Appendix 9

Meadowbank and Whale Tail 2022 Annual Geotechnical Inspection

CONFIDENTIAL

REPORT

2022 Annual Geotechnical Inspection

Meadowbank Complex, Nunavut

Submitted to:

Agnico Eagle Mines Ltd.

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Executive Summary

Agnico Eagle Mines Limited (AEM) has mandated Golder Associés Ltée (Golder) to carry out the 2022 geotechnical inspection of the Meadowbank mining complex, including the Meadowbank and Whale Tail Mine sites, in accordance with the requirements of the water licenses (No. 2AM-MEA0815 and 2AM-WTP1830). The inspection was carried out from 25 July to 1 August, 2022. It concerned the geotechnical aspects and the review of the instrument data available for the dewatering dikes, the structures of the tailings pond (tailings storage facility [TSF]), the structures of the all-weather access road (AWAR) located between the Meadowbank site, and the town of Baker Lake, as well as the road between the Meadowbank and Whale Tail Mine sites (Whale Tail Mine road), the fuel storage infrastructures at the Meadowbank site, the Whale Tail Mine site and Baker Lake, the other site infrastructures such as the jetties of the attenuation ponds, the diversion ditches and surface water management infrastructures, the access roads, the landfills, the contaminated soil storage areas (landfarm), the wastewater management pond (Stormwater Pond), the Rock Storage Facility (RSF) till plug, the diffusers, the erosion and sediment protection structures, the airstrip, as well as the retaining walls.

Based on observations collected during the inspection, as well as instrumentation data, the condition of the dewatering dikes is satisfactory. It is recommended to continue reporting piezometers that have recorded data below 0°C in the past on East Dike and Bay-Goose Dike, and with careful interpretation since damage may have occurred. Once a piezometer has frozen, it is no longer completely reliable even if it thaws.

The subsidence and tension cracks observed in 2013 and 2014 on the upstream side of the thermal cover of Bay-Goose Dike were still partly visible but no longer appear to be active. Water accumulation at the downstream toe and flow from the downstream side of Bay-Goose Dike to Bay-Goose pit should continue to be monitored. Flow areas identified as North Channel, Channel 1, and Channel 3 should continue to be carefully monitored as instrumentation data and field observations seem to indicate that flow is occurring in these areas but is draining directly into the pit instead of accumulating at the downstream toe of the dike. The flow of the Central Channel area should also continue to be monitored.

The dewatering dikes at the Whale Tail Mine site were in good condition during inspection. Settlement at the East abutment of Whale Tail Dike (WTD) had progressed since 2021 but does not negatively impact dike performance. IVR D-1 Dike showed signs of settlement in the west side but was performing well.

Seepage through the foundation of WTD, which is measured in the downstream collection trench, was visually stable in 2022. The seepage is managed by redirecting it by gravity to the attenuation pond with a pumping system in place to intercept the seepage, although it is not currently active. Monitoring of the instrumentation data and seepage rates must continue to understand spatial and temporal evolution of the seepage.

No seepage was observed in 2022 at the downstream toe of Waste Rock Storage Facility (WRSF) Dike and the foundation was frozen all year long. This confirms the effectiveness of the thermal berm that was constructed in 2020 upstream of the dike, as well as the low upstream pond level management strategy that were part of the AEM mitigation plan. Monitoring of the instrumentation data must continue to validate the effect of these measures on the foundation and assess its long-term thermal behaviour.

Based on the observations collected during the inspection, as well as the instrumentation data, the TSF structures are generally in good condition. The tailings beaches were adequate along the structure. After the South Cell pond

was drawn down in 2021 to 2022, water was no longer ponding against the south side of Central Dike and Saddle Dam 5, as well as the downstream side of the west end of the Stormwater Dike that separates the two TSF cells. Saddle Dam 3 was also mostly free of ponded water against its upstream side.

No new deformation was observed on Stormwater Dike in 2022 although old deformation features were still visible. It is recommended to continue to monitor the potential movements of the Stormwater Dike and to follow the emergency measures plan in case the situation deteriorates. The presence of water against the downstream toe of this dike is geotechnically acceptable, although water was further from the dike in 2022. Some signs of tailings mass consolidation were visible just upstream of Stormwater Dike.

Most traces of erosion and tension cracks in the fine filter material of the North Cell Internal Structure have disappeared after remediation work. Some new minor tension cracks were present in the East sector. The structure is performing well.

A water pond is present at the downstream toe of Central Dike. This accumulation of water is fed by an underground flow that is partly connected to the south cell of the TSF. During the inspection, the accumulation of water was observed at the downstream toe of the dike, approximately between Sta. 0+300 and the southern access road at Sta. 0+830. The water was orange in colour with high turbidity earlier in the season, similar to previous years. At the time of inspection, an average seepage rate of approximately 150 m^3/h was being pumped to the South Cell of the TSF to maintain the downstream pond level at elevation (El.) 115 m.

Most of the AWAR culverts were in good condition. It is recommended that special attention be paid to culverts R-00A (2+550), PC-14 (4+260), the unidentified culvert at kilometre 5+700, and the culvert PC-16 (54+950). If insufficient capacity to manage runoff is observed at the time of the spring freshet, then it would be recommended to clear the obstructions or repair the culverts. It is also recommended to monitor the progress of erosion of culverts PC 17A (8+830), PC-11 (39+552), R14 (67+840), R18-B (82+500), R-20 (85+490), R-23 (93+600), and R24 (98+100) during the spring freshet, since there are signs of water flow below the road at these locations. If the condition of these culverts continues to deteriorate due to erosion, it is recommended that they be repaired. The bridges along the AWAR were in good geotechnical condition and no notable sign of erosion of the abutments was observed. Bridge 1 has a deformation of the metal panels of the two abutments. Signs of settlement were observed at two of the bridges. Remediation work is not required at this time; however, the situation should be monitored.

The presence of unstable blocks and loose rocks along steep walls is still observed in quarries 3, 7, 9, 10, 16, 18, and 23 along the AWAR, although no significant degradation of the wall conditions have been observed in the absence of work in these quarries. It is recommended that workers use caution in these quarries if work resumes and for AEM to inform them of the potential hazards.

The culverts on the Whale Tail Mine road were in good condition. It is recommended to pay special attention to culverts #5 (117+525), #7 (118+013), #7-2 (118+016), #12 (4+179 to 4+186; 3 outlets out of 5), #13 (120+615), #27-2 (123+300), #37 (125+035), #38 (125+049), #42 (125+416), #45 (125+710), #48 (127+203), #52 (128+195), #54 (128+388), #55 (128+440), #61 (129+050), #63 (129+390), #65 (130+924), #66 (132+324), #70 (133+837), #82 (136+143), #83 (136+300), #85 (136+671), #86 (136+740), #88 (136+861), #89 (137+180), #93 (138+100), #101 (139+025), #105 (140+555), #111 (142+461), #112 (142+630), #113 (142+736), #115 (142+865), #116 (142+940), #118 (143+433), #133 (148+141), #137 (148+940), #138 (149+000), #150 (152+171 to 152+179), #160 (155+966), #178 (161+170), #192 (163+190), #217 (166+790), #226 (168+935 to 168+937), #234 (170+385), #243 (171+593), #256 (173+350), #268 (175+774), and #281 (178+350). If insufficient capacity to manage runoff is observed at the time of the spring freshet, then it would be recommended to clear the obstructions or repair the culverts. It is also recommended to monitor the erosion progress of culverts # 167 (41 + 843) and # 232 (53 + 928) since there are signs of water flow under the road at these locations. Culvert erosion should be monitored during the spring freshet. The bridges along the Whale Tail Mine road were in good geotechnical condition and no notable sign of erosion of the abutments was observed besides limited surficial erosion of the granular fill behind a concrete wall at Bridge 148, which poses no geotechnical concern.

During the inspection of the quarries and eskers along the Whale Tail Mine road, unstable and loose rocks along steep walls and unstable ground slopes were observed in all quarries and eskers except eskers # 3, # 5, and # 6. No significant degradation of the wall and slope conditions have been observed in the absence of work in these locations; however, it is recommended that workers be cautious at these locations if work resumes there and that AEM advise them of the dangers of falling boulders or potential slope failures.

The fuel storage infrastructure at the Whale Tail Mine site was in good condition, with some backfill material missing.

Water accumulation was much lower than usual in the containment areas of all fuel storage infrastructures. The disposal of fluids accumulated in secondary containment infrastructure should continue to be managed to minimize the amount of water in contact with the base of the tanks. Exposed geomembrane was observed on the north and south side of Tanks 1 to 4 and in the northeastern corner of Tank 4, similar to previous years, and newly exposed geomembrane was seen on the south side of Tanks 5 and 6. It is recommended to cover the exposed area with a geotextile and backfill material to restore the protection of the geomembrane. Tension cracks at the top of the slope north of Tank 5 detected in 2020 still appeared inactive. The area should be monitored and repaired as necessary to protect the geomembrane.

A hole in the exposed geomembrane was present at the Baker Lake site at the south-southwest corner of Tank 3 at the toe of the slope, similarly to the past years. The liner should be repaired, and the exposed area should be covered with geotextile and backfill material to restore the protection of the geomembrane. Animal burrows have been observed at the Baker Lake site near the south side of Tanks 3 and 4. It is recommended to assess whether the underlying geosynthetics have been damaged.

The geomembrane of the 20 Jet A fuel tanks at the Baker Lake site remains exposed but little water is ponding in the containment area. The geomembrane had a tear in the southwest corner of the tanks where the repair did not hold and the liner needs to be repaired again to restore containment. It is recommended to remain vigilant during the spring freshet and throughout the year to manage the accumulation of water in the containment area.

It is recommended to monitor the performance of the five culverts installed in the Vault road during the spring freshet. A set of two culverts is installed between lakes NP1 and NP2 near the Meadowbank site; these culverts are in good condition. Another set of three culverts is installed further down the road to the Vault pit, and these culverts are all partially collapsed in the middle.

The Meadowbank West and East Diversion ditches and their sediment control elements, as well as the Whale Tail Mine site Diversion ditches, were in good condition. It is important to inspect them during the spring freshet.

The landfill, the wastewater management pond (Stormwater Pond), the airstrip, and the crusher retaining wall at Meadowbank, as well as the diffusers, landfill, attenuation pond ramp, and Tramp Metal Removal Facility retaining wall at the Whale Tail Mine site were in good condition. The Meadowbank and Amaruq contaminated soil storage areas (landfarms) were in good condition.

Sommaire exécutif

Agnico-Eagle Mines Ltée (AEM) a mandaté Golder Associés Ltée (Golder) pour réaliser l'inspection géotechnique 2022 du complexe minier Meadowbank, y compris les sites de Meadowbank et Whale Tail Mine, en conformité avec les exigences du permis d'utilisation des eaux d'AEM (licences No. 2AM-MEA0815 et 2AM-WTP1830). L'inspection a été réalisée du 25 juillet au 1er août 2021 et concernait les aspects géotechniques et la revue des données d'instruments disponibles pour les digues d'assèchement, les structures du parc à résidus (PAR), les structures de la route d'accès (AWAR) située entre le site de Meadowbank et la ville de Baker Lake, ainsi que la route de Whale Tail Mine, les infrastructures d'entreposage du carburant au site de la Mine, au site de Whale Tail Mine et à Baker Lake, de même que les autres infrastructures du site telles que les jetées des bassins d'atténuation, les fossés de dérivation et les infrastructures de gestion des eaux de surface, les routes d'accès, les zones d'entreposage de matières résiduelles, les zones d'entreposage de sols contaminés, l'étang de gestion des eaux usées (Stormwater Pond), le till de colmatage de la halde à stériles (RSF), les diffuseurs, la structure de protection contre l'érosion et les sédiments, la piste d'atterrissage ainsi que les murs de soutènement.

Selon les observations collectées lors de l'inspection et d'après les données d'instrumentation, la condition des digues d'assèchement est satisfaisante. Il est recommandé de continuer à signaler les piézomètres qui ont enregistré par le passé des données à une température inférieure à 0 °C aux digues East Dike et Bay-Goose Dike et d'être très prudent lors de l'interprétation de leurs données, car les piézomètres pourraient être endommagés. Une fois qu'un piézomètre a gelé, il n'est plus totalement fiable même s'il dégèle.

Il est recommandé de conserver une distance suffisante entre la pile de roches stériles ultramafiques et le pied aval de la digue South Camp Dike afin de permettre une observation visuelle adéquate de la zone du pied aval.

L'affaissement et les fissures de tension observés en 2013 et 2014 du côté amont de la couverture thermique de la digue Bay-Goose Dike étaient encore partiellement visibles, mais ne semblent plus actifs. L'accumulation d'eau au pied aval et l'écoulement du côté aval de la digue Bay-Goose Dike vers la fosse Bay-Goose doivent continuer à être surveillés. Les zones d'écoulement identifiées comme North Channel, Channel 1 et Channel 3 doivent continuer à être rigoureusement surveillées, car les données d'instrumentation et les observations de terrain semblent indiquer qu'un écoulement se produit dans ces zones, mais s'évacue directement dans la fosse au lieu de s'accumuler au pied aval de la digue. L'écoulement de la zone d'écoulement Central Channel doit continuer à être surveillé.

Les digues d'assèchement du site de Whale Tail Mine (Whale Tail Dike, WRSF Dike, Mammoth Dike, North-East Dike) étaient en bonne condition lors de l'inspection. Le tassement au niveau de la culée Est de la digue Whale Tail Dike (WTD) a progressé depuis 2021 mais n'affecte pas encore négativement la performance de la digue. La digue IVR D-1 montrait des signes de tassement dans sa partie ouest mais fonctionne bien.

Les exfiltrations à travers de la fondation de la digue Whale Tail Dike mesurées dans la tranchée de collecte en aval étaient visuellement stables en 2022. Les exfiltrations sont gérées par redirection gravitaire vers le bassin d'atténuation et un système de pompage est en place pour intercepter les exfiltrations, bien qu'il ne soit actuellement pas actif. Le suivi de l'instrumentation et des exfiltrations doit se poursuivre afin de comprendre l'évolution spatiale et temporelle des exfiltrations.

Aucune exfiltration n'a été observée en 2022 au pied aval de la digue WRSF Dike et sa fondation était gelée toute l'année. Cela confirme l'efficacité de la berme thermique construite en 2020 en amont de la digue, ainsi que de la stratégie de maintien d'un niveau d'eau bas dans le réservoir en amont inclus dans le plan de mitigation d'AEM. Le suivi des instruments doit se poursuivre pour valider l'effet de ces mesures sur la fondation et évaluer le comportement thermique de celle-ci à long terme.

Sur la base des observations collectées lors de l'inspection, ainsi que des données d'instrumentation, les structures du PAR sont globalement en bonne condition. La plage de résidus était adéquate tout le long des structures. Après l'abaissement du niveau d'eau dans la Cellule Sud en 2021-2022, il n'y avait plus d'eau accumulée le long du côté sud de Central Dike et Saddle Dam 5, ainsi que du côté aval de l'extrémité ouest de la digue Stormwater Dike qui sépare les deux cellules du PAR. Le côté amont de Saddle Dam 3 était également majoritairement libre d'accumulation d'eau.

Aucune nouvelle déformation n'a été observée sur Stormwater Dike en 2022 même si les traces des anciennes déformations sont encore visibles. Il est recommandé de continuer à surveiller les mouvements potentiels de la digue Stormwater Dike et de suivre le plan de mesures d'urgence en cas de détérioration de la situation. La présence d'eau le long du pied aval est acceptable d'un point de vue géotechnique pour cette digue, bien que peu d'eau y était présente en 2022. Des signes de consolidation de la masse de résidus étaient visibles juste en amont de Stormwater Dike.

La plupart des traces d'érosion et des fissures de tension dans le matériau de filtre fin de la digue North Cell Internal Structure ont disparu après les travaux de remédiation. De nouvelles fissures de tension mineures étaient présentes dans le secteur Est. La structure est en bonne condition.

Un étang d'eau est présent au pied aval de la digue Central Dike. Cette accumulation d'eau est alimentée par un écoulement souterrain qui est relié en partie à la Cellule Sud du PAR. Lors de l'inspection, l'accumulation d'eau a été observée au pied aval de la digue, approximativement entre le chaînage 0+300 et le chemin d'accès sud au chaînage 0+830. L'eau avait une coloration orange avec une forte turbidité plus tôt dans la saison, comme au cours des années précédentes. Au moment de l'inspection, un taux d'exfiltration moyen d'approximativement 150 m^3/h était pompé vers la Cellule Sud du PAR pour maintenir le niveau de l'étang d'eau au pied aval à l'Él. 115 m.

Les ponceaux de l'AWAR étaient pour la plupart en bonne condition. Il est recommandé de prêter une attention particulière aux ponceaux R-00A (2 + 550), PC-14 (4 + 260), au ponceau non-identifié au kilomètre 5 + 700, et au ponceau PC-16 (54 + 950). Si une capacité insuffisante à gérer les écoulements est observée au moment de la crue printanière, il serait alors recommandé de dégager les obstructions ou de réparer les ponceaux. Il est également recommandé de suivre la progression de l'érosion des ponceaux PC 17A (8 + 830), PC-11 (39 + 552), R14 (67 + 840), R18-B (82 + 500), R-20 (85 + 490), R-23 (93 + 600) and R24 (98 + 100) lors de la crue printanière, puisqu'il y a des signes d'écoulement d'eau en dessous de la route à ces emplacements. Si la condition de ces ponceaux continue à se détériorer en raison de l'érosion, il est recommandé de les réparer. Les ponts le long de l'AWAR étaient en bonne condition géotechnique et aucun signe notable d'érosion n'a été observé. Le Pont 1 comporte une déformation des panneaux métalliques des deux culées. Des signes de tassement ont été observés sur deux des ponts. Il n'est pas requis d'effectuer des travaux de remédiation pour le moment, cependant la situation doit être surveillée.

La présence de blocs instables et de roches meubles le long de parois raides est encore observée dans les carrières 3, 7, 9, 10, 16, 18 et 23 situées le long de l'AWAR, bien qu'aucune dégradation significative des parois n'ait été relevée en l'absence de travaux dans les carrières. Il est recommandé aux travailleurs d'être prudents dans ces carrières en cas de reprise des travaux et à AEM de les informer des dangers potentiels.

Les ponceaux de la route de Whale Tail Mine étaient en bonne condition. Il est recommandé de prêter une attention particulière aux ponceaux #5 (117+525), #7 (118+013), #7-2 (118+016), #12 (4+179 to 4+186; 3 sorties sur 5), #13 (120+615), #27-2 (123+300), #37 (125+035), #38 (125+049), #42 (125+416), #45 (125+710), #48 (127+203), #52 (128+195), #54 (128+388), #55 (128+440), #61 (129+050), #63 (129+390), #65 (130+924), #66 (132+324), #70 (133+837), #82 (136+143), #83 (136+300), #85 (136+671), #86 (136+740), #88 (136+861), #89 (137+180), #93 (138+100), #101 (139+025), #105 (140+555), #111 (142+461), #112 (142+630), #113 (142+736), #115 (142+865), #116 (142+940), #118 (143+433), #133 (148+141), #137 (148+940), #138 (149+000), #150 (152+171 to 152+179), #160 (155+966), #178 (161+170), #192 (163+190), #217 (166+790), #226 (168+935 to 168+937), #234 (170+385), #243 (171+593), #256 (173+350), #268 (175+774), and #281 (178+350). Si une capacité insuffisante à gérer les écoulements est observée au moment de la crue printanière, il serait alors recommandé de dégager les obstructions ou de réparer les ponceaux. Il est également recommandé de suivre la progression de l'érosion des ponceaux #167 (41+843) et #232 (53+928), puisqu'il y a des signes d'écoulement d'eau en dessous de la route à ces emplacements. L'érosion des ponceaux devrait être suivie lors de la crue printanière. Les ponts le long de la route de Whale Tail Mine étaient en bonne condition géotechnique, et aucun signe notable d'érosion des culées n'a été observé en dehors d'une faible érosion superficielle du remblai granulaire en arrière d'un mur de béton au Pont 148, ce qui n'est pas problématique d'un point de vue géotechnique.

Lors de l'inspection de la route de Whale Tail, des roches instables et meubles le long de parois raides et des pentes de sol instables ont été observées dans toutes les carrières et les eskers, à l'exception des eskers #3, #5 et #6. Bien qu'aucune dégradation significative des parois et des pentes n'ait été relevée en l'absence de travaux, il est recommandé aux travailleurs d'être prudents à ces emplacements en cas de reprise du travail et à AEM de les informer des dangers potentiels de chute de blocs ou de ruptures de pente.

Les infrastructures d'entreposage de carburant du site de Whale Tail Mine étaient en bonne condition. Une partie de remblai granulaire était manquante.

L'accumulation d'eau dans les cellules de confinement de toutes les infrastructures d'entreposage de carburant était largement moindre que lors des années précédentes. L'évacuation des fluides accumulés dans les infrastructures de confinement secondaire devrait continuer à être gérée de sorte à minimiser la quantité d'eau en contact avec la base des cuves. De la géomembrane exposée a été observée au sud des cuves 1 à 4, et au coin nord-est de la cuve 4, comme au cours des années précédentes; il y a également une zone nouvellement exposée au sud des cuves 5 et 6. Il est recommandé de couvrir la zone exposée avec un géotextile et un matériau de remblai pour rétablir la protection de la géomembrane. Les fissures de tension détectées en 2020 au sommet du talus au nord de la cuve 5 semblent toujours inactives. La zone devrait être surveillée et réparée au besoin pour protéger la géomembrane.

Un trou dans la géomembrane exposée était présent au site de Baker Lake au coin sud-sud-ouest de la cuve 3 au pied de la pente, comme au cours des dernière années. La géomembrane devrait être réparée et la zone exposée devrait être couverte avec un géotextile et du matériau de remblai pour rétablir la protection de la géomembrane. Des terriers d'animaux ont été observés au site de Baker Lake à proximité du côté sud des cuves 3 et 4. Il est recommandé d'évaluer si les géosynthétiques sous-jacents ont été endommagés.

La géomembrane des vingt cuves de carburant Jet A au site de Baker Lake demeure exposée mais peu d'eau est accumulée dans l'aire de confinement. La géomembrane comportait une déchirure au coin sud-ouest des cuves; la réparation de la membrane n'a pas résisté et doit être réparée à nouveau pour rétablir le confinement. Il est recommandé de rester vigilant lors de la crue printanière et tout au long de l'année afin de gérer l'accumulation d'eau dans l'aire de confinement.

Il est recommandé de suivre la performance des cinq ponceaux installés dans la route de Vault lors de la crue printanière. Une série de deux ponceaux est installée entre les lacs NP1 et NP2 à proximité du site de Meadowbank; ces ponceaux sont en bonne condition. Une autre série de trois ponceaux est installée plus loin sur la route vers la fosse Vault, et ces ponceaux sont tous trois partiellement effondrés au milieu.

Les fossés de dérivation Ouest et Est de Meadowbank et leurs éléments de contrôle des sédiments, ainsi que les fossés de dérivation du site de Whale Tail Mine, étaient en bonne condition. Il est important de les inspecter durant la crue printanière.

La zone d'entreposage des matières résiduelles, l'étang de gestion des eaux usées (Stormwater Pond), la piste d'atterrissage et le mur de soutènement du concasseur à Meadowbank, ainsi que les diffuseurs, la zone d'entreposage des matières résiduelles, la rampe de l'étang d'atténuation et le mur de soutènement de l'infrastructure d'enlèvement des débris métalliques de Whale Tail Mine étaient en bonne condition. À Meadowbank et au site de Whale Tail Mine, les zones d'entreposage des sols contaminés étaient en bonne condition.

Study Limitations

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1.0 INTRODUCTION

Agnico Eagle Mines Limited's (AEM) Meadowbank Complex mandated Golder Associés Ltée (Golder) to conduct the 2022 annual geotechnical inspection, pursuant to the requirement of Type A Water Licence Permit No. 2AM-MEA0815 and 2AM-WTP1830 for the Meadowbank Complex, Nunavut, including the Meadowbank and Whale Tail Mine sites.

Under Part I, Item 12 (pages 23 and 24), AEM is required to undertake an annual geotechnical inspection of its facilities between the months of July and September.

The following structures were inspected the Meadowbank site:

- dewatering dikes (East Dike, South Camp Dike, Bay-Goose Dike, and Vault Dike)
- tailings storage facilities (Stormwater Dike, Saddle Dam 1, Saddle Dam 2, Saddle Dam 3, Saddle Dam 4, Saddle Dam 5, Central Dike, and the North Cell Internal Structure)
- South Cell pond and North Cell pond (reclaim ponds)
- geotechnical instrumentation
- all-weather access road (AWAR) and site roads (culverts and bridges at water crossings in particular)
- quarries on site and along the AWAR
- landfill and contaminated soil storage and bioremedial landfarm facility
- bulk fuel storage facilities at the mine site and in Baker Lake
- shoreline protection
- sediment and erosion control structures
- other structures: sumps, airstrip, crusher retaining wall, waste rock storage facility (WRSF) till plug, RF1-RF2, Stormwater pond, diversion ditches

The following structures were inspected at the Whale Tail Mine site:

- dewatering and water management dikes (Whale Tail Dike [WTD], WRSF Dike, IVR Dike, and Mammoth Dike)
- dewatering ramps and attenuation ponds (Whale Tail and IVR)
- geotechnical instrumentation
- Whale Tail Mine Road and site roads (culverts and bridges at water crossings in particular)
- quarries and eskers along the Whale Tail Mine Road
- bulk fuel storage facilities
- shoreline protection and diffusers
- sediment and erosion control structures
- Underground Ore Stockpile Saline Ditch, Underground WRSF Saline Ditch, IVR Diversion Ditch, and South Whale Tail Channel (SWTC)

- other structures: sumps and non-contact water management infrastructures, crusher retaining wall

The 2022 geotechnical inspection was conducted from 25 July to 1 August by Marion Habersetzer, a professional geotechnical engineer from Golder. During the inspection, the weather was rainy to sunny with daily temperatures varying between 9°C and 25°C. The inspection was scheduled at the time of year when the seasonal depth of thaw (active layer) is expected to be near its maximum. Surface water flow is generally low to moderate at this time of year. Peak water flows typically occur during the spring thaw (mid-June through mid-July).

This report describes the geotechnical aspects of the areas inspected and presents general observations and recommendations. Figure 1 shows the main mine site area.

1.1 Scope Limitations

The scope of the inspection is limited to the geotechnical aspects of each of the facilities listed in Section 1.0 above. The inspection did not include other assessments such as structural, mechanical, or environmental. For additional information related to the limitations of this scope, reference should be made to the Study Limitations provided at the beginning of this report.

2.0 PRIORITY LEVEL DEFINITIONS FOR RECOMMENDATIONS

In this report, each recommendation is assigned a priority level. The ranking system is used to help AEM determine the priorities of the recommendations. The priority levels and descriptions are based on those in the Health, Safety, and Reclamation Code for Mines in British Columbia (Ministry of Energy and Mines 2017) and the associated Guidance Document.

The priority levels and descriptions presented in Table 1 are used in this document. It is recommended that the status of each recommendation be reported on in the next geotechnical safety system inspection for a follow-up and/or closeout, as appropriate. The recommendations are presented in each section below and summarized in Table 2. The term “structure” refers to any kind of geotechnical structure assessed during the geotechnical inspection, including dams, storage facilities, roads, bridges, and others.

Table 1: Priority Levels and Descriptions

Priority Level	Description
P-1	A high priority or actual structure safety issue considered immediately dangerous to life, health, or the environment; or a significant risk of regulatory enforcement.
P-2	If not corrected, could likely result in structure safety issues leading to injury, environmental impact, or significant regulatory enforcement; or a repetitive deficiency that demonstrates a systematic breakdown of procedures.
P-3	Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
P-4	Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.

3.0 MEADOWBANK DEWATERING DIKES

The dewatering dikes at Meadowbank include: East Dike, South Camp Dike, Bay-Goose Dike, and Vault Dike. East Dike has been in operation since the dewatering of the northwestern arm of Second Portage Lake was completed in 2009. Bay-Goose Dike and South Camp Dike became operational in July 2012 when the dewatering of the Bay-Goose Basin was completed. Construction of Vault Dike was completed in March 2013 and phase 2 of the dewatering of Vault Lake was completed in 2014.

The most current version of the operation, maintenance, and surveillance (OMS) manual (AEM 2021b) is dated November 2021 for the Meadowbank dewatering dikes. The most current version of the overall Emergency Response Plan for the mine (AEM 2021d) is dated September 2021. It is good practice to review these documents each year to keep the information updated, particularly the 24-hour contact name and phone number. In 2022, AEM modified some of the dike inspection frequencies (AEM, 2022), which will be added into the next OMS update.

A detailed visual inspection of the dewatering dikes is performed by AEM once a month, except for the structures in permafrost (Vault Dike, South Camp Dike, Saddle Dams 1 to 5, NCIS, RF1-2, and Stormwater Dike which foundation is frozen on the upstream side), which are inspected monthly from May to September only. More frequent routine inspections are conducted as required by the OMS manual depending on the Trigger Action Response Plan (TARP) level. The monthly inspection reports were reviewed as part of the annual inspection. Most of the instruments on East Dike, South Camp Dike, and Bay-Goose Dike are connected to a system that automatically collects and transmits data every three hours. Data for all instruments can be visualized on the Vista Data Vision (VDV) software and are checked regularly (every three days at a minimum) by the mine environment team. A review of the instrumentation data for the Meadowbank dewatering dikes is presented in the following sections. During the year, monthly reviews of the instrumentation on the dewatering dikes are conducted by mine personnel and findings and internal recommendations are compiled in a follow-up file. Access to the instrumentation data on VDV was provided by AEM for all structures on site for Golder's review. Continued monitoring and review of instrumentation data is recommended. In the case of a significant variation in the instrumentation data, the designer should be notified according to the OMS manual. A significant variation is defined by a change compared to usual seasonal trends and should be followed up to monitor the evolution of the event and identify its causes and consequences, as well as the appropriate actions to be taken.

Figure A1 shows a plan view of East Dike, Figure A2 shows a plan view of South Camp Dike and Bay-Goose Dike, and Figure A3 shows a plan view of Vault Dike. These figures indicate the location of the photos taken and observations noted during the inspection.

3.1 East Dike

East Dike is located on the east side of Portage Pit and isolates the northwestern arm of Second Portage Lake. Dewatering of the northwestern arm of Second Portage Lake allowed for the development of Portage Pit and the construction of the tailings storage facility (TSF). At the time of the inspection, East Dike served as an access road to the northern portion of Bay-Goose Dike and had not been used as a haul road since 2011.

East Dike is approximately 800 m in length and was constructed within Second Portage Lake prior to dewatering. It consists of a wide rockfill shell with downstream filters and a soil bentonite (SB) cut-off wall that extends to bedrock up to 8 m below lake level.

3.1.1 Field Observations during Inspection

At the time of the 2022 inspection, two cracks (2 to 3 m long, 5 mm wide) accompanied by a small hole (about 150 mm) were observed in the crest around Sta. 60+500 and had been spray-painted. One is perpendicular to the dike, while the other is parallel to it. If the cracks progress over time or if new cracks appear, it is recommended to install crackmeters and/or extensometers and survey the crest to quantify the movement. The designer must be notified if a movement is noted. However, besides these two cracks, no signs of sloughing or settlement were observed on the structure (including the vicinity of the 2009 sinkhole near Sta. 60+472). Another small hole was observed near the North abutment. No sign of internal erosion was noted in the turbidity measurements (Section 3.1.2.5).

Three seepage zones were identified in the past near the downstream toe of East Dike (at Sta. 60+247, 60+498, and 60+575). The zones at about Sta. 60+247 and Sta. 60+498 each have a seepage collection sump with a pump connected to a year-round pumping system. At the time of the inspection, the seepage was being captured within these sumps. According to AEM, the zone at about Sta. 60+575 was practically dry all year, with very little ponding water and no flow observed during the inspection. No sign of new seepage on the ground surface or downstream was observed.

The unusual seepage event that happened in winter 2021, during which an unusual seepage draining to the surface of the downstream toe was observed and accompanied by a pressure rise in the nearby instruments of the South Channel, was again observed in 2022. This gives confidence to the interpretation of the mechanism. No visual sign of unusual seepage remained after freshet and during the inspection in July 2022. AEM also installed additional thermistors in the South Channel area to better monitor the area.

Following recommendations from the 2021 inspection, AEM installed additional thermistors in the South Channel area after submitting the plan to Golder for approval. The flow rate in the seepage pumping stations is still measured as a whole, with a new flowmeter for better measurements. Turbidity was measured in each station for several months in the spring of 2022. Turbidity was roughly equal in both stations. It is still recommended to separate the flow rate measurements according to each station.

From the visual inspection, the performance of East Dike is satisfactory, as:

- No visual signs of slope instability or erosion were observed on the upstream and downstream rockfill slopes.
- No visual signs of significant cracking or settlement were observed on the dike and along the cut-off wall alignment, besides minor tension cracks.
- Freeboard is adequate.

3.1.2 Geotechnical Instrumentation Data Review

Instrumentation has been installed within East Dike and includes piezometers, thermistors, inclinometers, and flow meters, as detailed in Appendix I (Table 1 and Table 2). The inclinometer at Sta. 60+195 was destroyed in the past and has not been replaced. Replacement of this instrument is not considered necessary; however, monitoring of East Dike should continue and if anomalous conditions are observed, inclinometer replacement should be re-evaluated.

The following subsections present a summary of the data collected between September 2021 and August 2022. Previous annual geotechnical inspection reports contain additional information regarding instrumentation data collected prior to September 2021.

3.1.2.1 Piezometers

Three arrays of multilevel vibrating wire piezometers (VWPs) are installed within East Dike as follows:

- South Channel (Sta. 60+190)
- North Channel (Sta. 60+490)
- North Shallows (Sta. 60+700)

At each location, multilevel VWPs were installed:

- upstream side of the cut-off wall, approximately 2 m from the centreline
- immediately downstream of the cut-off wall, approximately 2 m from the centreline
- further downstream of the cut-off wall, approximately 10 m from the centreline

Single VWPs were also installed downstream of the cut-off wall near the contact area (base of cut-off wall and top of the bedrock surface). VWP-400-C and VWP-420-C show a seasonal trend that keeps rising through the years since 2015 (up to 2 m in the winter of 2022). For the past four years, the rising seasonal trend has increased each year. The increase is not associated with a rise of temperature but rather the contrary; it is considered that this behaviour is linked to progressive freeze-back of the foundation bedrock. It is recommended to closely follow the significant seasonal trend in the future and react quickly if need be. VWP-500-C and VWP-510-C only exhibited a small increase in 2022, which suggests that this behaviour may similarly start in these instruments over the next years and should be monitored. Starting in the winter of 2021, field observations were associated with a yearly pressure increase in the South Channel, in the form of ponding water and seepage pathway shifts (detailed below).

Some of the installed piezometers on East Dike are broken or malfunctioning, most of them due to freezing, as detailed in Appendix I (Table 1). Those instruments give either no data or erratic data. A piezometer that has frozen at some point is unreliable, as freezing generally breaks the piezometer or shifts its calibration curve. It is therefore recommended to flag these piezometers and be very careful when interpreting their data.

The piezometer data show that the pore water pressure is stable compared to the value recorded in the past, with a long-term trend going towards a slow increase in the pore water pressure, possibly related to freeze-back of the pit walls.

Specific observations have been made for the three piezometric arrays located at Sta. 60+190, Sta. 60+490, and Sta. 60+700, as follows.

Sta. 60+190

At Sta. 60+190, the observed levels are consistent with expectations for a functioning cut-off wall. There is a consistent drop in the hydraulic head across the cut-off. The general trend in the piezometric readings has been steadily increasing since 2014 and the increase is accelerating since 2019. In February 2021, a large pressure increase (up to 2.5 m) was observed in lines P1 and P2 of piezometer 60+190, while on the field, water was observed ponding at the downstream toe of the dike and freezing in place. The increasing pressure trend continued at a slower pace until June 2021. Temporary pressure releases were observed after ice and snow were removed from the dike toe, allowing water to flow until it froze again, suggesting ice blockage at the toe of the dike contributed to the observed pressures. This trend is interpreted to be associated with restriction of the seepage pathway downstream of the dike. The identified mechanism was confirmed to be the most likely after discussions between

Golder, AEM, and the Meadowbank Dike Review Board (MDRB) members during the MDRB meeting held in November 2021. Following this event, the seepage collection system was amended to improve water collection near the surface.

In the winter of 2022, a similar behaviour was observed, although the amplitude was slightly lower. Similarly to 2021, warmer temperatures were correlated with a slower pressure build-up. The onset of freshet with temperatures above freezing led to a complete dissipation of the pressure anomaly and a return to normal piezometric levels in all instruments. The repeating of this pattern is consistent with the interpretation of the mechanism.

As with other sections of East Dike, the increasing pressure is associated with progressive freeze-back of the foundation. At Sta. 60+190, the thermal sensors indicate still thawed conditions except for the P1 line, which was starting to freeze in winter; however, it is probable that the surrounding areas were progressively freezing and concentrating the flow.

As observed in past years, no instrument froze in the winter (except for the P1 line, which is starting to freeze seasonally with no sign of damage) and the temperature data indicate the presence of seepage. Since temperature fluctuations at 190-P1-C do not show seasonal variations correlated to air temperature in contact with the ground surface, it is highly probable that seepage water from the upstream side of the dike is responsible for the thermal behaviour. The recorded piezometric pressure decreases toward the downstream side and with elevation, which seems to indicate that flow is occurring toward the pit. Given the hydraulic head response consistent with the expectations of a functioning cut-off wall, it is reasonable to assume that the seepage water is originating from a different part of the dike. Freeze-back of the foundation appears to affect the seepage pathways and this area will have to be monitored closely in the future as new pressure build-up episodes are likely to happen in winter.

Sta. 60+490

At Sta. 60+490, flow through the dike is observed as the piezometric pressure is very similar before and after the cut-off wall (490-P3-B versus 490-P2-B in particular). There are spike increases in the hydraulic head in the spring of 2020, similar to previous years. These spikes are probably due to pumping interruption for maintenance or change of discharge from the lake to the pit. Signs of seepage are also observed in the thermal instrumentation data associated with this piezometric array. The general trend in the piezometric readings in the bedrock has been steadily increasing since 2014 and the increase seemed to accelerate from 2019. In 2022, the fluctuations are slightly higher than in 2021 with a general 0.7 m increase and should continue to be monitored. At Sta. 60+490, the thermal sensors indicate still unfrozen conditions, although 490-P1-C is approaching freezing seasonally. However, it is probable that the surrounding areas are progressively freezing (as indicated by thermal variations in piezometer 60+500-C) and concentrating the flow.

None of the instruments are frozen; there is a correlation between the lake temperature and the temperature recorded by the piezometric array at this location, and the temperature data follow the same trend with very little offset. These piezometric and thermal trends correspond to the seepage zone observed at Sta. 60+498. The recorded piezometric pressure decreases towards the downstream side and with elevation, which seems to indicate that flow is occurring towards the pit.

