological receptors, as well as toddlers and adults as human receptors.

[82] COPCs are contaminants that may pose a risk or cause adverse effects to the ROCs.

Parameters that were predicted to exceed relevant guidelines and shown to be greater than baseline concentrations were selected as COPCs.

The Phase II Report outlines the derivation of the SSRBCC for the COPCs identified during Phase I. As described in the Phase II Report, "SSRBCC are media-specific concentrations that were derived using site- and ROC-specific exposure considerations and contaminant-specific toxicological information."
Numerous comments regarding SSRBCC were received during the public review of the interim CRP Version 4.0. The comments received tended to fall within two general categories:

1. Concerns about the use of risk-based approach to developing site-specific closure criteria;
2. Detailed concerns about the SSRBCC Report (i.e., Appendices X-8.1 and X-8.1) and the proposed closure criteria in Appendix V:
    a. Clarity around defaulting to guidelines when SSRBCC not derived;
    b. Clarity around final choice of SSRBCC when more than one is derived for a given parameter;
    c. Technical considerations related to SSRBCC derivation; and
    d. Revisions to Appendix V of the CRP and Appendices X-8.1 and X-8.2.

Each of these topics is discussed in further detail in the paragraphs below. Other comments regarding these chemical closure criteria, but not directly related to the derivation of SSRBCC, are also discussed below (see "Other Revisions to Closure Criteria for SW1, P1, NI2, NI3, and I3").

Concerns About the Use of Site-Specific Risk-Based Criteria and COPC Selection

Comments from the GNWT-ENR generally indicate that it does not support the use of a risk-based approach to developing site-specific closure criteria as proposed by DDMI (GNWT-ENR comments 5 and 6). The GNWT-ENR stated that it "maintains the opinion that closure criteria should only be based on a risk based approach as a last resort" and "recommends that the Board not approve closure criteria that are strictly risk-based at this point in time" (GNWT-ENR comment 6). This is not the first time that this concern has been raised by the GNWT. In the preliminary review of the SSRBCC Report (i.e., the one that was for the purpose of discussion as explained in Section 4.6), the GNWT raised a general concern with the use of a risk-based approach to derive closure criteria. To better understand the nature of the GNWT-ENR's concerns, the Board issued an Information Request to the GNWT-ENR on July 29, 2016.[83] A response from the GNWT-ENR was received on August 31, 2016.[84] Some of the key points from the response are summarized in the following bullet points:

- The GNWT-ENR stated that "conducting risk assessments in the absence of what can be reasonably or practically achieved is premature";
- The GNWT-ENR stated that it is "concerned that DDMI is proposing an approach to develop closure criteria based solely on toxicity (notably Toxicity Reference Values) and not the conditions that could be reasonable or practically achieved by application of best practices for closure and reclamation";
- The response discussed when to apply risk-based criteria: "a risk assessment would be appropriate in the event that no feasible or practical methods exist for reclamation that would

[83] See WLWB Online Registry for Diavik - WLWB IR to the GNWT - Risk-based Closure Criteria and Progressive Reclamation Security - Jul 29_16.pdf

[84] See WLWB Online Registry for Diavik - GNWT Response to WLWB IR - Risk Based Closure Criteria - Aug 31_16.pdf

return the site to pre-development conditions or achieve guidelines intended to protect aquatic or terrestrial life….If the risk assessment showed that an unacceptable risk remained, the proponent would need to consider some form of long-term active site management or treatment." In other words, it appears that the GNWT-ENR is explaining that risk-based criteria would be used as a last resort;

- The GNWT-ENR noted that "the use of best closure practices may result in post-closure conditions significantly lower than the risk based concentrations"; and
- With regards to providing "alternative approaches to determining criteria", the GNWT-ENR noted that if pre-development or baseline conditions are not possible, then typical standards such as CCME guidelines should be considered; the GNWT-ENR also stressed importance of consulting with interested parties.

The move towards adopting primarily site-specific risk-based closure criteria deviates from what was originally proposed by DDMI in Version 3.2 of the interim CRP. In Version 3.2, DDMI explained that it would rely first on generic guidelines and that a risk-based approach may need to be used for some parameters that do not have achievable/appropriate benchmarks. Specifically, in the preamble of Appendix V, where closure objectives and criteria were detailed, DDMI stated the following:

> In general DDMI will use available standards or guidelines as initial closure criteria – for example CCME Water Quality Guidelines. These standards/guidelines are understood to be conservative (erring on the side of caution) and as such will be used as initial criteria unless it has been identified that the [sic] there are specific site conditions (for example presence of more sensitive species). If it is determined at some point that these initial criteria are not achievable or are not appropriate (for example exposure pathway not applicable) then DDMI may conduct a site-specific risk assessment to derive a site-specific risk-based closure criteria. Once derived, DDMI would apply to have the risk-based criteria accepted as revised closure criteria.

Although the COPC selection step completed as part of the SSRBCC Report involves this step, reviewer comments (as discussed below) indicate some potential missing steps and gaps. Furthermore, as part of the interim CRP Version 3.2 (Appendix VIII), DDMI laid out a Closure Planning Framework, which outlines reclamation research plans. As explained by DDMI:

> The Framework shows an iterative process of taking a design concept, evaluating the expected performance of the design against objectives and criteria, and considering options to improve the design. Information from the research plans will improve understanding of the expected performance of a specific design concept, focus closure criteria, and identify possible design options or alternatives.

In Appendix VIII of the interim CRP Version 3.2, DDMI explained that the evaluation component of the framework would be a risk-based approach. The risk-based approach described in Appendix VIII sounds similar to that outlined in the SSRBCC Report; however, the approach in Appendix VIII included a feedback step by which closure criteria may be revised, the need for more research identified, or the requirement to develop alternative closure options be identified. DDMI appears to be asking for the approval of SSRBCC as presented in the interim CRP Version 4.0 without having clearly demonstrated that achieving initial criteria is not possible, how these may be refined in the future, and how they may be used to drive changes to the closure designs. This aspect of DDMI's approach does not appear to align with the Board's objective of minimizing waste, as stated in MVLWB (2011) *Water and Effluent Quality Management Policy* (Water

Quality Policy).[85] It appears that some additional steps and discussion are needed before specific SSRBCC can be approved.

One important thing to clarify is what is meant by a risk-based approach. In its responses to the GNWT-ENR comment 5, DDMI stated:

> We do not agree with the GNWT's opinion regarding limiting the use of a risk-based approach. Rather, we believe that most if not all closure criteria will be risk-based at some level. For example, the AEMP Benchmarks that the GNWT supports using with closure criteria are themselves risk-based.

As explained in Diavik's AEMP Design,[86] the aquatic life AEMP benchmarks are based on CCME water quality guidelines for the protection of aquatic life, Health Canada Drinking Water Quality Guidelines (HC DWQGs), guidelines from other jurisdictions, or adaptations of guidelines to site-specific conditions (i.e., site-specific water quality objectives (SSWQOs)). To be clear, even generic criteria like those based on CCME are developed with a risk-based approach. What the GNWT-ENR appears to object to is the use of site-specific ecological and human health risk assessments to determine closure criteria, without having demonstrated that generic criteria can be achieved using best practices. CCME guidelines are based on achieving no adverse effect to the environment and are developed with the intention of being protective of all species.[87] Although they are risk-based, they are developed to be conservative and to be protective of all species over a wide-range of conditions. The SSRBCC developed by DDMI are developed to be site- and receptor-specific (i.e., less generic). To achieve this, decisions are being made by DDMI about which receptors (e.g., species) and toxicity reference values should be used to make it tailored to specific conditions. By virtue of this exercise, the level of conservatism is reduced. A substantial number of comments were received during the public review outlining concerns and recommendations about the development of SSRBCC (see "Detailed Concerns About the SSRBCC Report and DDMI's Proposed Closure Criteria in Appendix V" below; also see EMAB comment 106), suggesting that there may be some unresolved issues with respect to those details. Resolving all these issues requires a high level of scrutiny, which does not appear to be warranted unless it is determined that SSRBCC are needed and accepted.

The overarching issue here appears to be that DDMI has put forth site-specific risk-based closure criteria for all chemical criteria related to the protection of humans, wildlife, and vegetation, without first fully demonstrating that they are needed in all cases. Although the COPC selection step in Phase I of the SSRBCC Report makes comparisons to predicted concentrations, it is not clear whether these predicted concentrations are representative of closure conditions (e.g., predictions of PKC area seepage come from current surveillance network program (SNP) monitoring data from the PKC pond, predictions of WRSA seepage appear to be based on A154/418 Type I rock instead of A21 Type I rock, etc.). There are a number of comments from the public review, which are discussed elsewhere, highlighting that a demonstration of predicted closure conditions (e.g., seepage water quality, soil, and sediment quality) have not been provided for all of the closure components as final closure plans and modelling studies are still in progress (e.g., see discussion in Section 4.2; PKC Facility Issue #1). There is also no discussion about the amount of uncertainty around those predictions or consideration about alternative closure options that could be used to reduce/mitigate any of the predicted closure concentrations. Thus, it is unclear under which circumstances it may be required or reasonable to deviate from standard guidelines.

---

[85] See WLWB (www.wlwb.ca) 'Policies and Guidelines' for MVLWB Water and Effluent Quality Management Policy (2011)

[86] See WLWB Online Registry for Diavik - AEMP Design Version 4.1 - Jun 20_17.pdf

[87] See CCME webpage for Canadian Environmental Quality Guidelines.

Another concern related to this topic is that there is a lack of clarity and possibly some gaps with respect to which chemical parameters will have closure criteria. As explained above, SSRBCC were only derived for parameters that were selected as COPCs. EMAB stated that the "approach taken for identification of contaminants of potential concern (COPCs) results in a narrow definition that may have implications on the SSRBCC" (EMAB comments 102 and 103). EMAB also explained that the COPC selection process may exclude parameters that are increasing because of the mine, but do not (or are not predicted to) exceed guidelines (EMAB comments 102 and 103). EMAB acknowledged that DDMI has explained it would default to guidelines for parameters that do not have SSRBCC developed, but EMAB explained that "the SSRBCC Reports are not transparent about which parameters show elevated concentrations in comparison to baseline conditions. As a result, it is not clear what parameters should have criteria established in addition to those with SSRBCC." EMAB also questioned how closure criteria may be established for variables shown to increase as a result of the mine, but that do not have existing guidelines (EMAB comment 147). Together, these comments suggest that more transparency and discussion is required with respect to determining which chemical parameters should have closure criteria. For example, Appendix 2 of the MVLWB/GNWT (2017) *Guidelines for Effluent Mixing Zones* (Mixing Zone Guidelines)[88] includes steps/considerations for identifying 'parameters for review' and 'parameters of interest' that could potentially be applied to any kind of chemical parameter at closure (i.e., water quality, soil quality, and sediment quality). DDMI was recently advised to consult Appendix 2 of the Mixing Zone Guidelines when proposing closure criteria;[89] the Board requires DDMI to do this as part of its revisions in Version 4.1 of the CRP or propose another process for identifying 'parameters for review' and 'parameters of interest' that addresses reviewer concerns.

The Board acknowledges that a considerable amount of work has gone into developing SSRBCC and that reviewers have invested resources into reviewing them. Despite this, it is important to take a step back to make sure that if SSRBCC are being applied, that it is being done in a way that is acceptable to parties and in line with Board policies, such as Water Quality Policy. As explained in section 3.6, the Board previously identified that significant work remained with respect to developing closure criteria, which led to the Board's requirement for a Criteria Report. The requirement for a Criteria Report was to address a wide-range of outstanding issues with respect to closure criteria and it was expected that the risk-based criteria component to be presented in the context of the Framework presented in Appendix VIII of the interim CRP Version 3.2. In lieu of a more holistic Criteria Report, DDMI submitted the SSRBCC Report, which was distributed for public review for the purpose of discussion. Concerns about adopting SSRBCC as proposed by DDMI were raised by reviewers at that time. Similar concerns, along with a number of other issues that the Board had identified as outstanding, were also identified during subsequent reviews of closure criteria in the WRSA CRP submitted by DDMI. Version 4.0 of the interim CRP was the opportunity for reviewers to see how the SSRBCC Report would be used in the context of closure criteria for the whole project (i.e., all closure components).

Prior to investing more resources into considering the full suite of SSRBCC, it is necessary to make sure that a comprehensive and appropriate list of chemical closure criteria are being proposed and that SSRBCC are being applied only where appropriate. To accomplish this, the following steps are necessary:

1. DDMI needs to include a more thorough and transparent discussion about the process used for determining which parameters should be considered at closure. This can be included in Version 4.1 of the interim CRP.

[88] See WLWB (www.wlwb.ca) 'Policies and Guideline' for MVLWB/GNWT Guidelines for Effluent Mixing Zones (2017)

[89] See WLWB Online Registry for Diavik - Closure and Reclamation Plan - WRSA - Directive and Reasons for Decision - Feb 9_18.pdf

2. A better understanding and description of predicted closure conditions (i.e., chemical concentrations) is needed to help demonstrate when standard guidelines may not be appropriate/achievable. This should be coupled with a consideration and discussion of alternative closure options.

These steps are reflected in the following revisions to be included in Version 4.1 of the interim CRP:

- ***Revision #27: Include a more thorough and transparent discussion about the process used for determining which parameters will have closure criteria.***

- ***Revision #28: Provide complete, up-to-date predictions of post-closure chemical concentrations (for all components and site-wide) and provide a clear and transparent explanation about how they were derived, the level of uncertainty, and if/how they will be refined through time.***

- ***Revision #29: Include a detailed description of its approach, with rationale, for demonstrating if/when the use of standard guidelines as closure criteria for chemical parameters are not appropriate/achievable. This approach must include a consideration and discussion of alternative closure options. DDMI must include tables comparing standard guidelines, closure concentration predictions, and the proposed SSRBCC to support this discussion.***

Detailed Concerns About the SSRBCC Report and DDMI's Proposed Closure Criteria in Appendix V

Based on the discussion above, the Board has determined the application of SSRBCC as presented in the interim CRP Version 4.0 is premature and that a larger discussion/description about the approach being used to determine when SSRBCC should be applied is first required. It is recognized, however, that a great deal of effort has gone into the development of the SSRBCC Report and that reviewers have provided a considerable amount of feedback on this topic. A number of comments received during the public review deal with concerns about the technical details of the SSRBCC derivations and the associated choice of closure criteria. It is not clear that all issues related to SSRBCC need to be resolved because it is unclear to what extent they will be utilized as closure criteria; however, it would be unfortunate to lose some of this information, especially if SSRBCC are put forward in some capacity at a later date. In addition, DDMI made a number of commitments with regards to revisions to these appendices, which would be expected to be reflected in future versions of the CRP. In an effort to capture some of the thinking/feedback that has already been provided, the Board has attempted to summarize some of the main issues here and provide revisions for potential future iterations. The way in which these revisions are incorporated will depend on how DDMI proposes to use and include SSRBCC in the future.

- ***Decision D: DDMI is to incorporate or address SSRBCC Revisions #1 through 9, where applicable, when it submits Version 4.1 of the interim CRP.***

SSRBCC Revisions #1 through 9 are described in these Reasons for Decision and are listed in Appendix D.

A. Clarity around defaulting to guidelines when SSRBCC not derived:

The SSRBCC Report (i.e., Appendices X-8.1 and X-8.2) of the interim CRP Version 4.0 provides tables of all the derived SSRBCC. These values are summarized in Appendix V of the interim CRP Version 4.0, where they are presented as closure criteria for various closure objectives. As explained above, SSRBCC were only derived for parameters that were selected as COPCs. Although DDMI has explained that it would default to existing guidelines for parameters not selected as COPCs, these parameters, and the associated

default guidelines have not been included in the list of closure criteria. A number of comments received during the public review identified instances where it is not clear that the proposed closure criteria would be a standard guideline because no SSRBCC is derived (EMAB comments 102, 103, 145, and 150) or it is not clear which standard guideline will be used because more than one exists (EMAB comments 132 and 134).

- ***SSRBCC Revision #1: Clarity must be provided in Appendix V. The closure criteria tables presented must include the list of all parameters with closure criteria, not just those based on SSRBCC. If a standard guideline is used for parameters where more than one guideline is available, DDMI must include rationale for its choice.***

EMAB raised questions about how closure criteria will be established for higher trophic levels (i.e., birds and mammals) when defaulting to CCME EQGs for aquatic life because "CCME EQGs do not consider the protection of higher trophic level organisms" (EMAB comments 124, 127, and 146). In response to EMAB comment 146, DDMI explained that the "CCME (2017) EQGs include guidelines that are routinely used to assess potential effects to wildlife, including higher trophic levels (e.g., the soil and water quality guidelines for agricultural livestock)." There appears to be disagreement here between EMAB and DDMI regarding the protection of higher trophic levels when defaulting to CCME EQGs. It is also currently not clear what other options are available to DDMI because EMAB did not provide examples of what other guidelines or approaches could be used in such cases.

