Appendix 44

Whale Tail Follow up Letter WRSF

January 27th, 2020

Re.: Agnico Eagle Whale Tail Project – WRSF Flow Follow up (2019-333) - Additional Information

This letter provides additional information following the water flow through the Whale Tail Waste Rock Storage Facility (WRSF) Dike reported on August 25, 2019. Specifically, this letter includes:

- a summary of the background information on the event,
- water quality test results,
- results of the investigation of the event and additional actions taken,
- instrumentation monitoring results,
- discussion of possible mechanisms leading to the event, and
- the proposed path forward.

Please note that an initial follow-up document was submitted on September 20, 2019. This letter provides additional information to the earlier document.

Background

Agnico Eagle Mines Limited – Meadowbank Division (Agnico Eagle) informed you via email on August 25, 2019, that during a routine inspection of the Whale Tail WRSF Dike carried out on August 24, 2019 at 10:30 am, a water flow was observed at the toe of the dike flowing toward Mammoth Lake (UTM 14W 0605380 7255454) (see Figure 1).

This event report was submitted in compliance with the requirements of Part H, Item 8b of Water License 2AM-WTP1826 (Water License), subsection 12(3) of the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (Canada), paragraph 5.1(a) of the *Environmental Protection Act* (Nunavut), subsection 38(5) of the *Fisheries Act* (Canada) and paragraph 24(1)(a) of the *Metal and Diamond Mining Effluent Regulations* (MDMER) made under the *Fisheries Act* (Canada). A follow-up document was submitted on September 20, 2019, providing additional details and information.

Following observation of the water flow, special measures were immediately put in place on August 24th to reduce the flowrate by pumping water out of the WRSF collection pond, with the ultimate objective to stop the flow as quickly as possible. Given the nature of the topography at the toe of the WRSF Dike (flat terrain at an elevation close to the lake elevation with the presence of a boulder field), and its difficult access, we realized that installing a pumping station at the toe could not be done rapidly and that the best course of action was a rapid head reduction in the pond by emptying it.

The WRSF pond was considered to be essentially empty by September 1st, within one week of the first observation. In the meantime, an access road to the toe of the dike was constructed to allow the installation of a water collection system to pump the water back upstream. The collection system was operated until the onset of freezing conditions on September 30th but after the pond was emptied. By this time it was mostly collecting drainage water downstream of the dike.

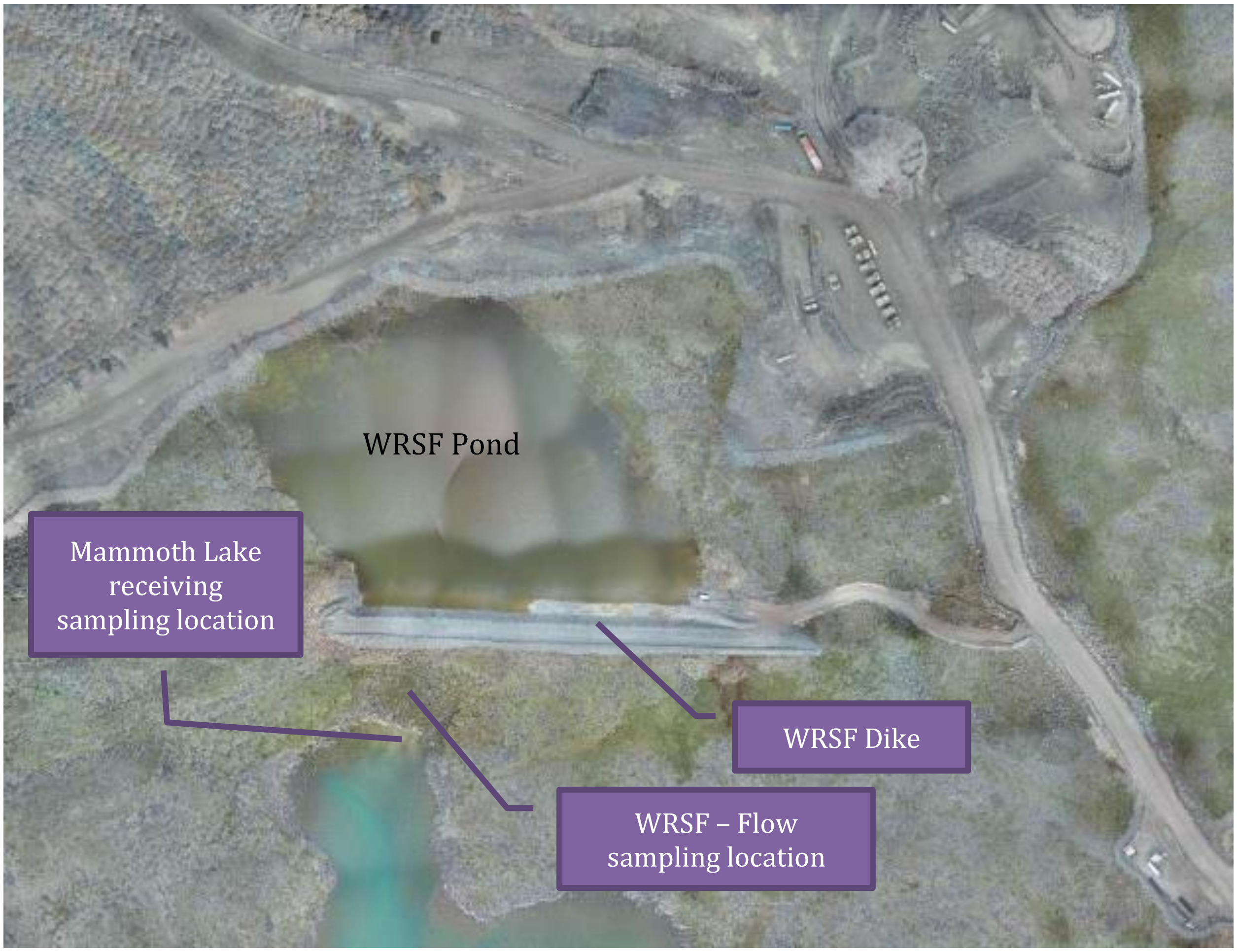


Figure 1: WRSF Flow and Receiving Environment Location

The initial estimate provided of the quantity of water released from the flow through the WRSF pond dike between August 15 and September 1 was approximately 15,000 m^3. Verification of pumping rates, along with bathymetry of the WRSF pond and the water elevation, have enabled us to refine this estimate. As shown on Figure 2, on August 15, the volume of water in the pond was estimated at 99,657m^3. From that volume, 38,135m^3 was pumped to Quarry 1 to empty the pond. This meant that the rest of the water, or approximately 61,500m^3, had seeped through the dike. This estimate is intended to be conservative.

