Appendix 14

Meadowbank and Whale Tail MDRB Report No.29

December 18th, 2021

Mr. Alexandre Cauchon
General Manager
Agnico–Eagle Mines, Meadowbank Division
Baker Lake Office

Email: alexandre.cauchon@agnicoeagle.com

Dear Mr. Cauchon,

Report No 29
Meadowbank Mine Dike Review Board (MDRB)
Site visit August 24th to 26th, 2021 and Conference call of November 22nd.

1.0 INTRODUCTION

A site visit was made by the MDRB from August 24th to August 26th, 2021, partly in preparation for the review meeting held, on-line, on November 22nd. All three Board members: Don Hayley, Kevin Hawton and Anthony Rattue participated in both events.

The primary objective of the in-person meeting was a field visit to Meadowbank, Vault and Amaruq sites, however, COVID issues led to premature termination of the visit. In the time available, presentations on Meadowbank, Vault and Amaruq were made. The material covered current operations, 2020-2021 construction work, and performance monitoring of the structures. Members of Golder Associates (GAL) and SNC-Lavalin Inc. (SLI) participated in some of the discussions.

An on-ground visit of Meadowbank facilities and a helicopter-only view of Vault and Amaruq sites were accomplished.

The November conference call provided an up-date on the activities of 2021 and included information on construction, operations and performance monitoring.

A brief summary of the subject matter and comments are presented in the following sections. The Board's recommendations are underlined in the text.

2.0 OPERATIONS

An overview of mine status, current operations and future potential was provided to the Board for information. Issues at Amaruq related to local pit wall stability and water infiltration were mentioned for which AEM is currently carrying out studies to resolve.

The November conference call provided an update on the 2021 planned operations versus actual mill throughput, tailings deposition, water reclaim and fresh water consumption, as well as the path forward with respect to tailings deposition. An expanded summary of the water reclaim operational challenges (i.e. at Pit A and Pit E) experienced in 2021 was also provided.

The update covered minor construction activities at the IVR Dike and Whale Tail Dike at Amaruq together with some works at East Dike (Meadowbank). These items will be covered later in the appropriate sections of this report.

3.0 WATER AND TAILINGS MANAGEMENT AT MEADOWBANK

3.1 Tailings Management

All ore from Meadowbank, Vault and Amaruq is processed at the Meadowbank facility and consequently the tailings are also deposited at this facility. The current tailings deposition is entirely "in-pit". Deposition of tailings into Goose Pit has terminated and Pit E is currently in use. Some "landscaping" deposition was made into the North Cell (NC) of the Tailings Storage Facility (TSF) during the early part of the summer. (Photo No. 1) The Board agrees that warm weather deposition in the NC is appropriate to prepare the final tailings surface for NPAG capping rockfill.

The tailings deposited in the South Cell (SC) has undergone consolidation since the 2020 deposition and near surface encapsulated ice and snow have melted leaving an irregular "lunar" surface in some areas. (Photo No. 2) Additional landscaping deposition in this cell would also be useful prior to the initiation of closure capping.

In anticipation that the capping will not be immediate, AEM has embarked on a surface sealing exercise to suppress the potential for dust generation at certain times of the year. (Photo Nos 3, 4 and 5)

The Board raised the following points regarding tailings management:

- The present and anticipated future water quality in the various pits needs to be part of the equation to minimize impacts on closure planning (surface and groundwater).

- As tailings are typically deposited from a single discharge point on one side of the pit there will be a tendency for some segregation of particles to occur laterally across the width of the pit. The discharge point in the Goose Pit was on the east side and the coarser fraction would be expected on this side with greater fines content on the opposite west side. The opposite is true for the Pit E where the discharge is on the west side of the pit. (Photo No. 6) The Board recommends that any potential effect of the particle distribution on hydrogeological modelling be given at least an initial evaluation. As previously suggested, in-situ testing/sampling such as CPT (performed in winter from the ice surface) could provide the required data, including confirmation of in situ permeability and density. Sampling for the grain size distribution could be added to the program. However, before embarking on such a program, it would be informative to carry out parametric sensitivity analyses to determine whether any of the following, for example, constitute issues of concern:
    - a) Evaluation of available storage capacity;
    - b) Long-term hydro-geological impact post closure;
    - c) Bearing capacity of the tailings to support the waste rock capping placement.

- Some areas on the tailings surface in the TSF are higher than intended for the closure grading and some reshaping will be required. A revised grading plan could be considered to minimize tailings excavation and maximize regrading through additional tailings deposition.

- AEM may wish to initiate a longer-term tailings conceptual storage options assessment, considering a range of potential Life of Mine (LOM) storage requirements from the Meadowbank Mill. Although there is currently a significant amount of capacity/flexibility with the use of exhausted pits for tailings storage, an assessment of the long-term potential storage scenarios would allow for more confident planning and possible commencement of progressive reclamation activities for the TSF and select Pits.

- The impact of the dust suppressant on the behaviour of the tailings beach behavior and runoff characteristics should be observed/monitored. Specifically of interest is the impact on crack development and subsequent healing (densification), and amount of runoff versus infiltration into the tailings beach/cracks.

At the November meeting, additional information was provided with regard to the planning to ensure adequate capacity for the Life Of Mine (LOM) and to optimize conditions as they pertain to closure requirements. Bathymetric surveys in Goose Pit indicate that consolidation of the tailings is more rapid and leads to greater densities than predicted which bodes well for the ability to contain the tailings produced over the LOM within the confines of pit E.

3.2 Water Management

Some problems with reclaiming the supernatant water arose during the winter season. Solutions have been found; however further improvements are still sought for the upcoming winter seasons in order to minimise the use of fresh water in the mill process.

