

Permits

From: Tyree Mullaney
Sent: Monday, July 4, 2016 8:49 AM
To: Permits
Subject: FW: Tundra: CARD response to IRs
Attachments: YELLOWKN-#847326-v1-Tundra_-_Regulatory_-_Submission_Package_to_MVLWB_-_CARD_Responses_to_Tech_Session_Information_Requests_-_30_June_2016.PDF

MV2016L8-0003 MV2016X0011 – INAC CARD – Tundra – Responses to Information Requests.

Initial application

Technical Session

Thanks

T

From: Murray Somers [mailto:Murray.Somers@aandc-aadnc.gc.ca]
Sent: June 30, 2016 4:36 PM
To: Tyree Mullaney <tyree@mvlwb.com>
Cc: Carey Ogilvie <Carey.Ogilvie@aandc-aadnc.gc.ca>; Joel Gowman <Joel.Gowman@aandc-aadnc.gc.ca>
Subject: Tundra: CARD response to IRs

Good Afternoon Tyree,

Please see that attached responses from CARD with respect to the Information Requests issued by the MVLWB following the June 23rd Technical Session. We hope that our responses provide further clarity to the Board Staff, and assist in the development of a comprehensive Type A Water Licence and Land Use Permit.

As we discussed previously, CARD is willing to continue further discussions with the MVLWB staff regarding the option of applying for a separate Type B Water Licence to cover the Adaptive Management Phase of the Tundra Mine Remediation Project.

Best regards,

Murray

Murray Somers

Project Officer, NWT Region

INAC/ Government of Canada

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June 30, 2016

Tyree Mullaney
Mackenzie Valley Land and Water Board
P.O. Box 2130
Yellowknife NT, X1A 2P6

Dear Ms. Mullaney,

**Re: INAC-CARD Response to Information Requests from Technical Session
Type 'A' Land Use Permit and Water Licence Renewal Applications
Tundra Mine Remediation Project**

Indigenous and Northern Affairs Canada (INAC) – Contaminants and Remediation Division (CARD) submit the following responses to the 5 Information Requests submitted by the Mackenzie Valley Land and Water Board, following the June 23, 2016, Technical Session for CARD's applications for a Type A Water Licence renewal and Type A Land Use Permit to continue the remediation of Tundra Mine.

If you have any questions or concerns regarding these responses, then please contact Joel Gowman at (867)669-2423 [joel.gowman@aandc-aadnc.gc.ca] or Murray Somers at (867)669-2420 [murray.somers@aandc-aadnc.gc.ca].

Sincerely,

Joel Gowman
Project Manager
Indigenous and Northern Affairs Canada
Contaminants and Remediation Division

cc. Carey Ogilvie – Senior Manager, INAC-CARD

Canada

1. Water Treatment Facility

Based on all of the current and historical water quality data downstream of the Water Treatment Facility, including, but not limited to, information collected for the Human Health and Ecological Risk Assessment, baseline data, and Annual Reports, please provide evidence and rationale that supports INAC-CARD's recommendation to maintain the discharge criteria identified in Part D, item 6 of the existing Water Licence MV2009L8-0008.

Since commencing the tailing water treatment component of the Tundra Mine remediation, INAC-CARD has successfully treated and discharged approximately 1,500,000 m³ from the Tailings Containment Area (TCA). Water quality monitoring completed throughout the annual reporting period has documented that the approach proposed by INAC-CARD and approved by the Board in 2009 has consistently met the Water License criteria and has generally met the more stringent levels modeled within the earlier risk assessment. The monitoring program has also incorporated periodic monitoring of benthic invertebrates and fish in the receiving environment and has not observed any negative impacts to the receptors within the receiving environment.

The consistent performance of the technology utilized by INAC-CARD on this project has proven our commitment to the environment and meeting our remedial objectives for the project. Historically, the large volume of tailings water stored in the TCA has provided the water treatment plant with a relatively consistent feedstock for treatment. The water treatment criteria listed in the contract currently align with the lower criteria from the risk assessment which motivates the Contractor to diligently monitor and adjust the plant operation for optimum performance. While the water treatment plant has demonstrated its robust and versatile capacities, INAC-CARD anticipates that much of the water requiring treatment in finalizing the remedial objectives may be more variable in quality. INAC-CARD expects that the water treatment plant can manage the forecasted variation in chemical, pH, and physical (i.e. – TSS) characteristics in the remaining tailings water within the current license criteria but respectfully requests that the criteria not be lowered to the more conservative values. Furthermore, we anticipate that relatively small volume of tailings water still requiring treatment is unlikely to provide any detectible negative impacts to water quality or to the aquatic receptors in the catchment.

INAC-CARD remains committed to the baseline and trigger-based sampling requirements outlined in our Surveillance Network Program to ensure that the Project continues to positively impact the environment and our stakeholders who visit the area.

