BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CANZINCO MINES LTD.

NANISIVIK MINE, NUNAVUT

2022 ANNUAL GEOTECHNICAL INSPECTION

PROJECT NO.: 0255034 DATE: February 28, 2023

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Project No.: 0255034

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Dear Zied,

Re: Nanisivik Mine 2022 Annual Geotechnical Inspection Report

Please find attached our above captioned report on the 2022 Annual Geotechnical Inspection undertaken at Nanisivik Mine. If there are any questions or comments regarding this report, please contact the undersigned at your convenience.

Yours sincerely,

BGC ENGINEERING INC.
per:

Scott Garrison, M.Eng., P.Eng.
Geological Engineer

EXECUTIVE SUMMARY

The Annual Geotechnical Inspection was undertaken at the Nanisivik Mine site in August 2022, as a requirement under Water Licence 1AR-NAN2030. The program involved the following:

- Completion of a site inspection by a professional geotechnical engineer. The site inspection included visual observations of all reclamation measures undertaken at the Nanisivik Mine site since 2004.
- Collection of geotechnical monitoring data from various instruments located around the mine site.
- Review of the geotechnical monitoring data to assess the performance of various reclamation measures with respect to the original design intent.

The following paragraphs provide a summary of the significant observations, conclusions, and recommendations based on the results of the 2022 Geotechnical Inspection Program undertaken at the Nanisivik Mine site. Any party that relies on this report must read the full report.

Embankments

The West Twin Dyke and Test Cell Dyke were physically stable with no signs of erosion or seepage. The breaches constructed in the remnant dykes at the East Adit Treatment Facility continue to permit natural drainage of the area with only limited ponding in the Retention Pond.

Hydraulic Structures

The West Twin Dyke Spillway continues to effectively drain water from the Surface Cell cover into the Reservoir and is generally functioning as intended. Limited erosion was observed in 2022, although it is likely that additional maintenance will be required in the future. The spillway should continue to be inspected for additional erosion and maintenance should be undertaken when deemed necessary in future geotechnical inspection reports.

As observed and reported during previous inspections, a small head pond developed on the Surface Cell cover at the spillway inlet. The presence of the shallow head pond is not considered to negatively impact the overall cover performance; hence the elimination of the head pond is not considered necessary.

Despite continued seepage observed at the West Twin Outlet Wall, level logger data continues to support visual observations that the water level upstream of the outlet wall is maintained at or above the wall invert during the open water season. Continued deformation of the perimeter slopes of the upstream Polishing Pond was observed in 2022. As noted in previous inspections, the area of instability was located farther from the outlet wall compared to previous years. Hence, there are no concerns that this instability will impact the performance of the outlet wall. Based on the water quality measurements collected since the East Twin Lake access road was breached in 2008, the seepage losses from the Polishing Pond do not appear to be affecting the overall performance of the West Twin Area reclamation measures. The seepage losses should continue to be monitored for increases in flow rate or for initiation of particle transport. Additional seepage control measures could be considered, if necessary.

Previous inspections made recommendations to repair left bank armouring material following observations of erosion along a section of the East Twin Creek Diversion Channel. In response to these observations, maintenance was undertaken at the diversion dyke in 2018. The maintained areas were visually assessed during the 2022 inspection and limited erosion was observed. Seepage discharge observed at the toe of the left bank of the dyke during previous inspections was observed again in 2022. The seepage water is interpreted to originate in the Polishing Pond and interpreted to only flow during the summer, when the active layer thickness is near its maximum depth. The seepage flow rate was visually estimated to be similar in comparison to recent years, and the flow was observed to be clear and free of sediment. No further maintenance of the diversion dyke is recommended at this time but the dyke should continue to be monitored for additional erosion and seepage flows.

Thermal Covers

Based on monitoring data collected from various frost gauges and thermistors, the thermal covers performed adequately throughout 2022. In general, the active layer thaw in 2022 was observed to be similar to what was measured in 2020 and 2021. The 2022 weather was variable: in general (compared to the 1977-2022 dataset), the 2021 fall was the warmest on record, the 2021/2022 winter and 2022 spring were colder than average and the 2022 summer was average. Since the active layer thaw depths tend to reflect summer temperatures, average thaw depths were observed in 2022. Based on field observations during the annual geotechnical inspection, surface water conditions on site were generally drier than recent years. And, anecdotally, locals in Arctic Bay commented on the 2021/2022 winter as having little snow and the 2022 spring/summer as having less rain than recent years.

The minor erosion, cracking, and thermokarsting/settlement observed on the Surface Cell and Test Cell cover systems that has been noted in previous inspections was not observed to have visually changed in several years. However, the cracks and heaving in an oval pattern near the central-southern portion of the cover continued to grow since 2021, with some shale becoming exposed below the armouring layer. The heaving is likely due to the freeze-back of the pore water in the underlying tailings. The heaving/cracking is not considered to impact the stability of the West Twin Dyke. Should the cracks deepen through the shale cover and expose tailings, they pose a risk of negatively impacting the local performance of the cover system and surrounding water quality. Localized snow accumulation within the cracking may exacerbate the issue by locally increasing thaw depths. Localized re-grading of the cover materials should be undertaken to limit snow accumulation and potentially to reduce the rate of growth of the heave. The water quality observed at the final discharge point for the West Twin Disposal Area, based on a sample collected and tested in August 2022, remained well below the discharge criteria, indicating that to date, no degradation of water quality has been observed, and is an indication that the cover systems continue to perform as intended.

Several instruments to monitor the performance of the thermal covers on site have ceased functioning in the past few years. This is expected, as most instruments were installed nearly 20 years ago. Replacement of the failed instruments is not considered necessary at this time, given generally positive performance monitoring results since installation.

Visual monitoring of the thermal covers is recommended to monitor for additional surface deformation and erosion, specifically the heave feature. Additionally, at the heave feature, measurements of the cracking (length, width, depth), and measurements of any exposed shale cover (length, depth), should be recorded and compared at each inspection. Localized regrading of the heave feature during an upcoming geotechnical inspection is recommended to limit snow accumulation and potentially to reduce the rate of growth of the heave.

Talik and Mine Waste Freeze-back

Overall freeze-back of the taliks in the Surface Cell and Test Cell appears to be proceeding faster than anticipated. In 2022, cooling of ground temperatures shallower than approximately 15 m bgs was observed, relative to 2020 and 2021, but generally remained slightly warmer than 2019. Cooling of ground temperatures at depths greater than approximately 15 m bgs and downward progression of the permafrost base continued in 2022, but the rate has slowed in recent years suggesting that ground temperatures are likely reaching thermal equilibrium at depth. Mine waste remained frozen through 2022. All piezometers within the Surface Cell, and four out of five piezometers within the Test Cell, have frozen back due to continued downward progression of the permafrost base. The piezometers have been observed to freeze back at lower temperatures when the piezometer tip is at a lower elevation, as well as when it is located further away from the edge of the original lakebed. These relationships are likely related to the depression of the freezing point due to increasing solute concentrations in the unfrozen pore water contained within the remnant talik.

In areas where no talik exists (e.g., landfill, open pits), freeze-back of the materials underlying the cover systems has occurred and the rate of cooling has generally slowed over recent years, suggesting ground conditions are approaching thermal equilibrium at depth.

Mine Openings, Crown Pillars and Raises

The covers constructed over the mine openings generally appear to be physically stable. Cracking at the East Open Pit crown pillar does not appear to have progressed in many years. No maintenance is recommended, but continued visual inspection is warranted.

Shale and Armour Borrow Areas

In general, the shale and armour borrow areas appear to be physically stable and no ponding was observed. No maintenance is recommended at any of the borrow areas.

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LIMITATIONS

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1.0 INTRODUCTION

Nanisivik Mine is located on the Borden Peninsula on northern Baffin Island, Nunavut, just south of Strathcona Sound, as shown on Drawing 01.

Mining operations at Nanisivik ceased in September 2002. The geotechnical site inspection in 2022 was conducted under Nunavut Water Board Licence 1AR-NAN2030 (the Licence), effective from January 9, 2020, through January 8, 2030. The Licence details the site water quality criteria to be met, that in conjunction with the annual geotechnical inspection report, is used as an indicator of closure performance of the Nanisivik Mine.

The Licence authorizes CanZinco Mines Ltd. (the Licensee) to conduct post-closure monitoring and maintenance activities at the former Nanisivik Mine. Part H, Item 4 of the Licence states the following:

> *"The Licensee shall undertake a geotechnical inspection during the years set out in Schedule H, Table 1. The inspection shall be carried out annually by a Geotechnical Engineer and the results of the inspection shall be documented in a report. The inspection shall be conducted in accordance with the Canadian Dam Safety Guidelines (2007) where applicable and be consistent with the previous Annual Geotechnical Inspection reports submitted by BGC Engineering Inc. for the project, and shall taking into account all major earthworks and any changes to the project."*

In fulfillment of these regulatory requirements, Mr. Zied Tebaibi, Site Manager Langlois Mine, requested that BGC Engineering Inc. (BGC), conduct an inspection visit. The current report provides a summary of the conditions observed and any resulting recommendations and maintenance issues. The report also provides a comprehensive review of geotechnical monitoring data collected on site during the 2022 site inspection. Table 1-1 provides a list of the structures that were included within the inspection.

Additionally, the Licence relies upon two contingency plans:

- 2020 update to geotechnical instrumentation contingency plan (BGC, March 13, 2020a)
- 2020 update to post-closure geotechnical monitoring contingency plan (BGC, March 13, 2020b).

The above reports outline the contingency measures that may be taken in the event of unsatisfactory closure performance related to instrumentation or geotechnical considerations.

Table 1-1. Summary of inspection items.

Facility Type	Inspection Item
Embankments and Containment Structures	West Twin Dyke
	Test Cell Dyke
	East Twin Creek Diversion Dyke
	East Adit Treatment Facility
	Day Tank Farm Area
	West Twin Outlet Channel
Thermal Covers	Surface Cell
	Test Cell
	Toe of Test Cell Dyke
	Toe of West Twin Dyke
	Landfill
	West Open Pit
	East Open Pit
	Oceanview Open Pit
	Upper Dump Pond
	Industrial Complex
Mine Openings, Crown Pillars and Raises	00/01 Portals and crown pillar
	17 N Portal
	Oceanview Portal
	K-Baseline Portal
	9S Portal
	Former Portal to Mill Foundation
	Lower Adit
	Shale Hill Raise
	Oceanview East and West Raises

Facility Type	Inspection Item
Shale and Armour Borrow Areas	Mt. Fuji Shale Borrow Area
	West Twin Shale Borrow Area
	East Twin Shale Borrow Area
	Area 14 Shale Borrow Area
	Townsite Shale Borrow Area
	Shale Hill Shale Borrow Area
	Twin Lakes Delta Armour Borrow Area
	Kuhulu Lake Road Borrow Area
	09S/17N Armour Borrow Area
	Chris Creek Armour Borrow Area

1.1. 2020-2029 Monitoring Schedule

As part of the Water Licence renewal process in 2019/2020, BGC undertook a review of the geotechnical monitoring requirements for the Nanisivik Mine site, with the intent to develop a reduced monitoring frequency for the term of the 1AR-NAN2030 Water Licence. The results of this review are documented in a project memorandum (BGC, April 24, 2019). As part of the Water Licence, the monitoring frequency of geotechnical instrumentation (thermistors, piezometers, frost gauges) was reduced to a single monitoring event per year, provided that current performance trends and general site stability continue to be observed. In addition to a reduction in per-annuum monitoring, the Water Licence allows a further reduction in the monitoring frequency to omit monitoring years in a tapered fashion such that annual inspections are gradually spaced farther apart. Annual inspections are intended to be performed concurrent with monitoring events.

The 2020-2029 monitoring schedule incorporated within the Water Licence is provided in Appendix I. Based on the performance monitoring and observations reported herein and the project monitoring schedule (BGC, April 24, 2019), the next site inspection and instrumentation monitoring event is planned for August 2024.

2.0 SCOPE OF SERVICES

BGC Engineering Inc. (BGC) has provided geotechnical engineering, mine waste and mine closure support to the Nanisivik Mine since 2000, including the development and implementation of the reclamation plan for tailings deposits, waste rock piles, portals and open pits. BGC has overseen the implementation of the post-closure geotechnical and geothermal performance monitoring plan since completion of the bulk of the reclamation measures in 2004/2005. BGC has conducted an annual geotechnical site inspection since 2001.

At CanZinco's request, BGC provided a proposal on May 3, 2022, that outlined BGC's scope of work for the 2022 monitoring season. Included within the scope of work is the following:

- A site visit in August 2022 to complete the annual geotechnical site inspection, including collection of geotechnical instrumentation readings, and collection of water quality samples required by the Licence.
- Issuance of a geotechnical inspection summary report, including review and interpretation of geotechnical instrumentation.
- Project management.

The results of water quality monitoring, including third--party laboratory analysis, are discussed in a separate BGC report titled "2022 Annual Water Quality Monitoring Report, Nanisivik Mine, Nunavut" dated February 2023. Direction to proceed with the proposal, including a signed consultancy agreement, was provided on May 24, 2022.

3.0 MINE RECLAMATION ACTIVITIES

The Final Closure and Reclamation Plan (FCRP) was submitted to the Nunavut Water Board for review and approval in March 2004. The review process included a technical meeting in Yellowknife in May 2004 and a public hearing in Arctic Bay in June 2004. The Board conveyed its approval of the plan in a letter to Breakwater Resources (previous site owner/operator) dated July 6, 2004.

The reclamation of the mine site began in August 2004, with the bulk of reclamation completed between 2004 and 2008. Instrumentation was installed to monitor closure performance, as further described throughout Section 6.0. The reclamation activities are summarized in the project completion report (BGC, September 28, 2009) and documented in detail in various as-built reports referred to throughout this document. Post closure monitoring of the site is on-going and has been conducted in many areas of the site since 2006.

4.0 CLIMATE REVIEW

Climatic data was collected at the Nanisivik Airport by Environment Canada from 1976 to 2010, which was located approximately 10 km south of the West Twin Disposal Area (WTDA) and approximately 250 m higher in elevation. The recorded climate data were previously analyzed by Golder (October 1998) to provide a basis for deriving the existing climate parameters such as precipitation, air temperatures, and lake evaporation at the project site. The following list is a summary of the main climatic parameters, based on data from 1977 to 1997, provided by Golder (October 1998):

- Mean Annual Air Temperature (MAAT) was estimated to be -15.2°C
- Mean annual precipitation total was estimated to be 240 mm
- Twenty-four-hour Probable Maximum Precipitation (PMP) value was estimated to range from 140 to 210 mm
- Mean annual lake evaporation value, as measured at the Nanisivik site, was approximately 200 mm.

Climate monitoring was discontinued at the Nanisivik Airport in January 2011. Currently, the nearest available climate monitoring station is located at Arctic Bay, approximately 30 km from Nanisivik. Data collected from Arctic Bay since 2011 is provided on Figure 01. The MAAT recorded at the Arctic Bay weather station in 2022 was approximately -13.1°C. This is 2.5°C cooler than 2021 and 0.5°C cooler than the Arctic Bay 2011 to 2022 MAAT. In general, temperatures in 2022 were average. The MAAT in August and October were warm and the MAAT in September was the third warmest on record; MAAT in February was one of the coolest on record; MAATs in all other months were approximately average. The Air Thaw Index calculated for 2021 was approximately 481-degree Celsius days (°C•d). This value is more than that of 2021 (411°C•d), and very near the 2011 to 2022 average of 479°C•d.

Due to the approximately 630 m difference in elevation and the proximity to the coastline, the climate data sets from Arctic Bay and the historical data collected from the Nanisivik airport station are not directly comparable. To put the climate data collected from Arctic Bay since 2011 in historical context, a correction factor is required. A correction factor of -2°C has been estimated (Nanisivik airport 2°C cooler than Arctic Bay) based on a review of the overlap of data sets while monitoring data was collected from both sites in 2010 and 2011, the air temperature data collected sporadically on site since 2013, and the available historical MAAT at both Arctic Bay and Nanisivik. This correction factor was applied to the climate data collected from Arctic Bay between 2011 and 2022 to create a hybrid climate data set for the Nanisivik mine site of 1977 to 2022 data.

Compared to the average of the corrected hybrid climate data set (1977 to 2022) the site MAAT during the fall (September through November 2021) was the warmest on record, while winter (December 2021 to February 2022) and spring (March through May 2022) were cold, and summer (June to August 2022) were average. The corrected MAAT in 2022 was approximately -15.1°C, 0.6°C cooler than the 1977-2010 MAAT of -14.5°C. The corrected Air Thaw Index (ATI) calculated in 2022 was approximately 289-degree Celsius days (°C•d), which is higher than in 2021

(207°C•d) and lower than the 1977 to 2010 mean of 304°C•d. Both the MAAT and the corrected ATI were below average in 2022.

Additionally, BGC noted that surface water conditions on site were generally drier than recent years. The observed surface water conditions were supported anecdotally by locals in Arctic Bay who commented on the 2021/2022 winter as having little snow and the 2022 spring/summer as having less rain than recent years.

5.0 MINE DESCRIPTION

Mining of lead and zinc concentrate was conducted at Nanisivik Mine between 1976 and 2002. During that time, mining was conducted at four small open pits (West Open Pit, East Open Pit, East Trench, and Oceanview Open Pit) and underground (Main Lens, Area 14, Oceanview, and K-Baseline). The locations of each mining area are illustrated on Drawing 01. The ore was processed at the mill and the tailings were transported to the WTDA, located at West Twin Lake.

The WTDA is comprised of an upper, solids retention pond, named the Surface Cell, and a lower, water retention pond, called the Reservoir, as shown on Figure 02. The Surface Cell and Reservoir are separated by the West Twin Dyke, a frozen-core, rockfill dyke. Prior to construction of the West Twin Dyke, tailings were deposited throughout the original West Twin Lake. After construction of the dyke, tailings were primarily deposited into the Surface Cell. Excess water was then siphoned or pumped from the Surface Cell into the Reservoir, where it was reclaimed for use in the mill. The Reservoir was subsequently further separated by constructing the Test Cell Dyke, creating additional tailings disposal capacity in what was known as the Test Cell.

The Reservoir and a final Polishing Pond were separated by a rockfill causeway and stop log structure. Water from the Polishing Pond was then discharged to Twin Lakes Creek at the decant structure located at the outlet from the pond. The decant structure was replaced in 2005 by the West Twin Outlet Channel. In September 2008, the stop log structure was removed and the rockfill causeway was breached allowing the Reservoir and Polishing Pond to behave as a flow-through hydraulic system.

6.0 2022 SITE INSPECTION

Scott Garrison, P.Eng., and Christy Rouault, P.Eng. (AB/BC), conducted the geotechnical site inspection between August 18 and 23, 2022. In general, site conditions during the inspection were cool (between 0 and 5 °C), overcast, and windy. Occasionally, there was fog and light rain, at times obscuring visual observations. The inspection items in Table 1-1 were free of snow cover during the inspection. Snow cover remained on many adjacent north-facing slopes in the region. During the inspection, the following site activities were conducted:

- Each of the elements from Table 1-1 was inspected on foot. Pertinent observations concerning the physical condition of each element were recorded by photograph.
- Instrument readings were collected.
- Aerial drone imagery was collected where time and weather conditions permitted.
- Ground-based LiDAR data was collected at selected locations.
- Water samples were collected and forwarded to a third-party laboratory for analysis (Water Quality report provided under separate cover).

Select photos are provided in Appendix II. The following sections review the results of the geotechnical inspection and geotechnical instrumentation monitoring program at the various site facilities.

6.1. Embankments and Containment Structures

Several embankments and containment structures were constructed at Nanisivik Mine throughout its history for various purposes. These include the following:

- West Twin Dyke
- Test Cell Dyke
- East Adit Treatment Pond Dyke
- East Adit Retention Pond Dyke
- Day Tank Farm Spill Containment Berm
- Main Tank Farm Spill Containment Berm.

The following sections provide a summary of the inspection conditions at each of the structures mentioned above. It should be noted that since the West Twin Dyke and Test Cell Dyke have been incorporated into the Surface Cell and Test Cell tailings covers, respectively, the inspection conditions for these structures are reviewed in Section 6.3 (Thermal Covers). Additionally, no inspection of the Day Tank Farm or Main Tank Farm areas was completed as both facilities have been fully decommissioned and berms have been removed.

6.1.1. East Adit Treatment Facility Dykes

Construction Details

The East Adit Treatment Facility was located approximately 3 km east of the mill, downslope from the East Adit area, as shown on Drawing 01. The facility was comprised of a Treatment Pond and a Retention Pond, both of which employed earthen dykes to retain surface water flow. Water that flows through this area is runoff water from the surrounding drainage basin, where the water quality is affected and/or impacted by naturally mineralized soil and rock.

Both dykes are shale rockfill structures mixed with a combination of one or more of the following: regional talus, glacial till, marine clay, and/or bentonitic clay. The Treatment Pond Dyke is approximately 5 m above the surrounding ground surface. The Retention Pond Dyke is approximately 3 m above the surrounding ground surface.

Commitments were made in the 2004 Reclamation and Closure Plan (CanZinco, March 2004) to restore natural drainage by breaching/removing any man-made diversions or catchments. As such, both dykes were breached in 2006. The breaches are approximately 5 m wide at the base and are sloped back to the remnant crest of the dykes at an angle of approximately 3(H):1(V).

Inspection Conditions

Select photos from the inspection are provided in Appendix II (Photos 1 & 2). The main observations made during the inspection are summarized by the following:

- Both the breach of the East Adit Retention Pond and the breach of the East Adit Treatment Pond promote drainage of the former pond areas as intended.
- As observed during previous inspections, a small remnant pond was observed in the East Adit Retention Pond area which has been present since breaching. The ponding has been reduced in areal extent over time due to continued natural backfilling of the area by sediments, mostly weathered shale, being transported and deposited in this area from natural deposits upslope.
- Some channelization of remnant sediments was observed in the bottom of the East Adit Treatment Pond.

As expected, natural sedimentation has steadily been reducing the areal extent of remnant ponding in the East Adit Retention Pond. As such, additional remedial actions at the East Adit Treatment Facility are not considered necessary.

6.2. Water Conveyance Structures

Several water conveyance structures were constructed at Nanisivik Mine, both prior to, and during the reclamation process. These include the following structures:

- West Twin Dyke Spillway
- West Twin Outlet Channel
- East Twin Creek Diversion Berm and Channel.

The following sections provide a summary of the inspection conditions at each of the structures mentioned above.

6.2.1. West Twin Dyke Spillway

Construction Details

The West Twin Dyke Spillway is located at the south end of the Surface Cell, as shown on Figure 02. The spillway conveys water from the Surface Cell to the Reservoir. The physical details of the spillway are summarized by the following:

- The spillway is approximately 550 m long.
- The bottom of the spillway is approximately 6 m wide.
- The grade of the spillway bottom varies from 0% at the inlet to 7% near the middle of the spillway and 2% at the outlet.
- The bottom of the spillway is founded on rock from the inlet to 100 m down gradient of the access ramp. The remainder of the spillway bottom is comprised of rockfill.
- The side slopes of the spillway vary from near vertical in rock to approximately 3(H):1(V) in soil side slopes.
- Side slopes are composed of poor-quality rock or soil are armoured with riprap.

Inspection Conditions

Select photos from the inspection are provided in Appendix II (Photos 3 through 8). The main observations are summarized by the following:

- A small pond was observed at the spillway inlet on the Surface Cell cover (Photo 3). The maximum depth of the pond was estimated to be approximately 10-15 cm, less than previous years.
- The upper portion of the spillway (upstream of the access ramp) showed signs of further erosion of the armour material compared to 2021, particularly along the left bank, but remained in satisfactory condition (Photo 4).
- Maintenance activities were undertaken in 2018 to address erosion along the left bank, downstream of the access ramp. The maintenance activities are described in a memorandum appended to BGC's *Nanisivik Mine 2018 Annual Geotechnical Inspection Report (March 11, 2019)*. Erosion of the maintained area was noted in 2022, to a greater degree than has been observed during annual inspection from 2019 to 2021 (Photos 5 to 7).
- During 2018 maintenance activities, transported armour material that was deposited at the base of the spillway was removed or compacted in-place. No new deposition of armour material in the base of the spillway was observed during the 2019 to 2022 inspections (Photo 8).
- As noted in previous inspections, surface flow was observed to travel down the spillway before going subsurface into the rockfill approximately 150 m upstream of the spillway outlet. This is not considered to have an adverse impact on spillway performance at this time.

While the spillway remains effective in directing and confining flow from the Surface Cell to the Reservoir, additional maintenance may be required in the future. It is recommended that the spillway and side slopes continue to be visually monitored for additional erosion and maintenance be undertaken as necessary.

6.2.2. West Twin Lake Outlet Channel

Construction Details

The West Twin Lake Outlet Channel is located in the northeast corner of the WTDA, as shown on Figure 02. The channel conveys water from the Reservoir into Twin Lakes Creek. The channel replaces the former decant station located in the same area. The main design feature of the channel is a steel-reinforced, concrete wall which provides water retention and elevation control for the water level in the Reservoir. The physical details of the channel are summarized by the following:

- The concrete wall is approximately 17 m long and 0.3 m thick.
- The central portion of the wall where the flow occurs is 7 m wide and has an invert elevation of approximately 370.2 m.
- The wall contains sloping side walls (4(H):1(V)) and the elevation of the top of the side walls is approximately 370.8 m.
- The concrete wall is founded into the underlying bedrock via a steel-reinforced, concrete footing.
- The channel is armoured to approximately 370.8 m elevation, upstream and downstream of the wall.
- A plunge pool is located downstream of the wall to provide energy dissipation during flooding events.

In 2007, a geosynthetic clay liner (GCL) was installed upstream of the concrete wall, as recommended in the 2006 inspection report. This was completed in response to observations of declining water levels upstream of the wall during periods of low inflows. The declining water levels were inferred to suggest seepage losses through the foundation of the wall. As such, the GCL approach was suggested as a way to limit the potential for these seepage losses.

In September 2008, the culverts in the East Twin access road that had previously impeded the flow from the Reservoir to the Polishing Pond were removed and the Reservoir is now considered to be a flow-through hydraulic system at the normal water level. Due to the limited depth of the breach, the former East Twin access road restricts flow into the former Polishing Pond area at lower water levels.

Inspection Conditions

Select photos from the inspection are provided in Appendix II (Photos 9 through 13). The main observations are summarized by the following:

- During the inspection, the water level upstream of the wall was noted to be flowing approximately 0.5 cm above the elevation of the wall invert (Photo 10).
- Slumping and settlement of the perimeter slopes of the upstream Polishing Pond continued to degrade since the 2021 inspection (Photos 11 through 13). The area of active instability remains over 50 m away from the outlet wall area. As such, there is limited

concern with respect to the instability and its potential impact on the effectiveness of the outlet wall to function as intended, but it should continue to be visually inspected for changes.

Water level loggers were installed in the remnant Polishing Pond and Reservoir during the 2021 inspection trip and were downloaded during the 2022 inspection. Water level logger data for the Polishing Pond and Reservoir are shown with site air temperature data on Figure 03. As observed in previous years, the data suggests that as freezing air temperatures cause icing of the Reservoir, inflows into the remnant Polishing Pond are reduced and water levels in the remnant Polishing Pond drop. During August/September 2021, the drop in the water level of the Polishing Pond was 57 cm, comparable, but slightly less than recent years, where 60-70 cm drops have been observed. Water level data collected from the Reservoir in August/September 2022, showed a drop of 10 cm during the same period. These observations support the concept that water cover in the Reservoir is maintained despite seepage losses from the remnant Polishing Pond typically observed at the end of the monitoring season. The loggers were re-deployed during the inspection.

The observed seepage losses and stability issues along the edge of the remnant Polishing Pond are thought to be related to the excavation of sediments from the Polishing Pond during site reclamation activities in 2005. Excavation of these sediments created a deeper pocket of water upstream of the wall, measured to be between 3 and 4 m in the deepest parts of the pond. This provides a heat source which has likely resulted in thawing of the ground beneath the pond.

Based on the water quality measurements collected since the East Twin Access Road was breached in 2008, the seepage losses through the foundation of the wall do not appear to be influencing the overall performance of the West Twin Area reclamation measures. As suggested by the water level data discussed previously, the impact of seepage losses on the main water level in the Reservoir is minimized by the various breaches creating flow restrictions between the Reservoir and the remnant Polishing Pond. Additionally, the seepage losses from the remnant Polishing Pond do not appear to have changed much with time, as demonstrated by the water level measurements collected since closure. In previous inspection reports, it has been suggested that additional mitigation measures be considered to reduce the seepage losses, pending additional monitoring data and inspection observations. Given the recent observations, additional mitigation measures are not considered to be required at this time but monitoring of the water levels in the Reservoir and remnant Polishing Pond should continue.

6.2.3. East Twin Creek Diversion Dyke and Channel

Construction Details

The East Twin Creek Diversion Dyke is located along Twin Lakes Creek between East Twin Lake and the West Twin Outlet Channel, as shown on Figure 02. The diversion dyke and channel re-directs flow from East Twin Lake away from its previous drainage course, which drained directly into West Twin Lake (the Reservoir). The flow from the diversion channel combines with the flow from the Reservoir downstream of the West Twin Outlet Channel.

The diversion dyke is approximately 2 m above the adjacent ground level and is comprised of sand, gravel, and cobbles derived from the nearby Twin Lakes sand and gravel deposit. A portion of the dyke was re-graded during reclamation construction to be less susceptible to erosion. Additionally, the re-graded portion of the dyke was armoured with riprap to further protect against erosion.

Inspection Conditions

Select photos from the inspection are provided in Appendix II (Photos 14 through 16).

Previous inspections made recommendations to repair the left bank armouring material following observations of erosion along a section of the East Twin Creek Diversion Channel. In response to these recommendations, maintenance was undertaken in 2018. The maintenance activities are described in detail in a separate memorandum appended to BGC's *Nanisivik Mine 2018 Annual Geotechnical Inspection Report (March 11, 2019)*. During the 2022 annual inspection, further erosion was observed compared to 2021. However, the maintenance work was visually observed to continue to perform suitably. It is recommended that the diversion dyke continue to be inspected for additional erosion of the side slopes and maintenance be undertaken as necessary.

The seepage discharge observed at the toe of the left bank during previous inspections appeared similar in 2022. The seepage water originates from the Polishing Pond and flows within the active layer of the East Twin Creek Diversion Dyke. The seepage flow in 2022 was observed to be clear and free of sediment. The seepage is interpreted to be exacerbating the previously observed erosion impacts at this location. No mitigation efforts to address the observed seepage are recommended at this time, but the discharge point should continue to be visually monitored, along with associated impacts.

6.3. Thermal Covers

The following sections provide a summary of each of the thermal covers constructed at site, including construction details, a summary of the observations made during the 2022 inspection, and reviews the monitoring data collected in 2022. A table documenting the instrumentation monitoring undertaken in 2022 is provided in Appendix III. No additional data collection is planned prior to August 2024, in line with the monitoring schedule defined within the Water Licence.

An additional note on the interpretation of the geothermal monitoring data; for the purposes of interpretations made in this report, the following assumptions were made:

- In the active layer, ground conditions are considered “thawed” when ground temperatures of 0°C and warmer are observed.
- In the taliks, ground conditions are considered “thawed” when ground temperatures warmer than -0.5°C are observed. This temperature adjustment accounts for freezing point depression effects which have been noted in the tailings talik at the site. As the base of permafrost progresses deeper within the taliks, increased concentrations of solutes in the remnant pore water result in a depressed freezing point.

6.3.1. Surface Cell Tailings Cover

Construction Details

A thermal cover was constructed over the tailings in the Surface Cell in 2004 and 2005. The thermal cover consists of a 1 m thick layer (minimum thickness) of granular shale overlain by a 0.25 m thick layer (minimum thickness) of armour material comprised of sand, gravel, and cobbles. It should be noted that, due to surface grade considerations, significantly increased shale thicknesses (greater than 2 m thick) were applied to approximately 30% of the Surface Cell. Additionally, due to practical construction considerations related to the grain size distribution of the armour materials, the armour layer thickness regularly exceeded 0.25 m. The shale was sourced from the Mt. Fuji and Area 14 borrow areas (Drawing 01). The armour material was sourced from the Twin Lakes Delta deposit (Drawing 01). The Surface Cell tailings cover is drained by a series of swales which convey surface water to the spillway inlet located at the south end of the Surface Cell. The spillway transfers water draining off and through the Surface Cell cover system into the Reservoir. It should be noted that surface flow is not regularly observed on the Surface Cell and that the majority of the water flow occurs sub-surface due to the coarse nature of the cover materials.

Inspection Conditions

Select photos from the inspection are provided in Appendix II (Photos 17 through 25). The main observations are summarized by the following:

- As has been observed in previous inspections, some minor thermokarst features were noted along the south shoreline, along the east edge of the main N/S drainage swale (Photo 17) and just north of the E/W trench (Photo 18). These localized thermokarsts are not considered to be negatively impacting the overall performance of the cover system. Additionally, the same thermokarst features have been observed in past inspections and do not appear to be changing with time, suggesting they are currently physically stable.
- No erosion of the cover materials was noted, but some minor settlement deformation in the bottom of the main drainage swale was observed closer to the spillway entrance, similar to observations made during previous inspections.
- The cracking noted in the northeast and southwest quadrants of the cover system in 2016 did not visually appear to have changed in width or extent since 2016 (Drawing 02). The cause of this cracking is uncertain but is likely related to thermal effects within the cover materials or continued freeze-back of pore water in the underlying tailings.