Sta. 60+700

At Sta. 60+700, piezometers at the P1 and P2 lines (downstream of the dike and close to the centreline) are frozen, while the P3 line freezes seasonally. These instruments are starting to show erratic data, with P1 levels exceeding P2 levels, and are no longer reliable. The general trend in the piezometric readings has been steadily increasing since 2014 and the increase seems to be accelerating since 2019 and should be monitored. Freeze-back of the foundation observed at Sta. 60+700 is likely causing the rise in pressure.

The temperature data are consistent with observations noted during previous years and indicate mostly frozen conditions.

3.1.2.2 Thermal Regime

Five thermistor strings with 16 nodes at 1 m intervals are installed on East Dike, as detailed in Appendix I (Table 1). The instrumentation data for the September 2021 to August 2022 period are consistent with historical trends, with a slow long-term cooling trend. Specific observations have been made for each instrument for the period analyzed, as follows.

In addition to thermistors, thermal sensors of piezometers installed in the cut-off wall and bedrock along the centreline at 60+550, 60+600, and 60+650 also indicate frozen conditions.

Sta. 60+092 and Sta. 60+842

The thermistors installed at Sta. 60+092 and Sta. 60+842 are located on the southern and northern abutments. The thermistor at Sta. 60+092 was not functional after September 2020, while only three beads have been functional at Sta. 60+842, making data too scarce in the covered period for a review of the thermal regime. The upper 1 m of the dike of both abutments is still in the active layer and there was typically little to no change in the ground thermal regime over the past years. Since the dike is still in operation for several years and the abutment is subject to develop and aggregate ice lenses, it is recommended to replace those strings of thermistors to monitor the thermal regime until the post-closure phase of the mine.

Sta. 60+185

The thermistor string installed in the South Channel at Sta. 60+185 (bedrock about 6 m below water surface at elevation [El.] 127 m) recorded the following temperature variations, similar to previous years:

- The upper layer of the cap material (from El. 136 m to El. 134 m) was thawed in August 2022 and was frozen during the winter period (active layer). The active layer shows significant fluctuations in temperature, from 3.3°C to -12.5°C. The material between El. 134 m and 132 m remains frozen.
- The cut-off wall below El. 132 m remained thawed all year with a maximum temperature of 2.2°C. This result concurs with potential seepage inferred from the thermal behaviour at 190-P1-C at Sta. 60+190. However, 190-P1-C is further downstream from the dike and the lag between maximum 190-P1-C and the data seem to suggest that water is originating from a different part of the dike structure closer to Sta. 60+490.
- The bedrock portion of the dike (below El. 126 m) remained thawed. The bedrock had a temperature variation between 1°C and 2°C.

Seepage is observed downstream and is collected in a seepage station, which was amended in 2021 following the newly observed seepage at the downstream toe surface. To better understand the behaviour of the South Channel area and detailed seepage pathway restriction, additional thermistors were installed downstream of the South Channel in May 2022, between Sta. 60+232 and 60+267, at a distance from the toe (32 to 145 m from the centreline). Thermistors at 60+232 and 60+233 showed that the till and bedrock were frozen, except at 60+232 in the topmost part of the till, which thawed over the summer. The thermistor at 60+267, which is the farthest from the dike, showed that the till and bedrock marginally thawed below El. 117 m (up to 0.3°C).

Sta. 60+485

The thermistor string at Sta. 60+485, installed within the North Channel (bedrock at approximately El. 126 m, 7 m below lake level) indicated the following temperature variations, similar to previous years:

- The upper portion of the cut-off wall located in the lake (from El. 136 m to El. 132 m) was in an active zone. Significant temperature fluctuations were recorded (8.9°C to -15.2°C).
- The cut-off wall below El. 132 m and the bedrock remained thawed during the year with significant variations in temperature (between 11.9°C and 0°C).

The thermal variation observed within the cut-off wall below El. 132 m and in the bedrock is significant, with fluctuations between almost 12°C and slightly above 0°C. From September 2021 to August 2022, there is a positive correlation between recorded temperatures and the upstream lake temperatures, indicating advective flow through the dike (i.e., recorded temperature changes are primarily a result of temperature changes in water flowing through this area). The delay between changes in the recorded temperatures within the lake and within the cut-off wall is minimal. The temperature responses recorded in the piezometers at Sta. 60+490 P2 (A, B, C) are also significant, as are the responses recorded within the piezometers at Sta. 60+472, Sta. 60+480, and Sta. 60+500. Temperatures in piezometers at Sta. 60+190 P1-C, Sta. 60+450, and Sta. 60+490 P1/P3 react as well. At the edge of the seepage area, temperature sensors in piezometers 400-C and 420-C show cooling trends in the foundation, suggesting that the seepage is getting more constrained as foundation freeze-back occurs. Seepage is observed downstream and is collected in the sump and removed via the pumping system.

Sta. 60+695

The thermistor string installed in the North Shallow at Sta. 60+695 (bedrock at approximately El. 128.5 m, 4.5 m below upstream lake level) recorded the following temperature variations:

- The thermistor beads from El. 136 m to 134 m indicate that the upper portion of the cut-off wall was thawed in August 2022 and frozen during the winter (active layer), similar to previous years. The recorded temperature variations are between 6°C and -18°C.
- The thermistor beads from El. 134 m to 126 m indicate that the cut-off wall and the till between these elevations remained frozen throughout the monitoring period, with temperature fluctuations between 0°C and -9.6°C. The frozen depth is steadily increasing, indicating continuation of the strong freezing trend observed since 2018 in the area.
- The temperature recorded in the bedrock varied between -0.9°C and 0.8°C increasing with depth.

In addition to thermistor data, piezometer thermal sensors confirm a general cooling trend observed between Sta. 60+550 and 60+700. At Sta. 60+700, piezometers (P1 and P2 lines) are entirely in permafrost, while the upstream line (P3) remains seasonally thawed in contact with lake water.

3.1.2.3 Inclinometers

Two inclinometers are installed on East Dike at Sta. 60+495 and 60+705, as detailed in Appendix I (Table 2). The inclinometer displacements are referenced along Axis A and Axis B; Axis A is perpendicular to the cut-off wall alignment (positive displacements are towards the Pit side), while Axis B is parallel to the cut-off wall (positive displacements are towards the increasing chainage), perpendicular to Axis A. Only the data for inclinometer 30+705 were available for review in 2022.

Recorded displacements are small. The maximum cumulative displacements at the crest were observed in the inclinometer installed at Sta. 60+705. The cumulative displacement is about 47 mm perpendicular to the cut-off wall (Axis A) and -25 mm aligned to the cut-off wall (Axis B). From 2021 to 2022, no significant movements were observed for all inclinometers; they have all been relatively stable since 2014. The recorded displacements are well within the tolerable displacements for the structure and are not a concern.

3.1.2.4 Seismograph

No peak particle velocity measurements (measured by the peak vector sum) were taken in 2022 for East Dike as no blasts occurred in the vicinity of East Dike.

3.1.2.5 Flow Meters

The flow at the downstream toe between September 2021 and August 2022 was measured by the flow meters installed in the two seepage collection sumps downstream of East Dike. The average flow measured during the year was around 8.4 m^3/h with 2021 values averaging approximately 15.5 m^3/h in summer. The measured flow is relatively stable compared to values from the past year. Over the 2021/2022 winter, the flow was measured between 8.2 and 11.5 m^3/h and had decreased compared to the last two years. It is considered that flow during winter is more representative of the seepage, with no incidence of precipitation and snowmelt. It should be noted that during the winter of 2020/2021 and 2021/2022, field observations and recorded pressure increases in the instruments of East Dike suggest the establishment of a new seepage pathway. AEM amended the seepage collection stations and flowmeters to improve seepage monitoring and rate measurement. Golder still recommends installing a flowmeter at each seepage collection station to measure the seepage rates independently. It was also recommended to measure turbidity in each station instead of only sampling the total volume, as it would provide more information on the origin of the turbidity in the event of a change. AEM did measure turbidity in each station during freshet of 2022, finding similar values in both sampling stations. The procedure should continue in the future to detect any change.

During the year, the water quality in the sump was monitored by the environment department every week during freshet and the summer season. According to the procedure in place, the water is pumped in Portage Pit instead of being sent to Second Portage Lake when the total suspended solids criterion is exceeded. This was the case from 30 April in 2022. Over the past years, the total suspended solids were usually acceptable during the winter until the freshet. At the time of the inspection, the water was still pumped into the pit. According to AEM, following recommendation from 2021, the turbidity was measured separately in the two pumping stations during freshet and turbidity measurements were found to be similar. No unusual turbidity value suggests internal erosion of the dike materials.

Based on the instrumentation data, the performance of East Dike is satisfactory, as:

- Seepage rates, while higher than anticipated in the design (expected to be between 300 and 600 m^3/day), are stable compared to historical values and are controlled by the pumping system in place. The total suspended solids criterion is low enough for the water to be released in Second Portage Lake, except during the freshet and summer, as in previous years.
- Instrumentation data: piezometric, thermal, seepage, and inclinometer data do not show deteriorating conditions.
- The unusual seepage observations during the winter of 2021 were well documented and investigated, and the mechanism identified after analysis by both AEM and Golder is not deemed likely to impact the performance of

East Dike. The confidence in the interpreted mechanism increased after observing similar behaviour in the instruments in 2022 with no visible impact on the field.

A photographic log and the record of inspection form for East Dike is provided in Appendix A1.

3.2 South Camp Dike

South Camp Dike is located south of the plant site area and is used to connect the mainland to South Camp Island. South Camp Dike, in conjunction with Bay-Goose Dike, isolates a portion of Third Portage Lake (Bay-Goose Basin) that allowed the development of Goose Island Pit and the southern portion of Portage Pit. It covers a narrow channel, approximately 60 m wide, with shallow water depths ranging from 0.5 m to 1.0 m.

South Camp Dike has a broad rockfill shell with a bituminous geomembrane liner installed on the upstream side. Compacted granular material mixed with bentonite was placed above the toe of the liner. The liner was installed on native frozen (permafrost) till material in a trench approximately 3 m to 5 m below the lakebed surface. At the time of the inspection, South Camp Dike was used as an access road to connect the southern part of Bay-Goose Dike and the contractor’s garage area with the mine facilities.

3.2.1 Field Observations during Inspection

An ultramafic waste rock stockpile about 10 m high is located 20 m away from the downstream toe of the dike. The distance between South Camp Dike and the waste rock dump is sufficient to allow a complete visual inspection of the downstream area of the dike. It is recommended to continue keeping the downstream toe of the dike clear to facilitate inspection. The downstream toe and slope area were in good condition.

Water was ponding on the downstream side of South Camp Dike. No flow was observed. The pond was slightly larger than in 2021, despite the recent dry weather, suggesting that this pond could be fed by additional sources on top of precipitation runoff. Some water seemed to be coming from the nearby waste rock stockpile.

No geotechnical issues or seepage were observed during the inspection.

A photographic log and record of inspection form for South Camp Dike is provided in Appendix A2.

3.2.2 Geotechnical Instrumentation Data Review

Two thermistor strings are installed on the upstream side of South Camp Dike. SD-10 is located near the liner toe. SD-09-A is located approximately 20 m further upstream within Third Portage Lake. Based on the thermistors data, no signs of seepage are evident, and the recorded value follows historical trends.

The following summarizes the observations regarding the thermal regime at these locations:

- The temperature profile at SD-09-A on the upstream side of the dike shows the soils located beneath the dike foundation and liner have remained frozen (permafrost) below El. 128 m. An unfrozen interval is seen between El. 128 and 129 m. An active layer is present between El. 133 m and 131 m.
- The temperature profile at SD-10 shows that the foundation of the dike below the thermal cap stayed frozen all year long.

3.3 Bay-Goose Dike

Bay-Goose Dike is located within Third Portage Lake on the southern side of Portage Pit and encompasses the Goose Island Pit. Bay-Goose Dike, in conjunction with South Camp Dike, isolates a portion of Third Portage Lake (Bay-Goose Basin).

Bay-Goose Dike is approximately 2,200 m long and consists of a wide rockfill shell, with downstream filters and a cut-off wall. For the majority of the dike, the cut-off wall extends to bedrock and consists of SB and/or cement-soil bentonite (CSB). For portions of the dike where the cut-off wall was not constructed to bedrock, jet grouting of the soil between the base of the cut-off wall and the bedrock was performed, thereby extending the low permeability element of the dike to the bedrock surface. The water depth beneath the dike is up to 9 m, with a maximum depth to bedrock below lake elevation upwards of 20 m.

Instruments to monitor and assess the performance of the dike are installed on Bay-Goose Dike. The instrumentation includes piezometers, flow meters (water collection pipe and a plastic bucket), thermistor strings, and inclinometers. Every blast in the vicinity of the dike was monitored for blast vibration during mining of the Meadowbank pits, but monitoring has now been terminated since no more blasting activity occurs there.

3.3.1 Field Observations during Inspection

The tension cracks observed in 2013 and 2014 on the upstream side within the thermal cap (between approximately Sta. 32+100 and 31+750) were still visible during the 2022 inspection but did not show signs of progression and were not active anymore. Settlement within the thermal cap and on the upstream side of the crest (from approximately Sta. 32+100 to 31+950 and 31+400 to 31+300), ranging from 0.1 m to greater than 1.0 m, was observed but did not show any significant sign of movement since previous years. These areas should continue to be closely monitored to confirm no aggravating conditions are developing. Since it is difficult to visually observe movement on an unequal surface, it is recommended to fill past deformations to produce a flat surface for better observation. The filling work should be completed in summertime to avoid thawing snow in the backfill material that could generate additional deformation. AEM has started this work in 2022, and will continue in 2023.

Seepage channels and water accumulation were observed at the toe of the dike during the inspection (North Channel, Central Channel, Central Shallows, and Channel 3). There is currently no downstream seepage collection system at the downstream toe of the dike as the amount of seepage arriving downstream is currently too small to require such a system. Part of the seepage seems to drain to the pit. Flow from these channels is monitored by various stations. At the time of the inspections, stations 6, 7, 8, and 9 were active and no turbidity was observed in the water at the downstream toe. Refer to Section 3.3.2.5 for flowmeter measurements. Visually, the area downstream of the dike appeared drier than in previous years, likely due to the recent dry weather on site.

Water was observed flowing in the North Channel during the inspection at Sta. 30+420 m. The flow was low and not measurable. According to AEM, water was observed ponding at the toe during the year. Due to the topography, it is possible that water is ponding in this area from a nearby seepage channel (i.e., near the northern abutment). It is recommended to regularly inspect this area, monitor the flow of water, and be aware of signs of seepage from the toe of the dike and in Pit E4.

Water flow was observed into the Central Shallow seepage channel during the inspection at Sta. 30+625 and 30+655. The flow was low and within the expected trend.

A water pond formed by the Central Channel seepage was observed downstream at Sta. 31+125. The mine pumps this pond several times in the summer, and piezometers show a response to the pumping. The inflow has not been monitored in this area since 2015. It is recommended to keep measuring the water inflow when pumping the water pond formed at Central Channel.

Water flow was observed at Channel 3 during the inspection at about Sta. 31+500 m. The flow was low and within the expected trend. A drainage channel is dug into the ring road nearby to allow water to flow freely into the pit. According to AEM, water has arrived to the pit from this location during the year through a drainage ditch.

A water pond was observed downstream at Sta. 31+750, between Channel 2 and Channel 1. This water pond is not considered seepage as its level never changes except at freshet and after rain events. It is recommended to visually inspect the pond periodically and, if the level changes, to monitor water flow.

Channels 1 and 2 were not active at the time of the inspection. An accumulation of water was observed further downstream against Goose Pit ring road. According to AEM, water is observed downstream in that area during freshet season and naturally drains to Goose Pit without reaching the dike toe. The instrumentation near Sta. 32+000 (Channel 1) indicates a potential seepage zone in that area. It is probable that seepage occurs at this location but drains directly to the pit. The instrumentation at this location needs to be closely monitored for changing trends.

Due to Goose Pit being mostly flooded, water inflow through the wall is no longer visible except at the top of the walls. The previously observed water inflows near Channels 1, 2, and 3 are not being monitored because the pit is not accessible anymore.

From the visual inspection, the performance of Bay-Goose Dike is satisfactory, as:

- No visual signs of slope instability or erosion were observed on the upstream and downstream rockfill slopes.
- The settlement and sloughing observed in the thermal cap and in the upstream side of the crest are stable and are no longer active.
- Freeboard is adequate.

A photographic log and the record of inspection is provided in Appendix A2.

3.3.2 Geotechnical Instrumentation Data Review

Instruments were installed on Bay-Goose Dike to monitor the performance of the dike following construction, during dewatering and operation, and into closure. They include piezometers, thermistors, and inclinometers (standard type and time domain reflectometer cable). At the time of the inspection, all the piezometers and thermistors on Bay-Goose Dike had an automatic data collection and transmission system to the VDV database. The following subsections present a summary of the data collected between September 2021 and August 2022.

It must be noted that the current instrumentation of Bay-Goose Dike was designed for performance monitoring from dewatering to closure based on the expected operation duration of about 10 years. The in-pit tailings deposition implies that the dike will be in operation for another decade. The review of the available instrumentation and its spatial distribution by AEM and Golder shows that coverage is still adequate. Routine monitoring of the instruments should continue and focus particularly on areas with SB / CSB contact, areas with seepage, and areas where instruments exhibit a trend that is different from previous observations or unexpected variations.

3.3.2.1 Piezometers

Arrays of multilevel VWPs were installed within Bay-Goose Dike as detailed in Appendix I (Table 4).

At each location, multilevel VWPs were installed:

- Upstream of the cut-off wall, approximately 2 m from the centreline.
- Immediately downstream of the cut-off wall, approximately 2 m from the centreline.
- Further downstream of the cut-off wall, approximately 14 m from the centreline.

In addition, single VWPs were installed immediately downstream of the cut-off wall near the contact area (base of cut-off wall and top of bedrock surface) at several stations.

Some of the installed piezometers on Bay-Goose Dike are broken or malfunctioning, probably from freezing, as detailed in Appendix I. Those instruments give either no data or erratic data. A piezometer that has frozen at some point is unreliable, as freezing generally breaks the piezometer or shifts its calibration curve. It is therefore recommended to flag these piezometers and be very careful when interpreting their data while staying vigilant about any rapid piezometric variance. The first time a piezometric rapid increase associated to a frozen piezometer is observed, it is important to remain vigilant without overweighting the abnormal trend. For the instruments showing very high piezometric readings, it is recommended to compare the pressure recorded to the instrument limit to identify if the variance could be due to factors other than mechanical problems such as seepage.

From 2012 to 2022, a generalized trend can be observed in the pore water pressure measurements of most non-frozen piezometers located along the dike (upstream and downstream side). An increase in pore water pressure is observed during winter (approximately November to May). The pore water pressure tends to stabilize or decrease during freshet (approximately May to September). Historically, the rising trend has been attributed to ice build-up at the downstream toe of the dike and the decrease has been attributed to ice melting.

A cooling trend starting in July 2012 can be observed in all piezometers installed on Bay-Goose Dike. The instruments located farther on the downstream side generally record lower temperatures than the instrument closer to the dike and the lake. As a result, the instruments on the upstream side of the dike are generally the last ones to freeze and the ones farthest on the downstream side are the first to freeze. In some sectors, most of the piezometers are in frozen condition, while in some sectors almost none of the piezometers are in frozen condition. There seems to be a correlation between the sector in which seepage has been observed historically and the number of frozen instruments. In sectors where freeze-back is occurring, pressures are generally on a slow and steady rise.

There is generally a drop in the hydraulic head across the cut-off wall and within the grouted bedrock in the downstream direction. In general, the data from the piezometers are similar to the historical trend.

In addition to the seasonal trend described above, specific observation trends can be observed for various areas of the dikes. These areas generally coincide with seepage channels as the majority of piezometers are frozen in non-seepage channel areas.

The OMS manual provides procedures in the event of significant or rapid pore water pressure increases or decreases that need to be followed. The designer needs to be advised in the event of unusual variations.

North Portion (Sta. 30+158 to 30+516.5)

The piezometric level has been stable since 2015 with cyclical variation but has not recovered to the level before 2015. In the unfrozen piezometers on the downstream side near the cut-off wall, similar to previous years but with a slightly lower amplitude, a 0.3 m increase in pore water pressure is observed for instruments on the downstream side from the beginning of summer 2022 and had not dissipated at the time of the inspection. Large-scale seasonal variations are seen in the pore water pressure recorded in all piezometers, with fluctuation more pronounced on the downstream side. At 30+378.5 m, pore water pressure on the downstream side is now roughly equal to the upstream water head.

These variations in pore water pressure are happening in the zone associated with the North Channel seepage and monitored by seepage stations no. 8 and no. 9. In the past, the pressure typically increased in magnitude of the pore water pressure until freshet and then suddenly decreased from mining activity and the depressurization of the rock walls in Pit E5. However, with the pit walls freezing back, pressure is progressively prevented from dissipating by drainage through the wall face. Equalization of water pressures on both sides of the wall at 30+378.5 m suggest a progressive blockage of the seepage pathway downstream of the dike at this location, rather than an increase in seepage rates based on the observed decrease in visible seepage. It is possible that the seepage will overtop the blockage and relocate to a nearby location where the pathway is still open; attention must be paid during routine inspection to detect any new seepage location.

The temperature recorded by the piezometers indicates a general cooling trend. See section on thermal regime below for more details.

Central Shallows (Sta. 30+645.5 to 30+804)

The majority of the piezometers installed in this area are frozen and give erratic data. Seepage station no. 7, which was active during the summer of 2022, is near this area.

The unfrozen piezometers (30+645) indicate stable pore water pressures in 2022 with a slight increase (0.15 m) during the summer. Before 2021, this seasonal increase dissipated almost entirely after the summer. In recent years, the pressure increase dissipated to a lesser extent after the summer.

Central Channel (Sta. 31+020 to 31+220)

There is a seepage zone with ponding water observed downstream associated with this channel. The majority of the piezometers in this area are not frozen.

From 2012 to 2022, the maximum and minimum recorded pore water pressures for the piezometers downstream have been following the usual trend with a slight increase in the past three years. Since mining was stopped and there are no more blasting operations, the general trend has smoothed out. There is generally a pressure build-up from the winter onset to the freshet in June the following year. In 2022, the pressure fluctuation was about 0.6 m, similar to previous years. Compared to previous years, the amplitude of the release at freshet is continuing to decrease, which is associated with the progressive freeze-back of the foundation bedrock seen in the thermal sensor of the VWP at Sta. 31+165. Pressures measured downstream of the dike (P2 line) have exceeded the upstream water head during the winter for several years. This is not correlated to any observation of the field but is linked to these instruments freezing. At the moment, flow rates within the usual trend exclude increased seepage at this location. As with the North Channel, a seepage pathway change is possible in the future.

On a smaller scale, the pore water pressure data tend to fluctuate more during freshet than during winter. This behaviour seems to be consistent with the explanation that the recorded pore water pressures are influenced by the pumping of the water pond located downstream.

Channel 3 (Sta. 31+565 to 31+700)

There is a seepage zone monitored by station no. 6 associated with this channel. There is a drainage channel dug into the ring road in the area to allow water to flow freely in the pit. The piezometric array in this area is mostly frozen and a cooling trend can be observed in the recorded temperature since 2011.

From 2018 to 2022, the pore water pressure has been slowly and steadily increasing, with a decrease in the seasonal variation amplitudes. All piezometers show that pressure minimum has slightly increased over since 2018 (0.5 m per year).

Piezometers at Sta. 31+600 located downstream now read the same values or slightly higher values than the upstream instruments. This could indicate a rise in the downstream pressure due to freeze-back of the surrounding area, as normal seepage rates measured in 2022 exclude an increase in the seepage at this location.

Channels 1 and 2 (Sta. 31+815 to 32+105)

No seepage has been observed at the toe of the dike in 2022, but there is a water pond in this location that naturally drains to Goose Pit through a constructed drainage channel. Most of the piezometers are not frozen in this area.

The recorded pore water pressure in the piezometers located in Channels 1 and 2 has generally been stable (0.4 to 0.6 m fluctuation from winter to freshet) since last year for the piezometric arrays of Channels 1 and 2. The rapid pressure rise trend observed in 2018 in this area has not been observed in 2022 in any instrument. However, a marked seasonal increase (about 0.5 m in 2022) is still observed over the winter at 31+885 in P2 instruments (directly downstream of the dike) except for the deeper instrument in the bedrock. This pressure dissipated in the summer of 2022. During this increase, the P2 water pressures exceed the upstream levels, suggesting blockage of the seepage pathway, similar to other seepage locations experiencing freezing, despite all sensors being unfrozen at 31+885. This suggests that the seepage pathway may be blocked at another location where it normally flows, which was the interpretation given to the 2018 pressure rise. All piezometers in the area are on a steady increase since 2018, with pressure rising by up to 0.35 m in 2022.

The thermal data at Sta. 31+815 might indicate some sign of seepage as the thermal cooling is less pronounced and there is a wider fluctuation of temperature recorded at this location than in the other thermistors nearby.

3.3.2.2 Thermal Regime

Thirty-three thermistors (from T1 to T30 and T3' to T5') have been installed on Bay-Goose Dike. From September 2021 to August 2022, the following observations have been made.

In addition to thermistors, thermal sensors of piezometers installed show a general cooling trend and freeze-back of instruments over the years.

Sta. 30+134 (T1), Sta. 30+827 (T14), and 32+140 (T30) – Abutments

The three thermistors installed at Sta. 30+134 (T1), Sta. 30+827 (T14), and Sta. 32+140 (T30) are located on the northern abutment, Goose Island, and the western abutments. The first node of these thermistors is installed about 1 m below the dike crest. For this period, the dike and its foundation were entirely frozen on the northern abutment (T1), the Goose Island abutment (T14), and the western abutment (T30).

Piezometers at 30+158 confirm this trend with all three lines (P1, P2, P3) frozen all year long.

Sta. 30+185 (T2), Sta. 30+489.5 (T9), Sta. 30+553.25 (T10), Sta. 30+621.5 (T11), Sta. 30+650 (T12), Sta. 30+713 (T13), Sta. 31+080 (T15), Sta. 31+134.5 (T16), Sta. 31+170 (T17), Sta. 31+352 (T18), Sta. 31+752.5 (T21), and Sta. 31+820 (T22) – SB Wall

Twelve thermistors were installed in the SB portion of the cut-off wall. All the thermistors except for T18 show a similar trend:

- The wall is mostly frozen all year below El. 134 m, with the exception of a few nodes in T2 (El. 129 m), T9 (El. 131 m), and T12 (El. 131 to 132.5 m).
- There is generally an active layer in the upper bedrock, while the deeper bedrock is thawed all year. The bedrock is frozen down to El. 115 m to 125 m, except at T16 where the bedrock remains entirely unfrozen. T12 shows more seasonal variations (freeze/thaw at depth) than other instruments.
- All thermistors except T22 show that the frozen front is progressing deeper every year.

T18 (31+352) indicates that the wall and the bedrock remained frozen.

Piezometers at 30+645.5, located between T11 and T12, show that P1 and P2 lines are entirely frozen, while P3 line is still unfrozen but progressively coming close to 0°C.

Piezometers at 31+165, located between T17 and T18, show that the P1 line is in permafrost and that the P2 line is only frozen in the till and upper bedrock while the deep bedrock cools down but remains unfrozen.

Piezometers at 31+815, located between T21 and T22, show that the upper three sensors in the P1 line are now in permafrost while the deeper bedrock and the P2 and P3 line remain unfrozen.

Sta. 30+260 (T3), Sta. 30+261.5 (T3’), Sta. 30+272 (T4), Sta. 30+273.5 (T4’), Sta. 30+288.5 (T5), Sta. 30+290 (T5’), Sta. 30+330.5 (T6), and Sta. 30+827 (T14) – CSB / SB Wall

This portion of the dike contains a cut-off wall where settlement could occur due to CSB, a rigid material, sitting on top of SB, a soft material. The thermistor nodes configuration for T3 (Sta. 30+260), T4 (Sta. 30+272), and T5 (Sta. 30+288.5) has nodes located very close together to monitor the interface between the CSB and SB materials as noted below. Thermistors T3, T4, and T5 were not installed to the designed depths, but instead have been installed below the interface and monitor the bedrock contact. T3’ (30+261.5), T4’ (Sta. 30+273.5), and T5’ (Sta. 30+290) provide readings across the CSB / SB interface.

T3 to T5 show that the SB wall and the bedrock are starting to freeze with pockets of unfrozen material currently remaining in the bedrock but with a marked cooling trend. T4 is now fully frozen all year for the first time since installation.

Thermistor T6 indicates that the SB and foundation are completely unfrozen below El. 130 m. From El. 130 to 131 m, the CSB wall fluctuates above and below 0°C, and from El. 131 to 135 m the dike remained frozen.

No seepage directly downstream of this portion of the dike was observed; however, based on the topography, it is anticipated that seepage from this area could drain to a lower point within the North Channel (i.e., 30+360). These thermistors show that the till and bedrock were largely unfrozen from September 2021 to August 2022 (see details below).

Piezometers at 30+276.5, located in bedrock between T4’ and T5, show that the P1 and P2 lines are now in permafrost, while P3 line remains unfrozen but cooling down.

T14 (30+827) indicates that the wall and the bedrock remained frozen.

Sta. 30+386 (T7), Sta. 30+417.5 (T8), Sta. 31+595 (T19), Sta. 31+605 (T20), Sta. 31+850 (T23), Sta. 31+880 (T24), Sta. 31+960 (T25), Sta. 31+995 (T26), Sta. 32+030 (T27), Sta. 32+060 (T28), and Sta. 32+100 (T29) – Jet-grouted Section

Eleven thermistors were installed in areas where the bottom of the cut-off wall was jet grouted. These thermistors show that the maximum frozen layer depth was above 124 m to 130 m between September 2021 and August 2022. The majority of the rockfill stayed frozen all year and the till and bedrock were unfrozen all year with an exception at T19, T20, and T29. A general cooling trend is observed, which is relatively slow in all instruments except in T19, T20, and T29, where it is faster.

At T19, the frozen front has almost reached the case of the section that is both jet-grouted and grouted, about El. 119 m.

At T20, the jet-grouted section is now continually frozen, while the grouted section below El. 116 m is still unfrozen.

Piezometer 31+600, located between T19 and T20, shows that P1 and P2 lines are freezing from the surface. The deeper instruments and the P3 line remain unfrozen. Similarly, piezometers at 32+105, located near T29, show that the P1 line is in permafrost and that the P2 and P3 lines are freezing back with the upper sensors frozen all year long, while the deep bedrock at the P2 and P3 line remain unfrozen.

Piezometers at 32+000, located between T26 and T27, show that the upper two sensors (in till) in the P1 line are in permafrost while the bedrock, most of the P2 and the P3 line, remain unfrozen.

Piezometers Thermal Sensors in Seepage Channels

North Channel (Sta. 30+158 to 30+516.5)

Piezometers at 30+453.5 are progressively freezing, with the P1 line and the upper sensor in the P2 line (P2C in bedrock) now frozen. Piezometers at 30+378.5 are unfrozen all year, except for the upper sensor in the P1 line (P1C at the bedrock interface) now frozen all year long. A continued cooling trend is observed in the North Channel.

Channel 1 and 2 (Sta. 31+815 to 32+105)

Piezometers at 31+885 are unfrozen all year and the temperatures are stable (no cooling). Piezometers at 32+000 are still unfrozen except upper instruments on the P1 and P2 lines (P1B1/B2 in till and P2B2/C in till) that are now frozen. Similarly, piezometers at 32+065 remain unfrozen; however, the upper sensors in the P1 and P2 line (P1B2/B3 in till and bedrock, P2B3/C in till) are now frozen or very close to freezing. A cooling trend is observed in piezometers at Sta. 32+000 and 32+065.

3.3.2.3 Inclinometers

Eight standard inclinometers are installed on Bay-Goose Dike, as detailed in Appendix I (Table 5 and Table 6). The inclinometer displacements are referenced along Axis A and Axis B. Axis A is perpendicular to the cut-off wall alignment (positive displacement towards the Pit side) while Axis B is perpendicular to Axis A, parallel to the cut-off wall (positive displacements towards the increasing stationing). Cumulative displacement in Axis A varied from 0.1 mm to 12.5 mm. Cumulative displacement values for Axis B varied from 0.1 mm to about 10 mm. The larger settlement happened in the upper portion of the dike and in the thermal cap. Recorded displacements are mainly small and are within the tolerable displacements for the structure.

In August 2021, a local displacement of 4 mm towards the south, parallel to the wall, was measured at El. 134.5 m. This measurement was not repeated during the next data acquisition, suggesting that the August 2021 readings were erroneous. One possible reason would be the presence of remaining ice or slight blockage in the inclinometer that caused error in the measurements.

No significant movement was observed for other inclinometers from September 2021 to August 2022, of which measurements have remained relatively stable since 2014. Offsets in the measurement were previously linked to the replacement of the reel.

3.3.2.4 Seismograph

Seismograph monitoring of blast vibrations on the crest of Bay-Goose Dike has been done for every blast at Goose-Pit and Pit E4/E5. AEM analyzed the monitored blast vibrations after each event. The maximum allowable peak vector sum for all dikes is set at 50 mm/s per designer recommendations. No blast was done in the reported period since mining activities were terminated at the Meadowbank site.

3.3.2.5 Flow Meters

In 2022, the total average flow of all active monitored seepage stations, no. 6, 7, 8, and 9, due to seepage from the toe of the dike was measured at a maximum of 20.5 m^3/d, compared to 18 m^3/d in 2021, and much higher values in early years of operations. More measurements were taken in 2022 during freshet compared to previous years. The measured flow does not take into account the inflow of water from the pond at Central Channel, as this value has not been measured since 2015 (61 m^3/d in 2013 and 2014). Overall, seepage is relatively stable and less than anticipated and therefore not currently a concern.

The North Channel is being monitored by stations 8 (30+420) and 9 (30+380) and had no measurable flow in 2022. It is the third year that no measurable seepage is observed at this seepage station, which could be linked to the progressive freezing of the area.

The Central Shallow seepage channel is being monitored by station 7 and had an average flow of 8.2 m^3/d compared to 8.3 m^3/d in 2021. This is consistent with historical trends.

Channel 3 is monitored by station 6, which recorded an average of 12.3 m^3/d compared to 7.1 m^3/d in 2021. This is consistent with historical trends.

Flows observed in 2022 are stable compared to previous years. It is recommended to continue monitoring the evolution of the seepage at the toe of the dike and to continue measuring the inflow of water from the pond at Central Channel.

Based on the instrumentation data, the performance of Bay-Goose Dike is satisfactory, as piezometric, thermal, seepage, and inclinometer data do not show concerning deteriorating conditions, although the evolution of the North Channel and Channels 1 and 2 must be monitored.

3.4 Vault Dike

Vault Dike is located across a shallow creek that connects Wally Lake and Vault Lake, at the Vault Pit area. Vault Dike was designed and constructed as a zoned rockfill dam with filter zones and an impervious upstream liner consisting of a bituminous membrane. The dike has an upstream key trench made of aggregate mixed with bentonite.

3.4.1 Field Observations during Inspection

No geotechnical concerns were identified, and Vault Dike was in good condition.

A photographic log and record of inspection form for Vault Dike is provided in Appendix A3.

3.4.2 Geotechnical Instrumentation Data Review

Four thermistor strings were installed on Vault Dike and four are operational, as detailed in Appendix I (Table 7). The instrumentation is indicating that the foundation of the dike is mostly frozen all year long and that the structure is behaving as expected with data following historical trends. Given that the remaining instruments indicate a frozen state as expected, it is considered unnecessary to replace the broken instrument.

The following thermal regime observations were made:

- The instrumentation shows that the entire foundation of Vault Dike (till and bedrock) is frozen, with instruments at the centre of the dike (TH06 and 07) showing a decrease in the active layer thickness over the years (permafrost rising in the dike material).
- The upstream toe liner tie-in remained entirely frozen all year long.
- The active layer in the rockfill was up to 3.5 m thick in the summer of 2022.

4.0 WHALE TAIL MINE DEWATERING AND WATER MANAGEMENT DIKES

The dewatering and water management dikes at the Whale Tail Mine site include: WTD, WRSF Dike, IVR Dike, and Mammoth Dike. WTD has been in operation since the dewatering of Whale Tail North pond in March 2019. The commissioning of WRSF Dike and Mammoth Dike began with freshet 2019 onset when water reached the toe of the structures. The IVR Dike was built in early 2021 and now fully commissioned for the first year.

The most current version of the OMS manual (AEM 2021c) is dated November 2021 for the Whale Tail Mine dewatering dikes. The most current version of the overall Emergency Response Plan (AEM 2021d) is dated September 2021. It is good practice to review these documents each year to keep the information up to date, particularly the 24-hour contact name and phone number. In 2022, AEM modified some of the dike inspection frequencies (AEM, 2022), which will be added into the next OMS update.

A detailed visual inspection of the dewatering dikes is performed by AEM once a month, except for Mammoth dike which is inspected monthly from May to September only due to it being in permafrost and stable. More frequent routine inspections are conducted as required by the OMS manual depending on the Trigger Action Response Plan (TARP) level. All instruments on WTD, IVR Dike, WRSF Dike, and Mammoth Dike are connected to a system that automatically collects and transmits data every three hours. Data for all instruments can be visualized on the VDV software. A review of the instrumentation data for the Whale Tail Mine dewatering dikes is presented in the following sections. During the year, regular review of the instrumentation on the dewatering dikes is done by mine personnel and observations and recommendation are compiled in a follow-up file. Access to the instrumentation data on VDV was provided by AEM for all structures on site for Golder’s review. Continued monitoring and review of instrumentation data is recommended. In the case of a significant variation in the instrumentation data, the designer should be notified according to the OMS manual. A significant variation is defined by a change compared to usual seasonal trends and should be followed up to monitor the evolution of the event and identify its causes and consequences, as well as the appropriate actions to take.

Figure C3 shows a plan view of WTD, Figure C1 shows a plan view of WRSF Dike, and Figure C4 shows a plan view of Mammoth Dike. These figures indicate the location of the photos taken and observations noted during the inspection.

4.1 Whale Tail Dike

WTD is a structure to isolate the Whale Tail Pit from Whale Tail Lake. The WTD is located on a shallow plateau of the lake floor with an approximate 2 m depth of water. This plateau is located between deeper sections of the lake with water depths of about 12 m. The WTD is a zoned rockfill dike with a core composed of a dynamically compacted fine filter. The low permeability element of this structure is a cement-bentonite cut-off wall consisting of secant piles drilled through the densified fine filter core and anchored into the bedrock. The elevation of the cut-off wall is 157 m, and is covered by a 2 m thick rockfill thermal cover with a crest at elevation of 159 m. The bedrock foundation was curtain grouted to a depth of 10 m along the western section of the dike in 2018 to 2019. The foundation along the eastern section of the dike was not initially curtain grouted as it was frozen at the time of construction. The dike has an average height of 9 m and a 13 m wide crest. Upstream and downstream rockfill platforms with a crest elevation of 154 m are present, although the upstream platform is submerged by water.