2. Overall SNP stations for decommissioning

Please propose Surveillance Network Program stations with associated effluent quality criteria, if applicable, with supporting evidence and rationale to ensure ongoing protection of the environment following decommissioning. Include the rationale for monitoring each location, sampling frequencies and parameters, and status and activation/deactivation triggers.

Phase II Continuation

Table 1 provides a breakdown of the proposed monitoring program for the remainder of Phase II remediation. Table 1 provides a more accurate representation of the currently active monitoring locations on site. There are only slight variations from the current monitoring program stipulated under MV2009L8-0008, with the following proposed changes:

1. removal of groundwater wells that have been destroyed as a result of remediation (i.e. dam removal and tailings excavation); and
2. Addition of monthly sewage effluent discharge monitoring at monitoring station SNP 14-2.6, which is within the wetland proposed as the sewage discharge location in IR#3 below.

CARD is proposing to maintain the same water treatment effluent criteria as MV2009L8-0008.

Maintaining the same water treatment effluent criteria and very similar monitoring program will continue to have the same level of protection to the environment as operations that have occurred under MV2009L8-0008.

Adaptive Management Phase

Table 2 provides a breakdown of the proposed monitoring program for the Adaptive Management Phase. The proposed Adaptive Management Sampling frequency has been reduced to “spring”, “once in July” and “monthly”, as per the baseline requirements of the monitoring program under MV2009L8-0008. The following changes are being proposed:

1. removal of any additional groundwater wells that have been destroyed as a result of remediation (i.e. dam removal and tailings excavation);
2. removal of seepage monitoring as the TCA will no longer be retaining water;
3. removal of water treatment effluent discharge monitoring locations;
4. relocate sampling stations within Upper and Lower Ponds (14-6A, 14-7A) to locations that will retain flow post-remediation; and
5. install a new monitoring station near the current Seep 6 to capture any potential sewage discharge to the adjacent wetland.

As stated in CARD's response to IR#1, the effluent quality criteria (EQC) and compliance point during the Adaptive Management Phase will be established following the completion of the new Human Health and Ecological Risk Assessment (HHERA), Geochemistry Report, and Water Management Plans, currently under production by our consultants. These reports will be used to develop an appropriate EQC and compliance point for the Adaptive Management Phase.

The current HHERA (SENES 2008) predicts that water quality in Hambone Lake and Powder Mag Lake will experience impacts by historic mining operations and the water treatment program in the short term (at minimum) following Phase II Remediation. For this reason, CARD is proposing the EQC compliance point for the Adaptive Management Phase be set at the outflow of Sandy Lake (SNP station 14-6H). As stated above, this may be revised based on the outcome of the revised 2016 HHERA results.

The 2016 HHERA results will provide a more accurate prediction of post remediation water quality for the short term and long term, and will model this to determine the impacts to human health and the downstream environment. The HHERA will determine an EQC that will be protective of human health and the downstream environment. The 2016 HHERA will contribute to establishing post-remediation EQCs, which will be applied as a trigger for additional action plan development and implementation.

3. Sewage discharge

Please recommend Surveillance Network Program station locations, testing requirements (sampling frequencies and parameters), activation triggers, and discharge criteria for sewage discharge from the Sewage Treatment Facility, if needed as a contingency measure.

INAC-CARD acknowledges the sewage waste discharge criteria included in MV2009L8-0008 and has noted the Board Staff's concerns related to the approved Sewage Management Plan which proposes the use of chlorine to mitigate fecal coliform levels prior to discharge. INAC-CARD further acknowledges that utilization of chlorine to directly control fecal coliforms (***outside of use of chlorinated compounds in general cleaning products for standard camp operations***) may present additional environmental impacts and will re-evaluate the currently approved Sewage Disposal Facility Operation and Maintenance Plan to determine the impact of removing chlorine from the 'pre-discharge' phase of the treatment.

In the event that a discharge from the sewage treatment facility is required under the renewed Type A water license, INAC-CARD is proposing that the current SNP location – Seep #6 is designated as the compliance point for this waste stream. It is proposed that a discharge location on the northwest corner of the natural wetland be designated within an updated Sewage Disposal Facility Operation and Maintenance Plan. Wetlands have been well-documented in their natural ability to provide 'polishing' treatment for treated sewage and wastewater. Any waste discharged from the facility to this designated location would be subject to natural treatment through bacterial degradation and ultraviolet light exposure. The slow seepage rate between this particular wetland and the TCA Upper Pond will facilitate a relatively lengthy residency time for the polishing process prior to the discharged waste migrating out of the TCA and into the receiving environment. It is also important to note that this migration pathway from the proposed discharge location in the wetland to Hambone Lake (previously impacted by mining activities and not considered a potable water source) is approximately 1.5 kilometers.