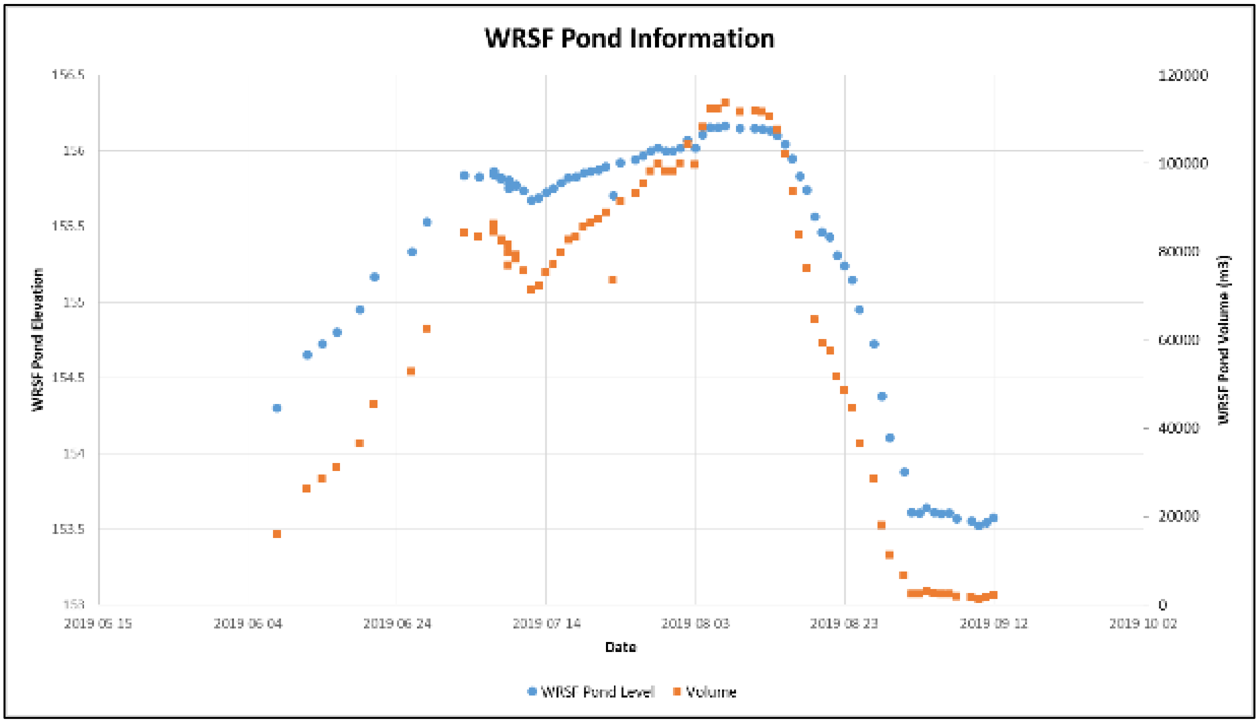


Figure 2: WRSF pond water elevation and associated volume

At peak conditions, the flow has been estimated to be approximately 172 m^3/hour. These estimates have been done by comparing the actual rate of decrease of the pond level compared to the expected rate of decrease of the pond resulting only from the pumping activities.

As mentioned in our earlier communications, the visual detection of this seepage downstream of the dike was difficult because of the presence of a boulder field at the toe which caused the flow to be somewhat diffuse as well as the presence of natural runoff reporting in this area.

Toxicity and water quality results

Toxicity tests

A series of samples were taken for analysis on August 26th from the water source (WRSF Pond) as well as from the receiving waterbody (Mammoth Lake). The toxicity test results were provided in the September 20, 2019 report and showed no mortalities.

Water quality sampling

Samples were also taken to test the water quality specifically for MDMER related parameters (Table 1 and Table 2, below) on August 26th. Sampling locations were identified as WRSF flow (water sampled downstream of the dike, where the flow was first observed and where a sump was excavated) and Mammoth Lake receiving (water sampled within a few meters of the shoreline of Mammoth Lake north).

Sampling and subsequent sample shipment were executed according to site Standard Operating Procedures and samples were sent on the same day via charter and transported directly to an accredited and certified laboratory (H2Lab) in Val d'Or, Quebec.

Analysis results from these samples and from subsequent samples taken at both locations showed no exceedances of the MDMER water quality criteria. These results are consistent with the expected water quality for this contact water.

A full complement of samples for extended parameters were also collected on August 27th, 30th, September 2nd and on a weekly basis until freeze up (September 29, 2019) and sent to the accredited laboratory. Water quality results from these additional samples are shown in Appendix A. No MDMER or Water License exceedances were shown for this complement of sampling.

Table 1: WRSF- MDMER related water quality results: Mammoth Lake North

Sample Date			26 Aug, 2019	27 Aug. 2019	2 Sept. 2019	9 Sept. 2019	16 Sept. 2019	22 Sept. 2019	29 Sept. 2019
Location			Mammoth Lake receiving water area (North)						
Parameter	Unit	MDMER Limits							
pH	pH units	6.0 - 9.5	7.47	7.32	7.18	7.68	7.74	7.9	6.9197
Conductivity	uS/cm	-	642.6	630.2	559.6	332.2	195	202.4	278.5
Temperature	°C	-	8.95	8.56	8.39	6.65	7.01	7.23	7.14
Dissolved oxygen	mg/L	-	9.23	10.19	10.29	10.57	11.8	11.68	12.05
Dissolved oxygen	%	-	81.2	89.7	90.5	89.2	99.4	98.9	100
Turbidity	NTU	-	6.71	6.26	3.62	1.18	1.7	1.73	1.41
Total susp.solids	mg/L	30	5	4	2	2	1	5	1
Cyanide	mg/L	2	0.003	-	-	-	-	-	-
Arsenic	mg/L	1	0.008	0.0079	0.0052	0.0022	0.0016	0.0017	0.0013
Copper	mg/L	0.6	0.0046	0.0048	0.0043	0.0008	0.001	0.0007	0.0006
Lead	mg/L	0.4	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015
Nickel	mg/L	1	0.0212	0.023	0.0186	0.006	0.0049	0.0036	0.0033
Zinc	mg/L	1	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Radium-226	Bq/l	1.11	0.02	-	0.011	0.007	0.034	0.001	0.001