- An oval-shaped heave feature near the central-southern portion of the cover has been observed during each inspection since 2016 (Drawing 02, Photos 19 through 23). Cracking and uplift of the feature appear to be due to heaving of the underlying tailings material during freeze-back. The heave appears to have grown substantially since it was first noted in 2016, but in 2022 it was observed to be approximately the same height, length, and width as was observed in the 2021 inspection (Photo 21). The cracks, however, have increased in width and depth and are up to approximately 2.8 m wide and 0.6 m deep and exposed shale was observed with an approximate thickness of 0.3 m (Photo 22 and 23). Should the cracks deepen through the shale cover and expose tailings, they pose a risk of negatively impacting the local performance of the cover system and surrounding water quality. Measurements of the cracking (length, width, depth), exposure of shale cover (depth), and overall heave (length, width, height), should be recorded and compared at each inspection. Localized snow accumulation within the cracking may exacerbate the issue by locally increasing thaw depths. Localized re-grading of the cover materials should be undertaken to limit snow accumulation and potentially to reduce the rate of growth of the heave

Localized re-grading of the cover material around the heave feature is recommended. Elsewhere on the Surface Cell cover system, the surface of the cover should continue to be visually inspected for additional deformation and cracking.

Monitoring Data

The Surface Cell is instrumented with 10 thermistors, seven vibrating wire piezometers, six frost gauges and two monitoring wells. The location of each of these instruments is provided on Drawing 02. Select plots providing the results of the monitoring are provided, for interpretation purposes, on Figures 04 through 08.

The instrumentation has two main purposes: monitor the depth of the active layer thaw in the cover and monitor the ground temperatures and pore pressures in the talik during freeze back. Monitoring wells originally installed in the Surface Cell and Test Cell taliks to monitor pore water quality during freeze-back are no longer functional due to freeze-back of the tailings and are no longer monitored, in accordance with the approved geotechnical and geothermal monitoring program.

Figure 04 provides data from thermistors installed throughout the Surface Cell talik. The graphs illustrate the following:

- The ground thermal profile in the upper approximately 15 m is cooler than 2021, reflective of cooler air temperatures at site in 2022 compared to 2020 and 2021.
- The upper 25 to 30 m of the ground profile appears to be frozen, as illustrated by data recorded from Thermistors BGC03-07, BGC03-09, BGC03-10, BGC03-11, BGC03-15, and BGC05-05.
- At depths greater than approximately 15 m, the tailings continue to freeze back, as illustrated by data recorded from Thermistors BGC03-09, BGC03-10, BGC03-11, and

BGC05-05, although the rate of freeze-back has slowed over the past several years, as expected.

Figure 05 illustrates the downward progression of the freezing front over time in the Surface Cell. The depth of the -0.5°C isotherm from various thermistors is plotted against the distance from the crest of the West Twin Dyke. The data suggests the -0.5°C isotherm has migrated downwards to a depth of 22 to 26 m bgs since the cover system was completed in 2005. The data also illustrates how the thickness of frozen ground increases with proximity to the West Twin Dyke.

Figure 05 also illustrates that the freeze-back of the Surface Cell talik continues to proceed quicker than anticipated, compared to the results of the geothermal analysis documented in BGC (February 6, 2004a). This is illustrated by comparing the observed depth of the -0.2°C isotherm with the freeze-back envelope predicted by the original geothermal modeling. The -0.2°C isotherm was used for this comparison as it was the freezing point depression assumed during the original geothermal modelling completed as part of the talik freeze-back assessment (BGC, February 6, 2004a). The rate of freeze-back in recent years has slowed, as expected, as the system approaches thermal equilibrium at depth.

Figure 06 provides data collected from the piezometers installed in the Surface Cell talik. The graphs indicate that all of the piezometers in the Surface Cell talik have frozen back in response to continued downward progression of the permafrost base in the tailings. These piezometers were installed at depths ranging from 15 to 24 m bgs. The temperature readings within piezometer BGC05-13 have not been obtainable since 2012, and thus, only piezometric elevation has been plotted since this time.

Figure 07 illustrates the relationship between piezometer tip depth and the freeze-back temperature of the piezometers in the Surface Cell cover system. The freeze-back of the piezometer tips occurred at temperatures ranging from -0.5°C to -1.3°C, and the freeze-back temperatures appear to decrease with depth. For the purposes of this assessment, freeze-back of the piezometer tip is taken to be the time at which a significant drop or increase in erratic nature of the recorded pore pressure is observed. The deeper the piezometer tip, the lower the temperature before freeze-back occurred.

The closed system nature of the Surface Cell also creates a dimension of freezing which is related to the distance from the edge of the original lakebed. The further the piezometer is at lateral distance from the edge of the original lakebed, the lower the freeze-back temperature was recorded within the piezometer.

These relationships are likely related to the increasing solute concentration in the remnant talik as it becomes smaller, and cryo-concentration occurs. The freezing point of the water becomes lower with a higher solute concentration near the centre of the talik.

Figure 08 shows the data collected from select Surface Cell frost gauges. The data suggests that the active layer thaw in 2022 was approximately 6 cm deeper than in 2021, on average. The active layer thaw remained within the cover material, with the exception of Frost Gauge 3, which shows an active layer extending approximately 10 cm into tailings. Since construction of the closure works in 2004, the maximum annual active layer thickness has generally decreased, indicating improved overall thermal performance, believed to be largely due to increased thickness of the ice-saturated layer at the base of the cover. In recent years, the depth of thaw appears to be stabilizing near the top of the inferred ice-saturated layer.

The results of water quality testing undertaken on samples collected at the inlet of the West Twin Dyke Spillway are provided on Figure 09. The sample collected in late August 2022 exhibited a total zinc concentration of 0.01 mg/L. This total zinc concentration is a decrease from the concentrations measured in 2019 (0.04 mg/L), 2020 (0.03 mg/L), and 2021 (0.02 mg/L). For comparison, since 2008, the measured annual maximum has varied from below the detection limit (<0.01 mg/L) to 0.04 mg/L. The water quality monitoring data suggests that the cover system continues to perform as intended.

6.3.2. West Twin Dyke

Construction Details

The West Twin Dyke is a frozen core, upstream constructed, earth fill dyke that separates the Surface Cell and the Reservoir (Drawing 03). The dyke is constructed of frozen, compacted shale and founded on frozen, settled tailings. The dyke is approximately 14 m high and the downstream face slopes at an angle of approximately 15°. The downstream face of the dyke was surfaced with a 0.25 m thick layer (minimum thickness) of sand, gravel and cobbles sourced from the Twin Lakes Delta.

Inspection Conditions

Select photos from the inspection are provided in Appendix II (Photos 24 through 28). The main observations made during the inspection are summarized by the following:

- No settlement or cracking of the crest and immediate upstream area was noted
- The downstream face of the dyke shows no indications of erosion or settlement
- No seepage was noted on the face of the dyke or at the toe of the dyke.

In general, the dyke appeared to be in a satisfactory condition and no maintenance is recommended.

Monitoring Data

The West Twin Dyke was instrumented with five thermocouple cables installed within the dyke, as well as four thermistors and one vibrating wire piezometer installed from the crest of the dyke. The location of each of these instruments is provided on Drawings 02 (thermistors and piezometers) and Drawing 03 (thermocouple cables). Select plots providing the results of the monitoring, for interpretation purposes, are provided on Figure 10. One thermistor data logger was installed during the 2022 site inspection in the West Twin Dyke at BGC05-15 in order to record ground temperature data during 2023, to be collected in the next scheduled site visit in August 2024 (Photos 24 and 25).

Figure 10 provides data from Thermistor BGC03-34, which provides a geothermal monitoring profile from 5 m below the crest of the dyke to approximately 14 m bgs. It also provides data from an additional thermistor installed from the crest of the dyke (BGC05-15), as well as one vibrating wire piezometer (BGC05-17). The 2022 thermistor data indicates the following:

- The profile at the crest of the dyke, within Thermistor BGC05-15, is colder than -3°C to a depth of at least 30 m bgs, approximately 14 m below base of dyke.
- The upper approximately 15 m, as observed in BGC03-34 and BGC05-15, has cooled since 2020 and 2021, reflecting mean annual average air temperatures at site in 2022, that were cooler than the past few years.
- Below approximately 15 m depth the cooling trend observed since the installation of the instruments has continued, as observed in BGC05-15.
- The vibrating wire piezometer BGC05-17 was malfunctioning in August 2021 and was functioning again in August 2022. This piezometer froze back in 2016 at a temperature of approximately -1.2°C, and was recorded to be -3.9°C in 2022.

6.3.3. Test Cell Area

Construction Details

The Test Cell area consists of the Test Cell, former Test Cell Dyke, and Toe of Test Cell Dyke. A thermal cover was constructed over the Test Cell area in 2004 and 2005. The thermal cover consists of a 1 m thick layer (minimum thickness) of granular shale overlain by a 0.25 m thick layer (minimum thickness) of armour material comprised of sand, gravel and cobbles. It should be noted that, due to surface grade considerations, significantly increased shale thicknesses (greater than 2 m) were applied to approximately 20% of the Test Cell. Additionally, due to practical construction considerations related to the grain size distribution of the armour materials, the armour layer thickness regularly exceeded 0.25 m. The shale was sourced from the Mt. Fuji, East Twin, and Area 14 borrow areas (Drawing 01). The armour material was sourced from the Twin Lakes Delta deposit (Drawing 01). The Test Cell tailings cover is drained by a main swale which conveys surface water directly into the Reservoir.

The Test Cell Dyke is an earth fill dyke that separates the Test Cell and the Reservoir (Figure 02). The dyke is constructed of frozen, compacted shale and founded on frozen, settled tailings. The dyke was approximately 4 m high. During reclamation, the top 2 m of shale material in the dyke was removed and placed in the Test Cell as cover material. The remnant dyke was surfaced with a layer of armour material, approximately 0.25 m thick. As such, the dyke is now essentially integrated into the Test Cell cover.

A thermal cover was constructed over the tailings at the toe of the Test Cell Dyke in 2005. The thermal cover consists of a 1 m thick (minimal thickness) layer of granular shale overlain by a 0.25 m thick layer (minimal thickness) of armour material comprised of sand, gravel and cobbles. It should be noted that, due to surface grade considerations, shale fill thickness in excess of the 1 m minimum thickness was applied to the tailings beach at the toe of Test Cell Dyke, especially immediately adjacent to the remnant Test Cell dyke. The shale was sourced from the Mt. Fuji and Area 14 borrow areas (Drawing 01). The armour material was sourced from the Twin Lakes Delta deposit (Drawing 01). The riprap was sourced from the dolostone outcrop at the south end of the West Twin Dyke.

Inspection Conditions

Select photos from the inspection of the Test Cell and Test Cell Dyke are provided in Appendix II (Photos 29 through 38). Photo 29 is an aerial UAV image showing the overall surface of the cover system. The main observations are summarized by the following:

- No erosion or ponding was observed.
- Similar to previous inspection observations, the north-south arm of the Test Cell Dyke and the Test Cell Cover just inside of the dyke remains undulating, suggesting some amount of settlement of the cover materials has occurred (Photos 30 and 31). This undulating nature of the cover in this area has not noticeably changed in the last several years and the cover is overbuilt in this area due to grade requirements. The undulating nature is not considered to negatively impact drainage or the thermal performance of the cover and, as such, this area is not of concern.
- Thermal cracks (<20 cm wide and <20 cm deep) and minor thermokarsting were observed in some areas of the cover system but are not considered to be negatively impacting the performance of the cover. Photo 32 shows the overall flat surface of the cover system.
- The low-lying area near the toe of the left abutment of the West Twin Dyke does not appear to have changed in many years and is likely the result of settlement of cover materials. (Photo 33). This low-lying area is not considered to negatively impact the performance of the cover.

Selected photos from the inspection of the cover along the toe of the Test Cell Dyke and through the Test Cell outlet is provided in Appendix II (Photos 34 through 36). The main observations are summarized by the following:

- No erosion of the cover was observed
- No disturbance due to ice plucking of the riprap was observed.

In general, the tailings cover in the Test Cell area appears to be in satisfactory condition. As such, no maintenance is recommended.

Monitoring Data

The Test Cell area is instrumented with seven thermistors, five vibrating wire piezometers, and four frost gauges. As previously noted in the Surface Cell monitoring review, the monitoring wells installed in the Test Cell talik are frozen to the bottom due to talik freeze-back and are no longer monitored in accordance with the approved monitoring program. The location of each of these instruments is provided on Drawing 03. Select plots providing the results of the monitoring are provided on Figures 11 through 14. One thermistor data logger was installed during the 2022 site inspection in the Test Cell Cover System at BGC05-04 in order to record ground temperature data during 2023, to be collected in the next scheduled site visit in August 2024 (Photos 37 and 38).

Figures 11 and 12 respectively provide geothermal and piezometric monitoring data collected from the Test Cell Cover in 2022. The data indicates the following:

- The active layer thaw was confined within the cover materials throughout 2022. Frost gauges FG-7 and FG-8 indicate that the active layer was approximately 1.2 m thick (approximately 0.2 m above the base of the cover). The 2022 active layer thickness measurements are between that of 2020 and 2021, reflective of average Thaw-Degree-Days at site in 2022.
- The subsurface profile between 1.5 and 15 m depth in the Test Cell at the base of the West Twin Dyke (BGC05-04) is colder than -1.0°C and is presumed to be frozen. At 15 m depth, temperatures of below -7.5°C are measured. The rate of cooling has slowed in recent years, indicating that the geothermal profile is approaching thermal equilibrium.
- The pore pressures and ground temperatures measured at Piezometer BGC05-18 (19 m depth) have decreased considerably since 2016. Pore pressures stabilized in 2019, while ground temperature continues to drop. This suggests the piezometer has obtained freeze-back at approximately 0.4°C, with a current temperature of approximately -6.0°C.
- Similarly, as above, the pore pressures and ground temperatures measured at Piezometer BGC05-22 (23 m depth) have also decreased considerably since the 2016 inspection. This suggests the piezometer has obtained freeze-back at approximately 0.4°C, with a current temperature of approximately -2.3°C.
- The monitoring data from Piezometer BGC05-20 shows that pore water temperature measured at the piezometer tip, installed at approximately 18 m bgs, has remained relatively stable since 2013 at between -0.3°C and -0.5°C. The pore pressure continued a gradual increasing trend observed since 2013 that may be an indication of increasing hydraulic isolation between the reservoir and the test cell talik, as anticipated.

Select plots providing the results of the monitoring of the Test Cell Dyke are provided on Figure 13. The monitoring data indicates the following:

- Data from thermistors BGC03-22 and BGC05-29 suggest that the dyke and foundation beneath the dyke is frozen to approximately 25-28 m bgs. The 2022 geothermal profile is cooler than 2020 and 2021.
- In thermistor BGC03-22, the node at 27 m cooled slightly in 2021 and 2022 after remaining fixed near the freezing point for nearly two decades. This freezing time lag near the

freezing point is expected, as a result of latent heat effects. This suggests that unfrozen tailings remain below 27 m but the tailings continue to slowly freeze back.

- The vibrating wire piezometer BC05-24, installed approximately 20 m bgs beneath the dyke, has frozen back as indicated by the tip temperature around -5.9°C and the corresponding variability in pore pressures. The recorded pore pressure is considered to be localized and associated with the freeze-back of the piezometer tip and is not considered to be representative of pore water pressures throughout the Test Cell talik.

Select plots providing the results of the monitoring of the tailings cover at the toe of the Test Cell Dyke are provided on Figure 14. The graphs indicate the following:

- The subsurface profile at the toe of the Test Cell Dyke (BGC05-27) between 3 and 23 m bgs is colder than -0.5°C and is presumed to be frozen. As observed elsewhere on site, the geothermal profile has cooled since 2020 and 2021, reflective of average ambient temperatures, cooler than in 2020 and 2021. The monitoring data demonstrates that the upper 23 m of the subsurface profile is frozen, despite being along a shoreline which was periodically submerged in water during operations of the tailings disposal area. The fact that permafrost exists at this location, to the extent it does, is considered beneficial to the overall Test Cell talik freeze-back. This is because it exceeds expectations and assumptions made in the contaminant loading model (CanZinco, March 2004) which assumed a completely thawed tailings profile adjacent to the water.
- The monitoring data from Piezometer BGC05-28, installed approximately 19 m bgs, had a stable piezometric elevation of about 370 metres above sea level (m asl) until 2022. This elevation is consistent with the elevation of the water level in the Reservoir and suggested hydraulic connectivity between the tailings at depth and the Reservoir. In 2022, the piezometric elevation increased considerably, corresponding with considerable cooling of the piezometric tip down to -2.1°C. This suggests that the piezometric tip has frozen back at approximately -1.8°C. The pore water pressure in 2022 is associated with the freeze-back and is not considered to be representative of the pore water pressures throughout the Test Cell talik.

Figure 07 illustrates the relationship between piezometer tip depth and the freeze-back temperature of the piezometers in the Surface Cell and Test Cell cover systems. In contrast to the Surface Cell, the hydraulic connectivity that is present between the Test Cell and the Reservoir creates a cooler temperature needed to obtain freeze-back closer to the reservoir. One piezometer froze back in 2022 (BGC05-28) and one piezometer has yet to freeze back (BGC05-20). The freeze-back of piezometer BGC05-28 supports the above interpretation that freeze back temperature of the piezometer tips within the test cell talik, which is hydraulically connected to the Reservoir, do not correlate with depth.

6.3.4. Toe of West Twin Dyke Tailings Cover

Construction Details

A thermal cover was constructed over the tailings at the toe of the West Twin Dyke in 2005. The thermal cover consists of a 1 m thick layer (minimum thickness) of granular shale overlain by a

0.25 m thick layer (minimum thickness) of armour material comprised of sand, gravel, and cobbles. The shale was sourced from the Mt. Fuji and Area 14 borrow areas (Drawing 01). The armour material was sourced from the Twin Lakes Delta deposit (Drawing 01). The riprap was sourced from the dolostone outcrop at the south end of the West Twin Dyke.

Inspection Conditions

Select photos from the inspection are provided in Appendix II (Photos 39 through 41). Photo 39 shows an overview of the toe of the West Twin Dyke. The main observations are summarized by the following:

- No erosion of the cover was observed.
- As observed during previous inspections, some minor thermokarst features were present, but are not considered to be negatively impacting the overall performance of the cover system (Photo 40 and 41). No visual changes in the appearance of these thermokarst features have been noted in recent years, suggesting the area is generally physically stable.
- No erosion or ice plucking of the riprap along the shoreline was observed.

No additional maintenance items were recommended.

Monitoring Data

The tailings cover at the toe of the West Twin Dyke is instrumented with two thermistors. The location of each of these instruments is provided on Drawing 03. Select plots providing the results of the monitoring are provided on Figure 15. The graphs indicate the following:

- In 2022, no data below 3 m could be collected from Thermistor BGC05-26. Since 2010, the subsurface profile below 3 m at this location, as illustrated by the data collected from Thermistor BGC05-26, has remained colder than -5°C and has been frozen to at least 24 m bgs, the depth of the bottom of the instrument. The bottom 15 m of the instrument was measuring ground temperatures in the bedrock, demonstrating the frozen nature of the bedrock near the base of the West Twin Dyke. Since recent performance has been positive, the active layer portion remains functional, and nearby thermistor 03-19 remains functional, replacement of this instrument is not considered necessary at this time.
- The monitoring data collected from Thermistor BGC03-19 indicates cooler temperatures than 2020 and 2021, reflective of cooler air temperatures in 2022 compared to 2020 and 2021. The ground profile remains frozen from approximately 3 m depth to at least the bottom of the instrument at 11 m depth.

West Twin Disposal Area Water Quality

As required in Water Licence 1AR-NAN2030, a single water quality sampling event was undertaken at the West Twin Outlet Channel in August 2022. This channel is considered the final discharge point for water from the WTDA before entering the environment in Twin Lakes Creek. The sample was collected and forwarded to a laboratory for analysis. The sample was tested for pH, conductivity, Total Suspended Solids (TSS), sulphate, total metal concentrations, and ammonia (NH_3). Laboratory pH and total concentrations of zinc, lead, cadmium and TSS recorded at the West Twin Outlet Channel in 2022 are illustrated on Figure 16. The concentrations observed in the 2022 sample met discharge criteria, as samples have since the covers were completed in 2005. The 2022 total zinc concentration was observed to be 0.05 mg/L, well below the discharge criteria of 0.25 mg/L. The low metals and sulphate concentrations suggest that the thermal covers and the water cover in the Reservoir are effective in limiting metal loading to the water in the Reservoir.

BGC's report titled "2022 Annual Water Quality Monitoring Report, Nanisivik Mine, Nunavut," dated February 2023, should be referenced for a detailed review of the results of the water quality monitoring program undertaken in 2022.

6.3.5. Landfill Cover

Construction Details

A thermal cover was constructed over the Nanisivik Landfill in 2005. The thermal cover consists of a 2 m thick layer (minimum thickness) of granular shale overlain by a 0.25 m thick layer (minimum thickness) of armour material comprised of sand, gravel, and cobbles. The shale was sourced from the Townsite Shale borrow area. The armour material was sourced from the Twin Lakes Delta deposit. The face of the landfill is sloped at approximately 3(H):1(V).

It should be noted that the thermal cover constructed at the Landfill was built over an existing surficial shale cover that was continuously placed and maintained during operations as part of the on-going landfill operating procedures (for pest control and protection against wind transport). No attempts were made during construction of the thermal cover in 2005 to verify the existing cover thickness and thereby, reduce the fill requirements. Therefore, it can be assumed that the thermal cover is thicker than just the material placed in 2005.

Inspection Conditions

Select photos from the inspection are provided in Appendix II (Photos 42 through 47). The main observations are summarized by the following:

- No erosion of the cover was observed, either on the upper flatter portion of the cover or on the sloping face of the Landfill (Photo 42).
- No seepage directly from the landfill cover was observed. Following rainfall during the 2022 inspection, some flow was observed adjacent to the toe of the cover at the Northeast corner of the landfill cover, a portion of which likely flows along the ice-saturated layer within the landfill cover.
- Some exposed shale has previously been observed on the lower portion of the west face, but no changes in areal extent were noted during this inspection. The exposed shale is due to an insufficient amount of armour material available for covering during construction and is not related to erosion. Previous attempts undertaken to spread the armour over the exposed shale were determined to be impractical from a construction standpoint. Considering the observed stability of the area since construction, additional maintenance is not considered necessary.

- Progression of cracking and thermokarst features have been observed along the upslope water deflection berm and in the area southwest of the cover in past inspections (Photos 43 through 46). This has resulted in a minor amount of surface water running along the west edge of the cover system. This water deflection berm was not a design element, and pre-dates the reclamation of the facility. Further progression of the cracking and thermokarsting in this area was observed during the 2022 inspection, resulting in increased surface water flow along the western margin of the cover at a minimum lateral distance of 5.3 m between the edge of the cover armour and the thermokarst cracking at the northwest corner of the diversion berm. No newly exposed shale was observed. This flow is not considered to be negatively impacting the performance of the adjacent landfill cover system to date, but maintenance may be required should thermokarsting progress to the extent of impacting the performance of the landfill cover system.
- No areas of settlement or thermokarst features were observed on the surface of the landfill cover system.

No maintenance items are recommended at this time but should the thermokarsting observed at the upslope water deflection berm progress, armouring may be required to protect the landfill cover from erosion.

Monitoring Data

The Landfill cover is instrumented with one thermistor and one frost gauge. The location of each of these instruments is provided on Drawing 04. Select plots providing the results of the monitoring are provided on Figure 17. The graphs indicate the following:

- The active layer thaw did not penetrate the underlying waste material throughout 2022. The depth of active layer thaw recorded in 2022 was nearly the shallowest on record.
- The overall geothermal performance of the landfill cover in 2022 was observed to be similar compared to recent years. The geothermal profile between 3 and 15 m bgs was slightly cooler in 2022 compared to 2021 and nearly identical to 2020, remaining between -3°C and -11°C, reflective of annual average ambient temperatures. At the base of the instrument, near 15 m bgs, the temperature has remained relatively stable in recent years, suggesting ground conditions are near thermal equilibrium at depth.
- The maximum temperature recorded at the thermistor node located at 2.3 m bgs, near the cover/landfill debris interface, was approximately -3.2°C.
- The landfill debris underlying the cover remained frozen throughout the year.

6.3.6. West Open Pit

Construction Details

A thermal cover was constructed over the West Open Pit in 2006. The thermal cover consists of a 2 m thick layer (minimum thickness) of granular shale overlain by a 0.35 m thick layer (minimum thickness) of armour material comprised of sand, gravel and cobbles. The shale was sourced from the Townsite Shale borrow area. The armour material was sourced from the local borrow source located along the road between the 09S portal and the 17 North Portal. The face of the West Open Pit cover is sloped at a maximum angle of approximately 3(H):1(V).

Inspection Conditions

Select photos from the inspection are provided in Appendix II (Photos 48 through 51). The main observations are summarized by the following:

- No erosion of the armour surface was noted
- No areas of settlement or thermokarst features were observed
- No advancement in the crack width or length in the crown pillar has been observed in at least 10 years
- No seepage water was observed at the toe of the cover.

Based on the observations noted above, the West Open Pit waste rock cover is considered to be physically stable. As such, no maintenance is recommended.

Monitoring Data

The West Open Pit cover is instrumented with one thermistor (BGC08-01), but this instrument was non-functional and unable to be read since the 2019 inspection. The location of this instrument is provided on Drawing 05. It is suspected that this instrument has reached the end of its useful lifespan, and it is unlikely that it will resume functionality. Although this is the only instrument installed in the West Open Pit cover system, the performance of the cover has been satisfactory since the cover was built, and previous data suggests that the waste rock used to backfill the open pit has frozen back. As such, replacement of this instrument is not considered necessary at this time. It remains recommended that the West Open Pit continue to be visually monitored during annual inspections.

6.3.7. East Open Pit

Construction Details

A thermal cover was constructed over the East Open Pit in 2005. The thermal cover consists of a 2 m thick layer (minimum thickness) of granular shale overlain by a 0.35 m thick layer (minimum thickness) of armour material comprised of sand, gravel, and cobbles. The shale was sourced from the Shale Hill borrow area. The armour material was sourced from the local borrow source located along the road between the K-Baseline Portal and Kuhulu Lake. The face of the East Open Pit cover is sloped at a maximum angle of approximately 3(H):1(V). A remnant highwall exists along the south edge of the pit area. The remnant highwall ranges from 1 to 5 m high and is sloped back at an angle of approximately 60°. A bench exists between a portion of the remnant highwall and the main portion of the cover system.

Inspection Conditions

Select photos from the inspection are provided in Appendix II (Photos 52 through 56). The main observations are summarized by the following:

- Some surface (rill) erosion was noted on the surface of the cover in 2022, as it has been during previous inspections (Photo 52). No advancement of the erosion has been noted in recent years.
- Some cracking of the cover materials was observed, in similar condition to previous inspections. This cracking is thought to be related to thermal expansion and contraction of the cover materials and settlement of the underlying backfill materials.
- Some cracking was noted on the crown pillar of the cover (Photos 53 and 54). No advancement in the crack width or length in the crown pillar has been observed in at least 10 years.
- No areas of settlement or thermokarst features were observed on the surface of the cover.

The minor erosion noted on the surface of the cover was anticipated. The armour material at this location contains a fine-grained fraction that was expected to wash away with time leaving behind the coarse-grained fraction, a process known as self-armouring. As such, the armour thickness at this location, and many others where alternative armour materials were used, was increased to 0.35 m. The coarse-grained fraction of the armour material is expected to limit the amount of erosion that can occur, without negatively impacting the geothermal performance of the cover.

As mentioned, the cracking in the crown pillar at the East Open Pit was not observed to have progressed. The cracking coincides with the mined-out rib pillar and the area of the 39 Portal. No opening to the underground has been observed during any inspection undertaken since reclamation of the East Pit in 2005. As such, the cracking was not seen to be of immediate concern especially given the lack of progression over the past decade. Accordingly, no maintenance is recommended, but the crown pillar should continue to be visually monitored for additional deformation.

Monitoring Data

The East Open Pit Waste Rock cover is instrumented with two thermistors and two frost gauges. The location of each of these instruments is provided on Drawing 06. One of the frost gauges (FG-14) ceased functioning in 2018. Select plots providing the results of the monitoring are provided on Figure 18, which indicate the following:

- Data from Thermistor BGC05-02, installed in the area with a thin layer of waste rock backfill (approximately 3 m thick), indicates that the waste rock remains frozen back. The geothermal profile is comparable to what was observed in 2021.
- Data from Thermistor BGC05-03, installed in the area with a thicker layer of waste rock backfill (approximately 9 m thick), indicates the waste rock, and hydrocarbon contaminated soil buried at depth, remains frozen back. The geothermal profile is comparable to what was observed in 2021.
- The rate of cooling, based on year over year changes in ground temperatures recorded in both BGC05-02 and BGC05-03 suggest that ground conditions are likely near thermal equilibrium at depth.
- The active layer monitoring data from Thermistor BGC05-02 and BGC05-03 indicates that the active layer was confined within the cover materials throughout 2022. Thawing remained confined to the cover material, with an approximate active layer thickness of 1.2 to 1.5 m, approximately 0.8 m to 1.2 m above the base of the cover system.
- Frost gauge FG-13 indicates that the active layer was approximately 1.7 m thick, which is approximately 0.7 m above the base of the cover, shown on Figure 18. The active layer thickness was slightly more than 2021 but comparable to recent years.

6.3.8. East Trench Waste Rock Cover

Construction Details

A thermal cover was constructed over the East Trench in 2005. The thermal cover consists of a 2 m thick layer (minimum thickness) of granular shale overlain by a 0.35 m thick layer (minimum thickness) of armour material comprised of sand, gravel, and cobbles. The shale was sourced from the Shale Hill shale borrow area. The armour material was sourced from the local borrow source located along the road between the K-Baseline Portal and Kuhulu Lake. The face of the East Trench cover is sloped at an angle ranging between 4(H):1(V) and 6(H):1(V).

Inspection Conditions

An aerial UAV photo from the inspection is provided in Appendix II (Photo 57). The main observations are summarized by the following:

- As noted in previous inspections, minor surface (rill) erosion was observed near the upslope edge of the cover where seepage water periodically discharges from natural rock outcrops onto the surface of the cover. The coarse-grained fraction of the surface armour layer in this area is limiting the progression of the erosion. No advancement of this erosion was noted in 2022.
- No seepage was observed at the toe of the cover.

In general, the East Trench cover appears to be physically stable. As such, no maintenance is recommended.

6.3.9. Oceanview Open Pit Waste Rock Cover

Construction Details

A thermal cover was constructed over the Oceanview Open Pit in 2005. The thermal cover consists of a 2 m thick layer (minimum thickness) of granular shale overlain by a 0.35 m thick layer (minimum thickness) of armour material comprised of sand, gravel, and cobbles. The shale was sourced from the Shale Hill borrow area (Drawing 01). The armour material was sourced from the Chris Creek “A” borrow area (Drawing 01). The face of the Oceanview Open Pit cover is sloped at a maximum angle of approximately 3(H):1(V). The surface of the cover in the bottom of the pit slopes to the north at a grade of approximately 3%.

Inspection Conditions

Select photos from the inspection are provided in Appendix II (Photos 58 through 61). The main observations are summarized by the following:

- The upslope water deflection berm appeared to be effective in directing surface water away from the cover, although no flow was observed during the inspection.
- Minor surface erosion (<10 cm deep) was noted along the backslope at the south end of the cover, as has been noted during previous inspections (Photo 58). Some minor ponding of water was observed at the upstream end of the erosion (Photo 59). The erosion appears to be slowly progressing, based on visual observations, but is not expected to impact the overall performance of the cover system. Self armouring of the erosion areas is occurring as the coarser particles within the armour layer are exposed and concentrated at surface, as anticipated.
- Some seepage was observed at the toe of the cover (Photo 60), believed to be flow-through seepage along the frozen material within the cover. This seepage is expected and is not considered to negatively impact the performance of the cover.

- Some acid rock drainage staining was observed on the east edge of the cover, as it has been during previous inspections. The stained area originates upslope of the extent of the cover and appears to cover a similar extent to what has been observed in previous inspections.
- The minor sinkhole observed in the middle of the cover surface during the 2015 inspection did not appear to have grown since.
- In general, the Oceanview Open Pit cover appears to be in satisfactory condition (Photo 61). As such, no maintenance is recommended. The surficial erosion should continue to be visually monitored for additional progression.

As discussed previously, minor erosion of the surface of the cover was anticipated. Similar to the East Open Pit cover, the armour material at this location contains a fine-grained fraction that was expected to wash away with time. As such, the armour thickness was increased to 0.35 m. The coarse-grained fraction of the armour material is expected to limit the amount of erosion that can occur, without negatively affecting the geothermal performance of the cover.