The downstream side of the dike was dewatered between March and September 2019 and the Whale Tail South (WTS) Lake level upstream side of the dike is limited by discharge through the SWTC. Significant seepage was observed at the toe of the dike from the summer of 2019. The surface seepage is collected in a trench from Sta. 0+720 to 0+430 and monitored by two V-notch weirs installed in the trench at Sta. 0+430 and 0+520. About 35 visible streams from the downstream toe are identified with survey sticks at the crest of the trench. Another 20 are identified right at the toe of the dike. Two other streams in the two bays downstream of 0+430 are observed as well. A sandboil area was reported by AEM at 0+365 as well as an additional visible flow area at 0+277. Based on WTS water level measurements in the past two years, it is likely that about 200 to 550 m^3 of the seepage is not visible but flows through the bedrock. Both visible and underground seepage appear to report to the Attenuation Pond and Whale Tail Pit (through the south wall) by gravity.

To mitigate the seepage, a grouting remediation campaign was conducted from November 2019 to March 2020 to inject a grout blanket at the interface between the fractured bedrock and the secant piles, directly downstream of the cut-off wall between Sta. 0+750 and 0+176. The effectiveness of this campaign seems to be confirmed by instrument data and observed seepage flow rates (Section 4.1.2).

A seepage interception system composed of a series of four pumping stations (P1 to P4) was installed over the winter of 2020 at the downstream toe of WTD, on the downstream side of the seepage collection trench. This system has not yet been commissioned. Refer to Section 11.6 for the description of this system.

4.1.1 Field Observations during Inspection

No immediate geotechnical concern was observed with WTD during the inspection. The dike is currently closed to all traffic.

Near the East abutment, the movement observed in 2021 has progressed slightly. Some tension cracks (20 mm wide, a few metres long) are still visible, although less numerous than in 2021. The settlement on the downstream side of the crest near the East abutment appears to have increased to 500 to 700 mm (compared to 300 to 500 mm deep in 2021). The areas showing the most settlement also exhibited a slight displacement of the downstream toe (by about 700 mm in the downstream direction), although no bulging is visible. The movement still only appear downstream of the cut-off wall. This area is known to be subject to new foundation thawing from instrumentation data and the deformations are likely thaw-induced. It is recommended to repair the crest to design elevation and keep monitoring the deformation. Repair works should be done in summer to avoid trapping snow in the rockfill and creating further crest deformations.

During the inspection, a small amount of water was observed flowing out of the rockfill at the downstream toe of the dike, around Sta. 0+170. The location seems to be above WTS water level and has no obvious correlation with runoff or a nearby water discharge. The origin of this water was investigated by AEM and surveyed at El. 156 m, above the lake level. This indicates that it is likely coming from melting of the ice in the backfill due to the unusually hot weather, rather than seepage.

At the time of the inspection in July 2022, the V-notch measuring seepage was not functional but was planned by AEM to be reinstalled at a different location in the summer. According to AEM, the seepage rate was stable compared to 2021, about 60 to 100 m^3/h. The seepage water was clear but shows a high pH in the seepage channel (around 9 to 10). According to AEM, the water quality has been relatively constant since the fall of 2019. The seepage interception system was not active since the water quality is not suitable for pumping back to WTS. Instead, the seepage water is let to drain towards the Attenuation Pond for treatment.

The discharge of water from the water treatment plan in WTS was located upstream of the dike at approximately Sta. 0+700 through the diffusers (Section 11.2).

4.1.2 Geotechnical Instrumentation Data Review

Piezometers, thermistors, and a seepage monitoring station are installed on WTD (Appendix I). Many of these instruments have shown evidence of seepage through the bedrock since their installation.

4.1.2.1 Piezometers

In general, the series of P1 and P2 piezometers (downstream of the cut-off wall) react to pumping of the Attenuation Pond, suggesting a connection through the bedrock. The P3 instruments (upstream of the cut-off wall) show higher pressures than the downstream side. At Sta. 0+260, the P1 line further downstream indicates higher pressure than the P2 line, closer to the wall. At Sta. 0+360, this is only the case near the surface of the foundation (piezometers C). This trend is not observed at Sta. 0+440, where P1 pressures are lower than P2 pressures. In general, gradients are consistent with observed seepage areas and directions. An upstream to downstream and downward vertical gradient is observed across the wall (P2-P3 lines). Lower pressure at Sta. 0+360 in the P2 line compared to the corresponding piezometers at 0+260 and 0+440 suggests a lateral gradient towards this location, consistent with the potential seepage flow path identified by the geophysical survey.

The piezometers have mostly stabilized around the beginning of August 2019 after dewatering of the downstream side and are now on a stable trend. The series of P3 piezometer generally show a link to the downstream pond level at depth (piezometers A and B) and to the lake water level within the embankment (piezometers C). The exception to this trend is PZ 0+440 P3, where all piezometers follow the lake water level trend. At 0+260, deeper P3 instruments (A and B), P2 instruments as well as P1A (in the bedrock) react slightly to lake level variations.

New piezometers were installed in the spring of 2021 at 0+550 and 0+701. These instruments appear to have stabilized following their installation and indicate a functioning cut-off wall. PZ 0+701 P1C and P2D showed high pressure fluctuations between respectively November 2021 and February 2022, and between August 2021 and

March 2022. The pressure increase almost entirely dissipated in PZ 0+701 P1C, while it entirely dissipated in PZ 0+701 P2D. AEM confirmed both instruments as functional. This trend could be linked to confined pressure with frost, but the pressure dissipating before freshet requires further investigation.

In addition to the general trends, the following observations were made:

- PZ 0+260 P1C showed a rapid increase in pressure (+0.7 m) at the end of August in 2020 and 2021 and the pressure remained high during the following winter before slowly dissipating during the spring. However, in 2022, a large drop in pressure (about 9 m) was observed instead, starting in May. Pressure is back to normal values in August 2022. The mechanism is not understood despite the instrument being confirmed functional and must continue to be monitored. PZ 0+260 P1B also had a sharp pressure increase in February of 2022 (+2 m), in the general trend observed in 2021 but with a higher amplitude, which then slowly dissipated by August. The variations do not seem linked with fluctuations of the Attenuation Pond level, nor the WTS lake level. Of the piezometers at 0+260, only P1C is frozen and therefore this increase cannot widely be attributed to freezing around the instruments. According to AEM, this is due to seepage pathway freezing and causing an ice blockage at the end of the seepage channel near the Attenuation Pond, gradually freezing the seepage channel up to the toe of the dike.
- PZ 0+260 P3A and B exhibit a yearly pressure rise between September and November (+0.3 m in 2022), which then dissipates. The variations do not appear linked with fluctuations of the Attenuation Pond level. None of the piezometers at 0+260 are frozen and therefore this increase cannot be attributed to freezing around the instruments.
- PZ 0+360 P1C has been flagged as unreliable due to unrealistic data trends showing an excessively high increase in pressure. However, it has a unique consistent trend that seems to be seasonal for several years: a large pressure increase occurs in December (about +35 m in 2021); followed by a partial dissipation in April 2021 (about -28 m in 2022); and another spike in May (about +16 m in 2022). The pressure comes back to below the lake level by November. No other variation observed in other instruments is visible in PZ 0+360 P1C. This instrument is not frozen and should continue to be monitored.
- PZ 0+440: P1B and P2C are on a yearly slow rising trend between August and November (+0.3 m in 2022), and the pressure then dissipates slowly by February. No correlation with WTS or Attenuation Pond levels is observed, nor the presence of ice at the downstream toe observed in the winter. These instruments have been noted in the past for having local trends that could indicate an uncertain mechanism potentially including flow across the cut-off wall but this is not supported by thermal data. They are also exhibiting more small-scale variations (instrument noise) than other piezometers at this location.

Some piezometers have been flagged as frozen over the past years (PZ 0+260 P1C, PZ 0+360 P2A, PZ 0+440 P2C, and P3C). At this date, PZ 0+360 P2A has thawed, while PZ 0+260 P1C remains frozen and PZ 0+440 P2C/P3C undergo seasonal freezing. On all these instruments, readings appear normal, not suggesting any apparent damage to the sensors. The data must be interpreted with caution.

4.1.2.2 Thermistors

Eight thermistor strings have beads showing capacitive effects due to water infiltration within the cable. Other than those, here are the relevant observations:

- West abutment (0+110, 0+142): in permafrost condition until August 2020 when the bedrock thawed entirely and rapidly at 0+142, reaching the lake temperature, suggesting seepage is currently flowing through the upper bedrock in this area. This section of the bedrock was not injected during the grouting campaign as it was still frozen. Cooling seems to be occuring in the deep bedrock after the initial thawing and seasonal freezing below El. 148 m continued in 2022. At the very edge of the abutment (0+110), the bedrock is still frozen, placing the limit of the permafrost between 0+110 and 0+142.

- 0+210, 0+425, 0+475, 0+550, 0+635: the bedrock remains thawed at these locations with seemingly little amplitude in the seasonal variations. 0+425 and 0+550 were installed in March 2021.
- 0+240, 0+380, 0+596, 0+645 (installed in March 2021): the bedrock remains frozen since installation between El. 140 to 142 m and 135 to 130 m and thaws seasonally below that elevation.
- 0+310, 0+360, 0+453, 0+530, 0+580: rapid warming in summers in the upper bedrock, similar to INC-0+560, suggesting lake connection through fractured upper bedrock in this zone. The yearly warming seems to be less pronounced over time in all these instruments.
- 0+520: strong seasonal variations linked to lake temperatures in summer. A potential explanation is that water may flow along the grout curtain stopping at 0+516 and seeping through the bedrock (potential seepage location). The deep bedrock seems to be starting to freeze again below El. 130 m after April 2020, with cooling continuing in 2022. This could be a result of the bedrock grouting operations.
- 0+407: strong reactivity in the cut-off wall and at the bedrock interface. The deep bedrock has been thawed since the installation of the instruments but seems to be starting to freeze at El. 131 m, which is the only available bead in the deeper bedrock. This could be a result of the bedrock grouting operations.
- 0+500 (installed in March 2021): the bedrock remained thawed entirely all year with a temperature variation of about 11°C, similar to TH 0+520.
- 0+607, 0+665, 0+675, 0+685, 0+695, 0+707: temperature variations are mainly located within the wall and in the upper bedrock, suggesting less connectivity of the bedrock to the lake at this location. This might suggest a potential defect within the wall and a seepage location within the heavily fragmented bedrock. Permafrost condition no longer observed in deep foundation (below El. 132 m) since the end of 2020 at 0+607.
- 0+720, 0+740: the temperature variations seem to be mostly above the interface, with little variations in the thawed upper bedrock (between 0°C and 3°C).
- Most thermistors installed upstream of the cut-off wall (0+190, 0+260, 0+336, 0+710) indicate that the temperature trend within the bedrock follows the lake water seasonal temperature variations since July 2019, suggesting the bedrock is fractured and connected to the lake in these areas. Several beads are no longer functional on these instruments.
- Upstream thermistor at 0+750: the bedrock was originally in a permafrost state below El. 148 m. However, the bedrock above El. 143 m thawed after August 2020 and is now on a stable trend, reacting to seasonal lake temperature variations since, suggesting seepage is going through the upper bedrock in this area. This section of the bedrock was not injected during the grouting campaign as it was still frozen.
- East abutment (0+772, 0+790): all of the bedrock is in a permafrost state. Until April 2020, the bedrock above El. 148 m showed a small reactivity to lake temperature variations, while the base of the wall from El. 151 m to 153 m exhibited a stronger connection to the lake, similar to nearby TH 0+675. All the bedrock and the wall up to El. 154.5 m are now in permafrost at 0+772. This could be a result of the bedrock grouting operations.

TH 0+790 was installed in 2021 and currently shows continuously frozen bedrock. The permafrost limit is therefore now placed between 0+772 and 0+750.

- Downstream instruments (0+340, 0+618): these instruments were installed a distance away from the downstream toe to monitor freeze-back of the foundation. At 0+340, the bedrock thawed all year below El. 138 m, but the freezing front appears to deepen yearly. At 0+618, the bedrock remained frozen during the summer of 2022 for the first time.

Based on temperature profiles and geophysical surveys conducted in 2019, AEM identified the most conductive zones (less latency and most compliance to lake trend), ranked as follows: 0+520, 0+453, 0+310, 0+210, and finally 0+675. The less thermally reactive zones shown by TH 260-360-407-607 confirmed that the potential seepage zone at 0+360 shown by the geophysical surveys was not backed by thermal analysis, perhaps because it is in deep bedrock. However, 0+210 showed a seepage zone. In summary, likely seepage zones were identified by thermistors at:

- 0+210
- 0+450 to 0+550
- 0+650 to 0+750

These areas were targeted by the bedrock grouting campaign. Several areas show freezing of previously thawed bedrock (0+260, 0+360, 0+407, 0+520, 0+772), suggesting a reduction in the local seepage rate through the bedrock. On the contrary, some areas previously in permafrost experienced a rapid thawing in 2020 (0+142, 0+750 upstream), and the trend appears stable since then (no further degradation). This is likely due to the seepage flow concentrating due to the decrease in conductivity in grouted zones and relocating to previously frozen areas near the abutments. In the case of the East abutment, this correlates with observed tension cracking due to thaw-induced settlement, although the permafrost at Sta. 0+772 indicate that the movement is not likely to progress indefinitely. Although seepage relocation and continued thawing of the foundation has the potential to increase the seepage rates and impact structure performance, no such increase is observed at the moment.

Some areas show a strong reactivity to lake water temperature variations (most of them between 0+520 and 0+707) that correlates with the seepage pathways identified. The thermal trends have been stable for several years and currently do not suggest deteriorating conditions.

4.1.2.3 Inclinometers

Four shape-array accelerometers (inclinometers) are installed in the cut-off wall of WTD. Displacements observed are within the OMS manual values (less than 50 mm cumulative displacement). Movements with an amplitude of 2 to 3 mm on the longitudinal axis of the dike have been observed at some other locations but are within the instrument precision limit and so may not be accurate.

There is a seasonal cooling and warming trend observed in the thermistors of the inclinometers that are within the cut-off wall, the same is observed on both the piezometer temperature and thermistor strings. The following observations were made for the different inclinometers:

- INC-0+205: the cut-off wall is moving slightly towards the downstream side (maximum amplitude 32 mm) and slightly towards the west (maximum 14.1 mm). No significant movement was recorded in 2022. The thermistor suggests that the upper bedrock is thermally connected to the lake temperature, which is confirmed by nearby thermistor TH-0+210, although the inclinometer started freezing for the first time over the winter of 2021 and is still cooling down.

- INC-0+366: above the platform at El. 154 m, the cut-off wall was moving slightly towards the downstream side (maximum 13.9 mm from the baseline). Between El. 143 and 154 m, the wall is moving towards the downstream side (maximum 6 mm). No significant movement was recorded in 2022. This area seems thermally connected to the lake as well through the bedrock, as the thermistor shows seasonal variations in the bedrock. Progression of the freezing front is observed in the dike over the years.
- INC-0+560: the portion of the cut-off wall above the platform at El. 154 m was moving towards the upstream side (maximum 21.3 mm) and towards the east (maximum 17 mm). No significant movement was recorded in 2022. The thermal regime is stable in this instrument, with the bedrock fully thawed and rapid warming in summer at the base of the cut-off wall, but with a lag compared to the lake temperature variations which does not suggest significant seepage.
- INC-0+726: above El. 152 m, the cut-off wall was moving mostly towards the upstream. Below El. 152 m, the wall was moving towards the downstream side. Movement towards the east is observed between El. 145 and 155 m (maximum 20 mm) and towards the west above that elevation (maximum 18.2 mm). The general movement trend is more pronounced at the bedrock interface. No significant movement was recorded in 2022. The bedrock was thawed since 2019, but started to freeze during the winter in 2021 above El. 147 m.

4.1.2.4 Flowmeters

The seepage flow that daylights at the downstream toe of the dike is collected into a trench where several V-notch weirs have been installed. Some areas of seepage are not collected but only visually assessed, accounting for about 100 m^3/h in 2020, and stable since then according to AEM. Calculations done by AEM in the past based on measured water levels on both sides of the dike suggested that about half of the seepage was not observed but instead flowed within the bedrock.

In 2022, the flow rate estimated by pumping (since the V-notch weir at Sta. 0+430 was not functional) was around 100 to 150 m^3/h. The minimum rate was estimated at 39.4 m^3/h in March 2022, however this value is underestimated due to the seepage channel being blocked by ice for 1.5 month according to AEM. Pumping rates were used to estimate the seepage rate in the past when the V-notch weir was not functional and AEM previously estimated a maximum of 100 m^3/h with this method; however, it is not as precise or consistent as the V-notch weir due to other inflows into the attenuation pond. It is important to keep a functional seepage rate measurement all year. At the time of the inspection, AEM was planning to reinstall a more durable V-notch weir before the end of the summer.

The grouting operations seem to have significantly decreased the seepage rate compared to 2019. Even though the impact on the non-visible seepage flowing through the bedrock is unknown and it is possible that seepage could drain to different areas of the downstream side and not be measured, flows incoming to the Attenuation Pond and Whale Tail Pit are reportedly steady since grouting operations and seem to confirm seepage reduction. It is recommended to keep monitoring the areas to detect any new visible seepage, such as the abutments, especially the thawing East abutment through which thermal data suggest water may be flowing. Monitoring of the pumping flow within the pit is not considered accurate due to the several water inflow from the surface and other inflow from the pit wall, except in winter where no surface runoff occurs. It is recommended to monitor the southern pit wall water inflow and evaluate if it is possible to install a flow monitoring point capturing the water inflow for the south wall at least relatively visually.

4.2 Waste Rock Storage Facility Dike

The WRSF Dike is a water retention infrastructure designed to prevent contact water from the Whale Tail WRSF accumulating in the WRSF pond from draining to Mammoth Lake. The water collected in the WRSF pond located upstream of the dike is pumped to the Attenuation Pond and treated prior to being discharged. An area of approximately 109 ha drains towards the WRSF pond. The WRSF Dike is located south of the Whale Tail WRSF. This structure is a zoned rockfill dike with a filter system. The low permeability element of the dike consists of a bituminous geomembrane installed on the upstream face up the El. 157.8 m and anchored in a key trench with fine filter amended with bentonite. The key trench is excavated in frozen fluvioglacial sand and gravel type material or bedrock.

In the summer of 2019, seepage was observed at the downstream toe of the WRSF Dike, along with tension cracks and settlement in the crest surface. The upstream pond was pumped out to control the seepage. The seepage mechanism, although not confirmed, was suspected by AEM to be linked with thawing of the foundation below the upstream toe liner tie-in and/or a defect in the liner.

During the winter of 2020, a thermal berm was built on the upstream side of the dike, to promote freezing of the key trench and the foundation. The thermal berm is composed of compacted sand and gravel, which has been amended with bentonite up to El. 156 m, covered with a rockfill protection layer on the crest and upstream slope. A sump was excavated at the upstream toe of the thermal berm around Sta. 0+300 to pump out the upstream pond water as needed to maintain the water level at the operational level at El. 154 m.

4.2.1 Field Observations during Inspection

The WRSF Dike was in good condition at the time of the inspection.

Some water was observed ponding at the downstream toe of the dike, as in previous years. No sign of flow indicating seepage was observed. The dike and upstream thermal berm are performing well.

A pipeline was present at the upstream toe for upstream pond level water management; however, the pumping system installed in the upstream sump was not active at the time of the inspection.

No pumping was occurring in the downstream sump at the time of the inspection.

4.2.2 Geotechnical Instrumentation Data Review

Only thermistors are monitoring WRSF Dike (Appendix I). There are nine thermistor strings installed within the WRSF Dike.

These instruments show that:

- The upstream liner tie-in (TH-01 and TH-03) is now entirely frozen. This confirms the effectiveness of the mitigation measures put in place to promote freezing of the tie-in.
- The exposed rockfill (TH-02, TH-04) reacted to seasonal variations (active layer above El. 153 m) while the rockfill covered by the thermal berm (TH-03, TH-06, TH-07) remained frozen.
- The foundation till (frozen at the time of construction) remained frozen under the thermal berm between September 2021 and August 2022 (TH-06, TH-07). The till was still frozen under the dike at the time of inspection in August 2022 (TH-04); however, it is possible that later in summer, the topmost metre of till under

the dike has episodic thawing similar to that of summer 2021. The overburden upstream of the dike at 0+172 is in the active zone (TH-05). The underlying bedrock in these areas remains frozen.

- The foundation bedrock remains frozen during the entire year.
- Thermistors installed in the upstream thermal berm (TH-08 and TH-09) show that the rockfill is in the active zone but that most of the esker (below El. 156.5 m) as well as underlying materials have remained frozen between September 2021 and August 2022, indicating that the thermal berm is performing as intended.

4.3 IVR Dike

IVR Dike D-1 (IVR Dike) is a water retaining infrastructure built to prevent water from the IVR Attenuation Pond from flowing towards the Amaruq main camp area. This structure is a zoned rockfill dike with a filter system and an upstream thermal berm. The low permeability element of the dike consists of a low linear density polyethylene (LLDPE) installed on the upstream face up to El. 165.5 m and anchored in a central key trench with fine filter amended with bentonite. The key trench is excavated in frozen glacial till or bedrock. The liner is covered in a granular material protection layer. IVR Dike is equipped with an emergency spillway at El. 164.8 m. Additional rockfill was placed on top of the crest near the abutments to increase thermal insulation where dike height is the lowest. The dike was built in the winter of 2021 and the till foundation outside the key trench was only prepared by removing organic materials at the surface.

4.3.1 Field Observations during Inspection

No major geotechnical concern was observed during the 2022 inspection. At the time of the inspection, IVR Dike was fully commissioned, with the IVR Attenuation Pond reaching the upstream toe of the dike. The downstream area was mostly dry. There was no sign of flow or seepage.

Relatively small areas of settlement (300 to 500 mm) were observed on the north abutment, upstream of the thermal rockfill berm. A large area of the dike between Sta. 0+100 and 0+300 show settlement (up to about 300 mm), roughly in the footprint of the former water channel. Tension cracks were visible in the rockfill near the downstream edge of the crest in the southern part of the dike.

The deformations are likely due to settlement in the rockfill and shallow foundation after thawing during the first summer season the dike was fully commissioned, especially in the former water channel area. Instruments show that the foundation is still frozen 2 m below the ground surface. As a result, these deformations are not a concern at the moment but must be monitored to detect any structural degradation. It is recommended to survey the area and to follow-up on the settlement over time to better understand the development of the movement. No repairs are required in the current conditions.

Pipes are passing along the downstream toe of IVR Dike at the time of the inspection, partially blocking the emergency spillway outlet. These objects must be raised on a support at the spillway outlet to avoid blocking it and to ensure the hydraulic capacity of the spillway. If lifted on concrete blocks, these blocks should be placed outside of the spillway outlet and a horizontal support should be placed between them so that no obstruction is left within the spillway. According to AEM, this was done since the inspection, to be inspected next year.

4.3.2 Geotechnical Instrumentation Data Review

Only thermistors are monitoring IVR Dike (Appendix I). There are seven thermistor strings installed within IVR Dike.

Instruments show the following trend for the first year of operation of IVR Dike:

- The rockfill dike remained frozen below El. 163 m (IVR-TH-04) with temperatures ranging from -13°C to 0°C.
- The key trench remained frozen below El. 162.5 m (IVR-TH-01, IVR-TH-05). Temperatures in the key trench show seasonal variation with the warmest period being in winter due to the time delay but remained below 0°C all year (below -3°C at the bottom of the key trench). The coarse filter remined frozen during the summer of 2022, after thawing briefly in 2021 (IVR-TH-02).
- The foundation till and bedrock remained frozen (IVR-TH-02, IVR-TH-03, IVR-TH-04) with temperatures ranging from -13.3°C to -1.5°C in the till, and -10°C to -6.1°C in the bedrock.
- The upstream thermal berm remained frozen below El. 164 m (IVR-TH-03).
- The overburden and bedrock at the downstream edge of the dike footprint remained frozen in 2022 (IVR-TH-06) with temperatures ranging from -11.2°C to -0.5°C under the rockfill. Upstream of the dike (IVR-TH-07) remained frozen below El. 161 m, with temperatures ranging from -11.1°C to -0.4°C, while the exposed upper layer of overburden thawed.

4.4 Mammoth Dike

Mammoth Dike is a water retaining infrastructure built to isolate the Whale Tail Pit from Mammoth Lake. Mammoth Lake receives water from WTS Lake through the SWTC, treated water from the Attenuation Pond, and from the Northeast Sector. Mammoth dike is located across the northeast finger of Mammoth Lake. This structure is a zoned rockfill dike with a filter system. The low permeability element of the dike consists of a bituminous geomembrane installed on the upstream face up to El. 153.5 m and anchored in a key trench with fine filter amended with bentonite. The key trench is excavated in frozen glacial till or bedrock. The liner is covered in a granular material protection layer.

4.4.1 Field Observations during Inspection

No geotechnical concern was observed during the inspection. Water was ponding about 20 m away from the downstream toe in the low topographical point. No sign of flow indicating seepage was observed.

The crest of the dike has a low point where water tends to pond due to lack of regrading. It was dry at the time of inspection.

4.4.2 Geotechnical Instrumentation Data Review

Only thermistors are monitoring Mammoth Dike (Appendix I). There are three thermistor strings installed within Mammoth Dike.

The instruments show that the foundation bedrock remains frozen underneath the dike, with an active layer above El. 152 to 153 m that becomes slightly shallower over the years. The upstream liner tie-in is entirely frozen.

5.0 TAILINGS STORAGE FACILITY

The TSF is located within the dewatered portion of the northwestern arm of Second Portage Lake and consists of the North Cell and the South Cell. The South Cell is comprised of Central Dike, Saddle Dam 3, Saddle Dam 4, and Saddle Dam 5, all built to El. 145 m. The North Cell is comprised of peripheral structures Saddle Dam 1, Saddle Dam 2, RF1, and RF2. The North Cell was internally raised with the construction of the North Cell Internal Structure to a variable elevation ranging from 152 to 154 m. Stormwater Dike is an internal structure separating the North Cell from the South Cell. A plan view of the TSF is shown in Figure 1.

A retention basin and a series of diversion ditches surround the catchment basin of the North Cell. These structures are designed to convey surface water runoff away from the TSF. Since 2014, the Western Diversion Ditch has been collected within a retention basin prior to being pumped within the North Cell when the water quality is inadequate due to a turbidity problem from the erosion of the side slope and the crest of the ditches. Three temporary retention basins and one ditch are constructed within the North Cell at the downstream toe of the North Cell Internal Structure to collect seepage through and runoff from this structure. Refer to Section 10.2 for the inspection of these diversion structures.

The North Cell is being progressively closed in sections except for the North Cell Internal Structure area, which is receiving tailings. Progressive capping was halted in 2019 and tailings deposition resumed temporarily in the North Cell from the North Cell Internal Structure in 2021. The South Cell was filled to almost full capacity. However, tailings are consolidating and settlings since the end of the deposition, which freed up significant additional capacity according to AEM. Water is transferred as needed from the North Cell to the South Cell to control the water elevation of the North Cell, and excess water from the South Cell is pumped out to Bay-Goose Pit or Portage Pit. The OMS manual for the TSF includes alert criteria based on reservoir levels and clear responsibilities to manage the situation in case of rising water levels to avoid overtopping of the structures.

In the summer of 2014, the mine constructed an engineered tailings barrier along RF1 and RF2 to mitigate migration of tailings through RF1 and RF2. Refer to Section 10.3 for the inspection of these structures.

The most current version of the TSF OMS manual (AEM 2021a) is dated July 2021. The most current version of the overall Emergency Response Plan for the mine (AEM 2021d) is dated September 2021. An update is in progress by AEM. It is good practice to review these documents each year to keep the information up to date, particularly the 24-hour contact name and phone number.

An inspection of the TSF is performed once a month by AEM. The instruments have been automatically read every three hours since 2017. The monthly inspection reports were reviewed as part of the annual inspection and provided satisfactory information about the evolution of the structures. A summary of the instrumentation data obtained from the TSF is presented in Section 5.1.2 and Section 5.7.2. Access to VDV for instrumentation data was provided to Golder for review. Continued monitoring and review of instrumentation data is recommended. In the case of a significant variation in the instrumentation data, the designer should be notified according to the OMS manual. A significant variation is defined by a change compared to usual seasonal trends and should be followed up to monitor the evolution of the event and identify its causes and consequences, as well as the appropriate actions to take.

Figure B1 shows a plan view that indicates the location of the pictures and general observations related to the North Cell and South Cell, as well as the North Cell Internal Structure. Figure B2 contains a plan view that shows the location of the photos and observations noted on Stormwater Dike. Figure B3 contains a plan view that shows the location of the photos and observations noted on Saddle Dam 1, Saddle Dam 2, and Saddle Dam 3. Figure B4 contains a plan view that shows the location of the photos and observations noted on Central Dike, Saddle Dam 5, and Saddle Dam 4.

5.1 General Observations of the Tailings Facility

5.1.1 Field Observations during Inspection

Per the TSF design and the standard operating practices captured in the OMS manual, a tailings beach must always be present against all peripheral structures; except Saddle Dam 3, which design was modified to allow water ponding.

At the time of the inspection, the pond of water in the North Cell was limited and located towards the centre of the facility and there was a tailings beach against the peripheral structures to protect them from ice in the winter and prevent the migration of water out of the TSF (see Figure 1 for an approximate location of the tailings beach). The tailings elevation in the North Cell varied between approximately El. 149.5 m and 152.1 m and the pond elevation was at El. 147 m. The tailings beaches against the structures of the North Cell were adequate. The North Cell Internal Structure is built partially on the North Cell tailings and partially on the rockfill cover placed over the last few years for closure operations. No deposition had occurred since 2021 in the TSF. No water was channeling close to the dike slopes.

At the time of the inspection, the tailings elevation in the South Cell had gone down by about 0.7 to 1 m since 2021 when the surface varied between approximately El. 132 and 144.6 m due to consolidation. The surface had not entirely been surveyed yet in 2022, but the highest tailings elevations was estimated from a partial survey to be around 143.9 m in near Central Dike. The South Cell Pond had been drawn down significantly before the inspection, with a pond elevation of El. 138.8 m. As a result, water in the South Cell was no longer ponding against the south part of the downstream toe of Stormwater Dike, and a tailings beach was present against all of Stormwater Dike. This is a favourable point for South Cell closure and environmental concern given that it is inferred that the Stormwater Dike foundation presents some open windows of exposed fractured bedrock that may contribute to feeding the seepage at Central Dike. A tailings beach developed against the majority of Central Dike and Saddle Dams 4 and 5. Water was no longer significantly ponding against the liner in the corner of Central Dike and Saddle Dam 5. At the time of the inspection, no tailings deposition was done in the South Cell, as it has been inactive for several years; however, AEM is considering to resume deposition there in the future to enhance the landform and optimize the residual capacity that increased with tailings consolidation.

At the time of the inspection, Saddle Dams 3, 4, and 5 were operational, with water no longer ponding against the erosion protection of Saddle Dam 3 and adequate tailings beaches against Saddle Dams 4 and 5. Permanent sumps have not yet been installed on the downstream side of Saddle Dam 4 and Saddle Dam 5, and water accumulation is pumped as required. A permanent sump is in operation on the downstream side of Saddle Dam 3. It is important that the water level on the downstream side not be allowed to rise higher than the granular layer of the upstream toe liner tie-in to prevent uplifting of the geomembrane. In general, the TSF was observed to be drier than the previous years. According to AEM, the weather had been unusually hot and dry for several weeks prior to the inspection.

No depressions in the tailings have been observed this year during the inspection, nor reported by AEM. However, some small sandboil-like features with limited surrounding depression were observed in the tailings surface of the North Cell between Stormwater Dike and the rockfill capping around Sta. 11+100 and 10+650. AEM reported that air bubbles were noted coming from these holes earlier in July 2022, although that was no longer the case at the time of the inspection. The release of air from the tailings is likely correlated to consolidation of the unfrozen tailings mass. Part of the North Cell tailings are still unfrozen, mostly at depth and towards the reclaim pond, and are subject to consolidation under the weight of the capping. These features should be monitored to follow their evolution and confirm their origin and mechanism. This recommendation is compiled with those of Stormwater Dike in Table 2 at the end of this report.

Photographs of the North Cell and South Cell of the TSF are provided in Appendices B1 to B7.

5.1.2 Geotechnical Instrumentation Data Review

Nine thermistors are installed in the tailings of the North Cell of the TSF, as detailed in Appendix I (Table 12). They indicate that the tailings in the North Cell are not entirely frozen, including in the talik area where the reclaim pond was kept during operation.

1) NC-T1 shows that the tailings and the bedrock did not freeze between September 2021 and August 2022 below El. 140 m, with temperatures ranging between 0°C and 2.7°C. The unfrozen conditions were attributed to the presence of the supernatant water pond close to the instrument, and since it was always within the supernatant pond during tailings deposition. Between El. 140 m and 143 m, tailings remained frozen.

2) NC-T2 shows that the tailings and the bedrock did not freeze between September 2021 and August 2022 below El. 124.5 m, with temperatures ranging between 0°C and 1°C. The unfrozen conditions were attributed to the location of the instrument directly within the supernatant water pond. Between El. 124.5 m and 145.5 m, tailings remained frozen. An active layer is present in the tailings above El. 145.5 m.

3) NC-17-01 shows that the tailings and bedrock remained frozen between September 2021 and August 2022, with temperatures ranging between 0°C and -11°C.

4) NC-17-02 shows that the tailings and the bedrock did not freeze in 2022 below El. 137.5 m, with temperatures ranging between 0°C and 0.8°C. The unfrozen conditions were attributed to the presence of the supernatant water pond near the Saddle Dams close to the instrument. Between El. 137.5 m and 146.6 m, tailings remained frozen. The depth of the frozen layer (above El. 146.6 in 2022) is slowly increasing over the years.

5) NC-17-03 shows similar data to NC-17-02 and the same cooling trend near the surface. The unfrozen conditions were attributed to the presence of the supernatant water pond between RF1 and RF2 close to the instrument.

6) NC-17-04 shows that the bedrock and tailings remained frozen in 2022 below El. 135 m, with temperatures ranging between 0°C and -3°C. The tailings between El. 139 and 144.5 m remained frozen, with temperatures ranging between 0°C and -6°C. An active layer is observed in the tailings above El. 144.5 m.

7) NC-17-05 shows that the tailings and bedrock remained entirely frozen in 2022. No active layer was observed in the tailings.

8) NC-17-06 shows that the tailings and the bedrock remained frozen in 2022 below El. 145 m, with temperatures ranging between -9.1°C and 0°C. An active layer is observed in the tailings above El. 145 m.

9) NC-17-07 shows that the tailings and the bedrock remained frozen in 2022 below El. 146 m, with temperatures ranging between -17.7°C and 0°C. An active layer is observed in the tailings above El. 146 m.

10) NC-17-08 shows that the tailings and the bedrock did not freeze in 2022 below El. 140.5 m, with temperatures ranging between 0°C and 2.4°C. The unfrozen conditions were attributed to the location of the instrument directly within the supernatant water pond. Tailings remained entirely frozen above El. 140.5 m in 2022.

The temperature profile measured in thermistor SWD-01 is discussed in the next section.

5.2 Saddle Dam 1 – North Cell

Saddle Dam 1 is located in the northwestern corner of the TSF and forms one of the perimeter structures of the North Cell intended to retain tailings and supernatant fluid during the operation and the closure of the TSF. Saddle Dam 1 crosses a depression between the northwestern arm of Second Portage Lake and Third Portage Lake.

Saddle Dam 1 is a rockfill embankment with a 3H:1V upstream slope and a 1.3H:1V downstream slope. This structure has inverted base filters, upstream graded filters, and a LLDPE geomembrane liner on the upstream dike face. The geomembrane liner is placed between an upper and lower non-woven geotextile layer for protection, and is covered by approximately 0.3 m of granular material up to El. 140 m. No granular layer was placed above El. 140 m and the liner is exposed above that elevation. According to the design, a tailings beach must be maintained on the face of the structure to reduce the potential for ice damage to the liner. The abutments are founded on bedrock, while the central portion of the dike is founded on ice-poor soil. Till and/or crushed aggregate mixed with dry bentonite powder have been placed above the toe of the liner.

5.2.1 Field Observations during Inspection

During the inspection, it was observed that Saddle Dam 1 is performing well and does not show any geotechnical concern. An adequate tailings beach was observed along the upstream face of Saddle Dam 1. A stockpile of fine filter material has been present on the north part of the dike since 2011 and poses no geotechnical concern.

A permanent dewatering pump is installed downstream within a seacan container. Water was observed ponding near the sump. Pumping is done during freshet, and as necessary during summer. The environment department is monitoring the water quality during the year and this information is shared with the water management team. The water quality results indicate that the water is not seepage from the North Cell. Given that the foundation of Saddle Dam 1 is now frozen and therefore the weight of tailings will preclude any liner heave, it will be possible at a later stage to remove this pumping station and backfill the toe drain trench to allow natural drainage of the water toward Third Portage Lake. However, as this sump is a permanent feature, it is required that the water quality remains monitored and be reported; the sump therefore cannot be backfilled during operations to comply with legal requirements.

A photographic log and the record of inspection form for Saddle Dam 1 is provided in Appendix B2.

5.2.2 Geotechnical Instrumentation Data Review

Instrumentation on Saddle Dam 1 comprises thermistors, as detailed in Appendix I (Table 9). Four thermistor strings (T1, T2, T3, and T4) are installed on Saddle Dam 1 and are automatically read every few hours following the installation of dataloggers in 2017. Three thermistors (T1, T2, T3) are installed to monitor the thermal condition within the structure and its foundation. The fourth thermistor string (T4) is installed along the upstream face of the dam to monitor the thermal condition of the tailings.

Thermistor data from within the structure indicate that the dike foundation remained frozen from September 2021 to August 2022. The foundation soil and bedrock remained in a frozen state with temperatures ranging from about -2.5°C to -8.9°C. At the upstream toe, below El. 132 m, the compacted till base material below the liner remained frozen. The majority of the rockfill shell remained frozen during the reported year as the active layer was 2 m above El. 146 m. The instrumentation indicates the structure is behaving as expected with data following historical trends.

No sign of seepage or thawing of the foundation soil can be observed from the instrumentation data. The structure is performing as expected.

5.3 Saddle Dam 2 – North Cell

Saddle Dam 2 is located along the western side of the TSF and connects to the western corner of Stormwater Dike. Along with Saddle Dam 1, this dike forms one of the perimeter structures of the North Cell of the TSF that retain tailings and supernatant fluid during the operation and closure of the TSF. Saddle Dam 2 crosses a depression between the northwestern arm of Second Portage Lake and Third Portage Lake.

The upstream foundation of the dike and abutments are primarily founded on bedrock; however, some portions of the structure, underneath the inverted filter, are founded on ice-poor soil. During construction, a thin layer of low permeability till was placed and compacted along the toe liner tie-in connection with bedrock. A thin layer of crushed aggregate (0 to 22 mm) mixed with dry bentonite powder was also placed under the thin layer of low permeability till in areas where open factures were observed within the bedrock. The toe liner tie-in was then covered with till.

5.3.1 Field Observations during Inspection

During the inspection, it was observed that Saddle Dam 2 is performing well and does not show any geotechnical concern. An adequate tailings beach was observed against the upstream side of the structure.

