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Agenda for De Beers Snap Lake Closure Technical Workshop (MV2019L2-0004)
Dates: January 18-20, 2022
Location: Online via Zoom

Workshop Purpose:

The Board approved De Beers Snap Lake's Final Closure and Reclamation Plan (FCRP) Version 1.1 (V 1.1) and Aquatic Effects Monitoring Program (AEMP) Design Plan Version 1.1 (V 1.1) as interim submissions on October 7, 2021 and November 10, 2021 respectively. The Board directed Board staff to organize a workshop to provide an opportunity for De Beers and Parties to discuss the outstanding concerns regarding closure criteria, closure and post-closure monitoring, AEMP action levels, and monitoring frequency prior to the submission of the FCRP V 1.2 and AEMP Design Plan V 1.2. Once resubmitted, the FCRP V 1.2 and AEMP Design Plan V 1.2 will be distributed for a focused review on the outstanding items.

The workshop is intended to provide an open and collaborative forum where parties can discuss their outstanding concerns on the FCRP closure criteria, closure and post-closure monitoring, and the linkages with the AEMP action levels and monitoring frequency for the closure of the Snap Lake mine. The workshop will be focused on the discussion on how De Beers can address the Board directives (Tables 1 and 2). Although it would be ideal if as many issues as possible were resolved during this session, Parties are not bound by comments made during the workshop. Please note that this technical workshop is not a public hearing; Board members and their legal counsel will not be participating.

As a result of the current Covid-19 situation, the Workshop will be virtually in Zoom format only. Board staff will send the zoom link to the participants separately.

Workshop Objectives:

1. Develop a shared understanding of how closure criteria identified in external documents will be incorporated and presented in the FCRP;
2. Discuss De Beers' proposed AEMP action levels and monitoring frequency;
3. Discuss how De Beers could revise closure criteria to meet Board directives;
4. Discuss if any action levels from De Beers' proposed response frameworks could be utilized as suitable, measurable closure criteria;
5. Discuss how De Beers' proposed closure and post-closure monitoring timelines can more clearly incorporate the consideration and achievement of positive trends, physical and chemical stability, and long-term sustainability; and
6. Identify options for next steps and timing for updates, submission timelines, and review timelines of the FCRP and AEMP Design Plan.

Workshop Material:

- FCRP V 1.1
  - Board Directives dated October 12, 2021
- AEMP Design Plan V 1.1
  - Board Directives dated November 24, 2021

Reference Material (Response Frameworks):

Board staff have attached handouts to this agenda for response frameworks of all the management plans submitted. Please print these framework handouts ahead of the workshop to have them readily available to help with discussion during the workshop. These response framework handouts will be used during Days 2 and 3 of the Workshop for discussing whether the action levels would be suitable as closure criteria.

- AEMP Design Plan V 1.1 Section 16.4 (approved as interim submission)
- Landform Design Plan Appendix G.3 (part of FCRP V 1.1)
- Erosion and Sedimentation Plan V 1.1 Section 5.4 (approved)
- North Pile Management Plan V 5 Appendix A-2 Table 1 (under review)
- Water Management Plan V 5.1.1 Section 5 (approved)
- Acid Rock Drainage and Geochemical Characterization and Management Plan V 1 Section 8.4 (under review)

Workshop Agenda:

The workshop agenda is based on Board directives from the AEMP Design Plan V 1.1 and FCRP V 1.1 decisions. References to applicable Board directive numbers are provided beside each Agenda topic. The Board directives for the AEMP Design Plan and FCRP revisions are included in Table 1 and Table 2 for reference.

Please note that the allocated time slots are approximate. Board staff will facilitate the AEMP Design Plan discussion on Day 1 because the AEMP response framework may have implications for the closure criteria discussion on Days 2 and 3.

For each AEMP component, Board staff will initiate discussion by:

- Presenting the existing applicable action levels from AEMP Design Plan V 1.1; and
- Presenting the associated Board directives.

For each FCRP discussion topic, Board staff will initiate discussion by:

- Presenting the existing closure criteria from FCRP V 1.1; and
- Presenting associated Board directives.

For each discussion topic, De Beers will:

- Discuss ideas and changes to address Board directives for Parties to consider; and
- Discuss rationale for proposed changes or alternative ideas to address Board directives.

Following De Beers' discussion, Parties can comment on the ideas and changes identified and whether those ideas address their concerns and/or Board's directives.

Day 1: January 18, 2022

Time	Topics	Applicable Board Directive (Table 1)
8:45-9:00	Arrival (coffee and snacks will be provided) Join Meeting via Zoom	
9:00-9:15	Roundtable Introductions and Parties Expectations for the Event Opening statements Overview of the Workshop Objectives and Agenda	
9:15-11:45 *(Break at 10:15)*	AEMP Water Quality • Board Staff review of response framework and associated Board Directives • De Beers to discuss potential changes in response to Board directives • All Parties discuss	AEMP 1, 5, 9, 10, 16, 17
	AEMP Toxicity • Board Staff review of response framework and associated Board Directives • De Beers to discuss potential changes in response to Board directives • All Parties discuss	AEMP 1, 13
	AEMP Sediment Quality • Board Staff review of response framework and associated Board Directives • De Beers to discuss potential changes in response to Board directives • All Parties discuss	AEMP 1, 19
11:45 – 13:00	LUNCH (not provided)	
13:00-16:00 *(Break at 14:30)*	Continue discussion on AEMP Sediment Quality	
	AEMP Plankton • Board Staff review of response framework and associated Board Directives • De Beers to discuss potential changes in response to Board directives • All Parties discuss	AEMP 1, 20
	AEMP Benthic Invertebrate • Board Staff review of response framework and associated Board Directives • De Beers to discuss potential changes in response to Board directives • All Parties discuss	AEMP 1, 20

	AEMP Fish Health • Board Staff review of response framework and associated Board Directives • De Beers to discuss potential changes in response to Board directives • All Parties discuss	AEMP 1, 12, 13, 20
	AEMP Fish Consumption by Humans • Board Staff review of response framework and associated Board Directives • De Beers to discuss potential changes in response to Board directives • All Parties discuss	AEMP 1, 15

Day 2: January 19, 2022

Time	Topics	Applicable Board Directive (Table 2)
8:45-9:00	Arrival (coffee and snacks will be provided) Join Meeting via Zoom	
9:00-9:30	Introductions (Board staff) Recap from Day 1 (De Beers)	
9:30-11:45 *(Break at 10:15)*	Continuation of Discussion from Day 1 on AEMP	
	Response Frameworks Vs. Closure Criteria • AEMP Design Plan • Final Landform Design Plan/Erosion and Sedimentation Management Plan • North Pile Management Plan • Water Management Plan • Acid Rock Drainage and Geochemical Characterization and Management Plan	FCRP 12, 21
	Site Wide (SW1-7): • Board Staff review of Site Wide Objectives and Criteria and associated Board Directives • De Beers to discuss potential changes in response to Board directives • All Parties discuss	SW1: FCRP 3, 11, 43, 45 SW2: FCRP 2, 3, 12, 17, 18, 36 SW3: FCRP 2, 3, 4, 5, 6, 12, 13, 18, 23, 24, 25, 37 SW4: FCRP 2, 3, 4, 5, 6, 12, 13 SW5: FCRP 3, 12, 17, SW6: FCRP 3, 12 SW7: FCRP 2, 3, 41, 42, 43, 44, 45, 52
11:45 – 13:00	LUNCH (not provided)	
13:00-16:00 *(Break at 14:30*	Continuation of Discussion on Site Wide (SW1-7)	

Day 3: January 20, 2022

Time	Topics	Applicable Board Directive (Table 2)
8:45-9:00	Arrival (coffee and snacks will be provided) Join Meeting via Zoom	
9:00-9:30	Introductions (Board staff) Recap from Day2 1 and 2 (De Beers)	
9:30-11:45 (Break at 10:15)	Continuation of Discussion on Site Wide (SW1-7)	
	North Pile (NP1-2) • Board Staff review of North Pile Objectives and Criteria and associated Board Directives • De Beers to discuss potential changes in response to Board directives • All Parties discuss	NP1: FCRP 2, 3, 4, 12, 14, 15, 18, 19, 25, NP2: FCRP 2, 3, 4, 12, 14, 15, 18
11:45 – 13:00	LUNCH (not provided)	
13:00-16:00 *(Break at 14:30)*	Continuation of Discussion on North Pile (NP1-2)	
	Underground (UG1-3) • Board Staff review of Underground Objectives and Criteria and associated Board Directives • De Beers to discuss potential changes in response to Board directives • All Parties discuss	UG2: FCRP 3, 5, 12, 30, 35 UG3: FCRP 12
	Infrastructure (I1-3) • Board Staff review of Infrastructure Objectives and Criteria and associated Board Directives • De Beers to discuss potential changes in response to Board directives • All Parties discuss	I1: FCRP 12 I2: FCRP 12, 17 I3: FCRP 12
	Recap from Days 1-3 (De Beers)	
	Follow-up action items (Board staff)	
	Discussion on submission and review timeline (Board staff)	

Table 1 AEMP Board Directives

Directive Number	AEMP Board Directives	Review Comment Reference
1	Discuss the following issues on proposed action levels: 1. Potential issues resulting from requirements for concurrent changes in multiple AEMP components to trigger an action level; 2. The requirement in some action levels for a spatial component where it does not appear to be justified (e.g., triggers require failed toxicity tests at multiple stations); and 3. Where action levels require that a link to the mine be demonstrated, there is a need for a more explicit description of how the change would or would not be considered mine related.	MVLWB # 9, 10, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, and 41
5	Consider revising Closure Criteria 2B to remove the spatial component and ensure that investigation and monitoring of potential localized trends in water quality is possible	MVLWB #43 SLEMA #4
9	Provide information to support that assessment of temporal trends in water quality will not be impacted with a reduced sampling frequency and assess the power of the proposed monitoring program to assess the percentage of change that can be detected at a reduced sample frequency	SLEMA # 5, 6, 7
10	Request a reduction in screening stations for monitoring underground water once supporting data during closure and rationale are provided. This reduction could be discussed further at the closure workshop.	SLEMA #11
12	Consider a more conservative moderate action level for large-bodied fish, which does not link fish health or tissue chemistry to other AEMP components	ENR # 16 MVLWB # 3
13	Provide explicit wording for the revised Action Level Trigger, correct the possibility of missing relevant adaptive management triggers due to out-of-cycle results between toxicity and fish health, deleted “Toxicity—Ecological Function Maintained”: “... AND Confirmed Action Level trigger for fish health” from the Moderate Action Level definition.	MVLWB # 9
15	Discuss the proposed the Moderate Action Level for “Fish Safe to Eat”: “The Moderate Action Level will be triggered if concentrations in edible fish tissue are above 75% of a fish consumption guideline and indicative of a risk to humans from consumption AND there are effects in Fish Tissue Chemistry” (i.e., the same metal[s] is/are elevated in small-bodied fish tissue chemistry)”	MVLWB # 15
16	Discuss the proposed update to the text in the AEMP Design Plan to be consistent with this footnote and clarify that Action Levels related to toxicological impairment for water quality are based on average concentrations calculated separately from each of the mixing zones.	MVLWB # 16
17	Clarify the interpretation of “programs” for the Water Quality component as discussed in response to MVLWB Comment #19 in the next AEMP Design Plan Version 1.2 and discuss the moderate action level for toxicological impairment at the closure workshop.	MVLWB # 19
19	Discuss the proposed changes to management response as “The response to the Moderate Action Level trigger may be to conduct a special study where sediment toxicity testing is undertaken at sites with the maximum concentrations, at selected stations farther away from the sites of maximum concentrations, and at selected	MVLWB # 27

Directive Number	AEMP Board Directives	Review Comment Reference
	stations in the reference lake".	
20	Discuss the proposed change to the High Action Level Criteria for "Biological Components – Nutrient Response for the microcystin criteria to one or more rather than two or more as follows: "detectable microcystin concentrations at one or more stations in Snap Lake."	MVLWB # 38