The November conference call, included information on water consumption in the process plant. According to AEM, water use per tonne of ore has generally continued to increase since 2016 from approximately 0.85 m^3/t to 1.07 m^3/t. However, in 2021, although the ore throughput increased by 6%, the total water used decreased by approximately 1%. Of the total water used, 30% was freshwater (lower than the planned 34% for 2021) and 69% was reclaim, (higher than the planned 65%), however these ratios are very sensitive, in that interruptions or difficulty with reclaim water pumping increases the freshwater use. Options to increase and maintain reclaim capacity will be evaluated and AEM are targeting approximately 40% reduction in freshwater usage (0.2 m^3/t down from 0.34 m^3/t) in 2022. The board is pleased to see this effort to tighten up the water balance for the site.

Although the available volume in the pits at Meadowbank will likely be adequate to contain the total volume of contact water to LOM in 2027, it is recognized that treatment of water in the pits will be required for closure and therefore any reductions in the freshwater introduced to the process will ultimately save AEM time and money at closure. The ongoing planning will include not only the eventual total quantity of water, but also the start date of treatment to ensure no impact on operations.

Water management in the NC and SC of the TSF, and in the pond downstream of Central Dike relies entirely on the operation of pump systems. Again, winter operation has been subject to some issues and improvements are sought.

The Board has the following comments:

- The potential for advancing the construction of the permanent spillway between the NC and SC should be evaluated to permit some of the water transfer to be accommodated by gravity flow instead of pumping from the problematic collection sump. (Photo No. 8)

- The talik beneath the former Second Portage Lake is still a conductor with water seeping down through the tailings in both the NC and SC reporting to the Central Dike downstream pond as confirmed by thermistor and piezometric data. Nevertheless, the pumping rate at the pond continues to decline. See also the comment in section 3.3.
- Discussions should be held with Golder to establish whether the range of operating levels in the Central Dike downstream pond (Photo No. 9) could be widened to facilitate the pump operation. The range is currently set at 114.8 to 115.1m.

3.3 TSF Structure Performance

The performance of all the structures, namely Saddle Dams SD1, SD2, SD3, SD4 and SD5, Stormwater Dike and Central Dike is satisfactory. A few instruments have failed but the current complement is judged to be adequate for the monitoring in the foreseeable future.

With the deposition of tailings in the vicinity of Stormwater Dike and the presence of the pond (supernatant and run-off water) between this dike and SD-3, some thaw of the ground occupied originally by Second Portage Lake has occurred. This is indicated by the readings of thermistor SWD-03. Freezing had taken place since the lake was drained but now the situation has reverted to the pre-construction talik. As a consequence, the potential for infiltration has increased and a link is observed between the water depth in this pond and the seepage reporting to the pond downstream of Central Dike. The Board suggests that some “landscaping” tailings deposition may usefully diminish the size of the pond near Stormwater Dike to enhance freezing and reduce infiltration.

It is noted that, currently, no temperature measurements are taken within the tailings contained in the South Cell. The Board was advised that installation of thermistors will be forthcoming subsequent to any local placing of tailings to prepare the surface for closure cover construction.

It has been noted that the rising water level in Pit A may affect ground temperatures beneath the West Road and open seepage pathways from the pond downstream of Central dike towards the pit. This, by itself is not of concern, but the interpretation of the instrument readings in the foundation of Central Dike will need to consider this eventuality.

Maintenance work has been carried out on the rockfill dikes and the North Cell Internal Structure (NCIS) to repair erosion features.

4.0 MEADOWBANK DEWATERING DIKES

4.1 Vault Dike

Data presented under this heading included the Vault dike where the water head across the structure has not yet been reduced by the rising water level in the now worked-out Vault Pit. (Photo No. 10) The dike and its foundation remain frozen and thus, the performance is satisfactory.

4.2 South Camp Dike

There is no adverse behaviour at South Camp Dike.

4.3 East Dike

At East Dike, one of the oldest structures at Meadowbank, the continuing ingress of freezing in the foundation, as seen from the temperature measurements, is apparently also manifested by restricted seepage flow outlet points. At Stn. 60+195, (Photo No. 11) water was seen to be flowing over the downstream road in March, 2021. The Board concurs with the hypothesis that the change in flow paths is associated with ground freezing. Instrument data shows a steady rise in the piezometric levels at section 60+190 downstream since 2014. It is suggested that snow removal to maintain access to the pump station may actually exacerbate the situation by encouraging the frost penetration. In August, the Board suggested that AEM explore ways to enhance the drainage into the sump during the winter months so that ongoing monitoring of seepage rates can be continued. Ensuring free water escape pathways may be achieved by a combination of a rockfill thermal cover, and/or encouraging early snow accumulation. In fact, AEM acted on this suggestion and collector drains and a culvert were installed in October together with improved flow measuring equipment in the pump house. However, diligent visual surveillance will still be required to detect any tendency for freeze-up and previsions for snow management, extra insulation, heat tracing or steam thawing should be made.

Also, to be noted is the appearance of water flow on the Pit E ramp. This too is assumed to be related to restrictions in flow pathways due to frost ingress but, as this scenario is not yet proven, continuing surveillance is warranted. The need for any additional thermistor strings to focus on the various seepage pathways will need to be reviewed after the 2022 spring thaw.

It should be noted that these observations were made in the South Channel of the East Dike profile whereas the 2008 incident, involving erosion and the appearance of a sinkhole, occurred in the North Channel.