4. Submissions to the Board

Please provide a list of the various reports, studies, and/or plans that are underway or planned by INAC-CARD that are not currently required in Water Licence MV2009L8-0008. This information may be used to help inform water licence conditions.

In preparation for closure of this remediation project, INAC-CARD has commissioned our consultant team with completing a number of reports which will provide valuable insight and information to both our project team and the MVLWB Support Staff. The list below outlines the anticipated reports, contents, and currently anticipated timelines for completion:

2016 Human Health and Ecological Risk Assessment (Stantec) – Expected to correlate predictions from initial risk assessment with monitoring results and supplement existing project data to feed into rationale for adjusting the project's SNP and compliance points. Completion – December 2016.

Water Management Plan (AECOM) – Expected to forecast surface and groundwater inputs to the Tailings Containment Area supplemented by discussion of geochemical and total suspended solids consideration for water exiting the TCA. Completion – November 2016

Construction Summary Reports (AECOM) – Annual status summary of project components within the annual reporting period. Completion – 4 months following conclusion of the field season (typically early November)

Water Quality Monitoring Reports (Golder for 2016, annual contract) – Summary of water quality and receptor impacts within the catchment basin compared against the designated control lake. Completion – January of the year following the reporting period (i.e. – Jan 2017 for the 2016 monitoring program).

Status of Environment Report (consultant not determined) – Completion – 18 months following completion of remedial objective (re-establish hydraulic connection between Mill Pond and Hambone Lake).

5. NA

6. SNP stations for monitoring wells

Please provide a list of all surface and groundwater monitoring currently in place on-site and indicate which stations are outside of the Surveillance Network Program. Include the rationale for monitoring each location, sampling frequencies and parameters, and status and activation/deactivation triggers.

Table 3 provides a breakdown of all surface and groundwater monitoring currently required under MV2009L8-0008. The table includes the rationale for monitoring each location, sampling frequencies and parameters, station status, and activation/deactivation triggers. The SNP-specific monitoring locations have an SNP Identification under the column heading "Station ID", and additional monitoring have no Station ID.

TABLE 2
Tundra Mine Remediation Program
Proposed Monitoring Program for Adaptive Management Phase

Station Name	Station ID	Purpose	Activation Trigger	Deactivation Trigger	Water Licence MV2009L8-0008			Construction Monitoring (SENES 2011)			
					Spring	Monthly During Open Water	Monthly During Periods of Flow	Baseline			Sewage Effluent Discharge
								Spring ^(b)	July	Monthly During Open Water	
											Monthly
Tailings Containment Area and Surface Water in Pathway I											
Lower Pond (LP-01)	SNP 0014-6A	Post-remediation water quality monitoring	Completion of Phase II Remediation	Upon 2 consecutive years of statistically similar results as the Control Lake, or as acceptable by the Authorities Having Jurisdiction	Hyd, Cyn	SP, S, MI, N, TM	-	-	-	-	-
Upper Pond (UP-01)	SNP 0014-7A	Post-remediation water quality monitoring	Completion of Phase II Remediation	Upon 2 consecutive years of statistically similar results as the Control Lake, or as acceptable by the Authorities Having Jurisdiction	Hyd, Cyn	SP, S, MI, N, TM	-	-	-	-	-
Hambone Lake Inflow	SNP 0014-6B	Baseline Monitoring	Completion of Phase II Remediation	Upon 2 consecutive years of statistically similar results as the Control Lake, or as acceptable by the Authorities Having Jurisdiction	Hyd, Cyn	SP, S, MI, N, TM	-	-	SP, S, MI, N, TM	-	-
Hambone Lake Outflow	SNP 0014-6C	Baseline Monitoring	Completion of Phase II Remediation	Upon 2 consecutive years of statistically similar results as the Control Lake, or as acceptable by the Authorities Having Jurisdiction	Hyd, Cyn	SP, S, MI, N, TM	-	-	SP, S, MI, N, TM	-	-
Powder Mag Lake	SNP 0014-6E	Baseline Monitoring	Completion of Phase II Remediation	Upon 2 consecutive years of statistically similar results as the Control Lake, or as acceptable by the Authorities Having Jurisdiction	Hyd, Cyn	SP, S, MI, N, TM	-	-	SP, S, MI, N, TM	-	-
Powder Mag Lake Outflow	SNP 0014-6G	Baseline Monitoring	Completion of Phase II Remediation	Upon 2 consecutive years of statistically similar results as the Control Lake, or as acceptable by the Authorities Having Jurisdiction	Hyd, Cyn	SP, S, MI, N, TM	-	-	SP, S, MI, N, TM	-	-
Sandy Lake	SNP 0014-6F	Baseline Monitoring	Completion of Phase II Remediation	Upon 2 consecutive years of statistically similar results as the Control Lake, or as acceptable by the Authorities Having Jurisdiction	Hyd, Cyn	SP, S, MI, N, TM	-	-	SP, S, MI, N, TM	-	-
Sandy Lake Outflow	SNP 0014-6H	Baseline Monitoring	Completion of Phase II Remediation	Upon 2 consecutive years of statistically similar results as the Control Lake, or as acceptable by the Authorities Having Jurisdiction	Hyd, Cyn	SP, S, MI, N, TM	-	-	SP, S, MI, N, TM	-	-
Whaletail Lake Outflow	-	Baseline Monitoring	Completion of Phase II Remediation	Upon 2 consecutive years of statistically similar results as the Control Lake, or as acceptable by the Authorities Having Jurisdiction	-	-	-	Hyd	SP, S, MI, N, TM, Hyd, Cyn	-	-
Trans Saddle Lake	SNP 0014-6D	Baseline Monitoring	Completion of Phase II Remediation	Upon 2 consecutive years of statistically similar results as the Control Lake, or as acceptable by the Authorities Having Jurisdiction	Hyd, Cyn	SP, S, MI, N, TM	-	-	SP, S, MI, N, TM	-	-
Control Lake	SNP 0014-8	QA/QC	Completion of Phase II Remediation	Upon completion of the Monitoring Program	-	SP, S, MI, N, TM, Hyd, Cyn	-	Cyn	SP, S, MI, N, TM	-	-
Sewage Wetland (near Seep 6)		To monitor sewage effluent transport	Sewage Effluent Discharge	1 year following Sewage Effluent Discharge							OG, S, BOD, FC
Surface Water in Pathway II											
Mill Pond	SNP 0014-7B	Baseline Monitoring	Completion of Phase II Remediation	Upon 2 consecutive years of statistically similar results as the Control Lake, or as acceptable by the Authorities Having Jurisdiction	Hyd, Cyn	SP, S, MI, N, TM	-	-	SP, S, MI, N, TM	-	-