Table 2 FCRP Board Directives

Directive Number	FCRP Board Directive	Review Comment Reference[1]	Subtopic
2	De Beers revise closure criteria for physical stability, chemical stability, and/or the sustainability of vegetation to define what stability means and how it can be demonstrated.	ECCC 3, 4 GNWT-ENR 15, 32, 34, 35, 37, 40 MVLWB 10 SLEMA 4, 5, 6, 9, 10, 18, 67	Define Stability
3	De Beers to provide additional rationale for proposed post-closure monitoring timelines in Section 5.5 of the FCRP. The rationale provided should include consideration of the time it may take to achieve closure criteria and demonstrate site stability and trends.	ECCC 4 GNWT-ENR 15, 32, 33, 34 MVLWB 2 SLEMA 9 YKDFN 5	Monitoring Timelines
4	De Beers to revise closure criteria for physical stability, chemical stability, and/or the sustainability of vegetation to directly address trends, not as a footnote, but directly in all performance-based closure criteria.	ECCC 3, 4 GNWT-ENR 9, 15, 16, 19, 32 SLEMA 5, 7, 9, 10, 16, 18, 67 YKDFN 5	Trends
5	De Beers revise closure criteria for physical stability, chemical stability, and/or the sustainability of vegetation to directly address trends. For example: Closure criteria SW-3 be revised to address trends as follows: *a.* Water quality concentrations in Snap Lake are not trending upwards with a potential to exceed an AEMP benchmark; and *b.* Surface water concentrations are not trending upwards with a potential to exceed closure criteria.[2]	GNWT-ENR 15, 34	Trends
6	De Beers include the trends analysis recommended by the GNWT in the next version of the FCRP or propose another approach to analyzing trends.	GNWT-ENR 16	Trends
12	De Beers to include numerical chemical and stability criteria identified in external documents in Table 5.2 of the FCRP. If De Beers feels somewhere in Section 5.5 is more appropriate, clear cross-referencing should be provided.	ECCC 2 GNWT-ENR 7, 9, 10, 11, 13, 22, 40 MVLWB 10, 16 SLEMA 22, 31 YKDFN 3, 63, 69, 70, 73	Numerical Criteria
13	De Beers to provide clear, numeric criteria for SW3-2a.	GNWT-ENR 9, 10	Numerical Criteria
14	De Beers revise NP1 and NP2 to include numeric criteria to measure performance and remove information that does not meet the definition of	GNWT-ENR 7, 9, 32, 33, 35-39, 42	Measurable Criteria

[1] References may not be comprehensive.
[2] De Beers could propose changes to these criteria, provided they are consistent with the Board's direction.

Directive Number	FCRP Board Directive	Review Comment Reference[1]	Subtopic
	closure criteria.	MVLWB 9 SLEMA 10, 22, 23	
15	Closure criteria NP2-1 to refer to all monitoring components (visual and measurable) of NP1-1.	GNWT-ENR 7, 9, 32, 33, 35-39, 42 MVLWB 9 SLEMA 10, 22, 23	Measurable Criteria
17	De Beers to include the acceptable threshold for displacement or sloughing as closure criteria in an updated FCRP.	GNWT-ENR 39	Sloughing
18	Board staff recommend that De Beers include numerical criteria for TSS monitoring in criteria.	ECCC 2 GNWT-ENR 32, 42, 43 SLEMA 4, 6, 22	TSS
19	De Beers to include numerical criteria for maximum cover fill size into Table 5.2 of the FCRP or provide the appropriate context and cross-references for understanding maximum cover fill size in Section 5.5 of the FCRP.	MVLWB 10	Cover Fill
21	De Beers to participate in a workshop to consider whether the 'green' action levels identified in response frameworks and conditions that do not trigger low action levels in the AEMP are suitable closure criteria and incorporate them into Table 5.2 if they are.	GNWT-ENR 39 SLEMA 49, 50	-
22	At De Beers' discretion, The Board suggests that De Beers could opt to incorporate monitoring plans and response frameworks into the FCRP, provided they conform with the Licence Schedule requirements for each Plan. This may be preferrable to having monitoring plans scattered across multiple submissions but would require a significant (and likely redundant) effort from De Beers.	-	-
23	De Beers to include parameters from CCME Guidelines for the protection of agriculture (livestock and irrigation) to the closure criteria supporting the SW3 objective.	GNWT-ENR 13, 14 SLEMA 6	CCME Guidelines
24	De Beers to include criteria that ensure acute toxicity does not occur in surface runoff and seepage water as part of existing or as new criteria under objective SW3.	GNWT-ENR 18, 19	Acute Toxicity
25	De Beers to include acid rock drainage-specific criteria as recommended by SLEMA in the next version of the FCRP.	SLEMA 5, 10, 16, 19, 23, 38	ARD Criteria
30	De Beers to update the UG2 criteria to be based on the SNP results of station 02-20 d, e, and f, and SNAP 03 and 05.	GNWT-ENR 29, 42	Underground
35	De Beers to remove the wording in criteria UG2-2 that limits monitoring to the time 'when water is being pumped to the underground' and instead, propose an appropriate monitoring time to detect potential influences from the underground in Snap Lake.	GNWT-ENR 31 SLEMA 11	Underground
36	De Beers to identify the fish species being considered for criteria under object SW2 be identified in the FCRP.	MVLWB 5	Fish Species
37	De Beers to develop criteria for thallium and cesium in fish tissue or explain	GNWT-ENR 26, 27	Thallium and

Directive Number	FCRP Board Directive	Review Comment Reference[1]	Subtopic
	in detail why De Beers does not think these criteria are necessary.		Cesium
41	De Beers to clarify the purpose of SW7 and consider whether SW7 should be revised.	SLEMA 67, 69, 70 YKDFN 82	SW7
42	De Beers to clarify how Post-Closure inspections by qualified professionals and representatives of SLEMA will be incorporated into reporting on SW7 criteria and explain how De Beers will respond if the percentages presented in the criteria are achieved but if SLEMA and/or First Nations representatives do not believe that the species composition of cover meets the aesthetic goal.	SLEMA 67, 69, 70 YKDFN 79, 80, 82, 84, 85	Revegetation Goals
43	De Beers to provide additional information and evidence to support the predicted natural succession of vegetation and likelihood of establishment of other species over time.	SLEMA 67, 69, 70 YKDFN 79, 80, 82, 84, 85	Vegetation Succession
44	De Beers to add the following to the SW7 criteria: “A third party expert opinion confirms that natural succession of plants is likely to continue into the future and that vegetation has likely become self-sustaining” or provide a rationale for why this is not a suitable criterion.	SLEMA 67, 69, 70 YKDFN 79, 80, 82, 84, 85	Vegetation Succession
45	De Beers to propose closure criteria and monitoring related to the potential for metal uptake by plants.	SLEMA 54, 67	Metals Uptake
52	De Beers to include clarification in Section 5.5.2 regarding the intentions for post-closure meteorology monitoring.	YKDFN 47	Meteorology Monitoring

Table 17-1 Assessment Approach for AEMP-related Closure Criteria to Meet Site-wide 3 Objective – Surface Runoff and Seepage Water Quality that Is Safe for People, Vegetation, Aquatic Life, and Wildlife

Closure Criteria for Site-wide 3 Objective Related to Monitoring Completed under the AEMP	Assessment Approach to Meeting Closure Criteria
2b) Water Quality concentrations in Snap Lake are less than Aquatic Effects Monitoring Program (AEMP) benchmarks as defined in the approved AEMP Design Plan[8] and are demonstrated for a period of 5 years from the initiation of the Post-Closure period; *Footnote:* *[8]The Aquatic Effects Monitoring Program benchmarks incorporate health-based drinking water guidelines (Health Canada, 2019) if they are lower than water quality guidelines or site-specific water quality objectives for the protection of aquatic life.*	For all AEMP benchmarks listed in Table 6.3-6, with the exception of the nutrient benchmark for total phosphorus and the health-based drinking WQG for manganese: • The 95th percentile concentrations of TDS, major ions, nutrients and metals in standard AEMP samples (Section 6.3.3.4) collected in Snap Lake, each year for five years from the start of Post-closure, will be below AEMP benchmarks. • The average concentrations of TDS, major ions, nutrients and metals in standard AEMP samples (Section 6.3.3.4) at the mixing zones during each sampling event, each year for five years from the start of Post-closure, will be below AEMP benchmarks. For the AEMP benchmark for nutrient enrichment for total phosphorus listed in Table 6.3-6: • The average concentration of total phosphorus in standard AEMP samples (Section 6.3.3.4) in the main basin (i.e., whole-lake average) and in the northwest arm (northwest arm average) during each lake-wide sampling event, each year for five years from the start of Post-closure, will be below the AEMP benchmark for nutrient enrichment. For the AEMP benchmark based on the health-based drinking WQG for manganese listed in Table 6.3-6: • The 95th percentile concentration of manganese in samples collected at surface at SNP 02-20e and at mid-depth to surface at all other actively sampled stations in Snap Lake, each year for five years from the start of Post-closure, will be below the health-based drinking WQG for manganese. • If manganese results from surface samples at SNP 02-20e or mid-depth samples are not available at a station, then the available manganese results from an alternate sampling depth (e.g., bottom or mid-depth at SNP 02-20e or bottom at all other stations in Snap Lake) will be used. Based on at least five years of data from the start of Post-closure, concentrations of parameters with AEMP benchmarks are not increasing in Snap Lake, or if they are increasing, the increasing trend is not ecologically significant, with the following considerations: • Additional years of data prior to the start of Post-closure may be included in the trend assessment if the increasing trend began before the start of Post-closure. • An increasing trend is not considered ecologically significant if only found at one station in Snap Lake, or if the trend is also occurring in Northeast Lake with a similar slope. • An increasing trend is not considered ecologically significant if ambient concentrations and the slope of the trend are low enough that, if the increasing trend continued with the steepest slope identified, the AEMP benchmark would not be exceeded for 100 years or longer. • Statistical temporal trend analyses will follow methods described in Key Question 3 for water quality (Section 6.3.5.3). Exceedances of AEMP benchmarks or increasing trends that can be demonstrated to be not Mine-related (e.g., due to natural conditions or regional effects like climate change) would still allow closure criteria to be met.