- ***SSRBCC Revision #2: DDMI is to engage with EMAB on the issue of protection to higher trophic levels when revising SSRBCC and explain how EMAB's concerns have been addressed.***

EMAB discussed the guideline that was used for the concentration of lead in drinking water (EMAB comments 131 and 179). EMAB recommended a different value based on its statement that "[r]ecent science has indicated that a blood lead level of 10 dL/L (which is the basis of the HC DWQG) may be non-protective. HC is in the process of revising the DWQG, and until such time has indicated reliance on the TRVs in JHSC, 2010 if evaluation of lead is required." The choice of guideline is relevant here because it would influence whether lead gets screened in as a COPC for humans and would be the guideline that is defaulted to if no SSRBCC is derived. In response to EMAB comment 131, DDMI explained that the reference to JHSC (2010) could not be found in HC documentation. The Board understands that the comment from EMAB meant to reference an article published in the European Food Safety Authority (EFSA) Journal;[90] however, it remains unclear where and how HC has relied on this article.

- ***SSRBCC Revision #3: DDMI is to engage with EMAB on the issue of which lead guideline to apply for drinking water quality for humans when revising SSRBCC and explain how EMAB's concerns have been addressed.***

B. Clarity around final choice of SSRBCC when more than one is derived for a given parameter:

The derived SSRBCC are summarized in tables in Appendix V of the interim CRP Version 4.0. SSRBCC are presented for a variety of receptors and there are cases where more than one SSRBCC has been derived for a given parameter. For example, Appendix V includes a drinking water SSRBCC for humans (adult and toddler), five different types of birds (sandpiper, duck, ptarmigan, falcon, and eagle), and four different types of mammals (caribou, bear, fox, and vole). There were many comments regarding a lack of clarity about which SSRBCC will actually be used for each parameter, with a general recommendation that the

[90] EFSA Panel on Contaminants in the Food Chain, 2010. Scientific Opinion on Lead in Food. EFSA Journal 2010 8(4):1570.

most conservative one should be selected (EMAB comments 51, 100, 102, 103, 129, 155, 164, 178, and 190). In its responses, DDMI indicated its preference to maintain all the derived SSRBCC for transparency, but the Board agrees that it is currently difficult to determine what the final closure criteria would be because DDMI has not explicitly identified the closure criteria for each parameter and one would need to consult multiple sources for the derivation of the SSRBCC.

- ***SSRBCC Revision #4: In order to improve the transparency and clarity of drinking water SSRBCC, DDMI must provide a comprehensive table that illustrates all the derived SSRBCC for humans, mammals, and birds, and include a summary column that indicates the proposed closure criteria for a given parameter.***

C. Technical considerations related to SSRBCC derivation:

EMAB provided comments related to the toxicity testing endpoints used in the SSRBCC derivations (EMAB comments 98, 99, and 157) and several comments about including food chain exposure in the derivation of SSRBCC (EMAB comments 140, 149, 152, 159, and 179). While the comments discussed concerns, recommendations and possible solutions were not clear. DDMI provided a response to the comments from EMAB and explained that they have generally followed CCME guidance. It is currently not clear whether this response addressed all of EMAB's concerns.

- ***SSRBCC Revision #5: DDMI is to engage with EMAB on their comments related to toxicity testing endpoints (i.e., EMAB comments 98, 99, and 157) and food chain exposure in the derivation of SSRBCC (i.e., EMAB comments 140, 149, 152, 159, and 179) when revising SSRBCC and explain how EMAB's concerns have been addressed.***

EMAB discussed concerns about toxicological information that was excluded from the derivation of the SSRBCC and lack of clarity around how ROCs should be representative of a guild, not a specific species (EMAB comments 138 and 139). In its responses, DDMI explained that it would provide clarifications in Version 4.1 of the interim CRP (see Table 3 below).

- ***SSRBCC Revision #6: DDMI is to provide justification for the exclusion of any toxicological data, as explained in the follow-up response from EMAB.***[91]

EMAB provided recommendations for soil and sediment SSRBCC derivations for human exposure (EMAB comments 141 and 142). EMAB recommended that particulate inhalation should be added to the derivation of SSRBCC for contact with soils by humans (EMAB comment 141). EMAB stated that it is "an exposure pathway that is routinely considered in the derivation of standards/guidelines and is considered additive with the oral and dermal exposure routes." In its response, DDMI argued that this is not necessary because exposure will be below total suspended particles (TSP) criteria that have been developed for the Project. EMAB's point, however, appears to be related to the possibility of additive effects and it is not clear whether this concern is ruled out even if exposure is expected to be below the TSP criteria.

- ***SSRBCC Revision #7: DDMI is to address the potential concern of additive exposure to soil contaminants via particulate dust inhalation in its derivation of SSRBCC for contact with soil to humans.***

[91] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Review Summary and Attachments - Aug 13_18.pdf; pg. 442

EMAB recommended consideration of human exposure to sediment in derivation of the SSRBCC (EMAB comment 142). In its comment, EMAB stated "[h]uman exposure to sediment is a pathway to which Health Canada provides guidance for, and they have included low frequency/low duration exposures in their guidance document." EMAB also acknowledged that the guidance document is a recent publication by HC. In response, DDMI explained that expected exposure would be brief and limited to small surface area of the body and concluded that the potential risk to human health is negligible. DDMI also stated that "Health Canada (2010) does not provide guidance on the assessment of dermal contact with sediment; therefore, human exposure to sediment was not considered in the derivation of SSRBCC.". There appears to be a difference of opinion or interpretation on the guidance from HC, thus it is not clear whether it is reasonable to expect derivation of an SSRBCC in this case. Although the HC guidance document referenced by DDMI does not appear to include guidance on sediment contact, it does address contact with soil; it is not clear why the guidance for soil contact cannot be applied to sediment.

- ***SSRBCC Revision #8: DDMI is to explain whether it would be appropriate to apply the guidance for soil contact to sediment contact by humans and, if appropriate propose revised sediment SSRBCC.***

D. Revisions to Appendix V of the CRP and Appendices X-8.1 and X-8.2

Table 3 below outlines a list of additional revisions related to the SSRBCC Report (i.e., Appendices X-8.1 and X-8.2) and its incorporation into Appendix V of CRP Version 4.0. These revisions reflect clarifications requested by reviewers, which could easily be addressed by DDMI. In some cases, the clarifications were provided by DDMI in their responses and it would be helpful to incorporate the information in future versions of the SSRBCC Report. In other cases, DDMI indicated that it would provide clarifications in the next version of the interim CRP.

- ***SSRBCC Revision #9: DDMI is to incorporate revisions as outlined in Table 3.***

Table 3. Summary of Additional SSRBCC-related Revisions for Version 4.1 of the interim CRP

Issue	Revision	Comment ID
Revisions to Appendix V	Revise how SSRBCC information was included in Appendix V and update tables in Appendix V for consistency with the SSRBCC reports.	EMAB 97, 119, 120, 121, 122, 123, 125, 126, 128, 182, 183, 184, and 185.
Revisions to Appendix V	Revise the incorrect statement: "the human health SSRBCC for uranium of 0.02 mg/L is lower than the AEMP Benchmark for the protection of aquatic life (0.015 mg/L)", because 0.015 mg/L is smaller than 0.02 mg/L.	EMAB 180; WLWB Staff 29
Revisions to Appendix X-8.1	In consideration of EMAB's comments/recommendations, a clarification regarding the source of the "Project-specific Drinking Water Benchmarks" should be provided with Table 2.4-12.	EMAB 104, 130, and 151.
Revisions to Appendix X-8.1	Update aesthetic objective for xylenes in Table 2.4-12 to the correct Health Canada Drinking Water Quality Guideline.	EMAB 133
Revisions to Appendix X-8.1	Clarify that molybdenum was considered a COPC for human health.	EMAB 135

Issue	Revision	Comment ID
Revisions to Appendix X-8.1	Clarify why aluminum was not retained as a COPC for drinking water.	EMAB 136
Revisions to Appendix X-8.1	In consideration of EMAB's comments/recommendations, clarify the use of toxicological data and how ROCs should be representative of a guild, not a specific species.	EMAB 138 and 139
Revisions to Appendix X-8.1	In consideration of EMAB's comment/recommendation, revise discussion of bioaccumulation in fish.	EMAB 143
Revisions to Appendix X-8.1	In consideration of EMAB's comment/recommendation, a clarification regarding the use of AEMP benchmarks should be provided with Table 2.4-3. This could be a footnote reference to the AEMP Design or referring to "Diavik Diamond Mine Benchmarks" as "AEMP Benchmarks".	EMAB 148
Revisions to Appendix X-8.1	In consideration of EMAB's comment/recommendation, revise Figure 2.5-1.	EMAB 152
Revisions to Appendix X-8.1	In consideration of EMAB's comment/recommendation, revise Figure 2.5-2.	EMAB 153
Revisions to Appendix X-8.1	Revise incorrect information provided in Table 3.3-1 and clarify rationale for choice of CCME Interim Sediment Quality Guidelines as SSRBCC.	EMAB 156
Revisions to Appendix X-8.2	Provide more detailed summaries of how specific studies were used to develop the SSRBCC	EMAB 101
Revisions to Appendix X-8.2	Correct inconsistencies between values of the main text and those in supporting appendices within Appendix X-8.2.	EMAB 118, 155, and 164
Revisions to Appendix X-8.2	Clarify how exposure to food was considered/included in the derivation of SSRBCC for birds of prey.	EMAB 154
Revisions to Appendix X-8.2	In consideration of EMAB's comment/recommendation, include revisions to address defining protection goals and acceptable levels of effect.	EMAB 158
Revisions to Appendix X-8.2	Provide additional information to support the Toxicity Reference Values used.	EMAB 160 and 161
Revisions to Appendix X-8.2	Revise Toxicity Reference Values for molybdenum and selenium.	EMAB 163

Other Revisions to Closure Criteria for SW1, P1, NI2, NI3, I2, and I3

As previously described, SSRBCC are being proposed as closure criteria for the following closure objectives: SW1, P1, NI2, NI3, I2, and I3. The paragraphs above outline comments and recommendations related specifically to SSRBCC. Other comments were received about these closure criteria that are not necessarily directly related to concerns about the use or derivation of SSRBCC (see Table 4 below). DDMI indicated in its responses that it would consider the recommendations and address them with revisions in Version 4.1 of the interim CRP. Table 4 below outlines a list of revisions that reflect DDMI's responses during the public review.

- ***Revision #30: Incorporate revisions to Version 4.1 of the interim CRP as outlined in Table 4.***

Table 4. Summary of Chemical Closure Criteria Revisions for Version 4.1 of the interim CRP

Issue	Revision	Comment ID
SW1 - PKC seepage and closure criteria	Include a comparison of water quality predictions for PKC seepage to the closure criteria for objectives SW1 and SW2, and revise criteria accordingly, if required.	ECCC 7; WLWB Staff 15
SW1 - closure criterion for uranium	Reconsider drinking water criterion for uranium and report findings.	EMAB 53 and 181
Closure criteria for objective P1	In consideration of EMAB's comment/recommendation, reconsider and revise Appendix V Table V-4.	EMAB 85
Closure criteria for objective NI2	In consideration of EMAB's comment/recommendation, reconsider and revise sediment quality closure criteria related to NI2.	EMAB 89
Closure criteria for objective NI3	In consideration of EMAB's comment/recommendation, reconsider and revise sediment quality closure criteria related to NI3.	EMAB 90

Chemical Closure Criteria Issue #2: Criteria for Closure Objective SW2

Closure objective SW2 is stated as follows: "Surface runoff and seepage water quality that will not cause adverse effects on aquatic life or water uses in Lac de Gras or the Coppermine River." Closure criteria for SW2 are based on the use of water quality standards – AEMP Benchmarks in this case – for the protection of aquatic life. For clarity, DDMI did not use SSRBCs for closure objective SW2. As explained by DDMI, "A back-calculation approach was used to estimate the runoff/seepage concentration of each water quality parameter required to anticipate receiving water concentrations below the AEMP benchmark in Lac de Gras at the assessment boundary." This back-calculation approach included four assumptions/considerations:

- The Effect Magnitude defined as being 20% greater than the AEMP Benchmark, which is defined as a High Effects Magnitude in the CSR;
- Background water quality assumed to be the median open water concentration as defined in the AEMP Reference Conditions Report[92]
- A dilution factor assumed to be 85. DDMI explained that this came from the EA[93] and "was determined based on modelling of runoff to Lac de Gras and represents the expected level of dilution that would occur within 1 km";[2] and
- A 1 km assessment boundary, which DDMI explains also came from the EA and is defined as the "local" assessment area in the CSR.

Closure criteria have been previously discussed through review and consideration of DDMI's CRP for the WRSA. Following Version 1.0 of the WRSA CRP, the Board proposed a workshop to help address unresolved issues with DDMI's proposed criteria.[94] In its decision for Version 1.1 of the WRSA CRP, the Board stated that it "is of the view that DDMI has significantly improved the criteria. Nonetheless, outstanding issues remain, and closure criteria are not ready for final approval."[95] Many of these

[92] See WLWB Online Registry for Diavik - AEMP Reference Conditions Report - Version 1.3 - Apr 12_18.pdf

[93] See WLWB Online Registry for Diavik - Final Closure and Reclamation Plan - WRSA - Version 1.1 - Dilution Factor Info from EA - September 1998 - Jun 23_17.pdf.

[94] See WLWB Online Registry for Diavik - Final Closure and Reclamation Plan - WRSA - Directive and Reasons for Decision - Dec 16_16.pdf

[95] See WLWB Online Registry for Diavik - Final Closure and Reclamation Plan - WRSA - Version 1.1 - Board Directive and RFD - Aug 23_17.pdf

outstanding issues were raised in review of the interim CRP Version 4.0 and remain unresolved. These are discussed further in the paragraphs below.

The Effect Magnitude (i.e., 20% increase over benchmark) along with the use of a 1 km mixing zone is generally not supported by reviewers. ECCC stated that "given the small volumes likely to be discharged, setting the assessment boundary at 1 km inflates the proposed criteria beyond a realistic scenario of seepage/runoff concentrations during closure" (ECCC comment 3). The GNWT-ENR stated that it "shares the view that numerical criteria that define long-term exceedance of aquatic effects benchmarks within Lac de Gras for distances more than 1 km from shore are not acceptable" (GNWT-ENR comment 4). Several comments from EMAB indicated it was inappropriate to base the Effect Magnitude and the mixing zone of 1 km on the CSR (EMAB comments 38, 39, 57, 58, 197, and 198). EMAB explained that the objectives of the EA and those of closure are not the same; there is a difference between aiming to provide water quality that will not adversely affect aquatic life at closure versus aiming to avoid "significant" effects during the EA phase.

In response to EMAB comments 38 and 39, DDMI explained that EMAB appears to have misunderstood the extent (i.e., area) of effect that is being used to help establish closure criteria – by saying that DDMI is using the "significant adverse extent", EMAB is suggesting that the effect, as defined in the CSR, is regional which would be the whole lake, whereas the 1 km area is representative of the "local" area. Although there may be a misunderstanding regarding the area of extent as defined in the CSR, EMAB was still clear about its lack of support for the use of a 1 km mixing zone (EMAB comments 110, 112, 170, 171, and 187).

In response to EMAB comments 57 and 58, DDMI stated that "most mine areas [sic] designs are not expected to be able to achieve CCME water quality guidelines for protection of aquatic life prior to discharge to Lac de Gras", which is why they are proposing a regulated mixing zone. EMAB acknowledged that there may be a need for a small mixing zone but stated that the "onus in on Diavik to demonstrate that such mixing zones are needed using modelling that reflects the actual character of runoff and seepage that can be predicted to occur post-closure, based on existing data…" (EMAB comment 41). The GNWT-ENR recommends that a 60 m mixing zone be established, which was based on calculations provided by DDMI in response to Board direction on the WRSA CRP,[96] but acknowledges that some parameters might be problematic (GNWT-ENR comment 9).

Reviewer comments also highlighted issues with the proposed dilution factor and the lack of information on predicted seepage beyond the WRSA. DDMI has utilized a dilution factor of 85:1 stating this is the same factor used during the EA. EMAB explained that the applicability of the chosen dilution factor to post-closure conditions should be supported with updated predictions that take into account all potential discharge points (EMAB comments 55, 56, and 199).