As is the situation at many dams (Meadowbank and elsewhere), instruments including piezometers and thermistors give valuable information but only at discrete points. The overall performance can be surmised from a portrait generated from the compilation of this data but the best indicator is the measurement, whenever and wherever possible, of the global seepage rate from the structure and its foundation. Unfortunately, the flowmeter measurements are limited due to air which is drawn into the pipeline by the only partially submerged pumps. Improvements may be sought by the use of smaller pumps, level controllers or throttle valves on the outlet pipeline. It would also be useful to discriminate between seepage collected by the two pump stations that are installed in the North and South Channels.

Other than the above noted event, no adverse conditions have been revealed by the monitoring. The steady increase in some other piezometric values is believed to be also related to freezing and is judged to be acceptable with continued surveillance.

4.4 Bay-Goose Dike

At Bay-Goose Dike, similar comments can be made in relation to the piezometer fluctuations and a steady rise in some values.

It was mentioned that the evaluation of instrument readings is performed on a bi-weekly basis. Inspections are carried out weekly. For structures where adequate freezing of the foundation has been achieved it is unlikely that changes will occur rapidly. For other structures, for example Central Dike, the Board is concerned that early identification of changes may be missed and

suggests that the possibility of establishing alarm levels on select critical instruments be evaluated.

5.0 WATER MANAGEMENT AT AMARUQ SITE

5.1 WRSF Dike

The structure is performing well. With no periods of high water in Mammoth Lake being recorded this last spring, the foundation was able to freeze back. Also, there is little or no ponded water on the upstream side. (Photo No. 12)

5.2 Mammoth Dike

There are no issues, also due to a lower level of the lake at freshet.

5.3 South Whale Tail Diversion Channel

This channel (Photo No. 13) was constructed to divert run-off from the Whale Tail catchment directly towards Mammoth Lake thus by-passing the Amaruq mine site. Snow removal was performed in the invert prior to freshet. Good performance is noted.

5.4 IVR Dike

This is the first season of operation. The dike was constructed in early 2021. (Photo No. 14) In November, the Board was provided with a summary of the construction activities. Quality assurance was provided by GAL. Field-fit modifications were communicated to and accepted by the designer (SLI). It will be important to ensure that documentation of any change be included in the As-Built Reports for the structure.

The Board notes that from Stn. 0+205 to 0+312, the invert of the key trench is described as being on ice-rich till. The natural ground elevation is such that part of this sector is below the maximum operating pond level. The horizontal thermistor string extends from Stn. 0+145 to 0+217 and, therefore, does not entirely cover this sector. Close visual inspection will be needed in 2022 with the possible addition of vertical thermistors to complement the current array.

During the 2021 summer, some longitudinal cracking was noted on the shoulders, likely due to active zone thaw of the foundation at the toe. However, the instruments indicate that the foundation remains frozen at depth.

Water ponding was noted on the downstream side near the East abutment and a drainage trench was excavated to minimize accumulation. Additional rockfill to extend the downstream berm in this area and thus enhance ground freezing was also placed.

The freshet of 2022 may provide the first full test of the structure.

5.5 IVR Diversion Ditch

This was the first season of operation for this component. (Photo No. 15) The channel functioned as intended. Some longitudinal cracking similar to IVR Dike has been observed. Water ponding

at the downstream toe will be addressed by additional fill placement so as to enhance permafrost preservation.

5.6 Saline Ditch

Some maintenance items remain to be resolved to ensure performance as intended.

5.7 IVR Attenuation Pond Ramp

No adverse condition has been noted.

5.8 Whale Tail Dike

The dike has been in operation since 2019. (Photo No. 16) Seepage and thaw of the foundation were noted shortly after commissioning. A remedial grouting program was undertaken from Nov 2019 to March 2020. This had a successful outcome, insofar as considerable reduction in seepage, was achieved. This is currently believed to be of the order of 80 m^3/h. However, seepage flow rates are not accurately documented, given that part of the seepage reports by surface flow to the attenuation pond and part becomes groundwater recharge. The Board was advised that water quality is not satisfactory for direct discharge to South Whale Tail Lake. Consequently, the pump system is currently shut down.

Ice build-up was noted in the downstream area denoting artesian pressures generated by seepage below the dike and/or freezing ingress. Thermistor data indicates that equilibrium conditions have not yet been attained at the dike. Previously frozen areas at the abutments have likely thawed since the grouting program of 2019-2020. Seepage pathways may have increased but presently there are no means available to assess the change.

Elevated TSS levels have been observed in the seepage from the dike during the first half of 2021. It is unclear what has caused this trend, although it appears to have improved since June 2021. AEM intends to continue to investigate and monitor this situation.

Given the positive secant pile cut-off, the Board does not see an immediate concern for the integrity of the Whale Tail Dike. However, a gradual increase in seepage quantities through the thawed fractured bedrock should be considered a real possibility. The Board sees the need for a more in-depth interrogation of the available data to identify potential scenarios of deterioration.

The Board also wishes to re-iterate a previous recommendation to construct berms to an elevation above the waterline on the upstream side at both abutments to enhance ground freezing or at least encourage maintenance of existing permafrost. As an illustration of the different freeze-back performance, attention can be drawn to the East abutment thermistors. The August and November presentations included graphs for the thermistors WTD TH 0+750 and 0+772. From this data, it can be seen that freezing of the foundation is occurring at 0+772 where no ponding is observed in the aerial photo but the thaw bulb at 0+750, where open water is in contact with the dike, is increasing with time. The thermistor WTD TH-US0+710 gives ample evidence of the heat flux provided by the lake water in this vicinity.

