Appendix B-2

Responses to geotechnical recommendations

Dikes

Annual Geotechnical Inspection Recommendation (Golder, 2018)		Priority Level (Golder, 2018)	Recommendation (s) to be Implemented?	AEM Response to Recommendation	Additional Action(s) Required	Responsible Department(s)	Expected Date of Implementation
1. Inspection and Monitoring	Geotechnical inspections should be carried out and documented for D-CP1 and D-CP5 following the schedule developed in the OMS manual. These activities were completed in 2019; however, not quite to the schdedule in the OMS. The OMS manual indicates that daily inspections should be completed and documented using the same form as the weekly inspection, which were not completed in 2018. The OMS manual does not indicate if there is seasonal variability to the frequency of documented inspections. It may be acceptable to seasonally vary the frequency of inspections, but this should be reviewed with the Engineer of Record (EoR) for the dikes and the OMS manual should be updated as required.	High	Yes	The intent, feasibility and value of daily inspections, as well as seasonality variability, are issues that will be addressed during the annual review of the OMS. The frequency of documented visual inspections will be reviewed and discussed with internal stakeholders, the Design Engineer, the EoR and members of the Independant Review Board.	Discuss visual inspection schedule with all stakeholders during annual OMS review. Update OMS as required.	Engineering	June 2019
	In addition, instrumentation should be monitored and the data should be plotted and reviewed following the schedule developed in the OMS manual.	High	Already Implemented	The current schedule of instrumentation data collection, analysis and documentation follows the schedule developed in the OMS.	No	NA	NA
	The OMS should be reviewed and updated annually and is next due for review in June 2019.	High	Already Implemented	An annual review and update of the manual is a requirement of the OMS. The 2019 review will be scheduled to occur in June.	Encourage comments/suggestions from all registered users of the OMS prior to June 2019. Schedule review with registered manual holders and update and improve manual as required.	Engineering	June 2019
	Make sure thermistors in the water management dikes are well marked so they can be located and maintained during the winter and are not damaged during snow removal operations.	High	Already Implemented	Data loggers were installed on all ground temperature cables at both D-CP1 and D-CP5 in October 2018. Each data logger and solar panel is well marked and clearly visible.	No	NA	NA
2. Water Management	Water volumes within the containment ponds should be managed to the levels defined in the OMS manual, including maintaining the water level below the elevation defined for the end of October in the OMS manual over the winter to promote freezing of the dikes.	High	Already Implemented	Upstream water elevations are checked on a daily basis during open water season and monthly during the winter as per the OMS guidelines. Deviations from the levels defined in the OMS are communicated to all stakeholders and management strategies are adjusted accordingly.	No	NA	NA
3. Dike Repair/Maintenance	Cracks and areas of settlement in the containment pond dikes should be filled and/or recontoured to close the cracks and reduce the potential for infiltration and erosion.	Medium	No	The permanent water retention dikes have been in operation for almost two years and are currently stable, with no significant geotechnical concerns identified during the Annual Inspection. Although the dikes were not designed to be resistant to water infiltration (ie. no sloping of the crests to shed surface water), it is acknowledged that the establishment of preferential water pathways within the thermal cover could lead to undesirable impacts on the stability of the structures over time. Therefore, the requirement to close the observed cracking systems on the crest of D-CP5 and the upstream crest of D-CP1 and the implementation of a regularly scheduled maintenance program will be discussed during the OMS review in June 2019 with internal stakeholders, the Design Engineer, the EoR and members of the independent Review Board.	Discuss infill of cracking and regular maintenance program with all stakeholders during annual OMS review. Update OMS as required. Schedule maintenance as required.	Engineering	June 2019
	The pipe ramp constructed out of sand upstream of D-CP1 near Stn. 1+140 is susceptible to erosion and some erosion was observed since the 2017 inspection. It is recommended that the pipe ramp be covered with a coarser rockfill to protect it from erosion.	Not Provided	Yes	The pump ramp at D-CP1 should be covered with a more robust construction material. In addition, the HDPE pipe running over D-CP1 should be covered with enough rockfill material to allow for emergency equipment/vehicle access to the dike.	Cover pump ramps with rock fill material. Protect HDPE with screened esker material/sand. Repair work will be scheduled with the appropriate department.	Engineering/E&I/Construction	Late summer 2019