Station Name	Station ID	Purpose	Activation Trigger	Deactivation Trigger	Water Licence MV2009L8-0008			Construction Monitoring (SENES 2011)			
					Spring	Monthly During Open Water	Monthly During Periods of Flow	Baseline			Sewage Effluent Discharge
								Spring ^(b)	July	Monthly During Open Water	
											Monthly
Landfill Outflow	SNP 0014-4	Phase 1 remediation - Baseline Monitoring	Completion of Phase II Remediation	Upon 2 consecutive years of statistically similar results as the Control Lake, or as acceptable by the Authorities Having Jurisdiction	-	SP, S, MI, N, TM, Hyd	-	-	SP, S, MI, N, TM	-	-
Bulldog Lake	SNP 0014-7C	Baseline Monitoring	Completion of Phase II Remediation	Upon 2 consecutive years of statistically similar results as the Control Lake, or as acceptable by the Authorities Having Jurisdiction	Hyd, Cyn	SP, S, MI, N, TM	-	-	SP, S, MI, N, TM	Hyd	-
Matthews Lake Near-field	SNP 0014-1	Baseline Monitoring	Completion of Phase II Remediation	Upon 2 consecutive years of statistically similar results as the Control Lake, or as acceptable by the Authorities Having Jurisdiction	-	TSS, N, pH, total aluminum, turbidity	-	Hyd, Cyn	SP, S, MI, N, TM	SP, S, MI, TM	-
Matthews Lake Far-field	-	Baseline Monitoring	Completion of Phase II Remediation	Upon 2 consecutive years of statistically similar results as the Control Lake, or as acceptable by the Authorities Having Jurisdiction	-	-	-	-	SP, S, MI, N, TM	SP, S, MI, N, TM	-
Groundwater Wells											
BH 3	-	To identify pathways that contaminants may take to reach downstream lakes along Pathway I.	Completion of Phase II Remediation	Either: 1.) Upon 2 consecutive years of statistically similar results as the Control Well, 2.) as acceptable by the Authorities Having Jurisdiction, or 3) If the well is dry for 2 consecutive years	-	-	-	Hyd, Cyn	-	SP, S, MI, N, DM	-
BH 4	-	To identify pathways that contaminants may take to reach downstream lakes along Pathway I.	Completion of Phase II Remediation	Either: 1.) Upon 2 consecutive years of statistically similar results as the Control Well, 2.) as acceptable by the Authorities Having Jurisdiction, or 3) If the well is dry for 2 consecutive years	-	-	-	Hyd, Cyn	-	SP, S, MI, N, DM	-
BH 7	-	To assess subsurface drainage from the main mine site tank farm area.	Completion of Phase II Remediation	Either: 1.) Upon 2 consecutive years of statistically similar results as the Control Well, 2.) as acceptable by the Authorities Having Jurisdiction, or 3) If the well is dry for 2 consecutive years	-	-	-	Cyn	-	SP, S, MI, N, DM, Hyd	-
BH G	-	To assess subsurface drainage from the landfill.	Completion of Phase II Remediation	Either: 1.) Upon 2 consecutive years of statistically similar results as the Control Well, 2.) as acceptable by the Authorities Having Jurisdiction, or 3) If the well is dry for 2 consecutive years	-	-	-	Cyn	-	SP, S, MI, N, DM, Hyd	-
BH H	-	To assess subsurface drainage from the old fuel storage area.	Completion of Phase II Remediation	Either: 1.) Upon 2 consecutive years of statistically similar results as the Control Well, 2.) as acceptable by the Authorities Having Jurisdiction, or 3) If the well is dry for 2 consecutive years	-	-	-	Cyn	-	SP, S, MI, N, DM, Hyd	-
BH I	-	To assess subsurface drainage from the old fuel storage area.	Completion of Phase II Remediation	Either: 1.) Upon 2 consecutive years of statistically similar results as the Control Well, 2.) as acceptable by the Authorities Having Jurisdiction, or 3) If the well is dry for 2 consecutive years	-	-	-	Cyn	-	SP, S, MI, N, DM, Hyd	-
Control Well (BH 5)	-	The Control Well is used as a reference well for comparisons to other groundwater wells sampled.	Completion of Phase II Remediation	Either: 1.) Upon 2 consecutive years of statistically similar results as the Control Well, 2.) as acceptable by the Authorities Having Jurisdiction, or 3) If the well is dry for 2 consecutive years	-	-	-	Cyn	-	SP, S, MI, N, DM, Hyd	-
Other Stations											