Monitoring Data

The Oceanview Pit Waste Rock cover is instrumented with one thermistor and one frost gauge. The location of each of these instruments is provided on Drawing 07. Select plots providing the results of the monitoring are provided on Figure 19. The graphs indicate the following:

- The active layer was confined within the cover materials throughout 2022.
- The maximum active layer thaw depth indicated by Thermistor BGC05-01 was estimated to be approximately 1.4 m bgs, which is approximately 1.0 m above the base of the cover.
- The waste rock underlying the cover has frozen back and remained frozen throughout 2022.
- Thermistor BGC05-01 shows that the 2022 geothermal profile is comparable to recent years. At the base of the thermistor, at 17.5 m, the temperature has been similar for several years, suggesting ground conditions are near thermal equilibrium at depth.
- Frost gauge FG-16 indicates that the thaw depth was approximately 1.2 m thick in August 2022, approximately 1.2 m above the base of the cover, which is deeper than 2021 but similar to recent years, as shown on Figure 19.

6.3.10. Area 14 Waste Rock Cover

Construction Details

Area 14 is a satellite ore body situated on a west-facing slope, approximately 1 km to the east of East Twin Lake (Drawing 01). A waste rock pile was created outside the portal during mining operations. In 1988, the waste rock pile was flattened, and a thermal cover was constructed over the top of the waste rock pile, but the face was left exposed.

In 2005, the thermal cover at the Area 14 waste rock pile was completed by constructing a cover over the exposed face and armouring the entire surface of the cover. The thermal cover consists of a 2 m thick layer (minimum thickness) of granular shale overlain by a 0.35 m thick layer (minimum thickness) of armour material comprised of sand, gravel, and cobbles. All shale was sourced from the Area 14 shale borrow area (Drawing 01). All armouring material was sourced from the hill side immediately north of the Area 14 portal.

Inspection Conditions

A photo from the inspection is provided in Appendix II (Photo 62). The main observations are summarized by the following:

- No erosion of the cover materials was observed
- No areas of settlement or thermokarst features were observed on the surface of the cover
- No seepage was noted at the toe of the cover.

In general, the Area 14 waste rock cover appears to be in a physically stable condition. As such, no maintenance is recommended.

Monitoring Data

The Area 14 Waste Rock cover is instrumented with one frost gauge, with the location provided on Drawing 08. Frost gauge FG-15 indicates that the active layer was approximately 1.3 m thick, which is 1.1 m above the base of the cover, as shown on Figure 20. The depth of the active layer has not changed greatly since prior to 2006, suggesting the cover performance is generally stable.

6.3.11. Upper Dump Pond Tailings Cover

Construction Details

The upper dump pond was an emergency tailings storage containment cell located between the water tank and the West Twin Disposal Area, as shown on Drawing 01. A thermal cover was constructed over the tailings in the Upper Dump Pond in 2005. The thermal cover consists of a 2 m thick (minimal thickness) layer of granular shale overlain by a 0.25 m thick layer (minimal thickness) of armour material comprised of sand, gravel, and cobbles. The shale was sourced from the Townsite shale borrow area (Drawing 01). The armour material was sourced from the Twin Lakes Delta deposit (Drawing 01).

Inspection Conditions

Select photos from the inspection are provided in Appendix II (Photos 63 and 64). The main observations from the inspection are summarized by the following:

- No erosion of the surface of the cover was observed
- No seepage was noted at the toe of the cover
- No areas of settlement or thermokarst features were observed on the surface of the cover.

In general, the Upper Dump Pond tailings cover appears to be in a physically stable state. As such, no maintenance is recommended.

Monitoring Data

The Upper Dump Pond tailings cover is instrumented with one frost gauge. The location of this instrument is provided on Drawing 09. Frost gauge FG-17 indicates that the active layer was approximately 1.6 m thick, which is 0.7 m above the base of the cover, shown on Figure 21. The active layer thickness in 2022 falls within the range observed in recent years.

6.3.12. Industrial Complex Foundation Cover

Construction Details

The Industrial Complex is located approximately 1 km north of the town site (Drawing 01). The Industrial Complex housed the concentrator, DMS circuit, power plant, maintenance shops, warehouse, administration and technical offices, and associated facilities. The facility was built on bedrock and a reinforced concrete foundation.

The Industrial Complex was dismantled between 2005 and 2006 and the remnant foundation was backfilled with metals contaminated soils. In 2008, a thermal cover was constructed over the backfilled foundation. The thermal cover consists of a 2 m thick layer (minimum thickness) of granular shale overlain by a 0.35 m thick layer (minimum thickness) of armour material. The shale was sourced from the Mill Area deposit and the armour materials were locally sourced. The sloping face of the cover is approximately 3(H):1(V).

Inspection Conditions

Select photos from the inspection are provided in Appendix II (Photos 65 and 66). The main observations made during the inspection are summarized by the following:

- No erosion of the surface of the cover was observed
- No settlement or thermokarst features were observed on the surface of the cover
- No seepage was observed at the toe of the cover.

In general, the Industrial Complex cover appears to be physically stable. As such, no maintenance is recommended.

Monitoring Data

The Industrial Complex Foundation cover is instrumented with one thermistor. The location of this instrument is provided on Drawing 10. Select plots providing the results of the monitoring are provided on Figure 22. The graph indicates the following:

- The metals contaminated soils used to backfill the foundation footprint have frozen back.
- The active layer thaw (approximately 1.8 m) was confined within the cover materials throughout 2022, approximately 0.45 m above the base of the cover system, similar to recent years.

6.4. Mine Openings

6.4.1. 00/01 Portals and Crown Pillar

Construction Details

00 Portal

The 00 Portal is located at the edge of the West Open Pit at the western end of the mine, as illustrated on Drawing 01. The 00 Portal was the principal access at the western extremity of the mine. The portal measured approximately 5 by 5 m in cross-section. The brow immediately above the portal was approximately 4 to 5 m high.

In 2005, the portal was backfilled with waste rock. The backfill was placed approximately to within 1 m of the top of the portal and into the portal approximately 5 m from the entrance. The backfill extended outside the portal face and was sloped at an angle of approximately 3(H):1(V) and graded into the overall backfill of the West Open Pit. A thermal cover was subsequently constructed over the waste rock as part of the West Open Pit thermal cover.

01 Portal

The 01 Portal was located at the western end of the mine, as shown on Drawing 01. The 01 Portal housed the main ventilation fans during mining operations which were mounted in a plate steel bulkhead. The portal opening was approximately 22 m wide and 4 m high. The brow immediately above the portal was approximately 4 to 5 m high.

In 2005, the portal was backfilled with waste rock. The backfill was placed approximately to within 1 m of the top of the portal and into the portal up to the face of the bulkhead. The backfill extended outside the portal face and was sloped at an angle of approximately 3(H):1(V) and graded into the overall backfill of the West Open Pit. A thermal cover was subsequently constructed over the waste rock as part of the West Open Pit thermal cover.

00/01 Crown Pillar

A stope connecting the 00 and 01 portals was located approximately 5 m behind the West Open Pit highwall. A portion of the rock between the 00 and 01 portals, known as the 00/01 rib pillar, was removed during later stages of mine development as part of the pillar recovery program. After the recovery of a portion of the rib pillar, a crack developed in the crown pillar above the area that had been mined. In 2005, a fill pillar was constructed beneath the cracked portion of the crown pillar to provide additional support and prevent development of an opening into the mine workings if the pillar were to collapse. The pillar was constructed out of waste rock and was constructed approximately to within 1 m of the top of the opening.

Inspection Conditions

The area of the West Open Pit cover where the portals had existed was inspected in 2022. The observations are summarized by the following:

- No indications of surface deformation were observed
- No indications of seepage from the mine workings were observed.

No maintenance of the portal plugs or the cover over the portal plugs is recommended.

The crown pillar was also inspected from surface. The observations are summarized by the following:

- Similar to previous inspection observations, a small crack (1 - 3 cm wide) was observed in the crown pillar area (Photos 48 and 49). Based on visual observations, the size of the crack has not changed relative to previous years, and no additional cracking has occurred.
- No visually distinguishable deformation was observed in the crown pillar.
- Overall, no significant changes have been observed in the West Open Pit crown pillar since the fill pillar was constructed in 2005.

In general, the portal plugs constructed for the 00 and 01 portals and the 00/01 crown pillar appear to be in satisfactory condition. It is recommended that the crown pillar area continue to be visually monitored to check for further propagation of the cracking.

6.4.2. 17 North Portal

Construction Details

The 17 North Portal was a culverted portal giving access to the Main Ore Zone. The location of the portal is illustrated on Drawing 01. The 17 North Decline was approximately 5 m by 5 m in cross section and the culvert was half round with a diameter of 5 m and a length of 28 m. The culvert was supported by a 0.25 m thick by 2 m high concrete wall on either side and it extended 5 m inside the dolostone bedrock of the drift.

In 2005, the culvert was removed, and the portal was backfilled with granular shale derived from the Shale Hill borrow area. The backfill was placed to within 1 m of the top of the portal and extended into the portal for approximately 4 m. The backfill extended outside the portal face and was sloped at an angle ranging between 4(H):1(V) and 7H:1V and graded into the surrounding topography. A 0.35 m thick layer of armour material, derived from the Kuhulu Lake borrow area, was then applied to the surface of the shale backfill.

Inspection Conditions

A select photo from the inspection is provided in Appendix II (Photo 67). The main observations are summarized by the following:

- No erosion of the surface of the cover was observed
- No seepage was observed at the toe of the cover
- Water was observed flowing along the east edge of the portal cover in 2022 but this believed to be surface water originating upslope of the cover and not seepage from the cover.

In general, the 17 North Portal cover appears to be physically stable and in satisfactory condition. As such, no maintenance is recommended.

6.4.3. Oceanview Portal

Construction Details

The Oceanview Portal was a bare rock entrance into the north side of the Oceanview underground workings. The location of the portal is illustrated on Drawing 01. The Oceanview decline had a cross section of approximately 5 by 5 m. The brow of the portal was approximately 5 m in height.

Prior to 2004, the portal had been backfilled with waste rock and covered with locally derived overburden materials. In 2005, a thermal cover was constructed over the existing portal plug. The cover consisted of a 2 m thick layer (minimum thickness) of granular shale overlain by a 0.35 m thick layer of armour material consisting of sand, gravel, and cobbles. The shale was derived from the Shale Hill borrow area. The armour material was derived from the Chris Creek “A” deposit. The thermal cover was extended to the east and north of the portal entrance in an old ore stockpile area. Additionally, a water deflection berm was constructed upslope of the cover extension to prevent concentrated surface water from flowing over the cover area.

Inspection Conditions

A select photo from the inspection is provided in Appendix II (Photo 68). The main observations from the inspection are summarized by the following:

- A small area of surficial settlement was observed near the southwest corner of the portal cover. The settlement area appears to have stabilized as it has not changed significantly since it was first observed in 2006.
- Some minor cracking was noted along the east edge of the portal cover, as has been noticed in previous inspections. The condition of the cracking does not appear to have changed in several years.
- No seepage was observed at the toe of the cover.
- The surface water deflection berm appeared to be effective in diverting water around the cover extension.

In general, the Oceanview Portal cover appears to be physically stable. As such, no maintenance is recommended.

6.4.4. K-Baseline Portal

Construction Details

The K-Baseline portal was a culverted entry used to access the K-Baseline ore body. The location of the portal is illustrated on Drawing 01. The K-Baseline decline was approximately 5 m by 5 m in cross section and the culvert was half round with a diameter of 5 m and a length of 28 m. The culvert was supported by two concrete pony walls, 1 m wide by 2.4 m high, on both sides. The concrete pony walls extended 3 m inside the dolostone bedrock of the drift.

In 2004, the culvert was removed, and the portal was backfilled with waste rock. In 2005, a thermal cover was constructed over the waste rock portal plug. The cover consisted of a 2 m thick layer (minimum thickness) of granular shale overlain by a 0.35 m thick layer of armour material consisting of sand, gravel, and cobbles. The shale was derived from the Shale Hill borrow area. The armour material was derived from the Chris Creek “A” deposit. An additional thermal cover was constructed over the area below the road immediately outside the portal where mineralized soils and additional waste rock were located. A surficial cover of shale was also constructed adjacent to the thermal cover to improve drainage conditions.

Inspection Conditions

An aerial UAV photo from the inspection is provided in Appendix II (Photo 69). The main observations are summarized by the following:

- No erosion of the cover was observed
- No seepage was noted at the toe of the cover
- No areas of significant settlement were observed in the cover
- Some minor cracking was noted on the surface of the cover, likely related to thermal expansion and contraction of the cover materials.

In general, the K-Baseline portal appears to be physically stable. As such, no maintenance is recommended.

6.4.5. Area 14 Portal

Construction Details

The Area 14 Portal was a bare rock portal that provided access to the Area 14 underground workings. The location of the portal is illustrated on Drawing 01. Mining ceased in this area around 1987 and the portal was backfilled with waste. The waste was covered and contoured with shale in 1987 and 1988.

In 2005, locally derived armour material was stockpiled adjacent to the portal cover for construction of the final armour layer. In late 2006, the stockpiled armour materials were spread over the portal area.

Inspection Conditions

The main observations are summarized by the following:

- No erosion of the cover was observed
- No seepage was noted at the toe of the cover.

In general, the Area 14 Portal cover appears to be physically stable. As such, no maintenance is recommended.

6.4.6. 09 South Portal

Construction Details

The 09 South (09S) Portal is located at the western end of the mine, as shown on Drawing 01. The 09S Portal is a culverted entry giving access to the Main Ore Zone. The 09 South drift is approximately 5 m by 5 m in cross section. The culvert is round with a diameter of 5 m and a length of 28 m. The bottom of the culvert is filled with rockfill to provide a smooth floor. The culvert extends approximately 13 m inside the shale bedrock of 09 south drift, leaving 15 m exposed on surface, a portion of which is covered with talus from the slope above.

The 09 South Portal remained open until the fall of 2008 to provide access to the underground workings during the underground waste disposal program. Once the underground waste disposal program was complete in September 2008, work on permanent closure of the 09 South Portal began.

In 2008, the culvert was removed, and the portal was backfilled with granular shale derived from the Mill Area deposit. The backfill was placed to within 0.5 m of the top of the portal and extended into the portal for approximately 5 m. The backfill extended outside the portal face and was sloped at an angle of approximately 4(H):1(V) and graded into the surrounding topography. A 0.25 m (minimum thickness) layer of locally derived armour material was then applied to the surface of the shale backfill.

Inspection Conditions

A photo from the inspection is provided in Appendix II (Photo 70). The main observations are summarized by the following:

- No erosion of the cover was observed
- No seepage was noted at the toe of the cover
- Some minor cracking and deformation of the cover was noted, in a similar condition as was observed in previous inspections. The area appears to have stabilized since the cracking was first noted in 2009
- Some shale from rock outcrops upslope was deposited on the surface of the portal cover.

In general, the 09 South Portal cover appears to be physically stable. As such, no maintenance is recommended.

6.4.7. Lower Adit

Construction Details

The Lower Adit is located at the western end of the mine near the Industrial Complex, as illustrated on Drawing 01. The Lower Adit provided the main access into the underground crusher and fine ore bin, as well as secondary access to the Main Ore Zone.

The Lower Adit Portal remained open until the fall of 2008 to provide ventilation to the underground workings during the underground waste disposal program. Once the underground waste disposal program was complete in September 2008, work on permanent closure of the Lower Adit Portal began.

In 2008, the portal was backfilled with granular shale derived from the Mill Area deposit. The backfill was placed to within 0.5 m of the top of the portal and extended into the portal for approximately 5 m. The backfill extended outside the portal face and was sloped at an angle of approximately 4(H):1(V) and graded into the surrounding topography. A 0.25 m (minimum thickness) layer of locally derived armour material was then applied to the surface of the shale backfill.

Inspection Conditions

An inspection photo is provided in Appendix II (Photo 71). The main observations are summarized by the following:

- No erosion of the cover was observed
- No seepage was noted at the toe of the cover
- No cracking or deformation of the cover was noted.

In general, the Lower Adit portal plug appears to be physically stable. As such, no maintenance is recommended.

6.4.8. Portal to Mill Foundation

Construction Details

A portal was driven beneath the Mill building in 1980 as part of emergency repair operations for the Mill. The portal is located approximately 70 m south of the Mill, adjacent to Twin Lakes Creek. The portal provided access to an ice lens which was present beneath the mill building. As part of the repair operations, the ice lens was mined out and concrete pillars were constructed to provide additional support for the Mill. After the repair operations were complete, the portal was plugged with shale rock fill.

Inspection Conditions

An aerial UAV photo from the inspection is provided in Appendix II (Photo 72). The main inspection observations for the Portal to Mill Foundation are summarized by the following:

- No erosion of the armoured portal plug was observed
- No seepage was noted at the toe of the portal plug.

In general, the portal plug appears to be physically stable. No maintenance is recommended.

6.4.9. Shale Hill Raise

Construction Details

The Shale Hill Raise provided ventilation for the underground workings in the Shale Hill area. The location of the raise (E582524 m, N8107427 m, UTM NAD 83 Zone 16) is illustrated on Drawing 01. The 3 m diameter raise was approximately 47 m deep. During mining operations, the raise was sealed with a 3 m diameter steel tank with the bottom cut out and with two adaptors in the top for 36inch ventilation fans. The tank was fixed to a cemented collar at the top of the raise.

Prior to 2005, the surface structure was removed and, according to mine site records, the Shale Hill raise was backfilled with waste rock. A mound of shale was constructed at surface with side slopes of approximately 3(H):1(V). In 2005, a 0.35 m thick layer of locally derived armour material was applied to the surface of the mound to complete the remediation of this raise.

Inspection Conditions

The Shale Hill Raise was not visited during the 2022 inspection but previous inspections have observed a 15 year history of no visual indications of erosion or surface deformation, and a stable armoured surface. As such, no maintenance is recommended, but the site should be visited during the next inspection.

6.4.10. Oceanview East Raise

Construction Details

The Oceanview East Raise was situated at the extreme east end of the Oceanview underground workings. The location of the raise (E585123, N8107506, UTM NAD 83 Zone 16) is illustrated on Drawing 01. The 4 m by 4 m raise was approximately 10 m deep and provided ventilation for the underground workings in the Oceanview area. During mining operations, the raise was covered with a wooden wind deflector with a locked door.

In 2002, the wooden deflector was removed and, according to mine site records, the raise was backfilled with waste rock. During backfilling, it was noted that an ice plug was present in the raise at a depth of approximately 1.5 m below ground surface. As such, waste rock was placed only to this depth. A 3 m high mound was placed on top of the raise to accommodate for possible future thaw of the ice plug. The mound was constructed of shale and surfaced with coarse rock.

Inspection Conditions

A photo from the inspection is provided in Appendix II (Photo 73). During the inspection, the armour surface appeared to be stable with no visual indications of erosion or surface deformation. As such, no maintenance was recommended.

During the annual inspection, and as noted in previous inspections, it was noted that periodic flows of groundwater seepage from upslope of the raise has caused acid rock drainage (ARD) staining of the ground surface around the raise. The source of the ARD is not known but is likely related to near surface exposure of sulphidic soils and/or bedrock. This water is collecting in a disturbed area downslope of the raise.

6.4.11. Oceanview West Raise

Construction Details

The Oceanview West raise was located near the west end of the Oceanview underground workings (E584851 m, N8107466 m, UTM NAD 83 Zone 16), as shown on Drawing 01. The 3 m diameter raise is approximately 26 m deep and provided ventilation for the underground workings. The raise was covered by a steel enclosure with a locked wooden cover.

In 2002, the steel enclosure was removed and, according to mine site records, the raise was backfilled with waste rock as part of the progressive reclamation of the mine site. During backfilling, it was noted that an ice plug was present in the raise at a depth of approximately 1.5 m below ground surface. As such, waste rock was placed only to this depth. A 3 m mound was placed on top of the raise to accommodate for possible future thaw of the ice plug. The mound was constructed of shale and surfaced with coarse rock.

Inspection Conditions

A photo from the inspection is provided in Appendix II (Photo 74). During the inspection, the armour surface appeared to be stable with no visual indications of erosion or surface deformation. As such, no maintenance is recommended.

6.4.12. Area 14 Raise

Construction Details

The location of the Area 14 Raise (E584187, N8105663, UTM NAD 83 Zone 16) is illustrated on Drawing 01. The raise had a cross section of 5 by 5 m and an approximate depth of 8 m. Mining ceased in this area around 1987 and the raise was completely backfilled to the floor of the underground workings. Backfilling was completed with waste rock and the surface was then covered and contoured with shale in the summer of 1987 and 1988.

Inspection Conditions

During the inspection, no settlement of the area surrounding the former raise was observed. As such, no maintenance is recommended.

6.5. Shale and Armour Borrow Areas

6.5.1. Shale Borrow Areas

Several shale borrow areas were developed during the reclamation process to provide material for construction of the thermal covers. The borrow areas include the following:

- Mt. Fuji
- Area 14
- West Twin
- East Twin
- Shale Hill
- Townsite.

The borrow areas were reclaimed when no longer required. The reclamation efforts included regrading of slopes for stability and sufficient grading of the floor of each borrow area to provide for positive drainage of surface water and to minimize ponding.

Select photos from the inspection are provided in Appendix II (Photos 75 and 76). The main observations are summarized by the following:

<u>Mt. Fuji (Photo 75)</u>

- The benches are continuing to slowly fill in from the raveling of the remaining bench faces and are expected to eventually form a stable slope at the natural angle of repose.
- The floor had no significant areas of ponded water and is considered generally well drained.
- No issues requiring maintenance were observed.

<u>Area 14</u>

- The re-graded pit walls appear to be stable.
- One area of erosion has occurred at the north end of the borrow area where natural surface water periodically discharges into the pit, typically during freshet. At this location, the overburden material has been eroded down to the top of the bedrock and has been deposited into the floor of the pit. This area was observed to have stabilized during recent inspections as down-cutting of these materials no longer appears to be occurring.
- The pit was partially covered in snow, and no ponding of water was observed at the time of the inspection, but there has been significant thermokarst development at the entrance to the pit, consistent with previous inspection observations. As such, it is likely that this impedes drainage at some point in the year. The material is sufficiently fractured that any ponded water likely drains when the ground thaws.

<u>West Twin</u>

- Was not visited during the 2022 inspection.
- No issues requiring maintenance have been identified in recent years.

East Twin

- Was not visited during the 2022 inspection.
- No issues requiring maintenance have been identified in recent years.

Shale Hill

- In general, the re-graded pit walls appear to be stable.
- No ponding was observed in the floor of the pit.
- No issues requiring maintenance were observed.

Townsite

- In general, the re-graded pit walls appear to be stable.
- No ponding was observed in the floor of the pit.
- No issues requiring maintenance were observed.

6.5.2. Armour Borrow Areas

Several armour borrow areas were developed during the reclamation process to provide material for construction of the thermal covers. The borrow areas, shown on Drawing 01, include the following:

- Twin Lakes Delta deposit
- Chris Creek “A” and “B” deposits
- Kuhulu Lake Road deposit
- 09S/17N Road deposit
- Area 14 deposit.

The borrow areas were reclaimed once no longer required. The reclamation efforts included sufficient grading of the floor of each borrow area to provide for positive drainage of surface water and to minimize ponding.

The main observations are summarized by the following:

Twin Lakes Delta deposit

- The floor of the quarry was, in general, well drained. The surface water flows to the north edge of the borrow area and then proceeds to flow west to the Reservoir.
- Isolated thermokarst features were observed on the floor of the quarry, consistent with recent site inspections.
- No issues requiring maintenance were observed.

Chris Creek “A” and “B” deposits

- Some minor ponding was observed on the floor of the quarry, likely associated with the thermokarst features that have been observed in previous inspections.
- No issues requiring maintenance were observed.

Kuhulu Lake Road deposit

- The Kuhulu Lake Road deposit was not observed during the 2022 inspection.
- No issues requiring maintenance have been identified in recent years.

09S/17N Road deposit

- The face of the borrow area did not exhibit any indications of erosion or thermokarst development.
- No issues requiring maintenance were observed.

Area 14 deposit

- The Kuhulu Lake Road deposit was not observed during the 2022 inspection.
- Previous inspections have observed stable re-graded pit walls but significant thermokarsting at the east end entrance of the pit and minor thermokarsting was noted throughout the pit. It has been interpreted from previous inspections that the thermokarsting impedes drainage during freshet, but the material is sufficiently fractured that any ponded water likely drains when the ground thaws.

6.6. Summary of 2022 Maintenance Recommendations

The maintenance items recommended throughout Section 6.0 are summarized in Table 6-1.

Table 6-1. Recommended maintenance and action items for 2022.

Inspection Item	Recommended Maintenance and Action Items
West Twin Dyke Spillway	The area should continue to be visually monitored for any signs of erosion or permafrost degradation induced deformation of the side slopes and channel bottom.
West Twin Outlet Channel	Monitor the water elevation in the Reservoir and Polishing Pond. Monitor slopes along perimeter of Polishing Pond for stability considerations.
East Twin Creek Diversion Channel	The diversion dyke should continue to be monitored for seepage through the East Twin Creek Diversion Dyke and for erosion along the East Twin Creek Diversion Channel.
Surface Cell Tailings Cover	Continue to monitor thermokarst areas for additional deformation. Monitor the heave feature that has been observed, measuring approximate heave dimensions and heave cracking dimensions. Monitor cracking shale exposure. Localized regrading of the heave feature during an upcoming geotechnical inspection is recommended to limit snow accumulation and potentially to reduce the rate of growth of the heave.
Landfill Cover	Monitor the thermokarst areas at the deflection berm near the southwest corner of the landfill cover.
East Open Pit/ East Trench Waste Rock Cover	Continue to visually monitor cracking in EOP crown pillar and minor surficial cracking and erosion of EOP and East Trench covers.
Oceanview Pit Waste Rock Cover	Continue to visually monitor surficial erosion along backslope.
00/01 Portals and Crown Pillar	Continue to visually monitor cracking in WOP crown pillar.
Instrumentation/ Monitoring	During the 2024 inspection, download the data from water level loggers installed in the Reservoir and Polishing Pond and the thermistor loggers installed in the Test Cell Cover (BGC05-04) and the West Twin Dyke (BGC05-15).

No maintenance or action items are recommended for other areas not specifically noted in Table 6-1.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The following paragraphs provide a summary of the significant observations, conclusions, and recommendations based on the results of the 2022 Geotechnical Inspection Program undertaken at the Nanisivik Mine site.

Embankments

The West Twin Dyke and Test Cell Dyke were physically stable with no signs of erosion or seepage. The breaches constructed in the remnant dykes at the East Adit Treatment Facility continue to permit natural drainage of the area with only limited ponding in the Retention Pond.

Hydraulic Structures

The West Twin Dyke Spillway continues to effectively drain water from the Surface Cell cover into the Reservoir and is generally functioning as intended. Limited erosion was observed in 2022, although it is likely that additional maintenance will be required in the future. The spillway should continue to be inspected for additional erosion and maintenance should be undertaken when deemed necessary in future geotechnical inspection reports.

As observed and reported during previous inspections, a small head pond developed on the Surface Cell cover at the spillway inlet. The presence of the shallow head pond is not considered to negatively impact the overall cover performance; hence the elimination of the head pond is not considered necessary.

Despite continued seepage observed at the West Twin Outlet Wall, level logger data continues to support visual observations that the water level upstream of the outlet wall is maintained at or above the wall invert during the open water season. Continued deformation of the perimeter slopes of the upstream Polishing Pond was observed in 2022. As noted in previous inspections, the area of instability was located farther from the outlet wall compared to previous years. Hence, there are no concerns that this instability will impact the performance of the outlet wall. Based on the water quality measurements collected since the East Twin Lake access road was breached in 2008, the seepage losses from the Polishing Pond do not appear to be affecting the overall performance of the West Twin Area reclamation measures. The seepage losses should continue to be monitored for increases in flow rate or for initiation of particle transport. Additional seepage control measures could be considered, if necessary.

Previous inspections made recommendations to repair left bank armouring material following observations of erosion along a section of the East Twin Creek Diversion Channel. In response to these observations, maintenance was undertaken at the diversion dyke in 2018. The maintained areas were visually assessed during the 2022 inspection and limited erosion was observed. Seepage discharge observed at the toe of the left bank of the dyke during previous inspections was observed again in 2022. The seepage water is interpreted to originate in the Polishing Pond and interpreted to only flow during the summer, when the active layer thickness is near its maximum depth. The seepage flow rate was visually estimated to be similar in comparison to recent years, and the flow was observed to be clear and free of sediment. No further maintenance of the diversion dyke is recommended at this time but the dyke should continue to be monitored for additional erosion and seepage flows.

Thermal Covers

Based on monitoring data collected from various frost gauges and thermistors, the thermal covers performed adequately throughout 2022. In general, the active layer thaw in 2022 was observed to be similar to what was measured in 2020 and 2021. The 2022 weather was variable: in general (compared to the 1977-2022 dataset), the 2021 fall was the warmest on record, the 2021/2022 winter and 2022 spring were colder than average and the 2022 summer was average. Since the active layer thaw depths tend to reflect summer temperatures, average thaw depths were observed in 2022. Based on field observations during the annual geotechnical inspection, surface water conditions on site were generally drier than recent years. And, anecdotally, locals in Arctic Bay commented on the 2021/2022 winter as having little snow and the 2022 spring/summer as having less rain than recent years.

The minor erosion, cracking, and thermokarsting/settlement observed on the Surface Cell and Test Cell cover systems that has been noted in previous inspections was not observed to have visually changed in several years. However, the cracks and heaving in an oval pattern near the central-southern portion of the cover continued to grow since 2021, with some shale becoming exposed below the armouring layer. The heaving is likely due to the freeze-back of the pore water in the underlying tailings. The heaving/cracking is not considered to impact the stability of the West Twin Dyke. Should the cracks deepen through the shale cover and expose tailings, they pose a risk of negatively impacting the local performance of the cover system and surrounding water quality. Localized snow accumulation within the cracking may exacerbate the issue by locally increasing thaw depths. Localized re-grading of the cover materials should be undertaken to limit snow accumulation and potentially to reduce the rate of growth of the heave. The water quality observed at the final discharge point for the West Twin Disposal Area, based on a sample collected and tested in August 2022, remained well below the discharge criteria, indicating that to date, no degradation of water quality has been observed, and is an indication that the cover systems continue to perform as intended.

Several instruments to monitor the performance of the thermal covers on site have ceased functioning in the past few years. This is expected, as most instruments were installed nearly 20 years ago. Replacement of the failed instruments is not considered necessary at this time, given generally positive performance monitoring results since installation.

Visual monitoring of the thermal covers is recommended to monitor for additional surface deformation and erosion, specifically the heave feature. Additionally, at the heave feature, measurements of the cracking (length, width, depth), and measurements of any exposed shale cover (length, depth), should be recorded and compared at each inspection. Localized regrading of the heave feature during an upcoming geotechnical inspection is recommended to limit snow accumulation and potentially to reduce the rate of growth of the heave.

Talik and Mine Waste Freeze-back

Overall freeze-back of the taliks in the Surface Cell and Test Cell appears to be proceeding faster than anticipated. In 2022, cooling of ground temperatures shallower than approximately 15 m bgs was observed, relative to 2020 and 2021, but generally remained slightly warmer than 2019. Cooling of ground temperatures at depths greater than approximately 15 m bgs and downward progression of the permafrost base continued in 2022, but the rate has slowed in recent years suggesting that ground temperatures are likely reaching thermal equilibrium at depth. Mine waste remained frozen through 2022. All piezometers within the Surface Cell, and four out of five piezometers within the Test Cell, have frozen back due to continued downward progression of the permafrost base. The piezometers have been observed to freeze back at lower temperatures when the piezometer tip is at a lower elevation, as well as when it is located further away from the edge of the original lakebed. These relationships are likely related to the depression of the freezing point due to increasing solute concentrations in the unfrozen pore water contained within the remnant talik.

In areas where no talik exists (e.g., landfill, open pits), freeze-back of the materials underlying the cover systems has occurred and the rate of cooling has generally slowed over recent years, suggesting ground conditions are approaching thermal equilibrium at depth.

Mine Openings, Crown Pillars and Raises

The covers constructed over the mine openings generally appear to be physically stable. Cracking at the East Open Pit crown pillar does not appear to have progressed in many years. No maintenance is recommended, but continued visual inspection is warranted.

Shale and Armour Borrow Areas

In general, the shale and armour borrow areas appear to be physically stable and no ponding was observed. No maintenance is recommended at any of the borrow areas.

8.0 CLOSURE

We trust the above satisfies your requirements at this time. Should you have any questions or comments, please do not hesitate to contact us.