Table 2: WRSF- MDMER related Water quality results: WRSF flow

Sample Date			8/26/2019	8/27/2019	8/30/2019	9/2/2019
Location			WRSF downstream flow in boulders			
Parameter	Unit	MDMER limits				
pH	pH units	6.0 - 9.5	6.79	7.17	7.54	7.03
Conductivity	uS/cm	-	640.6	621	671.7	682.3
Temperature	°C	-	8.59	9.99	11.05	9.76
Dissolved oxygen	mg/L	-	8.54	8.59	8.91	10.34
Dissolved oxygen	%	-	76.3	78	93.1	93.7
Turbidity	NTU	-	7.36	7.18	7.47	5.1
Total suspended solids	mg/L	30	6	4	4	3
Cyanide	mg/L	2	0.003	-	0.0005	-
Arsenic	mg/L	1	0.0078	0.0077	0.0087	0.0082
Copper	mg/L	0.6	0.0044	0.0054	0.0051	0.005
Lead	mg/L	0.4	0.00015	0.00015	0.00015	0.00015
Nickel	mg/L	1	0.0214	0.0226	0.0239	0.0252
Zinc	mg/L	1	0.0005	0.0005	0.0005	0.0005
Radium-226	Bq/l	1.11	0.02	-	-	0.025

Data from Tables 1 and 2 show water quality of the water flow at the toe of the WRSF dike and within the near field receiving water of Mammoth Lake over the period reported.

As shown in Table 1, the prescribed deleterious substances regulated pursuant to MDMER were below the prescribed limits in the receiving water of Mammoth Lake and were decreasing over time, which coincides with the reduction in water flow through the dike as the water in the WRSF pond was pumped out (pond empty by September 1st). Arsenic concentrations, the main parameter of concern identified during the Environmental Assessment process of the Whale Tail Project, are shown in Figure 3 below in both the seepage flow and in the receiving water, as an example to show the low concentrations of arsenic relative to the MDMER limit for discharge.

At no time did water quality in either the location, WRSF flow or Mammoth Lake Receiving, exceed any of the MDMER prescribed limits or Water License criteria.

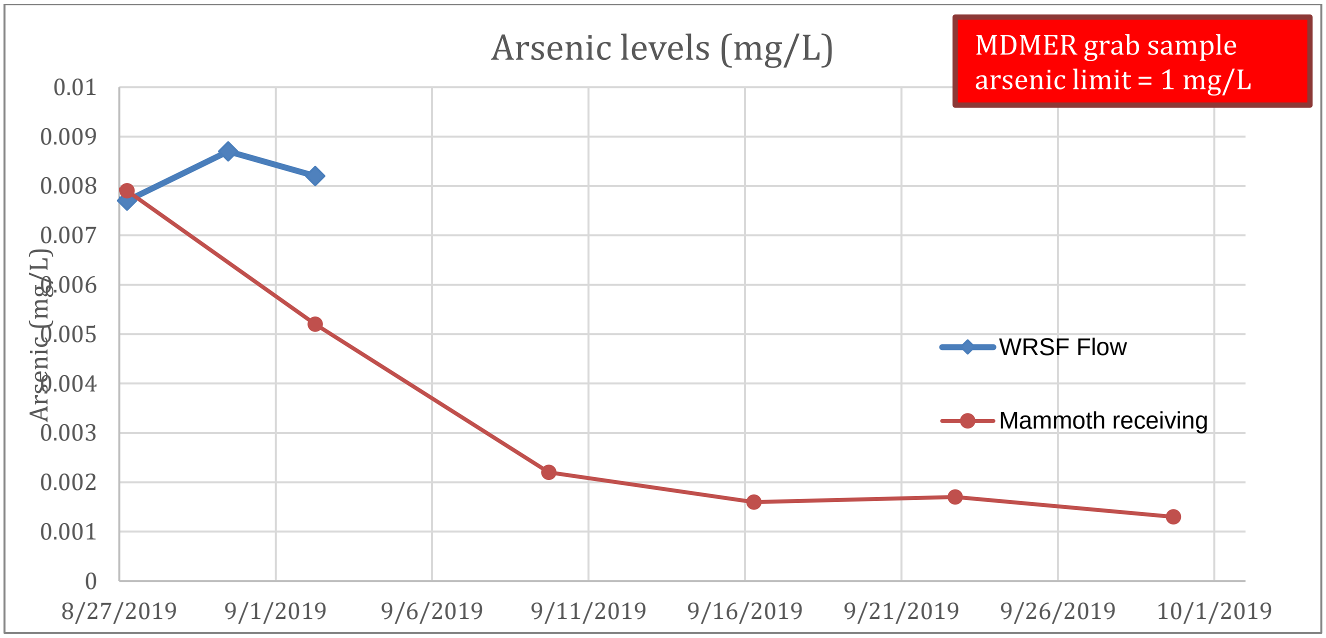


Figure 3: Arsenic Concentrations in Water of Mammoth North

Additional investigations, analysis and actions

Further investigations and analysis were completed to understand the cause of the seepage observed on August 25, 2019:

- Agnico Eagle's geotechnical engineers, along with the dike designer (SNC Lavalin) and the Engineer of Record (EoR), conducted a site visit/inspection on September 9, 2019, reviewed the available data and installed new instrumentation;
- A tracer test was conducted on October 8, 2019 and confirmed that the water levels were maintained below the authorized levels as per the dike design; and
- The Meadowbank Dike Review Board (MDRB) conducted a site visit and they supported the recommendation put forward, to keep a low water level in the pond and ensure freeze back during upcoming winter.

The following additional actions were taken:

- The downstream water was pumped back to the WRSF pond as much as possible:
    - An access road was constructed;
    - A sump was excavated;
    - A pump was installed, and flow was continuously directed back into the WRSF pond (then directed towards Quarry 1);
- The pumping was continued until September 30, 2019 at which time it was no longer possible to pump because of the decrease in flow and the freezing conditions.

The observations confirmed the initial assessment that, once low levels were maintained in the WRSF pond, no water originating from this pond was flowing towards Mammoth Lake. The pond has been kept at low levels since September 1, 2019.