Station Name	Station ID	Purpose	Activation Trigger	Deactivation Trigger	Water Licence MV2009L8-0008			Construction Monitoring (SENES 2011)			
					Spring	Monthly During Open Water	Monthly During Periods of Flow	Baseline			Sewage Effluent Discharge
								Spring ^(b)	July	Monthly During Open Water	
										Monthly	
Ponded Water on TCA Cover following construction	-	To assess water quality of water collected on TCA Cover	Completion of TCA Cover	Completion of Adaptive Management Phase	-	-	-	-	-	SP, MI, TM, Hyd, Cyn	-
TCA Discharge Channel	-	To assess initial water quality leaving the site post remediation activity	Completion of TCA Discharge Channel	Maintained for LTM	-	-	-	-	-	SP, S, N, MI, TM, Hyd, Cyn	-

Parameter	Analysis Suite
Hyd	Hydrocarbon
Cyn	Cyanide
SP	Standard Parameters
S	Solids
MI	Major Ion
N	Nutrients
TM	Total Metals
DM	Disolved Metals
OG	Oil and Grease
BOD	Biological Oxygen Demand
FC	Fecal Coliforms

TABLE 3
Tundra Mine Remediation Program
Current Monitoring under MV2009L8-0008

Station Name	Station ID	Purpose	Status	Activation Trigger	Deactivation Trigger	Water Licence MV2009L8-0008						Construction Monitoring (SENES 2011)									
						Spring	Monthly During Open Water	Monthly During Periods of Flow	Baseline			Effluent Discharge		PHC Excavation			Excavation and Relocation of Waste Material to Lower Pond		Construction of TCA Cover	Construction of Discharge Channel	
									Spring ^(a)	July	Monthly During Open Water	Monthly	Weekly	Weekly	Every 2 Weeks	Monthly	Every 2 Weeks	Monthly	Monthly	Monthly During Flow	Weekly - 2 months following construction
Tailings Containment Area and Seepages																					
Lower Pond (LP-01)	SNP 0014-6A	Contaminant Source Monitoring	Active	Phase II Construction Activity	Completion of water treatment program	Hyd, Cyn	SP, S, MI, N, TM	-	-	-	-	-	Cyn	SP, S, MI, N, TM	-	-	-	-	-	-	-
Upper Pond (UP-01)	SNP 0014-7A	Contaminant Source Monitoring	Active	Phase II Construction Activity	Completion of water treatment program	Hyd, Cyn	SP, S, MI, N, TM	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Seep 1	SNP 0014-2.1	Historic TCA seepage monitoring	Active - typically dry	Phase II Construction Activity	Completion of water treatment program	-	SP, S, MI, N, TM, Hyd	-	Cyn	Cyn	-	-	-	-	-	-	-	-	SP, S, MI, N, TM	Cyn	-
Seep 2	SNP 0014-2.2	Historic TCA seepage monitoring	Active - typically dry	Phase II Construction Activity	Completion of water treatment program	-	SP, S, MI, N, TM, Hyd	-	Cyn	Cyn	-	-	-	-	-	-	-	-	SP, S, MI, N, TM	Cyn	-
Seep 3	SNP 0014-2.3	Historic TCA seepage monitoring	Active - typically dry	Phase II Construction Activity	Completion of water treatment program	-	SP, S, MI, N, TM, Hyd	-	Cyn	Cyn	-	-	-	-	-	-	-	-	SP, S, MI, N, TM	Cyn	-
Seep 4	SNP 0014-2.4	Historic TCA seepage monitoring	Active - typically dry	Phase II Construction Activity	Completion of water treatment program	-	SP, S, MI, N, TM, Hyd	-	Cyn	Cyn	-	-	-	-	-	-	-	-	SP, S, MI, N, TM	Cyn	-
Seep 6	SNP 0014-2.6	Historic TCA seepage monitoring	Active - typically dry	Phase II Construction Activity	Completion of water treatment program	-	SP, S, MI, N, TM, Hyd	-	Cyn	Cyn	-	-	-	-	-	-	-	-	SP, S, MI, N, TM	Cyn	-
CI Trench	SNP 0014-2.5	Historic TCA seepage monitoring	Active - typically dry	Phase II Construction Activity	Completion of water treatment program	-	SP, S, MI, N, TM, Hyd	-	Cyn	Cyn	-	-	-	-	-	-	-	-	SP, S, MI, N, TM	Cyn	-
Control Seep	-	QA/QC	Active - typically dry	Phase II Construction Activity	Completion of water treatment program	-	SP, S, MI, N, TM, Hyd	-	Cyn	Cyn	-	-	-	-	-	-	-	-	SP, S, MI, N, TM	Cyn	-
Surface Water in Pathway I																					
End-of-Pipe (treated effluent discharge) ^(a)	-	Effluent discharge compliance	Active - during discharge	Annual effluent discharge	Completion of water treatment program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hambone Lake (within 10 m of effluent inflow)	-	Effluent discharge - downstream tracking	Active - during discharge	Annual effluent discharge	Completion of water treatment program	-	-	-	-	-	-	-	Cyn	SP, S, MI, N, TM	-	-	-	-	-	-	-