The attempt to re-construct the weir at Stn. 0+430 was described in a November presentation. Unfortunately, frost heave nullified the effort and seepage once again by-passes the V-notch. As was mentioned in the discussion relating to East Dike (see 4.3 above), it is generally recognized that measurement of seepage flow provides a better indicator of overall dike performance as

compared to the discrete point measurements of piezometric pressure or temperature. However, it is often the most difficult to accomplish. The Board commends the effort and would like to see further attempts possibly using a weir plate welded to a section of corrugated steel culvert over which fill could be placed to provide weight to counteract frost heave. Low permeability fill around the upstream part of the pipe and filter material around the downstream part could help to reduce the risk of erosion.

The current system of pumping from the attenuation pond is manageable at present but possibly not optimal for mining. Seepage is noted on the south-east wall of the Whale Tail Pit (Photo No. 17) and significant ice accumulation has been observed. This is presumed to be related to the talik (unfrozen lakebed) below the Whale Tail Lake.

The Board was unable to take a first hand look at the pit wall. Mapping of the exposures and associated seepage observations may provide insight into the major conductors within the talik zone. A compilation of all investigation data in the sector between the Whale Tail Dike and the Pit, including information of the thickness and nature of overburden beneath the attenuation pond would be useful. A preliminary evaluation of the practicality and economic viability of lining the attenuation pond to reduce infiltration may be of interest.

6.0 GOVERNANCE AND THE ENGINEER OF RECORD

The Engineer of Record (EoR) gave a verbal summary of the Third Annual Statement for the Meadowbank complex. The Board is pleased to note the proper functioning of this role as assumed by an in-house staff member. It should be mentioned that the primary objectives of the role of EoR is to provide continuity over time, and possibly with different design consultants, to ensure that any change in operations or modifications to structures are made with due consideration for the design intent and criteria. Independence of judgement is intrinsic to the ethics of a professional engineer but authority to report directly to upper management or, if needs be, to outside agencies have to be part of the management policy and this is apparently the case.

7.0 DAM SAFETY REVIEW

It is noted that an independent Dam Safety Review is planned for 2022 and the Board looks forward to being acquainted with the findings.

8.0 SUMMARY

In summary, the main points of the Board's deliberations are:
The Board concurs with the hypothesis of ground freezing being the driver of the observations at the East Dike South Channel pump station. AEM has already acted upon the recommendation to enhance the drainage into the sump during the winter months so that ongoing monitoring of seepage rates can be continued.

AEM should investigate the potential use of more reclaim water from the pits, based on acceptable water quality. This could potentially improve the water balance and minimize long-term treatment requirements.

The closure planning for the TSF should be advanced to a stage permitting the identification of elements beneficial to current operations and to advantageous progressive reclamation. Otherwise, opportunities may be missed.

The performance of Central Dike is improving and the Board concurs with the TARP level green. However, indicators such as alarm levels may be appropriate for a few instruments.

A more intensive evaluation of the data related to the Whale Tail Dike performance is merited.

9.0 RISK MANAGEMENT

The Board was provided with information relating to a Risk Assessment exercise conducted for the Tailings Management. There was no indication of action items that may have been derived from it. The Board would appreciate a presentation of this work at a forthcoming meeting.

10.0 NEXT MEETINGS

The Board awaits instruction on meetings/site visits for 2022. Any other participation will be through further ad-hoc conference calls.

11.0 ACKNOWLEDGMENTS

The MDRB (Board) wishes to thank the AEM personnel for organizing a site visit which, despite the circumstances, was highly successful and greatly appreciated. The November conference call was also informative and provided the opportunity for discussion of the issues.
The Board wishes to thank the personnel of AEM for the preparation of material and the participation of AEM, SLI and GAL in the visit and/or conference calls during the presentations.

Signed:



Don W. Hayley, P. Eng Kevin Hawton, P. Eng D. Anthony Rattue, P. Eng.

ATTACHMENT A

ATTENDANCE AT AUGUST 2021 SITE VISIT AND PRESENTATIONS INCLUDING NOVEMBER MEETING

Attendance		
Guillaume Baril	AEM	Geotechnical Technician
Fredérick L. Bolduc	AEM	Geotechnical Coordinator
Nicole Brisson	AEM	Water and Tailings Engineer
John Gage	AEM	Water and Tailings Engineer
Claude Gagné	AEM	Water Management
Patrice Gagnon	AEM	Water Management and Geotechnical Coordinator
Alexandra Hood	AEM	Director Reclamation
Michel Julien (On-line)	AEM	V.P. Environment
Alexandre Lavallée	AEM	Environment and Critical Infrastructure Superintendent
Thomas Lepine	AEM	EoR – Technical Specialist, Env. Management
Yves Boulianne (On-line)	GAL	Geotechnical Engineer
Marion Habersetzer (on-line)	GAL	Geotechnical Engineer
Anh-Long Nguyen (On-line)	SLI	Project Manager
Nina Quan (On-line)	SLI	Geotechnical Engineer
Don Hayley		Dike Review Board
Kevin Hawton		Dike Review Board
Anthony Rattue		Dike Review Board