The Trigger Action Response Plan status of the dike was elevated as per the OMS manual and this higher level resulted in a more intense surveillance program.

Instrumentation Monitoring Results

Installation of additional thermal monitoring instrumentation was completed in October 2019 in response to the seepage event. In addition to the existing 3 thermistors (TH-01, TH-02, TH-03), 4 new vertical instruments were installed (TH-04, TH-05, TH-06, TH-07). Locations are detailed in Figures 4 and 5 below. Figures 6 to 12 show collected data for the thermistors along with a short explanation of each instrument configuration and an interpretation of each thermistor data set. All data are logged into an existing data collection system.

Figure 4: WRSF Thermistor locations

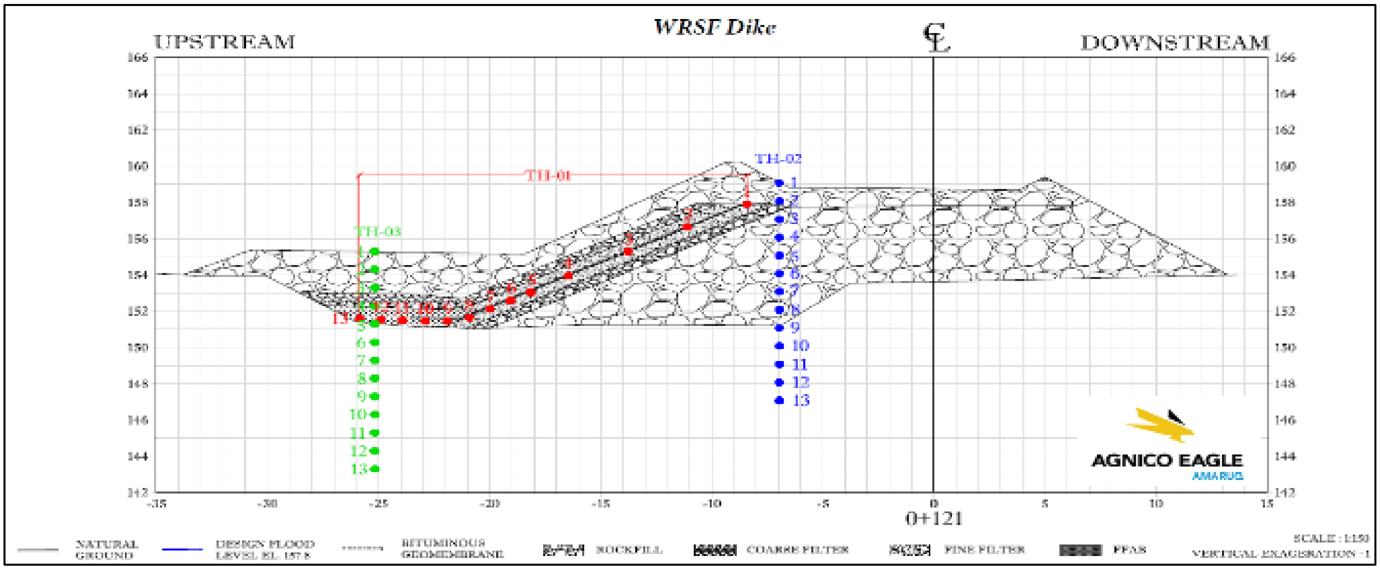
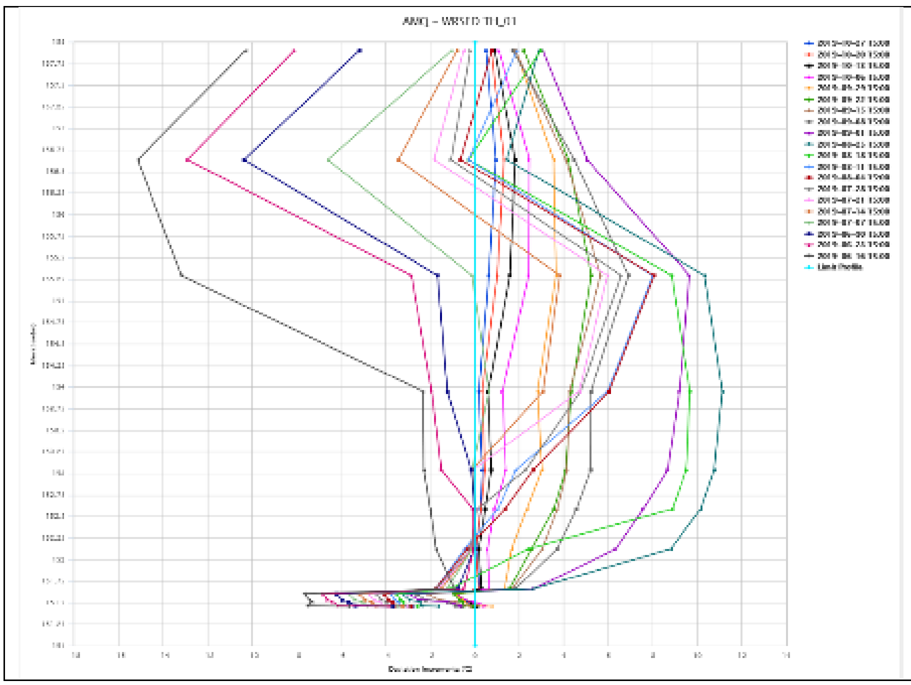


Figure 5: WRSF Thermistor TH1, TH2, TH3 locations (profile view)