	Survey monitoring plate M-3 on D-CP5 should be replaced.	Medium	Yes	Survey monuments M3 and M1 (damaged early 2019) will be replaced once the thermal cover on D-CP5 has thawed to allow hand excavation.	Continue monitoring temperatures within the dike (vertical GTC's) to determine depth of thaw and schedule survey monument replacement. Enhance protection of monuments once replacement has been completed. Restrict access to the crest of D-CP5 to authorized personnel only.	Engineering/E&I	Fall 2019
	Where access is feasible, removal of snow from the water collection pond dikes (temporary and permanent) is recommended to reduce the insulating effects of the snow, thereby allowing the temperature of the core material in the dikes and the foundations to drop as low as possible. Snow removal is more important if thermistor data is indicating that the dike and/or foundation temperatures are warmer than expected.	Medium	No	Snow clearing activities have the potential risk of damaging dataloggers, thermistor installations and trench sumps from the downstream of D-CP1 and the upstream of D-CP5. Thermistor data indicates that both dikes are generally performing as expected, with key trench and foundation conditions generally remaining below 0°C. Snow removal is therefore not currently a scheduled maintenance activity. However, snow will be cleared from the downstream toe of D-CP5 prior to freshet as a mitigation measure to prevent overtopping of the D-CP5 trench sump (an area of risk observed during freshet 2018). Thermistor records will continue to be assessed to ensure dike/foundation temperatures do not follow unexpected trends and if warmer than expected conditions arise, routine snow clearing will be reconsidered.	No	NA	NA
4. Sump/Channels	Monitor the cracking observed in the D-CP1 downstream sump berms and adjacent to the downstream channel.	Medium	Already Implemented	Regular inspection and documentation of the D-CP1 downstream sump and channels occur as part of the OMS inpsection plan for the dike.	No	NA	NA
	Recontour and/or compact the areas of cracking in the D-CP1 downstream sump berms to reduce the potential for water to infiltrate into the cracks leading to warming of the permafrost and additional thaw settlement and cracking	Medium	No	The D-CP1 downstream sump was constructed as per design and was not intended to be impervious to water infiltration. The sump area was excavated into natural ground, lined with geotextile and the slopes were covered with rip rap protection of thicknesses varying from 0.2 m to 0.4 m. This material was bucket-tamped into place. It is therefore not anticipated that any amount of recontouring or compacting would reduce the potential for water infiltration. This being noted however, routine maintenance of the sump area is specified in the OMS to prevent erosion and deterioration of the downstream water collection system. This maintenance will occur as required at the direction of the Geotechnical Engineer.	No	NA	NA
	The D-CP1 sump and downstream collection channel should be emptied in the fall/early winter to refreeze the ground around these facilities.	Medium	Already Implemented	As per the design specifications and OMS requirements for the downstream channel and sump, these facilities are emptied in the late fall prior to freeze-up.	No	NA	NA
	During open water season, keeping the water level in the downstream channel and sump low will reduce the potential for thaw of the ground around and associated settlement.	Medium	Already Implemented	Water levels in the D-CP1 sump are monitored and pump-back is automatically triggered when water levels exceed the height of the pump.	No	NA	NA

P Area

Annual Geotechnical Inspection Recommendation (Golder, 2018)		Priority Level (Golder, 2018)	Recommendation (s) to be Implemented?	AEM Response to Recommendation	Additional Action(s) Required	Responsible Department(s)	Expected Date of Implementation
1. OMS	If the P-Area dikes will continue to be used, they should be added to the OMS manual that was developed for D-CP1 and D-CP5. Geotechnical inspections and instrumentation monitoring should be carried out and documented following a schedule developed in the OMS manual.	High	No	The Annual Inspection points out that any potential failure of the P-Area dikes would now report to either CP1 or CP5 and as such, these structures are no longer considered as dams in accordance with CDA classification. AEM therefore does not consider these structures as significant enough in nature to warrant inclusion in the OMS for D-CP1 and D-CP5. However, as part of AEM's committment to exercising due dilligance, geotechnical inspections and instrumentation monitoring will continue for as long as these structures remain functioning.	No	NA	NA