ATTACHMENT B

SELECTED PHOTOGRAPHS

Photo No. 1 Meadowbank TSF, North Cell

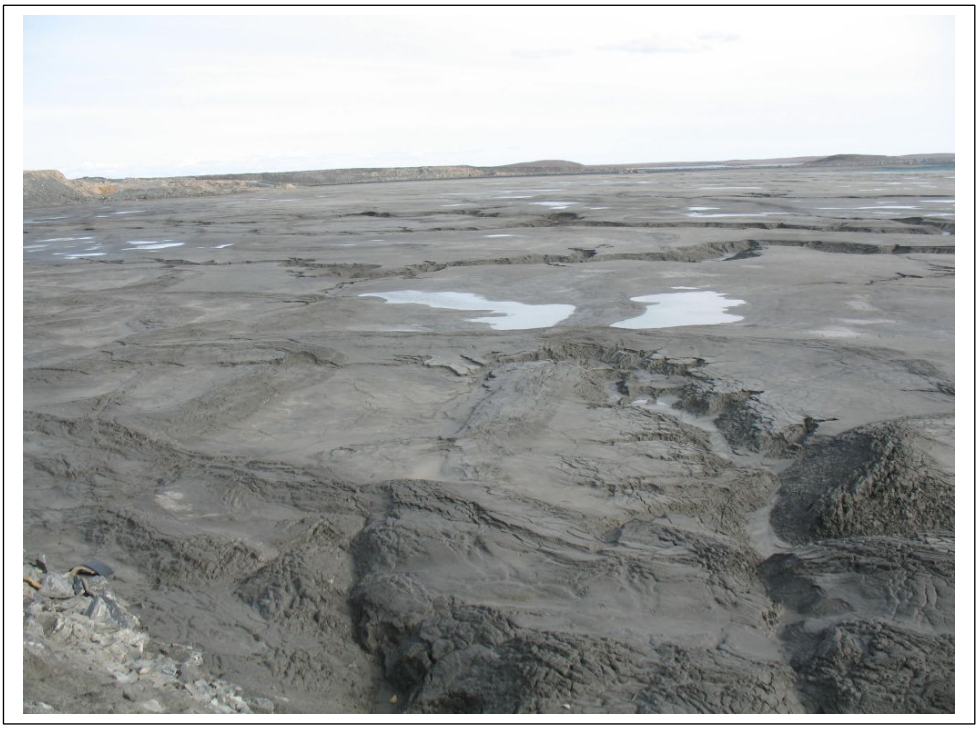

Photo No. 2 Meadowbank TSF, South Cell area adjacent to Stormwater Dike

Photo No. 3 Meadowbank TSF, sealant spreading

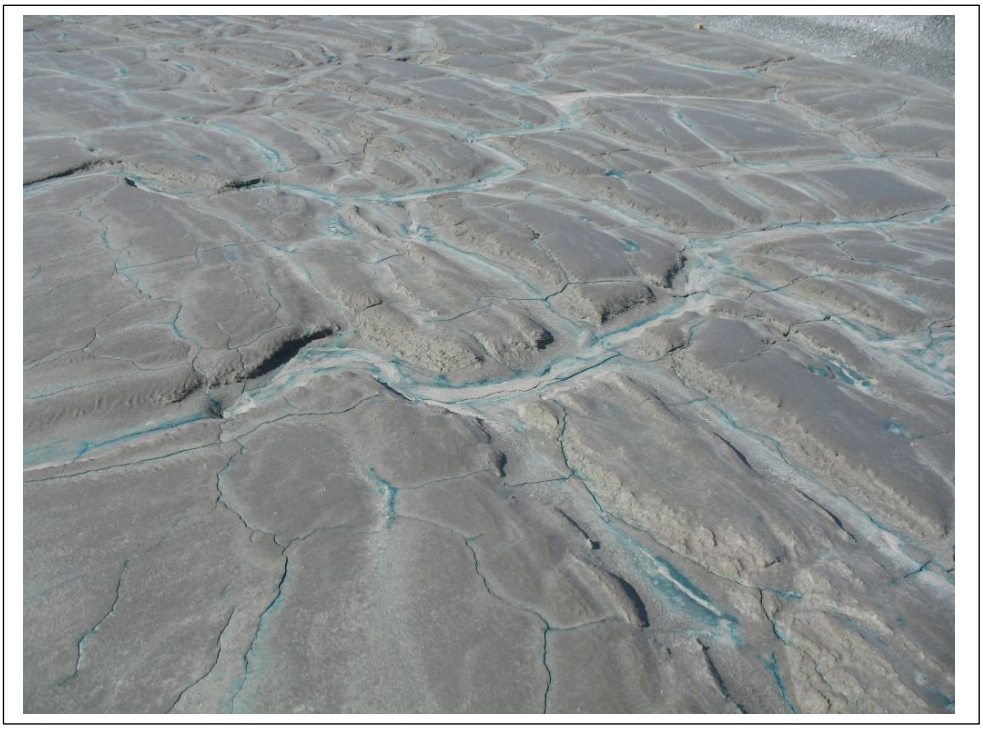

Photo No. 4 Meadowbank TSF, sealant on surface of tailings

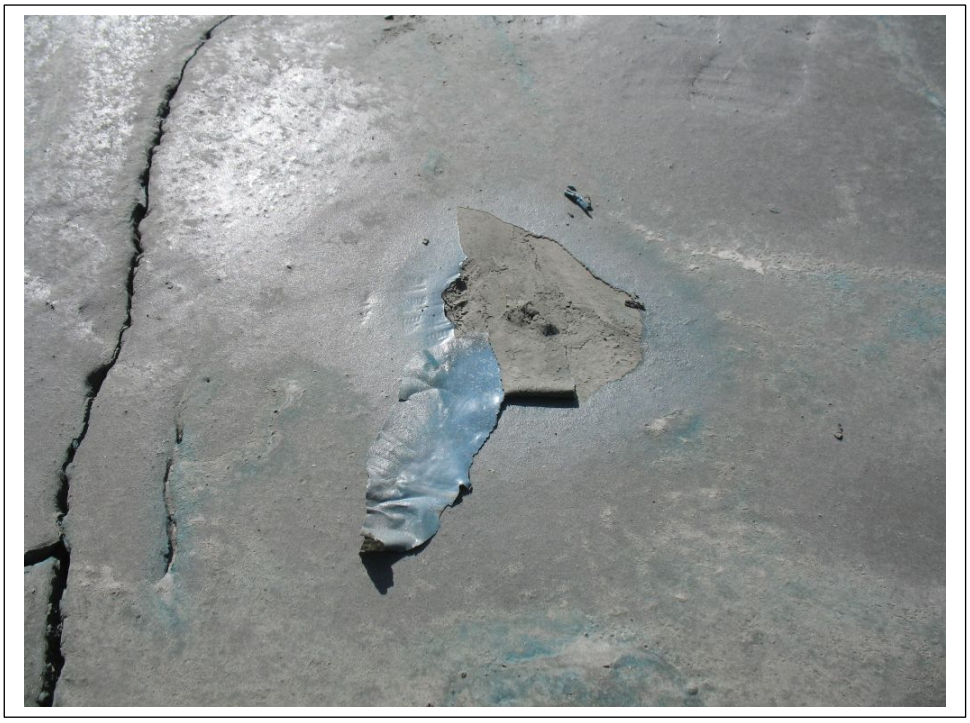

Photo No. 5 Meadowbank TSF, sealant film on tailings

Photo No. 6 Meadowbank, In-Pit deposition of tailings. Pit E

Photo No. 7 Meadowbank. Stormwater Dike and North (right) and South Cells of the TSF

Photo No. 8 Meadowbank. Water collection sump in the North Cell of the TSF

Photo No. 9 Meadowbank. Pond downstream of Central Dike. View from Central Dike.

Photo No. 10 Vault Pit. Vault Dike in background

Photo No. 11 Meadowbank. Area of seepage in March 2021 at East Dike Stn. 60+195

Photo No. 12 Amaruq. WRSF Dike

Photo No. 13 Amaruq. South Whale Tail Diversion Channel

Photo No. 14 Amaruq. IVR Dike

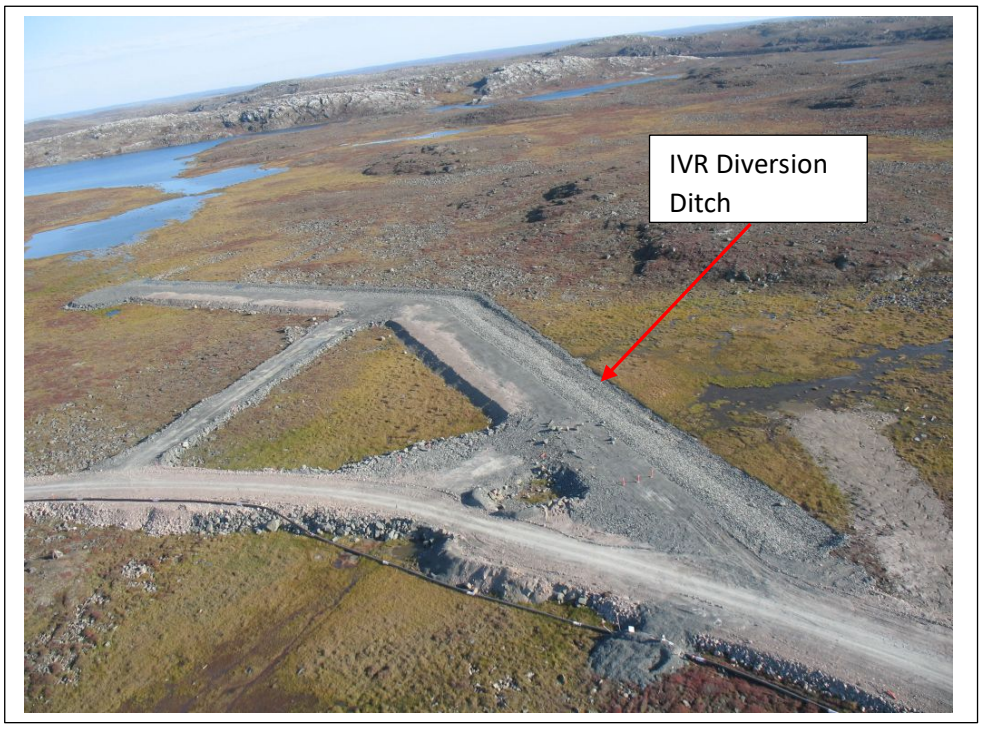

Photo No. 15 Amaruq. IVR Diversion Ditch and retaining berm

Photo No. 16 Amaruq. Whale Tail Dike

Photo No. 17. Amaruq. Whale Tail Pit

AGNICO EAGLE

To: D. Anthony Rattue, Don W. Hayley, and K. Hawton

From: Agnico Eagle Mines, Meadowbank, Nunavut Division

Date: January 25, 2022

RESPONSE TO COMMENTS, MEADOWBANK DIKE REVIEW BOARD No.29 – MEADOWBANK REPORT

The twenty-ninth meeting between the Meadowbank Dike Review Board (the Board) and Agnico Eagle Mines Limited (AEM) was held on November 22nd, 2021 through a conference call.

The objective of the meeting was present and discuss the current status of the operations and construction at the Meadowbank Complex which includes Vault and Amaruq, as is conducted yearly.

On December 20th, 2021, the Board provided their report (MDRB Meeting Report 29) with their recommendations. This letter provides the response from AEM related to the Board recommendations for the report. All Board recommendations are contained in the following table along with their location, action plan, current status, and anticipated completion date. This table will be used to follow up on each recommendation throughout the upcoming year and to update the Board when the next MDRB Meeting is held.