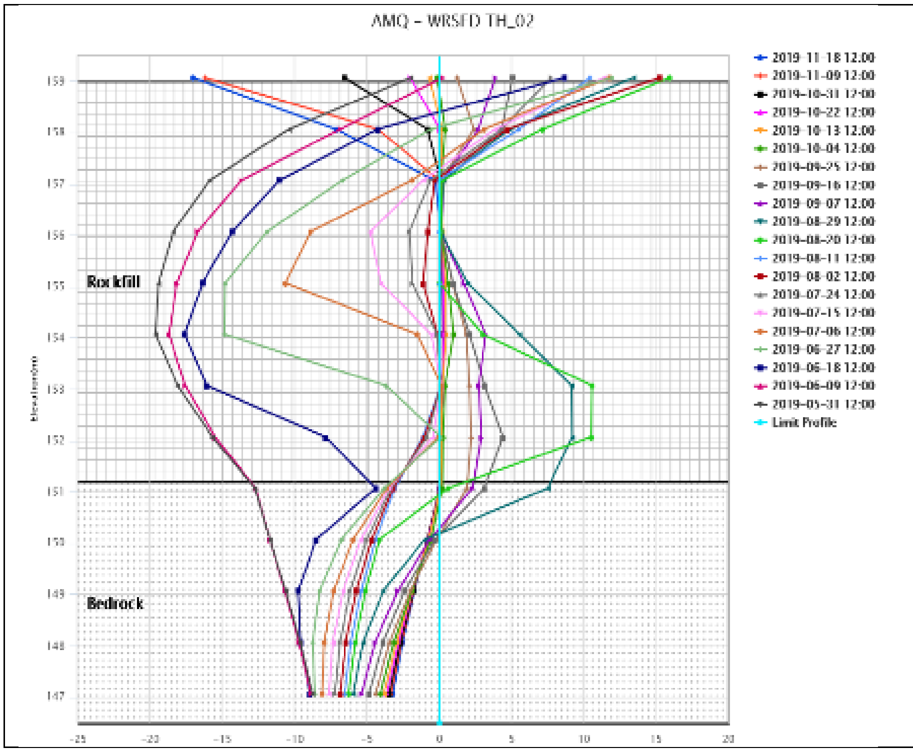
Configuration

- Installed March 2019
- 13 Beads TH
- Bead #1 (upper) to 8 in upstream slope
- Bead #9 to 13 in key trench
- No beads underneath FFAB (i.e. no bead in foundation)

Interpretation

- Upstream slope progressively warms as water raise in pond (water in contact with liner & TH)
- Peak temperature (11ºC) at elevation 154 occurred around August 20th in response to key trench excavation filling up with warm seepage water
- Beads in FFAB (#9+) show frozen condition until October 2019. Temperature reached slightly above 0ºC in FFAB in October

Figure 6: WRSF Temperature profile of thermistor TH-01



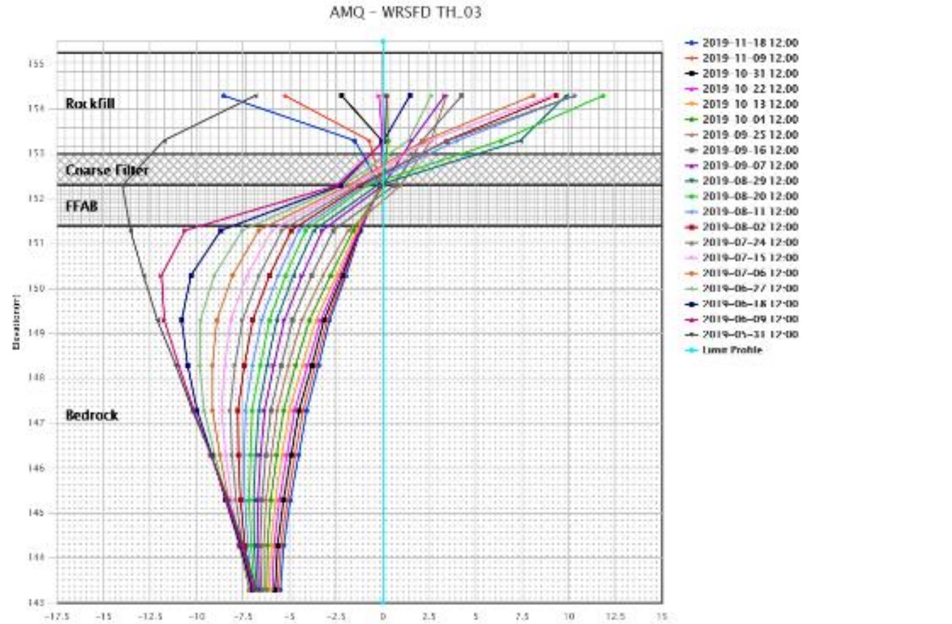
Configuration

- Installed March 2019
- 13 Beads TH
- Located downstream of liner
- Bead #1 (upper) to 8 in rockfill
- Bead #9 to 13 in bedrock

Interpretation

- All beads (except surface ones) were showing frozen (<0ºC) rockfill/bedrock before August 15 but with gradual warming up. Most likely due to key trench void filling slowly (over 2 months) with runoff water
- Sudden peak temperature (11ºC) at elevation 152.5 m occurred around August 20th in response to key trench excavation filling up with warm seepage water
- Since this event, temperatures are going back to freezing condition (close to 0ºC)

Figure 7: WRSF Temperature profile of thermistor TH-02



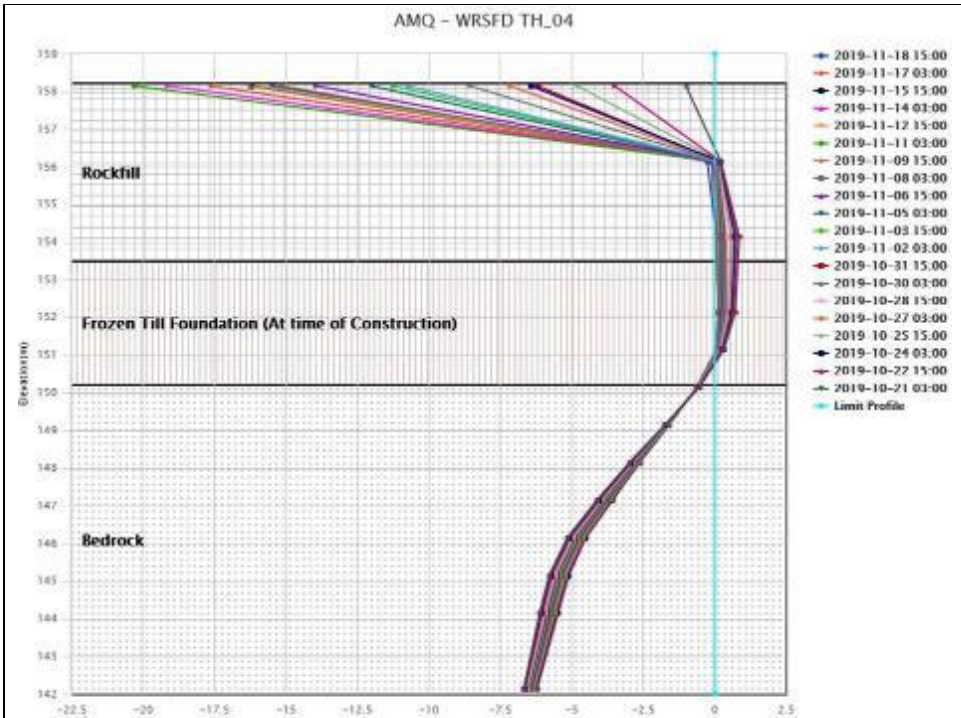
Configuration

- Installed March 2019
- 13 Beads TH
- Located upstream of liner, through FFAB and foundation
- Bead #1 (upper) to 3 in rockfill/coarse filter or FFAB
- Bead #4 to 13 in bedrock