Hambone Lake Inflow	SNP 0014-6B	Baseline Monitoring Effluent discharge - downstream tracking	Active	Phase II Construction Activity Annual effluent discharge	Phase II Completion Free flow from Mill Pond to Hambone Lake	Hyd, Cyn	SP, S, MI, N, TM	-	-	SP, S, MI, N, TM	-	-	Cyn	SP, S, MI, N, TM	-	-	-	-	-	-	-
Hambone Lake Outflow	SNP 0014-6C	Baseline Monitoring Effluent discharge - downstream tracking	Active	Phase II Construction Activity Annual effluent discharge	Phase II Completion Free flow from Mill Pond to Hambone Lake	Hyd, Cyn	SP, S, MI, N, TM	-	-	SP, S, MI, N, TM	-	-	Cyn	SP, S, MI, N, TM	-	-	-	-	-	-	-
Powder Mag Lake	SNP 0014-6E	Baseline Monitoring Effluent discharge - downstream tracking	Active	Phase II Construction Activity Annual effluent discharge	Phase II Completion Free flow from Mill Pond to Hambone Lake	Hyd, Cyn	SP, S, MI, N, TM	-	-	SP, S, MI, N, TM	-	-	Cyn	SP, S, MI, N, TM	-	-	-	-	-	-	-
Powder Mag Lake Outflow	SNP 0014-6G	Baseline Monitoring Effluent discharge - downstream tracking	Active	Phase II Construction Activity Annual effluent discharge	Phase II Completion Free flow from Mill Pond to Hambone Lake	Hyd, Cyn	SP, S, MI, N, TM	-	-	SP, S, MI, N, TM	-	-	-	-	-	-	-	-	-	-	-
Sandy Lake Crossing	SNP 0014-9	Erosion Monitoring Effluent discharge - downstream tracking	Active	Phase II Construction Activity Annual effluent discharge	Completion of water treatment program	-	-	SP, S, TM	-	-	-	-	-	SP, S, MI, N, TM, turbidity, water level	-	-	-	-	-	-	-
Sandy Lake	SNP 0014-6F	Baseline Monitoring Effluent discharge - downstream tracking	Active	Phase II Construction Activity Annual effluent discharge	Phase II Completion Free flow from Mill Pond to Hambone Lake	Hyd, Cyn	SP, S, MI, N, TM	-	-	SP, S, MI, N, TM	-	-	Cyn	SP, S, MI, N, TM	-	-	-	-	-	-	-
Sandy Lake Outflow	SNP 0014-6H	Baseline Monitoring Effluent discharge - downstream tracking	Active	Phase II Construction Activity Annual effluent discharge	Phase II Completion Free flow from Mill Pond to Hambone Lake	Hyd, Cyn	SP, S, MI, N, TM	-	-	SP, S, MI, N, TM	-	-	-	SP, S, MI, N, TM, Hyd, turbidity, water level	-	-	-	-	-	-	-
Whaletail Lake Outflow	-	Effluent discharge - downstream tracking	Active - during discharge	Annual effluent discharge	Completion of water treatment program	-	-	-	Hyd	SP, S, MI, N, TM, Hyd, Cyn	-	-	SP, S, MI, N, TM, Cyn	-	-	-	-	-	-	-	-
Courageous Lake	-	Effluent discharge - downstream tracking	Active - during discharge	Annual effluent discharge	Completion of water treatment program	-	-	-	-	SP, S, MI, N, TM	-	-	-	-	-	-	-	-	-	-	-
Trans Saddle Lake	SNP 0014-6D	Baseline Monitoring	Active	Phase II Construction Activity	Phase II Completion Free flow from Mill Pond to Hambone Lake	Hyd, Cyn	SP, S, MI, N, TM	-	-	SP, S, MI, N, TM	-	-	-	-	-	-	-	-	-	-	-
Control Lake ^(a)	SNP 0014-8	QA/QC	Active	Water Quality Monitoring	Completion of Water Quality Monitoring	-	SP, S, MI, N, TM, Hyd, Cyn	-	Cyn	SP, S, MI, N, TM	-	-	Hyd	-	-	-	-	-	-	-	-
Surface Water in Pathway II																					
Mill Pond	SNP 0014-7B	Baseline Monitoring	Active	Phase II Construction Activity	Phase II Completion Free flow from Mill Pond to Hambone Lake	Hyd, Cyn	SP, S, MI, N, TM	-	-	SP, S, MI, N, TM	-	-	-	-	-	-	-	-	-	-	-
Landfill Ditches ^(a)	SNP 0014-5	Phase 1 remediation - Baseline Monitoring	Active	Phase 1 - Construction of Landfill	Phase II Completion Free flow from Mill Pond to Hambone Lake	SP, S, MI, N, TM, Hyd	SP, S, MI, N, TM, Hyd	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Landfill Pond / Leachate	SNP 0014-3	Phase 1 remediation - Baseline Monitoring	Active - occasional dry	Phase 1 - Construction of Landfill	Phase II Completion Free flow from Mill Pond to Hambone Lake	-	SP, S, MI, N, TM, Hyd	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Landfill Outflow	SNP 0014-4	Phase 1 remediation - Baseline Monitoring	Active	Phase 1 - Construction of Landfill	Maintained for LTM	-	SP, S, MI, N, TM, Hyd	-	-	SP, S, MI, N, TM	-	-	-	-	-	-	-	-	-	-	-
Bulldog Lake	SNP 0014-7C	Baseline Monitoring Excavation - downstream tracking	Active	Phase II Construction Activity Excavation of soils and waste rock	Phase II Completion Free flow from Mill Pond to Hambone Lake	Hyd, Cyn	SP, S, MI, N, TM	-	-	SP, S, MI, N, TM	Hyd	-	-	Hyd	-	-	-	-	-	-	-