Best Regards,

Alexandre Lavallee
Environment & Critical Infrastructures Superintendent
Meadowbank, Nunavut Division
Agnico Eagle Mines

MDRB29 Recommendations and Action Plan

Recommendation Number	Location	Year [2]	Recommendation	Action Plan/Follow-up	Status	Completion Date
MDRB#29-1	Tailings Management	2021	The Board agrees that warm weather deposition in the NC is appropriate to prepare the final tailings surface for NPAG capping rockfill. Additional landscaping deposition in the SC would also be useful prior to the initiation of closure planning.	AEM agrees with the Board recommendation. During the 2022 update of the tailings deposition plan consideration will be given to pursuing tailings depostion in the SC.	Ongoing	Feb-22
MDRB#29-2	Tailings Management	2021	The present and anticipated future water quality in the pits needs to be part of the equation to minimize impacts on closure planning (surface and groundwater).	AEM is required by the License to monitor the water quality in the pits and to update a pit water quality forecast model and contaminant transport model for the closure plan including propositions of additional groundwater wells.	Closed	-
MDRB#29-3	Tailings Management	2021	The Board recommends that any potential effect of the particle distribution on hydrogeological modelling be given at least an initial evaluation. As previously suggested, in-situ testing/sampling such as CPT could provide the required data, including confirmation of in-situ permeability and density. Sampling of grain size distribution could be added to the program.	AEM is also committed to investigate the pore-water content of the tailings. While this Board recommendation could complement a pore-water investigation AEM is finding it technically challenging to access the tailings in Goose Pit due to the water cover thickness (> 30 m). An alternative technique might be more suitable to understand this risk such as doing a senstivity analysis of the hydrogeological model to understand the sensitivity of the model to particle distribution.	Open	Jun-22
MDRB#29-4	Tailings Management	2021	Some areas on the tailings surface in the TSF are higher than intended for the closure grading and some reshaping will be required. A revised grading plan could be considered to minimize tailings excavation and maximize regrading through additional tailings deposition.	AEM is planning to initiate in 2022 an update the TSF landform concept. Information will be shared with the MDRB as it becomes available.	Ongoing	Dec-23
MDRB#29-5	Tailings Management	2021	AEM may wish to initiate a longer-term tailings conceptual storage options assessment, considering a range of potential Life of Mine (LOM) storage requirements from the Meadowbank Mill. Altough there is currently a significant amount of capacity/flexibility with the use of exhausted pits for tailings storage, an assessment of the long-term potential storage scenarios would allow for more confident planning and possible commencement of progressive reclamation activities for the TSF and select Pits.	The remaining capacity of the in-pit has been assessed. Following this exercice AEM is planning to initiate a MAA process to identify alternate strategies for tailings storage at the Meadowbank Complex from a long term perspective.	Not Started	Dec-22
MDRB#29-6	Tailings Management	2021	The impact of the dust suppressant on the behaviour of the tailings beach behaviour and runoff characteristics should be observed/monitored. Specifically of interest is the impact on crack development and subsequent healing (densification) and amount of runoff versus infiltration into the tailings beach/cracks.	The surface of the tailings will be examined at next freshet from drone images to determine if the dust suppressant is impacting the tailings surface.	Not Started	Aug-22
MDRB#29-7	Tailings Management	2021	The closure planning for the TSF should be advanced to a stage permitting the identification of elements beneficial to current operations and to advantageous progressive reclamation. Otherwise, opportunities may be missed.	AEM will start in 2022 the review of the TSF closure concept to look for gaps in the current concept as well as to identify opportunities for progressive reclamation.	Ongoing	Aug-23
MDRB#29-8	Tailings Management	2021	The Board suggests that some 'landscaping' tailings deposition may usefully diminish the size of the pond near Stormwater Dike to enhance freezing and reduce infiltration.	This opportunity will be reviewed during the preparation of the tailings depostion plan in 2022. However it must be noted that the area where tailings capacity is remaining is near SD3. Tailings deposition was minimized in the area in the past to maintain a flow of water toward that area as per the closure landform of the TSF. Therefore before depositing tailings in the area the impact of this decision on the closure objective will have to be well understood.	Ongoing	Apr-22
MDRB#29-9	Water Management	2021	The potential for advancing the construction of the permanent spillway between the NC and SC should be evaluated to permit some of the water transfer to be accommodated by gravity flow instead of pumping from the problematic collection sump.	The design of the TSF landform for closure is planned to be updated in 2022. AEM agrees that there could be opportunity for doing some part of the work earlier once deposition in both cells is completed. AEM will keep this opportunity in mind.	Ongoing	May-23