Interpretation

- FFAB layer did not thaw completely over the summer months but coarse filter did
- No sudden peak of temperature observable in this TH
- Bedrock foundation remained frozen

Figure 8: WRSF Temperature profile of thermistor TH-03



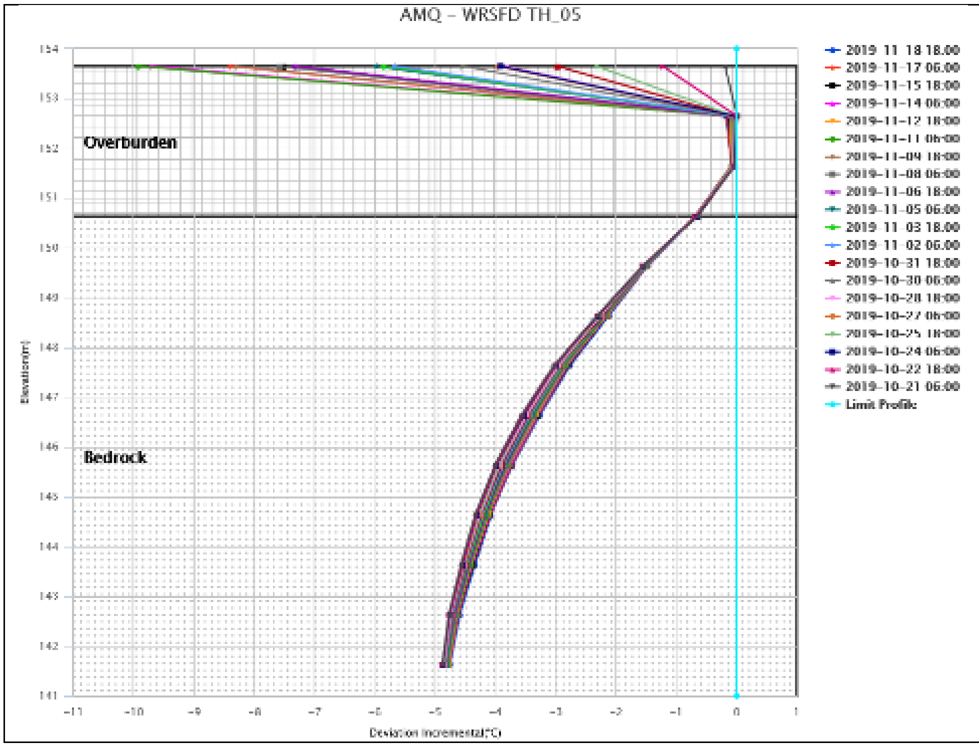
Configuration

- Installed October 2019
- 13 Beads TH
- Located downstream of liner
- Bead #1 (upper) to 3 in rockfill
- Bead #4 to 13 in bedrock

Interpretation

- TH installation was in response to seepage. No data of the critical period available
- Even in October, portion of the till foundation was still unfrozen
- No sudden peak of temperature observable in this TH
- Bedrock foundation remained frozen
- Very similar trend to TH2 for October/November

Figure 9: WRSF Temperature profile of thermistor TH-04



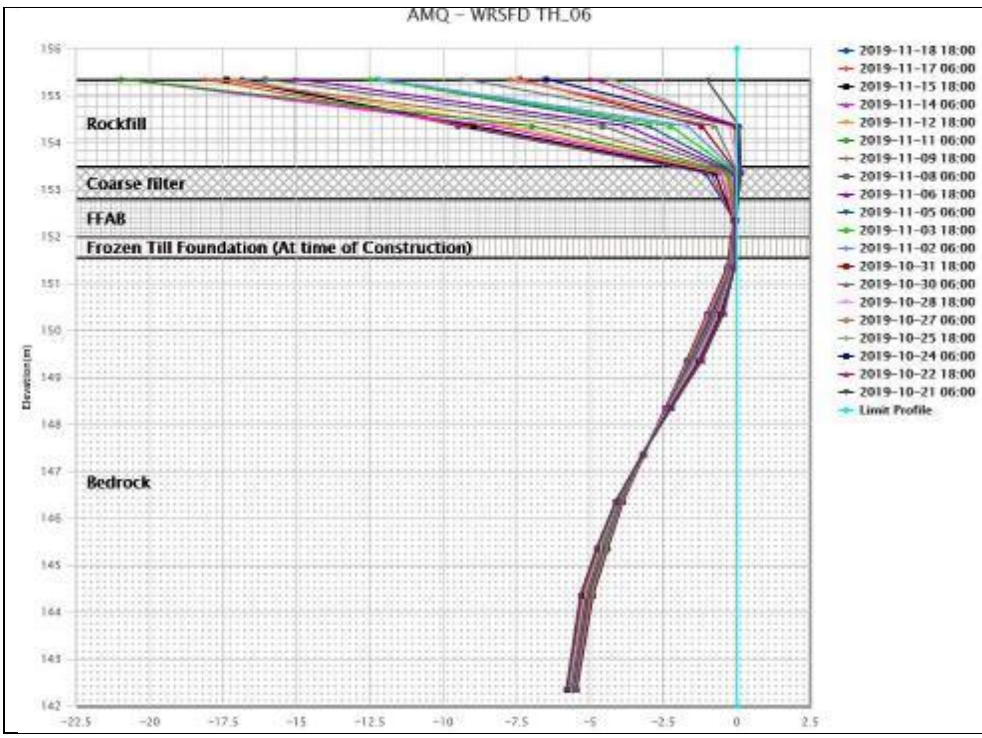
Configuration

- Installed October 2019
- 13 Beads TH
- Located 20m upstream of liner in low spot
- Bead #1 (upper) to 4 in overburden
- Bead #5 to 13 in bedrock