During the inspection, some water was observed ponding on the downstream side within the rockfill embankment (between approximately Sta. 20+275 and Sta. 20+475). This water has been observed since the 2015 annual inspection and the instrumentation indicates that the foundation remains frozen. Per AEM, water has been ponding at that location for a long time. The water is run-off water and is tested by the environmental team regularly during open water season.

A photographic log and the record of inspection form for Saddle Dam 2 is provided in Appendix B3.

5.3.2 Geotechnical Instrumentation Data Review

Instrumentation on Saddle Dam 2 comprises thermistors, as detailed in Appendix I (Table 10). Four thermistor strings (T1, T2, T3, and T4) have been installed at Saddle Dam 2 to monitor the thermal condition within the structure and its foundation.

Thermistor data from within the structure indicates that the dike foundation remained frozen from September 2021 to August 2022 with temperatures ranging from -4.1°C to -8°C. At the upstream toe of the dike, the semi-pervious backfill remained frozen during the year. The rockfill mostly stayed in frozen condition with an active layer above El. 146 m. The instrumentation indicates that the structure is behaving as expected with data following historical trends.

No signs of seepage or thawing of the foundation soil were observed. The structure is performing as expected.

5.4 North Cell Internal Structure – North Cell

The North Cell Internal Structure is located within the North Cell of the TSF, in its northern section. It is built over the existing tailings of the North Cell and the rockfill cover placed over the last years for closure operations.

The North Cell Internal Structure is designed and constructed as a permeable zoned rockfill dam with filter zones, built on the top surface dried tailings of the North Cell and on the existing rockfill cover. The bulk part of the North Cell Internal Structure consists of coarse rockfill material. The upstream face is designed at a 3H:1V slope and the downstream faces are designed at a 1.5H:1V slope. The upstream face of the North Cell Internal Structure comprises two granular filter zones. The filter zones are designed to prevent tailings migration and internal erosion, while allowing water to flow through the embankment. A system of ditches and sumps at the downstream toe of the structure is designed to collect seepage and runoff water.

5.4.1 Field Observations during Inspection

Tailings deposition had not happened since 2021 from the North Cell Internal Structure at the time of the inspection. The deposition points are well built, and channel features in the tailings indicate that the supernatant water has flowed well toward the west side of Stormwater Dike where water is transferred into the South Cell. Channelling of water at the upstream toe of the eastern part of the dike was no longer observed. AEM reported that some water was channelling close to the toe dike earlier in the season, but no erosion of the slope was noted and most of the tailings surface was dry at the time of the inspection.

Tension cracks (10-20 mm wide) were observed in the fine filter slope in the East sector of the dike. The layer of fine filter had been repaired by AEM in 2020 following a sloughing event. The coarse filter is not exposed, and the filter system is still functional. It is recommended to monitor the development of the cracks and repair the fine filter if the coarse filter is exposed to ensure good performance of the filter system; especially in the event of additional tailings deposition in the North Cell (e.g., to optimize the landform).

Some traces of old deformations from 2019 outside of the repaired sector remained visible but appeared stable.

In four locations along the dike, the fine filter was eroded from the top of the slope in a vertical washout scar, likely by water being discharged from a pipe on the crest. The locations are indicated on Figure B1. The underlying coarse filter was not visible, indicating that the filter system is not yet open and should still function. However, it is recommended to repair these scars to ensure the filters do not erode further and extend the water discharge pipe toward the North Cell to avoid water flowing on the filters. Alternatively, a sacrificial liner could be placed on the filter slope at the discharge location to protect the filter from being washed out.

The pumping stations on the downstream side of the dike are in place and working as needed. AEM indicated that the incoming water is from run-off and not from seepage. The capacity of the North Cell to store the inflow design flood must be ensured continuously during tailings deposition.

A photographic log and the record of inspection form for the North Cell Internal Structure is provided in Appendix B1.

5.4.2 Geotechnical Instrumentation Data Review

Four vertical thermistor strings were installed on the crest of the North Cell Internal Structure, with three of them in operational order, as detailed in Appendix I (Table 8). NCIS-01, NCIS-02, NCIS-03, and NCIS-04 show frozen tailings and an active layer within the rockfill (1.5 to 2.5 m thick). In the northern part of the dike (NCIS-03) where the rockfill cover is the thickest, the depth of the active layer seems to be slowly decreasing over the years.

Sixteen prisms are installed on the crest of the North Cell Internal Structure. Prisms were not read in 2022 in the absence of visible deformation on the crest.

5.5 Stormwater Dike

Stormwater Dike is an internal structure that subdivides the TSF into the North Cell and the South Cell within the dewatered northwestern arm of Second Portage Lake. Stormwater Dike cannot be considered as a temporary structure anymore since it is planned to not fill the South Cell to the same elevation as the North Cell. Therefore, there will remain an elevation difference between tailings elevations on both sides. For this reason, it is recommended to review the design basis criteria and assess whether the actual dike configuration and construction still meets the design criteria, and will continue to behave in a satisfactory manner in post-closure conditions. The work could be carried out by the Engineer of Record, but should be revised by the original dike designer.

In this document, the North Cell side is taken as upstream and the South Cell side as downstream.

Stormwater Dike is a rockfill embankment structure. The upstream slope is approximately 3H:1V and the downstream slope is about 1.3H:1.0V. A bituminous geomembrane liner has been installed above the graded filters on the upstream face of the dike. Low permeability till was placed and compacted along the upstream toe of the dike as a tie-in of the liner.

The majority of the dike is seated on dense till from the former lakebed within the talik, with lakebed sediments still present in some areas, while the abutments are generally founded on bedrock.

5.5.1 Field Observations during Inspection

Since 2016, tension cracks and signs of settlements have been noticed on the crest of Stormwater Dike in a repeated pattern over the years. The most probable mechanism of the movement is settlement due to the thawing of soft sediments caused by the rise of ponding water in the South Cell through the Stormwater Dike foundation. To mitigate against a possible foundation failure, a rockfill buttress support was constructed at the downstream toe of Stormwater Dike in the South Cell (from approximatively Sta. 10+300 to Sta. 10+700). After the movement had stopped during each episode, the cracks were filled with bentonite. This is a good practice to limit water infiltration within the cracks.

The structure was in good condition. No active cracks or deformations were observed on Stormwater Dike at the time of the inspection. Old cracks and settlement areas were still visible but appeared inactive. Following the dry weather, numerous surficial desiccation cracks had formed in the granular material of the crest.

Several holes were observed in the geomembrane, at the top of the slope, at the junction with the crest at Sta. 11+050 and 10+550. Although they are above the maximum operation water level, it is recommended to repair these holes to avoid infiltrations in the liner bedding material.

A pipe with a metallic connector was observed on the geomembrane at approximately Sta. 10+900. It is recommended to remove it or install a protective layer underneath it to avoid puncture.

During the annual inspection, the downstream toe of the dike was not visible since it has been entirely covered by tailings. The tailings surface was very uneven against Stormwater Dike due to the water drawdown. On the upstream side, capping was very close to the dike. Small sandboil-like features were visible in the tailings from the dike (Section 5.1.1).

A photographic log and the record of inspection form for Stormwater Dike is provided in Appendix B4.

5.5.2 Geotechnical Instrumentation Data Review

Two thermistors, one piezometer, and 20 prisms are monitoring Stormwater Dike, as detailed in Appendix I (Table 13). Extensometers and crackmeters previously in place have been disconnected, but AEM reconnected some of them for the summer 2022 for monitoring purposes.

SWD-01 is installed on the upstream side of Stormwater Dike within the North Cell tailings. This thermistor shows a stable trend at all depths. The tailings and the bedrock did not freeze between September 2021 and August 2022 below El. 132 m, with temperatures ranging between 0°C and 2.7°C. The unfrozen conditions were attributed to the presence of the supernatant water pond close to the instrument, which prevents freezing of the existing talik zone. The temperature readings indicate that the tailings between El. 132 m and 148 m remained frozen throughout the year. No active layer was observed since 2020.

SWD-03 is installed on the downstream side of Stormwater Dike (approximately Sta. 10+690 m) within the stabilization buttress and is covered by the South Cell reclaim pond. This thermistor shows that the lakebed sediments, till, and bedrock are entirely unfrozen all year since 2021, indicating that the talik condition that was initially present in this area before construction has returned. This could be explained by the water and tailings having overtopped the rockfill buttress, which previously allowed convection of cold air in winter to cool the foundation, but is now insulated from outside air variations. No visible deformations are associated with thawing in the foundation, which must be monitored closely for any deteriorating conditions.

The piezometers show a trend in pore water pressure that had followed the development of the water level in the South Cell reclaim pond but disconnected from it since March 2020. In 2022, the instruments showed the same behaviour as in 2020 and 2021, with pressure appearing disconnected from the South cell but still reacting to freshet inflow with a sharp increase in pressure. A second, smaller increase happened later in the summer. In 2021, this increase dissipated around October. In 2022, the pressure increase was about 12 m in PZ-SWD-03-A and 10 m in PZ-SWD-03-B, with the first partial dissipation observed in June. However, the pressures were on the rise again at the time of the inspection. It is recommended to watch for other unusual fluctuations in these instruments. These two instruments have been at 0°C since they were installed but have remained thawed since the summer of 2020 with a slow warming trend.

Prisms have not been read in 2022 in the absence of visible deformation.

5.6 Saddle Dam 3, Saddle Dam 4, and Saddle Dam 5 – South Cell

The South Cell of the TSF consists of four perimeter structures: Central Dike, Saddle Dam 3, Saddle Dam 4, and Saddle Dam 5. Saddle Dam 3 is located in the northwestern corner of the South Cell and is merged into Saddle Dam 2. Saddle Dam 4 is located in the southwestern corner of the South Cell and is merged into Saddle Dam 5, which merges with the southern end of Central Dike.

Saddle Dams 3, 4, and 5 are designed and constructed as zoned rockfill dams with filter zones, low permeability upstream liners, and upstream toe liner tie-in key trenches. Cross-sections of Saddle Dams 3, 4, and 5 consist of a rockfill embankment constructed from run-of-mine waste rock, placed in lifts, and compacted. The upstream faces are designed at a 3H:1V slope and the downstream faces are designed at a 1.5H:1V slope. The upstream faces of Saddle Dams 3, 4, and 5 are composed of two granular filter zones and a LLDPE liner extending along the upstream foundation. The filter zones are meant to keep the tailings inside the facility in the case of liner puncture, but mainly act as appropriate bedding for the liner. An upstream liner tie-in key trench excavated to bedrock and filled with compacted till is located along the upstream area of the structures.

5.6.1 Field Observations during Inspection

At the time of the inspection, all dikes were operational. The water level of the South Cell was below the upstream toe of the erosion protection cover of Saddle Dam 3. No geotechnical issues were observed with these structures. A section of pipe and a metal rod were present on the liner in the upstream slope of Saddle Dam 4 and should be removed to avoid damaging the liner.

During the inspection, water was observed ponding in some areas of the downstream side of Saddle Dam 4 and Saddle Dam 5. As the downstream toe is higher than the South Cell pond along Saddle Dam 4 and Saddle Dam 5, this water does not come from the TSF. On the downstream side of Saddle Dam 3, in the sump, water is ponding at a level below the South Cell elevation. It is important to maintain the water level on the downstream side lower than the level of the upstream toe liner tie-in granular material layer to prevent uplift of the geomembrane. As the elevation of the downstream side is lower than the elevation of the granular material, this should not be a problem if the downstream water level is managed.

A photographic log and the record of inspection forms for Saddle Dams 3 and 4 is provided in Appendix B5 and Appendix B6. A photographic log and the record of inspection form for Saddle Dam 5 is provided in Appendix B7.

5.6.2 Geotechnical Instrumentation Data Review

Five thermistors are installed at Saddle Dam 3 with three of them operational in 2022, as detailed in Appendix I (Table 14). These thermistors are mostly in permafrost condition, with the bedrock frozen all year. It will be important to keep following the performance of the structure as Saddle Dam 3 is operational for containment of supernatant water. Additional instrumentation will have to be installed for closure.

Four thermistors are installed at Saddle Dam 4 with three of them operational in 2021, as detailed in Appendix I (Table 15). These thermistors are mostly in permafrost condition, with the bedrock frozen all year. The beads in the bedrock for SD4-T4 (in the upstream toe liner tie-in) should be repaired.

Three thermistors were installed at Saddle Dam 5, as detailed in Appendix I (Table 16). SD5-T4 shows frozen bedrock and rockfill up to El. 142 m, while SD5-T2 further downstream indicates that the bedrock and the rockfill are frozen up to El. 140 m. SD5-T3 indicates that the bedrock and the compacted till of the tie-in are frozen up to El. 140 m.

5.7 Central Dike – South Cell

Central Dike is located along the eastern side of the TSF and crosses a depression within Second Portage Lake. Along with Saddle Dam 4 and Saddle Dam 5, Central Dike forms one of the perimeter structures of the South Cell.

Central Dike design includes a compacted rockfill embankment with an upstream seepage barrier, granular filters, and a key trench along the centreline of the dike transitioning on the upstream toe near both abutments. The foundation soils include lakebed sediments and till overlying bedrock. Soft and ice-rich soils were removed from the Central Dike footprint during construction.

5.7.1 Field Observations during Inspection

During the inspection, water was observed ponding at the downstream toe of the dike between approximately Sta. 0+300 and the southern access road at Sta. 0+830. Seepage into the basin at the downstream toe of Central Dike has been observed since 2014 when tailings deposition was transferred from the North Cell of the TSF to the South Cell. The rate of seepage increased proportionally to the rise of the pond level of the South Cell. Field investigations coupled with seepage-stability analyses indicated that the seepage is mainly controlled by openings in the bedrock and that the dike is physically stable. The decrease of the South Cell water level and use of tailings to seal the bottom of the cell reduced the seepage rate, which was 150 m^3/h at the time of the inspection and stable (Section 5.7.2). The South Cell level was very low in 2022 (El. 138.8 m) with pumping volumes similar to 2021, corresponding to precipitation only. AEM also reported that the seepage rate decreased to about 13.6 m^3/h during winter, which is much lower than in previous years. There is a possibility that the seepage could flow below the instrumented zone at Central Dike and flow directly to the Portage Pit downstream.

During the spring, the water in the downstream pond reportedly had an orange coloration with high turbidity, similar to previous years. This event is monitored by AEM and has been attributed to precipitation of iron oxide from bacterial processes.

Central Dike is in good condition. At the time of the inspection, there was a tailings beach against the entire length of the structure including the southern part, after the South Cell water level was drawn down. The geomembrane appeared in good condition. Stormwater Management Pond was being pumped out into the South Cell at the time of the inspection, and the discharge was located at the corner of Saddle Dam 5 and Central Dike. The water discharge that was previously done directly against the liner, with the water falling onto the LLDPE at a high velocity, had been moved to SD5 over the liner tie-in granular cover. No erosion was observed.

Angular granular material (fine filter) was observed in direct contact with the LLDPE liner at Sta. 0+950. If the tailings deposition resumed in the South Cell (e.g., to optimize the landform for closure), the geomembrane should be cleaned to avoid the risk of puncture.

A photographic log and the record of inspection form for Central Dike and Saddle Dam 5 is provided in Appendix B7.

5.7.2 Geotechnical Instrumentation Data Review

Instruments were installed on Central Dike to monitor dike performance during construction, operation, and closure. At the time of the inspection, the instrumentation on Central Dike consisted of a total of 55 piezometers and 21 thermistor strings installed in 18 boreholes, as detailed in Appendix I (Table 17).

The following presents a summary of the data collected from September 2021 to August 2022 for the piezometers and the thermistors.

5.7.2.1 Thermistors

The thermistors were showing similar trends as in the past. The following observations of the thermistor data can be made:

- Throughout the year, temperature variations up to 1°C can be observed for each bead, except in rockfill near the surface (up to 10 m deep) where the amplitude is larger.
- **P1 line (instruments installed along the central key trench):** instruments show thawed conditions within the rockfill, the till, and the bedrock (from El. 110 m to 65 m), typically with temperatures stable ranging between 1°C and 2°C.
- **P2 line (instruments installed along the downstream toe of the Central Dike footprint for a final crest elevation of 150 m):**
  - A cooling trend is visible at the extremities of the dike. The bedrock at 545-P2 was almost entirely frozen above El. 62 m when the instrument stopped working in 2021, with the interval between El. 74 and 80 m remaining thawed all year at around 0.1°C. At 875-P2, the base of the rockfill and the till are in permafrost, while the freezing front is slowly progressing at depth in the bedrock, reaching El. 97 m in 2022. The deep bedrock is stable with temperatures of up to 1°C.

- At 800-P2, the rockfill, till, and bedrock remain thawed and the temperatures were stable (1.3°C to 1.9°C). 650-P2 shows a similar situation (between 0.4°C and 1°C in the rockfill, till, and bedrock).

- **P3 line (downstream of Central Dike):**
  - Thermistors 465-P3 and 1050-P3 show stable permafrost conditions. Slow cooling in the upper bedrock is visible at 1050-P3.
  - Thermistor 650-P3 is still in mostly frozen conditions but seem to indicate thawing at El. 90 m and a general continuation of the slow warming that started at the end of 2020. This could be related to water and tailings deposition in nearby Portage Pit to monitor for further progression.
  - Thermistor 800-P3 is mostly stable, with the till and bedrock unfrozen below El. 105 m. The upper till is now only partly frozen. A very slow cooling of the bedrock was observed.
  - Thermistors 875-P3 and 975-P3 installed near Portage Pit showed that the bedrock remained unfrozen below approximately El. 95 m, with temperatures ranging from 0°C to 1°C. Freezing progressed around El. 75 m in 875-P3, while the frozen front reached down to El. 93 m in 975-P3 in 2022. A freezing trend is observed in these two instruments. This seems to indicate that a permafrost condition has developed in part of the Portage Pit wall.
  - The thermistor installed in the West Road (745-P3) indicated that the rockfill remained unfrozen above El. 120 m, deeper than in previous years. The upper rockfill showed a warming trend since 2017 where the foundation till thaws in summer and remains thawed for longer every year, while frozen conditions are observed the rest of the year. The rockfill and dense till between El. 104 and 123 m are no longer monitored as beads are either broken or capacitive but were previously observed to stay frozen all year long, suggesting that this instrument is at the limit of the permafrost downstream of Central Dike.

These observations tend to confirm the visual observation of seepage downstream as the foundation of the dike (till and bedrock) directly on the downstream side are unfrozen all year. A cooling trend is slowly starting on the edges of the dike but have not yet reached the middle where the seepage is located. Till and bedrock temperature tend to decrease further from the downstream side and the piezometers near Portage Pit show permafrost condition. The exception is instrument 650-P3, where development must be monitored to confirm the origin of the observed warming trend.

No thermal information is available in the Portage Pit wall. With the Pit filling up with tailings and water, it is possible that the frozen wall will thaw, or has already begun thawing, which could reopen some pathways for the South Cell water to seep through. This would be undetected in the Central Dike instruments installed higher up in the bedrock.

5.7.2.2 Piezometers

The general piezometric trend is stable. Most instruments are correlated with the downstream pond elevation.

It can be observed that the piezometers located in boreholes between Sta. 0+595 and Sta. 0+975 are strongly reacting to the level of the water pond located downstream of Central Dike. In those boreholes, the piezometers that are not frozen and not in suction (currently or previously) are recording piezometric elevation around El. 115 m, the downstream pond level. The piezometers between Sta. 0+595 and Sta. 0+975 located in the rockfill, till, and bedrock are reacting similarly, which seems to indicate a hydraulic connection between the downstream pond, the till, and the bedrock. The piezometric elevation recorded in the till and the bedrock between Sta. 0+595 and

Sta. 0+875 is generally slightly higher than the elevation of the downstream pond, indicating excess pore water pressure or a higher seepage flow. Piezometers 650-P2 and 875-P3 are the only instruments that seem to react to the South Cell level instead of the downstream pond level. Piezometer 650-P2-A has been on the rise since December 2015 with a deceleration of the increase after 2018, and the measured piezometric elevation exceeds the dike crest elevation (150 m). This instrument may need to be doubled to confirm this trend. Piezometers 875-P3-A and B are still on a slow rise despite the stabilization of the South Cell level and exhibit small reactions to the downstream pond variations. Pressure in piezometer 875-P3-B has now exceeded that in piezometer 875-P3-A. Piezometers at 875-P3 are also the only instruments in the P3 zone that are recording an unexplained upward trend.

The piezometers located at Sta. 465 and Sta. 580 are not reacting to the downstream pond water level or the elevation of the South Cell and indicate much lower piezometric elevations, with the exception being 580-P1R-A, located in the sand horizon in the bedrock. Piezometer 700-P1-B used to follow the downstream pond variations with a higher pressure, but now overlaps since July 2021 with the downstream pond level, suggesting the establishment of a direct hydraulic connection.

In the summer of 2022, the pressures in 595-P1-A and B (lower bedrock) increased by about 1 m, similar to 2021 and still following the downstream pond variations. Piezometer 825-P1-E is continuing a slowly increasing trend (about 0.6 m per year) and does not seem to react to the South Cell nor the downstream pond variations.

Generally, a downward hydraulic gradient in part of the bedrock and the till can be interpreted in piezometers located in the same boreholes. Small upward gradients in the till or the upper bedrock can also be observed in some boreholes, such as 580-P1-R, 595-P1, and 815 P1R. Significant upward pressure gradients in the bedrock can now only be observed in hole 850-P1, which means that several locations of previously observed upward gradient have now advanced towards a pressure equalization between the instruments. It is not possible to observe a generalized upward hydraulic gradient trend that would indicate that pressurized bedrock is transmitting pore water pressure to the till. The piezometric elevation in the bedrock is often similar to or smaller than recorded in some parts of the till layer. However, due to the topography, it is possible that water is flowing from bedrock located higher and induces excess pore water pressure on the foundation soil located lower below.

Some instruments were broken or malfunctioning, as detailed in Appendix I (Table 17). Those instruments give either no data or erratic data. A piezometer that has frozen once cannot be relied upon even if it thawed, as freezing generally breaks the piezometer or shifts its calibration curve. It is recommended to flag these piezometers and be careful when interpreting their data even if they seem probable.

As in previous years, it can be observed that some piezometers are recording negative pressure (suction). Negative pressure for unfrozen conditions was recorded in two piezometers, as detailed in Appendix I (Table 18), like in 2021. Piezometers in suction are recording very few variations in measured pore water, while the other instruments are reacting to the downstream pond elevation. These instruments are generally located in the bedrock. Based on the available information, it is not possible to determine the exact cause of this suction. This could be due to a problem with the instruments or to a non-continuous geological environment in which the water table is located locally below the installation depth of some of the instruments. The results of these instruments must be interpreted with caution.

5.7.2.3 Flow Meters

At the time of the inspection, a seepage flow of approximately 150 m^3/h was pumped out to maintain the downstream pond at El. 115 m, same as in 2021. Water inflow from this location has been pumped back to the pits (A and E) in 2022 to avoid ice build-up upstream of the dike. Pumping out water from the South Cell combined with an adapted tailings deposition plan effectively reduced the amplitude of the seepage over the last years and the seepage appears stable since 2020. AEM indicated that the flow had decreased to 13.6 m^3/h in winter of 2022 based on pumping data, a decrease from 25 m^3/h in 2021.

5.7.2.4 Seismograph

Seismograph monitoring of blast vibrations on the crest of Central Dike occurred at four locations along the dike for every blast at Portage Pit. The maximum allowable peak vector sum for all dikes is set at 50 mm/s per designer recommendations. No blast was done in the reported period since mining activities were terminated at the Meadowbank site.

5.7.2.5 Turbidity and Water Quality

The turbidity of water in the downstream pond has been monitored since 2015. The turbidity of the downstream pond usually increases with the pump speed. Turbidity was above the threshold value of 15 mg/L for environmental discharge during the summer season; however, the seepage pond water was discharged in the pits all year in 2022.

In the freshet of 2022, similar to previous years since 2017, a change in the water coloration was observed in the downstream pond. The water turned orange and back to normal several times in the cycles. An orange sludge was observed on the surfaces below the water level. No change in pH was measured but turbidity increased during the summer. Per AEM, the available results from chemical analyses indicate that no tailings were present in the downstream pond and that the coloration was linked to natural bacterial processes. This situation is stable.

6.0 ALL-WEATHER ACCESS ROAD

The AWAR, formerly referred to as the All-Weather Private Access Road, was built in 2007 to 2008 to connect the hamlet of Baker Lake to the Meadowbank Mine site. The road is approximately 107 km long with nine bridge crossings and culverts installed at a total of 38 locations. Each structure along the AWAR, designated names, approximate locations, and observations noted during the inspection is provided in Appendix D1.

The road design is based on a general rockfill sub-base and crushed granular rockfill surfacing with a combined minimum thickness of 1 m over thawed stable soil and 1.2 m over thawed susceptible soil.

No sign of thermal degradation of the permafrost was observed on the road during the inspection. It should be noted that signs of thermal degradation may not necessarily be observed due to the regular road maintenance performed by AEM. During the inspection, most water levels and flow velocities at the crossings were normal for the time of year. Some water crossings were drier than usual due to a very dry weather period before the inspection.

Fill material that comprises the majority of the road provides no significant barrier to low gradient water flow due to its coarse nature. During higher flow and runoff periods, water may flow through portions of the road fill. Water was observed flowing through the rockfill at some culvert locations during the inspection and signs that water flowed beneath the road were observed at some other locations during the inspection. This could also be due to the inlet or the outlet of some culverts having been installed too high or too low, which did not promote the flow of water through the culvert until a certain water level had been reached.

During the year, AEM conducts regular and event-based visual inspections of the fish-bearing water crossing locations along the access road. This data should continue to be compiled by AEM to confirm the hydraulic function of the crossings, the adequacy of the crossing locations with respect to the watercourses, and minimal impact to fish habitat.

It is understood that the AEM monitoring program includes an assessment of sedimentation and potential erosion issues at the major bridge crossings. Consideration should be given to expanding the AEM monitoring program to include all culverts and bridges along the road to assess whether they are providing adequate capacity during the freshet and following large precipitation events.

Following comments by Regulators on the monitoring of erosion of the bridge abutments and drainage of quarries, special attention was paid to these locations.

6.1 Culverts

The culverts were generally in good condition at the time of the inspection. No significant degradation of culvert conditions has been observed when compared to the 2021 inspection. Most culverts were unobstructed with no signs of erosion and no signs of damage to the culverts. Many sections of the road that were not equipped with culverts showed accumulation of ponding water against the sides of the road.

Culverts in the following discussion, and in the photographic log, have been identified by name (e.g., R-24) to be consistent with those indicated on the as-built drawings provided by AEM. Each culvert is also identified by its approximate kilometre location (e.g., km 98+250) along the road alignment.

Signs indicating that minor erosion has occurred were observed at the inlet of PC-17A (8+830), and at the outlet of R14 (km 67+840) and R24 (km 98+100). No action is recommended for the culverts showing signs of erosion as the situation seems stable. Culvert erosion progression should be monitored at freshet.

During the inspection, signs of water flowing beneath the road were observed at some locations. This is generally due to the inlet or the outlet of the culvert having been installed too high or too low, which did not promote the flow of water through the culvert until water reached a certain level. This condition can promote erosion and risk of washout beneath the road and should be monitored. This situation has been observed in the past and seems to be stable as no signs of deteriorating conditions were observed. This condition was observed at PC-17A (8+830), PC-11 (39+552), R-14 (67+840), R-18B (82+500), R-20 (85+490), R-23 (93+600), and R-24 (98+100). PC-11, PC-17A, R-14, R-20, and R-23 showed water flow during the inspection. Flows at PC-17A and at R-14 were stable after having shifted locations over the past years. No sign of erosion was noted. The progression of the situation should be monitored at freshet.

Obstructed and damaged culverts were observed at some locations during the inspection. In many cases, the obstructions are related to inlets and/or outlets becoming partially or completely obstructed by accumulated rockfill and road material. There was no substantial increase in the number of significantly damaged culverts observed during the 2021 inspection when compared to last year. The following culverts were too damaged and obstructed to function properly: R-00A (2+550), PC-14 (4+260), unnamed culvert at 5+700, PC-10 (36+865), and PC-16 (54+950). If insufficient capacity to handle the flow is observed at locations where culverts are obstructed or damaged, it is recommended to clear the obstructions or repair the culvert.

The observations and descriptions for each culvert at the time of the inspection as well as recommendations can be found in Appendix D1. For example, for some culverts, it is recommended to monitor the water level upstream and the flow through the culvert during high flow events (e.g., freshet season). A photographic log of the culverts is included in Appendix D2.

6.2 Bridges

Nine bridges are located along the AWAR: four Acrow Panel bridges and five Rapid Span bridges. A structural and/or mechanical assessment of the bridges was not conducted and is beyond the scope of this geotechnical inspection. A description of the observations of the bridges made during the inspection is presented in Appendix D1. A photographic log of the bridges is included in Appendix D3.

The bridges have been identified in sequence, increasing in number along the road from Baker Lake to Meadowbank (e.g., from Bridge 1 to Bridge 9). The name of each bridge (e.g., R02) is consistent with the as-built drawings of the AWAR provided by AEM. Each bridge is also identified by its approximate kilometre location (e.g., km 8+750).

Due to the low-lying terrain between Baker Lake and Meadowbank, water flow typically occurs in broad areas and not in well-defined channels. The majority of water crossings spanned by bridges have increased channelization of flow due to the embankment fill at the crossing location. No significant signs of embankment erosion were observed at the time of the inspection as they are generally constructed with coarse rockfill.

The bridges and their embankments were in good geotechnical condition at the time of the inspection. Signs of settlement were observed at Bridges R05 and R15 and this condition should continue to be monitored. Some bridges showed limited surficial erosion of the granular material on the abutments, but none posed a geotechnical concern or indicated degrading conditions. The following observations were made for each bridge during the inspection and are listed in Appendix D1:

- **Bridge R02 at about km 8+750**: normal flow was observed at the time of the inspection. No signs of erosion or turbidity were noted. Both abutments show deformation of the corrugated steel bins under the weight of the bridge. In 2011, two additional culverts of 1,800 mm in diameter were installed nearby to increase the drainage capacity during high flow events and prevent the road and the bridge from washing out. It is understood that AEM removes snow and ice at this location and other bridges before the freshet and will continue this practice in the future.

- **Bridge R05 at about km 17+600**: minor damage to the bin wall of both abutments was observed; it is likely a result of past snow removal activities. No reparation is required yet. No evidence of erosion was observed. The bridge was observed to dip slightly to the west. The streambed consists primarily of cobbles, gravel, and a few boulders towards the perimeter of the channel.

- **Bridge R06 at about km 23+100**: construction of the bridge has concentrated flow in this area. Very limited surficial erosion of the granular material on the north abutment was observed. No signs of turbidity were observed, and the bridge was in good condition at the time of the inspection.

- **Bridge R09 at approximately km 48+500**: construction of the bridge has concentrated flow in this area. Water is usually flowing under the northeast abutment (dry in 2022 due to low water levels), but no signs of turbidity or erosion were observed at the time of the inspection and the bridge was in good condition.

- **Bridge R13 at about km 62+060**: at the time of the inspection, the bridge was in good general condition. Some erosion of the granular material on the northeast abutment was observed but no signs of turbidity were observed.

- **Bridge R15 at about km 69+200**: signs of settlement were observed as the bridge was dipping toward the western side on both abutments. The bridge foundation did not show any signs of adverse conditions but is slowly settling. No remediation work is recommended for the moment, but the situation should be monitored. Minor damage to the bin wall of both abutments was also observed and is likely a result of past snow removal activities. Limited surficial erosion of the granular material at the south abutment, but no sign of turbidity was observed.

- **Bridge R16 at about km 73+800**: no signs of erosion or turbidity noted, despite some flow beneath the north abutment. Construction of the bridge has concentrated the flow in this area.
- **Bridge R18 at about km 79+500**: the bridge is generally in good condition. The middle steel panel on the bridge deck was repaired since last year. Limited surficial erosion of the granular material was observed, but no sign of turbidity or sediment migration into the streambed was observed. A boulder field is located beneath the bridge and no flow was observed at the time of the inspection.
- **Bridge R19 at about km 83+150**: steel plates with pipe anchors are installed along both embankments of the bridge. Some damage (bending) to the steel containment plates was observed, which may be associated with snow removal activities. The damage is minor and does not impact the geotechnical integrity of the bridge or of the embankment as the surrounding pipes seem to hold the metal sheet in place (protecting the abutment backfill). A series of minor tension cracks were observed in the top surface of the North abutment, similar to a few years prior. Progress should be monitored. No turbidity or erosion was observed at the time of the inspection.

7.0 WHALE TAIL MINE ROAD

The Whale Tail Mine Road was built between 2016 and 2019 to connect the Meadowbank Mine site to the Whale Tail Mine site under development. The road is 64 km long with eight bridge crossings and culverts installed at a total of 290 locations. Each structure along Whale Tail Mine Road, designated names, approximate locations, and observations noted during the inspection is provided in Appendix E1.

The road design is based on a general rockfill from quarries or sand and gravel from esker burrow pit sub-base and crushed granular rockfill surfacing with a combined minimum thickness of 1.0 m over thawed stable soil and 1.2 m over thawed susceptible soil.

The surface of the road at the time of the inspection is in good general condition. Erosion is minimal and limited to the side slopes between 160+430 and 176+000, with no hazard posed to traffic or the stability of the road. It is recommended to be aware of further signs of erosion along the high sandy side slopes along the road and to backfill potential erosion at the toe of bridges as soon as noticed. A photographic log of the inspected road is provided in Appendix E2.

No other sign of thermal degradation of the permafrost was observed on the road during the inspection. It should be noted that as with the AWAR, signs of thermal degradation may not necessarily be observed in the future due to the regular road maintenance performed by AEM. During the inspection, water levels and flow velocities at the crossings were normal for the time of year.

Fill material that comprises the majority of the road provides no significant barrier to low gradient water flow due to its coarse nature. During higher flow and runoff periods, water may flow through portions of the road fill. Water was observed flowing through the rockfill near some culverts during the inspection, and signs that water flowed beneath the road were observed at some locations during the inspection. This could also be due to the inlet or the outlet of some culverts having been installed too high or too low, which did not promote the flow of water through the culvert until a certain water level had been reached.

As with the AWAR, AEM is conducting regular and event-based visual inspections of the fish-bearing water crossing locations along the access road during the year. This data is compiled by AEM to confirm the hydraulic function of the crossings, the adequacy of the crossing locations with respect to the watercourses, and minimal impact to fish habitat.

It is understood that the AEM monitoring program includes an assessment of sedimentation and potential erosion issues at the major bridge crossings. Consideration should be given to expanding the AEM monitoring program to include all culverts and bridges along the road to assess if they are providing adequate capacity during the freshet and following large precipitation events.

Following comments by Regulators on the monitoring of erosion of the bridge abutments and drainage of quarries, special attention was paid to these locations.

7.1 Culverts

All culverts with a diameter larger than 900 mm were thoroughly inspected. Smaller diameter culverts were checked from the road surface. Culverts not observed should be considered possibly buried.

The culverts were generally in good condition at the time of the inspection. Most culverts were unobstructed with no signs of erosion or damage. Culverts observed to be buried last year were mostly still buried.

Many culverts seem to have been installed rather high, depending on the permeability of the road to freshet flow, therefore possibly posing a risk of road washout. The worst condition would be a continuous boulder field under the sand and gravel road foundation without a rockfill layer at the base of the road.

Culverts in the following discussion have been identified by their identification number to be consistent with those indicated on the list provided by AEM. Each culvert is also identified by its approximate kilometre location (e.g., km 132+324) along the road alignment, starting at Vault Pit.

No signs of erosion were observed during the inspection.

During the inspection, signs of water flowing beneath the road were observed at some locations. This is generally due to the inlet and the outlet of the culvert having been installed high above original natural ground surface, which does not promote the flow of water through the culvert until a certain water level has been reached. This condition can promote erosion and risk of washout beneath the road and should be monitored. The progression of the situation should be monitored at freshet.

Obstructed and damaged culverts were observed at some locations during the inspection. In many cases, the obstructions are related to inlets and/or outlets becoming partially or completely obstructed by accumulated rockfill and road material or blocks. The following culverts were completely obstructed or had at least one of the extremities collapsed: #5 (117+525), #7 (118+013), #7-2 (118+016), #12 (4+179 to 4+186; 3 outlets out of 5), #13 (120+615), #27-2 (123+300), #37 (125+035), #38 (125+049), #42 (125+416), #45 (125+710), #48 (127+203), #52 (128+195), #54 (128+388), #55 (128+440), #61 (129+050), #63 (129+390), #65 (130+924), #66 (132+324), #70 (133+837), #82 (136+143), #83 (136+300), #85 (136+671), #86 (136+740), #88 (136+861), #89 (137+180), #93 (138+100), #101 (139+025), #105 (140+555), #111 (142+461), #112 (142+630), #113 (142+736), #115 (142+865), #116 (142+940), #118 (143+433), #133 (148+141), #137 (148+940), #138 (149+000), #150 (152+171 to 152+179), #160

(155+966), #178 (161+170), #192 (163+190), #217 (166+790), #226 (168+935 to 168+937), #234 (170+385), #243 (171+593), #256 (173+350), #268 (175+774), and #281 (178+350). If insufficient capacity to handle the flow is observed at locations where culverts are obstructed or damaged, it is recommended to clear the obstructions or repair the culvert. It is still recommended to monitor culverts #167 (41+843; not seen in 2022, possibly buried) and #232 (53+928; not seen in 2022, possibly buried) where there are signs of water flowing below the culverts.

The observations and descriptions for each culvert at the time of the inspection as well as recommendations are provided in Appendix E1. For example, for some culverts it is recommended to monitor the water level upstream and the flow through the culverts during high flow events (e.g., freshet season).

7.2 Bridges

Eight bridges are located along Whale Tail Mine Road. A structural and/or mechanical assessment of the bridges was not conducted and is beyond the scope of this geotechnical inspection. A description of the observations of the bridges made during the inspection is presented in Appendix E1. A photographic log of the bridges is included in Appendix E2.

The bridges have been identified by their approximate kilometre location (e.g., km 132+000) along the road alignment, starting at Vault Pit.

Due to the low-lying terrain between Meadowbank and the Whale Tail Mine site, water flow typically occurs in broad areas and not in well-defined channels. The majority of water crossings spanned by bridges have increased channelization of flow due to the embankment fill at the crossing location. Embankments are generally constructed with coarse rockfill.

The bridges and their embankments were in good geotechnical condition at the time of the inspection. No signs of erosion or turbidity were observed. Only limited surficial erosion of the granular material behind the concrete wall at the southwest abutment of the bridge 148 (148+000) was noted, which does not pose a geotechnical problem but may create turbidity in the stream during freshet. The Southwest abutment of bridges 132 (132+000) and 142 (142+100) seem to settle but no deformation of the bridges is observed yet. They should be monitored.