Yours sincerely,

BGC ENGINEERING INC.
per:

REGISTERED PROFESSIONAL ENGINEER
S.D. GARRISON
LICENSEE
Feb 28, 2023
NT/NU

Scott Garrison, M.Eng., P.Eng.
Geological Engineer

Reviewed by:

Geoff Claypool, M.Eng., P.Eng.
Principal Geological Engineer

SG/GC/jtcs/js

PERMIT TO PRACTICE
BGC ENGINEERING INC.
Signature
Date 28-Feb-2023
PERMIT NUMBER: P 265
NT/NU Association of Professional Engineers and Geoscientists

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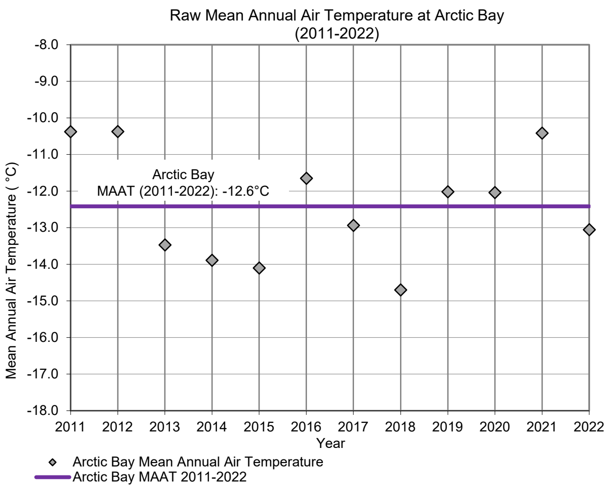
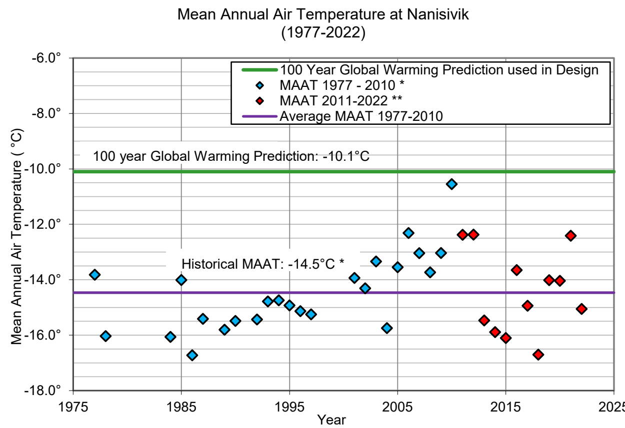
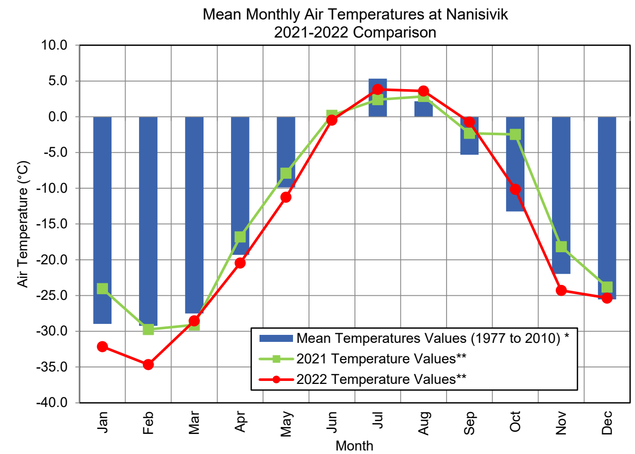
FIGURES

02-2023





*Historical average taken from 1977-2010 when data was available at the Nanisivik Airport
*2011-2022 temperature corrected by -2°C to adjust for new weather station location (Arctic Bay).



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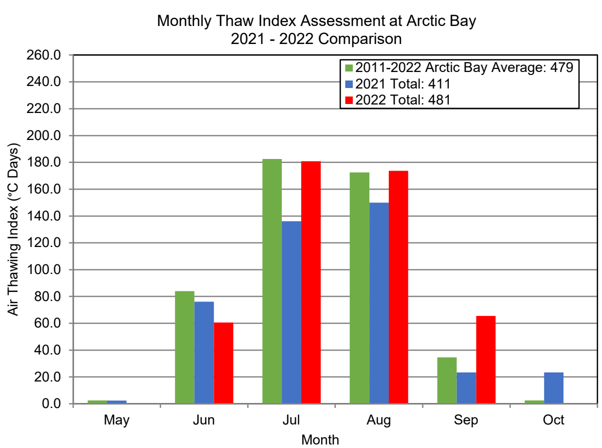

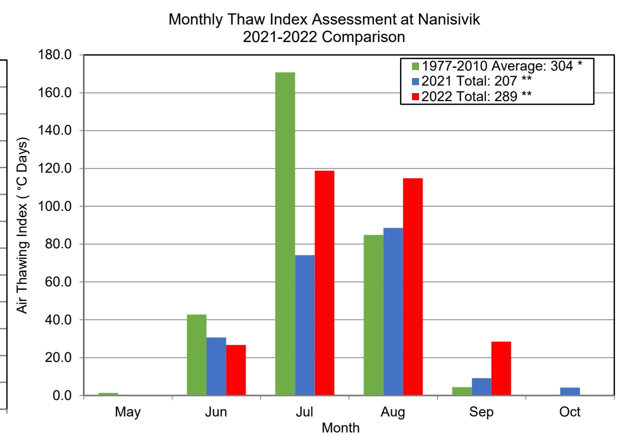

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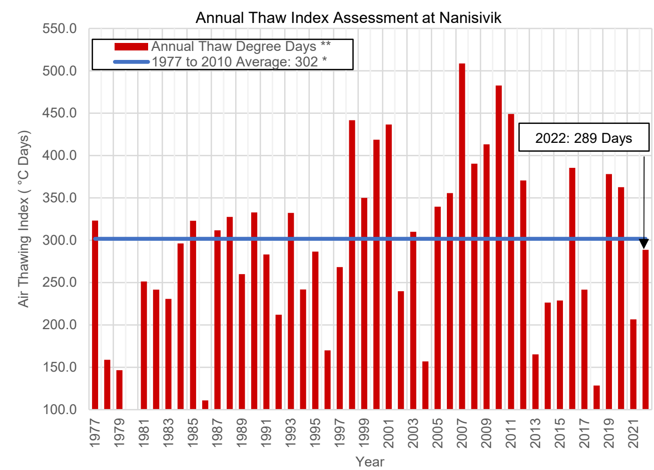
**2011-2022 air temperatures corrected by -2°C per day to adjust for new weather station location (Arctic Bay).



*Historical average taken from 1977-2010 when data was available at the Nanisivik Airport
**2011-2022 air temperatures corrected by -2°C to adjust for new weather station location (Arctic Bay)

NOTES

1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection" and dated February 2023.

PREPARED BY: JS	FIGURE TITLE: Climate Data		
CHECKED BY: GKC	CLIENT: CanZinco Mines Ltd.		
APPROVED BY: SDG	SCALE: N/A	PROJECT NO: 0255-034	FIGURE NO: 01

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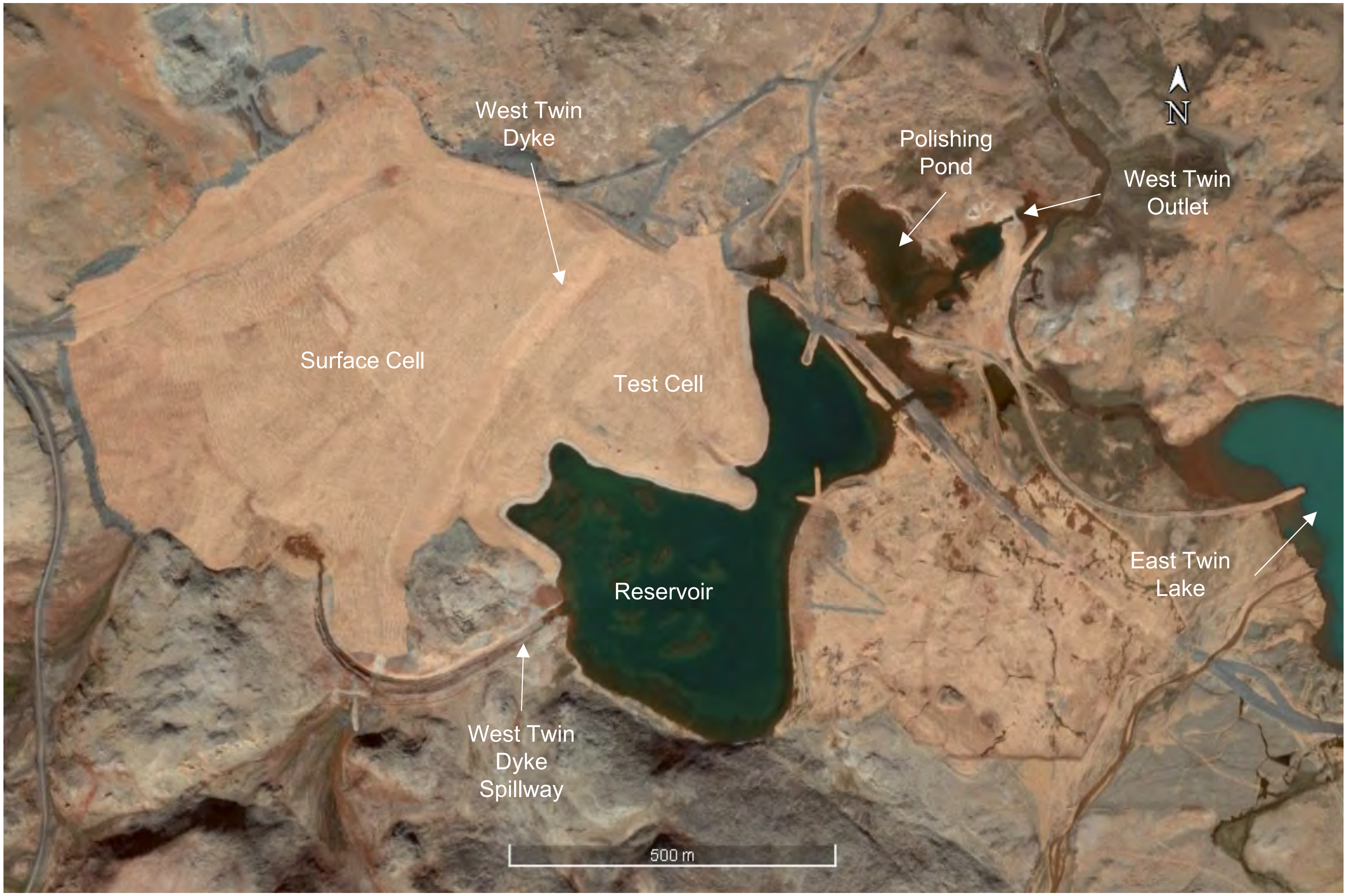
02-2023



NOTES
1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection", dated February 2023.
2. Photo derived from Google Earth, imagery date July 28, 2015

PREPARED BY: EK	FIGURE TITLE: Site Plan of the West Twin Disposal Area		
CHECKED BY: GKC	CLIENT: CanZinco Mines Ltd.		
APPROVED BY: SDG	SCALE: 1:10,000	PROJECT NO: 0255-034	FIGURE NO: 02

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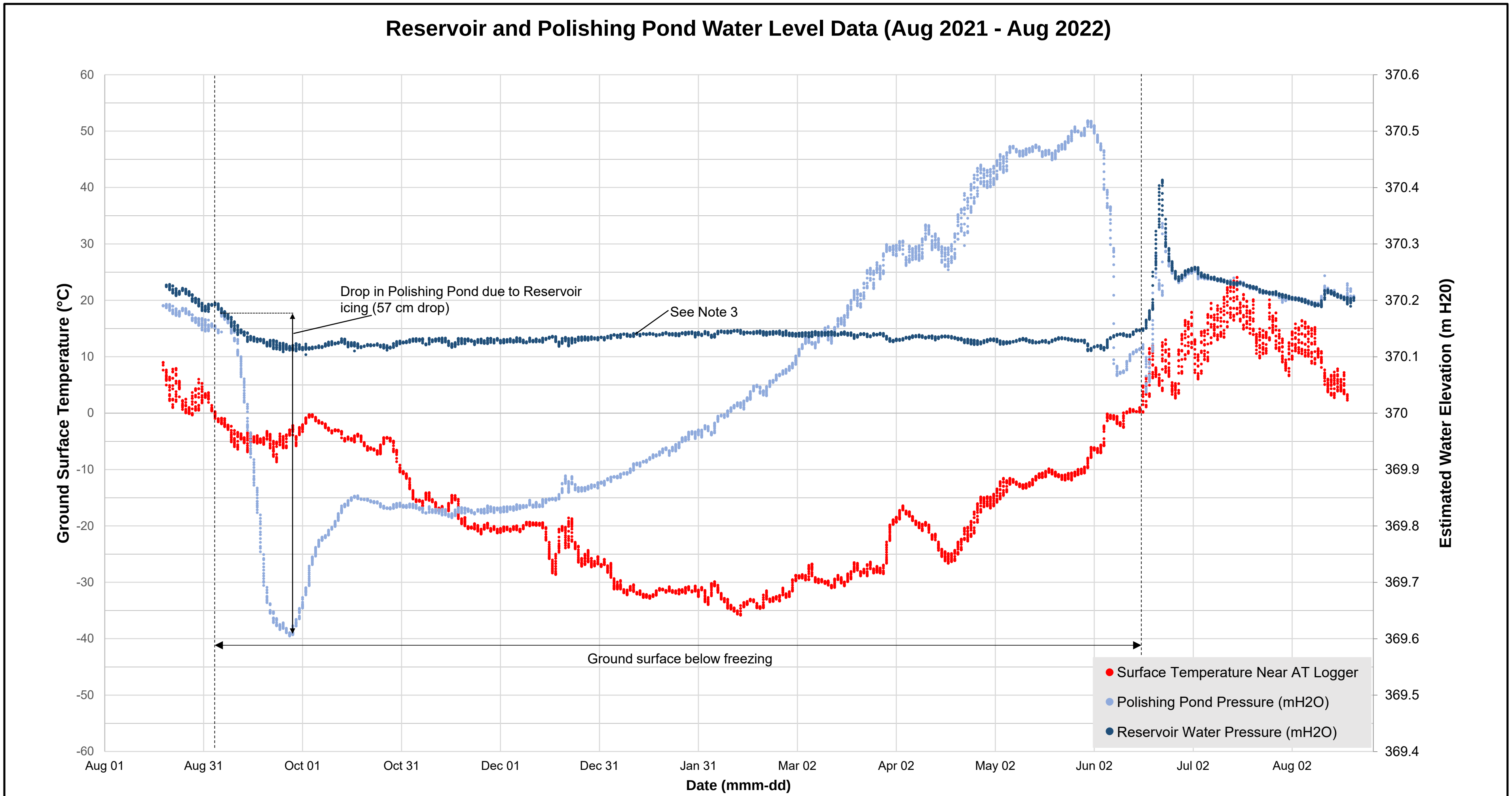
02-2023



NOTES

1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection" and dated February 2023.
2. Air temperatures were recorded at the Surface Cell.
3. Data was benchmarked to 2022 site visit observations that indicate polishing pond and reservoir water level at El. 370.2 m. Position of loggers may shift during spring breakup.

PREPARED BY: JS	FIGURE TITLE: Polishing Pond Water Level Data		
CHECKED BY: GKC	CLIENT: CanZinco Mines Ltd.		
APPROVED BY: SDG	SCALE: NOT TO SCALE	PROJECT NO: 0255-034	FIGURE NO: 03

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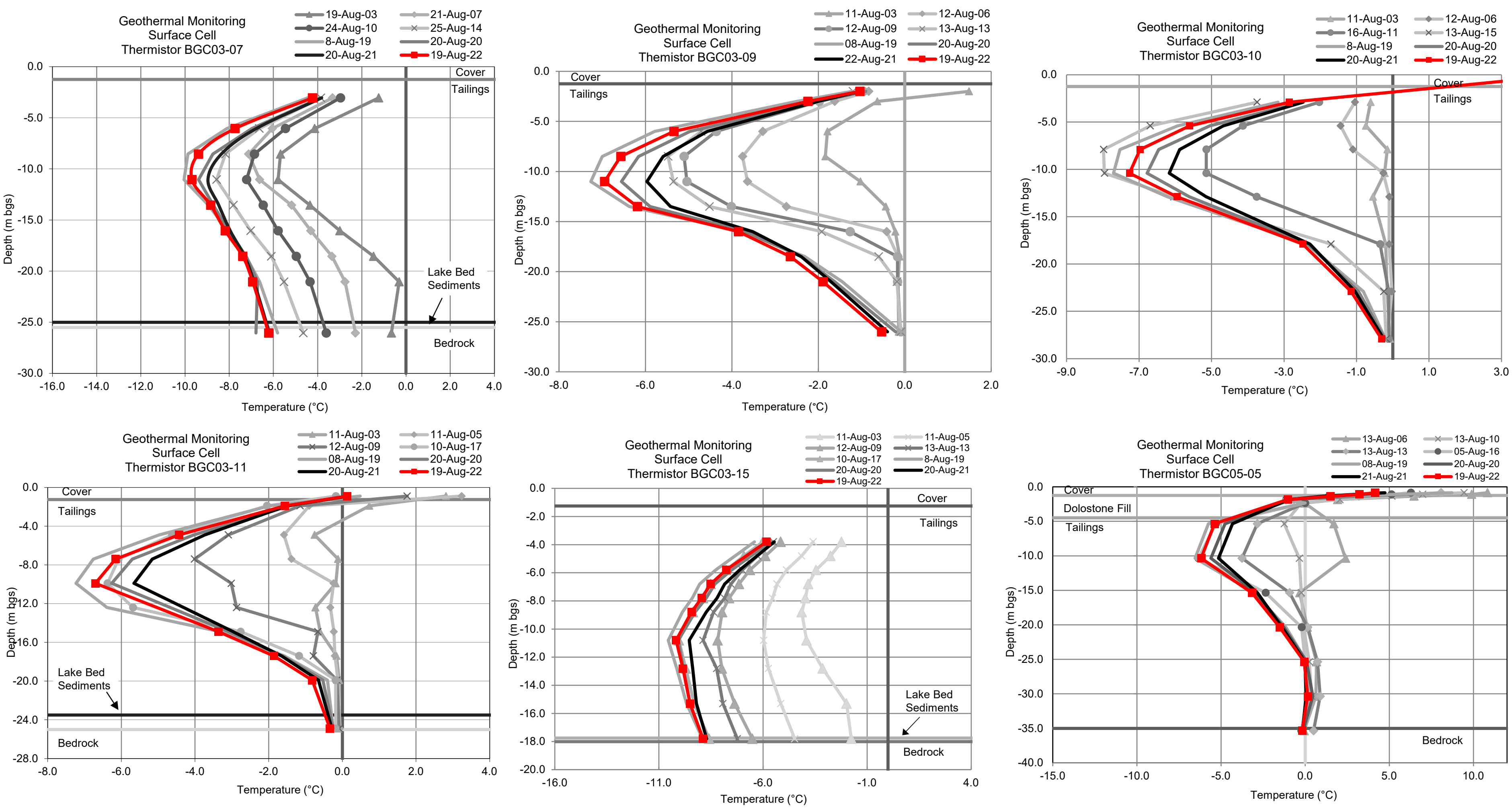

NOTES
1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection" and dated February 2023.

PREPARED BY:	FIGURE TITLE:		
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CHECKED BY:	CLIENT:		
GKC	CanZinco Mines Ltd.		
APPROVED BY:	SCALE:	PROJECT NO:	FIGURE NO:
SDG		0255-034	04

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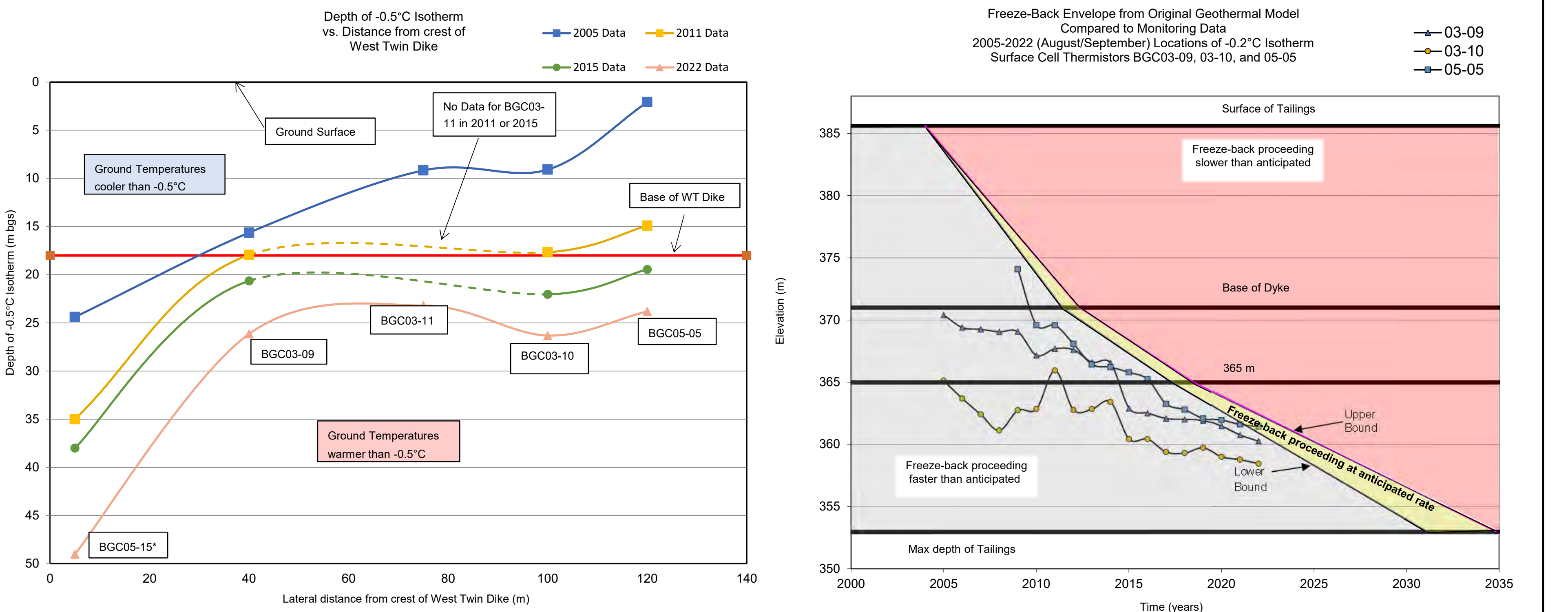

*Since 2005, the -0.5°C Isotherm for BGC05-15 is extrapolated using linear extrapolation of nodes at 20 to 30 m depth.

NOTES
1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection" and dated February 2023.

PREPARED BY: JS	FIGURE TITLE: Surface Cell Tailings Cover Geotechnical Monitoring Data 2		
CHECKED BY: GKC	CLIENT: CanZinco Mines Ltd.		
APPROVED BY: SDG	SCALE:	PROJECT NO: 0255-034	FIGURE NO: 05

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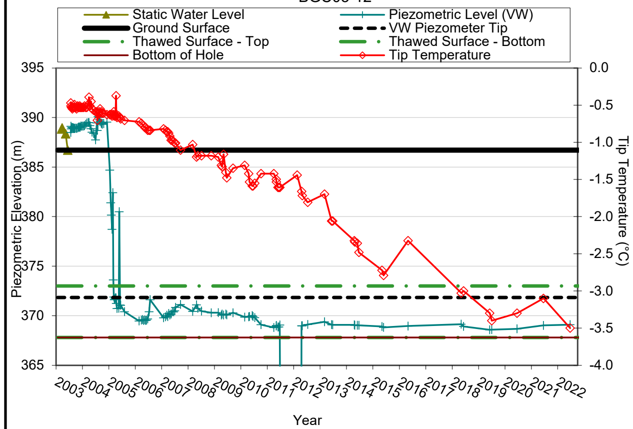
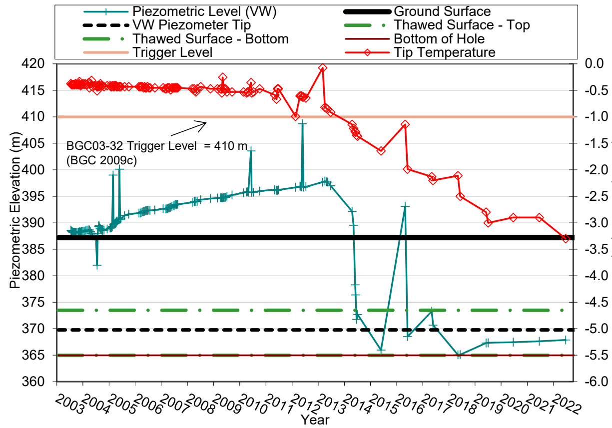
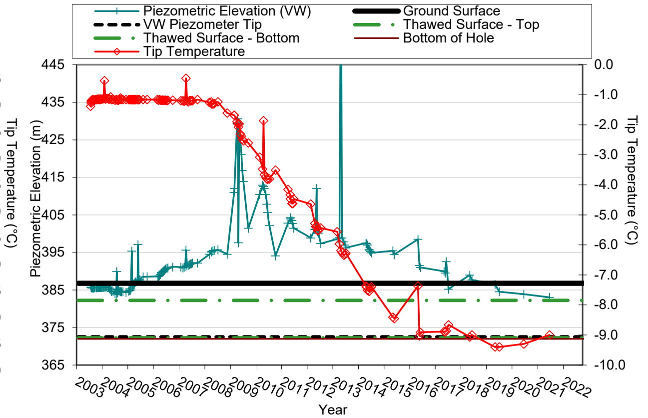
Piezometer Monitoring
Surface Cell Talik
BGC03-12



Piezometer Monitoring
Surface Cell Talik
BGC03-32



Piezometer Monitoring
Surface Cell Talik
BGC03-35



Piezometer Monitoring
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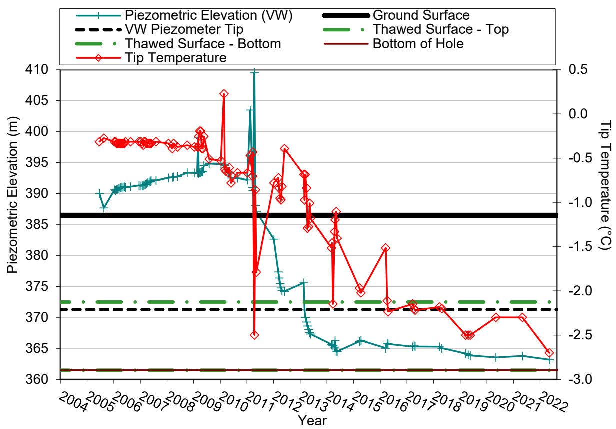
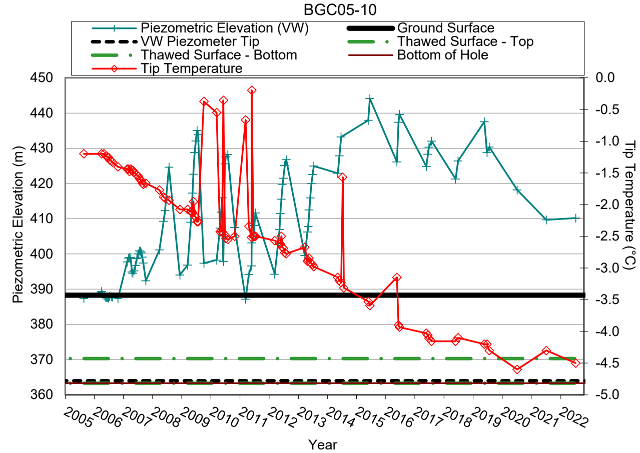
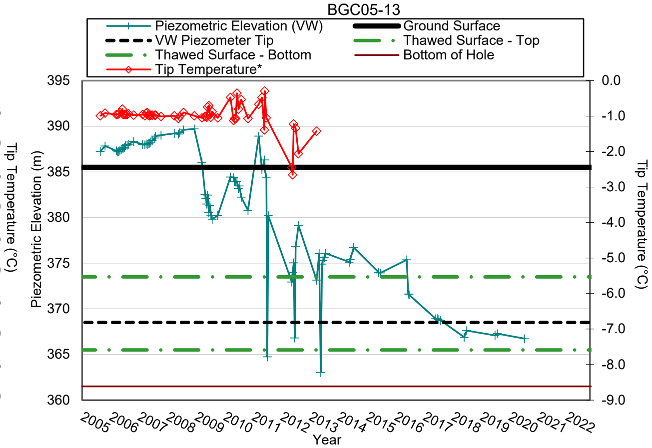
BGC05-07



Piezometer Monitoring
Surface Cell Talik
BGC05-10



Piezometer Monitoring
Surface Cell Talik
BGC05-13



*No resistance measurements obtained from 2012 through 2018. Tip Temperature measured directly beginning in 2019.

NOTES
1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection" and dated February 2023.

PREPARED BY: JS	FIGURE TITLE: Surface Cell Tailings Cover Geotechnical Monitoring Data 3		
CHECKED BY: GKC	CLIENT: CanZinco Mines Ltd.		
APPROVED BY: SDG	SCALE:	PROJECT NO: 0255-034	FIGURE NO: 06

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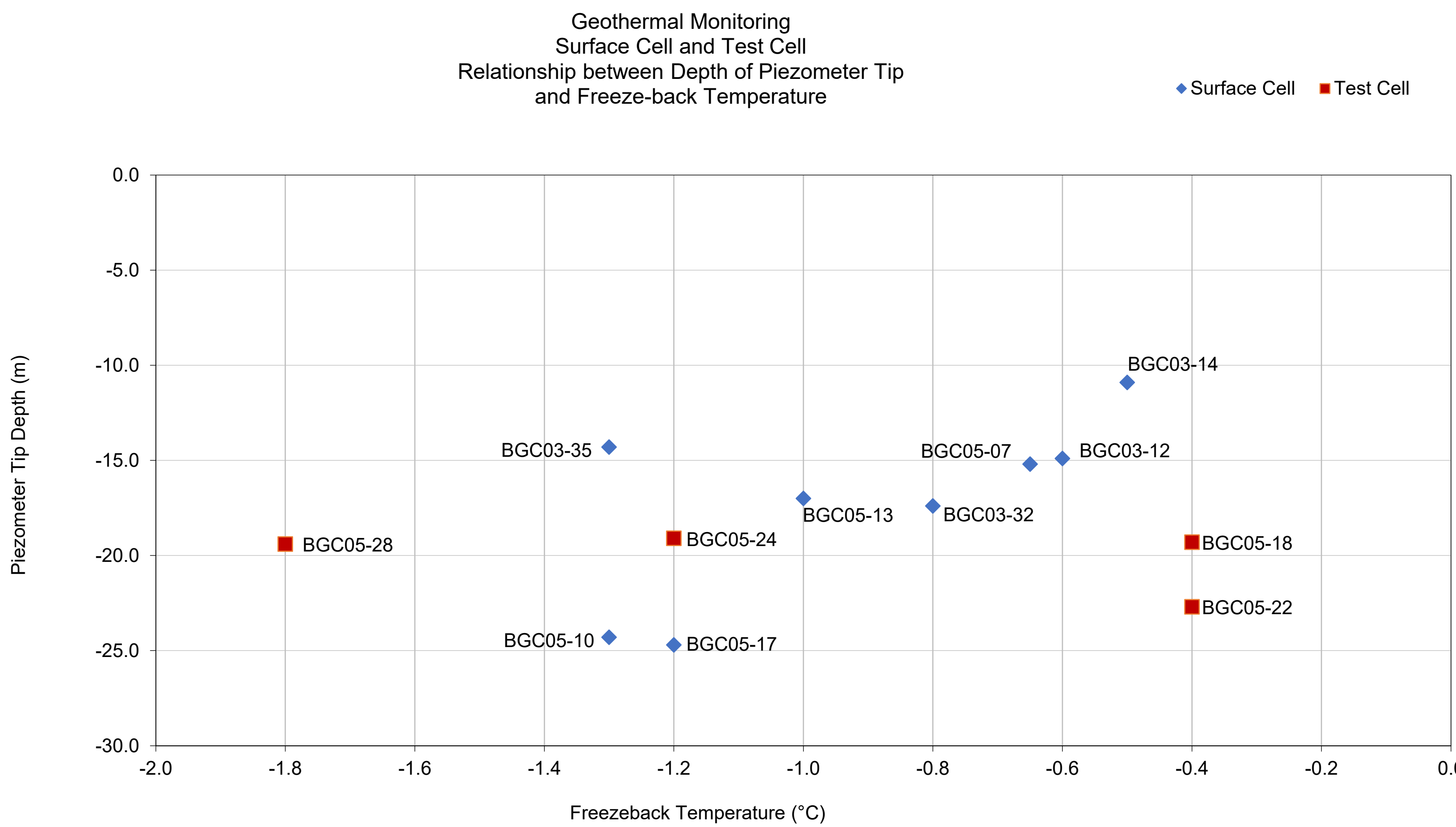

NOTES
1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection", dated February 2023.