Reviewers also identified issues with the predictions that DDMI used to justify the need for a 1 km mixing zone. ECCC pointed out that modelling of the PKC Area at closure has not been completed (ECCC comment 7) and EMAB noted that closure criteria for SW2 are based on predictions from the WRSA, not other mine components (EMAB comment 49). EMAB discussed the possibility that contaminant loads over time could decrease dilution available in Lac de Gras, suggesting that using baseline concentrations may not be the best approach when trying to predict concentrations in Lac de Gras at closure (EMAB comment 196). Finally, DDMI was asked about its decisions on which type of waste rock will end up being used in closure

[96] See WLWB Online Registry for Diavik - Final Closure and Reclamation Plan - WRSA - Response to WLWB Directive - Review Summary and Attachments - Nov 20_17.pdf (GNWT-ENR Comment 1 and 5)

activities because this would affect the concentration of metals in seepage from the Project area (WLWB staff comment 3).

Overall, the general issue here appears to be that DDMI is back-calculating criteria from a large mixing zone area (i.e., 1 km), rather than calculating forward to determine what size of mixing zone would be needed based on predicted concentrations. In addition, the predicted concentrations being used in the comparison of the back-calculated values are not inclusive of all the mine components or potential discharge points. In Version 3.2 of the interim CRP, DDMI indicated that an evaluation of mixing characteristics at the different discharge points would be one of the steps involved in determining water quality closure criteria. Specifically, in the pre-amble to Appendix V of the interim CRP Version 3.2, DDMI stated the following:

> The values presented for water entering Lac de Gras are concentrations in a runoff or seepage water entering Lac de Gras, that once mixed with Lac de Gras water would not impact on water uses in Lac de Gras (i.e. aquatic life or drinking water). They are initial planning values. In the absence of specific mixing characteristic information for each anticipated seepage/runoff discharge point, DDMI has used a dilution factor of 23 for initial planning purposes. The area of Lac de Gras where a 23 times dilution factor (mixing zone) is achieved will be different for each anticipated discharge point depending upon the actual mixing characteristics at each location. DDMI will assess the mixing characteristics for each anticipated discharge point. In the future DDMI will consult with WLWB, government and communities regarding the maximum acceptable aerial extent of closure mixing zones. All of this information will then be used to revise the values in Table V-7, as required, to consider discharge specific mixing conditions.

It is not clear why DDMI is no longer seeming to plan on completing these steps prior to finalizing closure criteria for SW2. The proposed steps outlined in Version 3.2 of the interim CRP would appear to help address some of the reviewers' concerns and allow for a more fulsome consideration of an appropriate mixing zone size. DDMI is currently proposing a dilution factor of 85:1 (based on the CSR), whereas Version 3.2 of the interim CRP proposed a dilution factor of 23:1 (based on the use of the diffuser). In the Board's Reasons for Decision for Version 1.1 of the interim WRSA CRP, the Board stated that the "estimated dilution that will occur by the edge of the mixing zone (85 times) may require refinement. A plume delineation study may help to resolve this issue; however, it is not clear if a study is feasible".[97] During the public review for CRP Version 4.0, DDMI was asked about the merits and feasibility of undertaking a plume delineation study (WLWB staff comment 26). DDMI responded that it would be difficult to complete and that they did not understand the purpose. While the purpose would be to help refine the dilution factor, DDMI did not identify the limitations thus it is not possible to comment on the feasibility of a plume delineation study at this time. It is clear that steps are needed to refine the dilution factor in order to help finalize closure criteria for SW2. DDMI has not explained its plan to complete this task.

Another general issue is that DDMI has not demonstrated that it has fully considered alternative options for parameters that are not predicted to meet CCME guidelines prior to reaching Lac de Gras. EMAB noted how the proposed closure criteria for copper and silver were adjusted to ones higher than the back-calculated values in order to be "achievable" and that it considered this to be unacceptable (EMAB comment 114). EMAB explained similar concerns related to nitrogen compounds (EMAB comment 115).

[97] See WLWB Online Registry for Diavik - Final Closure and Reclamation Plan - WRSA - Version 1.1 - Board Directive and RFD - Aug 23_17.pdf

In addition, EMAB indicated that the use of MMER limits as closure criteria, for achievability reasons, for some of the parameters is also not appropriate (EMAB comments 111 and 117). Finally, EMAB noted that allowing seepage that does not meet CCME guidelines to enter Lac de Gras does not match what was committed to in the EA and noted that the CSR indicated that DDMI had proposed to collect and treat runoff as long as water quality parameters exceed aquatic life thresholds (EMAB comment 40).

In response to EMAB comment 40, DDMI noted that Closure Goal #8 of the CRP states: "Final site conditions that do not require a continuous presence of Mine Staff." DDMI pointed out that this closure goal is consistent with the Closure Planning Guidelines, which favour the absence of long-term maintenance. It is not clear, however, that DDMI has fully explored mitigation options. This is reflected in the GNWT-ENR comment 4 that states: "closure criteria should be defined based on what the mine closure is expected to achieve, not on what the currently proposed closure measures can achieve." This is also reflected in the GNWT-ENR comment 9 that noted that other options (e.g., passive treatment) for addressing problematic parameters have not been discussed by DDMI. Further, as discussed above, it is not clear that predictions are refined enough to justify a 1 km mixing zone.

Based on the above discussion, DDMI still has some work to do in order to develop closure criteria for SW2 that will be acceptable to all parties. To accomplish this, the Board has determined that the following steps are necessary:

1. If DDMI wishes the Board to consider the use of a regulated mixing zone for setting closure criteria, it should more clearly outline the information as required by the Mixing Zone Guidelines (see Section 6.0 of the Mixing Zone Guidelines).
2. A better understanding of the following is needed to help demonstrate whether a regulated mixing zone will be required:
    a. The expected dilution in Lac de Gras at the various potential discharge points; and
    b. Water quality predictions for water in all potential discharge streams and in Lac de Gras.
3. Consideration and discussion of options to address potentially problematic parameters (e.g., different mixing zones and passive treatment).

These steps are reflected in the following revisions to be included in Version 4.1 of the interim CRP:

- ***Revision # 31: For closure objective SW2:***
    - ***a) Refine and compile predictions for water quality in all streams entering Lac de Gras in consideration of the different sources (e.g., WRSA and PKC Facility) and possible dilution prior to entry into the lake;***
    - ***b) Follow the steps required by the Mixing Zone Guidelines (see Section 6.0) and provide evidence to demonstrate the smallest practicable mixing zone;***
    - ***c) Outline a plume delineation study plan and/or provide substantive information to refine the dilution factor;***
    - ***d) Revise closure criteria for SW2 based on the results of (a) through (c);***
    - ***e) Provide evidence to support the achievability of proposed closure criteria; and***
    - ***f) Include a consideration and discussion of alternative options to address potentially problematic parameters (e.g., different mixing zones, passive treatment, and changes to the proposed closure design).***

One of the topics that remains unresolved is related to DDMI's proposal to apply a 20% increase to the AEMP Benchmarks when developing its closure criteria. The Board has previously identified this as an unresolved issue and stated that inflating the benchmarks is not standard practice.[98] The Board also stated that this proposal "would result in a higher standard of protection during operations than during closure, and it is not clear what the basis for this approach is or that this would allow DDMI to meet its closure objectives." At this time, it is not clear whether the issue of applying a 20% increase to benchmarks will need to be resolved because DDMI is required to refine and compile its water quality predictions for Lac de Gras at closure and demonstrate the smallest practicable mixing zone based on the steps in the Mixing Zone Guidelines (see Revision #31).

A couple of other unresolved issues related to closure criteria for SW2 include the list of parameters for which closure criteria have been presented, and the potential for acute toxicity of some of the proposed closure criteria. With respect to the list of parameters that have closure criteria, the selection process for these parameters was questioned, identifying that it was not clear what variables were considered for inclusion and not all variables with AEMP Benchmarks are included in the list (WLWB staff comment 25). In response, DDMI committed to providing a clarification for this process in Version 4.1 of the interim CRP (see Appendix B).

With respect to acute toxicity, ECCC noted that "criteria for numerous parameters are set at or above levels where acute lethality to fish would be expected" (ECCC comment 5). DDMI's response suggested that this could be addressed with toxicity testing; however, back-and-forth communication between ECCC and DDMI indicated that implementing this practice at closure presents feasibility challenges.[99] The required revision provided above (i.e., Revision #31) is for DDMI to take a number of steps to help refine the closure criteria for SW2. It is possible that once the closure criteria are revised to address Revision #31, none of the parameters will be set at levels were acute toxicity is expected. To be sure, DDMI must address the potential for acute toxicity when revising the closure criteria for SW2.

- ***Revision #32: Confirm that the proposed closure criteria for SW2 are below acute toxicity levels and include recommendations for how it will address parameters that show the potential to be acutely toxic.***

DDMI made other commitments in its response to comments regarding revisions associated to closure criteria for SW2 (EMAB comments 117, and 172 to 176; WLWB staff comment 27). These have been summarized in Appendix B.

<u>Chemical Closure Criteria Issue #3: Overlap Between Water Quality Criteria for Closure Objectives SW1 and SW2</u>

EMAB comment 190 states that there should only be one closure criterion per parameter. This was previously discussed with respect to parameters for which multiple SSRBCC were developed for drinking water (see section 4.1.3.2.1.2B). This concern, however, extends to overlap between closure criteria proposed for SW1 and SW2, which are both for surface runoff and seepage. Criteria for SW1 aim to be protective of humans and wildlife while criteria for SW2 aim to be protective of aquatic life in Lac de Gras. This means that surface runoff and seepage water quality must be protective of humans, wildlife, and

[98] See WLWB Online Registry for Diavik - Final Closure and Reclamation Plan - WRSA - Version 1.1 - Board Directive and RFD - Aug 23_17.pdf

[99] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Review Summary and Attachments - Aug 13_18.pdf

aquatic life in Lac de Gras. The interim CRP Version 4.0 offered clarification of where the SSRBCC would apply. As described in Appendix V, SSRBCC for drinking water would apply wherever water could be consumed by people or wildlife. This includes direct consumption of seepage/runoff or consumption of Lac de Gras water in proximity to where the seepage/runoff is released. This also supports the idea that surface runoff and seepage water quality must be protective of humans, wildlife, and aquatic life in Lac de Gras. To be protective of all three, it would seem that the most conservative of the three derived criteria would need to be applied. In response, DDMI stated the following:

> DDMI accepts that in some instances the lowest closure criteria for a parameter could be used as the only closure criteria in principle. For example if the back-calculated closure criteria for protection of aquatic life results in a runoff closure criteria that is lower than the wildlife closure criteria for direct consumption of runoff water then aquatic life runoff criteria could be applied as the only closure criteria. DDMI's preference is to continue to keep these separate at this time to ensure ongoing transparency on the basis for the closure criteria.

The Board has determined that the issue of transparency and clarity could be resolved by providing one comprehensive table for surface runoff and seepage water quality that shows all the derived closure criteria, with a summary column that shows the one that is being selected for a given parameter.

- ***Revision #33: Include in Appendix V of the interim CRP Version 4.1, a comprehensive table for surface runoff and seepage water quality that shows all the derived closure criteria, with a summary column that shows the one that is being selected for a given parameter***

The above response by DDMI suggests that using only one closure criteria for a parameter could work in cases where the criterion for the protection of aquatic life is lower than the criterion for drinking water. It is not clear, however, what would happen in the opposite situation, where the drinking water criterion is lower than the criterion for the protection of aquatic life. This specific question was raised for uranium (EMAB comments 53, 181, and 195). The uranium SSRBCC value (i.e., the currently proposed SW1 closure criterion for uranium) is lower than the uranium closure criterion for protection of aquatic life. While DDMI may be able to achieve the proposed uranium closure criterion for aquatic life in Lac de Gras, achieving the drinking water SSRBCC in surface runoff/and seepage does not appear to be achievable. DDMI has discussed mitigation options for addressing surface runoff and seepage that exceeds the drinking water SSRBCC (i.e., DDMI says it can cover areas on land with rock to prevent access by humans and wildlife). It has not, however, discussed any practical way of restricting access to Lac de Gras for humans and wildlife. EMAB recommended that the criterion for uranium be reconsidered (EMAB comments 53, 181, and 195) and DDMI committed to reconsidering this as part of Version 4.1 of the CRP (see Table 4).

In general, if there are other cases where DDMI does not intend to use the most conservative criterion, then it raises the question of how safety to humans and wildlife that may be exposed to Lac de Gras can be ensured. The Board has required this be considered and addressed, with rationale, by DDMI in Version 4.1 of the interim CRP.

- ***Engagement Requirement #6: Engage with parties regarding the question of how the safety of humans and wildlife in Lac de Gras will be ensured in cases where the closure criterion for SW2 is lower than the closure criterion for SW1 and provide a detailed explanation for any revisions proposed to address this issue.***

Chemical Closure Criteria Issue #4: Closure Criteria that are an AEMP Benchmark

DDMI has proposed the use of the AEMP Benchmarks as closure criteria for three of the closure objectives: M1, M2, and NI5. The objectives and associated criteria apply to the water quality in the open pits, the underground and dyke areas, and the North Inlet.

EMAB indicated that the use of the AEMP Benchmarks as proposed by DDMI does not achieve closure objective M1, which includes the objective of having water quality in the flooded pit and dyke area be similar to Lac de Gras (EMAB comment 75). EMAB also had some reservations about using the AEMP Benchmarks as criteria for closure objective M2 because more information is needed about where in the pits they will apply (EMAB comment 76). In both cases, DDMI responded that they would consider the recommendations and include revisions in Version 4.1 of the interim CRP. This is reflected in Appendix B.

EMAB commented about closure criteria for closure objective NI5 (EMAB comment 92). In follow-up correspondence with EMAB,[100] EMAB clarified its comment and recommendations regarding NI5. EMAB indicated that there is a lack of clarity with respect to the use of the AEMP Benchmarks for water quality: "it is not clear how these will interact with SW1 and SW2 that would also apply if used site-wide, or what locations would be used in the North Inlet to apply the aquatic effects benchmarks." EMAB also noted that "[s]ediment quality is not addressed in any of the DDMI criteria for Objective NI5, though it is clearly part of the objective." The AEMP Design does include Effects Benchmarks for sediment quality variables, thus it is possible that these are the criteria that DDMI means to apply to sediment quality. DDMI did not, however, provide a clarification on this topic in response to EMAB's correspondence. EMAB's clarification also notes that there are sediment quality criteria proposed for the North Inlet via closure objective NI2 and explains that there is a need to understand "whether the application of the criteria specified for NI2 will be sufficient to also achieve NI5 - or any changes that would be required."

- ***Revision #34: In Version 4.1 of the interim CRP, address the clarifications requested by EMAB (in the follow-up correspondence received by on EMAB comment 92) and clarify which closure criteria are being proposed for sediment quality.***

3.6.2 Non-chemical Criteria

The subsections below discuss other criteria that are non-chemical (e.g., physical stability of structures and re-vegetation targets).

Non-chemical Criteria Issue #1: DDMI's Proposed Criteria Involving Final Inspection and As-builts

For several objectives, DDMI has proposed one or both of the following two criteria:

- Satisfactory final inspection by a professional engineer; or
- As-built conforms adequately with approved design.

These two criteria were proposed for several closure objectives, most of which have long-term performance aspects to them (i.e., SW6, SW11, M3, M5, P2, P3, W1, W2, W3, and NI6). There were many reviewer comments on these two criteria. The GNWT-ENR commented that conformance with a final design is not enough to demonstrate long-term performance and recommended that DDMI develop

[100] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Review Summary and Attachments - Aug 13_18.pdf; pg. 441

numeric criteria (see GNWT-ENR comments 4, 10, and 11). The GNWT-ENR included specific recommendations for how DDMI could achieve this (see GNWT-ENR comments 10, 11 and 16).101

Similarly, EMAB commented that:

> [The] designs do not necessarily provide information to conclude that all of the objectives have been considered in developing the design, or for reviewers to evaluate the extent to which the objectives will be achieved if the design is implemented as proposed. Also, even if the design is implemented as proposed, final performance may be different than what is predicted in the design (see EMAB comments 43, 44, 45, 81, 87, 93, 201, and 202).

EMAB made specific recommendations to improve these criteria, for example using design criteria (e.g., factors of safety and design seismic events) as closure criteria and defining criteria for slope movement, settlement, erosion rates, and thermal performance (EMAB comments 74, 78, 86, and 206). EMAB also proposed specific criteria for waste rock stability to address for example, grading and settlement, slope stability, till slope creep, etc. (EMAB comment 212).

In response to these reviewer comments, DDMI agreed to develop numeric criteria in Version 4.1 of the interim CRP, where possible (see DDMI responses to comments identified above), although its not clear to what extent DDMI will do so.