8.0 QUARRIES AND ESKERS

8.1 Quarries along the All-Weather Access Road

Twenty-two quarries were developed in the past along the AWAR to provide material for its construction. An additional quarry was developed near the airstrip at Meadowbank to provide further construction materials. All quarries were inspected as part of the geotechnical inspection. A summary of the observations and recommendations made during the 2022 inspection for the structures along the AWAR road, including the quarries, is provided in Appendix E1. In accordance with the as-built drawings, the quarries have been numbered sequentially from 1 to 22 starting near Baker Lake and increasing towards Meadowbank. The airstrip quarry is referred to as Quarry 23 and is used to store miscellaneous items such as drill core on racks, diamond drill contractor drill rigs, seacan containers, pipes, and culverts.

The closure and reclamation plan requires that all quarries and borrow sources developed during the construction of the AWAR be reclaimed following their use. The closure plan further requires that all quarry slopes be left at an angle of 45° to 50°. During the inspection, it was observed that slope remediation was partly completed but none were totally reclaimed. Most quarries are clean although some walls need scaling. Most quarry walls were also free of loose blocks and granular material. Loose blocks and granular material had been placed at the toe of the walls. At the time of the inspection, most of the quarries were dry.

During the inspection, it was observed that Quarries 4, 13, and 14 were flooded. These quarries have been flooded for a couple of years and it is understood that AEM is evaluating how to eliminate the ponding of water. Quarries 15 and 23 contained minor accumulations of water. Quarries that contain significant amounts of ponded water should be monitored to assess if ponding persists and, if necessary, whether ditches should be developed to facilitate the drainage of water.

Unstable blocks and loose rocks along steep walls remain in Quarries 3, 7, 9, 10, 16, 18, and 23. The west wall of Quarry 3 also contains a falcon nest that prevents maintenance. Falcons were seen in several more quarries. It is recommended that workers be cautious in these quarries, be aware of the potential hazard, and stay at a minimum 20 m from the walls.

Quarry 20 was being used at the time of the inspection, with a stockpile of granular material presumable for road maintenance.

A photographic log of the quarries along the AWAR is included in Appendix F.

8.2 Eskers and Quarries along Whale Tail Mine Road

Seven eskers and five rock quarries were developed along Whale Tail Mine Road to provide material for its construction. Most of them are still active. All eskers and quarries were inspected as part of the geotechnical inspection. A summary of the observations and recommendations made during the 2022 inspection for the structures along Whale Tail Mine Road, including the eskers and quarries, is presented in Appendix E1. In accordance with the as-built drawings, eskers have been numbered sequentially from 1 to 6 starting at Meadowbank and increasing towards the Whale Tail Mine site. The quarries are not numbered and were identified for the inspection by their approximate location along Whale Tail Mine Road.

The closure and reclamation plan requires that all quarries and borrow sources developed during the construction of Whale Tail Mine Road be reclaimed following their use. The closure plan further requires that all quarry slopes be left at an angle of 45° to 50°. At the time of the inspection, all of the quarries and eskers were dry, except esker #2 and rock quarry 168, which contained a small accumulation of water. Rock quarry 165 was dry at the time of the inspection, but the concave shape of its floor suggests that it probably floods at freshet.

Unstable loose rocks along steep walls and unstable soil slopes were observed in all eskers and quarries, except eskers #3, #5, and #6. It is recommended that workers be cautious in these locations and are aware of the potential rockfall hazard.

9.0 BULK FUEL STORAGE FACILITIES

This section contains observations made during the 2022 annual inspection of the Baker Lake, Meadowbank, and Whale Tail Mine tank farm facilities (Main Camp only).

9.1 Baker Lake Tank Farm

The Baker Lake tank farm consists of seven large-capacity tanks (10 million litres each) and 20 Jet-A fuel tanks (100,000 L each) that were constructed within five bermed areas (containment cells). Tanks 1 and 2 are located within the first containment area, which is located on the western side of the fuelling area. Tanks 3 and 4 are located within a second containment area adjacent to the first. A central berm is located between the two containment areas. Tanks 5 and 6 are within the third containment area located north and upslope of Tanks 3 and 4. Tanks 5 and 6 are situated within an entirely separate containment cell sub-excavated into the hill slope above the initial tank farm area. Tank 7, built in the winter of 2020, is located within a new containment area built north and upslope of Tanks 5 and 6. A new tank (Tank 8) was built next to Tank 7 in summer 2021. Twenty Jet-A fuel tanks were installed in 2013 in a containment area located northwest of Tanks 5 and 6, lying over a 0.5 m-thick granular base fill material.

Each containment area has been lined with a 1.5 mm high density polyethylene geomembrane to provide secondary containment, except the Jet-A fuel tanks area that are lined with a bituminous geomembrane.

Visual inspection of the majority of the liner in the containment areas for Tanks 1 to 6 was not possible as it is covered with granular fill material to provide protection. The granular fill material protecting the geomembrane was eroded due to wave actions in some areas, exposing the geomembrane. This condition was observed all along the south and north sides of Tanks 1 and 4 and on the south side of Tank 6. A section of exposed geomembrane with a fold was observed at the northeastern corner of Tank 4. The hole in the exposed geomembrane (300 mm diameter hole) previously observed on the southwestern corner of Tank 3 at the toe of the slope had been repaired but the liner ripped again in two locations, as was frequently observed in the past. The reason is likely snow removal activities or other equipment passing close to the corner. The liner should be repaired. It is also recommended to cover the exposed area with geotextile and fill material to re-establish the liner protection and to prevent further damage by equipment. This observation has been recurring for several years and is deemed potentially highly consequential in the event of a leak in this area.

Few animal burrows were observed on the south side of Tanks 3 and 4 this year. It is recommended to assess whether the geosynthetics have been damaged. AEM expressed concern about possible damage to the geomembrane during removal of the granular cover. Golder considers that this verification should still be performed at least once to ensure that the recurring burrows are not causing damage to the geomembrane. This verification should be documented to allow for resolution of this recommendation.

Very little ponded water was observed on the southern side of all containment areas except the one around Tanks 7 and 8. Water ponding in these areas has been observed over the years; however, the amount of water ponding is minimal compared to previous years. No sump or pump was visible during the site visit, although AEM indicates that the containment areas were pumped dry in the spring. It is recommended to keep the water accumulation at a minimum near the tank foundation. Signs of high-water levels being present in this area in the past were noted during the inspection.

AEM reported that a fuel leak occurred in 2020 in one of the old fuel tanks. The tank was repaired, and all other tanks were maintained by AEM after that event. During the 2022 inspection, still no sign of damage was observed following this leak. However, the geomembrane is covered in granular fill over most of the tank containment area and damage (e.g., melting of the geomembrane) might have gone undetected. It is recommended to expose the geomembrane near the leak and inspect the liner for any sign of degradation, and repair it if needed, before reapplying the covering.

The geomembrane of the containment cell of the 20 Jet-A fuel tanks remains uncovered around the tanks. A hole in the liner (100 mm wide) was previously observed on the southwest corner of the containment area and repaired with a patch of geomembrane. However, this patch as well as a second one seems to have detached from the bituminous geomembrane, which is open at these locations. The liner must be repaired in a timely manner to restore containment, as a leak would potentially leak directly into the environment in this current state. Another small rip was found near the top of the slope on the south side of the containment area, to be repaired as well. The bituminous geomembrane no longer shows signs of melting. The melting of the bitumen that occurred in the past may have damaged it in such a way that contaminated water could seep into the environment.

The embankments around the first and second tank farm containment areas were stable. The northern slope of the containment area of Tanks 5 and 6 are steep and the sand and gravel cover may be prone to erosion. Tension cracks observed in the fine filter surface on top of the slope and on the crest in 2020 were still visible but appeared inactive. The area should be monitored and repaired if needed to re-establish liner protection.

The fuelling station on the western side of the tank farm consists of two containers and a pumping system. The fuelling area is covered by granular road base material. The fuelling station was in good geotechnical condition.

A photographic log of the Baker Lake tank farm and a plan view that shows the location of the photos and observations are included in Appendix G1.

9.2 Meadowbank Tank Farm (Main Camp)

The Meadowbank Main Camp tank farm consists of a single large-capacity tank (5.6 million litres) constructed within an area that has been sub-excavated to provide secondary containment. The area has been lined with a 1.5 mm high density polyethylene geomembrane.

At the time of the inspection, the tank backfill foundation pad was in good condition. Minor tension cracks were seen in the granular material southwest of the tank. The liner was well covered with granular fill material for protection.

Little water (approximately 15 mm) was observed ponding within the northern corner, much less than previous years. Signs of high-water levels being present in this area in the past were noted during the inspection. Pumping of ponded water is considered a good practice and should continue.

A fuelling station is located on the northern side of the tank farm. The fuelling area is covered by granular road base material and a geomembrane liner is installed below the refuelling area.

As the tank farm area has been sub-excavated, runoff from the tank farm is not anticipated to occur. The side slopes in the tank area are shallow and appear stable.

A photographic log and a plan view that shows the location of the photos and observations noted at the Meadowbank tank farm is provided in Appendix G2.

9.3 Whale Tail Mine Tank Farm

The permanent Whale Tail Mine tank farm is located north of the main camp.

At the time of the inspection, the tank farm was in good condition. No sign of instability was observed during the inspection. The bituminous geomembrane was largely exposed but in good condition. Very little water was observed ponding within the embankment on the southeastern side of the tank.

Some granular material is missing on the liner anchor on the eastern corner. It is recommended to repair this area.

The use of bituminous geomembrane, as with the other tank farms, can be environmentally problematic if a jet fuel spill melts the material after prolonged exposure, causing a breach in the containment system. Any fuel leak must be detected early enough to remove it before this happens to ensure integrity of the barrier.

A photographic log is contained in Appendix G3.

10.0 OTHER MEADOWBANK FACILITIES

This section contains the observations made for the other Meadowbank facilities visited during the 2022 geotechnical inspection such as site roads, the diversion ditch and erosion protection structure, the Rock Storage Facility (RSF) till plug, the landfill, the contaminated soil storage and bioremedial landfarm facility, the Stormwater Management Pond, the airstrip, and the crusher retaining wall. Figure H1 shows the location of the photos taken during the inspection for the other Meadowbank facilities.

10.1 Site Roads

The following roads were inspected:

- East Road: former haul road between North Portage Pit and East Dike.
- West Road: haul road between North Portage Pit and the plant.
- Site roads around the TSF dikes and the Pits.
- Vault Road: haul road between North Portage Pit and the Vault deposit.
- RF1: starts near the northern abutment of Stormwater Dike and follows the eastern perimeter of the North Cell of the TSF and the southwestern side of the Portage RSF.
- RF2: starts at the end of RF1 and follows the western side of the Portage RSF.

10.1.1 Field Observations during Inspection

These roads were of adequate width and had appropriate berms at the time of the inspection. The haul road leading up the ramp to the crusher was not inspected during this inspection for safety reasons due to the heavy traffic of long-haul trucks. No geotechnical concerns were identified with the site roads.

Three culverts are installed beneath Vault Road at coordinates 640 964 E / 7 217 466 N. They were slightly collapsed in the middle and showed signs of erosion at the inlet. The inlet of the northern culvert was out of the water. This condition has been observed since 2012. No action is required as the condition is stable. These culverts need to be monitored during freshet to ensure they provide sufficient capacity, and that erosion is not occurring. Two other culverts are located at 639 214 E / 7 216 189 N on Vault Road. These culverts are in good condition even though water flows below the culverts on the NP1 Lake side when the water level is low. It is recommended to observe this area at freshet and to clear the obstructions if insufficient capacity to handle the flow is observed.

Temporary roads developed for construction purposes were not inspected.

Photographs of the Vault Road culverts are provided in Appendix H1.

10.1.2 Geotechnical Instrumentation Data Review

Four thermistors were installed to monitor the temperature of RF1 and RF2 (which delineates the northeastern side of the TSF North Cell), as detailed in Appendix I (Table 11).

Two thermistors are installed on RF1 (T121-1 and RF1-3). Thermistor T121-1 showed frozen conditions all year long. RF1-3 showed frozen conditions all year long below El. 147.4 m and an active layer above that elevation, which decreased in depth over the years.

One thermistor is installed on RF2 (T122-1) and indicates that the RF2 foundation is in a permafrost state.

10.2 Diversion Ditches and Sediment and Erosion Protection Structure

A retention basin and a series of diversion ditches (Western and Eastern) surround the catchment basin of the North Cell. These structures are designed to convey surface water runoff away from the TSF.

Since 2014, the Western Diversion Ditch has been directing the water to a retention basin, which is then pumped to the TSF due to a turbidity problem caused by the erosion of the ditches. Discharge is now done in the South Cell to avoid water management issues in the North Cell. Rehabilitation work was done in 2016 to address the situation. The Eastern Diversion Ditch discharges to lake NP-2, then lake NP-1, and then to Dog Leg Lake. Sediment barriers and erosion protection structures are installed at the outlet of the diversion ditch in Lake NP-1, Lake NP-2, and Second Portage Lake (Dog Leg Lake).

During the inspection, it was observed that the diversion ditches around the TSF western and eastern extensions were in good condition. Minor tension cracks (about 2 to 3 m long) were observed in the granular material on the southern slope of the diversion ditch, north of the North Cell capping. No sloughing is observed, no action is required yet beyond monitoring. A piece of pipe is present in the Western Diversion Ditch near the sump and should be removed. The erosion protection structure and sediment barriers were also in good condition at the time of the inspection. It is important that they be inspected during the freshet season as snow melts and allows for visual assessment. The Western Diversion Ditch will need to be amended for closure to drain the accumulation of water in its northern part.

Photographs of the diversion ditch and its sediment and erosion protection structure are provided in Appendix H2.

10.3 Rock Storage Facility Till Plug

The RSF till plug is located on the upstream side of the Diversion ditches access road between the Portage RSF and lake NP2. The till plug is a zoned low permeability earth fill structure intended to prevent seepage from the RSF to reach lake NP2 and to facilitate seepage collection on the upstream side.

The till plug was constructed in the summer of 2013 and consisted of a layer of till with 1 m minimum thickness placed on a foundation excavated to permafrost, which was then covered by 1 m of fine ultramafic rockfill. The materials were compacted with an excavator bucket.

No sign of erosion or geotechnical issues were identified with this structure during the inspection. A pump equipped with an automatic switch was installed within the pond contained by the plug to redirect the water to the North Cell. As the chemical monitoring in NP2 has not shown any signs of contamination in recent years, the performance of the till plug is considered adequate.

Appendix H3 contains photographs of the till plug.

10.4 Landfill

The Meadowbank landfill is located on the northeastern side of the TSF within the Portage RSF area. It is being progressively constructed and filled. Waste material is being dumped within a bermed area on a pad built using waste rock from the Portage RSF. The waste is then covered with a thin layer of rockfill to reduce windblown debris. No geotechnical concerns were identified with the landfill. At the time of the inspection, a new landfill area was in operation at the base of the RSF. Photographs of the landfill are provided in Appendix H4.

10.5 Contaminated Soil Storage and Bioremedial Landfarm Facility

The Meadowbank Contaminated Soil Storage and Bioremedial Landfarm Facility is currently located north of Central Dike, within the South Cell. A 1 m thick till pad has been placed for the landfarm foundation. A berm surrounds the landfarm to contain the fluid/runoff, preventing it from moving laterally. Contaminated soils are stored within this cell to promote biodegradation until the soil meets environmental criteria before being disposed within the Portage RSF.

The active area lies over a natural steep slope covered by rockfill as a pad made to operate the landfarm. The west slope of the rockfill pad is at an angle of repose (seemingly 1.1 to 1.3H:1V). This rockfill was probably placed without lifts or compaction and extends into the South Cell. The slope is considered at risk for high deformation to slope failure. Small tension cracks observed on the crest in 2021 were no longer visible and the berm was in good condition. It is recommended to be aware of further development. If signs of instability are developing again inside the pile, the area should be closed and a thorough assessment and mitigation measures should be put in place.

Photographs of the Meadowbank Contaminated Soil Storage and Bioremedial Landfarm Facility are provided in Appendix H5.

10.6 Stormwater Management Pond

The Stormwater Management Pond is located near the main camp and is being used to store various site waters and sewage. No runoff from the pond was observed at the time of the inspection. No geotechnical concerns were identified with Stormwater Management Pond and the nearby crusher ramp. At the time of the inspection, due to a high-water level, Stormwater Management Pond was pumped out into the South Cell. Due to the proximity of the crusher ramp to the pond, it is recommended that regular geotechnical inspections of the crusher ramp be conducted. The surface of the ramp was not inspected on safety grounds.

10.7 Airstrip

There are several small channels dug adjacent to the airstrip to divert water into small excavations or ponds. The channels and ponds are unlined, and the ponds have no designed outlet structure. In general, these ponds serve to collect water and allow suspended sediments to settle out before the water overflows into other vegetated areas and/or infiltrates them, depending on the thermal state of the soils.

The runway was built to allow a Boeing 737-200 to land at the Meadowbank site. The northwestern boundary of the airstrip extends approximately 20 m within the lake and was constructed in two phases. Rockfill was placed 1 m above water during Phase 1 and the rockfill was constructed to its final elevation during Phase 2. The rockfill slopes for Phase 2 have a side slope of 1.5H:1.0V. The rockfill of Phase 2 is surrounded by a 17 m wide bench going from the toe of Phase 2 to the edge of the crest of Phase 1. The Phase 1 rockfill surface and visible side slope were built with coarse boulders to protect the embankment against waves and ice action. The airstrip construction within the lake is considered appropriate.

The slopes were profiled along a portion of the airstrip to a 3H:1V slope to prevent settlement.

No geotechnical concerns were identified with this structure during the inspection, although some erosion features are observed on the abutments, likely due to washouts of the material by runoff water. These scars are normally repaired as part of airstrip maintenance to prevent progression of the erosion.

10.8 Crusher Retaining Wall

No geotechnical concerns were identified with this structure during the inspection. A photographic log of the Meadowbank crusher retaining wall is provided in Appendix H6.

11.0 OTHER WHALE TAIL MINE FACILITIES

11.1 Attenuation Ponds and Jetties

The Whale Tail attenuation pond is located within the former footprint of Whale Tail North Pond, which was dewatered for the development of the Whale Tail Pit. It receives contact water pumped over the Whale Tail Mine site, and water is treated by the water treatment plant for environmental discharge in WTS Lake or Mammoth Lake.

The IVR attenuation pond is located within the former lake A53, which was partially dewatered and converted into an attenuation pond for the development of the IVR Pit. Similar to the Whale Tail attenuation pond, it receives contact water pumped over the Whale Tail Mine site, and water is treated by the water treatment plant for environmental discharge in WTS Lake or Mammoth Lake. At the time of the inspection, it had been operational for a year and the water was now reaching the IVR Dike.

A jetty and a pump pad were constructed at each attenuation pond to install the reclaim pump that transfers water from the attenuation pond to the water treatment plant. At the Whale Tail attenuation pond, the primary jetty was built in winter with run-of-mine non-acid generating rockfill on the frozen foundation. Due to thaw-induced settlement and space required for piping lines, the jetty was rebuilt and widened in the summer of 2019. A secondary jetty, also built with rockfill, leads to the pump pad from the ring road south of the pit. The IVR attenuation pond jetty was built in several steps since the dewatering of lake A53 in 2020.

No geotechnical concerns were identified with the Whale Tail and IVR attenuation ponds and jetties during the inspection. The discharge points of contact water into the Whale Tail attenuation pond are located directly on the lakebed sediments, which are eroded where the water flows down to the pond (channeling). This does not pose any geotechnical hazard but increases the turbidity in the reclaim water.

Photographs of the Whale Tail attenuation pond and jetty are provided in Appendix H7. Photographs of the IVR attenuation pond and jetty are provided in Appendix H8.

11.2 Mammoth Lake and Whale Tail South Diffusers

Three diffusers are installed in Mammoth Lake for discharge of non-contact and treated water into the environment. The diffusers appear to be installed well and functioning normally.

Additional diffusers are installed in WTS Lake. They appeared to function well.

Photographs of the Mammoth Lake and WTS diffusers are provided in Appendix H9.

11.3 South Whale Tail Channel

The SWTC is built between WTS Lake and Mammoth Lake and convey water from WTS to Mammoth Lake. Its purpose is to limit the water level in WTS to reduce the hydraulic head at WTD. The SWTC inlet elevation at WTS is 155.37 m and is built with a fan shape to reduce risks of blockage by ice or debris. The channel is excavated in the natural ground and covered in granular transition layers, a geotextile, and riprap. Figure C5 shows a plan view of the SWTC.

No geotechnical concerns were identified with this structure during the inspection. Water was flowing in the SWTC. Some settlement was observed in the rockfill berm and slope above the riprap, but since it did not reach the actual channel footprint, it is not deemed a concern at the moment. The riprap surface at the bottom of the channel was slightly uneven in some areas but poses no issue. Turbidity barriers were in place at the outlet in Mammoth Lake.

Photographs of the SWTC are provided in Appendix H10.

11.4 Underground WRSF Saline Ditch

The Underground WRSF Saline Ditch is a water collection ditch built in the periphery of the underground WRSF, located northeast of the Whale Tail Pit. Due to the underground operations in permafrost, large quantities of calcium chloride are used and retained in the waste rock. The purpose of the Saline Ditch is to collect saline water runoff from the facility, and to redirect it by gravity into the groundwater storage pond GSP-1 for recirculation. Figure C6 shows a plan view of the Saline Ditch.

The outlet of the ditch towards the GSP-1 (former AP5 quarry), from a culvert beneath the road, was obstructed by a wooden plank placed by AEM in the winter to avoid snow accumulation inside the culvert. It is recommended to clear this culvert. Most of the ditch debris has been cleaned up but some is still present around Sta. 0+550, where the outlet of the newly installed culvert remains blocked. It is recommended to clear these objects to allow water to flow to the outlet and prevent water flowing out of the ditch.

The Underground WRSF Saline Ditch is being backfilled all along the road by mud and gravel from the road maintenance, pushed into the ditch by snow removal operation in winter and surface grading in summer. The ditch depth has been significantly reduced despite regular cleaning, although a series of boulders has been installed recently along the road to reduce the amount of material being pushed into the ditch in the future. The ditch should be cleared regularly of this extra material to maintain its hydraulic capacity and respect the design freeboard.

Photographs of the Saline Ditch are provided in Appendix H11.

11.5 Underground Ore Stockpile Saline Ditch

The Underground Ore Saline Ditch is a water collection ditch newly built in the periphery of the underground ore stockpile, located northeast of the Whale Tail Pit near the Tramp Metal Removal Facility. Due to the underground operations in permafrost, large quantities of calcium chloride are used and retained in the ore, similar to the waste rock. The purpose of the Saline Ditch is to collect saline water runoff from the facility, and to redirect it by gravity into the groundwater storage pond GSP-1 for recirculation. Figure C6 shows a plan view of the Underground Ore Stockpile Saline Ditch.

During inspection, the Underground Ore Stockpile Saline Ditch was dry. No signs of deformation or erosion were observed. The outlet of the ditch towards GSP-1, from a culvert beneath the road, was clear. Numerous debris from underground operation and the Tramp Metal Removal Facility pad were present in the Underground Ore Stockpile Saline Ditch. It is recommended to clear these objects to allow water to flow to the outlet and prevent water flowing out of the ditch.

Minor tension cracks are present in the west slope of the ditch in its northern section. The cracks are due to the fine granular material moving in the slope and should be repaired if the movement causes material to accumulate in the ditch.

Photographs of the Underground Ore Stockpile Saline Ditch are provided in Appendix H12.

11.6 Sumps and Non-contact Water Management Infrastructures

A number of water collection sumps and non-contact water pumping stations are present on the Whale Tail Mine site. No geotechnical concern was observed with these structures. Water that meets environmental quality criteria is discharged into Mammoth Lake, otherwise it is collected in the attenuation pond and treated before discharge.

A seepage interception system composed of a series of four pumping stations (P1 to P4) is present at the downstream toe of WTD. The purpose is to collect the seepage water and redirect it to WTS if water quality permits, or the attenuation pond to limit water flowing through the foundation and delaying freeze-back, as well as providing a real-time monitoring of the visible seepage rate. Each pumping station is composed of a vertical culvert embedded in the foundation and equipped with an electrical pump, enclosed in a seacan. It is currently not in operation. All stations are in good condition.

11.7 Site Roads

Site roads and culverts at the Whale Tail Mine Site were mostly in good condition during inspection. These roads were of adequate width and had appropriate berms at the time of the inspection. On Road 22, no erosion issue was observed in 2022 following the installation of culverts and backfill of some areas adjacent to the road.

Road 24 (adjacent to SWTC) and Road 25 (Whale Tail WRSF periphery) were still in good condition.

The haul roads around the ore stockpile were not inspected for safety reasons. Temporary roads developed for construction and dewatering purposes were not inspected.

11.8 Landfill

The Whale Tail Mine landfill is located within the Whale Tail WRSF area. It is being progressively constructed and filled. Waste material is being dumped within a bermed area on a pad built using waste rock from the open pit. The waste will later be covered with a thin layer of rockfill to reduce windblown debris. No geotechnical concerns were identified with the landfill. Photographs of the landfill are provided in Appendix H4.

11.9 Contaminated Soil Storage and Bioremedial Landfarm Facility

The Whale Tail Contaminated Soil Storage and Bioremedial Landfarm Facility is currently located on Pad K, West of the IVR Attenuation Pond. A pad surrounded by a containment berm were built in 0 to 20 mm granular material in 2022. Contaminated soils will be stored within this cell to promote biodegradation until the soil meets environmental criteria before being disposed within one of the site WRSFs. The facility was still empty during the inspection.

Photographs of the Whale Tail Contaminated Soil Storage and Bioremedial Landfarm Facility are provided in Appendix H5.

11.10 IVR Diversion Channel

The IVR Diversion Channel is built north of the IVR Pit and the purpose is to collect and divert runoff water that comes from the North East watershed into Nemo Lake water to avoid water flow into the IVR Pit. The channel is excavated in the natural ground and covered in granular material, a geotextile, and riprap. An access built with esker material is adjacent to the channel. Figure C8 shows a plan view of the IVR Diversion Channel.

No geotechnical concerns were identified with this structure during the inspection. Minor tension cracks and holes were observed in the lateral slope of the access road, which is less than about 1.5 m high, due to esker material deforming in the slope. No immediate action is required, but it is recommended to repair the access road if the deformations prevent equipment traffic for maintenance.

Photographs of the IVR Diversion Channel are provided in Appendix H13.

11.11 Tramp Metal Removal Facility Retaining Wall

A new retaining wall was built at the Whale Tail Tramp Metal Removal Facility site, north of the Underground Ore Stockpile. No geotechnical concerns were identified with this structure during the inspection. The east part of the wall was observed from a distance for safety reasons. A photographic log of the Whale Tail Tramp Metal Removal Facility retaining wall is provided in Appendix H6.

12.0 SUMMARY AND RECOMMENDATIONS

The following table presents a summary of the key findings and recommendations of the 2022 geotechnical inspection, as well as progress observed compared to the previous inspection. General recommendations that do not require a specific action are not reiterated in the table for clarity purposes.

Table 2: Summary of Recommendations and Priority Levels from the 2022 Geotechnical Inspection

Year of Recommendation	Priority Level	Recommended Action	Follow-Up the Years After
Meadowbank Dewatering Dikes			
Bay-Goose Dike			
2018	P-4	Water ponds were observed at the downstream toe during the inspection, similar to the previous inspection. It is recommended to pump periodically to allow for good visual inspection of the downstream toe if visibility is impaired by the presence of the pond. The pond flow formed by seepage should continue to be monitored and recorded, no additional action to take.	**Resolved in 2022:** AEM monitors the seepage rate yearly at each station and the water does not hinder inspection.
2018	P-4	Limited evidence of seepage is observed at the downstream toe of the North Channel, Channel 1, and Channel 3. The instrumentation data and field observations seem to indicate that seepage occurs at these locations but flows directly to the Pits instead of the downstream toe area. To continue monitoring, no additional action to take.	**Resolved in 2022:** seepage is ongoing but yearly follow-up is done by AEM and the situation is stable.
2018	P-3	The piezometers in the North Channel show a pressure build-up with the drilling operations associated with the freezing of the nearby pit wall, which needs to be closely monitored to verify the interpretation of the freeze-back. The designer must be advised in the event of significant variations leading to a TARP level change, in accordance with the OMS manual.	**Resolved in 2022:** still the case, similar to other channels where a cooling trend is observed. Item now closed because regular monitoring is in place.
2020	P-4	The general trend in the piezometric readings has been steadily increasing since 2018 and the increase seems to accelerate (about 0.5 m/yr at the moment) and should continue to be monitored. No additional action needed.	**Resolved in 2022:** still the case, appropriate monitoring is performed. The designer must be advised in the event of significant variations leading to a TARP level change, in accordance with the OMS manual.

Year of Recommendation	Priority Level	Recommended Action	Follow-Up the Years After
2021	P-4	The dike crest deformation observed immediately after placement of the thermal cap several years ago do not ease the visual inspection as it is hard to visually observed movement on an unequal surface. It is recommended to fill up the past deformation in a way to produce a flat surface. A flat surface would ease the visual observation. The filling work should be completed in summertime to avoid snow in the backfill material that will later thaw and generate additional deformation.	Ongoing in 2022, planned to complete in 2023.
East Dike			
2019	P-3	VWP-400-C and VWP-420-C show a seasonal trend that is rising through the years since 2015 and doubled annually over the last two years. Total head is now rising close to 2 m in 2019 from those two VWPs, while temperature is cooling. It is recommended to further investigate this behaviour (planned by AEM) and closely follow the significant seasonal trends in the future to react quickly if need be. Based on those aspects, it is considered that those observations should have triggered a yellow threshold criterion per the Dewatering Dykes OMS manual (yellow - personal notification and action required).	**Resolved in 2022:** behaviour investigated and likely linked to freeze-back of the surrounding area. Still visible in 2022, with surrounding instruments starting to show more fluctuation as well. Keep monitoring.
2019	P-4	The general trend in the piezometric readings has been steadily increasing since 2014 and the increase seems to accelerate in 2019 and should be monitored.	Still the case in 2022, to be monitored closely due to new seepage pathway.

Year of Recommendation	Priority Level	Recommended Action	Follow-Up the Years After
2021	P-3	Following the unusual seepage event in winter 2021: ■ Improve the seepage monitoring by measuring the flow rate and turbidity at each seepage collection station. The flow rate measurement method must be improved for accuracy. ■ Install additional thermistors to cover the South Channel area along the centreline and at a distance from the downstream toe.	**Partially resolved in 2022:** ■ AEM installed additional thermistors in the South Channel area after submitting the plan to Golder for approval. ■ The flow rate is still measured as a whole, with a new flowmeter for better measurements. ■ Turbidity was measured in each station for several months this spring and was found to be equal in both.
2021	P-4	The two thermistors strings located at both abutments are not functioning anymore. Since the dike is still in operation for several years and the abutment is subject to develop and aggregate ice lenses, it is recommended to replace those strings of thermistors to monitor the thermal regime until post-closure phase of the mine.	Still the case in 2022, but no immediate need to replace (for closure).
2022	P-2	Two cracks accompanied by a small hole were observed in the crest around Sta. 60+500 and had been painted. If the cracks progress or if new cracks appear, it is recommended to install crackmeters and/or extensometers and survey the crest to quantify the movement. The designer must be notified if movement is noted.	

Year of Recommendation	Priority Level	Recommended Action	Follow-Up the Years After
Whale Tail Mine dewatering and water management dikes			
Whale Tail Dike			
2021	P-3	The following piezometers show unexplained trends, and mechanisms need to be investigated to rule out the development of adverse conditions: ▪ PZ 0+260 P3A and B exhibit a yearly pressure rise in the fall. ▪ PZ0+360 P1C exhibits a unique high-pressure trend that seems to be seasonal. ▪ PZ 0+550 P1C and 0+701 P1C are newly installed and showed large fluctuations in the winter of 2022. ▪ PZ 0+701 P2D is newly installed and had high pressure fluctuations between August 2021 and March 2022.	
2021	P-3	Monitoring of the pumping flow within the pit is not considered an accurate indicator of the seepage due to several water inputs from the surface and other inputs from the pit wall. It is recommended to monitor the southern pit wall water intake and evaluate if it is possible to install a flow monitoring point capturing the water input for the south wall at least relatively visually.	
2022	P-2	The settlement at the East abutment associated to foundation thawing has progressed and lateral movement towards the downstream side is observed, although less tension cracks are observed compared to 2021. It is recommended to repair the crest to design elevation and keep monitoring the deformation.	According to AEM, the work done in September 2022, including a first phase of a thermal berm. It will be continued in 2023. To inspect next year.
2022	P-3	A small amount of water is observed flowing out of the rockfill at the downstream toe of the dike, around Sta. 0+170. The origin of this water must be investigated to rule out possible seepage.	**Resolved in 2022:** field investigation confirmed that water

Year of Recommendation	Priority Level	Recommended Action	Follow-Up the Years After
			was not seepage but came from thawing withing the backfill.
2022	P-2	The V-notch weir usually installed in the seepage collection trench is out of service. It is recommended to replace it shortly to keep monitoring the relative seepage rate.	Planned by AEM at a different location further downstream this summer.
IVR Dike			
2021	P-3	Raise piping present in the lower part of the emergency spillway to free the spillway outlet. The raise must be done in a way that will not leave any obstruction in the spillway (e.g., concrete blocks outside of the spillway outlet and a horizontal support in between).	Still the case during the inspection in 2022. According to AEM, the pipes have since been raised to free the outlet, to inspect in 2023.
2022	P-3	A large area of the dike between Sta. 0+100 and 0+300 show settlement (up to about 300 mm), likely due to shallow foundation settlement in the footprint of the former water channel. It is recommended to survey the area and to follow-up on the settlement over time to better understand the mechanism.	
Tailings storage facilities			
Stormwater Dike			
2018	P-4	An assessment should be conducted as to whether the design criteria will still be met with a different final tailings elevation on both sides of the dike. This can be done by the Engineer on Record but needs to be reviewed by the design engineer. Tailings surface differential elevation could also impact the seepage flow, which may impact the thermal regime and affect the cells freeze back.	Still the case in 2022: no development on this aspect.
2020	P-4	Monitor the piezometers PZ-SWD-03-A and B as they are starting to show large and unexplained variations in the pressure readings.	Still the case in 2022 and being monitored: trend seems to be seasonal, mechanism to confirm.

Year of Recommendation	Priority Level	Recommended Action	Follow-Up the Years After
2022	P-3	Remove the pipe with a metallic connector from the liner at approximately Sta. 10+900 or install a protective layer underneath to avoid puncture.	
2022	P-4	Repair the holes in the liner (6 in total) located on top of the slope, at the junction with the crest at Sta. 11+050 and 10+550, to avoid infiltrations in the liner bedding material.	
2022	P-3	Monitor the development of sandboils and/or sinkholes in the North Cell tailings between the dike and the capping to follow their progression and confirm origin and mechanism.	
North Cell Internal Structure			
2020	P-3	Linear erosion features were observed at several locations in the upstream surface, where the fine filter has started to wash out from the crest to the toe of the upstream toe. They were likely caused by important volumes of water draining from the crest during freshet, as no water discharge had been done in these areas. To monitor for aggravation and possible repair needed.	Still the case in 2022 at several locations. Lengthening the pipes toward the centre of the cell could help reduce the water flow on the filter and its erosion. Alternatively, a liner could be used to protect the filter at the discharge location.
2022	P-3	Tension cracks (10-20 mm wide) in the fine filter slope in all the east sector of the dike. It is recommended to monitor the evolution of the cracks and repair the fine filter if the coarse filter starts to be exposed to ensure good performance of the filter system.	
Central Dike			
2019	P-3	Water was observed ponding along the LLDPE liner on the south side of Central Dike and Saddle Dam 5, from Sta. 0+850 m. It is recommended to remove this water before it freezes to protect the LLDPE liner. Recurring situation every year that is usually well managed by AEM.	**Resolved in 2022:** the South Cell has been largely dewatered and no significant amount of water is ponding

Year of Recommendation	Priority Level	Recommended Action	Follow-Up the Years After
			against Central Dike. The geomembrane appears in good condition.
2021	P-3	Water is being discharged from a small height at high velocity directly on the LLDPE liner at around Sta. 0+950. The liner should be protected with a sacrificial liner to avoid erosion by the water flow if AEM decides to discharge water into the South Cell again.	**Resolved in 2022:** the water is discharged into the South Cell from SD5, over the liner tie-in granular cover. No erosion is observed.
2022	P-3	Gravel is present on the geomembrane around Sta. 0+950. If tailings deposition resumes in the South Cell, it is recommended to clean the liner beforehand to avoid puncture.	
Saddle Dams 3, 4, and 5			
2021	P-3	A section of pipe with a metal connector and a metal rod are present on the liner of SD4 and should be removed to avoid damaging the liner.	Still the case in 2022.
All-Weather Access Road			
2018	P-4	The erosion of the culverts is stable. The progression of the erosion of culverts PC-17A (8+830), PC-11 (39+552), R14 (67+840), R18-B (82+500), R-20 (85+490), R-23 (93+600), and R24 (98+100) should be monitored at freshet for any signs of progression or washout, as signs of water flowing beneath the road were observed at these locations.	Still the case in 2021.
2018	P-4	For some culvert locations, monitoring is recommended to see if flow occurs through the culvert (i.e., during the freshet). If insufficient capacity to handle the flows is observed, or water circulates under the road, then it is recommended to clear the obstructions or repair the culverts. Particular attention should be paid to R-00A (2+550), PC-14 (4+260), the unnamed culvert at 5+700, and PC-16 (54+950).	Still the case in 2022.

Year of Recommendation	Priority Level	Recommended Action	Follow-Up the Years After
Whale Tail Mine Road			
2019	P-3	Obstructed and damaged culverts were observed at some locations: #5 (117+525), #7 (118+013), #7-2 (118+016), #13 (120+615), #27-2 (123+300), #45 (125+710), #48 (127+203), #54 (128+388), #55 (128+440), #64 (129+920), #65 (130+924), #83 (136+300), #85 (136+671), #86 (136+740), #88 (136+861), #89 (137+180), #93 (138+100), #97 (138+436), #98 (138+482), #101 (139+025), #105 (140+555), #112 (142+630), #113 (142+736), #115 (142+865), #116 (142+940), #117 (143+173), #118 (143+433), #133 (148+141), #150 (152+171 to 152+179), #151 (152+562), #160 (155+966), #163 (156+474), #192 (163+190), #234 (170+385), #241 (171+235), #268 (175+774), #278 (177+870), #283 (178+965), and #284-2 (179+072). If insufficient capacity to handle the flow is observed at locations where culverts are obstructed or damaged, it is recommended to clear the obstructions or repair the culvert. It is still recommended to monitor culverts #167 (41+843) and #232 (53+928) where there are signs of water flowing below the culverts.	Still the case in 2022 for #5 (117+525), #7 (118+013), #7-2 (118+016), #12 (4+179 to 4+186; 3 outlets out of 5), #13 (120+615), #27-2 (123+300), #37 (125+035), #38 (125+049), #42 (125+416), #45 (125+710), #48 (127+203), #52 (128+195), #54 (128+388), #55 (128+440), #61 (129+050), #63 (129+390), #65 (130+924), #66 (132+324), #70 (133+837), #82 (136+143), #83 (136+300), #85 (136+671), #86 (136+740), #88 (136+861), #89 (137+180), #93 (138+100), #101 (139+025), #105 (140+555), #111 (142+461), #112 (142+630), #113 (142+736), #115 (142+865), #116 (142+940), #118

Year of Recommendation	Priority Level	Recommended Action	Follow-Up the Years After
			(143+433), #133 (148+141), #137 (148+940), #138 (149+000), #150 (152+171 to 152+179), #160 (155+966), #178 (161+170), #192 (163+190), #217 (166+790), #226 (168+935 to 168+937), #234 (170+385), #243 (171+593), #256 (173+350), #268 (175+774), and #281 (178+350).
Quarries and Eskers			
2018	P-4	Presence of unstable blocks and loose rocks along steep walls and unstable slopes was observed in Quarries 3, 7, 9, 10, 12, 16, 18, and 23, as well as all eskers and quarries along the Whale Tail Mine road except Esker #5. It is recommended that workers be cautious in these quarries and are aware of the potential hazard.	Still the case in 2022 with Quarries 3, 7, 9, 10, 16, 18, and 23, as well as with all eskers and quarries along the Whale Tail Mine road excepted eskers #3, #5, and #6.
Bulk Fuel Facilities			
Baker Lake Tank Farm			
2018	P-4	Ponded water within most containment cells was observed. Removal of water should be managed to keep the water accumulation at a minimum near the tank foundation.	**Not observed in 2022:** almost no water ponding during the inspection in all containment cells.