PREPARED BY:	FIGURE TITLE:		
JS	Surface Cell Tailings Cover Geotechnical Monitoring Data 4		
CHECKED BY: GKC	CLIENT: CanZinco Mines Ltd.		
APPROVED BY: SDG	SCALE:	PROJECT NO: 0255-034	FIGURE NO: 07

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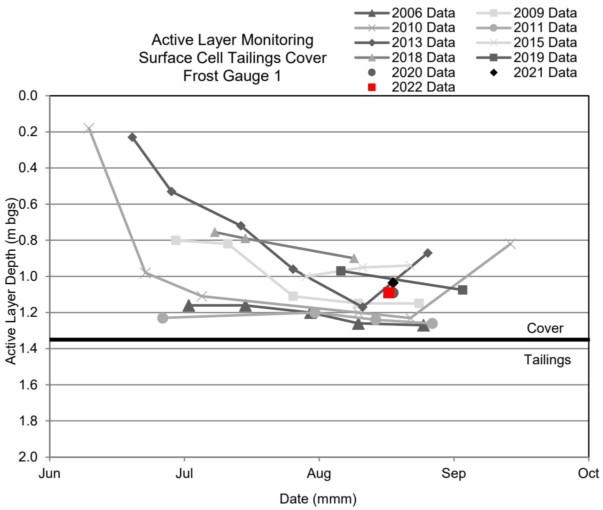

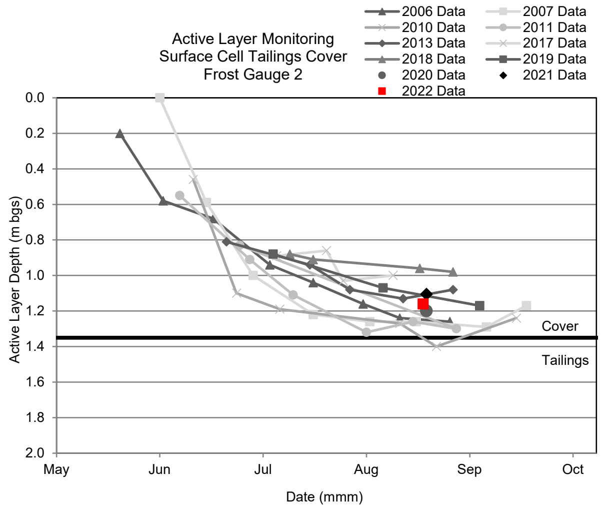

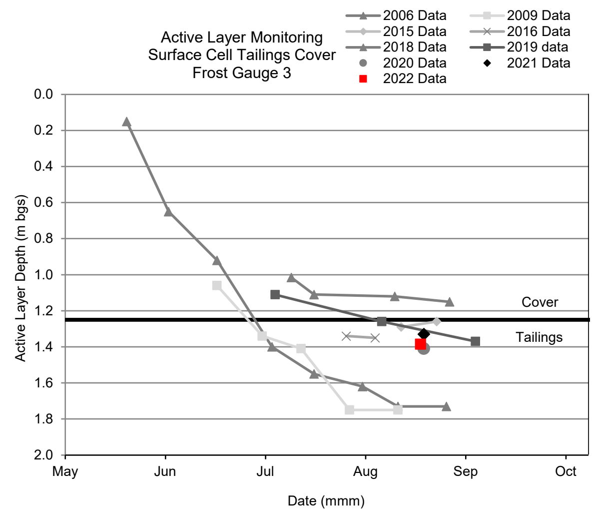

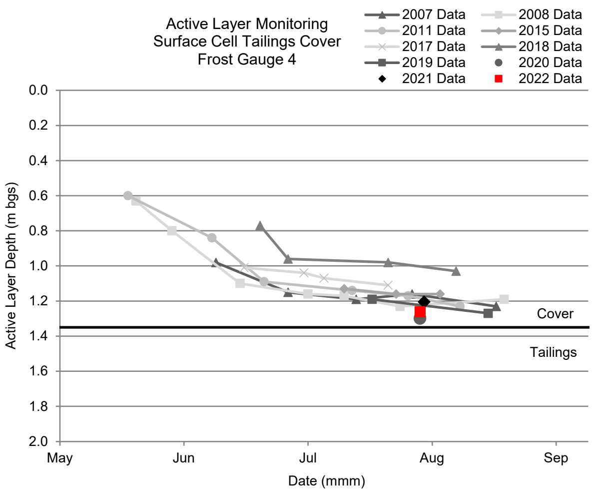

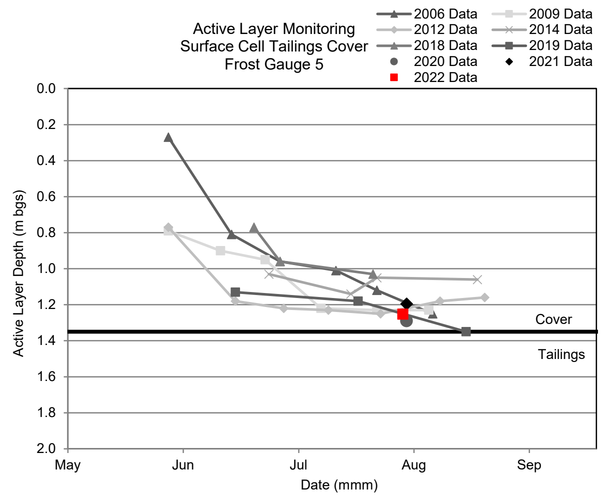

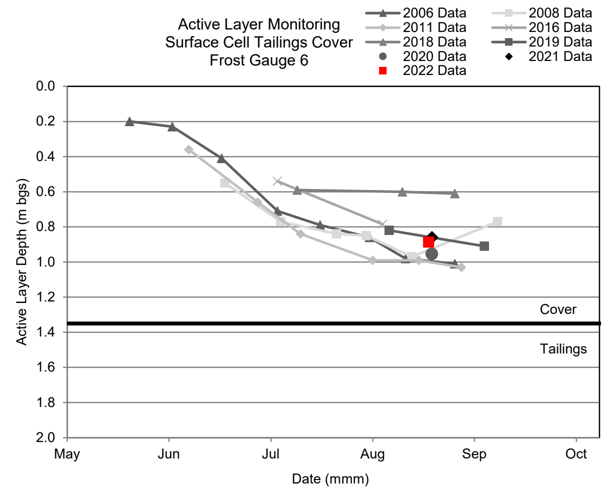

NOTES
1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection" and dated February 2023.

PREPARED BY: JS	FIGURE TITLE: Surface Cell Tailings Cover Geotechnical Monitoring Data 5		
CHECKED BY: GKC	CLIENT: CanZinco Mines Ltd.		
APPROVED BY: SDG	SCALE:	PROJECT NO: 0255-034	FIGURE NO: 08

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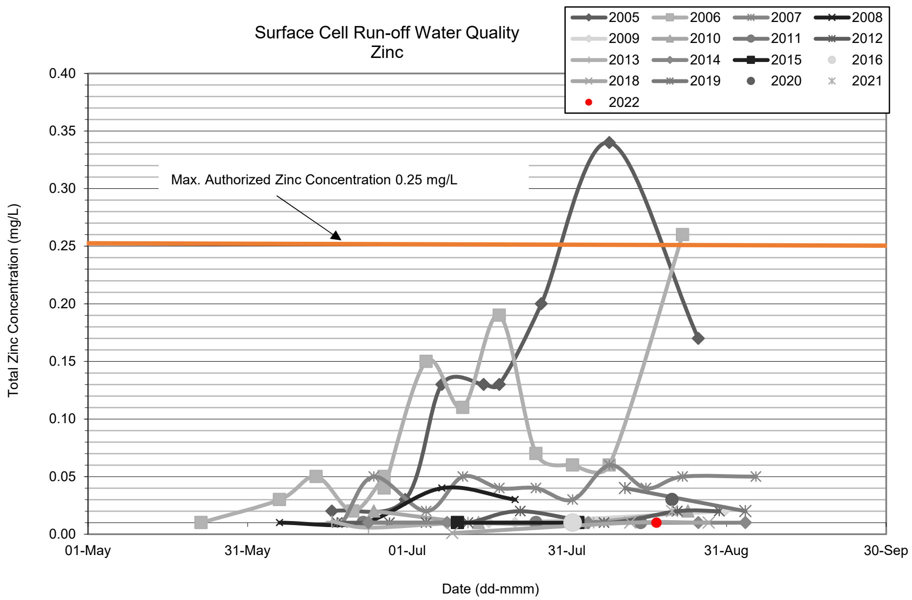

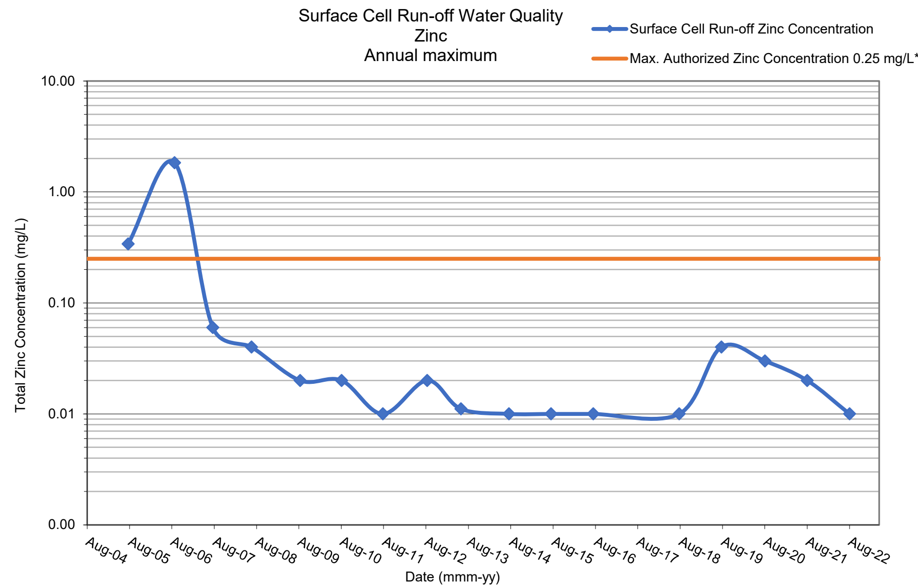

*Maximum authorized Zinc concentration for water quality monitoring station 159-4 downstream.

NOTES
1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection" and dated February 2023.

PREPARED BY: JS	FIGURE TITLE: Surface Cell Run-Off Water Quality Data		
CHECKED BY: GKC	CLIENT: CanZinco Mines Ltd.		
APPROVED BY: SDG	SCALE:	PROJECT NO: 0255-034	FIGURE NO: 09

0 5 10 mm in ANSI B sized paper

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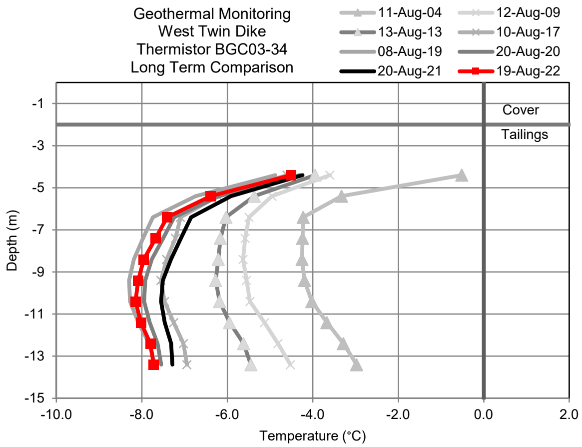
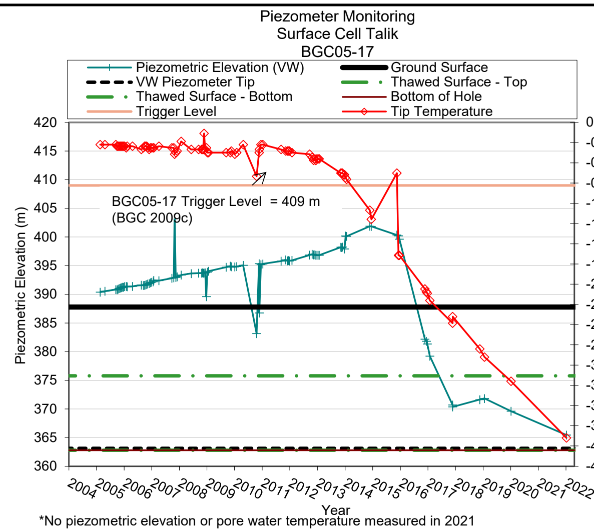
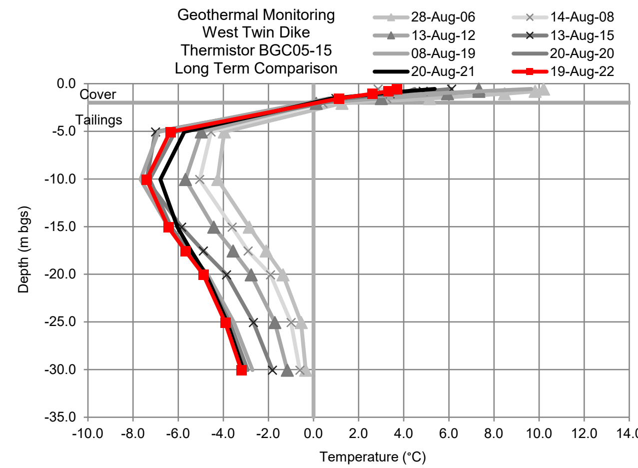
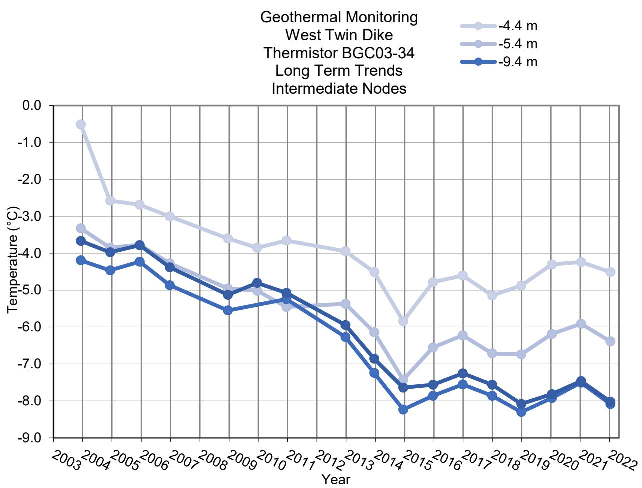
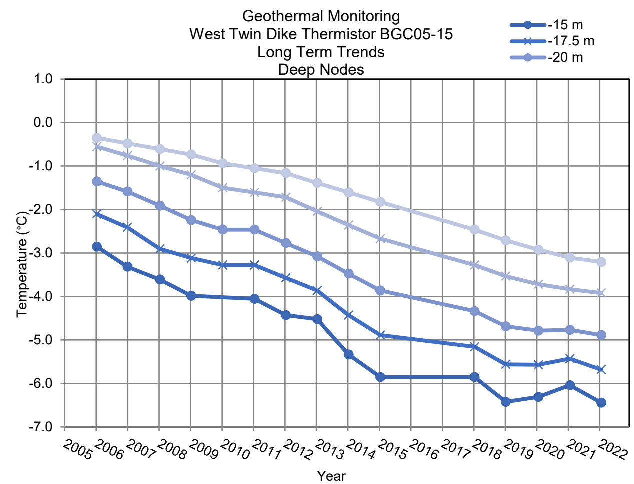
02-2023











NOTES
1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection" and dated February 2023.

PREPARED BY: JS	FIGURE TITLE: West Twin Dyke Geotechnical Monitoring Data		
CHECKED BY: GKC	CLIENT: CanZinco Mines Ltd.		
APPROVED BY: SDG	SCALE:	PROJECT NO: 0255-034	FIGURE NO: 10

0 5 10 mm in ANSI B sized paper

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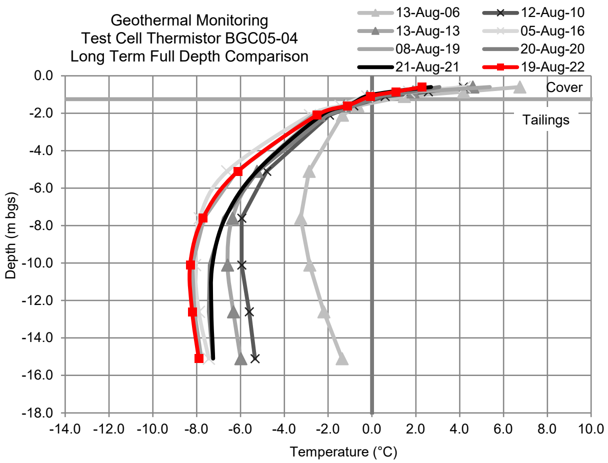

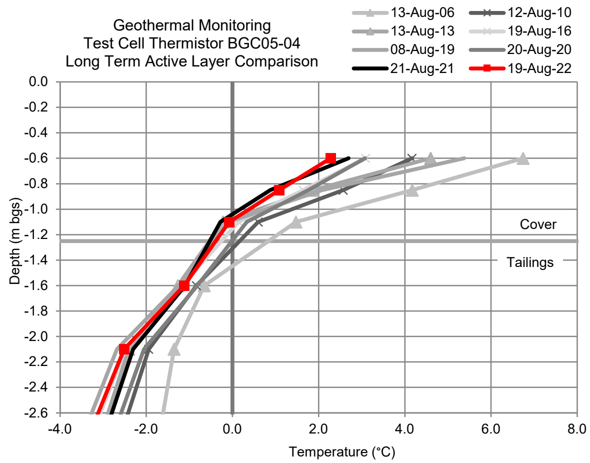

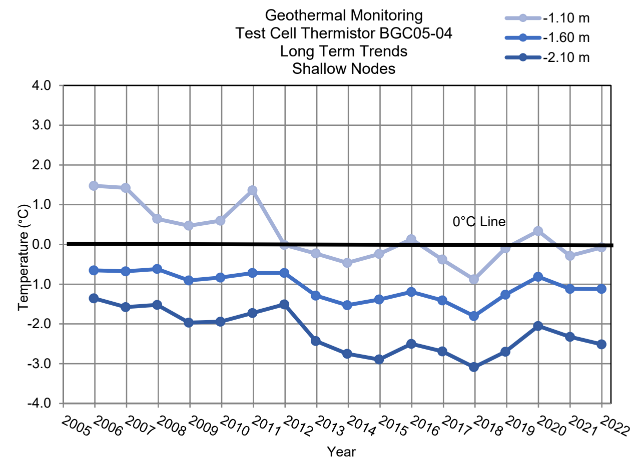

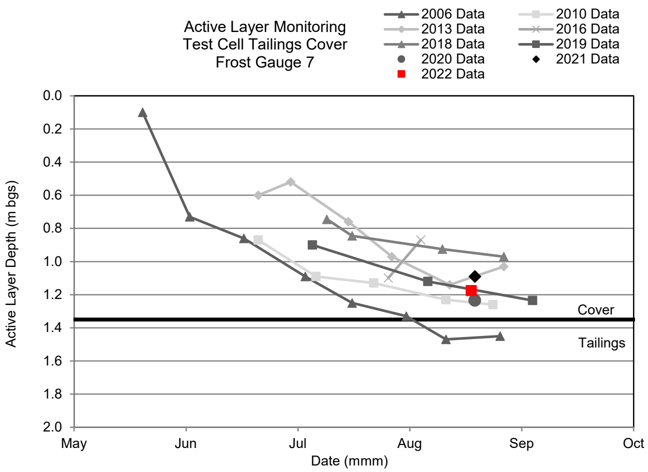

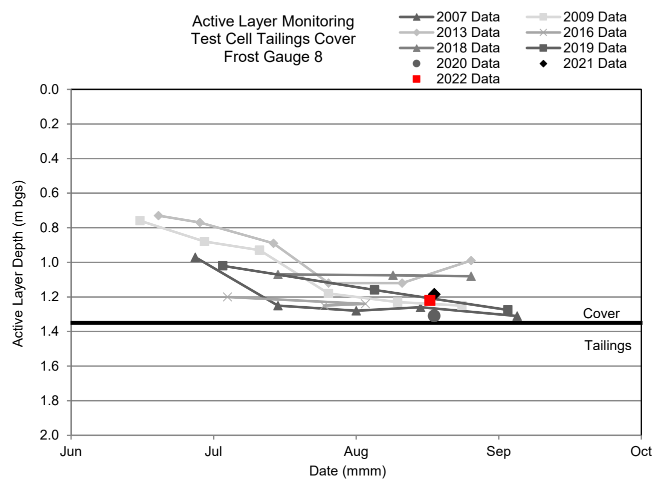

NOTES
1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection" and dated February 2023.

PREPARED BY: JS	FIGURE TITLE: Test Cell Tailings Cover Geotechnical Monitoring Data 1		
CHECKED BY: GKC	CLIENT: CanZinco Mines Ltd.		
APPROVED BY: SDG	SCALE:	PROJECT NO: 0255-034	FIGURE NO: 11

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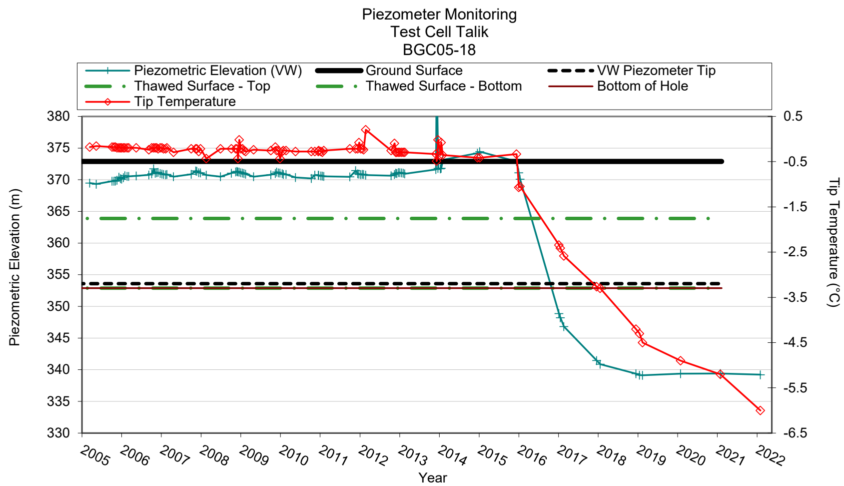
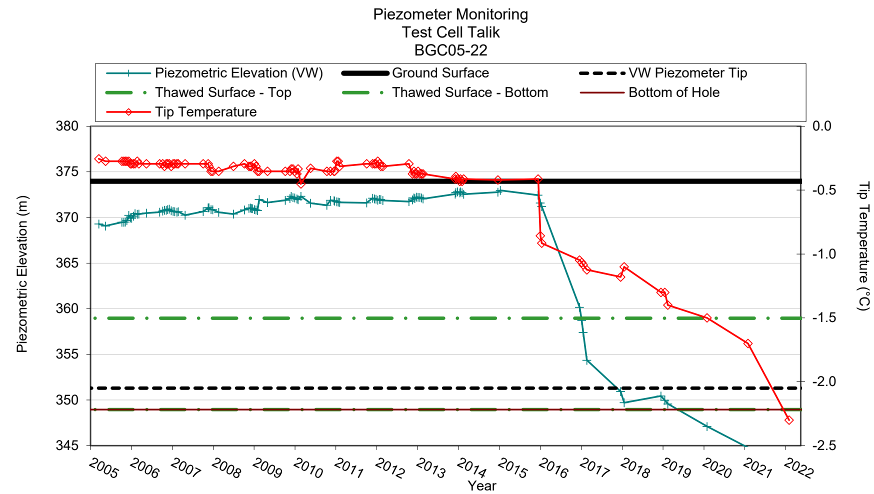
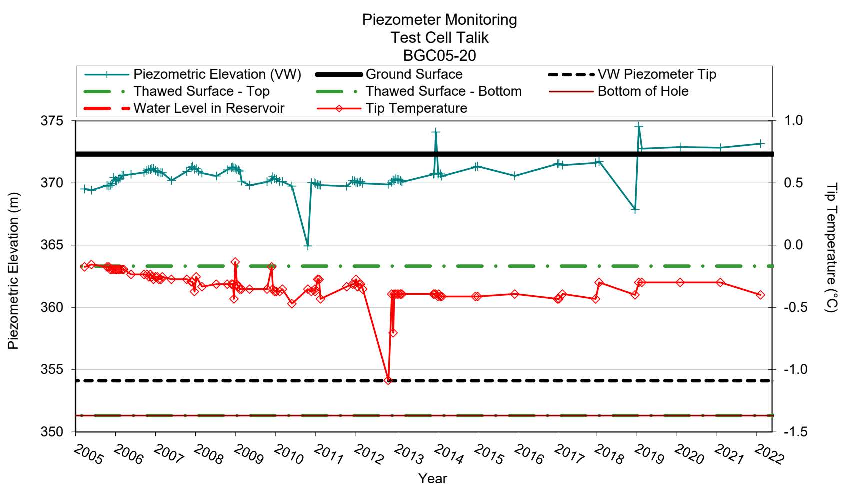




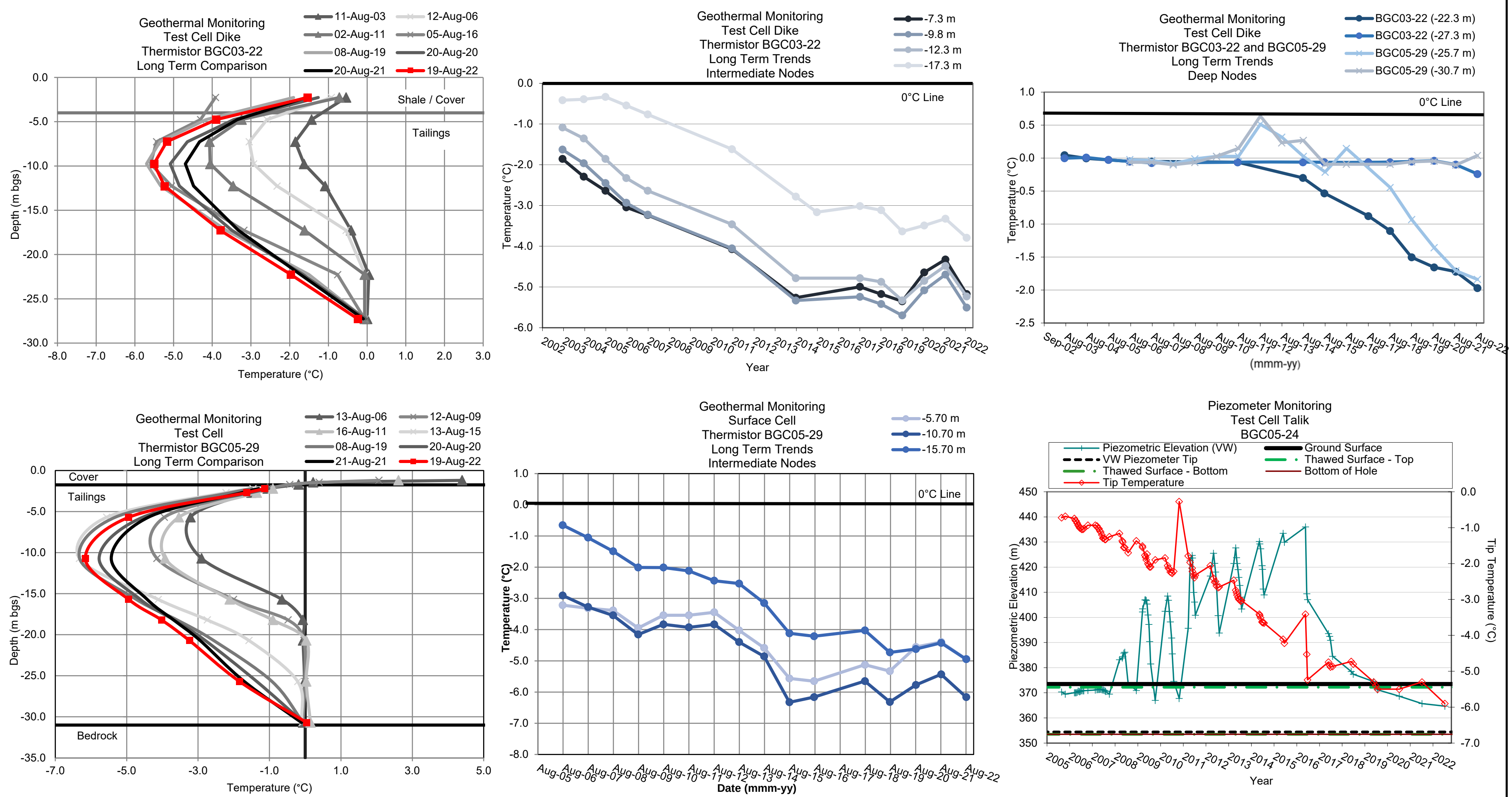


NOTES
1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection" and dated February 2023.

PREPARED BY:	FIGURE TITLE:		
JS	Test Cell Tailings Cover Geotechnical Monitoring Data 2		
CHECKED BY: GKC	CLIENT: CanZinco Mines Ltd.		
APPROVED BY: SDG	SCALE:	PROJECT NO: 0255-034	FIGURE NO: 12

0 5 10 mm in ANSI B sized paper

02-2023



NOTES
1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection" and dated February 2023.

PREPARED BY: JS	FIGURE TITLE: Test Cell Dyke Geotechnical Monitoring Data		
CHECKED BY: GKC	CLIENT: CanZinco Mines Ltd.		
APPROVED BY: SDG	SCALE:	PROJECT NO: 0255-034	FIGURE NO: 13

0 5 10 mm in ANSI B sized paper

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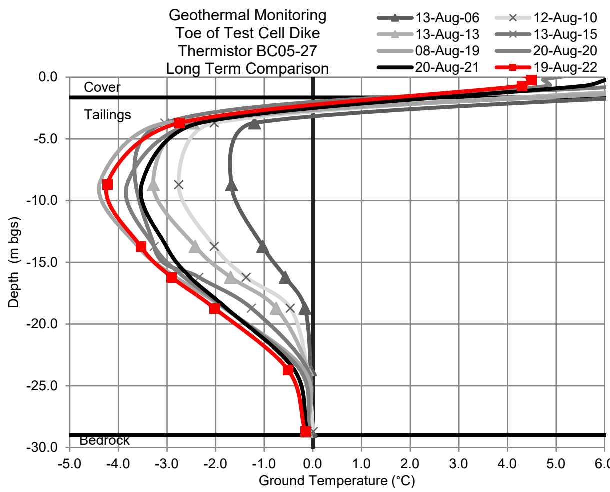

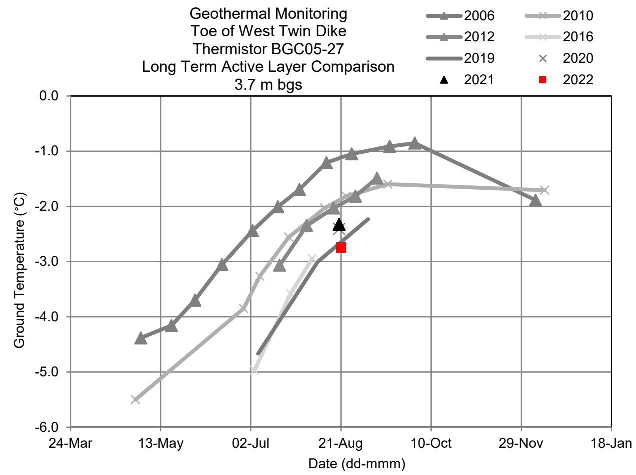

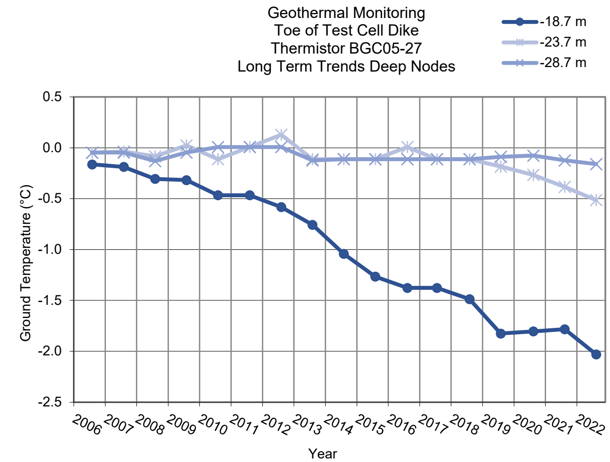

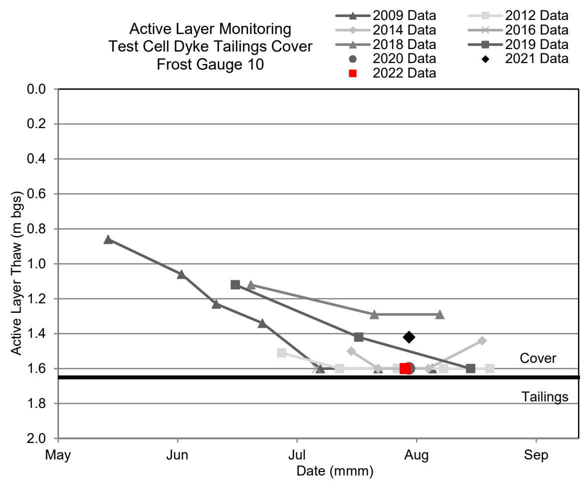

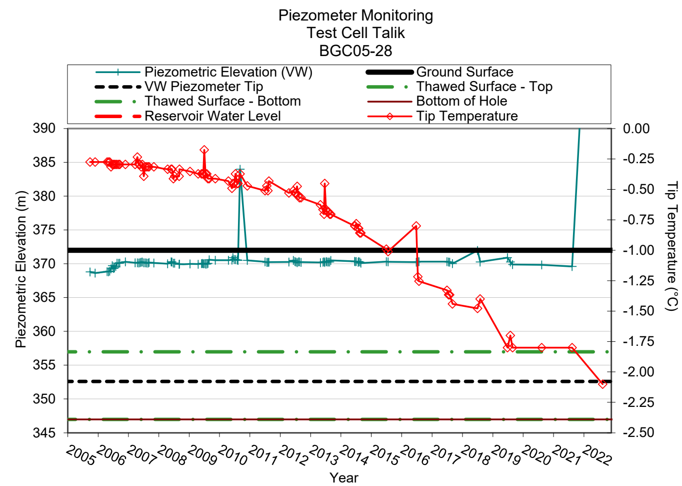

NOTES
1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection" and dated February 2023.