Generally, the Board agrees with the reviewer comments and recommendations. Final inspection and conformance with as-builts to design may be useful as part of a larger set of criteria. However, for several reasons, the Board is aware of the view that, these two criteria on their own are not enough to measure long-term performance. For example, designs may not include a full set of criteria for long-term performance. As noted by the GNWT-ENR, DDMI "incorrectly assumes that the designs will include all the necessary information to allow reviewers to have confidence the closure activity was adequately conducted, meet the expectations of communities and therefore achieve the closure objective" (GNWT-ENR comment 4). Even if designs do include a full set of criteria for long-term performance, these can be buried in the design documents, or not stated explicitly as closure criteria, and should therefore be repeated in Appendix V of the interim CRP Version 4.0, so that it is clear what the closure criteria are. Further, as noted by the GNWT-ENR, predictive models used to support the designs are only as good as the assumptions and inputs used in the models (GNWT-ENR comment 10). DDMI can therefore not assume that a design will achieve the performance they predict, an observation also made by EMAB (EMAB comment 43). EMAB summarized it well as follows: "we can design and construct a cover to avoid erosion, but we can only understand its success by observing and measuring post-construction performance, preferably against pre-defined criteria" (EMAB comment 43). For these reasons, and because DDMI has agreed to develop some numeric criteria, the Board has required DDMI to develop numeric criteria for long-term performance.

- ***Revision #35:***
  - ***a) For any criteria proposed as "Satisfactory final inspection by a professional engineer" or "As-built conforms adequately with approved design", propose additional specific (numeric and/or narrative) criteria. These criteria are SW6, SW11, M3, M5, W1, W2, W3, P2, P3, and NI6; and***

[101] See for example, GNWT-ENR comments 10 and 11.

b) In preparing these criteria, DDMI must consider all reviewer recommendations regarding this issue (e.g., EMAB 43, 44, 45, 74, 78, 81, 86, 87, 93, 201, 202, and 212; GNWT-ENR comments 4, 10, and 11).

Reviewers also commented on the lack of a timeframe in these criteria. In other words, the criteria do not indicate how long monitoring must occur to demonstrate that the criteria are met (e.g., EMAB comments 48 and 204). This issue is discussed further in the Security Discussion on long-term monitoring (section 3.7).

- ***Revision #36: Estimate the length of time needed to demonstrate that each criteria has been met and ensure these timeframes match the monitoring period described in the CRP (e.g., Appendix VI-2 of the interim CRP Version 4.0).***

Non-chemical Criteria Issue #2: Criterion for Closure Objective SW10

Objective SW10	DDMI's Proposed Criterion
Safe passage and use for caribou and other wildlife.	No repeated harm to caribou as a direct result of passage through or use of the area. (i.e. if a feature/area is confirmed as being a hazard based on more than one incident then objective is not met for that feature/area).

EMAB commented that DDMI's proposed criterion for closure objective SW10 appears to be appropriate but recommended linking the criteria to "an explicit identification of potential hazards to passage and use for caribou and other wildlife, and a detailed plan for assessment and monitoring of these hazards". EMAB also recommended inclusion of a zone of influence to provide landscape-level data on wildlife use of the post-closure site, and a link to adaptive management responses (EMAB comments 73 and 211). DDMI responded that the interim CRP refers to the Wildlife Effects Monitoring Programs (WEMP) and that DDMI is "working with the TK Panel on developing post-closure monitoring approaches that will be shared with communities and reviewers, and we trust that safe passage and use for caribou and other wildlife will be a priority of a Traditional Knowledge monitoring program" (response to EMAB comment 73). Information from the TK Panel and communities on potential hazards will be important for finalizing wildlife criteria and monitoring plans, and should be captured in the Traditional Knowledge and Community Participation reclamation research plan so this important work can be documented and tracked.

- ***Revision #37: Identify the need to work with the TK Panel and communities on wildlife criteria and monitoring plans in the Traditional Knowledge and Community Participation Reclamation Research Plan.***

In Appendix VIII-2 (Reclamation Research Plan V2), DDMI commits to several related research tasks, including an assessment of "metals levels in relation to the site-specific risk-based criteria being developed for ecological receptors, or other applicable guidelines", a process for evaluating exposure risk for humans or wildlife, development of a re-vegetation procedure and monitoring plan for review with stakeholders, and stakeholder engagement on re-vegetation procedure.[102] DDMI indicates in the Project Research Schedule that these tasks are planned to be completed in 2018.

- ***Revision #38: Report on the results of all completed tasks in the Infrastructure Area Reclamation Research Plan (RRP) and describe how the results impact criteria for closure objective SW10.***

[102] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Appendices I to VIII - Apr 20_17.pdf

Non-chemical Criteria Issue #3: Criterion for Closure Objective SW4

Objective SW4	DDMI's Proposed Criterion
Dust levels do not affect palatability of vegetation to wildlife	Monitoring evidence of post closure wildlife use of area

EMAB commented on the criterion for closure objective SW4 stating that "the criterion as stated lacks any stated threshold for testing whether the criterion has been successfully met, and thus cannot be applied" and "any evidence of post-closure use by wildlife would be sufficient to demonstrate successful achievement of the objective" (EMAB comment 61). EMAB recommended that the "criteria associated with objective SW4 should be focused on two different factors, noting that caribou are a focal receptor: 1. Measurements of post-closure deposition of fugitive dust... 2. Assessment of post-closure habitat use" (EMAB comment 61). DDMI responded that the current criterion "is intended as a more holistic criteria" (response to EMAB comment 61). DDMI was asked to explain "what monitoring evidence would be used to support this closure criteria" to which DDMI responded "[p]resence of caribou and/or other wildlife in the area" (WLWB staff comment 23).

The Board acknowledges that assigning criteria to this objective could be challenging. While the Board agrees with EMAB that the current criterion is difficult to apply, EMAB's criteria recommendations do not necessarily address palatability of the vegetation to wildlife specifically. DDMI has committed to further understanding the risk to caribou ingesting particular metals in vegetation (section 5.2.8.6). However, in relation to palatability, DDMI's current criterion does not provide a threshold to measure when the criterion would be successfully met (e.g., would only 1 caribou eating vegetation satisfy the criterion?). The Board believes additional engagement would benefit this issue. Ideally, DDMI could complete engagement on this for the interim CPR Version 4.1, however, given the many other issues that require engagement prior to submission of the interim CRP Version 4.1, and the lack of urgency with this criteria, addition of this task to a research plan would also be appropriate.

- ***Revision #39: Add research task to the Traditional Knowledge and Community Participation Reclamation Research Plan to determine how to measure palatability of vegetation to wildlife with the aim of informing the closure criteria for closure objective SW4, in consideration of EMAB's comments (61-63 and 208-210).***

Non-chemical Criteria Issue #4: Criterion for Closure Objective SW7

Objective SW7	DDMI's Proposed Criterion
Areas in and around the site that are undisturbed during operation of the mine should remain undisturbed during and after closure	Mine footprint area less than 13 km^2 post-closure (footprint is the directly-disturbed area as used in the Wildlife Effects Monitoring Program for direct habitat/vegetation loss)

EMAB recommended that DDMI provide specific measures to support the objective, and suggested as an example, that DDMI could provide a total projected footprint area and a limit on how much the footprint could increase (EMAB comment 69). DDMI responded that the criteria include a projected footprint area and noted that the methods used for this measurement and the current extent of the footprint can be found in the WEMP. DDMI in part addressed EMAB's comment, since the criterion includes a projected footprint area. However, it is difficult for the reader to assess DDMI's proposed area, unless the reader consults the WEMP, which is not a document required by DDMI's Water Licence, and is not necessarily easy for the reader to access. The Board believes the relevant information in the WEMP should be more

readily available. Also, DDMI should clarify how much of an increase over the current footprint is being proposed, either within the criteria itself or as an explanation elsewhere in the interim CRP, and how this relates to predictions during the environmental assessment.

- ***Revision #40: Include a map of the current footprint and indicate how much of an increase is represented by the maximum footprint (currently proposed as 13 km^2) compared to the operational footprint, and how this relates to predictions during the environmental assessment.***

Non-chemical Criteria Issue #5: Criterion for Closure Objective SW8

Objective SW8	DDMI's Proposed Criterion
No increased opportunities for predation of caribou compared to pre-development conditions.	Caribou predation directly attributable to a landscape feature unique to this area does not result in increased overall predation on the herd.

EMAB commented that the objective and criteria "do not have effective indicators that are measurable, do not have identified thresholds, and do not appear to support a timely response" and noted that "some closure design elements appear to be potentially contradictory to objective SW8". EMAB made several recommendations to remedy this (EMAB comment 70). In response, DDMI stated that it "generally agrees that if this closure criterion is approved, specific analyses will be required to both obtain estimates of herd predation rates and post-closure monitoring and assessment of any predation events on site." DDMI's response suggests that this information would be provided following approval of the criterion, while EMAB's comment appears to suggest that this information is needed prior to approval. The Board agrees with EMAB that the criterion does not describe how overall predation will be determined, and therefore does not meet the definition of a criteria, which must be able to "measure the success of selected closure activities in meeting closure objectives."

- ***Revision #41: Update this criterion so that it can measure the success of closure objective SW8 or present a schedule for acquiring the information necessary to propose a measurable criteria in the final CRP.***

Non-chemical Criteria Issue #6: Criteria for Closure Objective SW9

Objective SW9	DDMI's Proposed Criteria
Landscape features (topography and vegetation) that match aesthetics and natural conditions of the surrounding natural area.	• Surface of scarified native material (rock or till); • Mine footprint area less than 13 km^2 post-closure; • Final re-vegetation procedures applied to priority areas; • Change in biodiversity (richness and diversity units) of Regional Study Area less than 1%; • No surface visible buildings, equipment or non-local materials.

EMAB commented that "[t]he proposed DDMI criteria are insufficient to evaluate whether the objective has been met, as they do not address the objective in any direct way" (EMAB comment 71). EMAB recommended that "DDMI should propose criteria that actually allow for an evaluation of whether it has been met" and criteria could include "specifying range of slopes; shapes, sinuosity, and heights of features; types of visible vegetation from important viewscapes; and other aesthetic features, with characteristics on the post-closure mine footprint compared to characteristics of the pre-development and/or reference environment" (EMAB comment 71).

In response to EMAB (comment 71), DDMI stated that "[i]t is DDMI's opinion that the closure criteria specified for SW9 can readily be evaluated to determine if they have been met". DDMI also noted that "the process of engagement and review of the planned post-closure landscape as designs evolve are a more appropriate design approach than attempting to design to abstract concepts like sinuosity". DDMI proposed a new SW9 closure criterion of "as-built drawings submitted with closure completion reports and engagement logs, as required, that conform with landscape feature aspects of approved designs". As discussed above (see Non-chemical Criteria Issue #1), this criterion is not enough on its own and requires additional criteria to demonstrate that the objective has been met.

DDMI also committed to revising the fourth criteria for SW9 (i.e., change in biodiversity of Regional Study Area less than 1%) in response to EMAB and NSMA's comments (EMAB comment 72 and NSMA comment 1). DDMI committed to revising the re-vegetation criteria for SW9 (and SW5) based on reviewer comments and the results of the final re-vegetation research report prepared by the University of Alberta. These commitments, which are reflected in Appendix B, are helpful in evaluating objective SW9; however, additional criteria are needed to SW9.

The Board agrees with EMAB that not all the current criteria for SW9 are specific to the objective and think that some of the proposed criteria seem more like closure activities than criteria. For instance, "final re-vegetation procedures applied to priority areas" is more of a closure activity than a criterion and does not specifically address how success would be measured under this criterion (e.g., no measurement on how the landscape features match natural conditions). The criteria for SW9 must be more specific to how the objective will be met and DDMI should explain how the criteria can be evaluated.

- ***Revision #42: Revise the closure criteria associated with SW9 to be more specific to the closure objective and explain how the criteria can be evaluated.***

3.6.3 Closure Criteria that Include the Phrase "or the result of a detailed Risk Assessment"

A number of closure objectives, including some with both chemical and non-chemical closure criteria, include the following statement as part of the proposed closure criteria: "or the result of a detailed Risk Assessment." This statement is included for the following closure objectives: SW1, SW2, SW3, M1, M2, P1, NI2, NI3, NI5, I2, and I3. For example, closure objective M1 is: "Water quality in the flooded pit and [dyke] area that is similar to Lac de Gras or at a minimum protective of aquatic life" and the closure criteria is "AEMP Benchmark or the result of a detailed Risk Assessment."

GNWT-ENR comment 5 expressed concerns regarding defaulting to a risk-based approach for these closure criteria. These concerns are similar to those discussed in section 4.6.1, whereby the GNWT-ENR "is of the opinion that a risk assessment should be included as a contingency". The GNWT-ENR recommended that "DDMI remove the phrase 'or the result of a detailed Risk Assessment' from the tables for closure criteria" and that "the contingency of a risk assessment to develop alternative closure criteria should then be relocated to the contingency section of each associated mine component". DDMI's response reiterated its argument that "most if not all closure criteria will be risk-based at some level" and used the use of AEMP Benchmarks as an example. The difference between the use of standard guidelines and site-specific risk-based closure criteria has already been discussed in section 3.6.1.

DDMI's response states that a "potential disadvantage of removing this text is that the option for determining criteria based on a risk assessment may be lost if the closure criteria tables are used separate from the main report". The Board does not believe that there is any risk to leaving this text in the criteria tables since any final criteria will need to be approved by the Board. Furthermore, there are some larger

unresolved questions about the use of risk-based approaches that may inform the use of risk-based approaches in the development and finalization of closure criteria. The Board can consider whether DDMI should remove this phrase once the issues around risk assessments are resolved.

3.6.4 Rounding Numerical Criteria

EMAB recommended that a consistent approach should be used for addressing significant figures in the derivation of the Closure Criteria for all management areas (EMAB comment 109). DDMI responded that it would "incorporate any direction received from the WLWB". Although this comment/recommendation was made in relation to the closure criteria presented in Table V-7 of Appendix V, this comment could apply to all numerical closure criteria.

- ***Revision #43: Apply a consistent approach with regards to handling/rounding significant figures in its derivation of closure criteria.***

3.6.5 Other Comments on Closure Criteria

In addition to those discussed above, there were several reviewer recommendations on closure criteria that DDMI agreed to incorporate. These are captured in Appendix B (e.g., EMAB comments 23, 24, 60, 79, 80, 207 and GNWT-ENR comment 23, etc.).

For some closure objectives and criteria, there were no public comments. For clarity, the absence of any comments or discussion about these objectives and criteria does not mean that the Board believes they are acceptable. In the Board's view, all criteria should continue to be considered a work in progress.

3.7 Security

DDMI submitted an adjusted security estimate with interim CRP Version 4.0. At that time, the approved security estimate was $129,546,000.[103] DDMI's estimate submitted with interim CRP Version 4.0 was $123,122,000, which is $6,424,000 less than the approved amount. Following submission of interim CRP Version 4.0 and the RECLAIM estimate, the Board adjusted the security deposit with the approval of the WRSA interim CRP. The Board increased the RECLAIM estimate by nearly $24,354,000, mainly as a result of a unit cost change for the WRSA cover construction.[104]

DDMI's proposed changes with Version 4.0 of the interim CRP include a large (approximately $11 million) decrease in closure costs for building removal, and some increases for pit wall caribou ramps and vegetation in building footprints.

Because the Board has not approved of interim CRP Version 4.1, the Board has not determined a new security deposit amount at this time. Instead, the Board requires DDMI to re-submit the RECLAIM estimate with interim CRP Version 4.1, with the updates outlined below. These changes are largely based on the GNWT-ENR's recommendations. DDMI agreed with some of the GNWT-ENR's recommendations but proposed to incorporate those changes after the Board approves the interim CRP. The Board does not agree with this approach. This approach would require an additional review and approval process following interim CRP approval, which would further delay the security adjustment, and increase the

[103] This and other amounts in this paragraph include the $11,090,000 of security in the land lease. This amount is subtracted from the RECLAIM estimate to arrive at the security deposit in the Water Licence.

[104] See WLWB Online Registry for Diavik - Closure and Reclamation Plan - WRSA - Directive and Reasons for Decision - Feb 9 18; pg. 15.

length of time that the deposit does not match the on-site liability. Also, if the Board does not assess the detailed comments submitted now, there could be confusion and inefficiency during the review of interim CRP Version 4.1 if parties comment on similar issues.

- ***Decision E: DDMI is to submit an updated RECLAIM estimate with interim CRP Version 4.1 with Security Adjustments #1 through 15.***

Security Adjustments #1 through 15 are discussed below and listed in Appendix E. If DDMI is going to propose updates to the RECLAIM estimate beyond the adjustments required by the Board, DDMI should engage the GNWT on the additional changes before submitting the estimate. As noted in the INAC/GNWT/MVLWB's *Guidelines for Closure and Reclamation Cost Estimates for Mines* (2017, the Closure Cost Guidelines), the GNWT plays a central role in estimating closure costs, as they are responsible for approving Type A water licences, setting the form of security, holding security, updating the RECLAIM model, and ultimately for paying for the closure and reclamation of abandoned mine sites on GNWT-owned land. The Guidelines emphasize the importance of collaborating with the GNWT to build consensus and enable the proponent to provide a thorough rationale for any differences. This approach significantly improves the efficiency of the review and approval process and can improve the quality of the RECLAIM estimate.