Year of Recommendation	Priority Level	Recommended Action	Follow-Up the Years After
2018	P-3	The granular fill material protecting the geomembrane was eroded due to wave actions in some areas, exposing the geomembrane. This condition was observed all along the south side of Tanks 3 and 4 and on the west side of Tank 1. A section of exposed geomembrane with a fold was observed at the northwestern corner of Tank 2 and the northeastern corner of Tank 4. It is recommended to cover the exposed area with geotextile and fill material to re-establish the liner protection. Liner is exposed on the northern side of Tank 5. As this condition appears above the elevation of the southern berm, it is considered that the protection of the liner with granular material is not as important as in other areas; however, it remains a good practice and provides protection against animal damage.	**Partially resolved in 2022:** still exposed geomembrane on the north and south side of Tanks 1 to 4, in the northeastern corner of Tank 4, and newly exposed geomembrane on the south side of Tanks 5 and 6.
2018	P-2	A hole in the exposed geomembrane (300 mm diameter hole) was observed on the south-southwestern corner of Tank 3 at the toe of the slope. The hole in the geomembrane should be repaired to ensure a good performance of the retention basin. It is also recommended to cover the exposed area with geotextile and fill material to re-establish the liner protection.	Still the case in 2022: the geomembrane was damaged again at the same location. It should be repaired and covered with geotextile and granular material.
2018	P-3	Animal burrows were observed near the southern corner of Tank 2. It is recommended to assess whether the geosynthetics have been damaged under the granular cover at one location at least.	Still the case in 2022: animal burrows were observed on the south side of Tanks 3 and 4.
2020	P-2	A hole in the liner was observed on the southwestern corner of the containment cell of the 20 Jet-A fuel tanks. The hole in the geomembrane should be repaired to ensure a good performance of the retention basin.	Still the case in 2022: the repairs done on two holes in this area did not hold and the geomembrane is open. A third rip was observed on top of the slope in the same sector.

Year of Recommendation	Priority Level	Recommended Action	Follow-Up the Years After
2021	P-2	A fuel leak was reported by AEM in 2020 from one of the old fuel tanks. The geomembrane could be damaged by fuel contact under the granular cover. The geomembrane should be exposed for visual inspection in the leak area, repaired if needed, and covered again.	Still the case in 2021.
Meadowbank Tank Farm			
2018	P-4	Ponded water within the secondary containment cell was observed. Removal of water should be managed to keep the water accumulation at a minimum near the tank foundation.	**Not observed in 2022:** almost no water ponding during the inspection.
Whale Tail Mine Tank Farm			
2020	P-3	Some granular material is missing on the liner anchor on the eastern corner. It is recommended to repair this area.	Still the case in 2022. No movement observed in the liner.
Other Meadowbank structures			
Meadowbank Site Roads			
2018	P-4	Three culverts were installed on Vault Road (coordinates 640 964 E / 7 217 466 N). As previously observed in past annual inspections, these three culverts were partially collapsed in the middle and showed signs of erosion at the inlet. This is currently not a significant issue, but it is recommended to monitor these culverts at freshet to ensure they provide sufficient capacity and that erosion is not occurring.	Still the case in 2022.
Landfill and Contaminated Soil Storage and Bioremedial Landfarm Facility			
2018	P-2	The landfarm lies over a natural steep slope covered by rockfill as a pad made to operate the landfarm. The slope is considered at risk for high deformation to slope failure. The risk will increase as the water level in the South Cell rises. Signs of superficial slope failure were observed during the inspection. It is recommended to watch out for signs of instability and be prepared to close off the area if need be. Workers who access the area should be informed of the potential risk and be trained to recognize signs of instability.	**Resolved in 2022:** no cracks, area is stable.

Year of Recommendation	Priority Level	Recommended Action	Follow-Up the Years After
Other Whale Tail Mine structures			
Underground WRSF Saline Ditch			
2021	P-3	Blocks and debris are present in the ditch close to the south culvert (ditch outlet) and should be cleared to avoid water flowing out of the ditch.	**Partially resolved in 2021:** most of the debris have been cleaned up but some are still present around Sta. 0+550, where they block the outlet of the newly installed culvert.
2021	P-2	The ditch is being backfilled all along the road by mud and gravel from the road, pushed into the ditch by snow removal operation and surface grading. The ditch depth has been significantly reduced. The ditch should be cleared every year of this extra material to maintain its hydraulic capacity.	**Partially resolved in 2021:** some mud and gravel were still present in the ditch from road maintenance and spring surface erosion, but boulders have been placed between the road and the ditch to reduce pushing of road material into the ditch.
2022	P-3	The outlet of the ditch towards GSP-1, from a culvert beneath the road, was obstructed at its outlet by a wooden plank placed by AEM in the winter to avoid snow accumulation inside the culvert. It is recommended to clear this culvert.	
Underground Ore Stockpile Saline Ditch			
2022	P-2	Numerous debris from the stockpile and the crusher pad are present in the ditch. They must be removed to ensure the ditch capacity.	

Year of Recommendation	Priority Level	Recommended Action	Follow-Up the Years After
2022	P-3	Minor tension cracks are present in the West slope of the ditch in its northern section. The cracks are due to the fine granular material moving in the slope and should be repaired if the movement causes material to accumulate in the ditch.	

WRSF = waste rock storage facility; AEM = Agnico Eagle Mines Limited; VWP = vibrating wire piezometer; OMS = operation, maintenance, and surveillance; TARP = Trigger Action Response Plan; LLDPE = low linear density polyethylene.

13.0 REFERENCES

AEM (Agnico Eagle Mines Limited). 2021a. *Tailings Storage Facilities Operation, Maintenance and Surveillance Manual.* Version 10. July 2021.

AEM. 2021b. *Dewatering Dikes Operation, Maintenance, and Surveillance Manual*. Version 9. November 2021.

AEM. 2021c. *Whale Tail Water Management Infrastructure Operation, Maintenance and Surveillance Manual.* Version 2. November 2021.

AEM. 2021d. *Emergency Response Plan, Meadowbank Complex*. Version 16. September 2021.

AEM, 2022. Change in Water & Tailings Management Infrastructure Surveillance Program – Change in Inspection Program, March 6th, 2022.

Ministry of Energy and Mines. 2017. *Health, Safety, and Reclamation Code for Mines in British Columbia.* June 2017.

Signature Page

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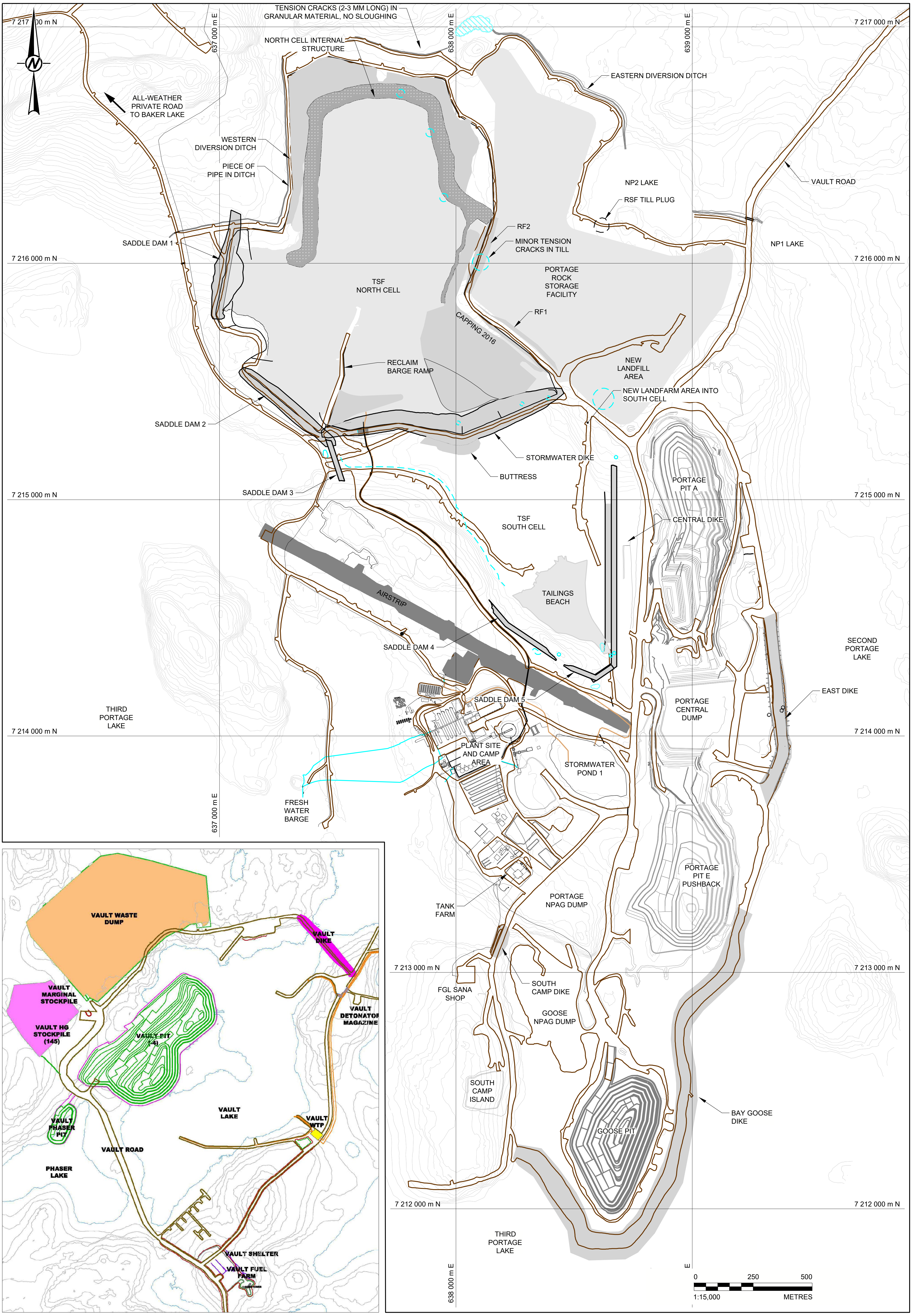

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TOPOGRAPHIC CONTOUR

NOTE

GRID REFERENCE: NAD 83, UTM ZONE 14.

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CLIENT

AGNICO EAGLE

CONSULTANT

wsp GOLDER

YYYY-MM-DD	2022-10-21
PREPARED	M. Habersetzer
DESIGN	C. Pachis
REVIEW	M. Habersetzer
APPROVED	Y. Boulianne

PROJECT

2022 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

MEADOWBANK MINE SITE DURING THE ANNUAL INSPECTION OF 2022

PROJECT No.	PHASE	Rev.	FIGURE
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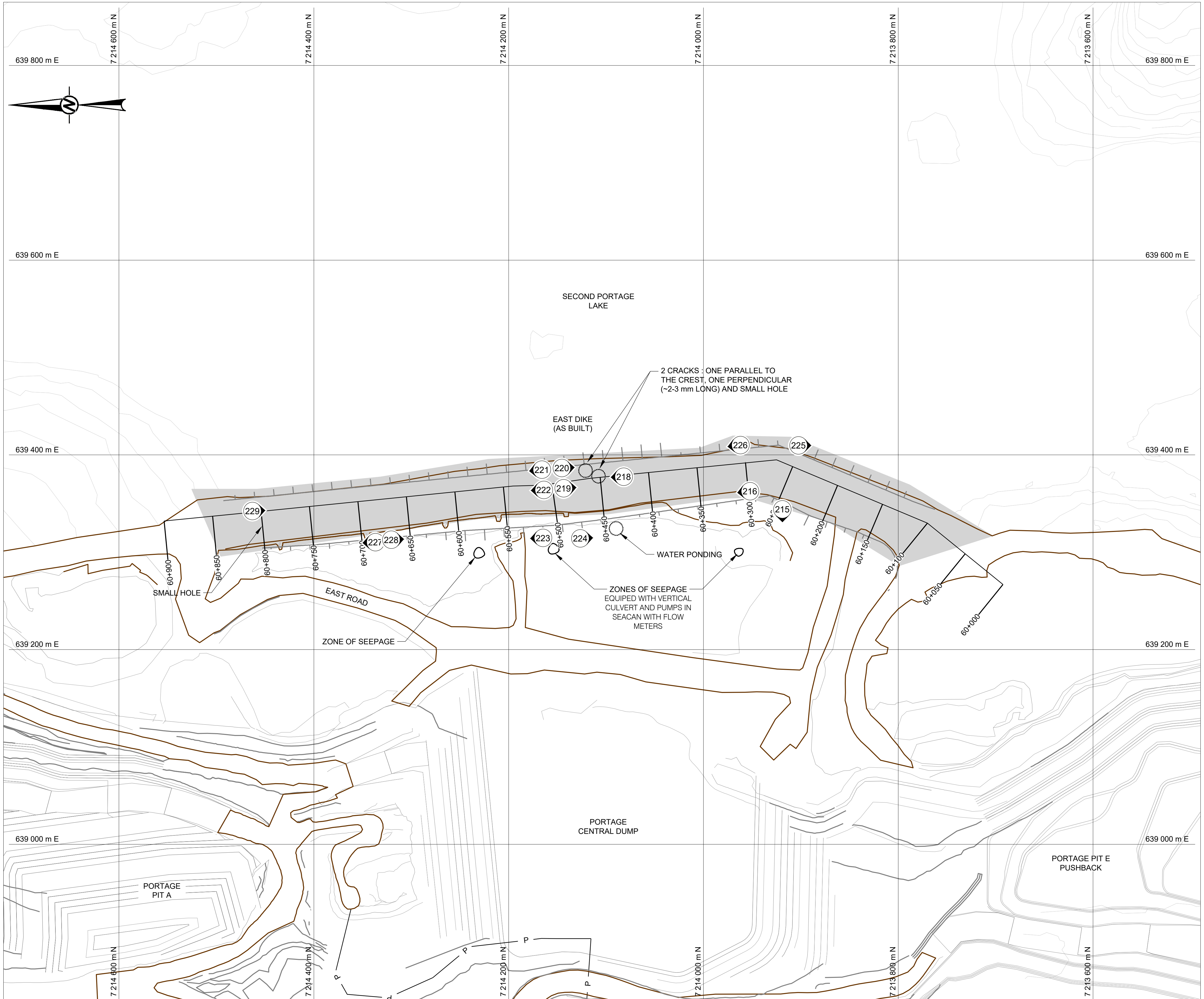

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TOPOGRAPHIC CONTOUR

IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2022

NOTE

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REFERENCE

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1:4 000 METRES

CLIENT
AGNICO EAGLE

PROJECT
2022 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE
EAST DIKE DURING THE ANNUAL INSPECTION OF 2022

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-10-21
PREPARED	M. Habersetzer
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REVIEW	M. Habersetzer
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PROJECT No.	PHASE	Rev.	FIGURE
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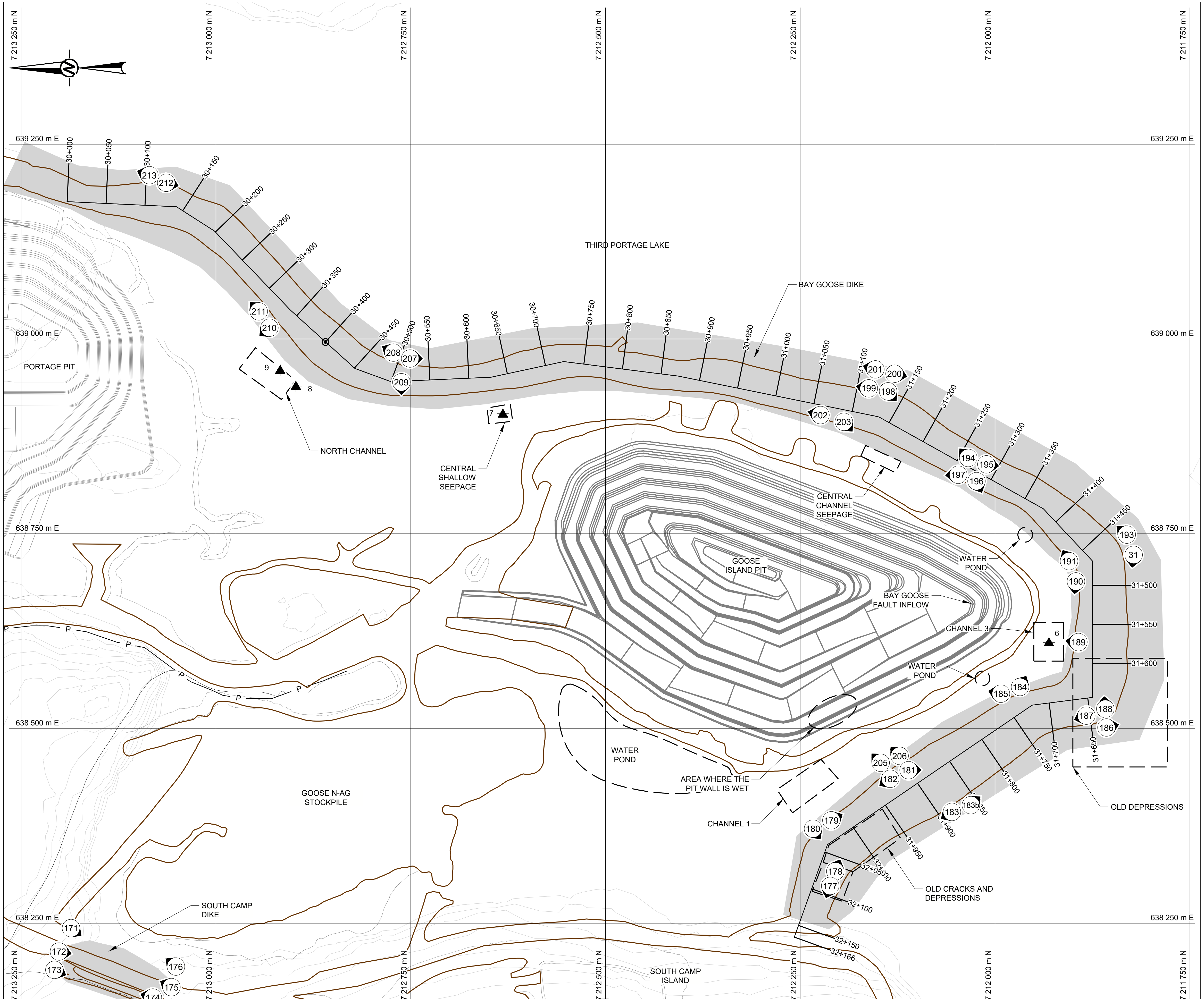

LEGEND

TOPOGRAPHIC CONTOUR

IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2022

MANUAL MONITORING FLOW STATION

WATER ACCUMULATION. NO SIGN OF FLOW.

NOTE

GRID REFERENCE: NAD 83, UTM ZONE 14.

REFERENCE

DRAWING BASE PROVIDED BY AEM LTD., MEADOWBANK DIVISION IN "MBK Site map updated JULY 2014.dwg" DATED JULY 8, 2014.

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PROJECT

2022 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

BAY-GOOSE AND SOUTH CAMP DIKES DURING THE ANNUAL INSPECTION OF 2022

CONSULTANT

WSP GOLDER

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PREPARED	M. Habersetzer
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PROJECT No.	PHASE	Rev.	FIGURE
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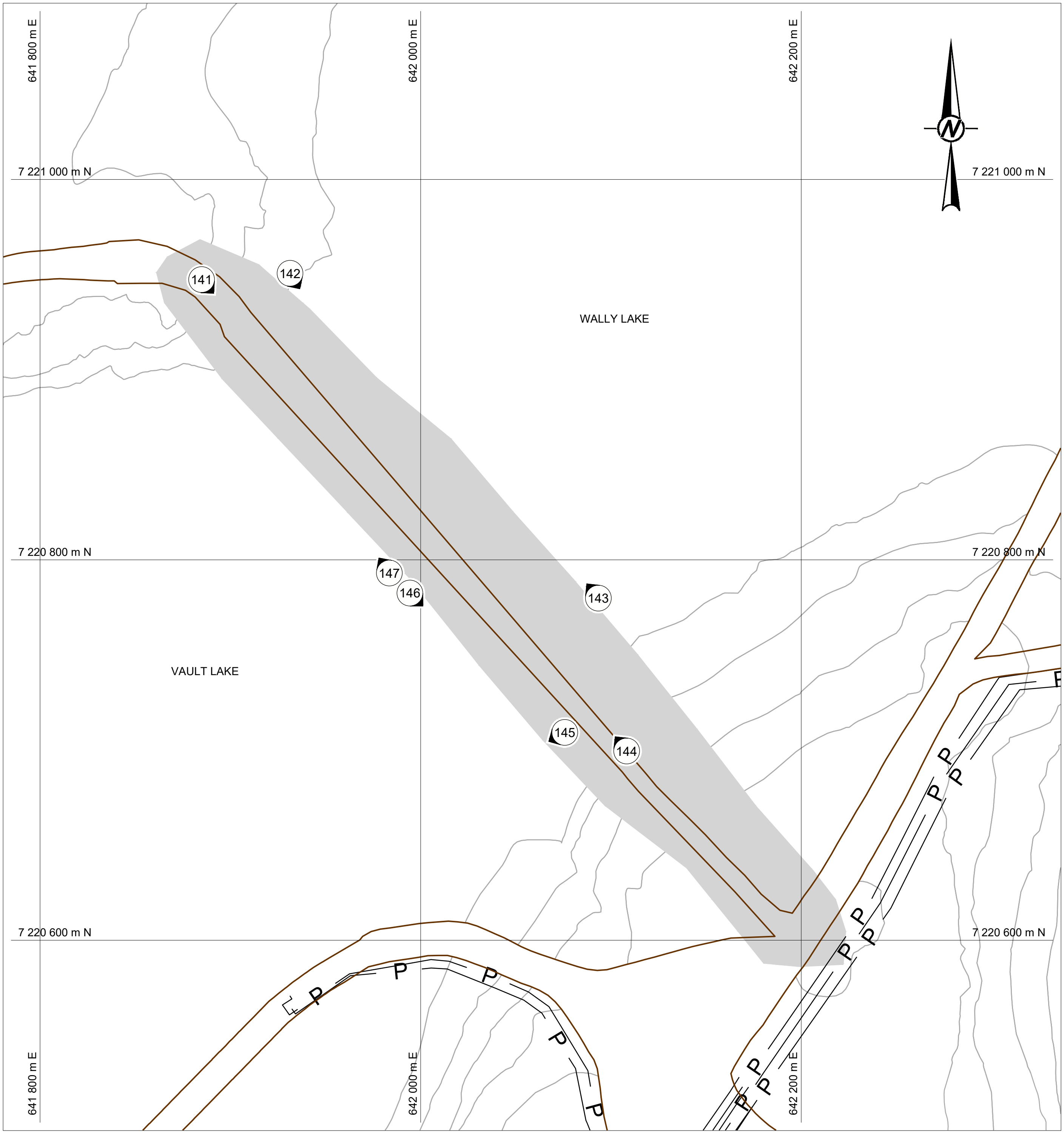

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TOPOGRAPHIC CONTOUR

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NOTE

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REFERENCE

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1:750 METRES

CLIENT

AGNICO EAGLE

CONSULTANT

wsp GOLDER

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DESIGN	C. Pachis
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APPROVED	Y. Boulianne

PROJECT

2022 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

VAULT DIKE DURING THE ANNUAL INSPECTION OF 2022

PROJECT No.	PHASE	Rev.	FIGURE
2146800622	5000	0	A3

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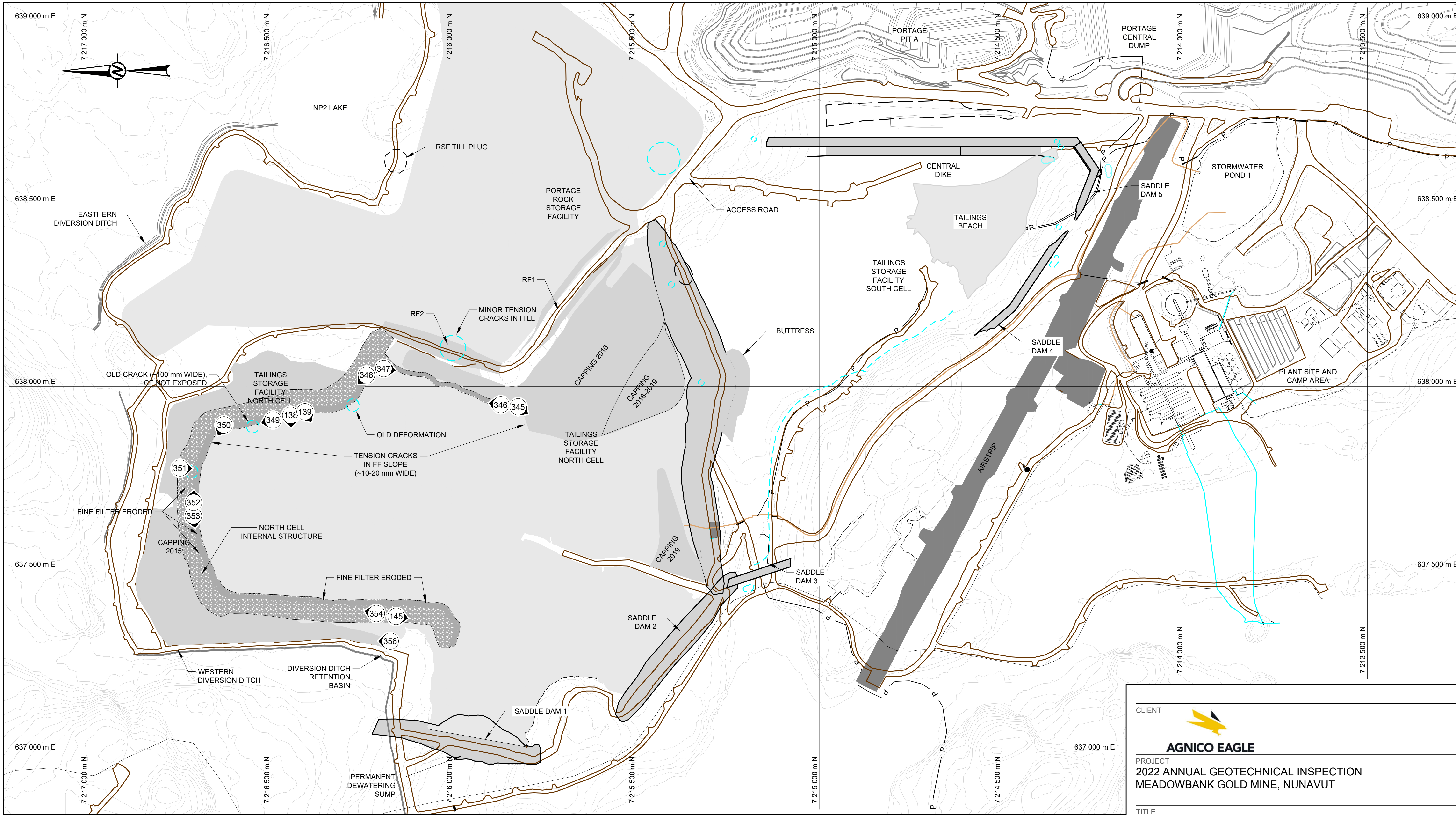

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TOPOGRAPHIC CONTOUR

IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2022

NOTE

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1:10 000 METRES

CLIENT

AGNICO EAGLE

PROJECT

2022 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

GENERAL VIEW OF TAILINGS STORAGE FACILITY DURING THE ANNUAL INSPECTION OF 2022

CONSULTANT

WSP GOLDER

YYYY-MM-DD	2022-10-21
PREPARED	M. Habersetzer
DESIGN	C. Pachis
REVIEW	M. Habersetzer
APPROVED	Y. Boulianne

PROJECT No.	PHASE	Rev.	FIGURE
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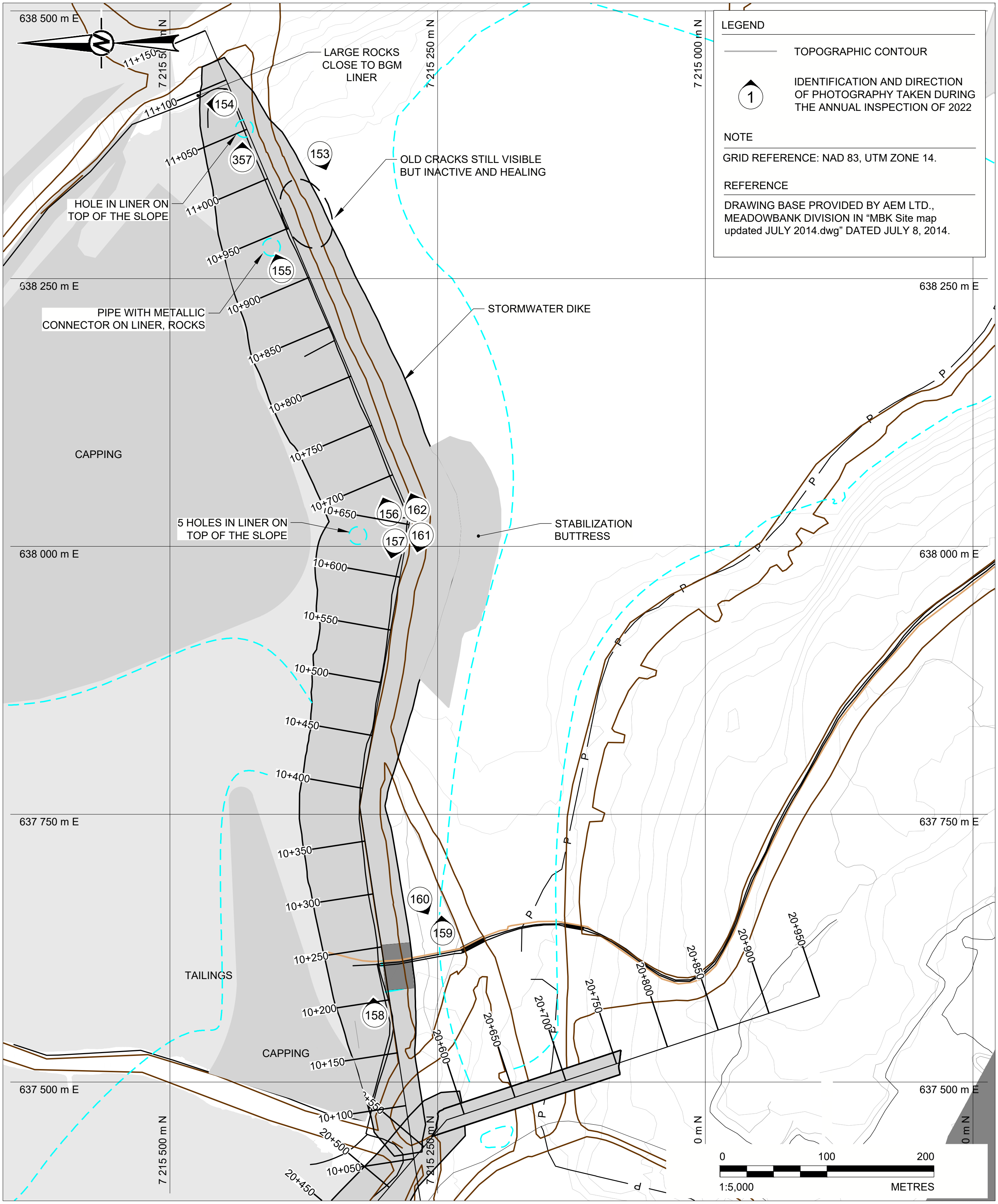

CLIENT

AGNICO EAGLE

CONSULTANT

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PROJECT

2022 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

STORMWATER DIKE DURING THE ANNUAL INSPECTION OF 2022

PROJECT No.	PHASE	Rev.	FIGURE
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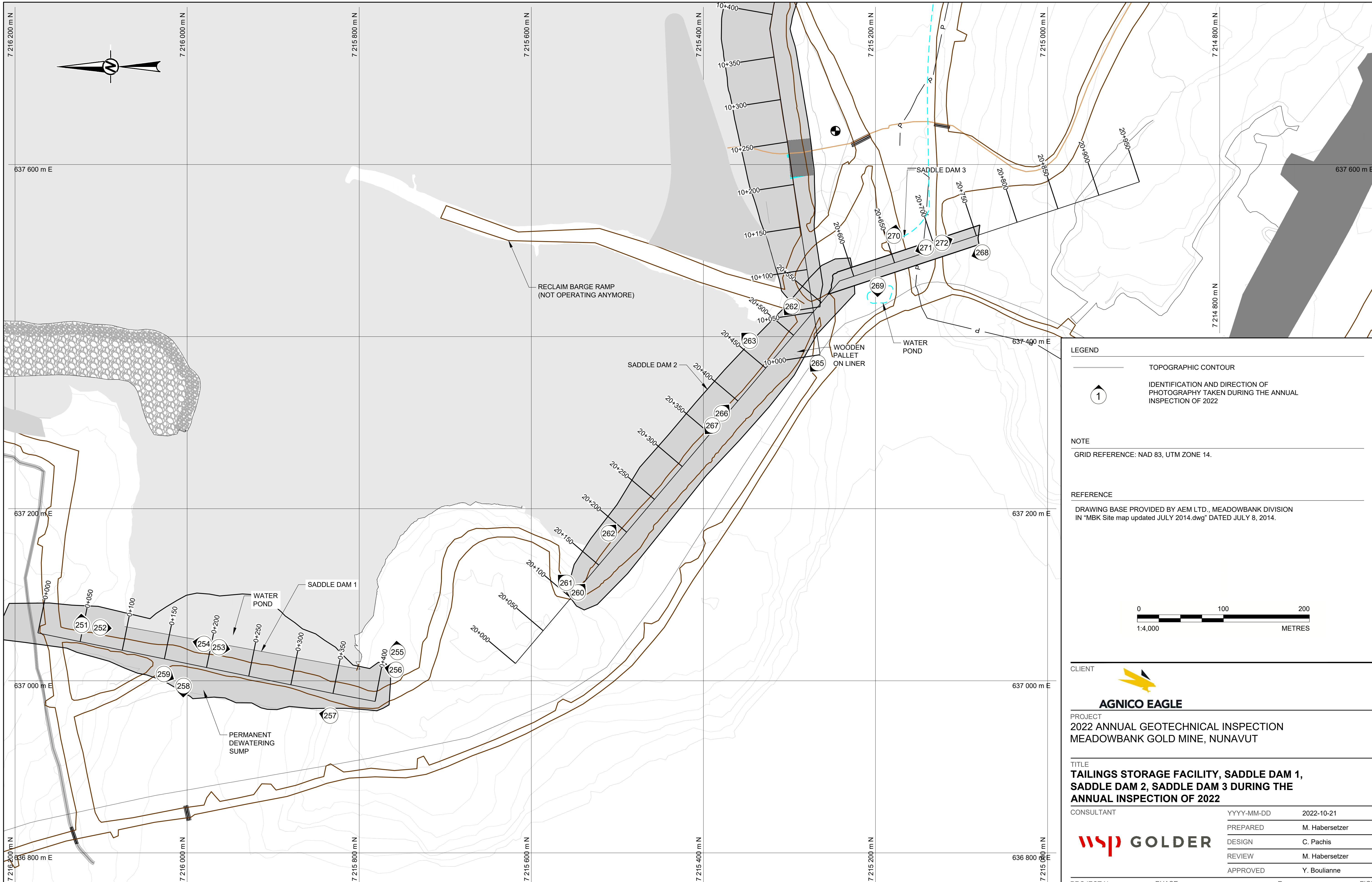

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TOPOGRAPHIC CONTOUR

IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2022

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CLIENT

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PROJECT

2022 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

TAILINGS STORAGE FACILITY, SADDLE DAM 1, SADDLE DAM 2, SADDLE DAM 3 DURING THE ANNUAL INSPECTION OF 2022

CONSULTANT

wsp GOLDER

YYYY-MM-DD	2022-10-21
PREPARED	M. Habersetzer
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REVIEW	M. Habersetzer
APPROVED	Y. Boulianne

PROJECT No.	PHASE	Rev.	FIGURE
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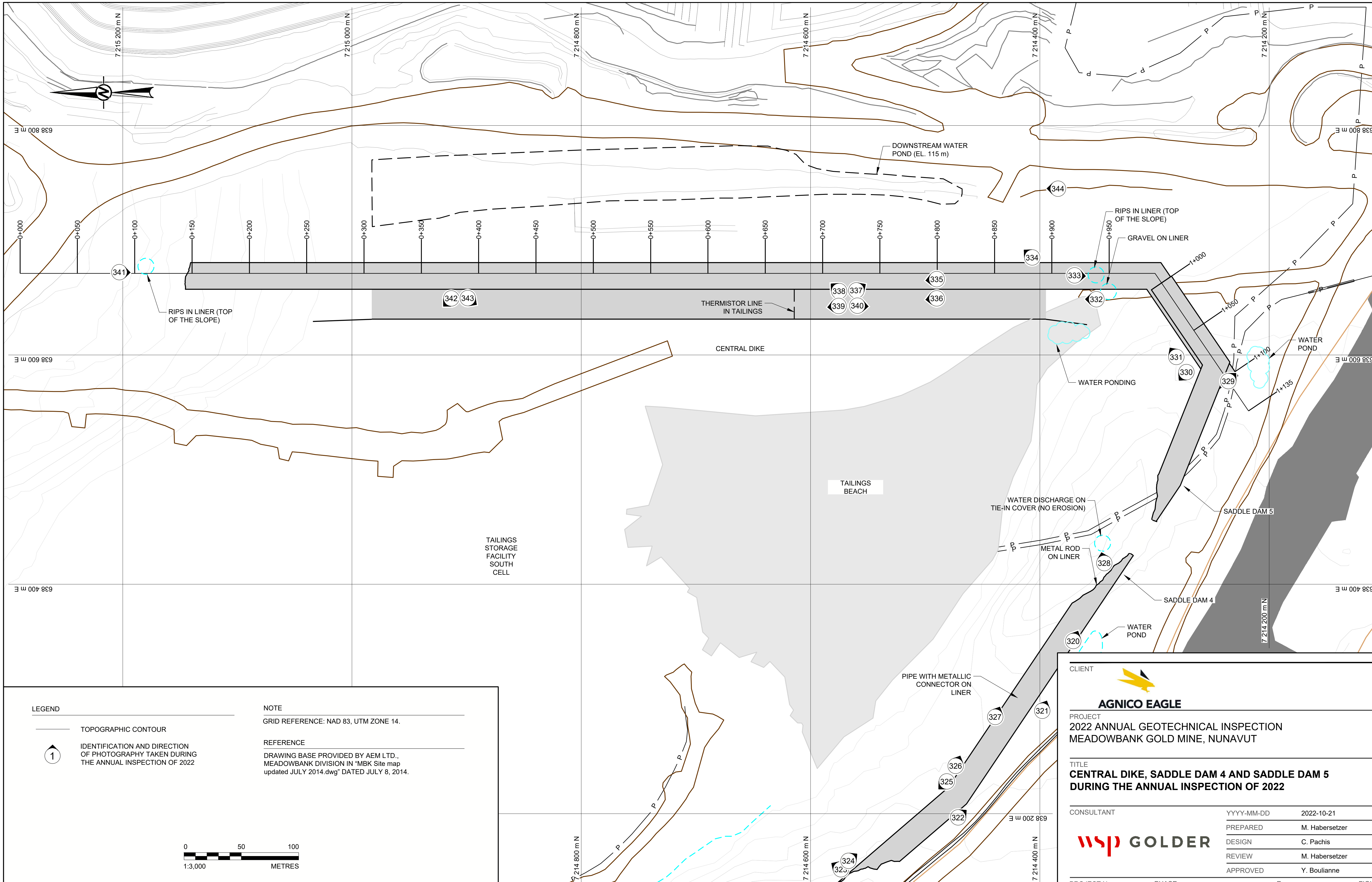

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NOTE

GRID REFERENCE: NAD 83, UTM ZONE 14.