Interpretation

- TH installation was in response to seepage. No data of the critical period available
- Partial, results seem to suggest that active layer in overburden was around 2m (153.5 to 151.5)

Figure 10: WRSF Temperature profile of thermistor TH-05



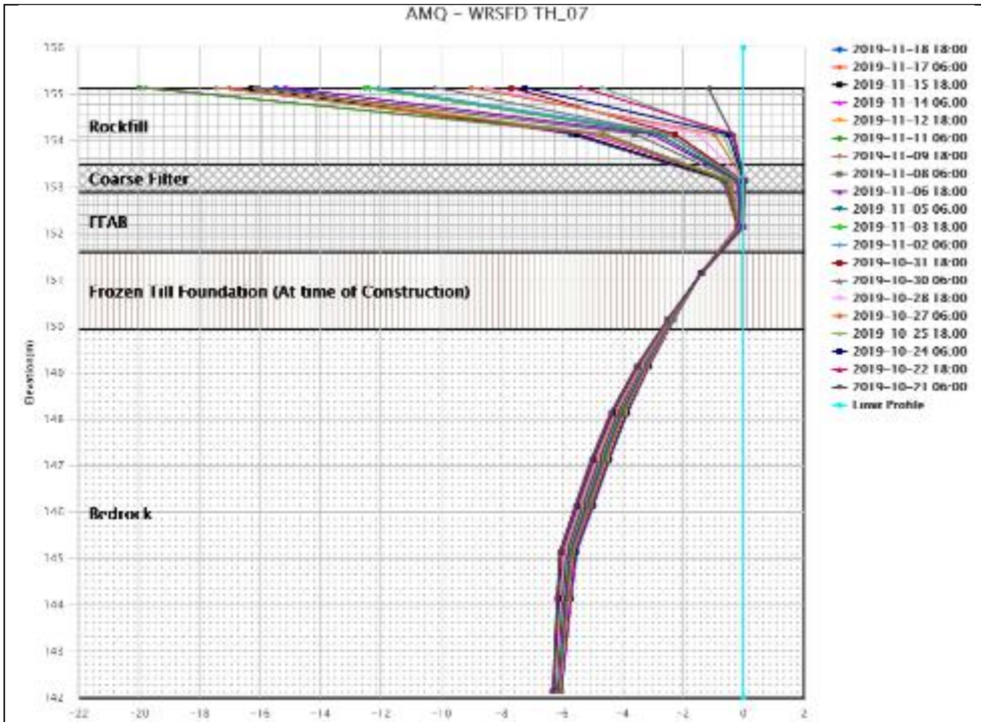
Configuration

- Installed October 2019
- 13 Beads TH
- Located through key trench, upstream of liner (similar to TH3)
- Bead #1 (upper) to 4 in overburden or filter
- Bead #5 to 13 in foundation

Interpretation

- TH installation was in response to seepage. No data of the critical period available
- Partial, results seem to suggest that active layer penetrated down to the foundation (elevation 151.0)

Figure 11: WRSF Temperature profile of thermistor TH-06



Configuration

- Installed October 2019
- 13 Beads TH
- Located through key trench, upstream of liner (similar to TH3)
- Bead #1 (upper) to 4 in overburden or filter
- Bead #5 to 13 in foundation

Interpretation

- TH installation was in response to seepage. No data of the critical period available.
- Partial, results seem to suggest that active layer stayed in FFAB

Figure 12: Temperature profile of thermistor TH-07

Seepage Mechanism Determination

Ongoing work to identify the exact mechanism that led to the seepage of water through the WRSF dike highlighted the following mechanisms: degradation of the permafrost within the dike foundation, damage to the liner, or a combination of both.

<u>Degradation of the permafrost within the dike foundation</u>:

Thermal monitoring results suggest that thawing of the dike foundation occurred, resulting in an increase of its hydraulic conductivity that led to the seepage. Thawing of the foundation has probably been induced by the higher than anticipated accumulation of water in the pond coupled with an insufficient thermal protection on the upstream toe of the dike.

Over the summer, the pond experienced high water levels (still within design limits) resulting from higher than anticipated precipitation. These sustained high water levels led to warming/thawing of the key trench plug (FFAB, Fine Filter Amended with Bentonite) at approximately elevation 152.5 m as shown in Figure 8 (TH-03). Thawing of the key trench created a sudden pathway for water to migrate downstream.

<u>Damage to the liner</u>:

While unlikely, it cannot be excluded that potential damages to the liner occurred as a result of excessive differential settlement between the dike and its foundation. However, the magnitude of the flowrate is such that it would have required an important defect in the liner. It is unlikely that excessive differential settlement could have resulted in such large-scale damage. It is therefore more likely that if any defects were present, they could account for only a portion of the flow.

Exposing the liner to investigate its integrity risks damaging it. The strategy is to monitor the thawing of the foundation using thermistors. If thermistor data do not show any thawing and seepage beyond the design value is observed, more intrusive verification of the liner would need to be done and could lead to its replacement.

Path Forward

A series of measures have been or will be implemented to minimize the risk of a similar occurrence in the future:

- The water level in the WRSF pond will be maintained at a low level throughout 2020 as per recommendation from the MDRB as a precautionary measure and to ensure protection of the freeze-back of the key trench;
- Permafrost penetration will be promoted during winter 2019-2020 by implementing a series of additional measures to increase the robustness of the infrastructure and in particular the upstream toe against permafrost degradation:
  - Strategic snow removal to keep the toe more exposed to winter conditions;
  - Keeping a low water level (if any) in the pond during winter and summer months;
  - Placing additional thermal cover material on the upstream portion of the dike; and
  - Assessing freeze back performance with periodic instrumentation review;
- A more robust downstream water collection system will be designed and constructed; and
- Thermistors monitoring will continue.

In addition, the following environmental monitoring will be conducted:

- A monthly limnology profile of Mammoth Lake will be completed over the winter and open water conditions;
- A core receiving environment monitoring program will be carried out, including Mammoth lake; and
- A sediment sampling campaign will be executed in the summer at Mammoth Lake.

This path forward was presented and approved by the MDRB during a meeting held in late November.

Conclusion

Agnico Eagle's team responded well to the event and was able to rapidly implement a series of measures when the water flow was observed. Following the emptying of the WRSF pond, the water flow was stopped by September 1st (which was later supported by a tracer test that did not show connectivity afterward). Also, water quality data showed that the overall impact of this event in the receiving environment was minimal.