2. Inspection and Monitoring	AEM personnel should continue to conduct geotechnical inspections and document visual observations such as cracking, slumping and/or seepage. Inspection reports should continue to be prepared for documentation. It is recommended that the frequency of visual geotechnical inspections be conducted weekly during freshet and monthly during the open water period.	Not Provided	Already Implemented	Visual geotechnical inspections and documentation will continue in 2019 on a monthly basis during the open water season.	No	NA	NA
	Thermistor data should continue to be collected, plotted and reviewed and pond water levels should continue to be measured and tracked.	Not Provided	Already Implemented	Pond water levels will continue to be read daily during open water season and tracked against the measured depth of thaw in the berms. Thermistor data will be collected, plotted and reviewed on a monthly basis.	No	NA	NA
	Make sure each thermistor cable is well marked so they can be located and maintained during the winter and are not damaged during snow removal operations.	Not Provided	Already Implemented	All thermistor cables are clearly marked and delineated.	No	NA	NA
	Consider adding data loggers to record the temperatures to facilitate data collection, particularly in the winter.	Low	No	Data loggers were installed for the permanent dikes in October 2018. However, owing to the temporary nature of the P-Area, the lower risk of failure and the greater accessibility of the thermistors, the expense of adding data loggers is not felt to be justified.	No	NA	NA
3. Water Management	Continue to collect and pump back seepage water as deemed necessary,in areas where seepage could impact downstream areas.	Not Provided	Already Implemented	Water levels within the collection ponds and seepage channels are monitored daily. Pumping of seepage water occurs as required and pumping records are provided daily.	No	NA	NA
	The water levels in the ponds should be reduced as much as possible in the winter to promote freezing of the dam cores. This would also increase the capacity within the ponds to manage water during the freshet, if necessary. The water levels should also be maintained as low as possible in the summer to reduce thermal warming due to water over the upstream toe of the dikes.	High	Already Implemented	Water levels within the collection ponds are monitored daily during open water season and are kept as low as possible based on the water management strategy and available treatment/discharge options. Daily meetings take place to discuss current water level statuses and targets with stakeholders. When water levels are deemed to be of concern, pumping to the P-Area is stopped and removal is maximized via transfer to the Saline Pond or active evaporation. Prior to freeze, a feasible water level target is made and reached via treatment or discharge. This target will be sufficient to ensure OMM is not reached during freshet.	No	NA	NA
4. Repair/Maintenance	If the dikes continue to be used, consideration for filling in the cracks, with additional fine rockfill or granular fill, regrading and re-compacting the slopes and crests may be warranted.	Medium	No	The Annual Inspection points out that overall, the P Area berms appear stable, with no significant geotechnical concerns identified. Therefore, owing to the temporary nature of the P Area berms and low risk of failure, AEM does not feel that the time and expense of regrading and re-compacting the slopes and crests is warranted. The exception however, would be Jetty #2 off of DP1-B. As was noted during the inspection and as documented in internal inspections throughout 2018, slumping and cracking in this area has been observed to increase over the past year. As Jetty #2 supports an evaporator and there is a risk of impacting operation of the area if the jetty fails, repair and mitigation work will be scheduled for 2019.	Schedule maintanance work with E&I for late summer 2019. Closely monitor jetty condition during summer thawing.	Engineering/E&I	September 2019
	Consider adding rockfill material to cover the till berm in P1, to protect the till and maintain its integrity if this berm is required for water management.	Low	No	The till berm in the middle of the P1 collection pond is not required for water management.	No	NA	NA
	Where access is feasible, removal of snow from the water collection pond dikes is recommended to reduce the insulating effects of the snow, thereby allowing the temperatures of the core materials in the dikes and the foundations to drop as low as possible with the potential that temperatures could get cold enough to maintain frozen conditions throughout the summer. Snow removal is more important if thermistor data indicates that temperatures within the dikes and/or foundations are warmer than expected.	Medium	No	Snow clearing activities have the potential risk of damaging thermistor installations, trench sumps and other infrastructure in the P Area. In addition, thermistor data indicates that the P Area berms will experience complete thawing during the summer/fall months, regardless of any snow removal efforts. Snow removal will therefore not be a scheduled maintenance activity.	No	NA	NA