MDRB29 Recommendations and Action Plan

Recommendation Number	Location	Year [2]	Recommendation	Action Plan/Follow-up	Status	Completion Date
MDRB#29-10	Water Management	2021	AEM should investigate the potential use of more reclaim water from the pits, based on acceptable water quality. This could potentially improve the water balance and minimize long-term treatment requirements.	AEM understands the importance of diminishing the use of fresh water and is setting itself targets and objectives to increase the use of reclaim water. These targets are followed using KPIs and an action plan was developed to look at further opportunities to increase the use of reclaim water.	Ongoing	Sep-22
MDRB#29-11	Central Dike	2021	The performance of Central Dike is improving and the Board concurs with the TARP level green. However, indicators such as alarm levels may be appropriate for a few instruments.	AEM will officialize the change in TARP level of the structure and will look into setting alarm levels on instruments.	Not Started	Mar-22
MDRB#29-12	Central Dike	2021	Discussions should be held with Golder to establish whether the range of operating levels in the Central Dike downstream pond could be widened to facilitate the pump operation.	AEM agrees with the recommendation and will seek the designer's opinion on broadening the operating range of the CD d/s pond.	Not Started	Mar-22
MDRB#29-13	East Dike	2021	The Board concurs with the hypothesis of ground freezing being the driver of the observations at the East Dike South Channel pump station. AEM should explore ways to enhance the drainage into the sump during the winter months so that ongoing monitoring of seepage rates can be continued. Ensuring free water escape pathways may be achieved by a combination of a rockfill thermal cover and/or encouraging early snow accumulation. In fact, AEM acted on this suggestion and collector drains and a culvert were installed in October together with improved flow measuring equipment in the pump house. However digilent visual surveillance will still be required to detect any tendency for freeze-up and previsions for snow management, extra insulation, heat tracing or steam thawing should be made.	As recomended by the Board, the effectiveness of this mitigation will be monitored during winter. AEM is ready to do additional mitigation in the sector if required.	Ongoing	May-22
MDRB#29-14	East Dike	2021	Also, to be noted is the appearance of water flow on the Pit E ramp. This too is assumed to be related to restrictions in flow pathways due to frost ingress but, as this scenario is not yet proven, continuing surveillance is warranted. The need for any additional thermistor strings to focus on the various seepage pathways will need to be reviewed after the 2022 spring thaw.	The need for additional thermistor strings to better understand the various seepage pathways will be reviewed after the 2022 spring thaw.	Not started	Aug-22
MDRB#29-15	East Dike	2021	Improvements may be sought by the use of smaller pumps, level controllers or throttle valves on the outlet pipeline. It would also be useful to discriminate between seepage collected by the two pump stations that are installed in the North and South Channels.	AEM is actively working on improving the flow measurement at both East Dike seepage stations. The flowmeter configuration as been modified to improve data accuracy.	Ongoing	Jan-22
MDRB#29-16	East Dike	2021	The steady increase in some other piezometric values is believed to be also related to freezing and is judged to be acceptable with continued surveillance.	-	Closed	-
MDRB#29-17	Instrumentation Monitoring	2021	For structures where adequate freezing of the foundation has been achieved it is unlikely that changes will occur rapidly. For other structures, for example Central Dike, the Board is concerned that early identification of changes may be missed and suggests that the possibility of establishing alarm levels on select critical instruments be evaluated.	AEM agrees with the Board recommendation. AEM will review during the next update of the OMS manual the surveillance strategy considering this recommendation.	Not Started	Jan-23
MDRB#29-18	IVR Dike	2021	The horizontal thermistor string extends from St. 0+145 to 0+217 and does not entirely cover this sector where the key trench is described as being on ice-rich till. Close visual inspection will be needed in 2022 with the possible addition of vertical thermistors to complement the current array.	Special attention will be given to the inspection of that sector in 2022. Additional vertical thermistors might be installed if required based on visual observation and data from the other instrumentation array.	Not Started	Aug-22

MDRB29 Recommendations and Action Plan

Recommendation Number	Location	Year [2]	Recommendation	Action Plan/Follow-up	Status	Completion Date
MDRB#29-19	WTD	2021	Given the positive secant pile cut-off, the Board does not see an immediate concern for the integrity of Whale Tail Dike. However, a gradual increase in seepage quantities through the thawed fractured bedrock should be considered a real possibility. The Board sees the need for a more in-depth interrogation of the available data to identify potential scenarios of deterioration. A more intensive evaluation of the data realted to WTD performance is merited.	AEM will do an in-depth review of the available data to determine whether the seepage rate is increasing.	Not Started	Mar-22
MDRB#29-20	WTD	2021	The Board also wishes to re-iterate a previous recommendation to construct berms to an elevation above the waterline on the upstream side of both abutments to enhance ground freezing or at least encourage maintenance of existing permafrost.	AEM acknowledges and understands the Board's recommendation. Based on the most recent instrumentation readings from the dike abutment, it appears that the maximal lateral extent for the boundary talik/permafrost has been reached this fall and is now stable. In the current state, water management downstream of the dike is quite manageable. We also foresee challenges with placing additional rockfill in the upstream basin for regulatory purposes. With all that in mind, we will not for now implement berms at the abutments of the dike. Obviously, this could be revisited in case of any change at the dike or downstream.	Closed	-
MDRB#29-21	WTD	2021	The Booard commends the effort to repair the WTD V-Notch and would like to see further attemps possibly using a weir plate welded to a section of corrugated steel culvert over which fill could be placed to provide weight to counteract frost heave. Low permeability fill around the upstream part of the pipe and filter material around the downstream part could help to reduce the risk of erosion.	AEM will try further attempts to repair the V-Notch at freshet 2022. The Board recomendation will be considered for the next repair attempt of the V-Notch.	Not Started	Sep-22
MDRB#29-22	WTD	2021	The Board was unable to take a first hand look at the pit wall. Mapping of the exposures and associated seepage observations may provide insight into the major conductors within the talik zone. A compilation of all investigation data in the sector between the Whale Tail Dike and the Pit, including information on the thickness and nature of overburden beneath the attenuation pond would be useful. Lining the attenuation pond may be a potential solution.	AEM has compiled various information on the pit inflow of the South Wall and has a good understanding of the current situation. This information was not provided to the Board as it was considered out of their scope. This information could be presented if the Board is interested in seeing it. AEM also has ruled out the attenuation pond as a significant contributor to the pit wall inflow (no significant change to the water inflow was observed when the attenuation pond was kept almost dry for a prolonged period of time).	Closed	-
MDRB#29-23	WTD	2021	The Board was provided with information relating to a Risk Assessment exercice conducted for the Tailings Management. There was no indication of action items that may have been derived from it. The Board would appreciate a presentation of this work at a forthcoming meeting.	AEM will present formally to the Board the results of the risk assessment and the action plan at the next MDRB meeting	Ongoing	Aug-22