Table 17-1 Assessment Approach for AEMP-related Closure Criteria to Meet Site-wide 3 Objective – Surface Runoff and Seepage Water Quality that Is Safe for People, Vegetation, Aquatic Life, and Wildlife

Closure Criteria for Site-wide 3 Objective Related to Monitoring Completed under the AEMP	Assessment Approach to Meeting Closure Criteria
2c) Mean fish health endpoints are within the regional normal range as defined in the approved AEMP Design Plan and demonstrated twice after the initiation of the Post-Closure period (once during the first three years of Post-Closure (Year 1-3) and once during the following three years of Post-Closure (Year 4-6)	Mean values for fish health endpoints related to survival (e.g., age), growth (e.g., size-at-age), reproduction (e.g., relative gonad size, relative fecundity), and condition (e.g., condition, relative liver size), measured as part of the small-bodied fish health survey using Lake Chub, will be compared to the regional reference normal range as defined in the approved AEMP Design Plan. If these endpoints remain within the regional reference normal range in both of the Post-Closure monitoring events (i.e., Year 1-3 and again Year 4-6), closure criteria would be met and monitoring of fish health would cease.
2d) Fish tissue metal concentrations are below Health Canada benchmarks[11] as defined in the approved AEMP Design Plan and as demonstrated once after the initiation of the Post-Closure period (between Post-Closure Years 4 and 6)	Mercury concentrations in fish tissue will be assessed as part of the small-bodied fish health survey using Lake Chub, but an additional non-lethal (i.e., tissue plugs) large-bodied fish program targeting Lake Trout will be undertaken during Post-Closure to confirm fish tissue mercury concentrations are below Health Canada benchmarks. An "adjusted" mercury concentration for a defined size of fish (e.g., 600 mm) will be considered, rather than individual samples or a mean, because Lake Trout mercury concentrations are expected to occasionally exceed Health Canada benchmarks in larger fish due to the nature of mercury to biomagnify (i.e., accumulate to a greater degree in top trophic level organisms) and bioaccumulate (i.e., accumulate to a greater degree in larger, older organisms). Therefore, a hypothetical 600 mm fish will be considered relative to Health Canada guidelines, where mercury concentration will be calculated in the 600 mm hypothetical fish based on the regression relationship between mercury concentration and length, using all fish captured during the survey.
3. *Future Use and Aesthetics* *The principle of future use has been considered through the identification of chemical stability requirements under SW3-2, whereby conformance with EA 1314-02 Measure 1 parts a through c[10] is demonstrated.* *Conformance with EA 131402 Measure 1d is demonstrated when the annual calculated total dissolved solids concentration at Node 22 (in Mackay Lake) is less than the Acceptable Limit[11], as defined in the approved AEMP Design Plan, within a minimum of 10 years of monitoring during the closure and post-closure period (until 2030)[12].* *Footnotes:* *[10]Mackenzie Valley Environmental Impact Review Board (MVEIRB), 2014. Report of Environmental Assessment and Reasons for Decision, De Beers Canada Inc. Snap Lake Amendment Project EA1314-02. September 2014.* *[11]If Total Dissolved Solids (TDS) concentrations are above the Acceptable Limit due to causes other than the Mine (e.g., regional changes in TDS concentrations due to climate change effects), the Acceptable Limit may be recalculated following the approved methods in Golder (2017a) using more recent reference data.* *[12]Ten years (2021 to 2030) are expected to be sufficient to capture peak concentrations at Node 22 based on model predictions (Golder, in prep)[(a)]. If concentrations at Node 22 are increasing based on data up to 2030 results, then monitoring should continue until concentrations at Node 22 are no longer increasing. Methods for identifying increasing trends will be provided in the approved AEMP Design Plan.*	See also approach above related to meeting SW3-2 closure criteria (2b,c, and d). Mean concentrations of calculated TDS in five samples collected during ice-covered conditions at Node 22 will be below the Acceptable Limit (19.1 mg/L) each year within a minimum of 10 years within the Closure and Post-Closure period (2021 to 2030). Concentrations of calculated TDS are not increasing at Node 22 based on at least 10 years of data from the Closure and Post-closure period (2021 to 2030). Exceedances of the Acceptable Limit or increasing trends that can be demonstrated to be not Mine-related (e.g., due to natural conditions or regional effects like climate change) would still allow closure criteria to be met. Statistical temporal trend analyses will follow methods described in Key Questions 3 and 4 for water quality (Sections 6.3.5.3 and 6.3.5.4, respectively).

a) Source: De Beers 2021a.

[11] Health Canada. 2015. Health Canada's Maximum Levels for Chemical Contaminants in Foods. Available at: https://www.canada.ca/en/health-canada/services/food-nutrition/food-safety/chemical-contaminants/maximum-levels-chemical-contaminants-foods.html. Accessed January 2021.

Table 17-2 Assessment Approach for AEMP-related Closure Criteria to Meet Underground 2 Objective – Underground Mine Should Not Contribute to the Contamination of Ground or Surface Water

Closure Criteria for Underground 2 Objective Related to Monitoring Completed under the AEMP	Assessment Approach to Meeting Closure Criteria
2. To meet this closure objective, the annual water quality concentrations at Snap Lake stations where water from the underground may enter the lake will be less than Aquatic Effects Monitoring Program (AEMP) benchmarks defined in the approved AEMP Design Plan for the period when water is pumped to the underground[17]. *Footnote:* *[17]If concentrations in Snap Lake are above an Aquatic Effects Monitoring Program benchmark but the exceedance is not related to groundwater (e.g., concentrations are not higher at locations above the underground mine compared to other locations in Snap Lake), then closure criteria for UG2 may still be met.*	For all AEMP benchmarks listed in Table 6.3-6 with the exception of the nutrient benchmark for total phosphorus and the health-based drinking WQG for manganese: • The average concentrations of TDS, major ions, nutrients and metals in bottom samples (Section 6.3.3.4) collected above the underground workings during each lake-wide sampling event will be below AEMP benchmarks Exceedances of AEMP benchmarks that can be demonstrated to be not Mine-related (e.g., due to natural conditions or regional effects like climate change) would still allow closure criteria to be met.

AEMP = Aquatic Effects Monitoring Program; TDS = total dissolved solids; WQG = water quality guideline.

Table 16.4-6 Proposed Interim Action Level – Protection of Traditional Land Use

Action Level	Water Quality (TDS) Protection of Traditional Land Use
Low *Effects are measurable but well below the Significance Threshold – trigger meant as a warning and requirement for further evaluation*	Average concentration of TDS at the outlets of Lac Capot Blanc[a] is above maximum prediction **OR** 50% to less than 75% of the area below the estimated normal curve of TDS concentrations measured annually at Node 22 is below the upper limit of the range of natural variability during any one sampling event[b]
Moderate *Effects are measurable and are trending towards the Significance Threshold, but still well below it*	Less than 50% of the area below the estimated normal curve of TDS concentrations measured annually at Node 22 is below the upper limit of the range of natural variability during any one sampling event[b] **AND** Range of natural variability has not changed over time[c]
High *Measured effects continue to trend towards the Significance Threshold*	Less than 50% of the area below the estimated normal curve of TDS concentrations measured annually at Node 22 is below the upper limit of the range of natural variability during any two consecutive sampling events[b]

a) The average TDS concentration from both outlets of Lac Capot Blanc during any one sampling event will be compared to the maximum predicted TDS concentration for the Water Licence period (2020 to 2035) in Golder (2021c).

b) Each year, the TDS concentrations from five samples collected at Node 22 will be used to construct a normal distribution using the mean and standard deviation of those five samples. The distribution will then be divided into quarters. If the concentration at the fourth quarter or third quarter line (upper 25% or 50%, respectively) is greater than the range of natural variability, the Low or Moderate Action Level, respectively, is triggered; triggering the Moderate Action Level also assumes that the range of natural variability has not changed over time. The High Action Level will be triggered if the Moderate Action Level is triggered two years in a row.

c) The most recent data from reference locations in MacKay and other lakes used in the determination of the range of natural variability will be reviewed to determine if regional effects (e.g., climate change) may have resulted in a change to the range. If so, the range of natural variability will be updated and used in the comparisons for Action Levels.

TDS = total dissolved solids;% = percent; mg/L = milligrams per litre; >= greater than.

Table 16.4-1 Action Levels – Drinking Water and Fish Safe to Eat

Action Level	Drinking Water for Humans/Wildlife "Water Safe to Drink"	Fish Consumption by Humans "Fish Safe to Eat"
Low *Effects are measurable but well below the Significance Threshold – trigger meant as a warning and requirement for further evaluation*	Mid-depth or shallower[a] concentration at any location in Snap Lake is above 60% of Health Canada health-based drinking WQG **OR** Mid-depth or shallower[a] concentration at any location is above 60% of CCME wildlife health WQG[b].	Fish taste and/or texture not acceptable **AND** Evidence from one or more AEMP components that the change in fish taste and/or texture can be linked to the Mine (as demonstrated by Moderate Action Level triggers for Water Quality, Sediment Quality, or Fish Health).
Moderate *Effects are measurable and are trending towards the Significance Threshold, but still well below it*	Mid-depth or shallower[a] concentration at any location in Snap Lake is above 70% of Health Canada health-based drinking WQG[b] **OR** Mid-depth or shallower[a] concentration at any location is above 70% of CCME wildlife health WQG[b].	Metals in edible fish tissue[d] above 75% of upper limit of regional reference normal range[e] in a direction that is indicative of a risk to humans from consumption **AND** Effects are supported by consistent effects in Fish Health (i.e., same metal[s] is/are elevated in small-bodied fish tissue chemistry) or effects are supported by consistent effects in two or more other AEMP components **AND** Effect is linked to the Mine
High *Measured effects continue to trend towards the Significance Threshold*	Mid-depth or shallower[a] concentration at any location in Snap Lake is above 85% of Health Canada health-based drinking WQG[b] **OR** Mid-depth or shallower[a] concentration at any location is above 85% of CCME wildlife health WQG[b] **AND** Risk to humans or animals from drinking the water is not acceptable[c]	Confirmed Moderate Action Level Trigger **AND** The human health risk assessment initiated under the Moderate Action Level identify a potential risk that triggers the High Action Level

a) Use of mid-depth samples for assessing drinking water Action Levels applies to all stations except at deep locations (i.e., SNP 02-20e) for manganese where a surface sample should be used for assessing drinking water Action Levels for manganese.

b) Result confirmed by the laboratory and through one round of confirmatory sampling.

c) Based on a risk assessment, to be completed when the Moderate Action Level is triggered, that considers the magnitude, extent, frequency and timing of elevated concentrations, as well as temporal trends and spatial patterns of concentrations and the most recent predictions.

d) It is assumed a large-bodied fish study would be initiated in response to the Moderate Action Level trigger for Fish Health or Fish Tissue Chemistry (Table 16.4-2); therefore, this Action Level assessment would occur one year after the initiation of that study. Should the Moderate Action Level be triggered, the initiation of a large-bodied fish study would be considered as a response action.

e) The definition of Normal Range was given in De Beers (2015c) and Barrett et al. (2015).

AEMP = Aquatic Effects Monitoring Program; SNP = Surveillance Network Program; <= less than;% = percent; CCME = Canadian Council Ministers of the Environment; WQG = water quality guideline; TK = Traditional Knowledge.

Table 16.4-2 Proposed Updated Action Levels for Closure– Toxicological Impairment

Action Level	Water Quality (substances of potential toxicological concern and measured toxicity) Ecological Function Maintained	Toxicity Ecological Function Maintained	Sediment Quality Ecological Function Maintained
Low *Effects are measurable but well below the Significance Threshold – trigger meant as a warning and requirement for further evaluation*	Concentration above 75% of the AEMP Benchmark[a] at the edge of the mixing zone (i.e., existing or new mixing zone boundary stations) **AND** Concentration greater than normal range[b], supported by an increasing temporal trend in Snap Lake[c]	IC25 for three brood reproduction with *C. dubia* of ≤100%, present in results at the edge of the mixing zone at more than one station (i.e., existing or new mixing zone boundary stations	Mean concentration above 75% of ISQG in Snap Lake **AND** Concentration greater than normal range **AND** Link to Mine[d] demonstrated by spatial or temporal trend, or water quality results
Moderate *Effects are measurable and are trending towards the Significance Threshold, but still well below it*	Concentration above the AEMP Benchmark[a] at the edge of the mixing zone (i.e., existing or new zone boundary stations) in two consecutive programs **and** concentration greater than normal range[b], supported by an increasing temporal trend in Snap Lake[c] **OR** Concentration above the AEMP Benchmark[e] at the edge of the mixing zone (i.e., existing or new zone boundary stations) **and** confirmed[d] IC50 for three-brood reproduction with *C. dubia* of ≤50%, present in results at the edge of the mixing zone at more than one station (i.e., existing or new mixing zone boundary stations) in the same year	Confirmed[e] IC50 for three-brood reproduction with *C. dubia* of ≤50%, present in results at the edge of the mixing zone at more than one station (i.e., existing or new mixing zone boundary stations) **AND** Confirmed Action Level for fish health	Mean Concentration above 75% of PEL in Snap Lake **AND** Low Action Level for toxicological impairment triggered for benthic invertebrates
High *Measured effects continue to trend towards the Significance Threshold*	Concentration above the AEMP Benchmark[e] at the edge of the mixing zone (i.e., existing or new zone boundary stations **and** confirmed[f] LC50 for survival with *C. dubia* of ≤100%, present in results at the edge of the mixing zone at more than one station (i.e., existing or new mixing zone boundary stations) in the same year[g] **OR** Concentration above an Effects Threshold[h] at the edge of the mixing zone (i.e., existing or new zone boundary stations)[g]	Confirmed[f] LC50 for survival with *C. dubia* of ≤100%, present in results at the edge of the mixing zone at more than one station (i.e., existing or new mixing zone boundary stations) **AND** Confirmed Action Level for fish health, and the mean fish health endpoint is beyond the regional reference normal range	Mean Concentration above 90% of PEL in Snap Lake **AND** Moderate or High Action Level for toxicological impairment triggered for benthic invertebrates