Main Site Other

Annual Geotechnical Inspection Recommendation (Golder, 2017)		Priority Level (Golder, 2018)	Recommendation (s) to be Implemented?	AEM Response to Recommendation	Additional Action(s) Required	Responsible Department(s)	Expected Date of Implementation
1. Channel 1	The cracking and sloughing along Channel 1 should be assessed to determine if the channel is too steep and rip rap is sloughing over geotextile or if it is caused by thermal degradation or permafrost adjacent to the channel.	Medium	No	The lateral slopes of Channel 1 were locally steepened (2H:1V) for approximately 80 m to accommodate the final crusher ramp design footprint. This deviation from the original design (3H:1V) was done with the approval of the Design Engineer. As discussed in the Tetra Tech as-built report " *Construction Summary (As-Built) Report for Channel1 and Culvert #13, #1, #2, #15, #16*" issued to the NWB February 18, 2019, it is acknowledged that this localized steepening may result in the possibility of slope problems. Channel 1 will be monitored and any signs of instability, sloughing or ravelling will be corrected if observed.	Include Channel 1 in routine geotechnical inspection program and finalize inspection schedule. Prepare inspection criteria and documentation forms. Schedule any repair and/or maintenance work required.	Engineering	Pre-freshet 2019
	If possible, the channel should be kept empty through the winter to promote freezing of the permafrost around the channel.	Medium	No	Channel 1 was constructed as per design and was mechanically excavated within the active layer, lined with geotextile and covered with rip rap protection of minimum thickness 0.3 m. As the channel lies entirely within the active layer, aggradation of the underlying permafrost was neither intended nor foreseen. AEM therefore feels that snow removal throughout the winter is not worth the risk of damage to the infrastructure.	No	NA	NA
	If the bottom of Channel 1 remains below the inlets for Culvert 16, consider lowering the invert of the lowest culvert or adjust the invert of the channel, if possible, so that water will not need to pond in the channel before flowing through the culverts.	Not Provided	No	Culvert 16 was installed as per design specifications as per " *Construction Summary (As-Built) Report for Channel1 and Culvert #13, #1, #2, #15, #16*" (Tetra Tech, 2019). As with all culvert systems installed at site, performance will be monitored regularly during freshet and open water season, with any adjustments or mitigation work conducted as required.	No	NA	NA
2. Wesmeg Esker	The Wesmeg Borrow area should be recontoured and either capped with a coarser material or revegetated to reduce erosion.	Medium	Already Implemented	Rehabilitation of all site esker sources (Wesmeg, Melladine and Tiriganiaq) is scheduled to occur before the cessation of construction activities in 2019. Rehabilitation of the Wesmeg esker is currently on hold pending completion of construction activities at the West Raise. Once drilling and concrete work has finished, the excavated area will be backfilled with the material currently stockpiled on the esker and final rehabilitation of the surface will be completed.	Follow up required upon completion of construction activities.	Engineering/Construction	Fall 2019
3. Channel 5	Monitor the cracking adjacent to Channel 5.	Medium	Yes	A routine geotechnical monitoring schedule and documentation process for water management infrastructures outside of the temporary and permanent dikes is currently being formalized by the AEM Geotechnical Engineer. Channel 5 will be on the list of infrastructure to be inspected by AEM personnel.	Include Channel 5 in routine geotechnical inspection program and finalize inspection schedule. Prepare inspection criteria and documentation forms. Schedule any repair and/or maintenance work required.	Engineering	Pre-freshet 2019
	If cracking gets worse, recontouring and/or compacting the areas of cracking to close the cracks will reduce the potential for water to infiltrate into the cracks leading to warming of the permafrost and additional thaw settlement and cracking.	Medium	No	Channel 5 was constructed as per design and was not intended to be impervious to water infiltration. The channel was excavated into natural ground, lined with geotextile and the slopes were covered with rip rap protection of thicknesses approximately 0.3 m. This material was bucket-tamped into place. It is therefore not anticipated that any amount of recontouring or compacting would reduce the potential for water infiltration. It is also noted that the area adjacent to the Channel is the remnants of the access road placed for construction of Berm 3. The esker material used to construct this access road was removed and placed as rip rap protection during the final stages of Berm construction. There was no expectation that the remnants of the road would be trafficable or usable at the conclusion of construction activities in the area.	No	NA	NA