PREPARED BY: JS	FIGURE TITLE: Toe of Test Cell Dyke Tailings Cover Geotechnical Monitoring Data
CHECKED BY: GKC	CLIENT: CanZinco Mines Ltd.
APPROVED BY: SDG	SCALE: / PROJECT NO: 0255-033 / FIGURE NO: 14

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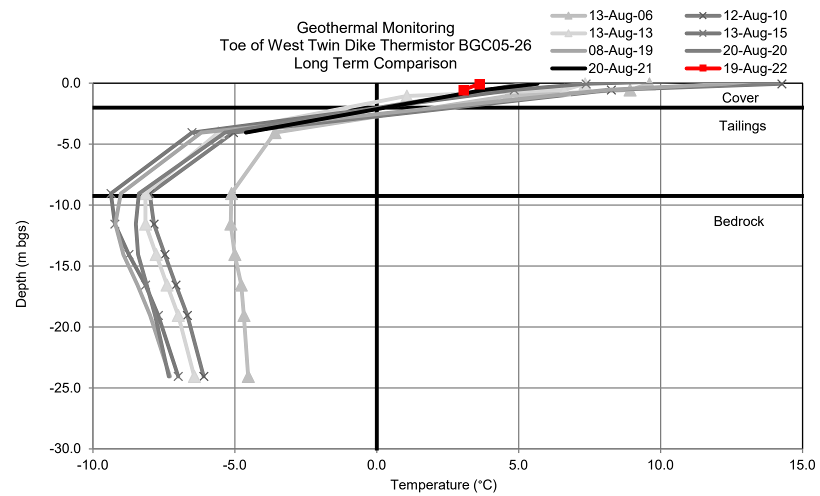

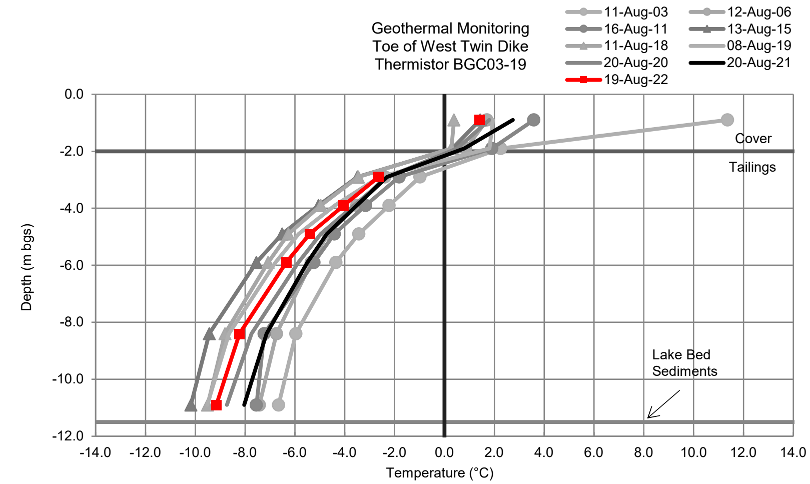

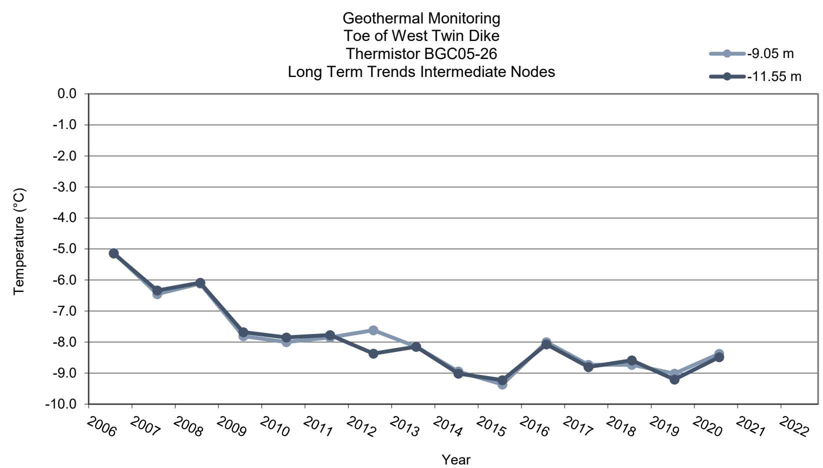

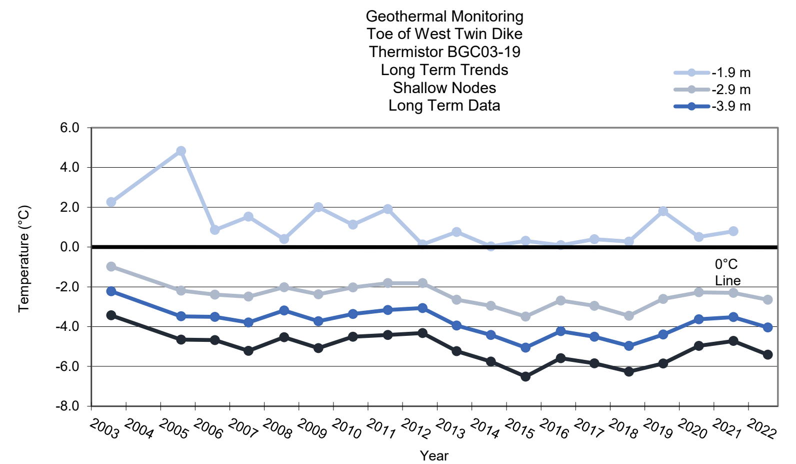

NOTES
1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection" and dated February 2023.

PREPARED BY: JS	FIGURE TITLE: Toe of West Twin Dyke Tailings Cover Geotechnical Monitoring Data		
CHECKED BY: GKC	CLIENT: CanZinco Mines Ltd.		
APPROVED BY: SDG	SCALE:	PROJECT NO: 0255-033	FIGURE NO: 15

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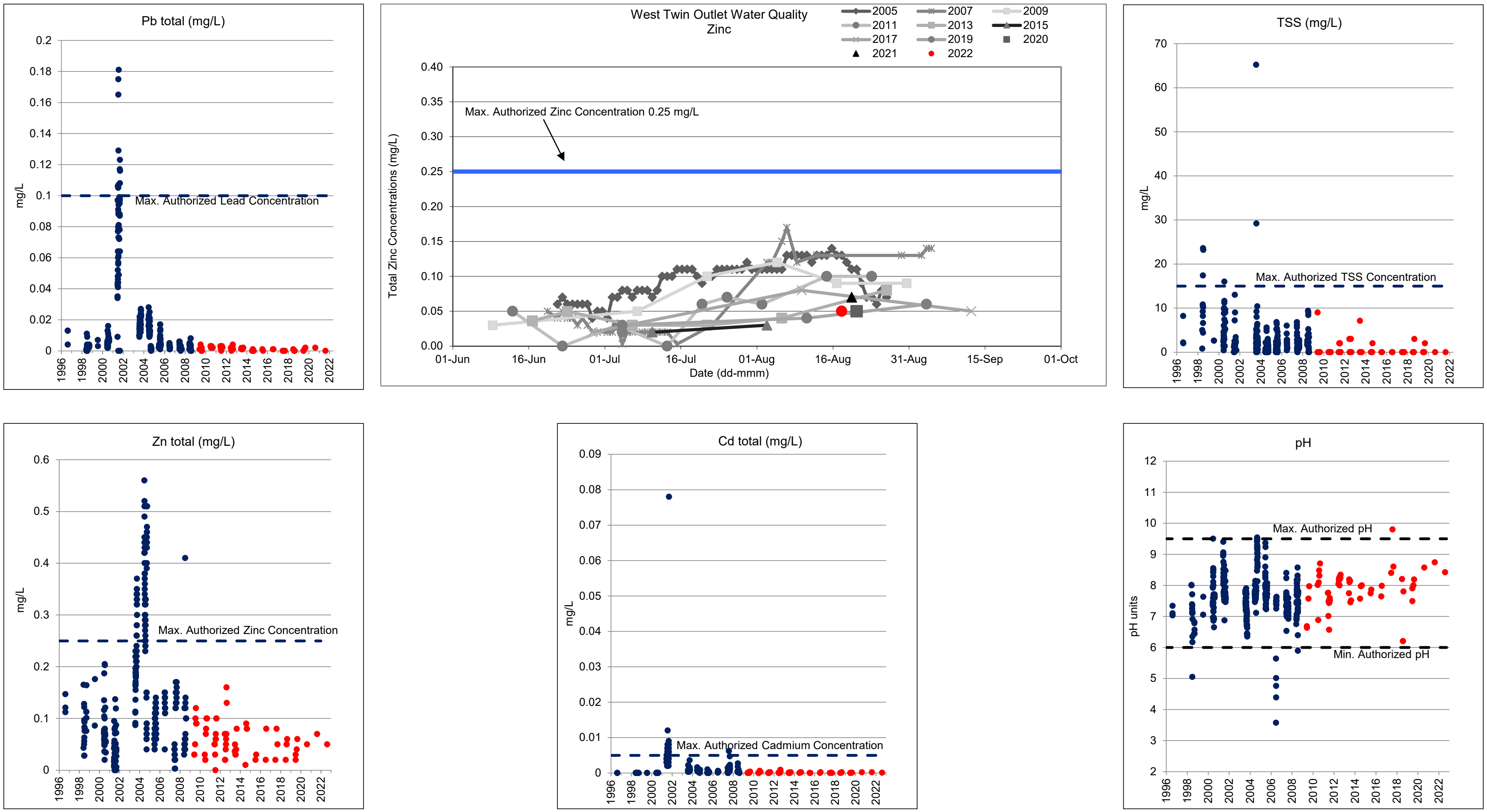
BGC ENGINEERING INC.

02-2023

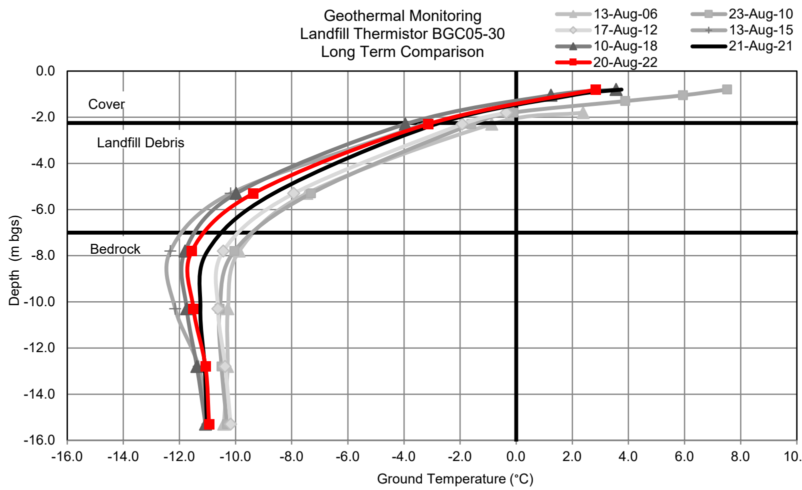


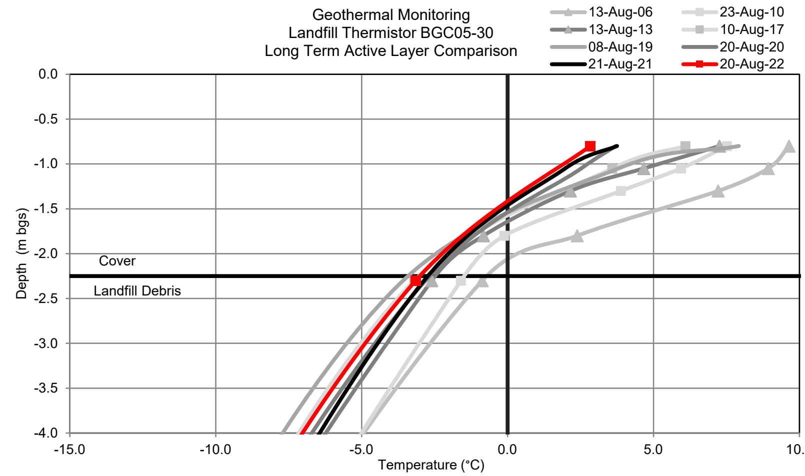
NOTES
1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection" and dated February 2023.
2. Data points represent individual water samples and may not be representative of the true annual maximum concentrations.
3. Maximum authorized concentrations according to Part D of Water Licence 1AR-NAN2030 (NWB 2020).

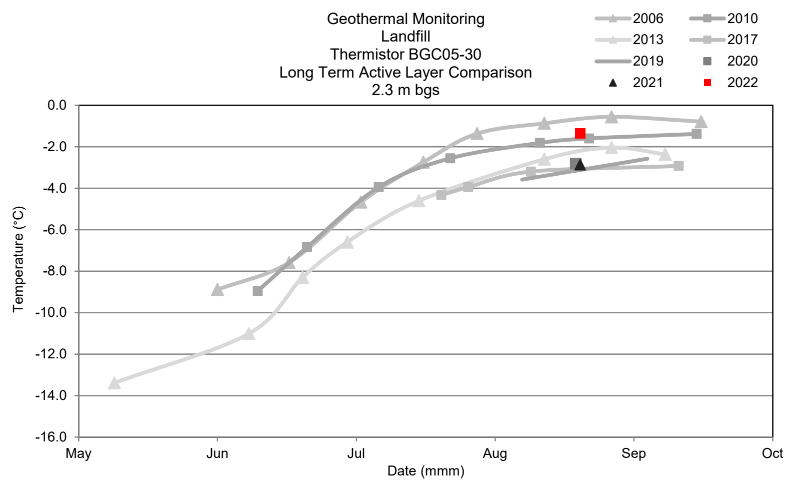
PREPARED BY: JS	FIGURE TITLE: West Twin Disposal Area Water Quality Data		
CHECKED BY: GKC	CLIENT: CanZinco Mines Ltd.		
APPROVED BY: SDG	SCALE:	PROJECT NO: 0255-033	FIGURE NO: 16

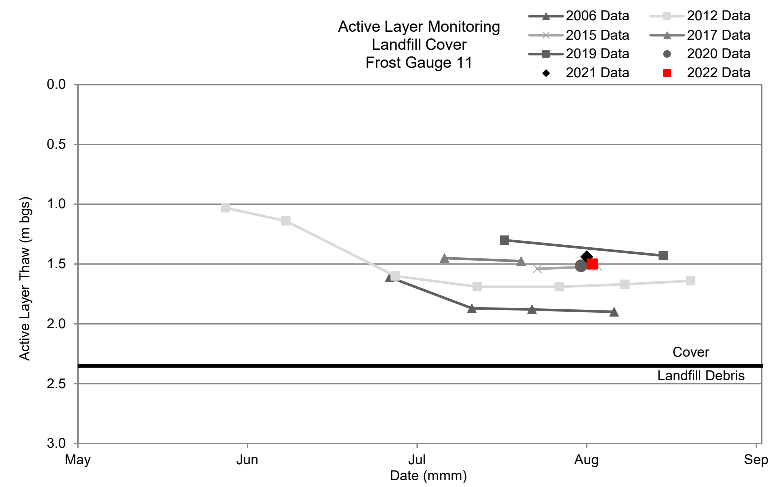
0 5 10 mm in ANSI B sized paper

BGC ENGINEERING INC.







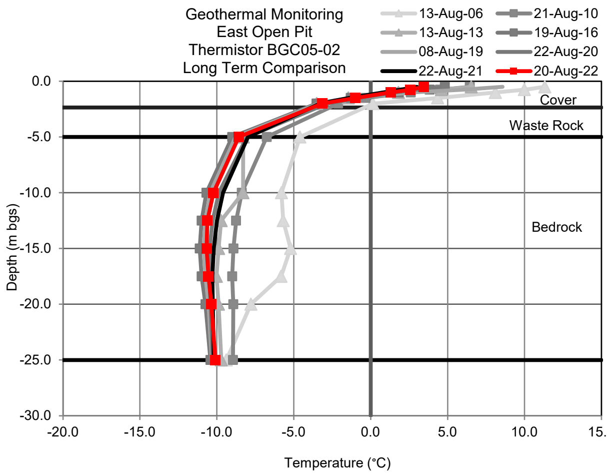


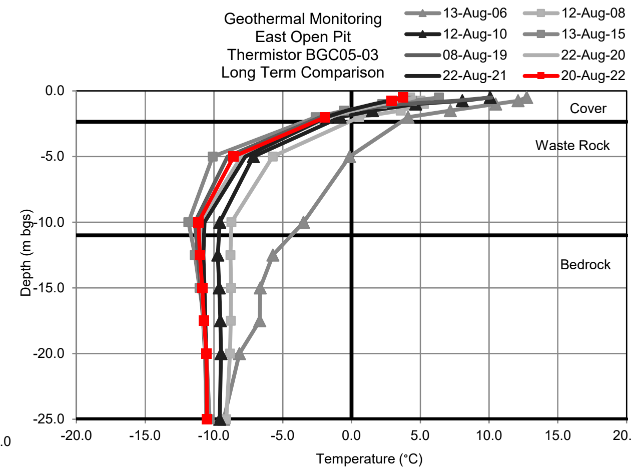
NOTES
1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection" and dated February 2023.

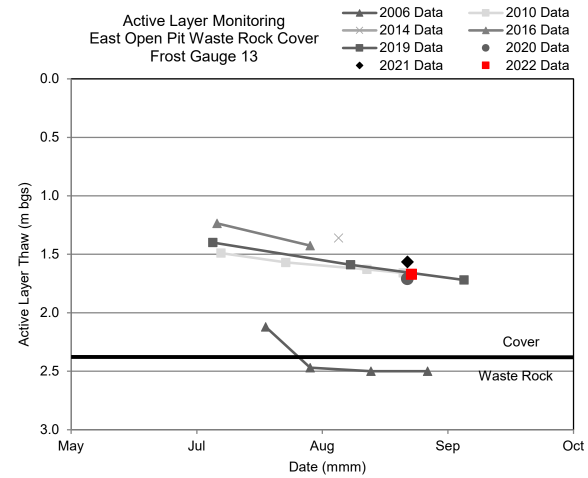
PREPARED BY: JS
CHECKED BY: GKC
APPROVED BY: SDG
FIGURE TITLE: Landfill Cover Geotechnical Monitoring Data
CLIENT: CanZinco Mines Ltd.
SCALE:
PROJECT NO: 0255-033
FIGURE NO: 17

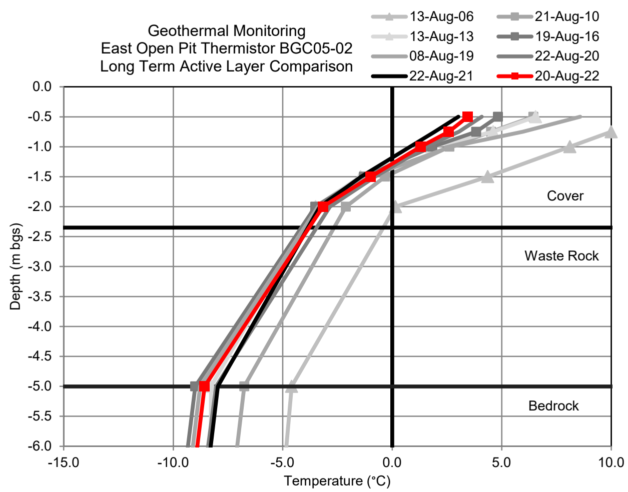
0 5 10 mm in ANSI B sized paper

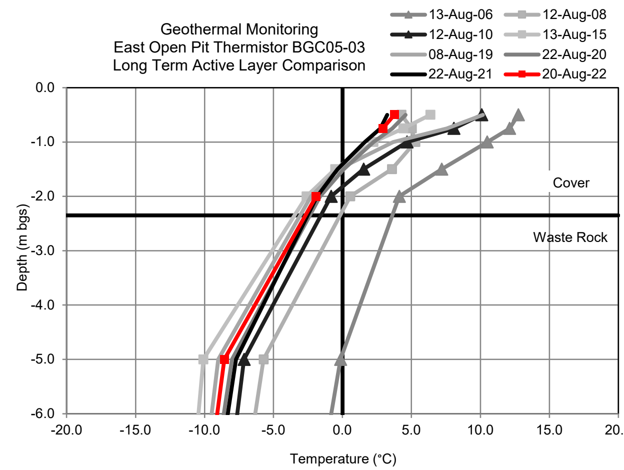
BGC ENGINEERING INC.











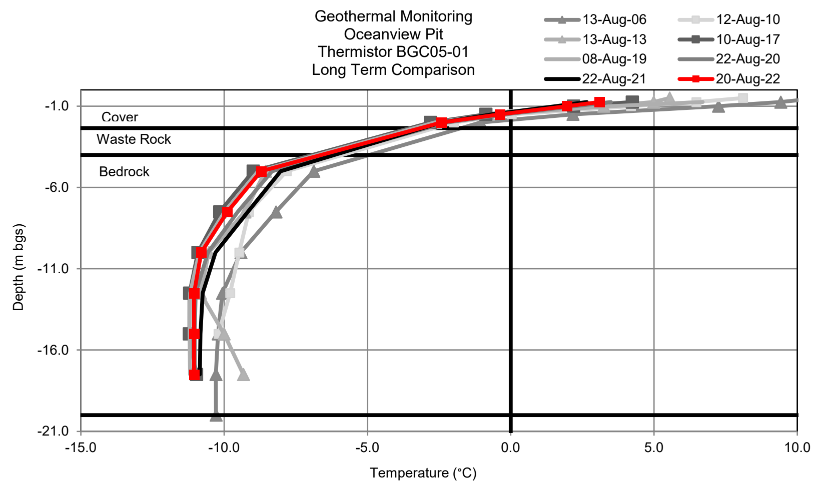
NOTES

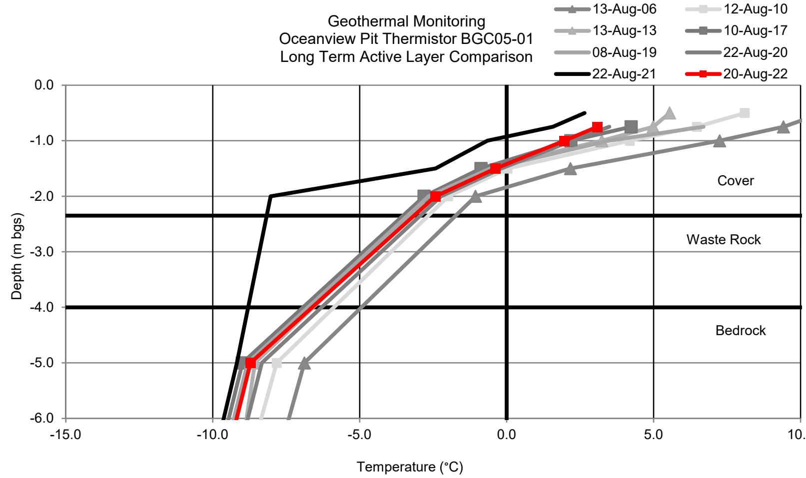
1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection" and dated February 2023.

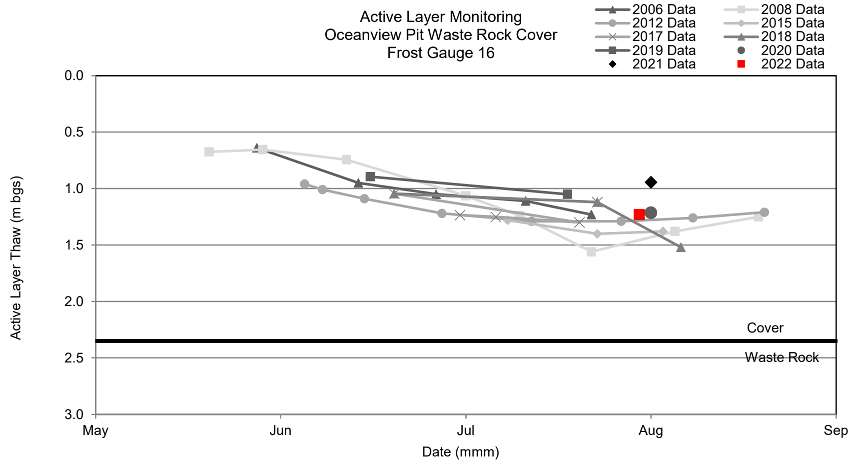
PREPARED BY: JS	FIGURE TITLE: East Open Pit Waste Rock Cover Geotechnical Monitoring Data		
CHECKED BY: GKC	CLIENT: CanZinco Mines Ltd.		
APPROVED BY: SDG	SCALE:	PROJECT NO: 0255-033	FIGURE NO: 18

0 5 10 mm in ANSI B sized paper

02-2023







NOTES
1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection" and dated February 2023.

PREPARED BY: JS	FIGURE TITLE: Oceanview Pit Waste Rock Cover Geotechnical Monitoring Data		
CHECKED BY: GKC	CLIENT: CanZinco Mines Ltd.		
APPROVED BY: SDG	SCALE:	PROJECT NO: 0255-033	FIGURE NO: 19

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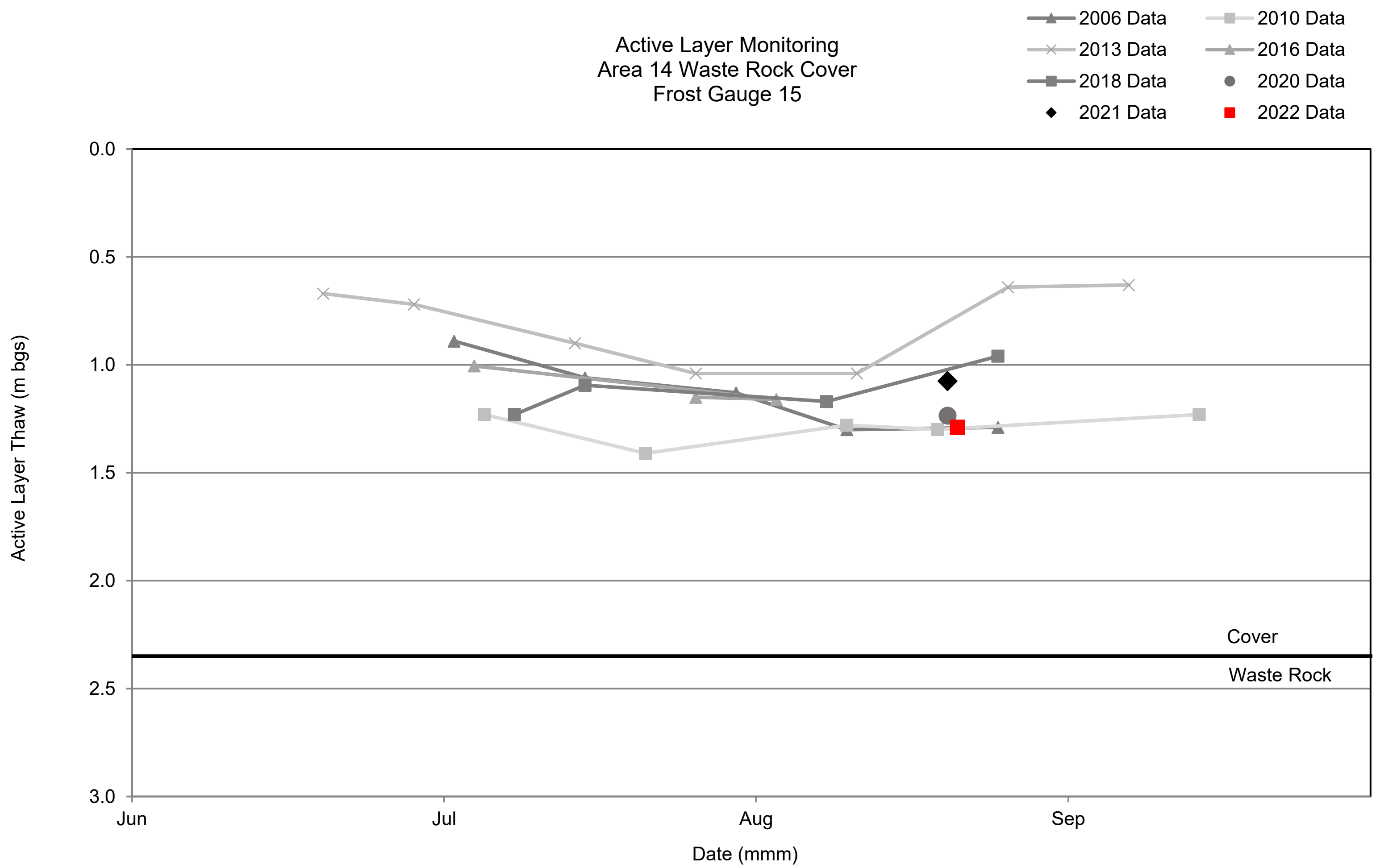

NOTES
1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection", dated February 2023.

PREPARED BY: JS	FIGURE TITLE: Area 14 Waste Rock Cover Monitoring Data			
CHECKED BY: GKC	CLIENT: CanZinco Mines Ltd.			
APPROVED BY: SDG	SCALE:	PROJECT NO: 0255-034	FIGURE NO: 20	

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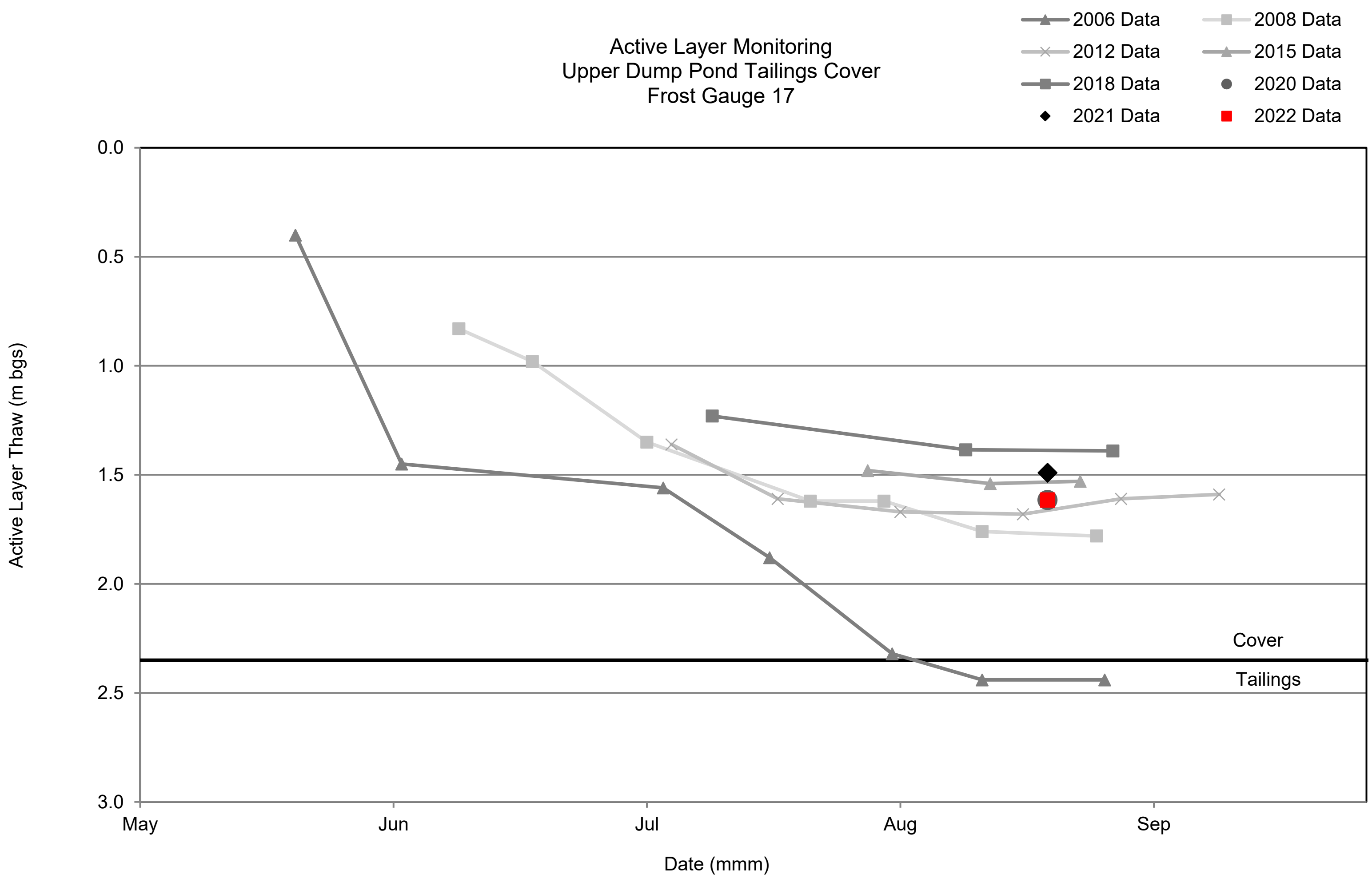
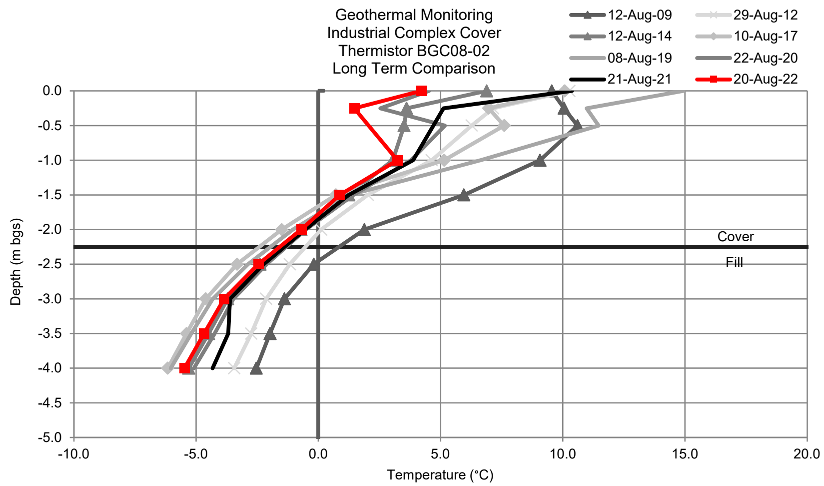
BGC ENGINEERING INC.