Note: The Moderate and High Action Level criteria assume the lower Action Level has been triggered; therefore, only the criteria that are unique to each Action Level are shown.

a) Average concentrations at each of the mixing zone boundaries (i.e., SNP 02-20d, SNP 02-20e, and SNP 02-20f during discharge to the existing mixing zone in the main basin, SNP 02-02h and SNP 02-20i during discharge to the new mixing zone in the main basin, and SNP 02-20j and SNP 02-20k during discharge to the new mixing zone in the northwest arm) are compared to applicable AEMP Benchmarks (Table 6.3-6). Applicable AEMP benchmarks for the toxicological Action Level assessment include all AEMP benchmarks for TDS, major ions, nutrients and metals in Table 6.3-6 with the exception of two AEMP benchmarks that are not toxicologically based: the health-based drinking WQG for manganese (Health Canada 2020) and the AEMP nutrient benchmark for phosphorus (Wetzel 2001, CCME 1999). The AEMP benchmark for aquatic life for manganese (Table 6.3-6; CCME 1999) should be used for assessing toxicological Action Levels and the AEMP benchmark for phosphorus should be used for assessing nutrient enrichment Action Levels (Table 16.4-5).

b) Snap Lake whole-lake average concentrations (i.e., excluding northwest arm stations), and northwest arm average concentrations once discharge to the northwest arm begins, will be compared to the Snap Lake normal range calculated based on average concentrations.

c) If similar increasing trends are identified in Snap and Northeast lakes, this would indicate a regional increasing trend not related to the Mine and would not trigger an Action Level.

d) Link to the Mine will be assessed by (1) examining effluent and mixing zone water quality results to see if the parameter in question was discharged to the lake at an elevated concentration relative to background; (2) evaluating spatial trends relative to the discharge location to see if there is a declining trend with distance from the point of discharge; and (3) evaluating temporal trends relative to the timing of initiation of discharge or an increase in loading of the parameter from the discharge, to see if there was an increase in concentration in sediments following the beginning of discharge or a change in discharge.

e) A confirmed effect is defined as an effect that is persistently observed, i.e., during the initial toxicity test and in subsequent confirmatory toxicity testing performed as soon as reasonably possible following the initial observation of toxicity.

f) In this case of the High Action Level for Ceriodaphnia dubia*, if the test result cannot be confirmed because a retest cannot be conducted due to seasonal delays (e.g., onset of winter conditions) or logistical constraints (e.g., availability of test organisms) then the result will be assumed as reliable (i.e., confirmed) as long as it meets the criteria described in Section 16.4.3.2.*

g) If a Moderate Action Level is triggered for water quality, follow up actions may include either more frequent chronic toxicity monitoring at the mixing zone, including toxicity monitoring during the time of year when the Moderate Action Level was triggered, or development of an Effects Threshold, or both.

h) Effects Threshold is a low-effect level on a sensitive representative species (e.g., EC_{20-25}, which are 20 to 25% effects concentrations; this is consistent with the definition of the CCME [2007] of a low-level effect level). A parameter-specific Effects Threshold could be developed in response to a Moderate Action Level and will be based on relevant toxicological data either through site specific toxicity testing or review of relevant toxicity data for site-specific aquatic biota from the literature.

AEMP = Aquatic Effects Monitoring Program; Mine = Snap Lake Mine; >= greater than; ; ≤ = less than or equal; P = probability;% = percent; IC50 = the concentration that causes a 50% inhibitory effect in the sublethal endpoint being measured, i.e., reproduction in this case; IC25 = the concentration that causes a 25% inhibitory effect in the sublethal endpoint being measured, i.e., reproduction in this case; LC50 = lethal concentration that results in 50% lethality to test population; ISQG = interim sediment quality guidelines; PEL = probable effects size.

Table 16.4-2 Proposed Updated Action Levels for Closure– Toxicological Impairment (continued)

Action Level	Plankton Community Ecological Function Maintained	Benthic Invertebrate Community Ecological Function Maintained	Fish Health Ecological Function Maintained
Low *Effects are measurable but well below the Significance Threshold – trigger meant as a warning and requirement for further evaluation*	Mean[a] total phytoplankton biomass or zooplankton biomass in Snap Lake below the normal range	Significantly lower (P<0.1) total density, richness, or densities of dominant taxa[b] in the Snap Lake main basin compared to Northeast Lake **AND** Mean[a] densities in Snap Lake below 50% of the normal range mean, or mean richness below the normal range	A statistically significant difference (P<0.1) in fish health endpoints[c] or fish tissue chemistry parameters compared to the reference lake (Lake 13) **AND** Change is in direction, and of magnitude[d], that is indicative of an impairment to fish health
Moderate *Effects are measurable and are trending towards the Significance Threshold, but still well below it*	Mean[a] total phytoplankton or zooplankton biomass in Snap Lake three times lower than the normal range mean (i.e., half a log unit decrease) **AND** Moderate Action Level exceedance consistent with toxicological impairment in one or more water quality endpoints	Mean[a] total density, or densities of dominant taxa in Snap Lake below the normal range, or mean richness below 75% of the lower bound of the normal range **AND** Moderate Action Level exceedance consistent with toxicological impairment in one or more water quality or sediment quality endpoints	Confirmed[e] Low Action Level **AND** Mean[a] fish health endpoint or fish tissue parameter outside the regional reference normal range in a direction that is indicative of an impairment to fish health **AND** Effect on the fish health or fish tissue chemistry is supported by consistent effects in one or more other AEMP components
High *Measured effects continue to trend towards the Significance Threshold*	Mean[a] total zooplankton biomass in Snap Lake 10 times lower than the normal range mean (i.e., a one log unit decrease) **AND** High Action Level exceedance consistent with toxicological impairment in one or more water quality endpoints	Mean[a] total density, richness, or densities of dominant taxa in Snap Lake below 50% of the lower bound of the normal range **AND** High Action Level exceedance consistent with toxicological impairment in one or more water quality or sediment quality endpoints	Confirmed[e] Moderate Action Level trigger for two or more fish health endpoints[f] in small-bodied fish or large-bodied fish[g] or one or more fish tissue chemistry parameters **AND** Effects exceed site-specific benchmarks[h] for fish tissue parameters, and are supported by a toxicological impairment response pattern in fish health

Note: The Moderate and High Action Level criteria assume the previous Action Level has been triggered; therefore, only the criteria that are unique to each Action Level are shown.
a) The arithmetic or geometric mean or median will be selected for Action Level comparisons as appropriate based on the distribution of the data (normal distribution: arithmetic mean; log-normal distribution: geometric mean; non-normal raw or transformed data: median).

b) Dominant taxa are defined as those accounting for more than 5% of total density based on mean values.
c) Key fish health endpoints are: condition, relative gonad size, and relative liver size. They will be assessed between Snap Lake and reference Lake 13.

d) Definition of a magnitude of change that is indicative of impairment to fish health is based on the critical effect sizes defined by Environment Canada's Metal Mining Effluent Regulations Guidance Document (Environment Canada 2012) and refers to an increase or a decrease in fish health endpoints. For fish tissue chemistry parameters, the critical effect size is a difference of 100%, which allows for both natural and analytical variability.

e) Confirmed indicates that the Action Level trigger has been observed in at least two consecutive monitoring programs, whether during the regular monitoring schedule or confirmed through a special study. It is assumed a fish palatability study may be initiated as part of the effort to confirm the results.

f) Fish health endpoints for the high Action Level includes those indicated in (c), as well as supporting endpoints (i.e., length, weight, etc.) as described in Section 11.

g) It is assumed a large-bodied fish health study may be initiated, if appropriate, at the Moderate Action Level trigger for small-bodied fish. Should the results of the AEMP fish health survey trigger the need for a large-bodied fish health program, it is expected the large-bodied program would be initiated outside of the regular AEMP schedule/cycle (i.e., it would not require six years to confirm effects). A large-bodied fish health special study would be expected to occur within one to two years of triggering small-bodied fish health results (i.e., the following year if possible, two years later if the Response Plan was not approved in time for conducting the program during the subsequent open-water season).

h) It is assumed site-specific benchmarks would be developed for fish tissue parameters triggering the Moderate Action Level.
P = probability; <= less than;% = percent; SD = standard deviation.

Table 16.4-5 Proposed Updated Action Levels– Nutrient Enrichment

Action Level	Water Quality (Nutrients) Ecosystem Function	Biological (Plankton, Benthic Invertebrates and Fish) Ecosystem Function
Low *Effects are measurable but well below the Significance Threshold – trigger meant as a warning and requirement for further evaluation*	Average concentration of total phosphorus in the whole lake or the northwest arm (depending upon the discharge location) is above 75% of the AEMP Benchmark[a] **AND** Increasing temporal trends in total phosphorus concentrations in Snap Lake[c]	Mean[f] total phytoplankton biomass in Snap Lake above the normal range, **or** mean[e] chlorophyll *a* concentration greater than 3.4 µg/L (i.e., 25% less than the top of oligotrophic range). **AND** A shift in phytoplankton community composition from chrysophytes and diatoms to cyanobacteria and chlorophytes measured as a ≥50% reduction in baseline proportions of chrysophytes and diatoms in Snap Lake
Moderate *Effects are measurable and are trending towards the Significance Threshold, but still well below it*	Average concentration of total phosphorus in the whole lake or the northwest arm (depending upon the discharge location) is above the AEMP benchmark[a] **AND** Total phosphorus concentration greater than normal range[b], supported by an increasing temporal trend in Snap Lake[c]	A 10-fold increase in mean total phytoplankton biomass in Snap Lake above the top of the normal range, **or** mean chlorophyll *a* concentration greater than 4.5 µg/L (i.e., within the mesotrophic range) **AND** A 10-fold increase in mean[e] total zooplankton biomass in Snap Lake relative to the normal range mean, **or** significantly higher (P<0.1) total benthic invertebrate density or densities of dominant taxa in Snap Lake compared to Northeast Lake, representing a 10-fold increase in mean[e] density in Snap Lake relative to the normal range mean
High *Measured effects continue to trend towards the Significance Threshold*	Average concentration of total phosphorus in the whole lake or the northwest arm (depending upon the discharge location) is above 20 µg/L[a] **AND** Unacceptable risk to fish in Snap Lake due to low dissolved oxygen concentrations or algal toxins[d]	A visual algal bloom or a shift in phytoplankton community composition to cyanobacteria dominance measured as ≥80% proportion of cyanobacteria in the community in Snap Lake, and detectable microcystin concentrations at two or more stations in Snap Lake **AND** Significantly lower (P<0.1) total benthic invertebrate density, or densities of dominant taxa[f] in Snap Lake compared to Northeast Lake, with the mean values in Snap Lake below the normal range, **or** a 10-fold decrease in mean[f] total zooplankton biomass in Snap Lake relative to the normal range mean **AND** Confirmed[g] significant difference (P<0.1) for two or more fish health endpoints[h,i] in small-bodied fish **or** large-bodied fish[i] compared to Lake 13, and mean[e] fish health endpoints outside the regional reference normal range, in a direction that is indicative of an impairment of fish health

Note: The Moderate and High Action Level criteria assume the previous Action Level has been triggered; therefore, only the criteria that are unique to each Action Level are shown.

a) Whole-lake average concentration is based on average concentrations from sampled locations in Snap Lake excluding the northwest arm; northwest arm average concentration is based on average concentrations from sampled locations in the northwest arm.

b) Snap Lake whole-lake average concentrations (i.e., excluding northwest arm stations), and northwest arm average concentrations once discharge to the northwest arm begins, will be compared to the normal range calculated based on average concentrations.

c) If similar increasing trends are identified in Snap and Northeast lakes, this would indicate a regional increasing trend not related to the Mine and would not trigger an Action Level.

d) Based on a risk assessment, to be completed when the Moderate Action Level is triggered, that considers the magnitude, frequency and timing of lower dissolved oxygen concentrations or algal toxins; temporal trends and spatial patterns of dissolved oxygen concentrations or algal toxins; the most recent predictions for dissolved oxygen concentrations, and the sensitivity to low dissolved oxygen concentrations and algal toxins for fish in Snap Lake, and the food they eat (e.g., benthic invertebrates).

e) The arithmetic or geometric mean or median will be selected for Action Level comparisons as appropriate based on the distribution of the data (normal distribution: arithmetic mean; log-normal distribution: geometric mean; non-normal raw or transformed data: median).

f) Dominant taxa are defined as those accounting for more than 5% of total density based on mean values.

g) Confirmed indicates that the Action Level trigger has been observed in at least two consecutive monitoring programs, whether during the regular AEMP schedule or confirmed through a special study.

h) Key fish health endpoints are: condition, relative gonad size, and relative liver size. They will be assessed between Snap Lake and the reference lake (Lake 13).

i) Fish health endpoints for the High Action Level includes the fish health endpoints indicated in (h), as well as supporting endpoints (i.e., length, weight, etc.) as described in Section 11.