- ***Engagement Requirement #7: Engage with the GNWT on any newly proposed cost adjustments in the interim CRP Version 4.1 RECLAIM estimate (beyond those required by the Board), prior to submitting the estimate.***

- ***Revision #44: If there are any newly proposed cost adjustments beyond those required by the Board, provide thorough rationale for any differences of opinion between the GNWT and DDMI (based on the results of engagement required by Engagement Requirement #7) on the security estimate for interim CRP Version 4.1.***

The required security adjustments fall into several categories:

1. The GNWT's security review
2. Inflation
3. Long-term maintenance
4. Long-term monitoring
5. Long-term water treatment
6. Instrumentation
7. Comprehensive security review and additional documentation

Each of these is discussed below, along with associated revisions to the interim CRP.

Security Issue #1: The GNWT's Security Review

The GNWT hired a consultant to review the RECLAIM estimate and recommended several security adjustments. These are presented in Table 5, along with DDMI's responses, and the Board's decision with rationale.

Table 5. Security Adjustments required with the interim CRP Version 4.1

Summary of GNWT Comment and DDMI Response	DDMI Response	Board Direction and Rationale
Geotechnical Inspections: The GNWT-ENR stated that the annual cost for geotechnical inspections ($20,000) included in the security estimate does not seem adequate. The GNWT-ENR recommended using the estimate submitted by DDMI with WRSA CRP ($134,950/year)[105] or a new estimate with supporting documentation (GNWT-ENR comment 36).	DDMI stated that: "DDMI will review these items as recommended by ENR and make any adjustments to an updated RECLAIM Estimate to be submitted following approval of the CRP".	***Security Adjustment #1: Review and update the current annual cost of geotechnical inspections in the security estimate based on frequency and expected costs. If DDMI estimates costs that are less than $134,950 for 4 days of inspections by a qualified team, provide the estimate and supporting information.*** As discussed above, the Board believes revisions to the security estimate should be made with submission of interim CRP Version 4.1, not after Board approval.
PKC Closure Activities: The GNWT-ENR commented that the existing conceptual plan is feasible but may take longer to complete construction than what is covered in the security deposit. This is consistent with Appendix X-5, section 7.6.2 which states "[a]s the rock cover construction will likely take several years…" The GNWT-ENR listed several factors DDMI should consider when updating this estimate (GNWT-ENR comment 34).	DDMI responded by noting there may be a change in the PKC closure plan and stated that "once the CRP is approved appropriate changes can be made to the RECLAIM estimate."	***Security Adjustment #2: Update the security estimate assuming that it will take a minimum of three years following final deposition into the PKC Facility before final closure can be completed. Associated schedule and costs should be updated accordingly and in consideration of the factors listed in GNWT-ENR comment 34.*** The Board disagrees with DDMI's assertion that the estimate should be updated because there may be a change in the PKC closure plan. DDMI has an approved PKC Facility Plan, and the security estimate should reflect the costs of the approved plan. See section 3.2 for more discussion on this issue.
PKC Cover Construction: The GNWT-ENR recommended that DDMI adopt the unit costs for rock cover construction that were used for the WRSA or provide a rationale for why the PKC and WRSA rock cover unit costs should be different (GNWT-ENR comment 35).	DDMI did not agree with the GNWT-ENR, or with the concept of adopting another company's (Dominion Diamond Ekati Corporation's or Dominion's) unit costs.	***Security Adjustment #3: Update the estimate for PKC cover construction using the assumptions and unit costs used in the current RECLAIM estimate for WRSA cover construction or provide a rationale for why the costs should be different.*** After DDMI submitted its response, the Board decided to adopt Dominion's cost estimating approach for DDMI's WRSA cover.[106] Therefore, these unit costs should be used for DDMI's PKC cover unless DDMI can provide a rationale for why there would be a difference between DDMI's WRSA and PKC cover construction costs.

[105] See WLWB Online Registry for Diavik - Final Closure and Reclamation Plan - WRSA - Version 1.1 - May 9_17.pdf

[106] See WLWB Online Registry for Diavik - Closure and Reclamation Plan - WRSA - Directive and Reasons for Decision - Feb 9_18

Summary of GNWT Comment and DDMI Response	DDMI Response	Board Direction and Rationale
PKC Spillway Costs: The GNWT-ENR stated that **"**DDMI have commented on the challenges in design of the spillway. It is recommended that a description of the activities, quantities, and unit costs associated with construction of the closure spillway be provided by DDMI. Particularly as the existing costs in the security estimate were provisions suggested by BCL in the absence of these costs having been included by DDMI (BCL, 2014)" (GNWT-ENR comment 35).	DMDI responded that "[t]he current estimate that includes activities, costs and quantities for the spillway was provided by BCL and approved by the WLWB. DDMI has no immediate basis to revise the estimate".	***Security Adjustment #4: Provide a description of the activities, quantities, and unit costs associated with construction of the closure spillway, and re-estimate the spillway costs based on this description.*** The Board does not agree with DDMI that if BCL originally prepared an estimate, DDMI cannot be required to improve it. Many of the inputs and assumptions in DDMI's RECLAIM were made before the mine was operational, and DDMI now has significantly more information to refine these estimates.
Pit Flooding Estimate: The GNWT-ENR stated that ". . . [t]he existing security estimate includes a provision of $1.4M for flooding the three pits. To assess the adequacy of this component, it is recommended that DDMI provide an update of pit flooding costs based on the recently submitted report contained in Appendix X-7.2" (GNWT-ENR comment 42).	DDMI responded that "the level of cost estimating detail requested by ENR is beyond what is intended for a liability estimate and is more appropriate for project funding approval. In any event, the information required to support this level of detail is not available. We understand that the $1.4M estimate for pumping was recommended by BCL and approved by the WLWB".	***Security Adjustment #5: Update pit flooding costs based on the recently submitted report contained in Appendix X-7.2. This estimate should include: capital costs for pumps, siphons and materials; earthworks and installation costs required at each siphon location; operation and maintenance; monitoring and performance assessment reports. If DDMI cannot develop this estimate, DDMI should contact the GNWT to seek input on next steps.*** The Board believes the GNWT-ENR's recommendation to be reasonable, but acknowledges that DDMI has indicated that the information is not available. Therefore, if DDMI cannot fulfill the GNWT's recommendation, DDMI can further engage with the GNWT on this issue.
Turbidity Curtain Costs: The GNWT-ENR commented that DDMI has considerable experience upon which to draw on for accurate costs for the installation and maintenance of turbidity curtains, and noted that Dominion Diamond Ekati ULC (Dominion) recently estimated Ekati Jay Project dyke breaching totalling approximately 2 million dollars. The GNWT noted that DDMI's estimate is approximately $117,310. (GNWT-ENR comment 42)	DDMI noted that they will review the current cost estimate for installation of turbidity barriers during dyke breach excavation and make any changes in an updated RECLAIM estimate to be submitted following approval of the CRP but added that it would be inappropriate for DDMI to review and comment on Dominion cost estimates.	***Security Adjustment #6: Review costs associated with dyke breaching and consider adopting the costs for breaching dykes, including turbidity curtains, presented in Dominion's security estimate. If costs at Ekati are not suitable or comparable, DDMI should explain why there are differences and why existing costs are sufficient.*** Consistent with the Board's recent decision to adopt Dominion's unit costs for DDMI's WRSA cover construction. The Board believes it is appropriate to base DDMI's turbidity curtain costs on Dominion's estimates, in the absence of better information.

Summary of GNWT Comment and DDMI Response	DDMI Response	Board Direction and Rationale
Water Treatment Volumes: The GNWT-ENR noted that water treatment costs in DDMI's RECLAIM estimate are based on total volumes treated (not annual) (GNWT-ENR comment 44). There are "more recent estimates of quantities requiring treatment during closure and post-closure for example in Table 7.10 of Appendix X–5 - Revised PKC Facility Closure Concept." The GNWT noted that this table indicates that during the 3 years of closure activities, the central pond will need to be pumped at the end of operations, and twice per year thereafter until the closure construction activities are complete (up to 5 additional years).	DDMI stated that it will "consider this recommendation in a revised RECLAIM Estimate to be submitted following approval of the CRP V4.1."	***Security Adjustment #7: Determine water treatment costs based on an estimate of annual quantities collected and treated over the closure and post-closure period. Consult recent estimates of quantities requiring treatment during closure and post-closure, and the length of time treatment will be required, for example, Table 7.10 of Appendix X-5 Revised PKC Facility Closure Concept.*** As noted above, DDMI is to prepare an updated security estimate now, not after Board approval of the interim CRP. The estimate should be consistent with available information.
Water Treatment Unit Costs: Unit costs for operation of the North Inlet Water Treatment Plant (NIWTP) during closure are provided as \$0.35/m^3. These costs may not be specific to the Diavik Mine. Considerations for input into these unit costs include a variety of variables such as fuel, power, mechanical, electrical, reagents, maintenance, winterization, etc. GNWT recommended a review of the operating costs for the NIWTP (GNWT-ENR comment 45)	"ENR's recommendation appears to run contrary to Board Guidelines MVLWB/INAC/GNWT 2017) which encourages the use of default RECLAIM unit costs. The operating costs that ENR recommends for review are DDMI costs rather than third party contractor costs. Board Guidelines specify that any site-specific cost be representative of third-party contractor costs. It is recognized that the Board Guidelines provide DDMI the opportunity to request a site-specific unit cost if DDMI believes the default unit costs in RECLAIM are not appropriate."	***Security Adjustment #8: Provide a review of costs to operate the NIWTP, including: operator, mechanic and electrician unless accounted for elsewhere in the estimate; start up and winterization costs if operating seasonally; reagents; fuel, for heating buildings and power to operate; water quality monitoring specific to operation, and use this information to determine the appropriate unit cost.*** DDMI's estimate is based on the bottom of the range in RECLAIM for this unit cost (\$0.35 to \$2.00). The GNWT-ENR's recommendation to review the operating costs of the NIWTP does not necessarily mean that a unit cost outside of the range in RECLAIM is necessary. DDMI should have sufficient information to support the appropriate unit cost.

Summary of GNWT Comment and DDMI Response	DDMI Response	Board Direction and Rationale
Building Removal: The GNWT-ENR noted that building removal costs should be based on height, not just footprint, and questioned whether DDMI had accounted for the height (GNWT-ENR comment 52)	DDMI confirmed that building height had not been accounted for and agreed to correct the estimate.	***Security Adjustment #9: Correct the RECLAIM estimate to account for building height, in accordance with the RECLAIM Manual.***
Mobilization: The GNWT-ENR noted that there is an error in the calculation of mobilization costs (GNWT-ENR comment 51)	DDMI agreed to review the estimate and correct any errors.	***Security Adjustment #10: Correct any errors in the mobilization costs, as noted by the GNWT-ENR (comment 51).***
Monitoring: The GNWT-ENR noted that monitoring costs in RECLAIM include $6,237,680 for "person, labour, equipment, logistics, etc." (Line 9), with no breakdown, explanation, or indication that the estimate is consistent with the monitoring schedules in the interim CRP (e.g., the schedule in Figure 8-1). That figure shows 16 years of engineering inspections, whereas the Security Estimate includes only 10. The GNWT noted that the cost of annual inspections should also reflect frequency (GNWT-ENR-49)	DDMI stated that the company will further describe and/or itemize monitoring costs in a revised RECLAIM Estimate to be submitted following approval of the CRP. DDMI also elaborated on its views that Figure 8-1 cannot be used as the basis for RECLAIM estimates.	***Security Adjustment #11: Describe and or itemize monitoring costs that make up the "person, labour, equipment, logistics, etc." line item (line 9) and explain the relationship between these costs and Figure 8-1.*** As discussed above, revisions to the security estimate are to be made with submission of interim CRP Version 4.1, not after Board approval. Also, DDMI's position regarding the difference between a proponent's closure planning schedule (as depicted in Figure 8-1) and the schedule in RECLAIM (representing a situation where a site is abandoned) warrants further discussion.

Security Issue #2: Inflation

DDMI was asked to describe the company's views on whether the closure cost estimate should be increased for inflation (WLWB comment 42). DDMI responded that it "does not believe a site-specific increase for inflation would be fair and if the RECLAIM Version 7 rates are not current then it is the responsibility of INAC and GNWT to release an update." DDMI stated its belief that this is the responsibility of the GNWT (and formerly INAC), referring to the Closure Cost Guidelines and the WLWB requirement to use the most recent version of RECLAIM."

DDMI's estimate is based on RECLAIM Version 7 which was released in May 2014. Therefore, DDMI's estimate is based on unit costs that have not been updated in 4 years, which means the estimate arguably less than the current liability. This is inconsistent with INAC's *Mine Site Reclamation Policy for the Northwest Territories* (2002), which states that "The total financial security for final reclamation required at any time during the life of the mine should be equal to the total outstanding reclamation liability for land and water combined." Further, inflation increases are consistent with the GNWT's RECLAIM 7 User Manual, which explains that there is a function built into RECLAIM to adjust the estimate for inflation, and that this can be done "when there is a time lapse between the estimate date and the calendar year in

which the RECLAIM was last updated." Also, the Board has already required Dominion to increase its estimate for inflation.[107]

- ***Security Adjustment #12: Propose adjustments to the RECLAIM estimate for inflation to account for the period since the RECLAIM model was released. See the Reclaim 7 User Manual - Mining Version (November 2017) for more information. DDMI can contact the GNWT for assistance with the inflation function in RECLAIM.***

In addition to the security deposit issues discussed above, two other issues which require a more in-depth discussion are addressed below. These are long-term maintenance and monitoring costs.

Security Issue #3: Long-term Maintenance

The RECLAIM estimate does not include long-term maintenance costs. This issue was raised during review of DDMI's WRSA CRP, and after reviewing Version 1.0 of the WRSA CRP, the Board required DDMI to include a long-term maintenance cost estimate.[108]

In response, DDMI submitted a high-level description of long-term monitoring and maintenance activities and estimated that annual costs for the site would be $566,775.[109] DDMI did not add these costs to RECLAIM. DDMI explained that:

> We understand that the activities in question are beyond the intended scope of DDMI's approved closure plans and possibly relate more to final relinquishment. Regardless, DDMI understands these concerns and has prepared Attachment #3 which provides a view on what a long-term monitoring and maintenance program might look like for the Diavik site as a whole, if it was required, and what it could cost.

During the public review of interim CRP Version 4.0, DDMI was asked for additional explanation of why DDMI prepared a cost estimate but did not include it in the RECLAIM estimate (WLWB staff comment 44). DDMI responded in part that:

> [The estimate of $566,775/year submitted with WRSA CRP Version 1.1] provides an initial view of what a monitoring and maintenance program might look like if required following the company's completion of closure activities - that is following acceptance of a Closure Completion Report and Performance Assessment Reports. As noted in Attachment #3 the potential need for long term monitoring and maintenance will not be known until the Board has reviewed the Performance Assessment Reports.

EMAB expressed concerns about long-term maintenance costs:

> Funding for long-term care is an issue that has been raised by EMAB on several occasions and remains a serious deficiency in the financial assurance provided by DDMI. Diavik should complete a detailed assessment of the potential long term care and maintenance costs. This should consider the potential on site requirements and the impacts of the loss of ice roads due to the closure of the mines and/or global warming impacts. Diavik should

[107] See WLWB Online Registry for W2012L2-0001 - Ekati - Security - PDC Refund Request Expectations - Jan 25_18.pdf

[108] See WLWB Online Registry for Diavik - Final Closure and Reclamation Plan - WRSA - Directive and Reasons for Decision - Dec 16_16.pdf

[109] See WLWB Online Registry for Diavik - Final Closure and Reclamation Plan - WRSA - Version 1.1 - May 9_17; Attachment #3.

> also assess the viability of ice road access under the current Global Warming projections. The initial budgets as proposed by DDMI are a good starting point. (EMAB comment 33).

In response, DDMI stated that "guidelines for the relinquishment of closure security need to be advanced substantially by GNWT (Lands and ENR) and the WLWB before we would consider it appropriate to advance these indicative cost estimates."

The GNWT-ENR also recommended adding the costs of long-term maintenance activities to the RECLAIM estimate (GNWT-ENR comment 5). DDMI responded that site-wide maintenance provisions are included in the "Post-Closure Monitoring and Maintenance" sheet of RECLAIM. The GNWT-ENR elaborated on its position in GNWT-ENR comment 37:

> Based on experiences in other jurisdictions and as sites move towards final closure in the NWT, it is becoming apparent that the long term monitoring and maintenance costs included within the current RECLAIM estimate are likely not sufficient. . . These monitoring and maintenance costs need to be more fully developed . . . ENR is not of the view that it is adding new items to the security such that full refunds are not provided but that it is a matter of ensuring that GNWT is fully secured for remedial requirements. Adjustments to the monitoring and maintenance amounts should happen as soon as possible, and could be included before progressive reclamation and any associated refunds have occurred.