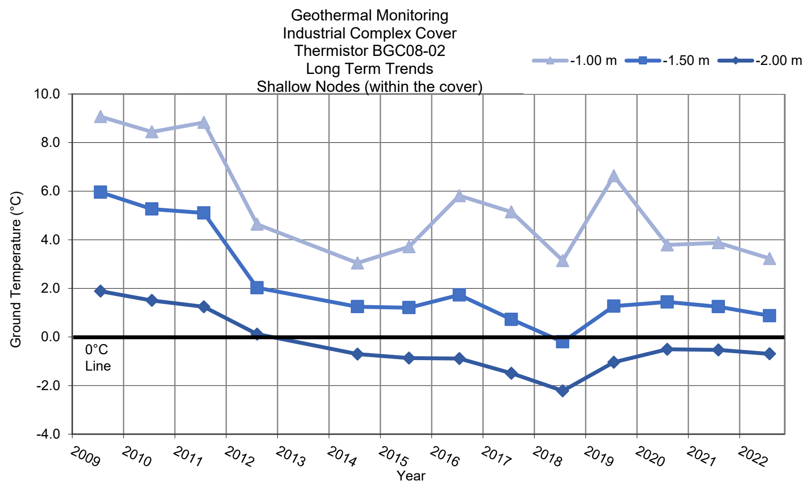


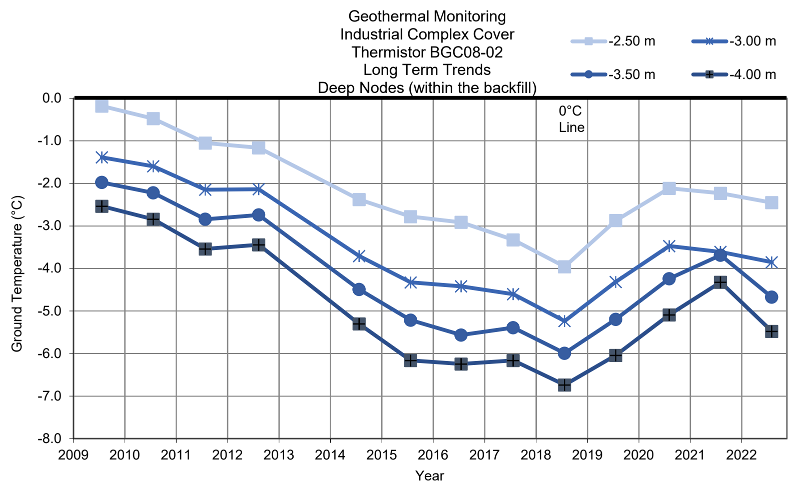
NOTES
1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection", dated February 2023.

PREPARED BY:	FIGURE TITLE:		
JS	Upper Dump Pond Tailing Cover Monitoring Data		
CHECKED BY: GKC	CLIENT: CanZinco Mines Ltd.		
APPROVED BY: SDG	SCALE:	PROJECT NO: 0255-034	FIGURE NO: 21

0 5 10 mm in ANSI A sized paper







NOTES
1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine 2022 Annual Geotechnical Inspection" and dated February 2023.

PREPARED BY: JS	FIGURE TITLE: Industrial Complex Cover Geotechnical Monitoring Data		
CHECKED BY: GKC	CLIENT: CanZinco Mines Ltd.		
APPROVED BY: SDG	SCALE:	PROJECT NO: 0255-033	FIGURE NO: 22

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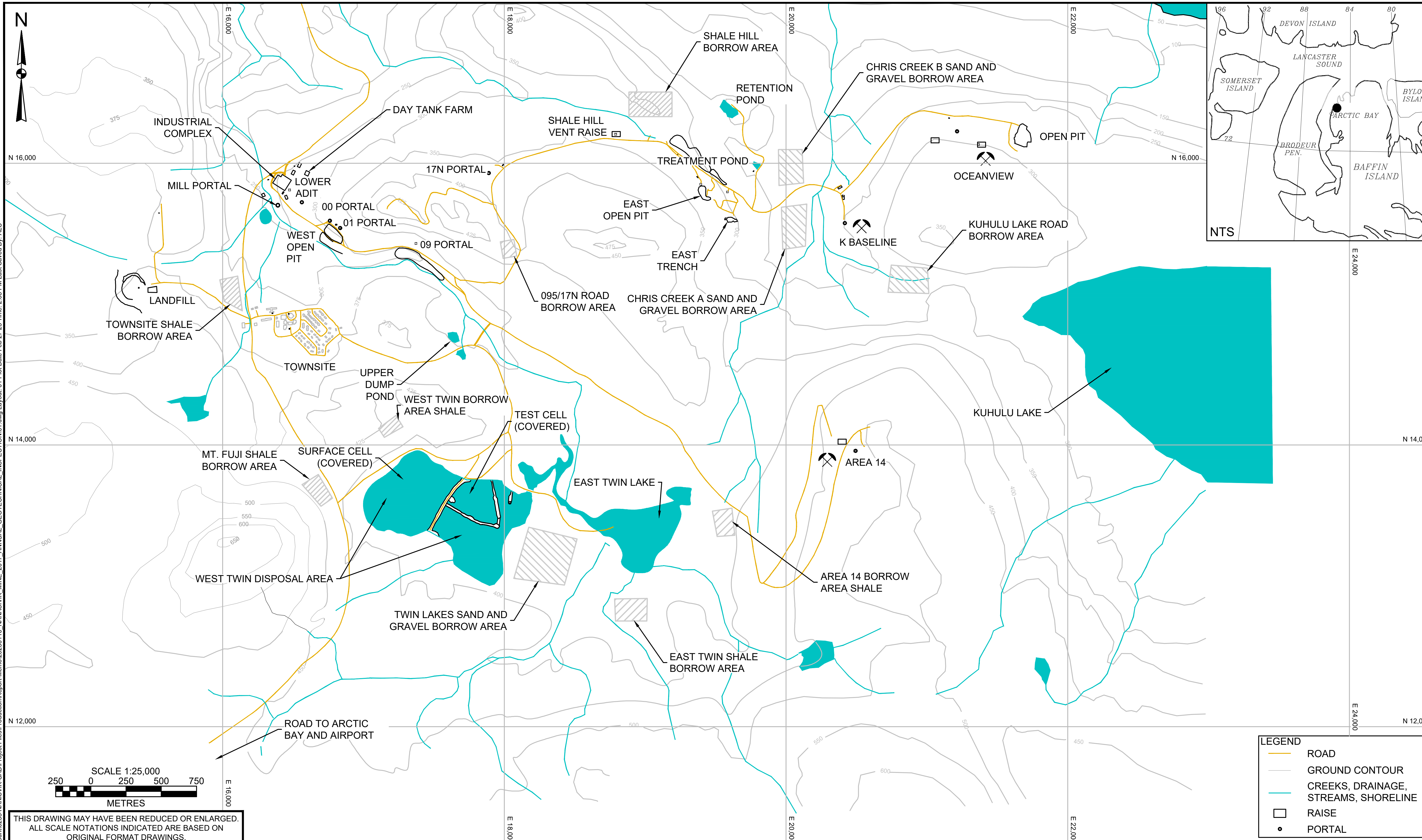
DRAWINGS



NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. THIS DRAWING MUST BE READ IN CONJUNCTION WITH BGC'S REPORT TITLED "NANISIVIK MINE 2022 ANNUAL GEOTECHNICAL INSPECTION" AND DATED FEBRUARY 2023.
3. CONTOUR LINES PROVIDED BY NANISIVIK MINE. FILE TITLED " NEW WTDA DRAWING.dwg", DATED OCTOBER 09, 2002. CONTOUR INTERVAL IS 50 m.
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REVIEW:	GKC
APPROVED:	SDG

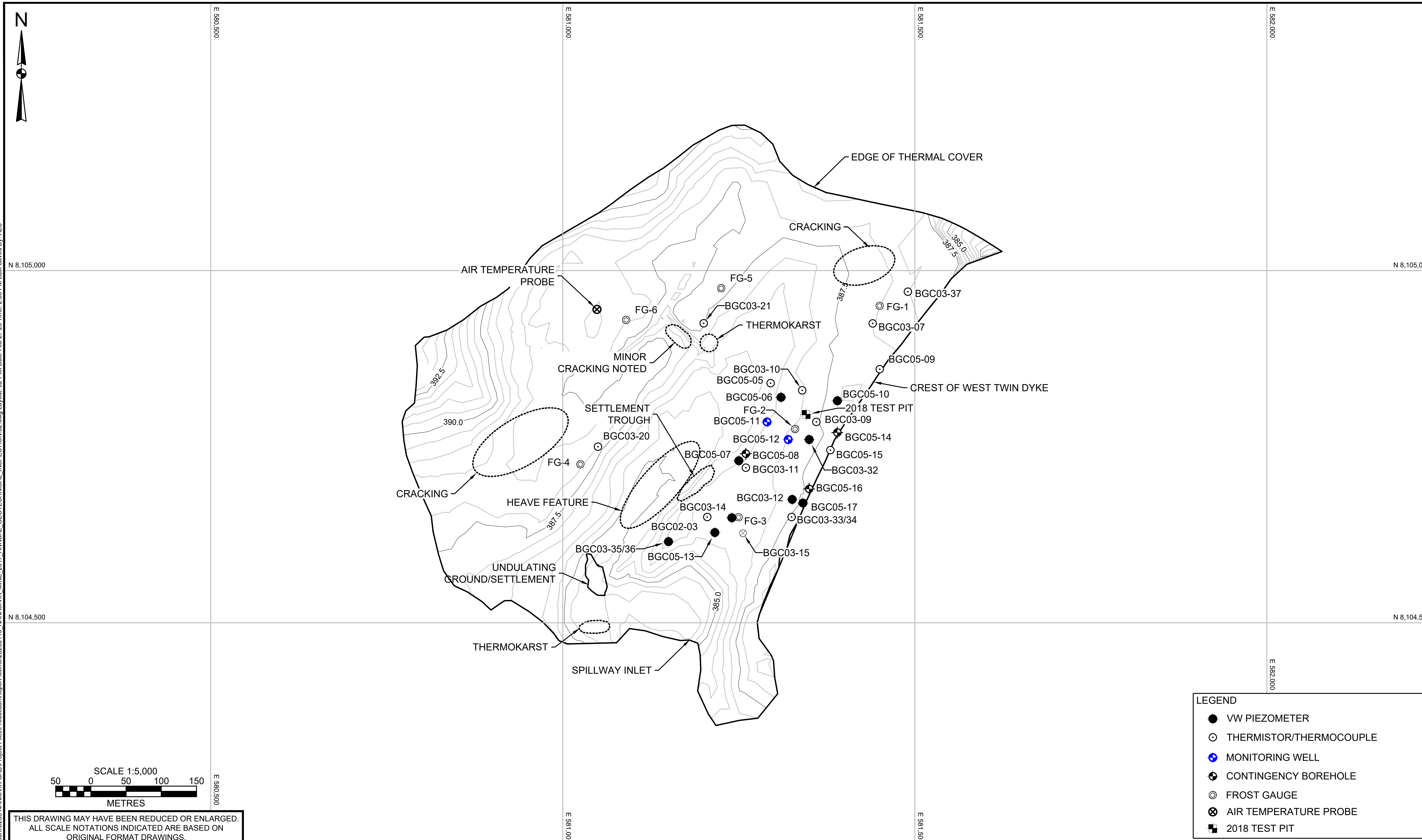
CLIENT: CANZINCO

PROJECT: NANISIVIK MINE 2022 ANNUAL GEOTECHNICAL INSPECTION

TITLE: SITE LOCATION PLAN

PROJECT No.: 0255034

DWG No.: 01



THIS DRAWING MAY HAVE BEEN REDUCED OR ENLARGED. ALL SCALE NOTATIONS INDICATED ARE BASED ON ORIGINAL FORMAT DRAWINGS.

NOTES:
1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. THIS DRAWING MUST BE READ IN CONJUNCTION WITH BGC'S REPORT TITLED "NANISIVIK MINE 2022 ANNUAL GEOTECHNICAL INSPECTION" AND DATED FEBRUARY 2023.
3. AS-BUILT SURVEY DATA PROVIDED BY ATCON CONSTRUCTION INC. DRAWING FILES ABAU24M1, ABAU25M1, AND ABAU26M1. SURVEYS CONDUCTED AUGUST 24 TO 26, 2005. DATA RECEIVED OCTOBER 06, 2005. CONTOUR INTERVAL IS 0.5 m.
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REVIEW:	GKC
APPROVED:	SDG

CLIENT: CANZINCO

BGC

PROJECT: NANISIVIK MINE 2022 ANNUAL GEOTECHNICAL INSPECTION

TITLE: SURFACE CELL TAILINGS COVER

PROJECT No.: 0255034

DWG No.: 02

NOTES:
1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. THIS DRAWING MUST BE READ IN CONJUNCTION WITH BGC'S REPORT TITLED "NANISIVIK MINE 2022 ANNUAL GEOTECHNICAL INSPECTION" AND DATED FEBRUARY 2023.
3. AS-BUILT SURVEY DATA PROVIDED BY ATCON CONSTRUCTION INC. DRAWING FILES ABAU09M2, ABAU17M2, ABSE16D1, ABSE17D1, ABSE18D1, ABSE18D2, ABSE19D1, ABSE20D1, ABSE20D2, AND ABSE20D3. SURVEYS CONDUCTED AUGUST 09 TO SEPTEMBER 20, 2005. DATA RECEIVED OCTOBER 06, 2005. CONTOUR INTERVAL IS 1.0 m.
4. PROJECTION IS NAD83, UTM ZONE 16N.
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SCALE: 1:2,500	CLIENT: CANZINCO	PROJECT: NANISIVIK MINE 2022 ANNUAL GEOTECHNICAL INSPECTION	
DATE: FEB 2023		TITLE: TEST CELL TAILINGS COVER	
DRAWN: AL	BGC		
REVIEW: GKC		PROJECT No.: 0255034	DWG No.: 03
APPROVED: SDG			

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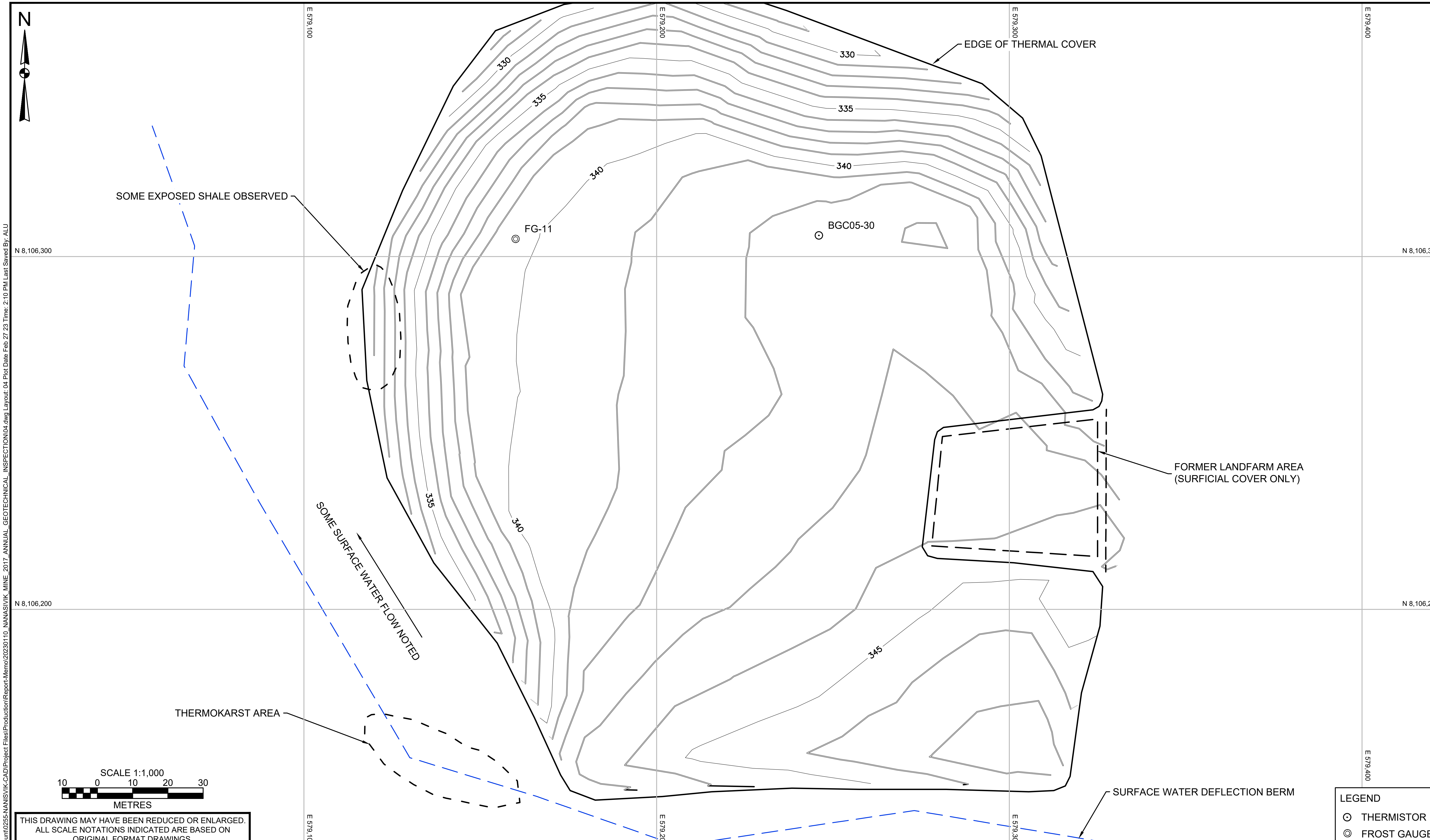

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NOTES:
1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. THIS DRAWING MUST BE READ IN CONJUNCTION WITH BGC'S REPORT TITLED "NANISIVIK MINE 2022 ANNUAL GEOTECHNICAL INSPECTION", AND DATED FEBRUARY 2023.
3. AS-BUILT SURVEY DATA PROVIDED BY ATCON CONSTRUCTION INC. DRAWING FILE ABSE07D1. SURVEY CONDUCTED SEPTEMBER 07, 2005. DATA RECEIVED OCTOBER 06, 2005. CONTOUR INTERVAL IS 1.0 m.
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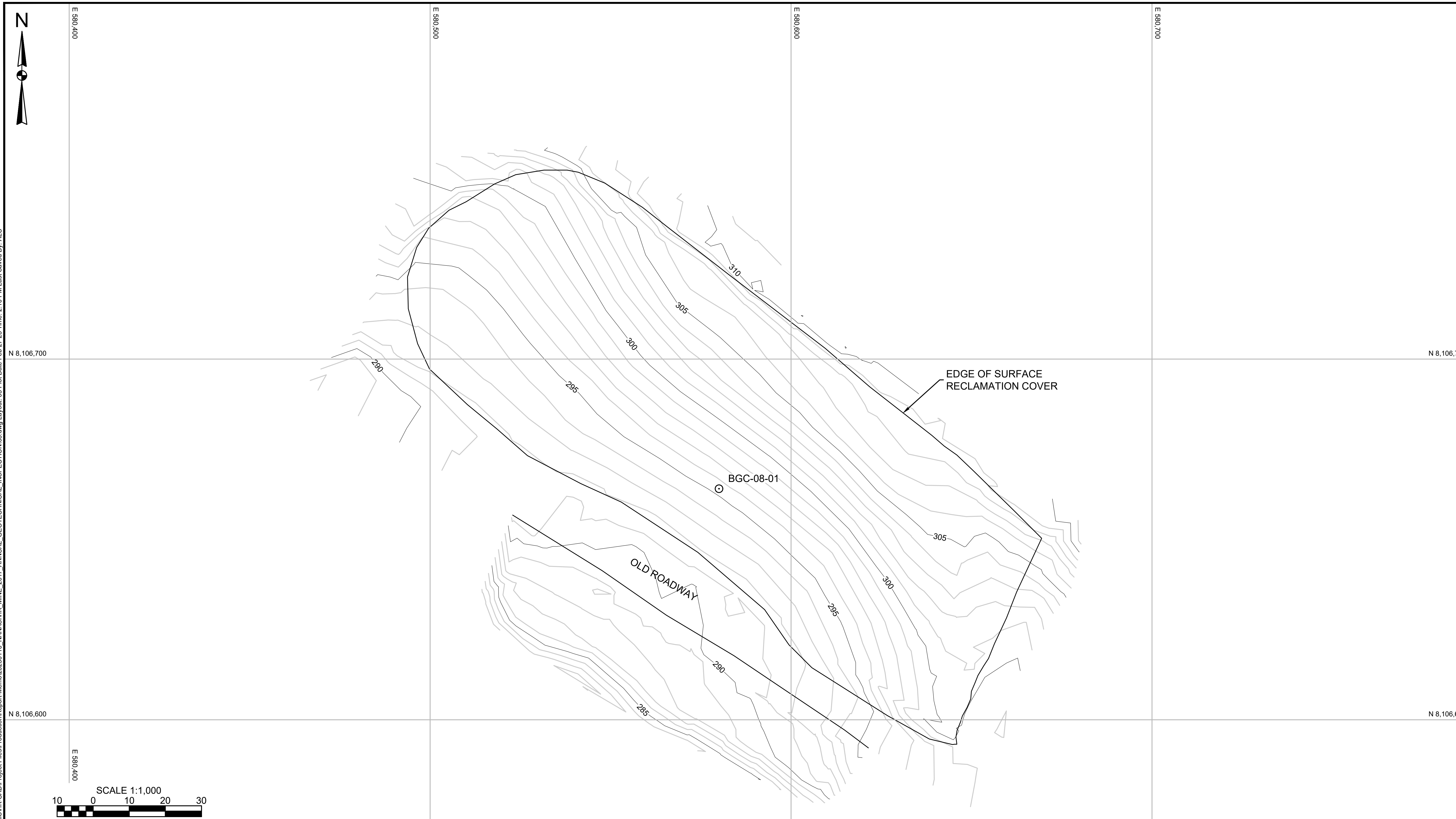
SCALE:	1:1,000
DATE:	FEB 2023
DRAWN:	AL
REVIEW:	GKC
APPROVED:	SDG
CLIENT:	CANZINCO
PROJECT:	NANISIVIK MINE 2022 ANNUAL GEOTECHNICAL INSPECTION
TITLE:	LANDFILL COVER
PROJECT No.:	0255034
DWG No.:	04



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CLIENT: CANZINCO

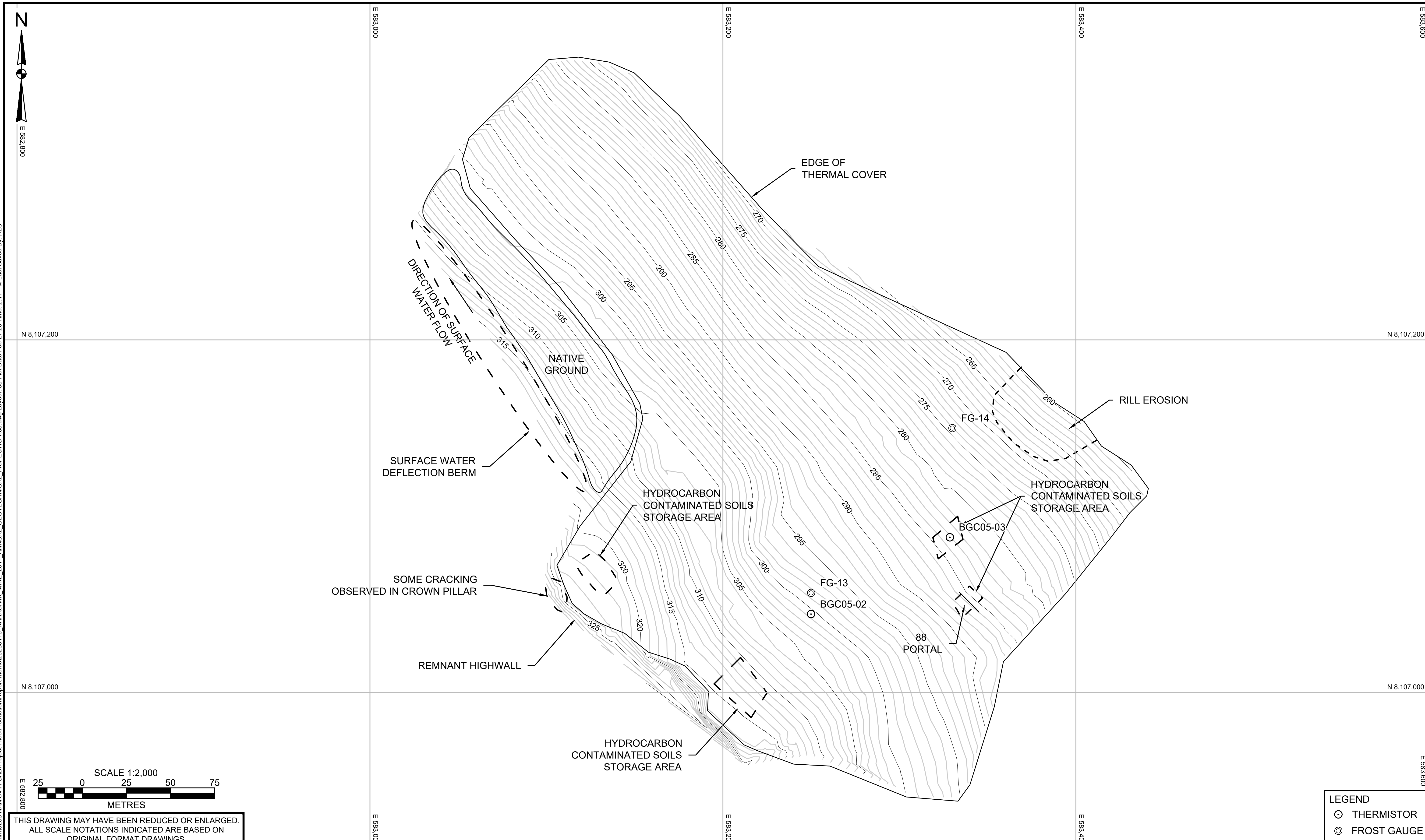
BGC

PROJECT: NANISIVIK MINE 2022 ANNUAL GEOTECHNICAL INSPECTION

TITLE: WEST OPEN PIT WASTE ROCK COVER

PROJECT No.: 0255034

DWG No.: 05



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CLIENT: CANZINCO

BGC

PROJECT: NANISIVIK MINE 2022 ANNUAL GEOTECHNICAL INSPECTION

TITLE: EAST OPEN PIT WASTE ROCK COVER

PROJECT No.: 0255034

DWG No.: 06

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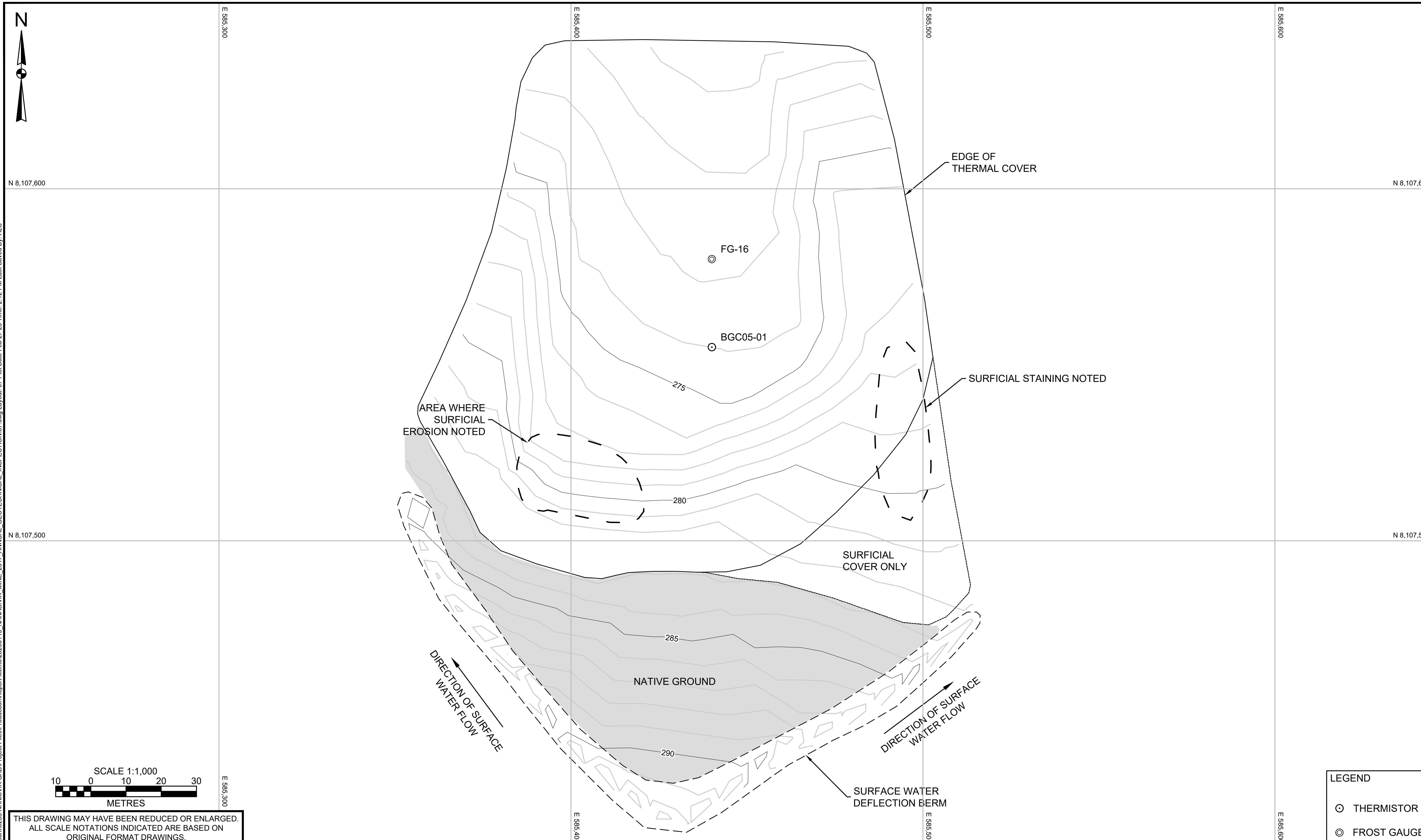

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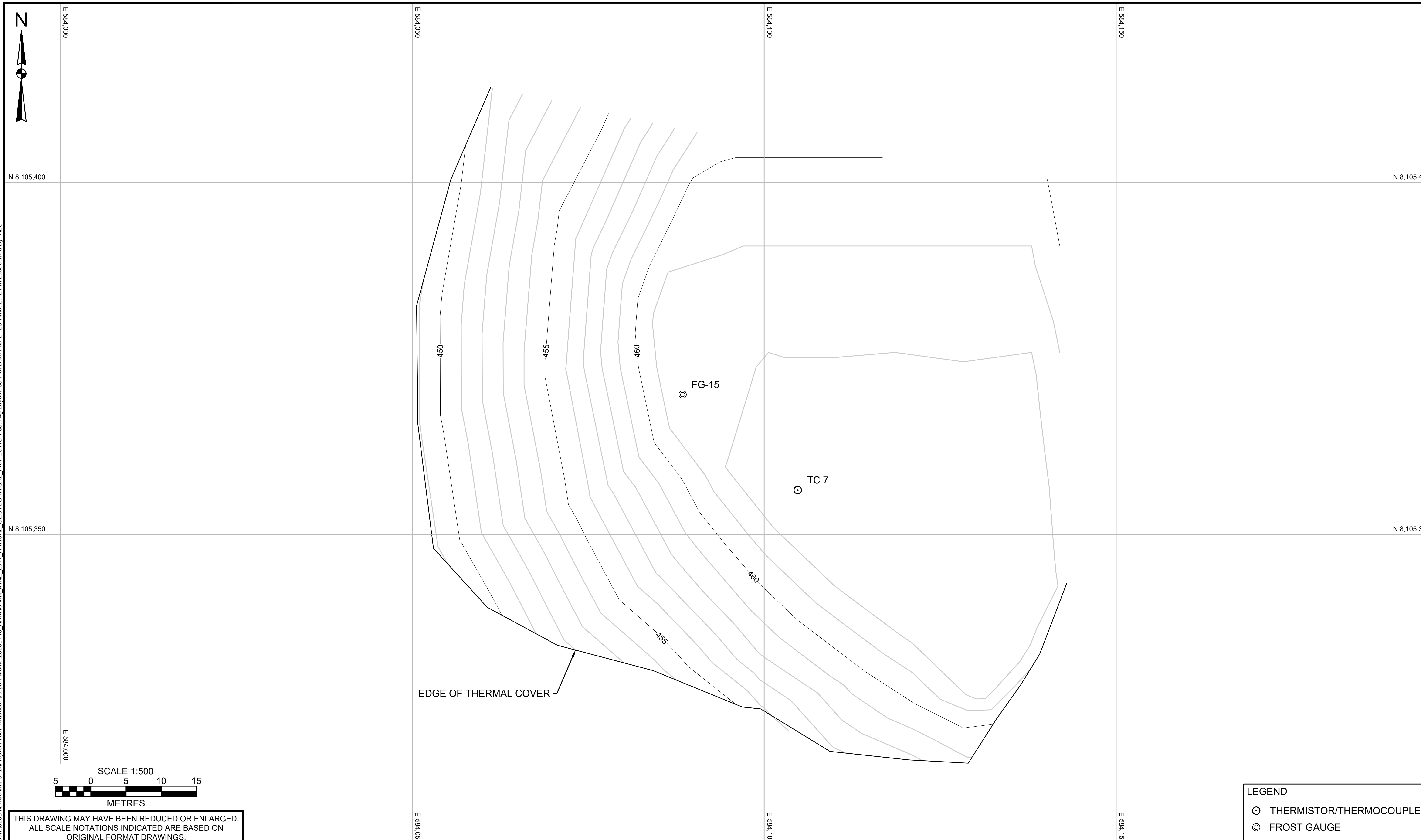
CLIENT:	CANZINCO
PROJECT:	NANISIVIK MINE 2022 ANNUAL GEOTECHNICAL INSPECTION
TITLE:	OCEANVIEW OPEN PIT WASTE ROCK COVER
PROJECT No.:	0255034
DWG No.:	07