AEMP = Aquatic Effects Monitoring Program; P = probability; <= less than; µg/L = micrograms per litre.

SITE-WIDE LANDFORM RESPONSE FRAMEWORK

Condition / Action	Threshold Values		
	Acceptable Situation	**Buffer Situation**	**Unsatisfactory Situation**
Landform Surfaces			
Erosion channel on top surface of roads, pads, airstrip or laydowns in areas not actively revegetated	• Depth and/or width < 0.5 m • Water draining from surface is clear	• Depth and/or width > 0.5 m, and; • Identification of sedimentation occurring downstream	• Erosion is causing instability of area that will result in additional excessive erosion, safety concerns for wildlife, and/or poor water quality
Ponding of water on top surface of roads, pads, airstrip or laydowns in areas not actively revegetated	• No visible ponding	• Ponding present year-round to an extent that may impact revegetation	• Ponding present year-round with poor water quality presenting a safety concern for wildlife
Action Required	• Continue with scheduled inspection and monitoring	• Inspection and monitoring results to be provided to qualified engineer for review and direction • Engineer to determine unacceptable degradation of surface condition and/or ponding and provide recommended actions as necessary	• Inspection and monitoring results to be provided to qualified engineer for review and direction • Engineer to re-assess thresholds and conditions for “out of compliance” situation with conditions currently on site • Plan and implement mitigation measures based on engineering review • Re-assess monitoring and inspection frequency

Condition / Action	Threshold Values		
	Acceptable Situation	Buffer Situation	Unsatisfactory Situation
Type 1 and 2 Water Crossings			
Movement (displacement, sloughing) of the drainage channel crest and slope resulting in blockage	• None visible • Blockage of < 20% of cross-sectional area with no visible issues	• Blockage between 20% and 75% of cross-sectional area	• Blockage of > 75% of cross-sectional area • Movement of slope or inlets/outlets causing instability
Erosion channel in drainage channel base and/or slope	• Depth and/or width < 0.5 m • Water draining from surface is clear	• Depth and/or width > 0.5 m, and; • Identification of sedimentation occurring downstream	• Erosion is causing instability of side slopes or poor water quality that will result in additional excessive erosion or safety concerns for wildlife
Action Required	• Continue with scheduled inspection and monitoring	• Inspection and monitoring results to be provided to qualified engineer for review and direction • Engineer to determine unacceptable degradation of channel condition and provide recommended actions as necessary	• Inspection and monitoring results to be provided to qualified engineer for review and direction • Engineer to re-assess thresholds and conditions for “out of compliance” situation with conditions currently on site • Plan and implement mitigation measures based on engineering review • Re-assess monitoring and inspection frequency

Condition / Action	Threshold Values		
	Acceptable Situation	Buffer Situation	Unsatisfactory Situation
Organics Pile			
Movement (displacement, sloughing) of the embankment crest and slope	• None visible • Toe displacement related to sloughing < 1 m from original location	• Toe displacement related to sloughing > 1 m from original location	• Toe displacement is causing instability of side slopes or poor water quality that will result in additional excessive erosion or safety concerns for wildlife
Erosion channel in embankment crest and slope	• None visible • Depth < 1 m	• Depth > 1 m	• Erosion is causing instability of side slopes or poor water quality that will result in additional excessive erosion or safety concerns for wildlife
Action Required	• Continue with scheduled inspection and monitoring	• Inspection and monitoring results to be provided to qualified engineer for review and direction • Engineer to determine unacceptable degradation of embankment condition and provide recommended actions as necessary	• Inspection and monitoring results to be provided to qualified engineer for review and direction • Engineer to re-assess thresholds and conditions for “out of compliance” situation with conditions currently on site • Plan and implement mitigation measures based on engineering review • Re-assess monitoring and inspection frequency

Condition / Action	Threshold Values		
	Acceptable Situation	Buffer Situation	Unsatisfactory Situation
Roads, pads, airstrip and laydowns			
Movement (displacement, sloughing) of the embankment crest and slope	• None visible • Toe displacement related to sloughing < 0.5 m from original location	• Toe displacement related to sloughing > 0.5 m from original location	• Toe displacement is causing instability of side slopes or poor water quality that will result in additional excessive erosion or safety concerns for wildlife
Erosion channel in embankment crest and slope	• None visible • Depth < 0.5 m	• Depth > 0.5 m	• Erosion is causing instability of side slopes or poor water quality that will result in additional excessive erosion or safety concerns for wildlife
Action Required	• Continue with scheduled inspection and monitoring	• Inspection and monitoring results to be provided to qualified engineer for review and direction • Engineer to determine unacceptable degradation of embankment condition and provide recommended actions as necessary	• Inspection and monitoring results to be provided to qualified engineer for review and direction • Engineer to re-assess thresholds and conditions for “out of compliance” situation with conditions currently on site • Plan and implement mitigation measures based on engineering review • Re-assess monitoring and inspection frequency

Condition / Action	Threshold Values		
	Acceptable Situation	Buffer Situation	Unsatisfactory Situation
Safety Berms			
Movement and/or degradation (erosion, cracking, slumping, sloughing, budging, heave, settlement, animal burrows, sinkholes, depressions, voids) of safety berms	• No signs of degradation or decrease in crest height	• Decrease in crest height > 0.25 m • Deformation of side slopes that will result in further decrease in crest height • Signs of water movement from pit to berm	• Crest height < 2 m
Action Required	• Continue with scheduled inspection and monitoring	• Inspection and monitoring results to be provided to qualified engineer for review and direction • Engineer to determine unacceptable degradation of berm condition and provide recommended actions as necessary	• Inspection and monitoring results to be provided to qualified engineer for review and direction • Plan and implement mitigation measures based on engineering review

Condition / Action	Threshold Values		
	Acceptable Situation	Buffer Situation	Unsatisfactory Situation
Covers over Concrete Foundations			
Cracking or erosion of cover over concrete foundations in areas not actively revegetated	• No concrete visible	• No concrete visible • Cracking causing erosion channel 0.5 m deep or greater	• Concrete visible
Action Required	• Continue with scheduled inspection and monitoring	• Inspection and monitoring results to be provided to qualified engineer for review and direction. • Engineer to determine unacceptable depth and width of cracking/erosion based on site-specific conditions and provide recommended actions as necessary.	• Inspection and monitoring results to be provided to qualified engineer for review and direction. • Engineer to re-assess thresholds and conditions for “out of compliance” situation with conditions currently on site. • Plan and implement mitigation measures based on engineering review. • Re-assess monitoring and inspection frequency

Table 1: Response Framework – North Pile Facility

	Monitoring Type	Monitor			Threshold Values by Category During Closure[c]			
					Green Acceptable Situation	**Yellow Concern Situation**	**Orange Buffer Situation[a]**	**Red Unsafe or Out of Compliance Situation[a]**
Engineering Criteria	Physical	Displacement, sloughing, or bulging of perimeter embankment crest and downstream slope.	**North Pile Area**	**Survey Prism ID[b]**	■ None visible ■ Survey prism monitoring results within range of historical trends	■ Visible displacement, bulging (≤0.5 m), or sloughing ■ Survey prism monitoring results increasing from range of historical trends	■ Toe displacement related to sloughing ≤3 m from original location ■ Bulging of downstream slope ≤4 m in height ■ Survey prism monitoring results continuously increasing from range of historical trends	■ Toe displacement related to sloughing >3 m from original location ■ Bulging of downstream slope >4 m in height
			Starter Cell	P1 to P22 (P18 to P22 replace as needed- west embankment) P21-19 and P21-20				
			East Cell	P23 to P25 P31 to P46 P21-17 and P21-18				
		Displacement or settlement of cell fill and cover.	Starter Cell	P21-01 to P21-10	■ None visible (design surface gradients maintained of ~2.0%) ■ Survey prism monitoring results within range based on cover trial findings, settlement review analysis of the deposited materials, and historical trends	■ Visible displacement (differential settlement resulting in surface gradients of 1.0%) ■ Survey prism monitoring results increasing from expected range based on cover trial findings, settlement review analysis of the deposited materials and historical trends. Differential settlement rate less than 100 mm / year	■ increasing visible displacement (differential settlement resulting in surface gradients of 0.5%) ■ Survey prism monitoring results continuously increasing from expected range based on cover trial findings, settlement review analysis of the deposited materials and historical trends. Differential settlement rate based on Engineer of Record / Owner review.	■ (see Note a)
			East Cell	P21-11 to P21-16				
		Sinkhole in perimeter embankment crest and downstream slope.			■ None visible	■ Visible sinkhole and depth ≤0.5 m	■ Sinkhole depth ≤1.0 m	■ Sinkhole depth >1.0 m
		Cracking of perimeter embankment crest and downstream slope.			■ None visible	■ Depth ≤1.0 m ■ Width ≤25 mm	■ Depth >1.0 m ■ Width >25 mm	■ (see Note a)
		Erosion channel in perimeter embankment crest and downstream slope (from runoff, overtopping, flow from distribution pipeline).			■ None visible	■ Depth ≤0.5 m	■ Depth >0.5 m	■ (see Note a)
	Seepage	Seepage through perimeter embankment (Seepage rate should not affect performance of the North Pile; proper management of water required (perimeter water control structures)			■ Visible seepage through lower portion of embankment similar to historical performance ■ Seepage is clear	■ Visible seepage higher on downstream slope or higher rate than historically observed ■ Seepage is turbid	■ Increasing trend in visible seepage elevation or rate, which is higher on the downstream slope or higher rate than historically observed. ■ Increasing seepage turbidity	■ (see Note a)
		Perimeter sump water level (At end of closure, refer to Tables 4A and 4B).			■ Practical minimum water level to less than 1/3 full of sump operating level	■ Between 1/3 to 2/3 full of sump operating level	■ Between 2/3 and 100% of sump operating level	■ >than 100% of sump operating level and within 1.5 m freeboard
	Thermal	Baseline and freeze-back thermal monitoring (For key North Pile performance instrumentation, see Table 2).			■ Thermal monitoring results within range of historical trends ■ Nodal temperatures within 1°C of previous year's reading	■ Thermal monitoring results varying from range of historical trends ■ Nodal temperatures within 2°C of previous year's reading	■ Thermal monitoring results continuously varying from range of historical trends ■ Nodal temperatures within 4°C of previous year's reading	■ (see Note a)

(a) Accumulation/combination of concern situations could lead to an emergency situation and threshold values needs to be assessed accordingly.

(b) The locations of the North Pile survey prisms are shown in attached Figure 1.

(c) Threshold values represent upper bound of designated situations.