DDMI responded in a similar way to other comments described above, and added that:

> [T]he potential need for long term monitoring and maintenance will not be known until the Board has reviewed the Performance Assessment Report. DDMI will review the RECLAIM Estimate of monitoring and maintenance for the period from the end of commercial production to completion of the final Performance Assessment Report and provide any changes in a revised RECLAIM Estimate that will follow approval of the CRP.

The Board does not agree with DDMI's position that long-term maintenance costs should not be in the RECLAIM estimate, for the following reasons:

- It is not clear what the basis is for DDMI's assertion that the need for long term monitoring and maintenance will not be known until the Board has reviewed the Performance Assessment Reports. DDMI has already identified several long-term maintenance activities as part of interim CRP Version 4.0 (and interim CRP Version 3.2), as noted by the GNWT-ENR (comment 50). For example, DDMI lists the following likely maintenance activities for the WRSA: repair of excessive cracking, slumping or erosion or corrections to any identified wildlife hazards. Similar activities are identified for other mine components. DDMI did not include costs for these activities in the security estimate. RECLAIM should reflect activities in the interim CRP.
- Including long-term maintenance costs in DDMI's RECLAIM estimate is consistent with the Closure Planning Guidelines, which state that: "Proponents should indicate whether any components will require passive long-term care and the expected timelines for relinquishment." Passive long-term care is defined in the Guidelines as "occasional monitoring, coupled with infrequent maintenance or repairs, that takes place following reclamation in the post closure phase of the mine site. Many mine sites require ongoing passive care, which can be an acceptable practice."
- The GNWT (on an interim basis) and the WLWB rely on the 2002 Indian and Northern Affairs Canada *Mine Site Reclamation Policy for the Northwest Territories* (the INAC Policy) as the basis

for considerations related to mine closure and security. The Policy is consistent with a RECLAIM estimate that includes long-term maintenance costs:
    - "Adequate security should be provided to ensure the cost of reclamation, including shutdown, closure and post-closure, is born by the operator of the mine rather than the Crown."
    - "Following mine closure, mining companies or their future owners should continue to be responsible for the site, including the remediation of any additional environmental complications which develop."
    - "The Minister may hold back an appropriate amount of financial assurance to cover future requirements for the site. In such cases, the mining company will be responsible for the care and maintenance of the site, but will also maintain a claim to any remaining financial assurance."
- The GNWT's RECLAIM User's Manual states that "Post-closure maintenance is typically required for all mine sites with waste rock piles, tailings storage areas, etc." The Manual provides examples of long-term maintenance activities, and information on calculating these costs, including the potential use of a discount rate (using the net present value calculation in RECLAIM).
- The Board does not agree with DDMI's claim that post-closure maintenance costs are already in the "Post-Closure Monitoring and Maintenance" sheet of RECLAIM. This sheet addresses only interim care and maintenance, which is quite different from long-term maintenance. Interim care and maintenance means the approximately 2- to 3-year period between the ceasing of operations and the commencement of closure work.[110] Long-term maintenance extends into the period following active closure.
- As the authority responsible for the RECLAIM spreadsheet and the landowner responsible for clean-up, the GNWT-ENR's position that long term monitoring and maintenance costs in DDMI's RECLAIM estimate are likely not sufficient is concerning.
- Long-term monitoring and maintenance cost estimates will be important considerations when the Board considers future security refund requests from DDMI. In response to a request from Dominion for the return of security for completed progressive reclamation, the Board required Dominion to estimate long-term monitoring and maintenance costs. DDMI should review the Board's directive to Dominion for background information on the link between these costs and security refunds.[111]

➢ ***Security Adjustment #13: Propose the costs of long-term maintenance activities to the RECLAIM estimate for interim CRP Version 4.1. The estimated costs and length of monitoring period should be consistent with Board Policy, Guidelines, the RECLAIM User's Manual, and interim CRP Version 4.1. DDMI should use Attachment #3 of the WRSA CRP Version 1.1 as a starting point and consider reviewer comments and the January 25, 2018 letter from the WLWB to Dominion regarding security refunds.***

Security Issue #4: Long-term Monitoring

The RECLAIM estimate includes monitoring costs for several monitoring programs, but only up until 2032 (i.e., 7 years after operations cease in 2025). Longer-term monitoring costs are not included. Some closure activities are planned for completion well after operations end (e.g., flooding the mine areas is planned

[110] 2014 Mining RECLAIM User's Manual.

[111] See WLWB Online Registry for W2012L2-0001 - Ekati - Security - PDC Refund Request Expectations - Jan 25 18; letter from WLWB to Dominion regarding PDC security refund.

to end in 2028, revegetation is planned to end in 2031).[112] This means that the proposed post-closure monitoring period for some activities is as little as one year.

Reviewers recommended longer monitoring periods:

- EMAB stated that DDMI's proposed end date for monitoring (2032) was unrealistic and noted that DDMI's assumption "appears to be based primarily on physical performance of the facilities, but does not necessarily consider broader environmental performance. . . If facilities must achieve critical performance outcomes permanently (e.g., dams) then monitoring and maintenance requirements are also permanent" (EMAB comment 46). EMAB provided specific examples related to the long-term performance monitoring needs for PKC dams and the WRSA cover (EMAB comments 46, 47 and 214), and advised that the criteria should include expected timing for achievement (EMAB 48). EMAB also noted that "water quality conditions could take many years to stabilize, and they could also change after many years of stable conditions." (EMAB comment 215). DDMI responded to most of EMAB's comments as follows:

  > As described in Appendix VI, the duration of post-closure monitoring and reporting for mine components will be informed by results documented in the Performance Assessment Reports for approval by the WLWB. It appears as though EMAB's recommendations relate more to their view of very long-term (decades) monitoring rather than the monitoring DDMI has proposed to support Performance Assessment and Closure Completion reporting requirements. DDMI does not propose making changes to the monitoring durations currently provided in Appendix VI.

- The GNWT-ENR advised that monitoring of the PKC Facility should be until at least 2038, rather than 2032 as proposed by DDMI, and provided a technical rationale for this recommendation (GNWT-ENR comment 31). DDMI did not address the GNWT-ENR's recommended monitoring length, but responded generically that the PKC Facility closure plans are undefined, and the company will consider how best to address outstanding issues in interim CRP Version 4.1.
- The GNWT-ENR commented that monitoring until 2032 may not provide sufficient time to assess the post-closure performance of the different site components and noted that it will take several years after the WRSA cover construction is complete (2022) before the active zone becomes constrained within the cover, and then several more years of monitoring to demonstrate performance. The GNWT-ENR noted that the length of post-closure monitoring will vary by mine component, and that they expect a minimum of 10 years of monitoring would be required after steady state conditions have been achieved (GNWT-ENR comment 40). DDMI defended their proposed monitoring duration and stated that "these durations may change (shorter or longer) based on monitoring results but it is DDMI's opinion that it is premature and unnecessary to attempt to define these further at this time."

The Board disagrees with DDMI that the company need not estimate longer monitoring periods until a performance assessment report is submitted. The reasons for this are the same as those described above regarding long-term maintenance. The estimated monitoring period is not driven by the frequency of performance assessment reports. As noted in the Closure Planning Guidelines: "The primary purpose of post-closure monitoring is to determine whether closure criteria have been met, and therefore that closure objectives and the closure goal have been achieved." The Guidelines also note that "the timeframe

[112] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Figures 3-28 to 9-4 - Apr 20_17; pg. 26 - Figure 8-1.

to successfully achieve closure criteria may be short-, medium-, or long-term." DDMI can make reasonable estimates of monitoring lengths required to demonstrate closure criteria have been met, based on existing information. Based on the component-specific examples provided by reviewers, a monitoring period on the order of decades does not seem unreasonable. The Board agrees with the GNWT-ENR that the monitoring periods may vary by mine component, as well by closure objective (e.g., physical vs chemical objectives).

In summary, estimating reasonable monitoring periods at this stage will allow for proper planning, a shared understanding of the predicted monitoring period length, closure criteria with time periods built into them, and a RECLAIM estimate that reflects the likely monitoring costs.

- ***Revision #45: Increase monitoring periods in Appendix VI-2 to match the likely period of time required to demonstrate that criteria have been met. To achieve this, DDMI must:***
  - ***a) For each closure objective, estimate the length of time required to monitor in order demonstrate that the criteria have been met, with supporting rationale; and***
  - ***b) Update all relevant parts of interim CRP Version 4.1 to match the monitoring period, including section 5.5, the schedule in Figure 8-1, criteria in Appendix V, monitoring described in Appendix VI, etc.***

- ***Security Adjustment #14: Propose monitoring costs, in consideration of the revised monitoring lengths, the estimate provided in Attachment #3 of WRSA CRP Version 1.1, and reviewer comments.***

Security Issue #5: Long-term Water Treatment

EMAB recommended that DDMI should "provide an estimated cost for the long term operation of a water treatment plant for waste rock pile runoff and seepage. This will provide a basis for assessing the potential security requirements should long term treatment be required." EMAB explained that the contingency plans in the interim CRP for the WRSA and PKC Facility are collection and treatment of water until quality/quantity is adequate for release into Lac de Gras. EMAB stated that "Diavik would like to have progressive reclamation costs returned (e.g. for waste rock pile cover) however without some idea as to the future costs for treatment, the WLWB cannot assess how much financial assurance should be retained to address these potential long term costs." (EMAB comment 168)

DDMI responded that it understands from Board guidance that the security estimate is to be based on the preferred closure concept or design described in the CRP, and that while water quality predictions have a high level of uncertainty, they are supported by 10 years of test data.

The Board has determined that additional discussion is needed on whether long-term water treatment is needed and whether it is appropriate to include the estimate in the security deposit. Nonetheless, there is enough uncertainty regarding post-closure water quality (see for example section 4.1; WRSA Issue #2), that an estimate would be useful at this stage. This would allow all parties to understand the relative cost of long-term treatment compared to the existing contingency amount in the RECLAIM estimate and enable a discussion on the issue.

- ***Revision #46: Include an estimate of long-term water treatment in interim CRP Version 4.1. Until there is further discussion on the need for treatment and the appropriateness of including the estimate in the security deposit, DDMI does not need to include the estimate in the RECLAIM estimate.***

Security Issue #6: Instrumentation Replacement Costs

EMAB recommended that DDMI include the costs of maintain and replacing instrumentation (e.g., observation wells, collection wells, thermistors, slope inclinometers", etc. in the RECLAIM estimate (EMAB comment 18). DDMI responded that these costs are not specifically in RECLAIM, but that RECLAIM cost estimates are factored from operating costs which would typically include maintenance/replacement of instruments." DDMI's response is not definitive, in that it is not clear whether these costs are included in all cases.

- ***Security Adjustment #15: Ensure the costs of maintaining and replacing monitoring instruments are included in RECLAIM.***

Security Issue #7: Comprehensive Review and Additional Documentation

The GNWT recommended a comprehensive update by DDMI with supporting documentation, and referred to their consultant's (Brodie Consulting Ltd, BCL) memo, which stated the following:

> Most of the costs included in the security estimate submitted with [interim CRP Version 4] remain the same as the 2011 security estimate or earlier. There is no readily available document or details that provide a description of quantities. The estimate would benefit by a comprehensive update by DDMI that includes a supporting document and considers the following recommendations.

Similarly, EMAB recommended that DDMI "specify what activities and materials are included in each line item in the RECLAIM estimate" (EMAB comment 35).

The Board agrees that the estimate would benefit from additional documentation and a comprehensive review to ensure the inputs are reasonably accurate. Most of the inputs have been carried forward from previous estimates, some as far back as the initial security estimate before mining began. There is a lot of operational data and other information that could be used to verify inputs to RECLAIM. Further, documentation of inputs and assumptions are important when DDMI or other parties propose cost updates, including security refunds. That said, the level of detail in the documentation and the level of effort DDMI should expend to conduct the review and improve documentation is not clear, and DDMI should discuss this issue with the GNWT first.

- ***Engagement Requirement #8: Engage with the GNWT regarding the appropriate level of detail for improved documentation for DDMI's RECLAIM estimate.***

- ***Revision #47: Based on the results of the engagement with the GNWT, improve the documentation submitted with the revised RECLAIM estimate for Version 4.1 of the interim CRP.***

3.8 Remaining Issues

Issues that do not fall neatly into one of the categories above (PKC Facility, WRSA, etc.) are discussed in this section. These issues, which generally cut across several closure topics, are:

1. Traditional Knowledge Monitoring Plan
2. Traditional Knowledge and Community Participation Research Plan
3. Reclamation Materials
4. Missing Information

5. Submission of Final Plans
6. Closure Planning Schedule

Remaining Issue #1: Traditional Knowledge Monitoring Plan

In its comments on the WRSA CRP (TG comments 2 and 3), the Tlicho Government noted that the many strong recommendations from Elders will be important to track over the coming years, and recommended a TK Monitoring Plan that requires long term and final review by the TK Panel. DDMI responded that "DDMI will work with the Traditional Knowledge Panel to determine a suitable TK Closure Monitoring Plan and schedule that incorporates the recommendations identified by the Panel." As with other aspects of the CRP where input from the TK Panel is necessary, DDMI must still engage with other parties before finalizing the TK Closure Monitoring Plan.

- ***Revision #48: Include a statement of DDMI's commitment to work with the TK Panel to determine a suitable TK Closure Monitoring Plan and schedule.***

Remaining Issue #2: Traditional Knowledge and Community Participation Research Plan

In interim CRP Version 3.2, one of DDMI's five reclamation research plans was a Traditional Knowledge and Community Participation Research Plan. DDMI removed this plan in interim CRP Version 4.0. DDMI was asked why this plan was removed (WLWB staff comment 31). DDMI responded as follows:

> It is explained in Appendix VIII-2 that DDMI will instead continue the current practice of working with the TK Panel to identify focus areas collaboratively between DDMI, the TK Panel and any feedback we may receive from community organizations. DDMI will continue to report and share the outcomes from TK Panel meetings with community organizations and DDMI will include relevant reports and a community engagement log in Annual Closure and Reclamation Plan Progress Reports and ultimately within the Final Closure and Reclamation Plan. DDMI's Engagement Plan identifies when and how DDMI will engage with communities.

While DDMI's response provides assurance that this important work will continue, it does not explain why the research plan was removed from the interim CRP. Including this work in the interim CRP as a Reclamation Research Plan allows reviewers and the Board to better understand the work that is being done, track research progress, and holds DDMI accountable for completing particular scopes that are outstanding

- ***Revision #49: Include the Traditional Knowledge and Community Engagement Plan as a reclamation research plan in Appendix VIII.***

Remaining Issue #3: Reclamation Materials

The GNWT-ENR commented that DDMI had provided conflicting information in interim CRP Version 4.0 about whether a stockpile of till would remain on-site after closure, particularly as it relates to possible unusable, off-spec material (GNWT-ENR comment 24). In response, DDMI maintained that a stockpile of till will not remain post-closure. The GNWT-ENR also commented that it was "unclear if reclamation materials such as till that has potentially many different reclamation uses, has been accounted for in each closure activity" and recommended "that DDMI begin to plan for material allocation and assess whether material prioritization is necessary" (GNWT-ENR comment 25). DDMI responded that it will "undertake

the recommendations described by ENR as final engineering designs are advanced and material specifications are determined".

The Board agrees with the GNWT-ENR that the information provided in interim CRP Version 4.0 does not paint a clear picture about material availability. While DDMI may not be able to confirm precise amounts until the detailed engineering phase, DDMI can make best estimates using existing information. This will allow DDMI to support its position that there will be enough material available for closure activities with no remaining stockpiles and confirm the assumptions regarding material costs in the security estimate.

- ***Revision #50: Add a table (or tables) that shows, for each reclamation material, the predicted quantity available for closure (accounting for possible off-spec material), the estimated quantity required for each closure activity, and the amount remaining once all closure activities are complete.***

Remaining Issue #4: Missing Information

DDMI submitted a conformance table (as required by Schedule 9, Condition 1(j))[113] following correspondence with Board staff.[114] The conformity check identified some items that appeared to be missing.[115] DDMI responded to most of these missing items,[116] however some remain outstanding.

In its approval of interim CRP Version 3.2, the Board established a list of required revisions for interim CRP Version 4.0. This included a more detailed description of risks associated with each selected closure activity and significantly more detail on contingencies. In correspondence to DDMI regarding the conformity check, it was stated that "[p]referred contingency plans have been identified for mine components, but details for these contingencies do not appear to have been included" and that "[t]his is particularly notable with respect to the preferred contingency identified in Section 5.2.6.9 which deals with the collection and treatment of seepage/outlet water".[117] In its response, DDMI provided additional detail and agreed to add the description to interim CRP Version 4.1, but did not address the rest of the outstanding requirement. The text that DDMI provided can be added to interim CRP Version 4.1, along with the required information regarding contingencies.