4. Berm 3	Ponding upstream of Berm 3 should be monitored to determine how much and how often ponding occurs and if Berm 3 can perform as required with the ponding.	Medium	Already Implemented	AEM currently monitors this area during freshet and throughout the open water season. Monitoring will continue in 2019. To-date, Channel 5 effectively drains to CP5 and no ponding against Berm 3 has been observed.	No	NA	NA
	The Berm 3 cover materials may be susceptible to erosion. This should be monitored, and if there is erosion, consideration should be given to placing courser material on the Berm to reduce the potential for erosion.	Medium	Yes	A routine geotechnical monitoring schedule and documentation process for water management infrastructures outside of the temporary and permanent dikes is currently being formalized by the AEM Geotechnical Engineer. Channel 5 will be on the list of infrastructure to be inspected by AEM personnel.	Include Berm 3 in routine geotechnical inspection program and finalize inspection schedule. Prepare inspection criteria and documentation forms. Schedule any repair and/or maintenance work required.	Engineering	Pre-freshet 2019
5. Portal 2	Monitor slopes above Portal 2 for rockfill instability during backfill placement.	High	Already Implemented	AEM Engineering oversaw an extensive scaling and ground support program of the rock and overburden faces at Portal 2 prior to the commencement of construction activities within the excavation. Regular, documented inspections by Ground Control Engineers were on-going during the backfill placement. Backfilling of Portal 2 was completed late in 2018.	No	NA	NA
	Snow management around and above Portal 1 and 2 may be advisable prior to freshet to reduceinflows entering the underground.	Low	Already Implemented	AEM currently clears snow around Portal 1 and Portal 2 throughout the winter and places the snow within P3 as deleterious substances may be mixed with snow. Clearing is conducted throughout the winter and is ensured in the weeks prior to freshet.	No	NA	NA
6. Exploration Landfill	A coarser rockfill layer should be placed over the decommissioned exploration landfill to reduce erosion and cracking.	Medium	No	The exploration landfill will be incorporated into Waste Rock Storage Facility 1 (WRSF1) once construction of this facility commences in 2019.	No	NA	NA
7. Saline Pond	Consideration for filling in the cracks with fine rockfill, recontouring and re-compacting the slopes and crests may be warranted to reduce the potential for infiltration into the berms that may increase the cracking and settlement.	Not Provided	No	A routine geotechnical monitoring schedule and documentation process for water management infrastructures outside of the temporary and permanent dikes is currently being formalized by the AEM Geotechnical Engineer. The perimeter berm of the Saline Pond will be on the list of infrastructure to be inspected by AEM personnel.	Include Saline Pond in routine geotechnical inspection program and finalize inspection schedule. Prepare inspection criteria and documentation forms. Schedule any repair and/or maintenance work required.	Engineering	Pre-freshet 2019
	Monitor the downstream side of the perimeter berm for ponding water and consider diverting it or pumping it so it does not seep into the saline pond and warm the foundation below the berm.	Not Provided	Yes	Monitoring is conducted site-wide as a means to identify areas of concern/seepage. The perimeter berm around the Saline Pond will specifically be added to the inspection template as an area of concern.	Add specific item to monitor the downstream side of the perimeter berm at Saline Pond for ponding. This will be added to the freshet and water structure inspection templates.	Environment	Pre-freshet 2019
	Where possible, try not to allow seepage water from DP3-A to pond against the Saline Pond berm to avoid permafrost degradation.	Medium	Already Implemented	AEM actively pumps the trench downtream of DP3-A during freshet and the open water season. In 2018, the trench pump was upgraded from a 3-hp submersible pump to a 5-hp submersible in order to ensure the trench remains below the elevation of the pump.	No	NA	NA
8. Industrial Pad	Where erosion is occuring on the slopes of the pads, the existing materials should be regraded and compacted, and a coarser material should be placed to further reduce erosion potential. Higher priority should be given to areas where erosion is encroaching on sea containers or other facilities placed close to the slope. The most significant pad erosion was observed at the north side of the main camp/industrial pad and the Emulsion Plant pad.	Medium	Yes	Construction of the Industrial Pad is scheduled to be completed in 2019. Final grading, capping and compaction will occur at this time.	Complete construction of the Industrial Pad to final grade as per design and technical specifications.	Construction	Summer 2019