Table 2: Response Framework – North Pile Facility – Thermal Monitoring Criteria

	Mine Phase	Zone		Instrument ID[b]	Threshold Values by Category During Closure[d]			
					Green Acceptable Situation	Yellow Concern Situation	Orange Buffer Situation[a]	Red Unsafe or Out of Compliance Situation[a]
Engineering Criteria (Thermal Monitoring)	Extended Care and Maintenance and Closure Performance	East Cell	Rib Berm 1	14-VTH-08	▪ Thermal monitoring results within range of historical trends ▪ Nodal temperatures within 1°C of previous year's reading	▪ Thermal monitoring results varying from range of historical trends ▪ Nodal temperatures within 2°C of previous year's reading	▪ Thermal monitoring results continuously varying from range of historical trends ▪ Nodal temperatures within 4°C of previous year's reading	▪ (see Note a)
			Cell 1	WC-TH14-09				
				TH08-19[c]				
			Cell 2	14-VTH-05				
				14-VTH-06				
				16-EC-VTH-02 (BGC BH-15EC-07)				
				TH08-14[c]				
				TH13-04				
			Cell 3	14-HTH-03				
				14-VTH-04				
				TH08-11[c]				
				TH13-03				
			Cell 4	14-HTH-02				
				TH08-09[c]				
				14-VTH-02				
				14-VTH-03				
			Cell 5	14-VTH-01				
				TH08-05[c]				
				TH08-06[c]				
				16-EC-VTH-01 (BGC BH-15EC-05)				
		Starter Cell	Cell B	TH06-08[c]				
			Cell C	TH06-05[c]				
			Cell D	TH06-02[c]				
	Closure Performance and Freeze-Back Monitoring	East Cell	Cell 2	NPC-TH21-06	▪ Thermal monitoring results within range of historical trends ▪ Nodal temperatures within 2°C of previous year's reading	▪ Thermal monitoring results varying from range of historical trends ▪ Nodal temperatures within 4°C of previous year's reading	▪ Thermal monitoring results continuously varying from range of historical trends ▪ Nodal temperatures within 6°C of previous year's reading	▪ (see Note a)
			Cell 3	NPC-TH21-04				
			Cell 4	NPC-TH21-02				
			Cell 5	NPC-TH21-01				
		Starter Cell	Cell A	NPC-TH21-08				
			Cell B	NPC-TH21-07				
				NPC-TH21-05				
			Cell D	NPC-TH21-03				

(a) Accumulation/combination of concern situations could lead to an emergency situation and threshold values needs to be assessed accordingly.

(b) The locations of the North Pile operational and baseline thermistors are shown in attached Figure 2.

(c) Select baseline instrumentation are included that are relevant to the overall performance monitoring of the North Pile.

(d) Threshold values represent upper bound of designated situations.

Table 3: Response Framework - North Pile Facility - Piezometer Levels by Area

	North Pile Area	Instrument ID[c]	Original Ground Elevation[d] (m)	Threshold Values by Category During Closure[f]			
				Green Acceptable Situation	Yellow Concern Situation	Orange Buffer Situation[a]	Red Unsafe or Out of Compliance Situation[a]
Engineering Criteria (Piezometer Level)	Cell 1 (East Cell)	14-SP-12	458.5	460.7 m (25% of embankment height)	461.6 m (35% of embankment height)	462.9 m (50% of embankment height, crest elev. 467.3 m)	>462.9 m
		14-SP-13	456.0	457.8 m (25% of embankment height)	458.6 m (35% of embankment height)	459.7 m (50% of embankment height, crest elev. 463.3 m)	>459.7 m
	Rib Berm 1 (East Cell)	14-VW-07 (tip elev. 464.5 m)	466.5	467.5 (25% of berm height)	467.9 m (35% of berm height)	468.5 m (50% of berm height, crest elev. 470.4 m)	>468.5 m
		14-VW-08 (tip elev. 461.1 m)	460.9	462.9 m (25% of berm height)	463.7 m (35% of berm height)	464.9 m (50% of berm height, crest elev. 468.9 m)	>464.9 m
	Cell 2 (East Cell)	14-SP-10	448.8	452.1 m (top of inferred base rock fill drain)	460 m (base of horizontal drain)	461.0 m (top of horizontal drain)	>461.0 m
		14-SP-11	448.0	449.5 m (top of inferred base rock fill drain)	458 m (base of horizontal drain)	460.0 m (top of horizontal drain)	>460.0 m
		14-VW-05 (tip elev. 448.0 m)	448.0	450.3 m (top of inferred base rock fill drain)	457 m (base of horizontal drain)	462.0 m (top of horizontal drain)	>462.0 m
		14-VW-06A (tip elev. 444.6 m)	448.0	448.5 m (top of inferred base rock fill drain)	458.5 m (base of horizontal drain)	459.0 m (top of horizontal drain)	>459.0 m
		14-VW-06B (tip elev.455.4 m)	448.0	Dry	458.5 m (base of horizontal drain)	459.0 m (top of horizontal drain)	>459.0 m
		SP08-10[b]	447.8	Monitor water levels			
	Cell 3 (East Cell)	14-SP-06	449.4	453.9 m (top of inferred base rock fill drain)	460.0 m (base of horizontal drain)	461.0 m (top of horizontal drain)	>461.0 m
		14-SP-07	448.6	453.7 m (top of inferred base rock fill drain)	460.0 m (base of horizontal drain)	461.0 m (top of horizontal drain)	>461.0 m
		14-SP-08	448.0	448.4 m (top of inferred base rock fill drain)	460.0 m (base of horizontal drain)	461.0 m (top of horizontal drain)	>461.0 m
		14-SP-09	448.0	448.4 m (equilibrium level of upstream instrument 14-SP-08; within inferred base rock fill drain)	459.5 m (base of horizontal drain)	461.0 m (top of horizontal drain)	>461.0 m
		SP08-09[b]	448.0	Monitor water levels			
		NPC-VWP21-05	TBD[e]	461.0 m (top of horizontal drain)	461.0 m (top of horizontal drain) to below cover surface	above cover (ponding at surface)	

Table 3: Response Framework - North Pile Facility - Piezometer Levels by Area

	North Pile Area	Instrument ID[c]	Original Ground Elevation[d] (m)	Threshold Values by Category During Closure[f]			
				Green Acceptable Situation	Yellow Concern Situation	Orange Buffer Situation[a]	Red Unsafe or Out of Compliance Situation[a]
Engineering Criteria (Piezometer Level)	Cell 4 (East Cell)	14-SP-04	449.1	451.6 m (top of inferred base rock fill drain)	460.0 m (base of horizontal drain)	461.0 m (top of horizontal drain)	>461.0 m
		14-VW-03 (Tip elev. 448.7 m)	450.0	450.7 m (top of inferred base rock fill drain)	459.0 m (base of chimney drain)	461.0 m (top of horizontal drain)	>461.0 m
		NPC-VWP19-06	TBD[e]	461.0 m (top of horizontal drain)	461.0 m (top of horizontal drain) to below cover surface	above cover (ponding at surface)	
	Cell 5 (East Cell)	14-SP-02	450.0	454.4 m (top of inferred base rock fill drain)	455.9 m	457.4 m (50% of current embankment height, crest elev. 465.0 m)	>457.4 m
		14-VW-01 (Tip elev. 448.3 m)	446.9	448.3 m (top of inferred base rock fill drain)	451.3 m	456.2 m (50% of current embankment height, crest elev. 465.8 m)	>456.2 m
		14-VW-02A (Tip elev. 445.9 m)	446.9	448.8 m (top of inferred base rock fill drain)	451.3 m	456.1 m (50% of current embankment height, crest elev. 465.7 m)	>456.1 m
		SP08-05[b]	447.2	Monitor water levels			
	Cell A (Starter Cell)	NPC-VWP21-01	TBD[e]	50% of embankment height	50% to 75% of embankment height	>75% of embankment height to cover surface	above cover (ponding at surface)
		NPC-VWP21-02	TBD[e]	50% of embankment height	50% to 75% of embankment height	>75% of embankment height to cover surface	above cover (ponding at surface)
	Cell D (Starter Cell)	NPC-VWP21-04	TBD[e]	50% of embankment height	50% to 75% of embankment height	>75% of embankment height to cover surface	above cover (ponding at surface)
	Cell F (Starter Cell)	NPC-VWP21-03	TBD[e]	50% of embankment height	50% to 75% of embankment height	>75% of embankment height to cover surface	above cover (ponding at surface)

(a) Accumulation/combination of concern situations could lead to an emergency situation and threshold values needs to be assessed accordingly.
(b) Select baseline instrumentation are included that is relevant to the overall performance monitoring of the North Pile.
(c) The North Pile locations of operational and baseline piezometers are shown in attached Figures 1 to 4.
(d) Original ground elevation based on topography survey data collected in 2000.
(e) Proposed VWP location – original ground elevation to be determined at time of installation.
(f) Threshold values represent upper bound of designated situations.

Table 4: Response Framework – East Influent Storage Pond and Water Management Pond

	Monitor				Threshold Values by Category During Closure[d]			
					Green Acceptable Situation	**Yellow Concern Situation**	**Orange Buffer Situation[a]**	**Red Unsafe or Out of Compliance Situation[a]**
Engineering Criteria	**Physical**	Displacement, sloughing, or bulging of dam crest and downstream slope.	**Area**	**Survey Prism ID[b]**	▪ None visible ▪ Survey prism monitoring results within range of historical trends	▪ Visible displacement, bulging, or sloughing ▪ Survey prism monitoring results increasing from range of historical trends	▪ Toe displacement related to sloughing ▪ Bulging of downstream slope >0.5 m in height ▪ Survey prism monitoring results continuously increasing from range of historical trends	▪ Toe displacement related to sloughing >1 m from original location ▪ Bulging of downstream slope >1 m in height
			East Influent Storage Pond	P21-121 to P21-125				
			Water Management Pond (closure phase)[c]	P26 to P30				
		Sinkhole in dam crest and downstream slope			▪ None visible	▪ Visible sinkhole and depth ≤0.5 m	▪ Sinkhole depth <1.0 m	▪ Sinkhole depth >1.0 m
		Cracking of dam crest and downstream slope			▪ None visible	▪ Depth ≤0.5 m ▪ Width ≤ 25 mm	▪ Depth >0.5 m ▪ Width >25 mm	▪ (see Note a)
		Erosion channel in dam crest and downstream slope (from runoff, overtopping)			▪ None visible	▪ Depth ≤0.5 m	▪ Depth >0.5 m	▪ (see Note a)
	Water Level	Structure	**Area**		▪ Water level at, or below, elev. 448.85 m (design EDF storage elev.; East ISP and WMP connected through East ISP outlet channel at elev. 448.5 m)	▪ Water level above elev. 448.85 m and at or below elev. 449.2 m (minimum 0.3 m below lowest liner elevation)	▪ Water level above elev. 449.2 m (<0.3 m below lowest liner elevation in East ISP)	▪ Water level above elev. 449.5 m (top of liner in East ISP)
			Water Management Pond (closure phase)[c]					
			East Influent Storage Pond					
	Thermal	Thermal monitoring	**Area**	**Thermistor ID[b]**	▪ Thermal monitoring results within range of historical trends ▪ Nodal temperatures within 1°C of previous year's reading	▪ Thermal monitoring results varying from range of historical trends ▪ Nodal temperatures within 2°C of previous year's reading	▪ Thermal monitoring results continuously varying from range of historical trends ▪ Nodal temperatures within 4°C of previous year's reading	▪ (see Note a)
			Water Management Pond (closure phase)[c]	BH00-10 [EISP-TH21-05]				
				BH-2				
				TH06-09				
				TH06-10				
			East Influent Storage Pond	EISP-TH21-01 to EISP-TH21-04	▪ Thermal monitoring results within range of historical trends ▪ Nodal temperatures within 2°C of previous year's reading	▪ Thermal monitoring results varying from range of historical trends ▪ Nodal temperatures within 4°C of previous year's reading	▪ Thermal monitoring results continuously varying from range of historical trends ▪ Nodal temperatures within 6°C of previous year's reading	▪ (see Note a)
				TH08-04				
	Water Levels	Piezometer levels	**Area**	**Instrument ID[b]**	▪ Piezometer levels within range of historical trends	▪ Piezometer levels varying from range of historical trends ▪ Piezometer level within 0.3 m of previous year's reading	▪ Piezometer levels continuously varying from range of historical trends ▪ Piezometer level within 0.5 m of previous year's reading	▪ (see Note a)
			Water Management Pond (closure phase)[c]	EISP-VWP21-01 to EISP-VWP21-05				
			East Influent Storage Pond	EISP-VWP21-06 to EISP-VWP21-08	▪ Piezometer levels within range of historical trends	▪ Piezometer levels varying from range of historical trends ▪ Piezometer level within 0.3 m of previous year's reading	▪ Piezometer levels continuously varying from range of historical trends ▪ Piezometer level within 0.5 m of previous year's reading	▪ (see Note a)
				SP08-04				

(a) Accumulation/combination of concern situations could lead to an emergency situation and threshold values needs to be assessed accordingly.
(b) The locations of operational and baseline instruments are shown in attached Figure 3.
(c) Monitoring criteria for the water management pond dams apply to closure phase only. At post closure phase water management pond Dam 1 will be breached, and water will no longer be retained.
(d) Threshold values represent upper bound of designated situations.