- ***Revision #51: For each reclamation activity, identify the preferred contingency and significantly increase the level of detail for this contingency. Ensure all uncertainties associated with the preferred contingency are addressed.***

[113] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - DDMI Response Re Conformance with Schedule 9 - May 9_17.pdf

[114] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Conformance with Schedule 9 - May 8_17.pdf

[115] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Conformity Check - May 16_17.pdf

[116] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - DDMI Response Re Conformity Check - May 17_17.pdf

[117] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - DDMI Response Re Conformity Check - May 17_17.pdf

- ***Revision #52: Add the following text to Section 5.2.6.9: "If long-term active water treatment is required, long-term site presence would be required to maintain the collection system and operate the water treatment plant. Fuel would need to be supplied for power. DDMI (1999a) – Section 4.3.2 lists the chemicals that would need to be supplied over the long-term. These include lime, sulphide, polymer and coagulant. The sludges from long-term active water treatment will basically consist of fine PK particles, metal hydroxides and metal sulphides. These will come from the clarifier underflow and backwashes will be in the order of 1%. They would be pumped to the PKC facility for disposal (DDMI, 1999a)."***

Note that long-term water treatment is a contingency only, and would be inconsistent with the expectations during the environmental assessment and with the Closure Planning Guidelines, which are based on the principle of no long-term active care. Inclusion of this information is to provide more detail about an activity that could be necessary if the selected closure activities are unsuccessful. As with other contingencies in the CRP, identifying long-term water treatment as a possibility does not constitute approval or negate any authorizations that would be required.

In the April 7, 2016 Board Decision on the proposed Modification to the North Dam of the Processed Kimberlite Containment Facility, DDMI was directed to "state in the next version of the interim CRP (Version 4) that the company will place a cover over the Type III rock in the north dam".[118] During the conformity check, it was not clear that this requirement was met. In response to the conformity check, DDMI referenced section 5.2.5 that addressed this requirement but also agreed that it could add the following statement to section 5.2.5:

- ***Revision #53: Add the following text to Section 5.2.5: "A cover will be placed over the Type III rock in the north PKC dam as noted in NCRP-WRSA Final Closure Plan V1.1 and included in Appendix X – North Country Rock Pile Closure Design Drawing 006 Detail 3."***

Remaining Issue #5: Submission of Final Plans

The GNWT-ENR commented on DDMI's schedule for submitting final closure plans for each of the mine components (GNWT-ENR comment 3). GNWT-ENR is "concerned that a number of component specific Final Closure Plans are planned for submission in 2020 (e.g. Open-pit, Underground and [Dyke] Areas, Processed Kimberlite Containment Area, North Inlet Area and, Mine Infrastructure Area)". The GNWT-ENR recommended that "DDMI submit Final Closure Plans for each mine component in a staggered fashion and as early as possible to allow for a thorough review of each plan" (GNWT-ENR comment 3). DDMI responded that it "generally supports the recommendation of staggered submissions but recommends that these staggered submissions be the final closure designs for each mine component rather than Final Closure Plans".

The Board agrees with the GNWT-ENR that staggered submissions could be beneficial, but do not agree with DDMI that this should only include the final design. To evaluate the final design, the Board and reviewers must have the research and engagement results that demonstrate that the design will meet closure objectives and criteria. This is consistent with DDMI's Water Licence which requires submission of a CRP, not design documents separately from a CRP.

[118] See WLWB Online Registry for Diavik - Modification - PKC Facility - North Dam - Directive and Reasons for Decision - Apr 7_16.pdf

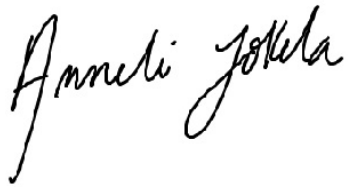
- ***Decision F: The Board advises DDMI that staggered submissions of final plans may be appropriate, and that proposed final designs must be submitted as part of a final CRP. The final CRP must demonstrate that research and engagement are complete and support the final design. DDMI should propose final criteria, and the final CRP should include the information identified in the Closure Planning Guidelines for a Final CRP.***

Remaining Issue #6: Closure Planning Schedule

According to Part K, Condition 7 of the Water Licence, and as acknowledged by DDMI in the interim CRP Version 4, DDMI's Final Closure Plan is due in 2020 (three years prior to the expiry date of the Water Licence). Although DDMI has presented a substantial amount of information regarding its closure planning efforts, it is difficult for the reader to confirm that DDMI will have completed all engagement and research in time to develop the final closure plan that meets the requirements of the Closure Planning Guidelines (e.g., final closure criteria, detailed descriptions of contingencies, etc.). A review of the final closure plan will likely take a substantial amount of time, particularly if it does not meet the requirements in the Closure Planning Guidelines. It is critical that DDMI ensures it can meet this deadline in order to prevent delays in implementing the closure plan following the end of operations.

- ***Revision #54: Add a site-wide closure planning schedule that demonstrates that DDMI will complete all reclamation research and engagement that will enable submission of a Final CRP in 2020 that meets the Board's expectations (as described in Decision F). The Reclamation Research Plans and the Research Status Tracking Table (Appendix VIII) should reflect that all research will be completed in time for final plan submission and should include detailed scopes of work for all remaining research tasks.***

Signed the 17th day of December 2018, on behalf of the Wek'èezhìi Land and Water Board



Witness

Joseph Mackenzie
Chair, Wek'èezhìi Land and Water Board

Appendix A: List of Revisions #1 through 54

As described in the Reasons for Decision, in submission of the interim CRP Version 4.1, DDMI must include the revisions in the Table below.

Revision Number	Description	Page Reference
1.	DDMI is to add only those aspects of the WRSA CRP into interim CRP Version 4.1 that require revision, and refer the reader to the approved WRSA Interim CRP Version 1.2 to read the main body of the plan.	pg. 6
2.	Add a description of a monitoring program that will demonstrate that closure criteria for physical stability have been met, and provide a rationale for DDMI's selected resolution in consideration of GNWT-ENR comment 11.	pg. 7
3.	Include the following information related to A154/418 Type I rock disposed in the WRSA and used in construction on-site (laydown pads, roads, etc.): a) An assessment of the post-closure risk posed by poor quality seepage/runoff from A154/A418 Type I rock; b) An assessment of closure options for this material (regardless of DDMI's assessment in 3a), including consolidation of A154/418 Type I rock used in construction on-site followed by placement of cover made from A21 rock or other material, passive water treatment, and other any options identified by DDMI; and c) DDMI's preferred closure activity for A154/418 Type I rock, with rationale.	pg. 9
4.	Add to the Traditional Knowledge and Community Participation Reclamation Research Plan a commitment to continue working with elders, the TK Panel, and communities to ensure the surface of the WRSA is safe for caribou and other wildlife, and add "till placement on caribous ramps" to the contingency section of the WRSA CRP.	pg. 9
5.	Clarify whether restoration of nesting habitat suitability (as identified in the CSR) will occur and if so where (e.g., WRSA). If not, discuss whether this contradicts the statements in the CSR.	pg. 10
6.	Include a discussion on the results of engagement on WRSA revegetation.	pg. 11
7.	Update PKC Facility seepage and outlet predictions using all information that is currently available (including consideration of PKC interception well water monitoring results). To support these predictions, summarize the results of all research related to PKC water quality predictions and explain how the results were used to predict post-closure water quality. Compare the predictions to proposed closure criteria to provide context.	pg. 14
8.	Clearly identify what tasks remain to refine water quality predictions, when each task will start, and when it will be completed.	pg. 14
9.	Identify the approximate timeline progressive reclamation of the PKC Facility will commence in, with rationale, and ensure this timeline is identified in a consistent manner throughout Version 4.1 of the interim CRP.	pg. 14
10.	Expand the PKC Facility reclamation research plan to address the uncertainties identified in section 5.2.6.6 of interim CRP Version 4.0, the trials and studies identified in section 11.0 of Appendix X-5, and outstanding issues identified in Table 1 (as necessary).	pg. 15

Revision Number	Description	Page Reference
11.	Clarify whether removal of PK slimes will remain as a contingency if DDMI obtains approval to place PK underground, or become the selected closure activity.	pg. 16
12.	Compare the PKC reclamation research required for a wet facility vs a dry facility, noting any overlap in research areas.	pg. 16
13.	Include a schedule of major PKC Facility closure planning and implementation milestones, including at a minimum (not necessarily in this order) timelines for the following: i) Completion of each reclamation research task in the expanded Reclamation Research Plan (see Revision #10); j) Engagement; k) Submission of an updated PKC Facility interim CRP (or final CRP) for Board approval prior to starting progressive reclamation; l) Submission of Final Design Reports for PKC Closure Cover; m) Submission of final closure criteria for PKC Facility; n) A determination on whether PK slimes will be removed from the PKC Facility; o) Start of Progressive Reclamation; and p) Other Construction milestones for the PKC closure cover and spillway construction.	pg. 16
14.	Include a risk/failure analysis for the PKC closure plan or identify when this will be submitted such that it can verify the PKC selected closure activity, in which case the task should be added to the Reclamation Research Plan. Alternately, DDMI can provide a rationale for why this is not needed until the design phase.	pg. 16
15.	Identify where geotextile will be used under the rock cover. If geotextile will not be used over all fine processed kimberlite, provide a rationale.	pg. 17
16.	Provide additional information on pond characteristics (size, depth, etc.) and evaluate whether these characteristics could pose a significant risk to wildlife, or identify when DDMI will provide this information. Include in the PKC Facility Reclamation Research Plan if appropriate.	pg. 17
17.	Provide a summary of results from the monitoring and inspection of PKC seepage to the WRSA, and discuss the concerns raised by the GNWT-ENR (comment 26).	pg. 17
18.	Identify that routing of water from the PKC to Lac de Gras is an outstanding issue and discuss how and when it will be resolved. Include in the Reclamation Research Plan if appropriate. Describe whether there is aquatic life in the path from the PKC Facility to Lac de Gras.	pg. 17
19.	Assess the effects of pond size on water quality or discuss how and when DDMI will perform this task. Include in the Reclamation Research Plan if appropriate.	pg. 17
20.	In order to confirm that the PKC pond will be maintained in the long-term and fine PK will not be exposed, revisit the water balance for the PKC Facility or identify how and when DDMI will perform this task. Include in the Reclamation Research Plan if appropriate.	pg. 18
21.	Add a literature review on natural degradation of hydrocarbons in north inlet sediments to the North Inlet Reclamation Research Plan.	pg. 20

Revision Number	Description	Page Reference
22.	Incorporate the results of engagement required by Engagement Requirement #2 and include a more detailed rationale for DDMI's selected closure option and why it rejected the other options in the Golder evaluation.	pg. 21
23.	Based on the results of the engagement required by Engagement Requirement #2, provide a rationale for the proposed timing of the final sediment investigation(s).	pg. 21
24.	Include a summary of the study design for the North Inlet Sediment Investigation in the North Inlet Reclamation Research Plan.	pg. 21
25.	Provide DDMI's assessment (including cost-benefit analysis) of the pros and cons of off-site disposal of hydrocarbon-contaminated soil compared to on-site disposal, report on the results of engagement required by Engagement Requirement #3, and provide DDMI's preferred option with rationale.	pg. 22
26.	Add a discussion about the possibility that other parties may wish the airstrip to be retained, a statement that DDMI is willing to participate in discussions with government and other interested parties to assess the fate of the airstrip, and a plan and approximate schedule for resolving this issue.	pg. 24
27.	Include a more thorough and transparent discussion about the process used for determining which parameters will have closure criteria.	pg. 34
28.	Provide complete, up-to-date predictions of post-closure chemical concentrations (for all components and site-wide) and provide a clear and transparent explanation about how they were derived, the level of uncertainty, and if/how they will be refined through time.	pg. 34
29.	Include a detailed description of its approach, with rationale, for demonstrating if/when the use of standard guidelines as closure criteria for chemical parameters are not appropriate/achievable. This approach must include a consideration and discussion of alternative closure options. DDMI must include tables comparing standard guidelines, closure concentration predictions, and the proposed SSRBCC to support this discussion.	pg. 34
30.	Incorporate revisions to Version 4.1 of the interim CRP as outlined in Table 4.	pg. 38
31.	For closure objective SW2: a) Refine and compile predictions for water quality in all streams entering Lac de Gras in consideration of the different sources (e.g., WRSA and PKC Facility) and possible dilution prior to entry into the lake; b) Follow the steps required by the Mixing Zone Guidelines (see Section 6.0) and provide evidence to demonstrate the smallest practicable mixing zone; c) Outline a plume delineation study plan and/or provide substantive information to refine the dilution factor; d) Revise closure criteria for SW2 based on the results of (a) through (c); e) Provide evidence to support the achievability of proposed closure criteria; and f) Include a consideration and discussion of alternative options to address potentially problematic parameters (e.g., different mixing zones, passive treatment, and changes to the proposed closure design).	pg. 42
32.	Confirm that the proposed closure criteria for SW2 are below acute toxicity levels and include recommendations for how it will address parameters that show the potential to be acutely toxic.	pg. 43

Revision Number	Description	Page Reference
33.	Include in Appendix V of the interim CRP Version 4.1, a comprehensive table for surface runoff and seepage water quality that shows all the derived closure criteria, with a summary column that shows the one that is being selected for a given parameter	pg. 44
34.	In Version 4.1 of the interim CRP, address the clarifications requested by EMAB (in the follow-up correspondence received by on EMAB comment 92) and clarify which closure criteria are being proposed for sediment quality.	pg. 45
35.	a) For any criteria proposed as "Satisfactory final inspection by a professional engineer" or "As-built conforms adequately with approved design", propose additional specific (numeric and/or narrative) criteria. These criteria are SW6, SW11, M3, M5, W1, W2, W3, P2, P3, and NI6; and b) In preparing these criteria, DDMI must consider all reviewer recommendations regarding this issue (e.g., EMAB 43, 44, 45, 74, 78, 81, 86, 87, 93, 201, 202, and 212; GNWT-ENR comments 4, 10, and 11).	pg. 46-47
36.	Estimate the length of time needed to demonstrate that each criteria has been met and ensure these timeframes match the monitoring period described in the CRP (e.g., Appendix VI-2 of the interim CRP Version 4.0).	pg. 47
37.	Identify the need to work with the TK Panel and communities on wildlife criteria and monitoring plans in the Traditional Knowledge and Community Participation Reclamation Research Plan.	pg. 47
38.	Report on the results of all completed tasks in the Infrastructure Area Reclamation Research Plan (RRP) and describe how the results impact criteria for closure objective SW10.	pg. 47
39.	Add research task to the Traditional Knowledge and Community Participation Reclamation Research Plan to determine how to measure palatability of vegetation to wildlife with the aim of informing the closure criteria for closure objective SW4, in consideration of EMAB's comments (61-63 and 208-210).	pg. 48
40.	Include a map of the current footprint and indicate how much of an increase is represented by the maximum footprint (currently proposed as 13 km2) compared to the operational footprint, and how this relates to predictions during the environmental assessment.	pg. 49
41.	Update this criterion so that it can measure the success of closure objective SW8 or present a schedule for acquiring the information necessary to propose a measurable criteria in the final CRP.	pg. 49
42.	Revise the closure criteria associated with SW9 to be more specific to the closure objective and explain how the criteria can be evaluated.	pg. 50
43.	Apply a consistent approach with regards to handling/rounding significant figures in its derivation of closure criteria.	pg. 51
44.	If there are any newly proposed cost adjustments beyond those required by the Board, provide thorough rationale for any differences of opinion between the GNWT and DDMI (based on the results of engagement required by Engagement Requirement #7) on the security estimate for interim CRP Version 4.1.	pg. 52

Revision Number	Description	Page Reference
45.	Increase monitoring periods in Appendix VI-2 to match the likely period of time required to demonstrate that criteria have been met. To achieve this, DDMI must: a) For each closure objective, estimate the length of time required to monitor in order demonstrate that the criteria have been met, with supporting rationale; and b) Update all relevant parts of interim CRP Version 4.1 to match the monitoring period, including section 5.5, the schedule in Figure 8-1, criteria in Appendix V, monitoring described in Appendix VI, etc.	pg. 61
46.	Include an estimate of long-term water treatment in interim CRP Version 4.1. Until there is further discussion on the need for treatment and the appropriateness of including the estimate in the security deposit, DDMI does not need to include the estimate in the RECLAIM estimate.	pg. 61
47.	Based on the results of the engagement with the GNWT, improve the documentation submitted with the revised RECLAIM estimate for Version 4.1 of the interim CRP.	pg. 62
48.	Include a statement of DDMI's commitment to work with the TK Panel to determine a suitable TK Closure Monitoring Plan and schedule.	pg. 63
49.	Include the Traditional Knowledge and Community Engagement Plan as a reclamation research plan in Appendix VIII.	pg. 63
50.	Add a table (or tables) that shows, for each reclamation material, the predicted quantity available for closure (accounting for possible off-spec material), the estimated quantity required for each closure activity, and the amount remaining once all closure activities are complete.	pg. 64
51.	For each reclamation activity, identify the preferred contingency and significantly increase the level of detail for this contingency. Ensure all uncertainties associated with the preferred contingency are addressed.	pg. 64
52.	Add the following text to Section 5.2.6.9: "If long-term active water treatment is required, long-term site presence would be required to maintain the collection system and operate the water treatment plant. Fuel would need to be supplied for power. DDMI (1999a) – Section 4.3.2 lists the chemicals that would need to be supplied over the long-term. These include lime, sulphide, polymer and coagulant. The sludges from long-term active water treatment will basically consist of fine PK particles, metal hydroxides and metal sulphides. These will come from the clarifier underflow and backwashes will be in the order of 1%. They would be pumped to the PKC facility for disposal (DDMI, 1999a)."	pg. 65
53.	Add the following text to Section 5.2.5: "A cover will be placed over the Type III rock in the north PKC dam as noted in NCRP-WRSA Final Closure Plan V1.1 and included in Appendix X – North Country Rock Pile Closure Design Drawing 006 Detail 3."	pg. 65
54.	Add a site-wide closure planning schedule that demonstrates that DDMI will complete all reclamation research and engagement that will enable submission of a Final CRP in 2020 that meets the Board's expectations (as described in Decision F). The Reclamation Research Plans and the Research Status Tracking Table (Appendix VIII) should reflect that all research will be completed in time for final plan submission and should include detailed scopes of work for all remaining research tasks.	pg. 66

Appendix B: Additional Revisions

In submission of the interim CRP Version 4.1, DDMI must include the revisions in the Table below. Inclusion of a revision in the table below does not necessarily mean that the revision will be approved in interim CRP Version 4.1, since the Board will consider further comments on the issue.