9. Emulsion Plant/Road	If erosion occurs in the esker sand material used to construct the emulsion plant road, rockfill should be placed to cap the road and reduce erosion. Placement of gravel road capping may also be beneficial to improve the road surface, particularly over the northern section of the road.	Not Provided	Already Implemented	The road to the emulsion plant was constructed using 600 mm minus esker material, due to the requirement of using "clean" (non-underground sourced) construction materials outside of the contained watershed areas. Capping of the access road with a finer grade produced esker material occured in late 2018.	No	NA	NA
	Consider adding a crushed surface material to the Emulsion Plant and storage area pads if trafficability continues to be an issue.	Medium	No	The Emulsion Plant and storage area pads are outside of the contained watersheds for the Project. Therefore, the choice of construction materials was limited to esker materials. Accordingly, the final grade of the Emulsion Plant pad was sloped to encourage drainage. In addition, a ditch was constructed around half of the pad to further encourage water away from the Plant and garage areas. It is expected that proper snow management in this area prior to freshet 2019 will alleviate many of the trafficability issues observed during 2018.	Ensure correct snow management occurs prior to freshet. Monitor trafficability pre/post freshet. Enhance drainage if required.	Environment/E&I	Prior to Freshet 2019
	It is recommended that the disturbed areas adjacent to the emulsion plant road are regraded so that water does not pond adjacent to the road and thaw the permafrost around and under the road which could lead to settlement.	Medium	Yes	Regrading of natural tundra is difficult, if not impossible to achieve without further thermal disturbance. However, the disturbed areas will be rehabilitated by application of a thermal cap of rock fill material of sufficient thickness to prevent thermal degradation.	Rehabilitate either side of the roadway by replacing the natural peat cover with a thermal cap of rockfill.	Engineering/E&I/Construction	Prior to August 2019
	Culverts should be installed in areas of the emulsion plant road where water was flowing over the road in 2018.	Medium	No	The Emulsion Road was monitored daily for flow across the road, with very minor flows observed for 4 days during the 2018 freshet. AEM will continue to monitor and measure flow rates in this area and culverts will be installed accordingly if required.	Measure flow across road during 2019 freshet and install culvert accordingly.	Environment	Freshet 2019
10. Site Roads/Culverts	Implement a road and culvert monitoring program for site roads, as is done for the AWAR, which is tied to the maintenance program	Medium	Already Implemented	AEM monitors culverts and potential sources of TSS from erosion of site roads at a frequency of daily during freshet, monthly thereafter and following rainfall events.	No	NA	NA
	Consider lowering the lower culvert of Culvert 1 so that water won't pond against the road prior to flowing through the culverts.	Not Provided	Already Implemented	The temporary culverts at Culvert 1 were removed in late 2018, replaced with the design specified diameter culverts and were lowered 0.2 m from the design invert elevations based on field observations from the previous year.	No	NA	NA

	Ponding of water adjacent to roads should be avoided. Disturbed areas from road construction should be recontoured to promote drainage away from the road and consideration should be given to installing culverts if ponding occurs in naturally low areas. This was most notable along the Emulsion Plant and Wesmeg Borrow access roads.	Medium	Already Implemented	Ponding has been noted to be ephemeral in most areas adjaent to roadways and thus permafrost degredation is not a concern when ponds only exist following rainfall events or for the first couple of weeks following freshet. With respect to TSS transport and road washout, AEM agrees that ponded areas should not be allowed to overtop during heavy rainfall.	AEM will continue to monitor roadways to identify locations of long-term ponding and plan to install culverts as needed to reduce ponding and potential for road wash outs.	Environment	Freshet/Open water season 2019
	If the Wesmeg Borrow access road is blocking drainage near Lake B33A that is leading to ponding adjacent to the road, a culvert should be installed to allow drainage so that there isn't permafrost degradation and settlement.	Medium	Yes	Ponding will be tracked at this location and a culvert will be installed if permanent ponding is occuring over the 2019 season.	Monitor ponding and install culvert if needed.	Environment	Freshet/Open water season 2019