Matthews Lake Near-field	SNP 0014-1	Baseline Monitoring Excavation - downstream tracking	Active	Phase II Construction Activity Excavation of soils and waste rock	Phase II Completion Free flow from Mill Pond to Hambone Lake	-	TSS, N, pH, total aluminum, turbidity	-	Hyd, Cyn	SP, S, MI, N, TM	SP, S, MI, TM	-	-	Hyd	-	-	-	-	-	-	-
Matthews Lake Far-field	-	Baseline Monitoring Excavation - downstream tracking	Active	Phase II Construction Activity Excavation of soils and waste rock	Phase II Completion Free flow from Mill Pond to Hambone Lake	-	-	-	-	SP, S, MI, N, TM	SP, S, MI, N, TM	-	-	-	-	-	-	-	-	-	-
Groundwater Wells																					
BH1	-	To identify pathways that contaminants may take to reach downstream lakes along Pathway II.	Inactive - destroyed during remediation activities	Phase II Construction Activity	Destruction during dam removal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH2	-	To assess tailings pore-water and identify pathways that contaminants may take to reach downstream lakes along Pathway I.	Inactive - destroyed during remediation activities	Phase II Construction Activity	Destruction during dam removal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH 3	-	To identify pathways that contaminants may take to reach downstream lakes along Pathway I.	Active	Phase II Construction Activity	Maintained for LTM	-	-	-	Hyd, Cyn	-	SP, S, MI, N, DM	-	-	-	-	-	-	-	-	-	-
BH 4	-	To identify pathways that contaminants may take to reach downstream lakes along Pathway I.	Active - typically dry	Phase II Construction Activity	Maintained for LTM	-	-	-	Hyd, Cyn	-	SP, S, MI, N, DM	-	-	-	-	-	-	-	SP, S, MI, N, TM	Cyn	-
BH 6	-	To identify pathways that contaminants may take to reach downstream lakes along Pathway I.	Inactive - destroyed during remediation activities	Phase II Construction Activity	Destruction during dam removal	-	-	-	-	-	-	-	-	-	-	-	-	-	SP, S, MI, N, TM	Cyn	-
BH 7	-	To assess subsurface drainage from the main mine site tank farm area.	Active	Phase II Construction Activity	Maintained for LTM	-	-	-	Cyn	-	SP, S, MI, N, DM, Hyd	-	-	-	SP, DM, Hyd	Cyn	-	-	-	-	-
BH 8	-	To assess subsurface drainage from the main mine site tank farm area.	Active - typically dry	Phase II Construction Activity	Maintained for LTM	-	-	-	Cyn	-	SP, S, MI, N, DM, Hyd	-	-	-	SP, DM, Hyd	Cyn	-	-	-	-	-
BH A	-	To assess the pore-water quality within the historic TCA.	Inactive - destroyed during remediation activities	Phase II Construction Activity	Destruction during tailings excavation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH B	-	To assess the pore-water quality within the historic TCA.	Inactive - destroyed during remediation activities	Phase II Construction Activity	Destruction during tailings excavation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH C	-	To assess the pore-water quality within the historic TCA.	Inactive - destroyed during remediation activities	Phase II Construction Activity	Destruction during tailings excavation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH D	-	To assess the pore-water quality within the historic TCA.	Inactive - destroyed during remediation activities	Phase II Construction Activity	Destruction during tailings excavation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH E	-	To assess pore-water quality in an area where iron oxidation was observed and where tailings may have been deposited.	Active - typically dry	Phase II Construction Activity	Maintained for LTM	-	-	-	Hyd, Cyn	-	SP, S, MI, N, DM	-	-	-	-	-	-	-	-	-	-
BH F	-	To assess the level of seepage from the north dam of the Lower Pond.	Inactive - destroyed during remediation activities	Phase II Construction Activity	Destruction during dam removal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH G	-	To assess subsurface drainage from the landfill.	Active - typically dry	Phase II Construction Activity	Maintained for LTM	-	-	-	Cyn	-	SP, S, MI, N, DM, Hyd	-	-	-	-	-	-	-	-	-	-
BH H	-	To assess subsurface drainage from the old fuel storage area.	Active	Phase II Construction Activity	Maintained for LTM	-	-	-	Cyn	-	SP, S, MI, N, DM, Hyd	-	-	-	SP, DM, Hyd	Cyn	-	-	-	-	-