Issue/Topic	Revision	Comment ID
Wildlife safety	Clarify how wildlife safety will be met in relation to the A418 Pit high wall.	WLWB staff 7
Revegetation	Provide a map showing areas proposed for re-vegetation.	EMAB 25
Revegetation	Include sampling of natural and re-vegetated plant material for metals uptake to assess potential risk to wildlife.	EMAB 25
North inlet dam	Include more detail on the plan for decommissioning the NI Dam and a discussion on post-closure monitoring of the effectiveness of the flow-through structure.	EMAB 16
South WRSA	Include the closure plans for the south WRSA and a revised security estimate.	WLWB staff 10, GNWT-ENR 39
Criteria for open pits/dyke breach	Provide proposed water quality criteria for dyke breaching, including sampling depths and include details on water quality stability or number of consistent water quality monitoring events prior to breach.	ECCC-4
Groundwater monitoring	Describe plans for post-closure groundwater monitoring, and a rationale where no groundwater monitoring is proposed.	WLWB staff 37
Lac de Gras post-closure monitoring	In consideration of ECCC's comment/recommendation, include a discussion on proposed locations of near-field closure sampling sites.	ECCC 6
North Inlet closure planning	Discuss sediment and surface water interactions, and identify the potential for deterioration of replacement Lac de Gras water quality as an effect of the contaminated sediments in the North Inlet.	ECCC 2, GNWT-ENR 22
Open pit closure plans – meromixis	In consideration of EMAB's comment/recommendation, clarify the statement about meromictic conditions providing better habitat conditions than if the water mixes to include an explanation that the water below the surface zone will be unsuitable for fish.	EMAB 7
Open-pit post-closure monitoring	As suggested by DDMI in a follow-up correspondence,[121] revise the text in Appendix VI-1 that states "Twice per year deep water quality samples will be collected from approximately 25 m above the pit bottom, if feasible" to read "Twice per year deep water quality samples will be collected from approximately 25 m above the pit bottom; specific methods/instruments remain to be determined."	EMAB-17
PKCF post-closure monitoring	Revise the cutoff for quarterly sampling of acute lethality to rainbow trout at SNP1645-42, 69 or 44 from 10 L/s to 50 m3/s in Appendix VI-3, and clarify that acute toxicity testing is intended to be conducted at all locations where this runoff enters Lac de Gras. These are expected to be at natural drainage locations or restored natural drainage locations that will also be designated SNP stations.	EMAB 19, ENR14
PKCF Contingency Planning	Expand upon the contingency measure for removal of the semi-fluid FPK material and explain what options would be applicable for removal and disposal of the FPK	EMAB 11

[121] See WLWB Online Registry for Diavik - Closure and Reclamation Plan Version 4.0 - Review Summary and Attachments - Aug 13_18.pdf

Issue/Topic	Revision	Comment ID
Pond 3 Lakebed Sediments	Provide additional details on why only a portion of the lakebed sediment in Pond 3 would be available for reclamation and provide an estimate of the lakebed sediment that will likely be available for reclamation.	WLWB staff 6
Post-closure monitoring of fish in East Island lakes	Include a figure indicating which inland lakes "have been consumed within the mine footprint, which lakes remain and, of the remaining lakes, which were found to be fish bearing."	GNWT-ENR 18
Post-closure SNP stations	In consideration of GNWT-ENR's comment/recommendation, include statement/discussion regarding establishment and approval of post-closure SNP stations.	GNWT-ENR 15
Progressive Reclamation	Include a summary of the Progressive Reclamation completed to date.	WLWB staff 36
Revisions to Appendix IX-2	Include TK Panel recommendations in Appendix IX-2 and attach Session 10 TK Panel Report.	WLWB staff 33
Revisions to Appendix VIII	Update the Reclamation Research Plans (RRPs) titles in Appendix VIII to include the previous title numbers for the four mine components.	WLWB staff 30
Revisions to Figure Annex	Add Figures 5-9 and 5-10 (from the north WRSA CRP Report)	WLWB staff 11
Revisions to Figure Annex	Revise Figures 3-8a and 3-8b to "Bedrock Geology" instead of "Surficial Geology"	WLWB staff 1
Schedule in Appendix VI-5	Consider changes to the monitoring schedule for revegetation and include any changes in Appendix VI-5.	EMAB 26
Section 1.3 in Appendix VI-4	Add a follow-up assessment of the sediment quality in the North Inlet in approximately 2030 to determine if reconnection between the North Inlet and Lac de Gras is possible (if reconnection has not already occurred).	EMAB 20
Section 3.2.3 Bedrock Geology	Revise Section 3.2.3 Bedrock Geology to include correct information.	WLWB staff 2
Section 5.2.8.3.4 - Hydrocarbon contamination	Clarify how hydrocarbon contaminated areas identified post-closure will be managed.	EMAB 23
Section 8 Schedule of Activities	Indicate where the underground backfill will be sourced from between now and 2025 (e.g., percentage from NCRP and SCRP, if applicable)	EMAB 15
SW5 – closure activities	Revise Table 5-8 and text in Section 5.2.5 and 5.2.6 to ensure consistency with the TK Panel recommendations related to revegetation of the PKC Facility and WRSAs.	NSMA 2
WRSA thermal monitoring	In consideration of GNWT-ENR's recommendation, re-consider the distribution of GTC's.	GNWT-ENR 12

Issue/Topic	Revision	Comment ID
Reclamation Research Appendix	Move Appendices VIII-1A and VIII-1B (Plant Uptake of Metals from PK and 2016 University of Alberta Annual Research Report) to a more appropriate location. These reports are not reclamation research plans and make it difficult to navigate Appendix VIII.	NA
	Closure Criteria Revisions	
SW2 – Selection Process for parameters with associated closure criteria	Clarify selection process for variables included in Table A.	WLWB staff 25
SW2 – Reference for AEMP Benchmarks	Include reference to the AEMP Design as the source of the AEMP Benchmarks and clarify any assumptions related to parameters with benchmarks that are dependent on environmental factors (e.g., pH, temperature, hardness).	EMAB 117, 172, 173, 174, 175, 176
SW2 - Water entering Lac de Gras post-closure	Revise Figure 5-20 to include a best estimate of post-closure seepage/runoff sources that may contribute to each identified drainage areas to Lac de Gras.	WLWB staff 27
SW3 - Closure criteria	In consideration of EMAB's comments/recommendations, re-consider and revise the closure criteria related to SW3.	EMAB 60, 207
SW5/SW9 – Closure criterion related to change in biodiversity	In consideration of comments/recommendations, re-consider and revise the closure criterion related to SW5 and SW9 that considers a change in biodiversity in an area less than 1% of the Regional Study Area.	EMAB 67, 72, NSMA 1
SW5/SW9 – Closure criteria	In consideration of comments/recommendations and report on re-vegetation research, re-consider and revise re-vegetation criteria.	GNWT-ENR 32; NSMA 1 and 3; EMAB 23 and 24
M1 - Closure criteria	In consideration of EMAB's comment/recommendation, re-consider and revise Appendix V Table V-2 and Section 5.2.4.3.5.	EMAB 75
M2 - Closure criteria	In consideration of EMAB's comment/recommendation, re-consider and revise Appendix V Table V-2, Appendix VI-1 and Section 5.2.4.3.5.	EMAB 76
M3 - Closure criteria	Revise the closure criteria for M3 to be "Satisfaction of DFO".	EMAB 77
M6 and M7 – Closure criterion	In consideration of EMAB's comments/recommendations, revise the closure criterion for Closure Objectives M6 and M7	EMAB 79 and 80
NI4 – Closure criterion	In consideration of GNWT-ENR's comment/recommendation 23, revise the closure criterion for NI4 and expand the discussion of planned closure activity for the North Inlet.[122]	GNWT-ENR 23

[122] EMAB also had a recommendation for this criterion (EMAB comment 91). In its response, DDMI indicated that it did not agree with EMAB. However, since DDMI will be revising the criterion for NI4 to address GNWT-ENR comment 23, there will be an opportunity to revisit EMAB's recommendation.

Appendix C: List of Engagement Requirements #1 through 8

As described in the Reasons for Decision, in submission of the interim CRP Version 4.1, DDMI must complete the Engagement Requirements described in the Table below.

Requirement Number	Engagement Requirement	Page Reference
1.	Engage on the issue of revegetation of the WRSA, with the aim of building consensus.	pg. 11
2.	Engage and build consensus on the North Inlet closure objectives and the fate of the North Inlet, including the Options in the Golder evaluation.	pg. 21
3.	Engage with parties on the closure options for hydrocarbon-contaminated soil.	pg. 23
4.	Engage with parties on this potential gap in closure objective SW1 and consider, with rationale, the inclusion of a revised, or new, closure objective to specifically address the protection of aquatic life in East Island lakes.	pg. 25
5.	Engage with parties on closure objective SW5 and consider revising closure objective SW5 and its associated closure criteria in light of engagement. If revisions to the objective or criteria are made, including a rationale.	pg. 26
6.	Engage with parties regarding the question of how the safety of humans and wildlife in Lac de Gras will be ensured in cases where the closure criterion for SW2 is lower than the closure criterion for SW1 and provide a detailed explanation for any revisions proposed to address this issue.	pg. 44
7.	Engage with the GNWT on any newly proposed cost adjustments in the interim CRP Version 4.1 RECLAIM estimate (beyond those required by the Board), prior to submitting the estimate.	pg. 52
8.	Engage with the GNWT regarding the appropriate level of detail for improved documentation for DDMI's RECLAIM estimate.	pg. 62

Appendix D: List of SSRBCC Revisions #1 through 9

As described in the Reasons for Decision, in submission of the interim CRP Version 4.1, DDMI must include the revisions in the Table below.

Requirement Number	Revision	Page Reference
1.	Clarity must be provided in Appendix V. The closure criteria tables presented must include the list of all parameters with closure criteria, not just those based on SSRBCC. If a standard guideline is used for parameters where more than one guideline is available, DDMI must include rationale for its choice.	pg. 35
2.	DDMI is to engage with EMAB on the issue of protection to higher trophic levels when revising SSRBCC and explain how EMAB's concerns have been addressed.	pg. 35
3.	DDMI is to engage with EMAB on the issue of which lead guideline to apply for drinking water quality for humans when revising SSRBCC and explain how EMAB's concerns have been addressed.	pg. 35
4.	In order to improve the transparency and clarity of drinking water SSRBCC, DDMI must provide a comprehensive table that illustrates all the derived SSRBCC for humans, mammals, and birds, and include a summary column that indicates the proposed closure criteria for a given parameter.	pg. 36
5.	DDMI is to engage with EMAB on their comments related to toxicity testing endpoints (i.e., EMAB comments 98, 99, and 157) and food chain exposure in the derivation of SSRBCC (i.e., EMAB comments 140, 149, 152, 159, and 179) when revising SSRBCC and explain how EMAB's concerns have been addressed.	pg. 36
6.	DDMI is to provide justification for the exclusion of any toxicological data, as explained in the follow-up response from EMAB.	pg. 36
7.	DDMI is to address the potential concern of additive exposure to soil contaminants via particulate dust inhalation in its derivation of SSRBCC for contact with soil to humans.	pg. 36
8.	DDMI is to explain whether it would be appropriate to apply the guidance for soil contact to sediment contact by humans and, if appropriate propose revised sediment SSRBCC.	pg. 37
9.	DDMI is to incorporate revisions as outlined in Table 3.	pg. 37

Appendix E: List of Security Adjustments #1 through 15

As described in the Reasons for Decision, in submission of the interim CRP Version 4.1, DDMI must update the RECLAIM estimate in accordance with the Table below.

Adjustment Number	Adjustment	Page Reference
1.	Review and update the current annual cost of geotechnical inspections in the security estimate based on frequency and expected costs. If DDMI estimates costs that are less than $134,950 for 4 days of inspections by a qualified team, provide the estimate and supporting information.	pg. 53
2.	Update the security estimate assuming that it will take a minimum of three years following final deposition into the PKC Facility before final closure can be completed. Associated schedule and costs should be updated accordingly and in consideration of the factors listed in GNWT-ENR comment 34.	pg. 53
3.	Update the estimate for PKC cover construction using the assumptions and unit costs used in the current RECLAIM estimate for WRSA cover construction or provide a rationale for why the costs should be different.	pg. 53
4.	Provide a description of the activities, quantities, and unit costs associated with construction of the closure spillway, and re-estimate the spillway costs based on this description.	pg. 54
5.	Update pit flooding costs based on the recently submitted report contained in Appendix X-7.2. This estimate should include: capital costs for pumps, siphons and materials; earthworks and installation costs required at each siphon location; operation and maintenance; monitoring and performance assessment reports. If DDMI cannot develop this estimate, DDMI should contact the GNWT to seek input on next steps.	pg. 54
6.	Review costs associated with dyke breaching and consider adopting the costs for breaching dykes, including turbidity curtains, presented in Dominion's security estimate. If costs at Ekati are not suitable or comparable, DDMI should explain why there are differences and why existing costs are sufficient.	pg. 54
7.	Determine water treatment costs based on an estimate of annual quantities collected and treated over the closure and post-closure period. Consult recent estimates of quantities requiring treatment during closure and post-closure, and the length of time treatment will be required, for example, Table 7.10 of Appendix X-5 Revised PKC Facility Closure Concept.	pg. 55
8.	Provide a review of costs to operate the NIWTP, including: operator, mechanic and electrician unless accounted for elsewhere in the estimate; start up and winterization costs if operating seasonally; reagents; fuel, for heating buildings and power to operate; water quality monitoring specific to operation, and use this information to determine the appropriate unit cost.	pg. 55
9.	Correct the RECLAIM estimate to account for building height, in accordance with the RECLAIM Manual.	pg. 56
10.	Correct any errors in the mobilization costs, as noted by the GNWT-ENR (comment 51).	pg. 56
11.	Describe and or itemize monitoring costs that make up the "person, labour, equipment, logistics, etc." line item (line 9) and explain the relationship between these costs and Figure 8-1.	pg. 56

12.	Propose adjustments to the RECLAIM estimate for inflation to account for the period since the RECLAIM model was released. See the Reclaim 7 User Manual - Mining Version (November 2017) for more information. DDMI can contact the GNWT for assistance with the inflation function in RECLAIM.	pg. 57
13.	Propose the costs of long-term maintenance activities to the RECLAIM estimate for interim CRP Version 4.1. The estimated costs and length of monitoring period should be consistent with Board Policy, Guidelines, the RECLAIM User's Manual, and interim CRP Version 4.1. DDMI should use Attachment #3 of the WRSA CRP Version 1.1 as a starting point and consider reviewer comments and the January 25, 2018 letter from the WLWB to Dominion regarding security refunds.	pg. 59
14.	Propose monitoring costs, in consideration of the revised monitoring lengths, the estimate provided in Attachment #3 of WRSA CRP Version 1.1, and reviewer comments.	pg. 61
15.	Ensure the costs of maintaining and replacing monitoring instruments are included in RECLAIM.	pg. 62