11. Operation Landfill	The slopes of the Operation Landfill should be monitored, particularly the northeast corner where water was observed to be ponding downstream and there was some possible sloughing on the slope. Regrading and compacting the slope in this area will reduce the potential for erosion.	Medium	No	The Operation Landfill was built to design specifications, with the floor sloped to encourage drainage to the northeast corner. During the design phase, some ponding in this area was anticipated, particularly during freshet and after rainfall events, as it was acknowledged that it may take some time for water to percolate through the perimeter berm. The designer-approved change in the construction materials of the Landfill (from 600 mm minus waste rock to 600 mm minus esker material) does increase the potential for erosion and/or sloughing of the perimeter berms. However, as the Landfill will be encapsulated within WRSF1 (surrounded by waste rock), it is not felt that additional maintenance on the facility will be of value at this time.	No	NA	NA
12. Other	A coarser rockfill cover should be placed over the pipe berm constructed out of sand on the south side of the effluent water treatment plant to protect against erosion.	Not Provided	Yes	The pipe berm at the EWTP should be covered with a more robust construction material.	Cover pipe berm with 600 mm minus esker/ROM material. Protect HDPE with screened esker/sand material.	Engineering/E&I/Construction	Late summer 2019

Exploration Site

Annual Geotechnical Inspection Recommendation (Golder, 2018)		Priority Level (Golder, 2018)	Recommendation (s) Implemented?	AEM Response to Recommendation	Additional Action(s) Required	Responsible Department(s)	Expected Date of Implementation
1. Landfarm	Minimize the amount of water contained within the exploration landfarm until it is decommissioned and remediated.	Medium	Already Implemented	AEM monitors water levels within the landfarm daily during freshet and following rainfall. Water is pumped to the contaminated snow cell for oil-water separation as needed.	No	NA	NA
2. Camp Pad	Repair surface erosion along south slope of exploration camp pad. Grade surface to reduce channelization of surface water flows and therefore reduce the potential for the erosion to reoccur. In this area, a coarser surfacing layer could be placed to help reduce the potential for future erosion.	Low	No	Decommissioning of the exploration camp facilities is scheduled to begin in 2019. Grading and rehabilitation works will occcur as per closure and reclamation plans.	No	NA	NA
3. Site Roads	The diffuser access road could be regraded to close up the cracks and reduce the potential for future cracking.	Low	No	The diffuser access road sees very limited light vehicle traffic. As this item is of low priority with a limited impact, maintenance work on this road will not be scheduled at this time. The roadway will continue to be monitored and addressed if required for trafficability.	No	NA	NA
	The exploration camp access road should be regraded and consideration given to placing some coarser rockfill on the slopes where there is erosion.	Medium	Yes	The areas of erosion along the exploration access road are observed to be along the shoulder area and could cause safety issues during pullovers. The side slopes should be regraded in these areas.	Regrade side slopes of exploration camp access road in areas where erosion affects shoulder stability.	E&I	Post-Freshet 2019
4. Culverts	The culverts through the exploration camp access road should be cleared of material. Large boulders should be removed from above the culverts to prevent potential damage to the culverts and appropriately sized riprap should be added to the road fills around the culverts for erosion protection where there isn't any.	Medium	Already Implemented	AEM performs culvert inspections weekly prior to freshet, daily during freshet, weekly thereafter during the open water season and following rainfall events. All material (i.e., snow, ice, boulders) is removed when observed. As per AEM's Sediment and Erosion Management Plan, when erosion or sediment entrainment is of concern, rip-rap will be applied to armor the system.	No	NA	NA
5. Fuel Storage	The cracks in the fuel storage pad should be monitored; however they are not considered to be a geotechnical concern.	Low	No	Due to the very minor nature of the cracking observed on the pad, and the low priority of the recommendation, additional monitoring of this area will not be undertaken at this time.	No	NA	NA

AWAR

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1. Culverts	Continue to monitor culverts and hydraulic effectiveness to assess if current culverts provide adequate capacity and if any changes are required. Evaluate if any culverts need to be installed at a lower elevation to reduce ponding and downstream erosion.	**Medium**	**Already Implemented**	AEM will continue to inspect AWAR culverts weekly prior to freshet, daily during freshet, weekly thereafter and during rainfall events. Focus is given towards identifying ponding and potential sources of sediment. Culvert effectiveness and ponding as the result of perched culverts are assessed.	**No**	**NA**	**NA**