Station Name	Station ID	Purpose	Status	Activation Trigger	Deactivation Trigger	Water Licence MV2009L8-0008			Construction Monitoring (SENES 2011)													
						Spring	Monthly During Open Water	Monthly During Periods of Flow	Baseline			Construction Activities										
									Spring ^(a)	July	Monthly During Open Water	Effluent Discharge		PHC Excavation			Excavation and Relocation of Waste Material to Lower Pond		Construction of TCA Cover	Construction of Discharge Channel		
Monthly	Weekly	Weekly	Every 2 Weeks	Monthly	Every 2 Weeks	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly								
BH I	-	To assess subsurface drainage from the old fuel storage area.	Active	Phase II Construction Activity	Maintained for LTM	-	-	-	Cyn	-	SP, S, MI, N, DM, Hyd	-	-	-	SP, DM, Hyd	Cyn	-	-	-	-	-	
BH J	-	To identify pathways that contaminants may take to reach downstream	Inactive - destroyed during remediation activities	Phase II Construction Activity	Destruction during dam removal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Control Well (BH 5)	-	The Control Well is used as a reference well for comparisons to other groundwater wells sampled.	Active	Phase II Construction Activity	Maintained for LTM	-	-	-	Cyn	-	SP, S, MI, N, DM, Hyd	-	-	-	SP, DM, Hyd	Cyn	-	cyn	-	-	-	
Ponded Water on TCA Cover following construction	-	To assess water quality of water collected on TCA Cover	Inactive - TCA Cover incomplete	Completion of TCA Cover	Maintained for LTM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	SP, MI, TM, Hyd, Cyn	-	-
TCA Discharge Channel	-	To assess initial water quality leaving the site post remediation activity	Inactive - TCA Discharge Channel Incomplete	Completion of TCA Discharge Channel	2 months following construction of the TCA Discharge Channel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	SP, S, N, MI, TM, Hyd, Cyn	SP, S, N, MI, TM

Parameter	Analysis Suite
Hyd	Hydrocarbon
Cyn	Cyanide
SP	Standard Parameters
S	Solids
MI	Major Ion
N	Nutrients
TM	Total Metals
DM	Disolved Metals
OG	Oil and Grease
BOD	Biological Oxygen Demand
FC	Fecal Coliforms