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AGNICO EAGLE

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2022 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

CENTRAL DIKE, SADDLE DAM 4 AND SADDLE DAM 5 DURING THE ANNUAL INSPECTION OF 2022

CONSULTANT

WSP GOLDER

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REVIEW	M. Habersetzer
APPROVED	Y. Boulianne

PROJECT No.	PHASE	Rev.	FIGURE
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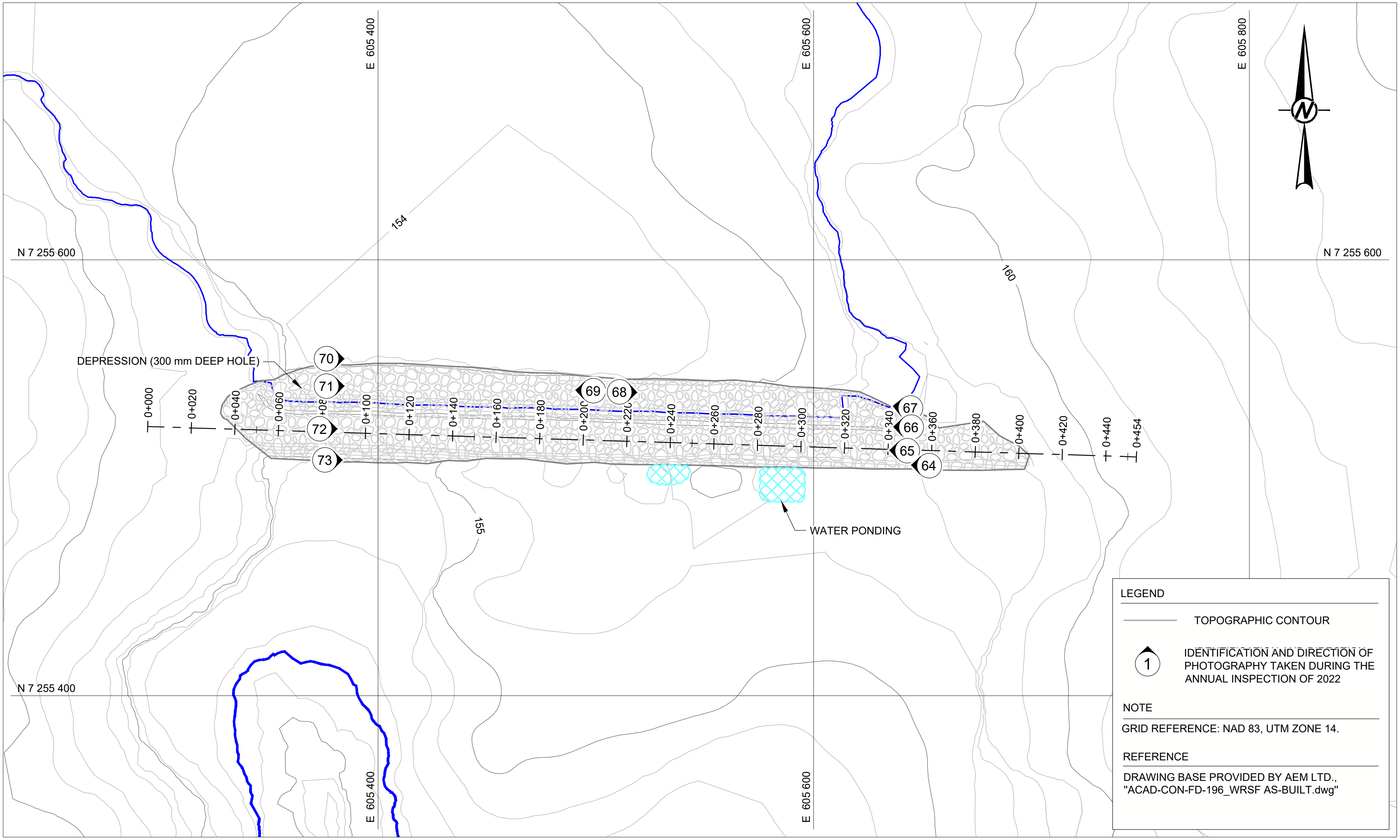

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CLIENT
AGNICO EAGLE

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PROJECT
2022 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE
WRSF DIKE DURING THE ANNUAL INSPECTION OF 2022

PROJECT NO.	PHASE	REV.	FIGURE
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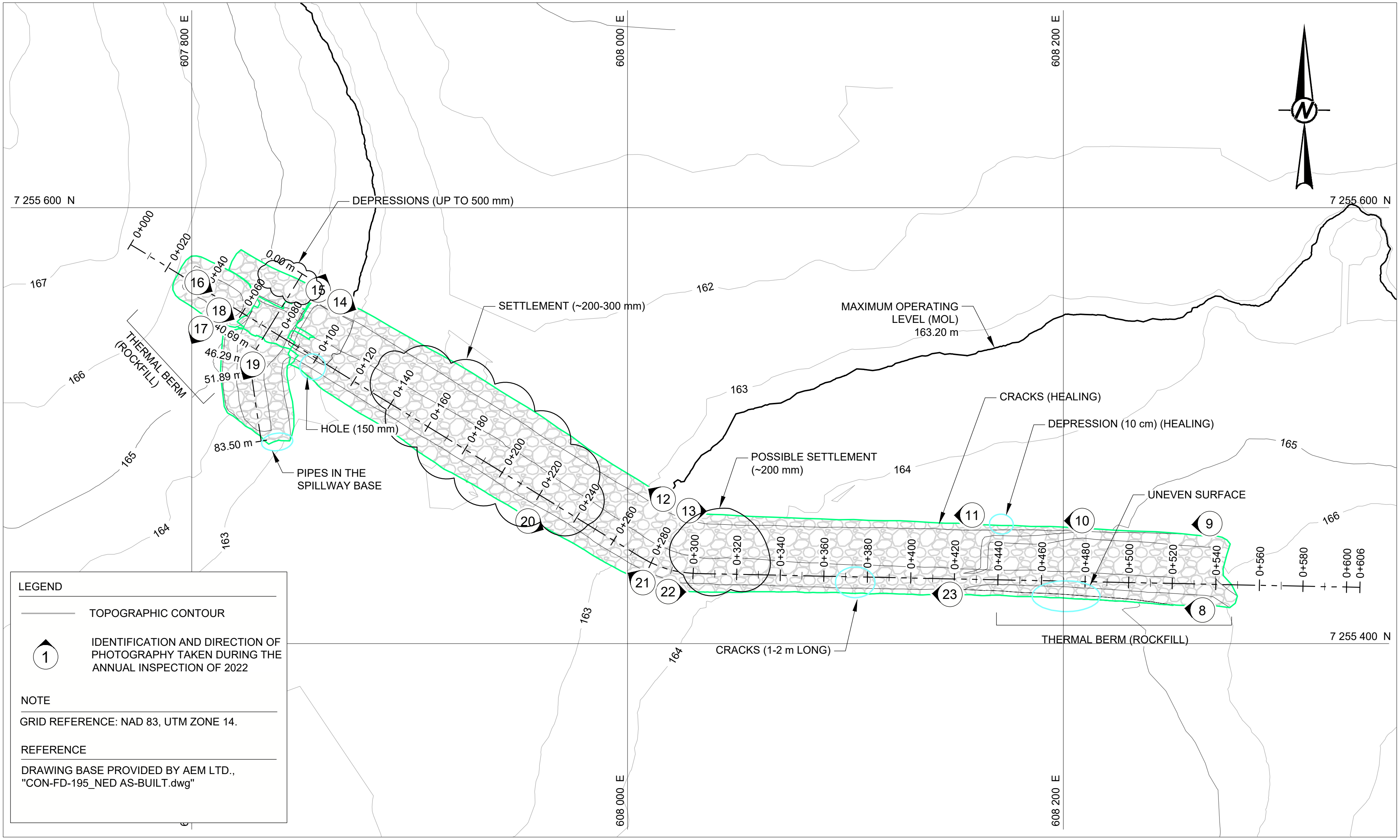

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IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2022

NOTE

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REFERENCE

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1:2 500 METRES

CLIENT

AGNICO EAGLE

CONSULTANT

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YYYY-MM-DD	2022-10-21
DESIGNED	C. Pachis
PREPARED	M. Habersetzer
REVIEWED	M. Habersetzer
APPROVED	Y. Boulianne

PROJECT

2022 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

IVR D1 DIKE DURING THE ANNUAL INSPECTION OF 2022

PROJECT NO.	PHASE	REV.	FIGURE
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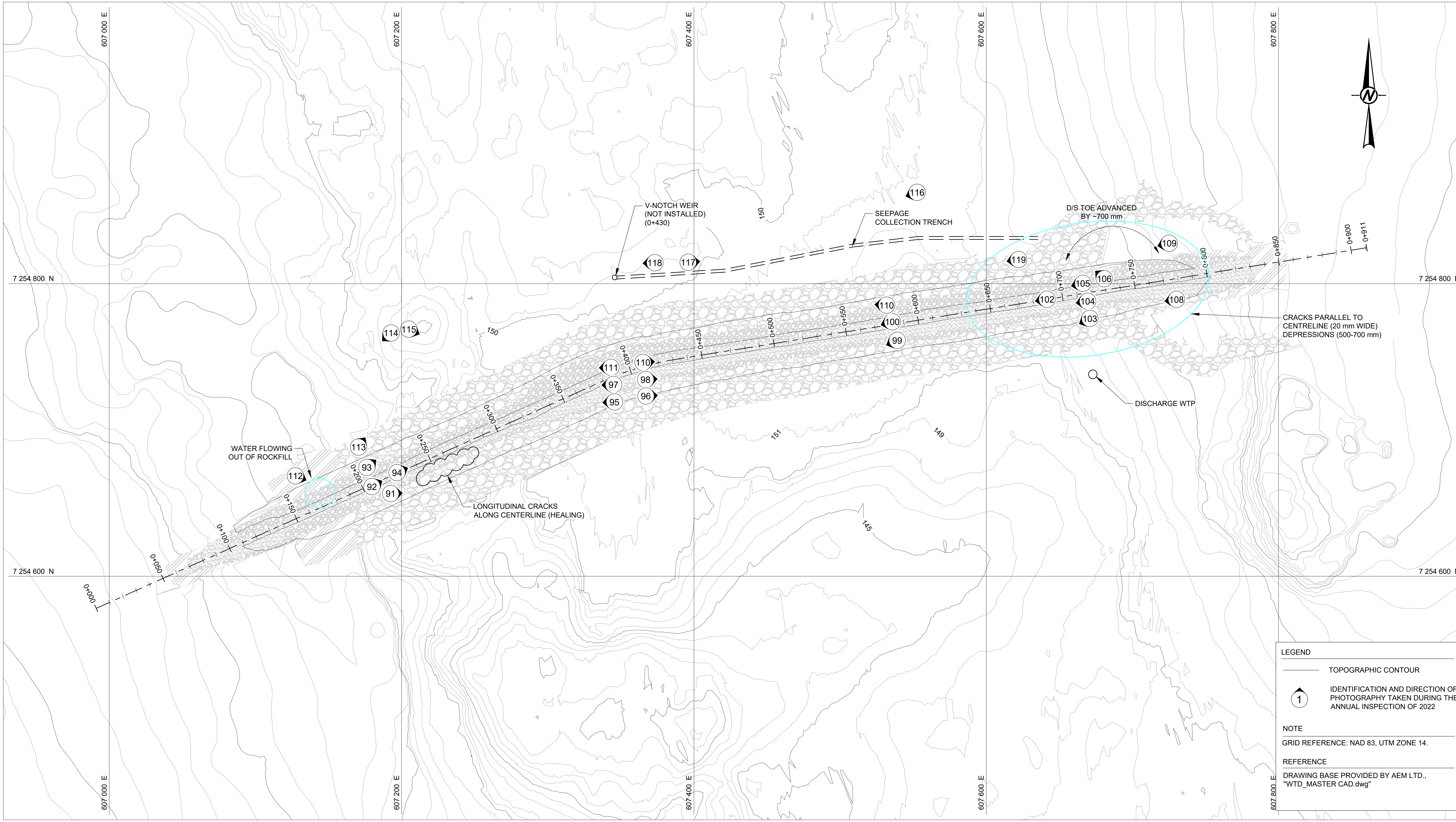

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CLIENT
AGNICO EAGLE

CONSULTANT
WSP GOLDER

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REVIEWED	M. Habersetzer
APPROVED	Y. Boulianne

PROJECT
2022 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE
WHALE TAIL DIKE DURING THE ANNUAL INSPECTION OF 2022

PROJECT NO.	PHASE	REV.	FIGURE
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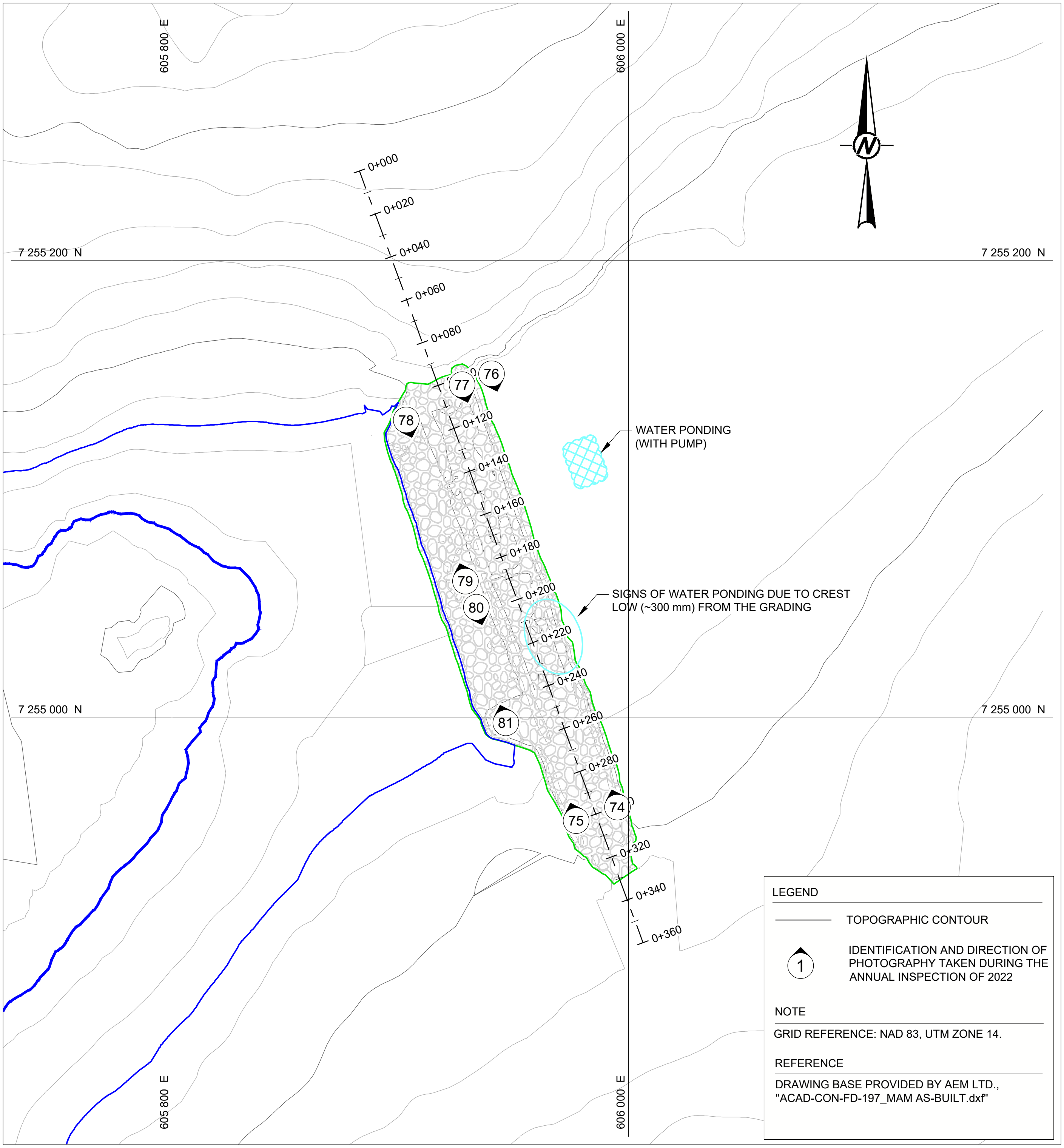

LEGEND

TOPOGRAPHIC CONTOUR

1 IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2022

NOTE

GRID REFERENCE: NAD 83, UTM ZONE 14.

REFERENCE

DRAWING BASE PROVIDED BY AEM LTD., "ACAD-CON-FD-197_MAM AS-BUILT.dxf"

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1:2 500 METRES

CLIENT

AGNICO EAGLE

CONSULTANT

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YYYY-MM-DD	2022-10-21
DESIGNED	C. Pachis
PREPARED	M. Habersetzer
REVIEWED	M. Habersetzer
APPROVED	Y. Boulianne

PROJECT

2022 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

MAMMOTH DIKE DURING THE ANNUAL INSPECTION OF 2022

PROJECT NO.	PHASE	REV.	FIGURE
2146800622	5000	0	C4

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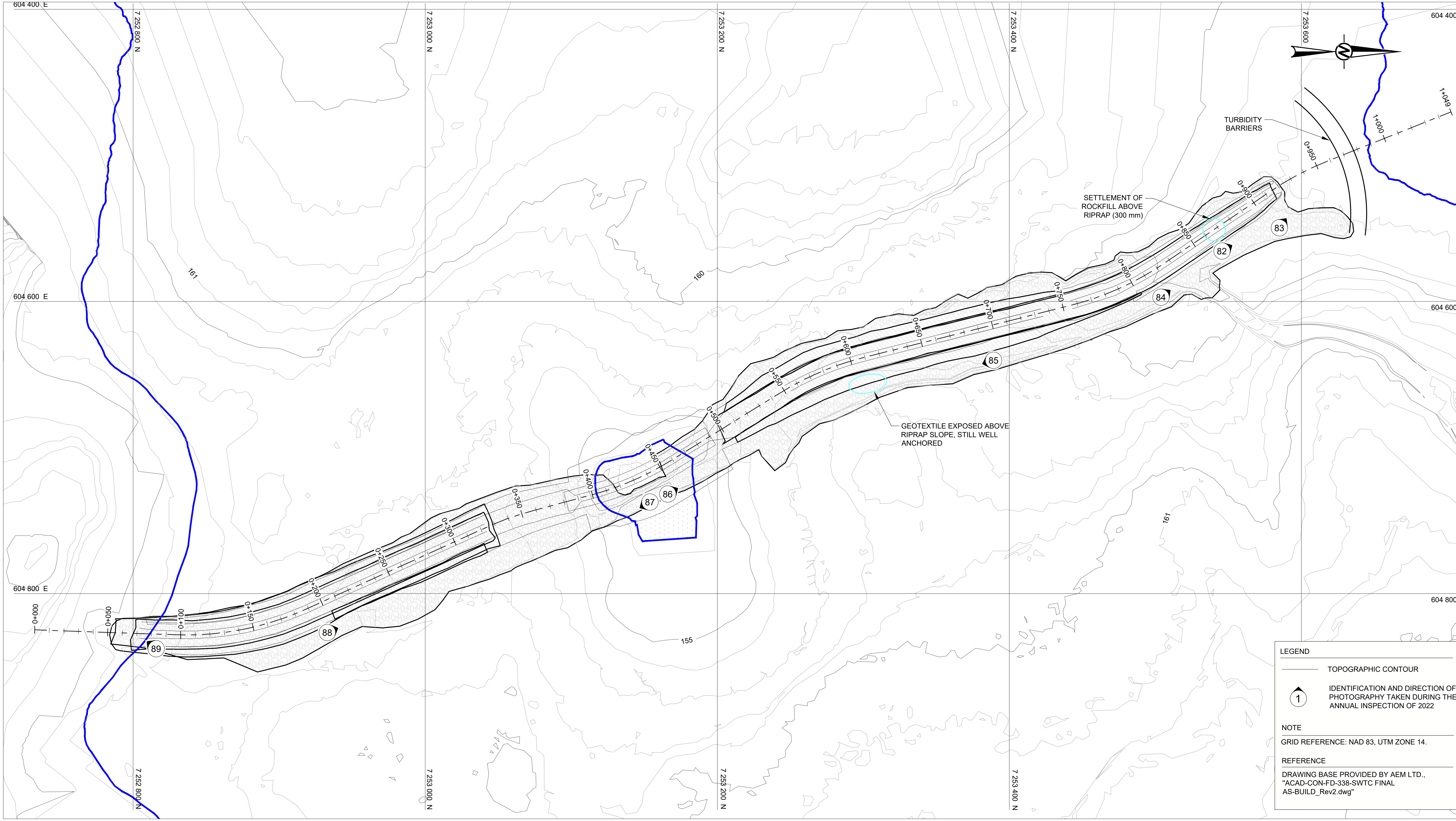

LEGEND

TOPOGRAPHIC CONTOUR

IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2022

NOTE

GRID REFERENCE: NAD 83, UTM ZONE 14.

REFERENCE

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1:2 500 METRES

CLIENT

AGNICO EAGLE

CONSULTANT

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DESIGNED	C. Pachis
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APPROVED	Y. Boulianne

PROJECT

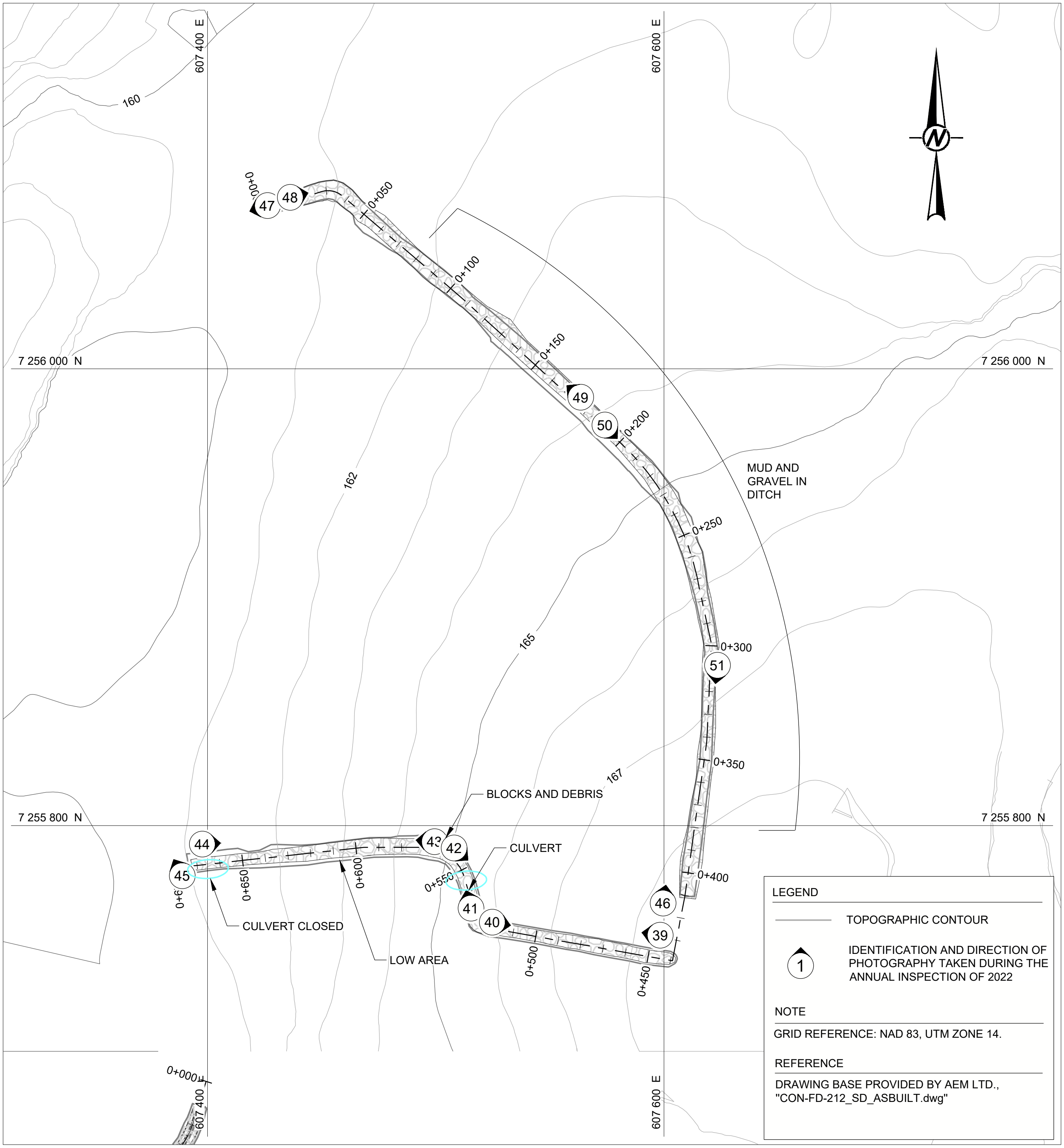
2022 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

SOUTH WHALE TAIL CHANNEL DURING THE ANNUAL INSPECTION OF 2022

PROJECT NO.	PHASE	REV.	FIGURE
2146800622	5000	0	C5

25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



LEGEND

TOPOGRAPHIC CONTOUR

IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2022

NOTE

GRID REFERENCE: NAD 83, UTM ZONE 14.

REFERENCE

DRAWING BASE PROVIDED BY AEM LTD., "CON-FD-212_SD_ASBUILT.dwg"

CLIENT

AGNICO EAGLE

CONSULTANT

WSP GOLDER

YYYY-MM-DD	2022-10-21
DESIGNED	C. Pachis
PREPARED	M. Habersetzer
REVIEWED	M. Habersetzer
APPROVED	Y. Boulianne

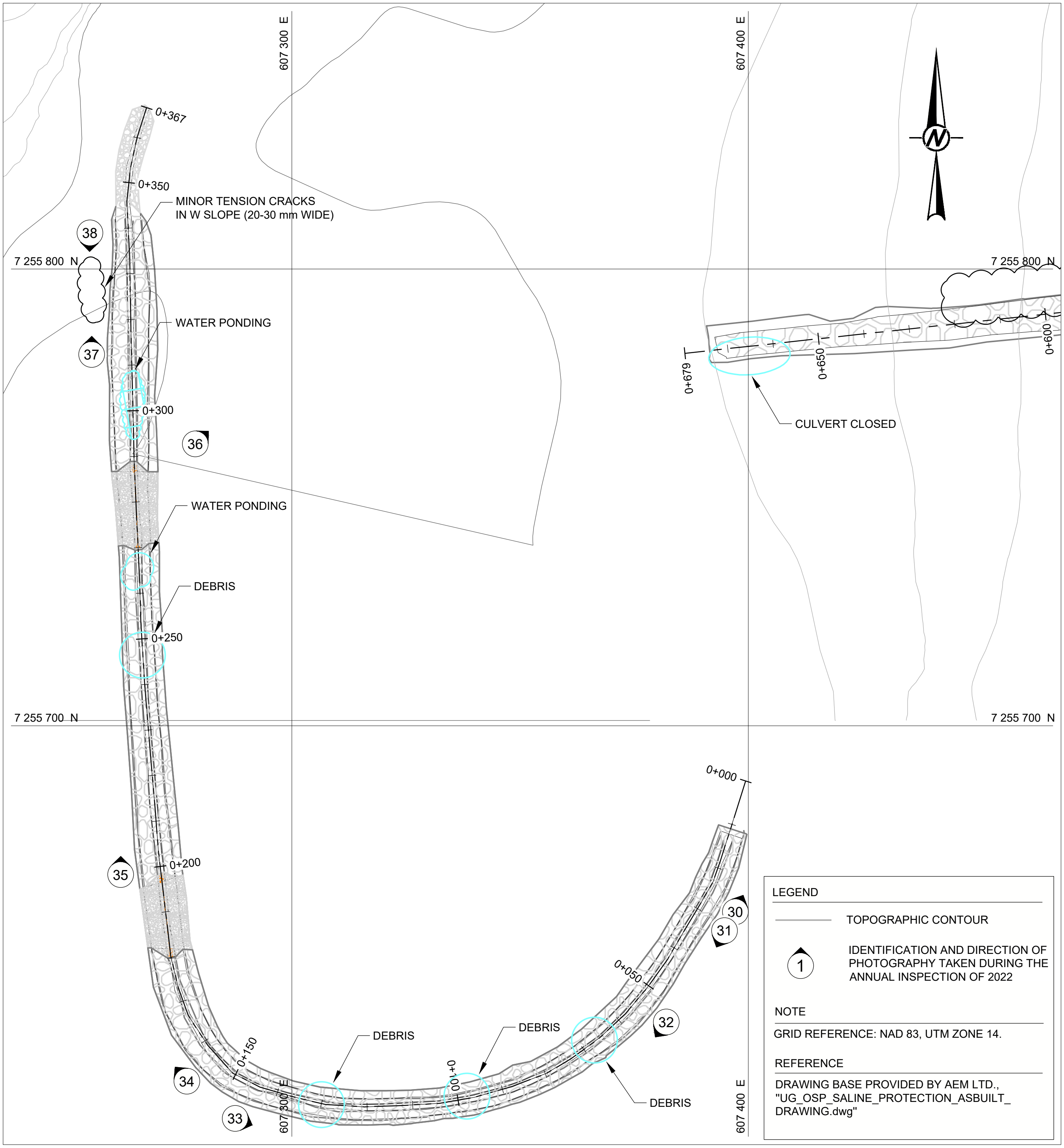
PROJECT

2022 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

UNDERGROUND WRSF SALINE DITCH DURING THE ANNUAL INSPECTION OF 2022

PROJECT NO.	PHASE	REV.	FIGURE
2146800622	5000	0	C6



CLIENT

AGNICO EAGLE

CONSULTANT

WSP GOLDER

YYYY-MM-DD	2022-10-21
DESIGNED	C. Pachis
PREPARED	M. Habersetzer
REVIEWED	M. Habersetzer
APPROVED	Y. Boulianne

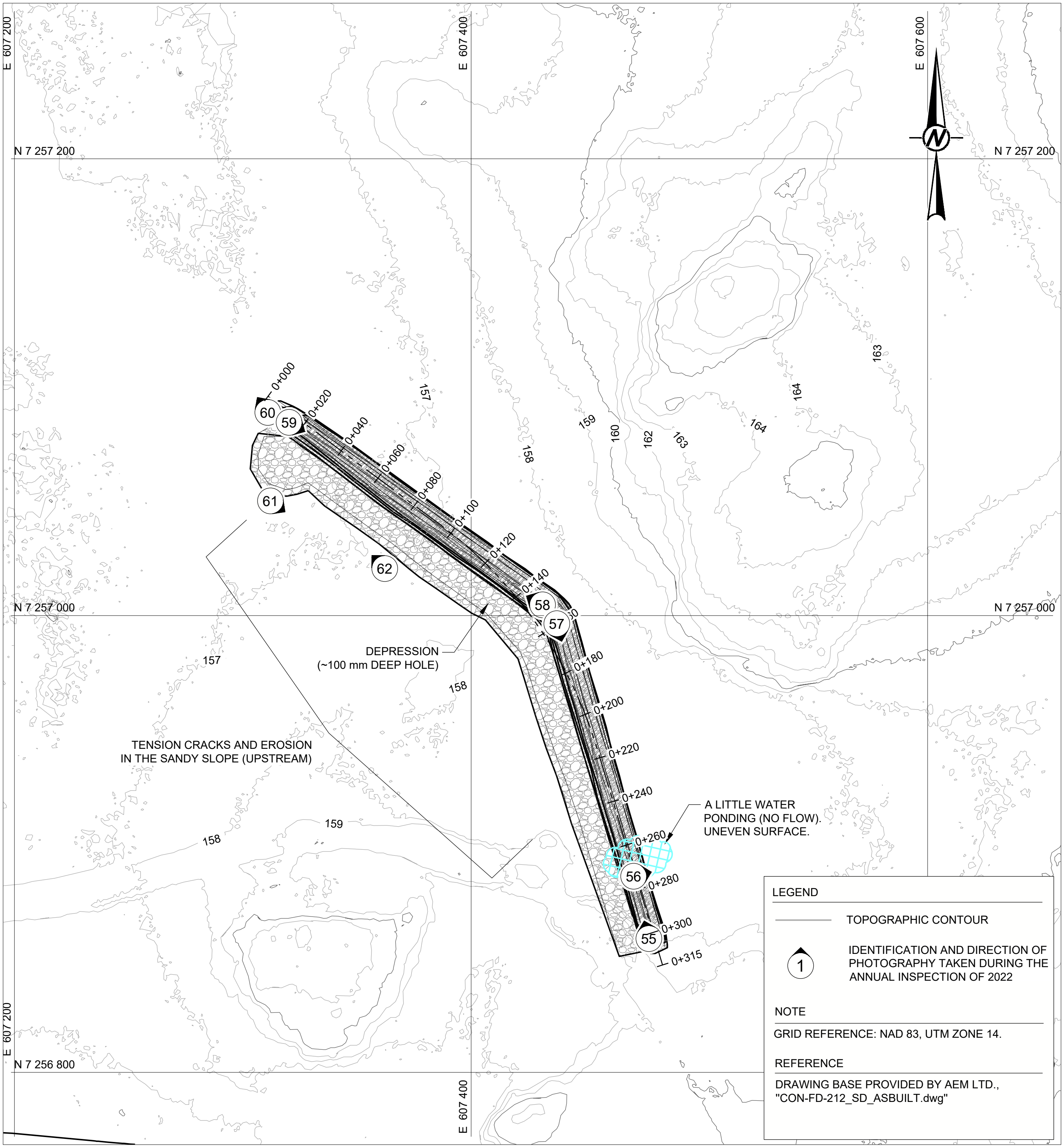
PROJECT

2022 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

UNDERGROUND ORE STOCKPILE SALINE DITCH DURING THE ANNUAL INSPECTION OF 2022

PROJECT NO.	PHASE	REV.	FIGURE
2146800622	5000	0	C7



CLIENT

AGNICO EAGLE

CONSULTANT

WSP GOLDER

PROJECT

2022 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

YYYY-MM-DD	2022-10-21
DESIGNED	C. Pachis
PREPARED	M. Habersetzer
REVIEWED	M. Habersetzer
APPROVED	Y. Boulianne

TITLE

IVR DIVERSION CHANNEL DURING THE ANNUAL INSPECTION OF 2022

PROJECT NO.	PHASE	REV.	FIGURE
2146800622	5000	0	C8

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25 mm

Last Edited By: cpachis Date: 2022-10-12 Time:3:57:40 PM | Printed By: CPachis Date: 2022-10-21 Time:10:17:14 AM
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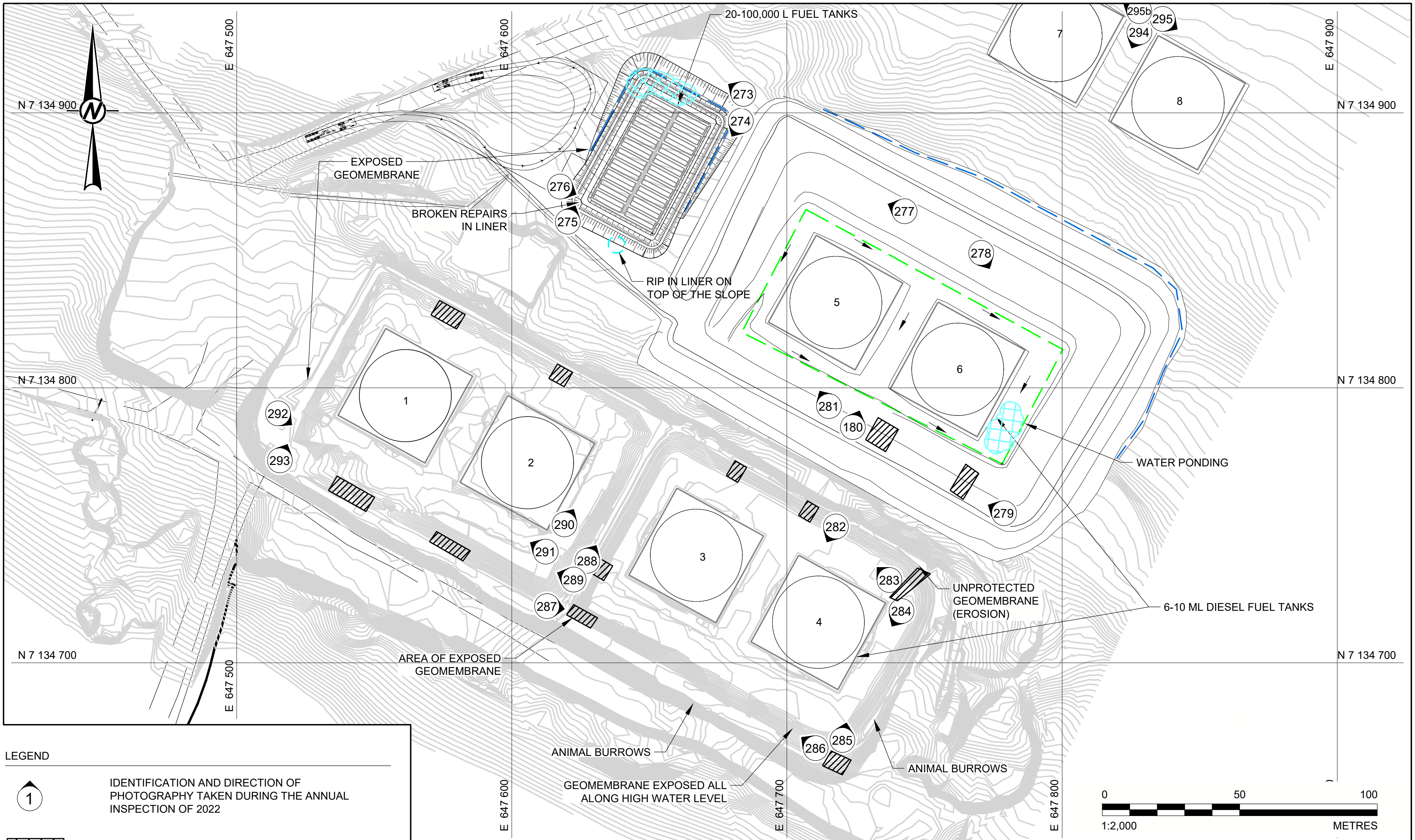


LEGEND

(1)	IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2022
[hatched box]	EXPOSED GEOSYNTHETICS

NOTE

1. GRID REFERENCE: NAD 83, UTM ZONE 14.
2. THE LOCATION AND DIMENSIONS OF TANKS 7 AND 8 AND THE SURROUNDING TOPOGRAPHY ARE APPROXIMATE AND FOR ILLUSTRATION PURPOSES ONLY. NO AS-BUILT DATA WAS AVAILABLE FOR THIS SECTOR.