	Monitor areas that have ponding, but no culverts and consider installing culverts to manage water.	**Medium**	**Already Implemented**	AEM will continue to monitor the AWAR for ponding, track ponded areas and assess the need for culverts.	**No**	**NA**	**NA**
2. Road Maintenance	The kilometer markings on the AWAR culverts should be checked and replaced with accurate numbers. At the time of the 2018 site visit, AEM indicated that new markers had been ordered but had not yet arrived.	**Medium**	**Already Implemented**	AEM has received the new marker signs for the culverts and installation will occur in 2019.	Install new markers on AWAR culverts.	E&I	End of July 2019
3. Inspections	Conduct inspections and document observations and recommendations as laid out in the Road Management Plan (AEM 2015b). Road inspections were completed and documented in 2018, but documentation indicates that the frequency of the inspections did not quite meet what is laid out in the Road Management Plan.	**High**	**Already Implemented**	Caribou migration affected inspections for approximately three weeks of July 2018, as only essential outdoor work was permitted for much of this duration. Aside from the caribou migration period and severe winter weather conditions, AEM will conduct inspections at the frequency stated within the Road Management Plan.	**No**	**NA**	**NA**

Itivia Bypass

Annual Geotechnical Inspection Recommendation (Golder, 2018)		Priority Level (Golder, 2018)	Recommendation (s) to be Implemented?	AEM Response to Recommendation	Additional Action(s) Required	Responsible Department(s)	Expected Date of Implementation
1. **Reporting**	The locations of some of the culverts through the Itivia by-pass road do not correlate with the design drawings (Tetra Tech 2017e) due to changes made during construction. The culvert locations should be referenced to the as-built report and drawings during the 2019 annual geotechnical inspection. The as-built report should confirm culvert sizes, locations and invert elevations have been constructed to the design. The as-built report should also confirm that safety berms have been constructed where required based on road fill height and confirm that road slopes have been constructed to design.	Medium	Already Implemented	The as-built report for the Itivia By-Pass Road was completed by the Design Engineer (Tetra Tech) and submitted to the NWB February 20, 2019.	No	NA	NA
2. **Inspection**	The section of the road and safety berm that is constructed with esker material may be susceptible to erosion. This should be monitored and maintenance completed as required.	Low	Already Implemented	The Bypass Road and one of the safety berms were constructed with material approved by the Design Engineer (600 mm minus esker material). Inspections of the roadway for erosion will be conducted as per the Road Management Plan.	No	NA	NA
	Conduct insepctions along Itivia by-pass road, as per the Road Management Plan (AEM 2015b), now that the road is complete.	Not Provided	Already Implemented	AEM will conduct inspections as per the Road Management Plan	No	NA	NA
3. **Water Management**	Ponding of water along the road should be monitored and if it is impacting the condition of the road, mitigation measures should be implemented, such as, lowering the culverts or ditching or placing fill to direct water to the culvert inlets.	Medium	Already Implemented	AEM will conduct inspections and implement mitigation measures as per the Road Management Plan	No	NA	NA
4. **Culverts**	The culverts should be cleared of all materials prior to freshet.	High	Already Implemented	As per AEM's Freshet Action Management Plan and Procedure, culverts will be cleared of all material prior to freshet and inspections will be carried out to ensure no blockages during freshet.	No	NA	NA
	The damaged outlets of the culverts through the entrance to the Itivia fuel storage area should be fixed.	Not Provided	No	Water levels observed within the culvert over 2018 did not pose a concern with respect to being impacted by the damage at the top of the culvert. The culvert will be monitored and if the damage is of concern then repairs will be made.	Monitor the outlet of the culvert to ensure damage does not pose an impact to flow passage.	Environment	2019 Open Water Season
5. **Fuel Farm**	Cover material should be re-established over the liner that has been exposed on the south containment berm of the Itivia fuel storage facility to protect the liner.	Medium	Yes	After freshet 2019 is completed, cover material should be raked into place over the liner system (exposed geotextile) to protect the system against exposure to UV radiation and risk of damage.	Schedule maintenance with E&I to occur post freshet 2019. Geotechnical Engineer to inspect maintenance work during and afterwards to ensure liner integrity is not compromised.	Engineering/E&I	Post 2019 Freshet