It is important to mention that while this dike did not perform as intended, at no time was there an issue with its overall integrity. While it is difficult to conclude on the exact mechanism that led to the flow of water through the dike, thermistor evidence seems to point toward the thawing of the foundation on the upstream side of the dike as the main contributor. Therefore, improving the robustness of this infrastructure by providing additional thermal cover on the upstream toe is considered the most effective measure to implement at this stage. This measure is fully supported by our external and internal technical specialists who believe that promoting freeze back during the winter of 2019-2020 (to be confirmed by monitoring data from the thermistors already installed) and maintaining low water levels in the pond, should reduce the risk of similar occurrence in the coming years.

Agnico Eagle is committed to maintaining very close monitoring of this area. Additional instrumentation in the structure have been installed, strict inspection as per the OMS manual will be conducted and water quality sampling downstream of the location of the seepage will be maintained with the core receiving environment monitoring program in Mammoth Lake.

Should you have any questions regarding this report, please do not hesitate to contact the undersigned.

Regards,

Robin Allard
General Supervisor
Environment
Meadowbank Division

Appendix A

Sample Date			8/27/2019	8/30/2019	9/2/2019	9/2/2019	9/9/2019	9/16/2019	9/22/2019	9/29/2019
Location			Mammoth Receiving	WRSF flow in boulders	Mammoth Receiving	WRSF flow in boulders	Mammoth Receiving	Mammoth Receiving	Mammoth Receiving	Mammoth Receiving
Parameter	**MDMER Limit**	**Unit**								
pH		pH units	7.32	7.54	7.18	7.03	7.68	7.74	7.9	6.97
Conductivity		uS/cm	630.2	671.7	559.6	682.3	332.2	195	202.4	278.5
Temperature		°C	8.56	11.05	8.39	9.76	6.65	7.01	7.23	7.14
Dissolved oxygen		mg/L	10.19	8.91	10.29	10.34	10.57	11.8	11.68	12.05
Dissolved oxygen		%	89.7	93.1	90.5	93.7	89.2	99.4	98.9	102.4
pH	6.0 - 9.5	pH units	7.77	7.66	7.69	7.77	6.76	7.25	7.42	7.35
Hardness		mg CaCO3/L	216	243	186	254	105	69	69	73
Total dissolved solids		mg/L	406	445	374	447	191	131	132	167
Total suspended solids	30	mg/L	4	4	2	3	2	1	5	1
Turbidity		NTU	4.9	-	3.23	4.43	1.21	0.77	1.19	1.45
Total alkalinity, as CaCO3		mg CaCO3/L	52	58	63	70	28	21	23	22
Chloride		mg/L	26.9	28.6	27.5	29.1	23.5	25.4	25.7	27.1
Fluoride		mg/L	0.11	0.11	0.08	0.09	0.06	0.06	0.06	0.07
Sulphate		mg/L	160	162	127	167	48.3	24.7	24.7	36.4
Total ammonia as NH4		mg/L	0.85	0.67	0.55	0.79	0.25	0.11	0.09	0.16
Un-Ionized Ammonia,		mg/L	0.01	0.005	0.005	0.01	0.005	0.005	0.005	0.005
Total phosphorus		mg/L	0.04	0.05	0.04	0.05	0.005	0.02	0.01	0.01
Total orthophosphate (P)		mg/L	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.02
Total Metals										
Aluminum		mg/L	0.064	0.194	0.027	0.087	0.0025	0.0025	0.006	0.023
Arsenic	1	mg/L	0.0079	0.0087	0.0052	0.0082	0.0022	0.0016	0.0017	0.0013
Barium		mg/L	0.0779	0.083	0.0582	0.0811	0.035	0.027	0.0257	0.0305
Cadmium		mg/L	0.00005	0.00005	0.00001	0.00005	0.00001	0.00001	0.00001	0.00002
Chromium		mg/L	0.0011	0.0015	0.0007	0.0009	0.0003	0.001	0.0003	0.0003

Copper	0.6	mg/L	0.0048	0.0051	0.0043	0.005	0.0008	0.001	0.0007	0.0006
Iron		mg/L	0.44	0.67	0.42	0.74	0.11	0.07	0.09	0.09
Lead	0.4	mg/L	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015
Manganese		mg/L	0.3666	0.5358	0.3486	0.6314	0.109	0.0137	0.0212	0.0542
Mercury		mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.00002	0.000005	0.000005
Molybdenum		mg/L	0.0021	0.0023	0.0016	0.0026	0.0013	0.0009	0.0011	0.0009
Nickel	1	mg/L	0.023	0.0239	0.0186	0.0252	0.006	0.0049	0.0036	0.0033
Selenium		mg/L	0.0034	0.0027	0.0017	0.0044	0.0009	0.00025	0.0015	0.00025
Silver		mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Titanium		mg/L	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Zinc	1	mg/L	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Dissolved Metals										
Aluminum		mg/L	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025
Arsenic		mg/L	0.0059	0.0058	0.0043	0.0047	0.0015	0.0011	0.001	0.0008
Barium		mg/L	0.0676	0.0743	0.0551	0.0668	0.0368	0.0218	0.0242	0.0309
Cadmium		mg/L	0.00004	0.00001	0.00001	0.00009	0.00004	0.00001	0.00001	0.00001
Chromium		mg/L	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Copper		mg/L	0.0022	0.0026	0.0024	0.003	0.0009	0.0006	0.00025	0.00025
Iron		mg/L	0.1	0.18	0.11	0.11	0.01	0.005	0.005	0.005
Lead		mg/L	0.00015	0.00015	0.008	0.00015	0.00015	0.00015	0.00015	0.00015
Manganese		mg/L	0.3613	0.5351	0.3335	0.5612	0.0941	0.012	0.0145	0.0491
Mercury		mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Molybdenum		mg/L	0.0019	0.0022	0.002	0.0022	0.0012	0.0008	0.0006	0.0009
Nickel		mg/L	0.0206	0.0226	0.0177	0.0216	0.0053	0.0041	0.0028	0.0032
Selenium		mg/L	0.0026	0.0043	0.001	0.0027	0.00025	0.00025	0.00025	0.00025
Silver		mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Thallium		mg/L	0.0006	0.0005	0.0008	0.0006	0.0001	0.0001	0.0001	0.0001
Zinc		mg/L	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Radium-226	1.11	Bq/l	-	-	0.011	0.025	0.007	0.034	0.001	0.001