REFERENCE

BASE PLAN PROVIDED BY AEM LTD. IN "PORTAGE_GOOSE_VAULT_END2019_LOM2013_V4D-WITH LABEL.dwg, RECEIVED OCTOBER 7, 2013

CLIENT

AGNICO EAGLE

CONSULTANT

WSP GOLDER

YYYY-MM-DD	2022-10-21
PREPARED	M. Habersetzer
DESIGN	C. Pachis
REVIEW	M. Habersetzer
APPROVED	Y. Boulianne

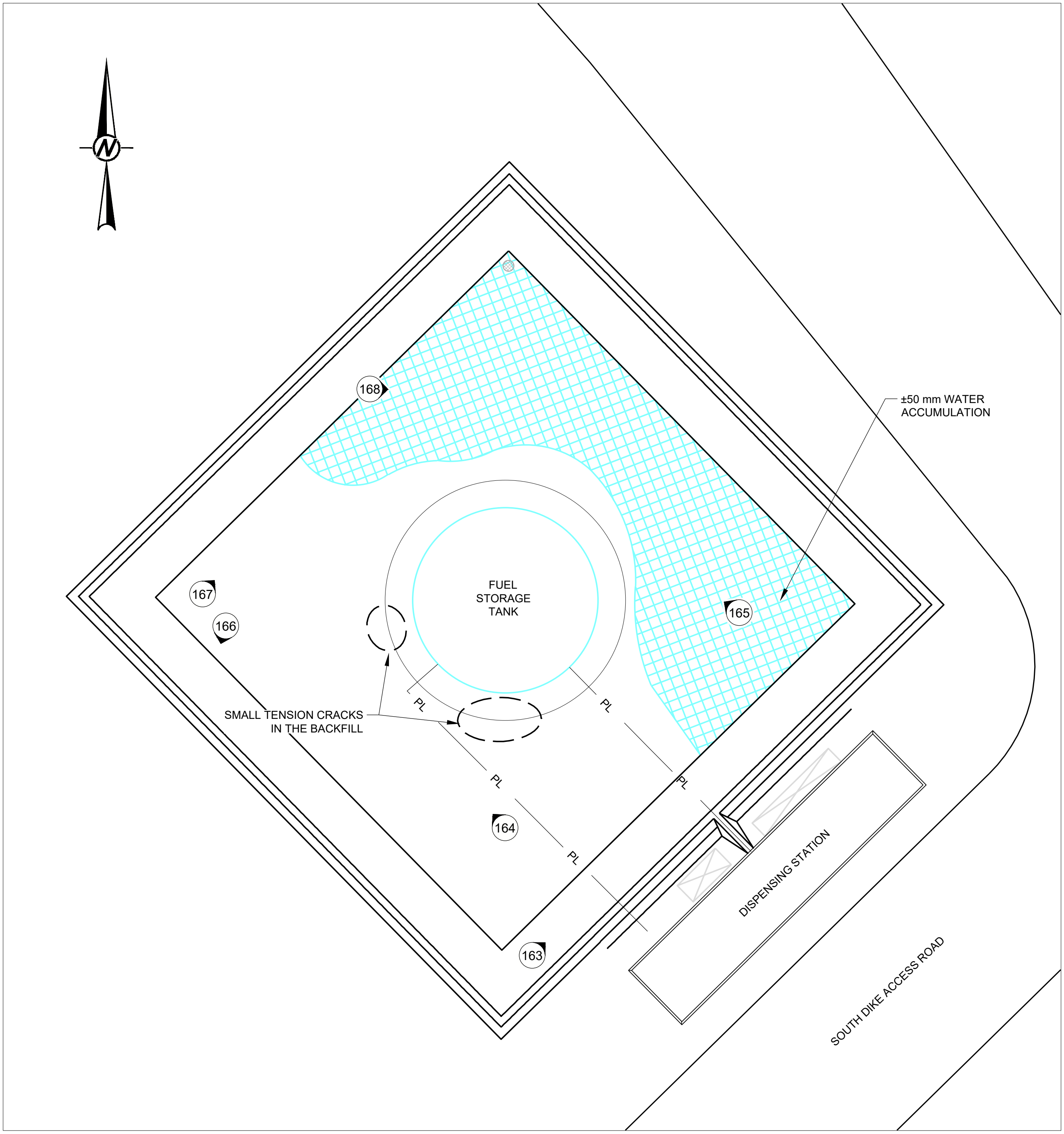
PROJECT

2022 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

BAKER LAKE TANK FARM DURING THE ANNUAL INSPECTION OF 2022

PROJECT No.	PHASE	Rev.	FIGURE
2146800622	5000	0	G1



LEGEND

1 — IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2022

REFERENCE

BASE PLAN INFORMATIONS IS PROVIDED BY CUMBERLAND DATED FEBRUARY 03, 2008

CLIENT

AGNICO EAGLE

PROJECT

2022 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

CONSULTANT

WSP GOLDER

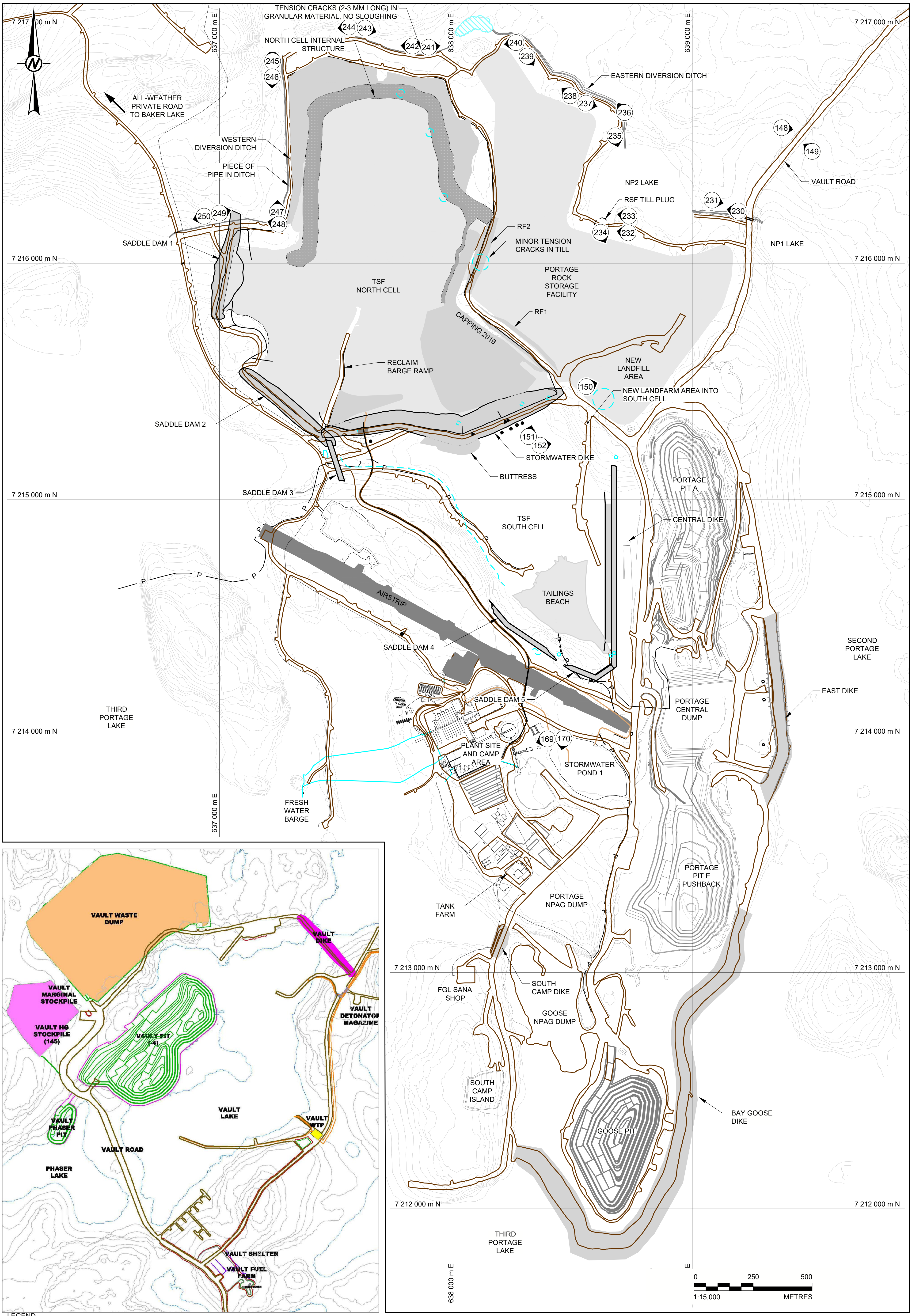
YYYY-MM-DD	2022-10-21
PREPARED	M. Habersetzer
DESIGN	C. Pachis
REVIEW	M. Habersetzer
APPROVED	Y. Boulianne

TITLE

MEADOWBANK TANK FARM DURING THE ANNUAL INSPECTION OF 2022

PROJECT No.	PHASE	Rev.	FIGURE
2146800622	5000	0	G2

Path: \\golder.gds\gal\Montreal\SIG\CAD\PROJETS\AGNICO-EAGLE\MEADOWBANK\PRODUCTION\2146800622\5000\ | File Name: 2146800622-5000-01-A B G H.dwg



LEGEND

TOPOGRAPHIC CONTOUR

IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2022

NOTE

GRID REFERENCE: NAD 83, UTM ZONE 14.

REFERENCE

DRAWING BASE PROVIDED BY AEM LTD., MEADOWBANK DIVISION IN "MBK Site map updated JULY 2014.dwg" DATED JULY 8, 2014.

CLIENT

AGNICO EAGLE

CONSULTANT

WSP GOLDER

YYYY-MM-DD	2022-10-21
PREPARED	M. Habersetzer
DESIGN	C. Pachis
REVIEW	M. Habersetzer
APPROVED	Y. Boulianne

PROJECT

2022 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

MEADOWBANK MINE SITE DURING THE ANNUAL INSPECTION OF 2022

PROJECT No.	PHASE	Rev.	FIGURE
2146800622	5000	0	H1

25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

APPENDIX A

DEWATERING DIKES

Appendix A-1

East Dike

Client:	AEM	**By:**	Marion Habersetzer
Project:	Meadowbank	**Date:**	July 29, 2022
Location:	East Dike	**Reviewed:**	Yves Boulianne

GENERAL INFORMATION			
Dam Type:	Rockfill embankment with a soil bentonite cut-off wall and downstream filters		
Weather Conditions:	Sunny	**Temperature:**	15°C

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
1. DAM CREST		225, 226, 219, 220, 221, 222, 229, 216	
1.1 Crest elevation	136.5 m Cut-off 136.1m		Design thermal cap crest revised in 2011 to El. 136.5 m (Golder 2011)
1.2 Reservoir level	133.02 m U/S		
Current freeboard	3.08 m		Design 2 m.
1.3 Distance to tailings pond (if applicable)	Not applicable		
1.4 Surface cracking	Two tension cracks (approx. 2-3 m in length) around Sta. 60+450 m. One parallel and one perpendicular to the crest. Presence of small holes.		
1.5 Unexpected settlement	None		
1.6 Lateral movement	Not apparent		

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
1.7 Other unusual conditions	None		
2. UPSTREAM SLOPE		225, 226, 220, 221, 229	
2.1 Slope angle	Approx. 1.6H:1V		
2.2 Signs of erosion	Stable		
2.3 Signs of movement (deformation)	None observed		
2.4 Cracks	None observed		
2.5 Face liner condition (if applicable)	Not applicable		
2.6 Other unusual conditions	None		
3. DOWNSTREAM SLOPE		216, 223, 224, 227, 228	
3.1 Slope angle	Approx.1.6H:1V		
3.2 Signs of erosion	None observed		
3.3 Signs of movement (deformation)	None observed		
3.4 Cracks	None observed		
3.5 Seepage or wet areas	Not apparent		
3.6 Vegetation growth	None observed		
3.7 Other unusual conditions	None		

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
4. DOWNSTREAM TOE AREA		215, 223, 224, 227, 228	
4.1 Seepage from dam	Yes, presence of 3 zones		Zone of seepage downstream near Sta. 60+247. A sump is installed (pumping system located in container on the photo). No additional seepage observed at the surface of the ground. Pumping collection system started on April 4, 2012. Flow is being monitored since July 2013.
			Zone of seepage downstream near Sta. 60+498. A sump is installed (pumping system located in container on the photo). Ponded water nearby. No additional seepage observed at the surface of the ground during the inspection. Pumping collection system started on April 4, 2012. Flow is being monitored since July 2013.
			Seepage zone near Sta. 60+575. According to AEM, this zone was practically dry all year. Water ponding was observed during inspection but no flow was noticed.
4.2 Signs of erosion	Not observed		
4.3 Signs of turbidity in seepage water	Not observed		
4.4 Discoloration/staining	No		
4.5 Outlet operating problem (if applicable)	Not applicable		
4.6 Other unusual conditions	Water ponding on the downstream side of the dyke around Sta. 60+450.		

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
5. ABUTMENTS			
5.1 Seepage at contact zone (abutment/embankment)	None observed		
5.2 Signs of erosion	None observed		
5.3 Excessive vegetation	No		
5.4 Presence of rodent burrows	None observed		
5.5 Other unusual conditions	None		
6. RESERVOIR			
6.1 Stability of slopes	Stable		Low relief region, stable upstream and downstream of dike. Portage Pit is on the downstream side of the dike.
6.2 Distance to nearest slide (if applicable)	None observed		
6.3 Estimate of slide volume (if applicable)	Not applicable		
6.4 Floating debris	None observed		
6.5 Other unusual conditions	None		
7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE			
7.1 Surface condition	No spillway or outlet structure exists, only dewatering pump		
7.2 Signs of erosion			
7.3 Signs of movement (deformation)			

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
7.4 Cracks			
7.5 Settlement			
7.6 Presence of debris or blockage			
7.7 Closure mechanism operational			
7.8 Slope protection			
7.9 Instability of side slopes			
7.10 Other unusual conditions	No		
8. INSTRUMENTATION			
8.1 Piezometers	Yes		See Section 3.1.2 of the report.
8.2 Settlement cells	No		
8.3 Thermistors	Yes		No data after June 2016. See Section 3.1.2 of the report.
8.4 Settlement monuments	Not anymore		They have been removed in the past.
8.5 Seismograph	Periodic		See Section 3.1.2 of the report.
8.6 Inclinometer	Yes		See Section 3.1.2 of the report
8.7 Weirs and flow monitors	Yes		Flow meters are installed for the two pumping systems downstream. The flow of the seepage zone at Sta. 60+575 is measured using a pipe.
8.8 Data logger(s)	Yes		The piezometers and thermistors on East Dike have automatic data collection since June 2012 (data transmitted every 3 hours).
8.9 Other			

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
9. DOCUMENTATION			
9.1 Operation, Maintenance and Surveillance (OMS) Plan			
9.1.1 OMS Plan exists	Yes		
9.1.2 OMS Plan reflects current dam conditions	Yes		
9.1.3 Date of last revision	November 2021		
9.2 Emergency Preparedness Plan (EPP)			
9.2.1 EPP exists	Yes		
9.2.2 EPP reflects current conditions	Yes		
9.2.3 Date of last revision	September 2021		
10. NOTES			

Inspector's Signature	Marion Habersetzer	**Date:**	July 29, 2022

Photograph A1-1 East Dike

Date: July 29, 2022 **Photo Number**: 222
Description: From approximately Sta. 60+500, looking north at the crest.

Photograph A1-2 East Dike

Date: July 29, 2022 Photo Number: 219
Description: From approximately Sta. 60+500, looking south at the crest.

Photograph A1-3 East Dike

Date: July 29, 2022 **Photo Number: 220**

Description: From approximately Sta. 60+500 upstream, looking south at the crest.

Photograph A1-4 East Dike

Date: July 29, 2022 **Photo Number: 221**

Description: From approximately Sta. 60+500 upstream, looking north at the crest.

Photograph A1-5 East Dike

Date: July 29, 2022 **Photo Number: 229**

Description: From approximately Sta. 60+810, looking south at the crest and upstream slope.

Photograph A1-6 East Dike

Date: July 29, 2022 **Photo Number: 226**

Description: From Sta. 60+300 upstream, looking north at the crest and upstream slope.

Photograph A1-7 East Dike

Date: July 29, 2022 **Photo Number: 225**

Description: From approximately Sta. 60+250 upstream, looking south at the upstream slope.

Photograph A1-8 East Dike

Date: July 29, 2022 **Photo Number: 215**

Description: From approximately Sta. 60+250, looking west at the downstream side and toe.

Photograph A1-9 East Dike

Date: July 29, 2022 **Photo Number: 216**

Description: From approximately Sta. 60+300, looking north at the downstream side and toe.

Photograph A1-10 East Dike

Date: July 29, 2022 **Photo Number: 224**

Description: From approximately Sta. 60+475, looking south at the downstream toe.

Photograph A1-11 East Dike

Date: July 29, 2022 **Photo Number: 223**

Description: From approximately Sta. 60+500, looking north at the downstream toe.

Photograph A1-12 East Dike

Date: July 29, 2022 **Photo Number: 228**

Description: From approximately Sta. 60+560, looking south at the downstream toe.

Photograph A1-13 East Dike

Date: July 29, 2022 **Photo Number: 227**

Description: From approximately Sta. 60+560, looking north at the downstream slope and toe.

Photograph A1-14 East Dike

Date: July 29, 2022 **Photo Number: 218**

Description: From approximately Sta. 60+425, looking north at the crest. Two small cracks are present.

Appendix A-2

South Camp Dike

Client:	AEM	**By:**	Marion Habersetzer
Project:	Meadowbank	**Date:**	July 29, 2022
Location:	South Camp Dike	**Reviewed:**	Yves Boulianne

GENERAL INFORMATION			
Dam Type:	Rockfill shell with upstream filter, a bituminous geomembrane liner and protective cover.		
Weather Conditions:	Sunny	**Temperature:**	15°C

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
1. DAM CREST		172, 173, 174, 175, 176	
1.1 Crest elevation	El. 136.6 m (rockfill) El. 134.7 m (liner)		
1.2 Reservoir level	U/S El.133.7 m D/S		No water observed at downstream toe since 2011, except periodic run-off.
Current freeboard	2.9 m (rockfill crest) 1.0 m (liner crest)		
1.3 Distance to tailings pond (if applicable)	Not applicable		
1.4 Surface cracking	None at the time of inspection		
1.5 Unexpected settlement	None at the time of inspection		
1.6 Lateral movement	Not apparent		
1.7 Other unusual conditions	None		

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
2. UPSTREAM SLOPE		173, 174	
2.1 Slope angle	Approx. 1.3H: 1V		Adequate
2.2 Signs of erosion	None observed		
2.3 Signs of movement (deformation)	None observed		
2.4 Cracks	None observed		
2.5 Face liner condition (if applicable)	Liner not visible at the time of the inspection		Bituminous geomembrane liner. Compacted granular material mixed with bentonite was placed above the liner, followed by a thermal cap layer covering the entire liner face.
2.6 Other unusual conditions	None		
3. DOWNSTREAM SLOPE		171, 176	
3.1 Slope angle	Approx. 1.4H:1V		Adequate
3.2 Signs of erosion	None observed		
3.3 Signs of movement (deformation)	None observed		
3.4 Cracks	None observed		
3.5 Seepage or wet areas	None observed.		
3.6 Vegetation growth	No		
3.7 Other unusual conditions	None		
4. DOWNSTREAM TOE AREA		171, 176	
4.1 Seepage from dam	Accumulation of run-off water.		Some water ponding. No sign of flow.
4.2 Signs of erosion	None observed		

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
4.3 Signs of turbidity in seepage water	None		
4.4 Discoloration/staining	No		
4.5 Outlet operating problem (if applicable)	Not applicable		
4.6 Other unusual conditions	None		
5. ABUTMENTS			
5.1 Seepage at contact zone (abutment/embankment)	None observed		
5.2 Signs of erosion	None observed		
5.3 Excessive vegetation	No		
5.4 Presence of rodent burrows	None observed		
5.5 Other unusual conditions	None		
6. RESERVOIR			
6.1 Stability of slopes	Stable		
6.2 Distance to nearest slide (if applicable)	Not applicable		
6.3 Estimate of slide volume (if applicable)	None observed		
6.4 Floating debris	None		
6.5 Other unusual conditions	None		

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE			
7.1 Surface condition	No spillway or outlet structure exists		
7.2 Signs of erosion			
7.3 Signs of movement (deformation)			
7.4 Cracks			
7.5 Settlement			
7.6 Presence of debris or blockage			
7.7 Closure mechanism operational			
7.8 Slope protection			
7.9 Instability of side slopes			
7.10 Other unusual conditions			
8. INSTRUMENTATION			
8.1 Piezometers	No		
8.2 Settlement cells	No		
8.3 Thermistors	Yes		Section 3.2.2 of the report describes the thermal condition.
8.4 Settlement monuments	No		
8.5 Seismograph	No		
8.6 Inclinometer	No		
8.7 Weirs and flow monitors	No		
8.8 Data logger(s)	Yes		

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
8.9 Other	No		
9. DOCUMENTATION			
9.1 Operation, Maintenance and Surveillance (OMS) Plan			
9.1.1 OMS Plan exists	Yes		
9.1.2 OMS Plan reflects current dam conditions	Yes		
9.1.3 Date of last revision	November 2021		
9.2 Emergency Preparedness Plan (EPP)			
9.2.1 EPP exists	Yes		
9.2.2 EPP reflects current conditions	Yes		
9.2.3 Date of last revision	September 2021		
10. NOTES			
Inspector's Signature	Marion Habersetzer	**Date:**	July 29, 2022

Photograph A2-1 South Camp Dike

Date: July 29, 2022 **Photo Number: 174**

Description: From the south abutment, looking north at the upstream slope and the thermistors instrumentation set-up.

Photograph A2-2 South Camp Dike

Date: July 29, 2022 **Photo Number: 173**

Description: From the north abutment, looking south at the upstream slope and thermistors instrumentation set-up.

Photograph A2-3 South Camp Dike

Date: July 29, 2022 **Photo Number: 175**

Description: From the south abutment, looking north at the crest.

Photograph A2-4 South Camp Dike

Date: July 29, 2022 **Photo Number: 172**

Description: From the north abutment, looking south at the crest.

Photograph A2-5 South Camp Dike

Date: July 29, 2022 **Photo Number**: 171

Description: From the north abutment, looking south at the downstream slope. There is some water ponding, from run-off.

Photograph A2-6 South Camp Dike

Date: July 29, 2022 **Photo Number**: 176

Description: From the south abutment, looking north at the downstream slope. There is some water ponding, from run-off.

Appendix A-3

Bay-Goose Dike

Client:	AEM	**By:**	Marion Habersetzer
Project:	Meadowbank	**Date:**	July 29, 2022
Location:	Bay-Goose Dike	**Reviewed:**	Yves Boulianne

GENERAL INFORMATION			
Dam Type:	Rockfill embankment with a cut-off wall (soil-bentonite, cement-soil-bentonite and jet grouting columns) and downstream filters		
Weather Conditions:	Sunny	**Temperature:**	15°C

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
1. DAM CREST		177, 178, 179, 180, 181, 182, 183, 183b, 184, 186, 187, 188, 190, 191, 193, 194, 195, 196, 197, 198, 199, 200, 201, 207, 208, 211, 212, 213	
1.1 Crest elevation	+/-138 cut-off 136.1m		Thermal cap completed in May 2013.

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
1.2 Reservoir level	133.7 m upstream		Downstream side dewatered since mid-November 2011.
Current freeboard	2.4 m		Design 2.0 m.
1.3 Distance to tailings pond (if applicable)	Not applicable		
1.4 Surface cracking	Yes		The tension cracks observed in 2013 on the upstream side within the thermal cap placed during winter 2013 are still visible but are no longer active.
1.5 Unexpected settlement	Yes		The rockfill cap added over the cut-off in the winter of 2013 is showing settlement all along the upstream side of the dike and over the cut-off. Settlement varies from 0.1 m to > 1 m. No longer active.
1.6 Lateral movement	Not apparent		
1.7 Other unusual conditions	Yes		

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
2. UPSTREAM SLOPE		177, 178, 183,183b,186, 187, 192, 193, 200, 201, 207, 208, 212, 213	
2.1 Slope angle	Approx. 1.6H:1V		Rockfill
2.2 Signs of erosion	Stable		
2.3 Signs of movement (deformation)	None observed		
2.4 Cracks	None observed		
2.5 Face liner condition (if applicable)	Not applicable		
2.6 Other unusual conditions	None		
3. DOWNSTREAM SLOPE		181, 182, 184, 185, 189, 190, 191, 196, 197, 202, 203, 205, 206, 209, 210, 211	
3.1 Slope angle	Approx.1.6H:1V		
3.2 Signs of erosion	None observed		
3.3 Signs of movement (deformation)	None observed		
3.4 Cracks	None observed		
3.5 Seepage or wet areas	Not apparent		
3.6 Vegetation growth	None observed		
3.7 Other unusual conditions	None		

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
4. DOWNSTREAM TOE AREA		181, 182, 184, 185, 189, 190, 191, 196, 197, 202, 203, 205, 206, 209, 210, 211	
4.1 Seepage from dike	Yes		Seepage zone observed as well as water pond. The seepage is being monitored by the mine and does not show signs of aggravation.
	North Channel		Monitored by stations 8 (30+420) and 9 (30+380). Water flowing was observed during the inspection.
	Central Shallow		Presence of 2 seepage channels at 30+650 and 30+625. Flow was observed during inspection at 30+650. Monitored by station 7.
	Central Channel		Presence of a seepage channel at Sta. 31+165. Water ponding was observed at the time of the inspection. It was pumped once after freshet only.
	Channel 3		Light flow observed during inspection. Monitored by station 6.
	Channel 1		This seepage channel was not flowing at the time of the inspection.
	Water Ponds		Presence of water pond with no sign of seepage. Located at 31+750. Water was observed downstream of Channel 1 ponding against the ring road of Goose Pit.
4.2 Signs of erosion	None observed		
4.3 Signs of turbidity in seepage water	No.		
4.4 Discoloration/staining	No		

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
4.5 Outlet operating problem (if applicable)	Not applicable		
4.6 Other unusual conditions	Yes		Inflow of water on pit wall. Probably due to the Bay-Goose fault and rock quality. In the vicinity of Channels 1, 2 and 3. Not monitored anymore.
5. ABUTMENTS			
5.1 Seepage at contact zone (abutment/embankment)	None observed		
5.2 Signs of erosion	None observed		
5.3 Excessive vegetation	No		
5.4 Presence of rodent burrows	None observed		
5.5 Other unusual conditions	None		
6. RESERVOIR		177, 178, 183, 183b, 186, 187, 192, 193, 200, 201, 207, 208, 212, 213	
6.1 Stability of slopes	Stable		
6.2 Distance to nearest slide (if applicable)	None observed		
6.3 Estimate of slide volume (if applicable)	Not applicable		
6.4 Floating debris	None observed		
6.5 Other unusual conditions	None		

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE			
7.1 Surface condition	No spillway or outlet structure exists, only dewatering pump.		
7.2 Signs of erosion			
7.3 Signs of movement (deformation)			
7.4 Cracks			
7.5 Settlement			
7.6 Presence of debris or blockage			
7.7 Closure mechanism operational			
7.8 Slope protection			
7.9 Instability of side slopes			
7.10 Other unusual conditions			
8. INSTRUMENTATION			
8.1 Piezometers	Yes		See Section 3.3.2 of the report.
8.2 Settlement cells	No		
8.3 Thermistors	Yes		See Section 3.3.2 of the report.
8.4 Settlement monuments	No		Survey monuments removed in the past.
8.5 Seismograph	Periodic		See Section 3.3.2 of the report.
8.6 Inclinometer	Yes		See Section 3.3.2 of the report.
8.7 Weirs and flow monitors	Yes		Seepage monitoring system installed at seepage channel to monitor flow.

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
8.8 Data logger(s)	Yes		The piezometers and the thermistors have automatic data transmission (every 3 hours).
8.9 Other			
9. DOCUMENTATION			
9.1 Operation, Maintenance and Surveillance (OMS) Plan			
9.1.1 OMS Plan exists	Yes		
9.1.2 OMS Plan reflects current dam conditions	Yes		
9.1.3 Date of last revision	November 2021		
9.2 Emergency Preparedness Plan (EPP)			
9.2.1 EPP exists	Yes		
9.2.2 EPP reflects current conditions	Yes		
9.2.3 Date of last revision	September 2021		
10. NOTES			
Inspector's Signature	Marion Habersetzer	**Date:**	July 29, 2022

Photograph A3-1 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 212

Description: From approximately Sta. 30+142 (north abutment) looking southwest at the crest and upstream slope.

Photograph A3-2 Bay Goose Dike

Date: July 29, 2022 **Photo Number:** 213

Description: From approximately Sta. 30+130 (north abutment), looking north at the crest and upstream slope.

Photograph A3-3 Bay Goose Dike

Date: July 29, 2022 **Photo Number:** 211

Description: From approximately Sta. 30+340 on the crest, looking northeast at the dam crest and downstream slope

Photograph A3-4 Bay Goose Dike

Date: July 29, 2022 **Photo Number:** 210

Description: From approximately Sta. 30+340, looking northwest at the north seepage channel.

Photograph A3-5 Bay Goose Dike

Date: July 29, 2022 **Photo Number:** 208

Description: From Sta. 30+500, looking northeast at the crest and the upstream slope.

Photograph A3-6 Bay Goose Dike

Date: July 29, 2022 **Photo Number:** 207

Description: From Sta. 30+500, looking south at the crest and the upstream slope.

Photograph A3-7 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 209

Description: From Sta. 30+500, looking west at the downstream slope and toe.

Photograph A3-8 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 200

Description: From approximately Sta. 31+130, looking south at the upstream slope.

Photograph A3-9 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 201

Description: From approximately Sta. 31+130, looking north at the crest and upstream slope.

Photograph A3-10 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 202

Description: From approximately Sta. 31+080 on the crest, looking north at the downstream slope and toe.

Photograph A3-11 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 203

Description: From approximately Sta. 31+080 on the crest, looking southwest at the pond of water at Central Channel seepage at Sta. 31+165.

Photograph A3-12 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 198

Description: From approximately Sta. 31+130, looking southwest at the crest.

Photograph A3-13 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 199

Description: From approximately Sta. 31+130, looking north at the crest.

Photograph A3-14 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 197

Description: From approximately Sta. 31+280 on the crest, looking north at the downstream slope and toe area.

Photograph A3-15 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 196

Description: From approximately Sta. 31+280 on the crest, looking southwest at the downstream slope and the water pond at the downstream toe at Sta. 31+350.

Photograph A3-16 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 195

Description: From approximately Sta. 31+280, looking south at the crest.

Photograph A3-17 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 194

Description: From approximately Sta. 31+280, looking northeast at the crest.

Photograph A3-18 Bay Goose Dike

Date: July 29, 2022 **Photo Number:** 192

Description: From approximately Sta. 31+475, looking west at the crest. Old cracks are disappearing.

Photograph A3-19 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 193

Description: From approximately Sta. 31+475, looking northeast at the crest. Old cracks are disappearing.

Photograph A3-20 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 191

Description: From approximately Sta. 31+475, looking east at the crest and the downstream slope.

Photograph A3-21 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 190

Description: From approximately Sta. 31+475, looking west at the crest and the downstream slope toward Channel 3.

Photograph A3-22 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 189

Description: From approximately Sta. 31+570, looking north toward Channel 3.

Photograph A3-23 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 188

Description: From approximately Sta. 31+645, looking east at the crest.

Photograph A3-24 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 187

Description: From approximately Sta. 31+645, looking northwest at the crest and upstream slope.

Photograph A3-25 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 186

Description: From approximately Sta. 31+640, looking southeast at the upstream slope.

Photograph A3-26 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 184

Description: From the crest at approximately Sta. 31+740. Looking southeast downstream toward Channel 3.

Photograph A3-27 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 185

Description: From the crest at approximately Sta. 31+740, looking north downstream at the water pond at Sta. 31+750.

Photograph A3-28 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 183

Description: From approximately Sta. 31+870, looking northwest at the crest and upstream slope.

Photograph A3-29 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 183b

Description: From approximately Sta. 31+870, looking southeast at the crest and upstream slope.

Photograph A3-30 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 181

Description: From approximately Sta. 31+920, looking south at the crest.

Photograph A3-31 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 182

Description: From approximately Sta. 31+920, looking northwest at the crest.

Photograph A3-32 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 206

Description: From approximately Sta. 31+920, looking southeast at the downstream toe.

Photograph A3-33 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 205
Description: From about Sta. 31+920, looking northwest at the downstream toe toward Channel 1 monitoring station.

Photograph A3-34 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 179
Description: From approximately Sta. 32+030 looking southeast at the crest and downstream slope.

Photograph A3-35 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 180

Description: From approximately Sta. 32+030 looking southeast at the crest.

Photograph A3-36 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 178

Description: From approximately Sta. 32+025 (south abutment) looking east at the crest and upstream slope. Zone of high magnitude settlement in the ultramafic cap. The tension cracks seem no longer active.

Photograph A3-37 Bay Goose Dike

Date: July 29, 2022 **Photo Number**: 177

Description: From approximately Sta. 32+025 (south abutment) looking west at the crest. Zone of high magnitude settlement in the ultramafic cap. The tension cracks seem no longer active.

Appendix A-4

Vault Dike

Client:	AEM	**By:**	Marion Habersetzer
Project:	Meadowbank	**Date:**	July 29, 2022
Location:	Vault Dike	**Reviewed:**	Yves Boulianne

GENERAL INFORMATION			
Dam Type:	Rockfill embankment with filter zones, impervious upstream liner (bituminous membrane) and an upstream key trench (aggregate mixed with bentonite)		
Weather Conditions:	Sunny	**Temperature:**	15°C

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
1. DAM CREST		144, 143, 147, 146, 141, 142	
1.1 Crest elevation	142.4 m		
1.2 Reservoir level	139.48 m U/S		
Current freeboard	2.92 m		
1.3 Distance to tailings pond (if applicable)	Not applicable		
1.4 Surface cracking	No		
1.5 Unexpected settlement	No		
1.6 Lateral movement	Not apparent		
1.7 Other unusual conditions	No		

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
2. UPSTREAM SLOPE		142, 143	
2.1 Slope angle	Approx. 1.5H:1V		
2.2 Signs of erosion	Stable		
2.3 Signs of movement (deformation)	None observed		
2.4 Cracks	No		
2.5 Face liner condition (if applicable)	Not applicable		
2.6 Other unusual conditions	None		
3. DOWNSTREAM SLOPE		144, 146, 147	
3.1 Slope angle	Approx.1.5H:1V		
3.2 Signs of erosion	None observed		
3.3 Signs of movement (deformation)	No		
3.4 Cracks	None observed		
3.5 Seepage or wet areas	Not apparent		
3.6 Vegetation growth	None observed		
3.7 Other unusual conditions	None		
4. DOWNSTREAM TOE AREA		145	
4.1 Seepage from dam	None		
4.2 Signs of erosion	Not observed		
4.3 Signs of turbidity in seepage water	No		
4.4 Discoloration/staining	No		

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
4.5 Outlet operating problem (if applicable)	Not applicable		
4.6 Other unusual conditions	None		
5. ABUTMENTS			
5.1 Seepage at contact zone (abutment/embankment)	None observed		
5.2 Signs of erosion	None observed		
5.3 Excessive vegetation	No		
5.4 Presence of rodent burrows	None observed		
5.5 Other unusual conditions	None		
6. RESERVOIR		145	
6.1 Stability of slopes	Good conditions		
6.2 Distance to nearest slide (if applicable)	None observed		
6.3 Estimate of slide volume (if applicable)	Not applicable		
6.4 Floating debris	None observed		
6.5 Other unusual conditions	None		
7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE	No spillway or outlet structure exists, only dewatering pump.		
7.1 Surface condition			
7.2 Signs of erosion			

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
7.3 Signs of movement (deformation)			
7.4 Cracks			
7.5 Settlement			
7.6 Presence of debris or blockage			
7.7 Closure mechanism operational			
7.8 Slope protection			
7.9 Instability of side slopes			
7.10 Other unusual conditions	No		
8. INSTRUMENTATION			
8.1 Piezometers	No		
8.2 Settlement cells	No		
8.3 Thermistors	Yes		See Section 3.4.2 of the report.
8.4 Settlement monuments	No		
8.5 Seismograph	No		
8.6 Inclinometer	No		
8.7 Weirs and flow monitors	No		
8.8 Data logger(s)	No		
8.9 Other			

INSPECTION ITEM	OBSERVATIONS DATA	PHOTO	COMMENTS & OTHER DATA
9. DOCUMENTATION			
9.1 Operation, Maintenance and Surveillance (OMS) Plan			
9.1.1 OMS Plan exists	Yes		
9.1.2 OMS Plan reflects current dam conditions	Yes		
9.1.3 Date of last revision	November 2021		
9.2 Emergency Preparedness Plan (EPP)			
9.2.1 EPP exists	Yes		
9.2.2 EPP reflects current conditions	Yes		
9.2.3 Date of last revision	September 2021		
10. NOTES			

Inspector's Signature	Marion Habersetzer	**Date:**	July 29, 2022

Photograph A4-1 Vault Dike

Date: July 29, 2022 **Photo Number**: 144

Description: From the east abutment, looking northwest at the crest.

Photograph A4-2 Vault Dike

Date: July 29, 2022 **Photo Number**: 146

Description: From downstream, looking southeast at the downstream toe.