Table 5: Response Framework – West Influent Storage Pond

	Monitor				Threshold Values by Category During Closure[d]			
					Green Acceptable Situation	**Yellow Concern Situation**	**Orange Buffer Situation[a]**	**Red Unsafe or Out of Compliance Situation[a]**
Engineering Criteria	**Water Level**	West Influent Storage Pond (Containment)			▪ Water level at, or below, elev. 441.1 m (design EDF storage elev.)	▪ Water level above elev. 441.1 m and below 443.7 m (minimum 0.3 m below lowest bedrock containment elev.)	▪ Water level above elev. 443.7m and below 444.0 m (<0.3 m below lowest bedrock containment elev.)	▪ Water level above elev. 444.0.m (above lowest bedrock containment elev.)
		West Influent Storage Pond (outlet channel used for discharge)			▪ Water level at, or below, elev. 445.3 m (0.3 m above design invert)	▪ Water level above elev. 445.3 m and below 445.6 m (0.6 m above design invert)	▪ Water level above elev. 445.6 m and below 446.0 (design event)	▪ Water level above elev. 446.0 m (greater than design event)
	Thermal	Thermal monitoring	**Area**	**Thermistor ID[b]**	▪ Thermal monitoring results within range of historical trends ▪ Nodal temperatures within 2°C of previous year's reading	▪ Thermal monitoring results varying from range of historical trends ▪ Nodal temperatures within 4°C of previous year's reading	▪ Thermal monitoring results continuously varying from range of historical trends ▪ Nodal temperatures within 6°C of previous year's reading	▪ (see Note a)
			West ISP	TH08-17				
				TH08-18				
				WC-TH14-01				
				WC-TH14-02				
				WISP-TH21-05				
	Water Levels	Piezometer levels	**Area**	**Instrument ID[b]**	▪ Piezometer levels within range of historical trends ▪ Piezometer level within 0.1 m of previous year's reading	▪ Piezometer levels varying from range of historical trends ▪ Piezometer level within 0.3 m of previous year's reading	▪ Piezometer levels continuously varying from range of historical trends ▪ Piezometer level within 0.5 m of previous year's reading	▪ (see Note a)
			West ISP	SP08-14				
				SP08-13				
				WC-SP14-01				
				WC-SP14-02				

(a) Accumulation/combination of concern situations could lead to an emergency situation and threshold values needs to be assessed accordingly.
(b) The locations of operational and baseline instruments are shown in attached Figure 4.
(c) West ISP outlet channel design even is the inflow design flood (IDF), defined as the probably maximum flood (PMF), and is estimated as the spring probably maximum precipitation (PMP) over snowmelt.
(d) Threshold values represent upper bound of designated situations.

Table 6: Response Framework – Action Required and Personnel Notified

	Threshold Values by Category During Closure			
	Green **Acceptable Situation**	**Yellow** **Concern Situation**	**Orange** **Buffer Situation**	**Red** **Unsafe or Out of Compliance Situation**
Action Required—Engineering Criteria	▪ Instrumentation monitoring and visual inspection according to frequency set out in North Pile Management Plan	▪ Increased instrumentation monitoring frequency, particularly in area of concern ▪ Monitoring results to be immediately provided to North Pile competent person and engineer of record for review ▪ North Pile competent person and Engineer of Record to assess the situation ▪ Document location, photograph, survey, and increase inspection and monitoring in area of concern ▪ Identify potential cause(s) ▪ Implement engineering review ▪ Plan and implement appropriate mitigation measures with engineering review ▪ Dewater sump(s), WMP, or influence storage ponds as required	▪ Suspend activities in area of concern ▪ Monitoring results to be immediately provided to Geotechnical Engineer for review ▪ Increased instrumentation monitoring frequency, particularly in area of concern ▪ North Pile competent person and Engineer of Record visit on site to assess the situation ▪ Plan and take appropriate mitigation measures with engineering review. For WMP or influence storage pond, consider lowering of water level(s) ▪ Document location, photograph, survey, and increase inspection and monitoring in area of concern ▪ Reassess thresholds and conditions for red category (emergency situation) taking into account the changing conditions presently observed and interactions of various items ▪ Dewater sump(s), WMP or influent storage ponds to drop water level as required	▪ Temporary evacuation of personnel and equipment from North Pile and suspension of activities ▪ Monitoring results to be immediately provided to the North Pile competent person and Engineer of record for review ▪ Update planning and take appropriate mitigation with engineering review ▪ For sumps, WMP and influent storage ponds, immediate lowering of water level, add multiple pumps as required
Personnel Notified	▪ **Environmental Coordinator** ▪ **Closure Manager** ▪ **Site Lead – Civil Works** ▪ **North Pile Competent Person** ▪ **Engineer of Record**	▪ **Closure Project Management Office** ▪ **Regulatory Specialist** ▪ Environmental Coordinator ▪ Closure Manager ▪ Site Lead – Civil Works ▪ North Pile Competent Person ▪ Engineer of Record	▪ **MVLWB, GNWT Inspector** ▪ **Head of Closure** ▪ **Environmental and Permitting Manager** ▪ Closure Project Management Office ▪ Regulatory Specialist ▪ Environmental Coordinator ▪ Closure Manager ▪ Site Lead – Civil Works ▪ North Pile Competent Person ▪ Engineer of Record	▪ **Mine Inspector** ▪ **Executive Head of Technical** ▪ MVLWB, GNWT Inspector ▪ Head of Closure ▪ Environmental and Permitting Manager ▪ Closure Project Management Office ▪ Regulatory Specialist ▪ Environmental Coordinator ▪ Closure Manager ▪ Site Lead – Civil Works ▪ North Pile Competent Person ▪ Engineer of Record

Note: Personnel shown in **bold print** are personnel to be notified in addition to personnel from the previous/lower threshold situation.
WMP = Water Management Pond; MVLWB = Mackenzie Valley Land and Water Board; GNWT = Government of the Northwest Territories.

whereby if discharge continued at those levels, at the full volume of water anticipated to be discharged every year, the AEMP benchmarks in Snap Lake would be maintained. A single exceedance, or even a series of exceedances of the moderate action levels are unlikely to result in an exceedance of an AEMP benchmark in any given year. The SNP and AEMP program will continue to monitor for all parameters at the edge of the mixing zone in Snap Lake to confirm AEMP benchmarks are achieved.

There are several management responses which could be implemented following the triggering of a low action level for water quality (Table 5-1). Responses will be implemented as appropriate in each instance, beginning with confirmation of the result and verification of the potential causes of the elevated concentration. Continued or additional monitoring will then be considered, and if warranted an application for revision of the action levels may be made to the MVLWB through an update to the WMP. The responses are the same for the moderate action levels, with the addition of consideration of mitigation during the closure phase for triggering of the moderate action levels.

During Post-Closure, the options for adaptive management are somewhat reduced. There will no longer be an active treatment option as the water treatment plant will be removed from site. Although an active treatment option will no longer exist, the risk of an exceedance, is also reduced. Water quality at site will improve over time and the performance of the PWCS and ISPs will also improve over time. The risk of an exceedance large enough to cause an environmental effect during the Post-Closure period is considered to be negligible. There are nonetheless several management responses that could be exercised during Post-Closure, depending on the issue (Table 5-1). As in any adaptive management system, monitoring is the key to success. De Beers will continue to monitor water inputs and outputs as per the water licence requirements and respond appropriately.

Table 5-1 Water Management Action Levels for Closure and Post-Closure

Action Level	Monitoring Station(s)	Definition	Period	Management Reponses
Low	SNP 02-17b (Water and Sewage Treatment Plant) SNP 02-17c (East Influent Storage Pond Discharge) SNP 02-17d (West Influent Storage Pond Discharge)	Concentration of any parameter that has an AEMP benchmark for Snap Lake, is greater than the Low Action Level Concentrations listed in Table 5-2 during the ice free season [(a)]	Closure (up to the point of breaching of the ISPs)	• Confirm result with subsequent tests • Verify the potential causes of the issue • Consider increased monitoring (e.g., collect additional samples) • Consider revision to the action level concentrations in Table 5-2 through WMP update submitted to the MVLWB • Consider possible follow up actions for sustained action level triggers [(b)] • Inform MVLWB in SNP report
			Post-Closure (after breaching the ISPs to allow for passive discharge)	• Confirm result with subsequent tests • Verify the potential causes of the issue

Action Level	Monitoring Station(s)	Definition	Period	Management Reponses
				• Consider increased monitoring (e.g., collect additional samples) • Consider revision to the action level concentrations in Table 5-2 through WMP update submitted to the MVLWB • Inform MVLWB in SNP report
Moderate		Concentrations of any parameter that has an AEMP benchmark in Snap Lake are greater than Moderate Action Level Concentrations listed in Table 5-2 during the ice free season [(a)]	Closure (up to the point of breaching of the ISPs)	• Confirm result with subsequent tests • Verify the potential causes of the issue • Consider increased monitoring (e.g., collect additional samples) • Consider revision to the action level concentrations in Table 5-2 through WMP update submitted to the MVLWB • Consider implementing mitigation measures [(c)] • Inform MVLWB in SNP report
			Post-Closure	• Confirm result with subsequent tests • Verify the potential causes of the issue • Consider increased monitoring (e.g., collect additional samples) • Consider revision to the action level concentrations in Table 5-2 through WMP update submitted to the MVLWB • Inform MVLWB in SNP report

a) The management responses would be considered only when action levels are triggered during a period when discharge is anticipated (i.e., ice free season).

b) Mitigation is not considered necessary at the low action level. At these levels, concentrations of parameters in Snap Lake will remain below Aquatic Effects Monitoring Program benchmarks. The low action levels were set specifically to trigger additional review of the results and possible follow up actions (e.g., monitoring), but not mitigation.

c) Mitigation measures to be considered include holding the water until such time as concentrations improve; transferring water from one storage area to another; and, treating the water if treatment infrastructure is available.

Table 5-2 Water Management Low Action Level and Moderate Action Level Concentrations for Closure and Post-Closure

Parameter [a]	Monitoring Data [b]	Concentration to Meet AEMP Benchmark in Snap Lake [c]	Action Level Concentrations	
			Low [d]	Moderate [e]
Conventional				
Total dissolved solids, Calculated (mg/L)	1,938	5,430	2,400	3,000
Total suspended solids (mg/L)	11	N/A	12	15
Faecal coliforms (CFU/100 mL)	0.9	N/A	8	10
pH	7.7	N/A	<6.5, >8.5	<6.0, >9.0
Total Petroleum Hydrocarbons (mg/L)	<0.10	N/A	>MDL	4
Major Ions				
Chloride (mg/L)	248	640	512	640
Fluoride (mg/L)	0.9	11	1.6	2.0
Sulphate (mg/L)	704	2,400	800	1,000
Nutrients				
Nitrate, as N (mg/L)	94	60	48	60
Nitrite, as N (mg/L)	0.4	1.2	0.95	1.2
Total ammonia, as N (mg/L)	1.0	12	9.7	12
Total phosphorus, as P (mg/L)	0.2	0.25	0.2	0.25
Total Metals and Metalloids				
Aluminum (mg/L)	1.3	1.7	1.3	1.7
Antimony (mg/L)	0.0006	0.12	0.095	0.12
Arsenic (mg/L)	0.001	0.1	0.020	0.025
Barium (mg/L)	0.07	20	16	20
Boron (mg/L)	1.2	29	4	5
Cadmium (mg/L)	0.00009	0.001	0.0008	0.001
Chromium (mg/L)	0.02	0.09	0.04	0.05
Cobalt (mg/L)	0.006	0.01	0.008	0.01
Copper (mg/L)	0.02	0.035	0.028	0.035
Iron (mg/L)	2.0	5.0	4.0	5.0
Lead (mg/L)	0.0010	0.02	0.016	0.02
Manganese (mg/L)	0.4	2.0	1.6	2.0
Mercury (mg/L)	0.00001	0.0003	0.00024	0.0003
Molybdenum (mg/L)	0.05	1.4	0.4	0.5
Nickel (mg/L)	0.1	0.5	0.4	0.5
Selenium (mg/L)	0.0008	0.02	0.016	0.02
Silver (mg/L)	0.00005	0.005	0.004	0.005
Strontium (mg/L)	3.0	37	30	37

Parameter [a]	Monitoring Data [b]	Concentration to Meet AEMP Benchmark in Snap Lake [c]	Action Level Concentrations	
			Low [d]	Moderate [e]
Thallium (mg/L)	0.00005	0.02	0.016	0.02
Uranium (mg/L)	0.01	0.033	0.026	0.033
Vanadium (mg/L)	0.004	2.0	0.08	0.10
Zinc (mg/L)	0.03	0.04	0.032	0.04

mg/L = milligrams per litre; AEMP = Aquatics Effects Monitoring Program; MDL = Minimum Detection Limit; N = nitrogen; P = phosphorus.

a) Action level concentrations were calculated for all parameters that have AEMP benchmarks in Snap Lake, except for nitrate because nitrate has a maximum average concentration effluent quality criteria of 60 mg N/L in Water Licence MV2019L2-0004. A constant pH of 8 and a constant DOC concentration of 3.5 mg/L were used to calculate the dissolved zinc Aquatics Effects Monitoring Program (AEMP) benchmark. As the pH increases and the DOC concentration decreases, the dissolved zinc AEMP benchmark decreases.

b) Faecal coliforms represent the 95th percentile concentrations of parameters from monitoring data at SNP 02-17b between June and October from 2017 to 2020. All other values in column 2 represent the 95th percentile concentrations of parameters from monitoring data at Sumps 1 to 5, SNP 02-02, and SNP 02-05 between June and October from 2017 to 2020. The values in column 2 are expected to change as a result of construction and demolition activities during Closure.

c) The values in column 3 represent the concentrations that can be discharged to Snap Lake while meeting AEMP benchmarks at the edge of the mixing zone, except for chloride, fluoride, total phosphorus, and total uranium. The values for chloride and total uranium were reduced to the acute water quality guidelines for the protection of aquatic life from the Canadian Council of Ministers of the Environment (i.e., 640 mg/L and 0.033 mg/L) (CCME 1999). The value for fluoride was reduced to 11 mg/L because acute toxicity can occur to freshwater aquatic life at concentrations ranging from 11.5 mg/L to greater than 800 mg/L of fluoride (McPherson et al. 2014). The value for total phosphorus represents the concentration that can be discharged to Snap Lake while meeting the AEMP benchmark, which applies to whole-lake average concentrations.

d) The values in column 4 represent the proposed low action level concentrations, which are 80% of the concentrations that can be discharged to Snap Lake while meeting AEMP benchmarks from 2021 to 2050. Action levels presented have also considered livestock water quality guidelines (WQG) for the protection of agricultural water uses (CCME 1999) and low action level concentrations values are less than or equal to these WQG.

e) The values in column 5 represent the proposed moderate action level concentrations, which are 100% of the concentrations that can be discharged to Snap Lake while meeting AEMP benchmarks from 2021 to 2050. Action levels presented have also considered livestock water quality guidelines (WQG) for the protection of agricultural water uses (CCME 1999) and moderate action level concentrations are less than or equal to these WQG.

5.3 Contingency

During the closure period, while the Water Treatment Plant and underground water return system remains in place, the following contingency options would be considered for addressing water that does not meet EQC:

- Discharge to the underground (upon approval of the Inspector) (discussed further in Section 3.2.2.6);
- Continue to store water, and re-circulate if required among storage locations on site longer until it meets EQC;
- Identify the location of the poor quality water and segregate it, if possible, while continuing to discharge water that does meet EQC;
- Investigate options such as placing a cover if the source of poor water may be from runoff;

Table 8-2 Closure Phase Response Framework

Monitoring Type	Monitor	Action Levels by Category During Closure[b]			
		Green Acceptable Situation	Yellow Monitor	Orange Plan	Red Act
Visual Inspection	Seepage through dams or North Pile perimeter embankments (physical characteristics)	• Visible seepage through lower portion of embankment as observed historically • Seepage is clear	• Seepage observed at new locations and/or at higher flow rates than historically observed • Seepage is turbid • Mild and isolated new metal precipitates or staining	• Seepage continuously observed at new locations and/or at higher flow rates than historically observed • Seepage is turbid • Moderate new metal precipitates or staining or one or more locations	• Not applicable
	Acid generating potential of rock samples collected during Geochemistry Inspection	• All samples non-acid generating	• Single isolated sample not forming part of a cover surface classified as PAG	• Multiple isolated samples not forming part of a cover surface classified as PAG	• Any sample of material forming part of a cover surface is classified as PAG • Exposed deposit of material not forming part of a cover surface with multiple samples classified as PAG, which the hydrogeochemist considers to be of sufficient size to impact seepage or runoff water quality
Seepage Water Quality	pH values	• pH between 6 and 9	• pH below 6 or greater than 9 in one sample, not attributable to naturally occurring conditions	• pH below 6 or greater than 9 in multiple samples over less than one year at one or more locations, not attributable to naturally occurring conditions	• Not applicable
	Trends in comprehensive water chemistry analysis	• All constituents stable or decreasing compared to historical results	• Increasing concentrations over less than one year	• Large increase in concentrations of constituents potentially indicative of ARD over less than one year • Sustained increase in concentrations of any constituents over more than one year which are not related to temporary activities	• Not applicable
Runoff Water Quality[a]	pH values at SNP 02-02, SNP 02-02b, SNP 02-02c, SNP 02-05, SNP 02-06, SNP 02-14	• pH between 6 and 9	• pH below 6 or greater than 9 in one sample, not attributable to naturally occurring conditions	• pH below 6 or greater than 9 in multiple samples over less than one year at one or more locations, not attributable to naturally occurring conditions	• pH below 6 or greater than 9 in several samples for over one year at one or more locations, not attributable to naturally occurring conditions
	Predicted mass loading rates	• Equal or below predicted mass loading	• Infrequent and/or short duration periods above predicted mass loading, which is not due to temporary natural elevated precipitation alone	• Sustained periods within one year above predicted mass loading rates, which is not due to temporary natural elevated precipitation alone	• Sustained periods greater than one year above predicted mass loading rates

Monitoring Type	Monitor	Action Levels by Category During Closure[b]			
		Green Acceptable Situation	Yellow Monitor	Orange Plan	Red Act
	Trends in comprehensive water chemistry analysis at SNP 02-02, SNP 02-02b, SNP 02-02c, SNP 02-05, SNP 02-06, SNP 02-14	• All constituents stable or decreasing compared to historical results	• Increasing concentrations over less than one year	• Large increase in concentrations of constituents potentially indicative of ARD over less than one year • Sustained increase in concentrations of any constituents over more than one year which are not related to temporary activities	• Sustained increasing trend in concentrations of constituents potentially indicative of ARD over more than one year • Sustained increasing trend in concentrations of EQC constituent(s)

(a) Threshold values for surface water based on Effluent Quality Criteria defined in Water Licence MV2019L2-004 Part F Condition 17; revision required on renewal of Water Licence.

Table 8-3 Post-Closure Phase Response Framework

Monitoring Type	Monitor	Threshold Values by Category During Post-Closure			
		Green Acceptable Situation	Yellow Monitor	Orange Plan	Red Act
Runoff Water Quality[(a)]	pH values at SNP 02-02b, SNP 02-02c	• pH between 6 and 9	• pH below 6 or greater than 9 in one sample	• pH below 6 or greater than 9 in multiple samples over at least one month at one or more locations	• pH below 6 or greater than 9 in the majority of samples over more than two months, or several samples for at least one year at one or more locations
	Trends in comprehensive water chemistry analysis at SNP 02-02b, SNP 02-02c	• All constituents stable or decreasing compared to historical results	• Increasing concentrations over less than one year	• Large increase in concentrations of constituents potentially indicative of ARD over less than one year • Sustained increase in concentrations of any constituents over more than one year	• Sustained increasing trend in concentrations of constituents potentially indicative of ARD over more than one year • Sustained increasing trend in concentrations of EQC constituent(s)

(a) Threshold values for surface water based on Effluent Quality Criteria defined in Water Licence MV2019L2-004 Part F Condition 17; revision required on renewal of Water Licence.

Table 8-4 Response Framework – Action Required and Personnel Notified

Response Category	Threshold Responses by Category			
	Green Acceptable Situation	**Yellow Monitor**	**Orange Plan**	**Red Act**
Action Required	• Visual inspection and water quality monitoring according to frequency set out in North Pile Management Plan	• Monitoring results to be immediately provided to North Pile competent person and geochemistry consultant for review • Document condition with photographs and visual observations • North Pile competent person and/or geochemistry consultant to assess the situation • Identify potential cause(s) • Implement additional monitoring if required based on review of results • Review surface water quality trends in context with Water Management Plan Action Levels.	• Monitoring results to be immediately provided to North Pile competent person and geochemistry consultant for review • Document condition with photographs and visual observations • North Pile competent person and geochemistry consultant to assess the situation • Implement additional monitoring if required based on review of results • Plan and implement appropriate mitigation measures with engineering review • Reassess thresholds and conditions for red category taking into account the changing conditions presently observed and interactions of various items • Review surface water quality trends in context with Water Management Plan Action Levels.	• Monitoring results to be immediately provided to the North Pile competent person and geochemistry consultant for review • North Pile competent person and geochemistry consultant to assess the situation • Update planning and take appropriate mitigation with engineering review • Implement contingency options described in the Water Management Plan • Review surface water quality trends in context with Water Management Plan Action Levels.
Personnel Notified	• **Closure Project Management Office** • **Regulatory Specialist** • **Engineer of Record** • **Environmental Coordinator** • **Closure Manager** • **Site Lead – Civil Works** • **North Pile Competent Person** • **Geochemistry Consultant**	• Closure Project Management Office • Regulatory Specialist • Engineer of Record • Environmental Coordinator • Closure Manager • Site Lead – Civil Works • North Pile Competent Person • Geochemistry Consultant	• **Head of Closure** • **Environmental and Permitting Manager** • Closure Project Management Office • Regulatory Specialist • Environmental Coordinator • Closure Manager • Site Lead – Civil Works • North Pile Competent Person • Geochemistry Consultant • Engineer of Record	• Head of Closure • Environmental and Permitting Manager • Closure Project Management Office • Regulatory Specialist • Environmental Coordinator • Closure Manager • Site Lead – Civil Works • North Pile Competent Person • Geochemistry Consultant • Engineer of Record

Note: Personnel shown in **bold print** are personnel to be notified in addition to personnel from the previous/lower threshold situation.