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REVIEW:	GKC
APPROVED:	SDG

CLIENT: CANZINCO

PROJECT: NANISIVIK MINE 2022 ANNUAL GEOTECHNICAL INSPECTION

TITLE: AREA 14 WASTE ROCK COVER

PROJECT No.: 0255034

DWG No.: 08

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REVIEW:	GKC
APPROVED:	SDG

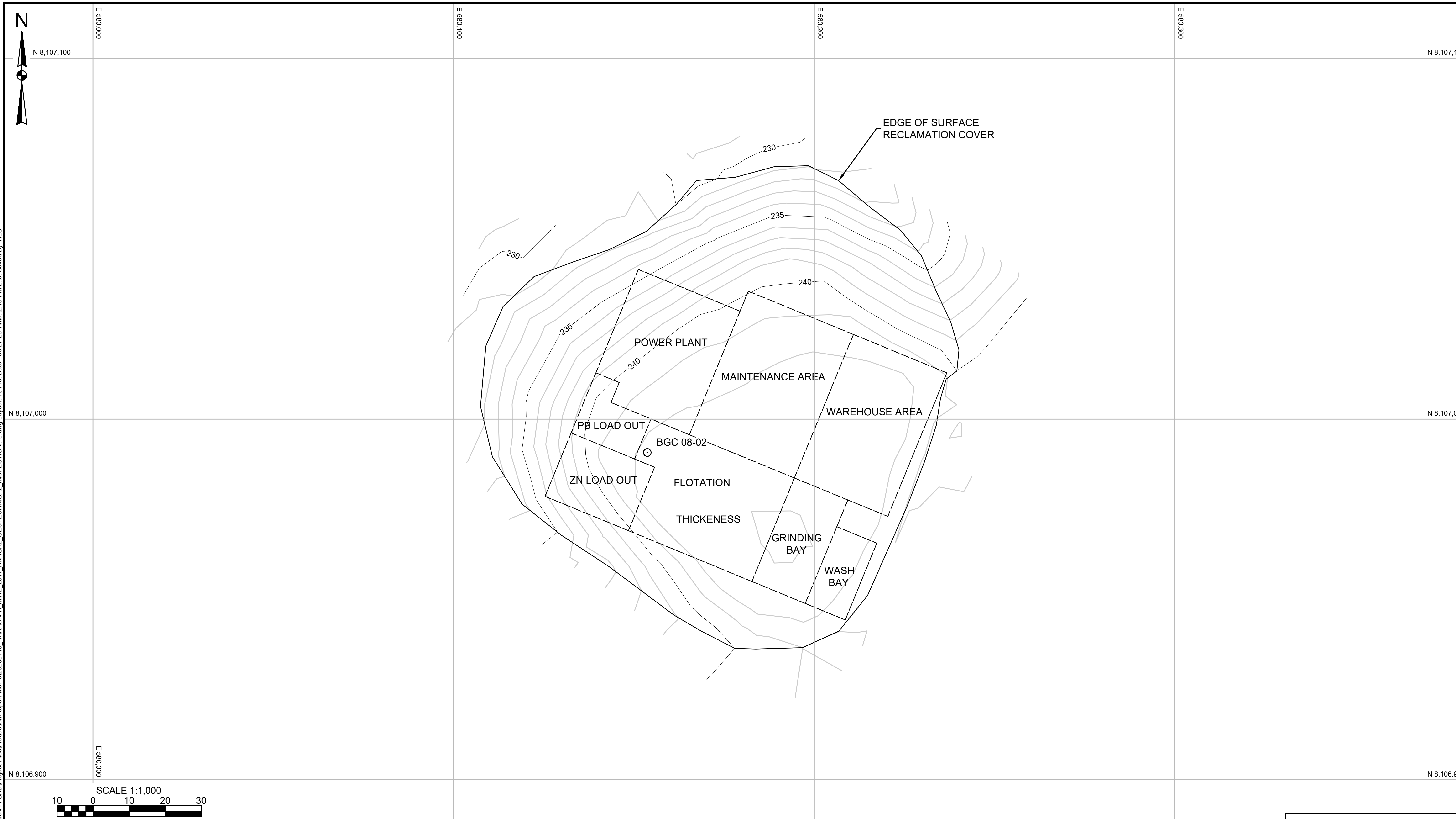
CLIENT: CANZINCO

PROJECT: NANISIVIK MINE 2022 ANNUAL GEOTECHNICAL INSPECTION

TITLE: UPPER DUMP POND TAILINGS COVER

PROJECT No.: 0255034

DWG No.: 09



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PROJECT: NANISIVIK MINE 2022 ANNUAL GEOTECHNICAL INSPECTION

TITLE: INDUSTRIAL COMPLEX COVER

PROJECT No.: 0255034

DWG No.: 10

APPENDIX I
2020-2029 GEOTECHNICAL MONITORING PROGRAM SCHEDULE

Instrument Name	Instrument Type	Status of Instrument	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
West Twin Dyke												
TC12	Thermocouple	Not functioning										
TC13A	Thermocouple	Not functioning										
TC31	Thermocouple	Not functioning										
TC32	Thermocouple	Not functioning										
TC33	Thermocouple	Not functioning										
BGC03-33	Thermistor		■	■	■		■		■			■
BGC03-34	Thermistor		■	■	■		■		■			■
BGC05-09	Thermistor		■	■	■		■		■			■
BGC05-15	Thermistor		■	■	■		■		■			■
BGC05-17	VW Piezo.		■	■	■		■		■			■
Surface Cell												
BGC02-03	Thermistor	Not functioning										
BGC03-07	Thermistor		■	■	■		■		■			■
BGC03-09	Thermistor		■	■	■		■		■			■
BGC03-10	Thermistor		■	■	■		■		■			■
BGC03-11	Thermistor											
BGC03-12	Vibrating Wire		■	■	■		■		■			■
BGC03-14	Vibrating Wire		■	■	■		■		■			■
BGC03-15	Thermistor		■	■	■		■		■			■
BGC03-20	Thermistor		■	■	■		■		■			■
BGC03-21	Thermistor	Not functioning										
BGC03-32	Vibrating Wire		■	■	■		■		■			■
BGC03-35	Vibrating Wire		■	■	■		■		■			■
BGC03-36	Thermocouple	Not functioning	■	■	■		■		■			■
BGC03-37	Thermistor	Not functioning										
BGC05-05	Thermistor		■	■	■		■		■			■
BGC05-06	VW Piezo.		■	■	■		■		■			■
BGC05-07	VW Piezo.		■	■	■		■		■			■
BGC05-08	Contingency											
BGC05-10	VW Piezo.		■	■	■		■		■			■
BGC05-11	Monitoring Well	Not functioning										
BGC05-12	Monitoring Well	Not functioning										
BGC05-13	VW Piezo.	Partially functioning	■	■	■		■		■			■
BGC05-14	Contingency											
BGC05-16	Contingency											
FG-1	Frost Gauge		■	■	■		■		■			■
FG-2	Frost Gauge		■	■	■		■		■			■
FG-3	Frost Gauge		■	■	■		■		■			■
FG-4	Frost Gauge		■	■	■		■		■			■
FG-5	Frost Gauge		■	■	■		■		■			■
FG-6	Frost Gauge		■	■	■		■		■			■

■ Instruments to be read

Instrument Name	Instrument Type	Status of Instrument	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Toe of West Twin Dyke												
BGC03-18	Thermocouple	Not functioning										
BGC03-19	Thermistor		■	■	■		■		■			■
BGC05-26	Thermistor		■	■	■		■		■			■
Test Cell												
BGC05-04	Thermistor		■	■	■		■		■			■
BGC05-18	VW Piezo.		■	■	■		■		■			■
BGC05-19	Thermistor		■	■	■		■		■			■
BGC05-20	VW Piezo.		■	■	■		■		■			■
BGC05-21	Monitoring Well	Not functioning										
BGC05-22	VW Piezo.		■	■	■		■		■			■
BGC05-23	Monitoring Well	Not functioning										
BGC05-24	VW Piezo.		■	■	■		■		■			■
BGC05-25	Contingency											
FG-7	Frost Gauge		■	■	■		■		■			■
FG-8	Frost Gauge		■	■	■		■		■			■
Test Cell Dyke												
BGC02-09	Thermistor	Not functioning										
BGC03-22	Thermistor		■	■	■		■		■			■
BGC05-29	Thermistor		■	■	■		■		■			■
Toe of Test Cell Dyke												
BGC05-27	Thermistor		■	■	■		■		■			■
BGC05-28	VW Piezo.		■	■	■		■		■			■
FG-9	Frost Gauge	Not functioning										
FG-10	Frost Gauge		■	■	■		■		■			■
Oceanview Pit												
BGC05-01	Thermistor		■	■	■		■		■			■
FG-16	Frost Gauge		■	■	■		■		■			■
East Open Pit												
BGC05-02	Thermistor		■	■	■		■		■			■
BGC05-03	Thermistor		■	■	■		■		■			■
FG-13	Frost Gauge		■	■	■		■		■			■
FG-14	Frost Gauge	Not functioning										
Landfill												
BGC05-30	Thermistor		■	■	■		■		■			■
FG-11	Frost Gauge		■	■	■		■		■			■
Area 14												
TC7	Thermocouple	Not functioning										
FG-15	Frost Gauge											
Upper Dump Road												
FG-17	Frost Gauge		■	■	■		■		■			■
West Open Pit												
BGC08-01	Thermistor		■	■	■		■		■			■
Mill Cover												
BGC08-02	Thermistor		■	■	■		■		■			■
Water Quality / Levels												
159-4	Water Level		■	■	■		■		■			■
159-4	Water Quality		■	■	■		■		■			■
Spillway Inlet	Water Quality		■	■	■		■		■			■

■ Instruments to be read

APPENDIX II
INSPECTION PHOTOS

LIST OF APPENDIX II INSPECTION PHOTOS

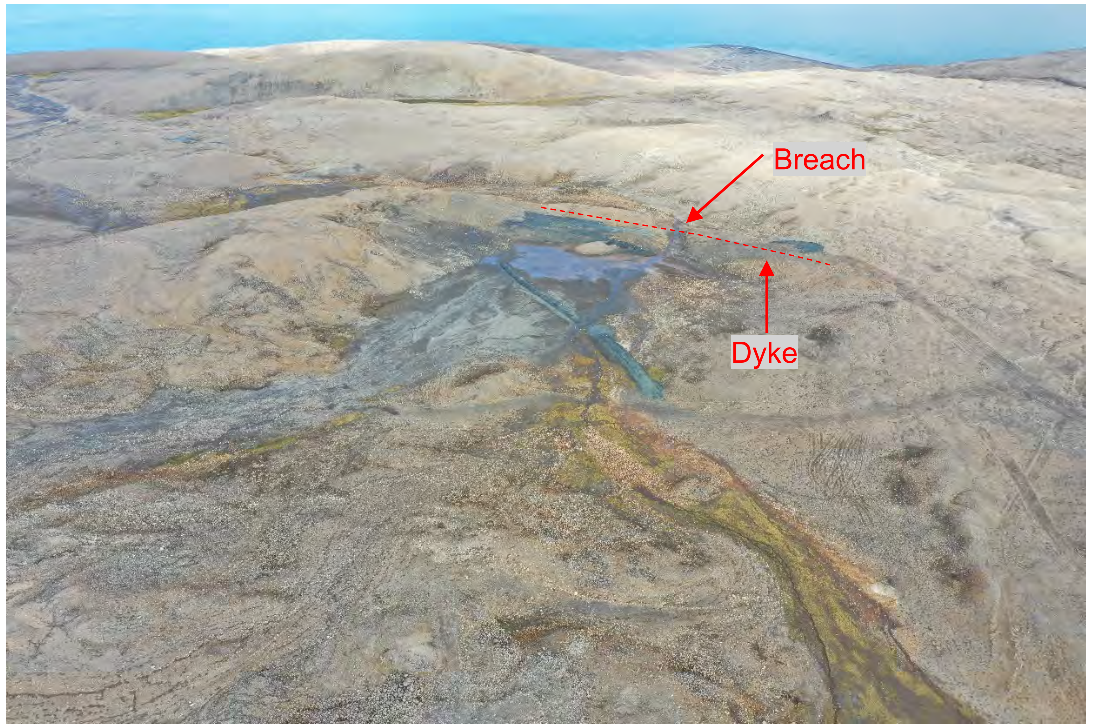

Photo 1. East Adit Treatment Facility - Retention Pond as seen from UAV.

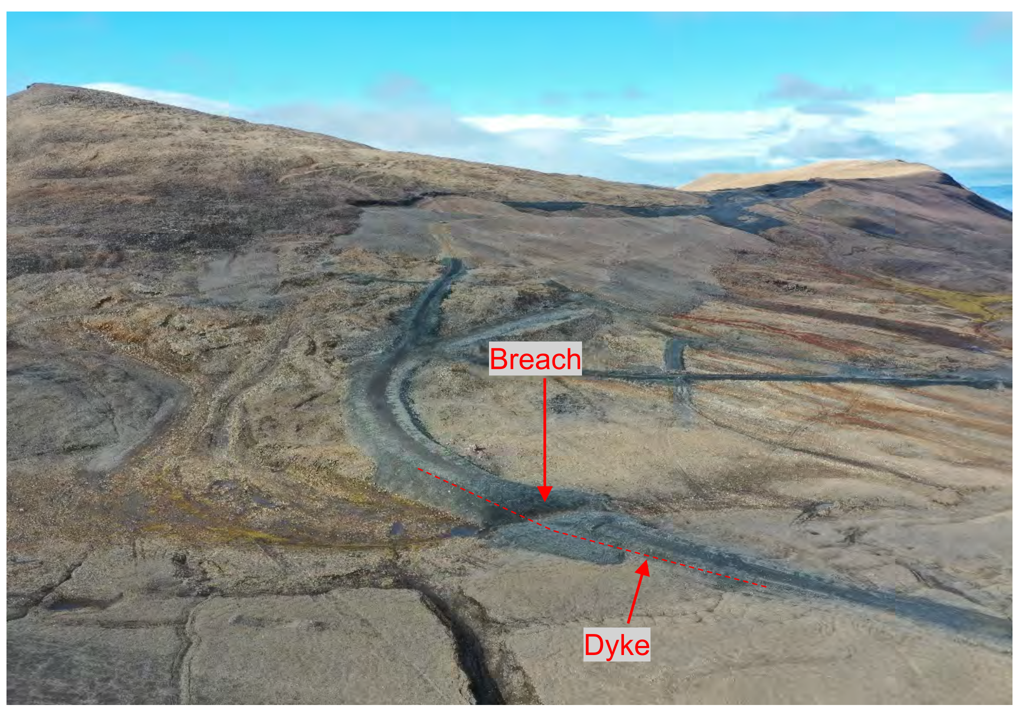

Photo 2. East Adit Treatment Facility - Breach in treatment pond as seen from UAV.

Photo 3. West Twin Dyke Spillway – Small headpond at spillway inlet as seen from UAV.

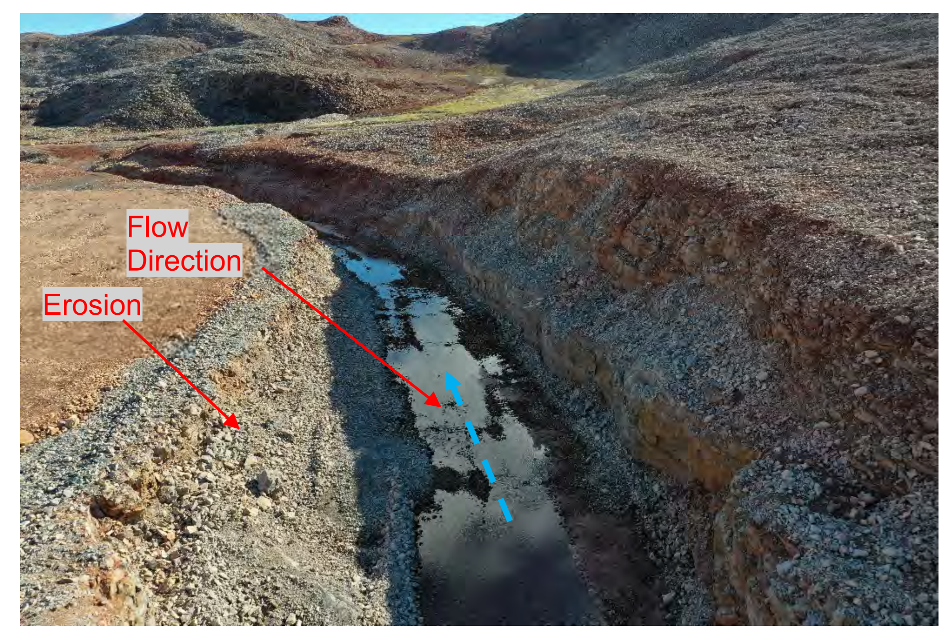

Photo 4. West Twin Dyke Spillway – Upper spillway, looking upstream from UAV. Note minor left bank erosion.

Photo 5. West Twin Dyke Spillway – Secondary area of 2018 left bank maintenance, approximately 100 metres downstream of the access ramp.

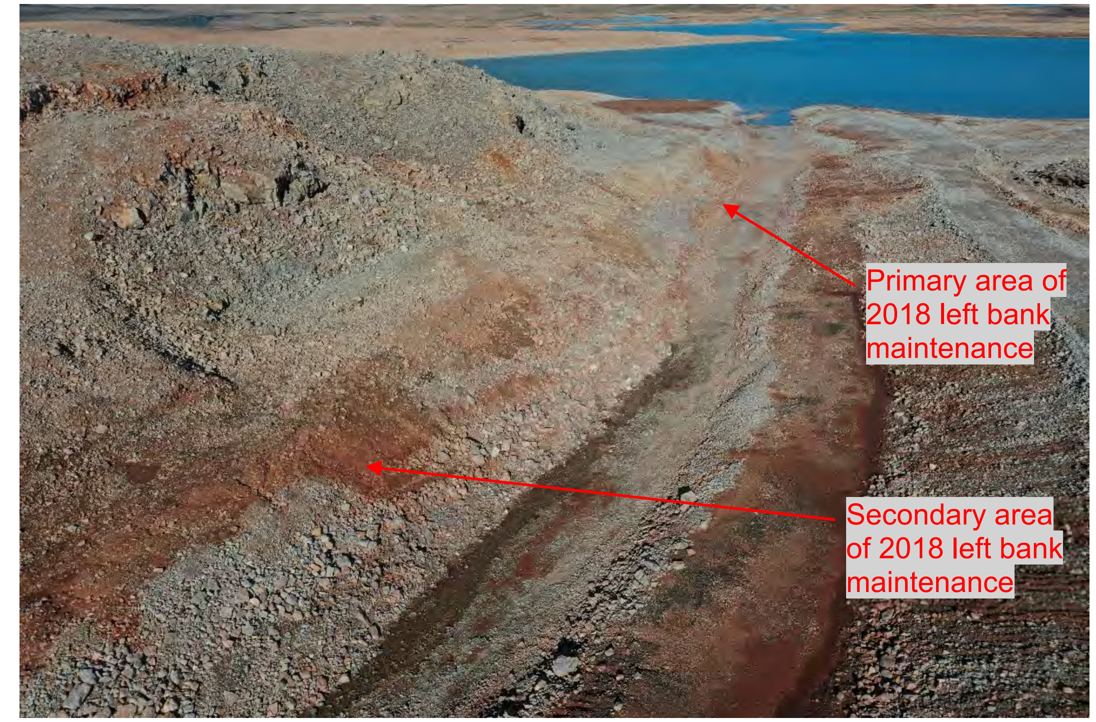

Photo 7. West Twin Dyke Spillway – UAV overview of left bank erosion downstream of the spillway access ramp.

Photo 6. West Twin Dyke Spillway – Primary area of 2018 left bank maintenance.

Photo 8. West Twin Dyke Spillway – Looking downstream at spillway outlet where 2018 maintenance was performed.

Photo 9. West Twin Outlet Wall – Overhead photo as seen from UAV.

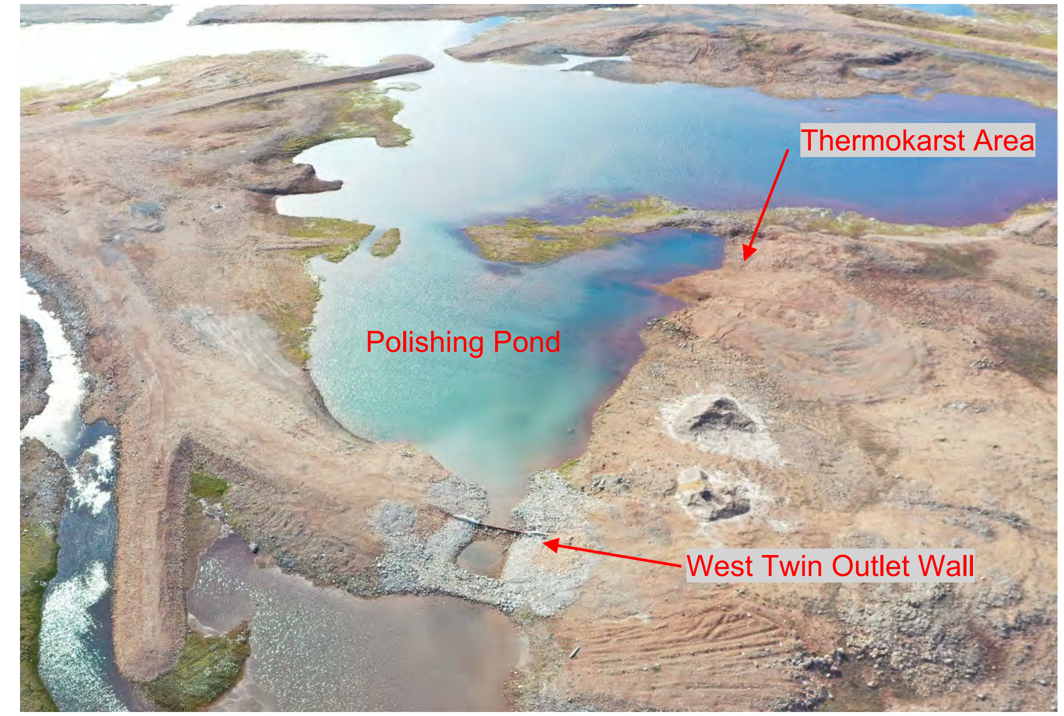

Photo 11. West Twin Outlet Wall – Overview, as seen from UAV.

Photo 10. West Twin Outlet Wall – As seen from right bank.

Photo 12. Polishing Pond – Thermokarsting around Polishing Pond, looking south.

Photo 13. Polishing Pond – Thermokarst cracking along the north side of the Polishing Pond.

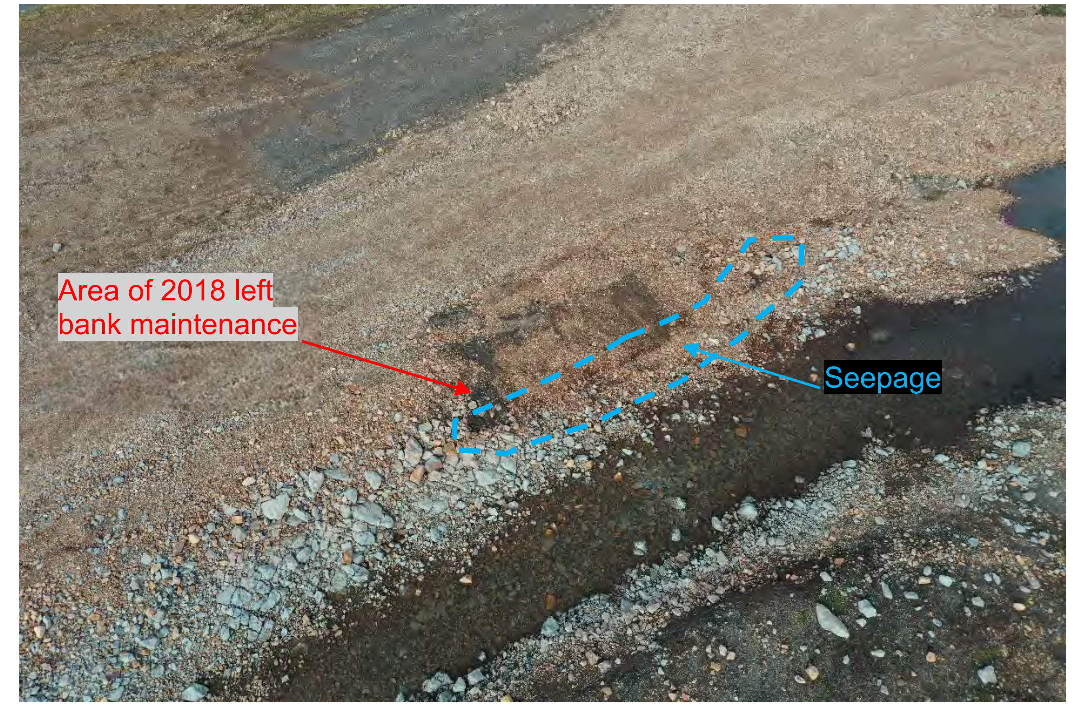

Photo 15. East Twin Creek Diversion – Area where 2018 left bank maintenance was performed, as seen from UAV.

Photo 14. East Twin Creek Diversion – Overview, looking downstream from UAV. Note minor erosion near upper right.

Photo 16. East Twin Creek Diversion – Looking downstream at area where 2018 left bank maintenance was performed.

Photo 17. Surface Cell Cover System – Minor thermokarsting along main N-S drainage swale.

Photo 18. Surface Cell Cover System – Minor thermokarsting along main E-W drainage swale.

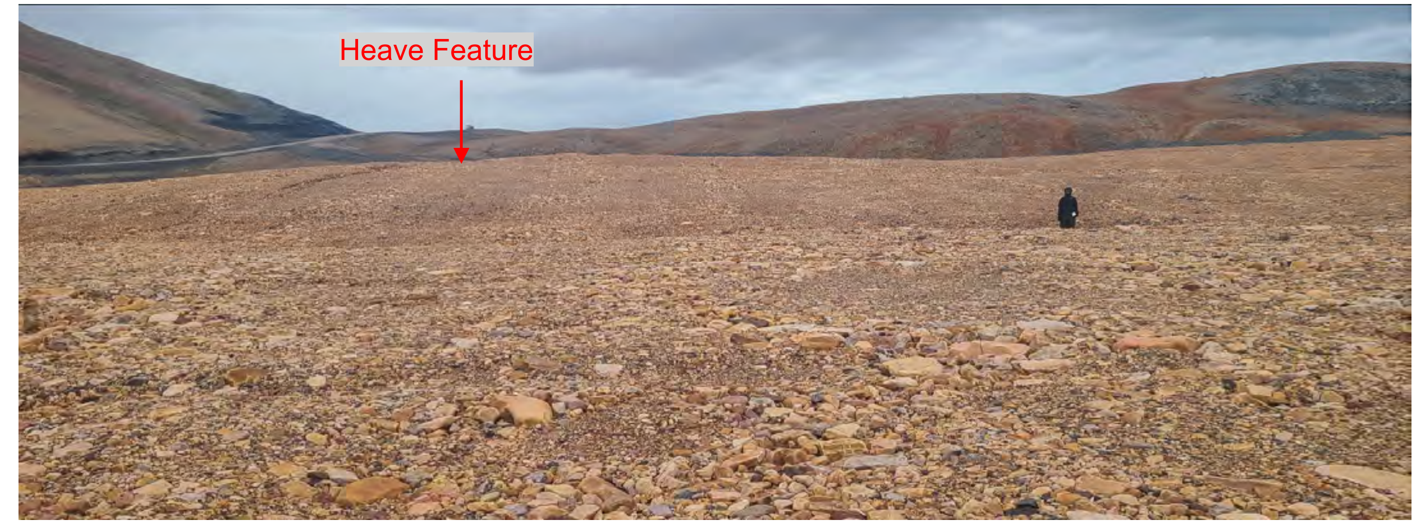

Photo 19. Surface Cell Cover System – Heave feature adjacent main N-S drainage swale.

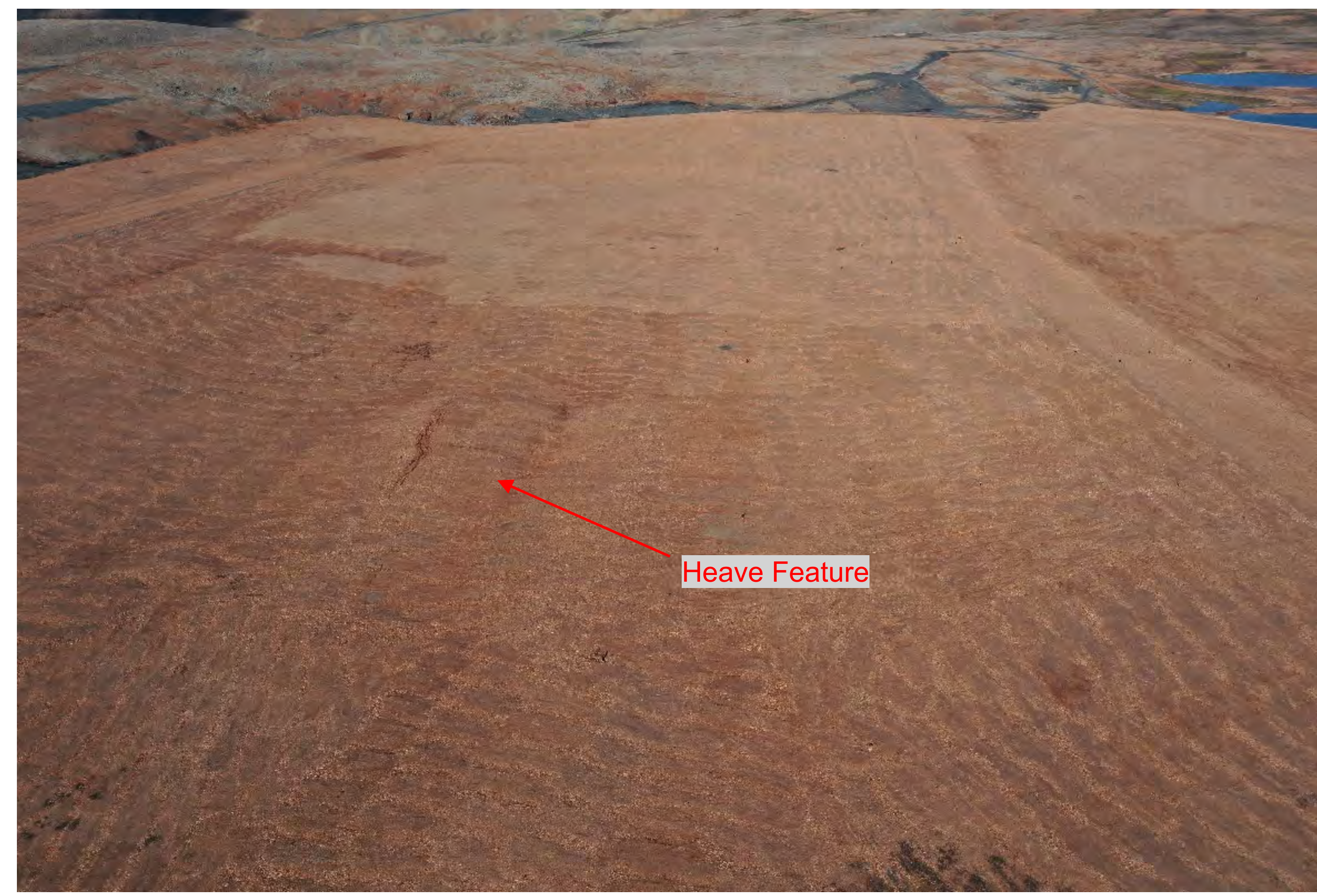

Photo 20. Surface Cell Cover System – Overview from UAV, looking Northeast. Note heave feature.

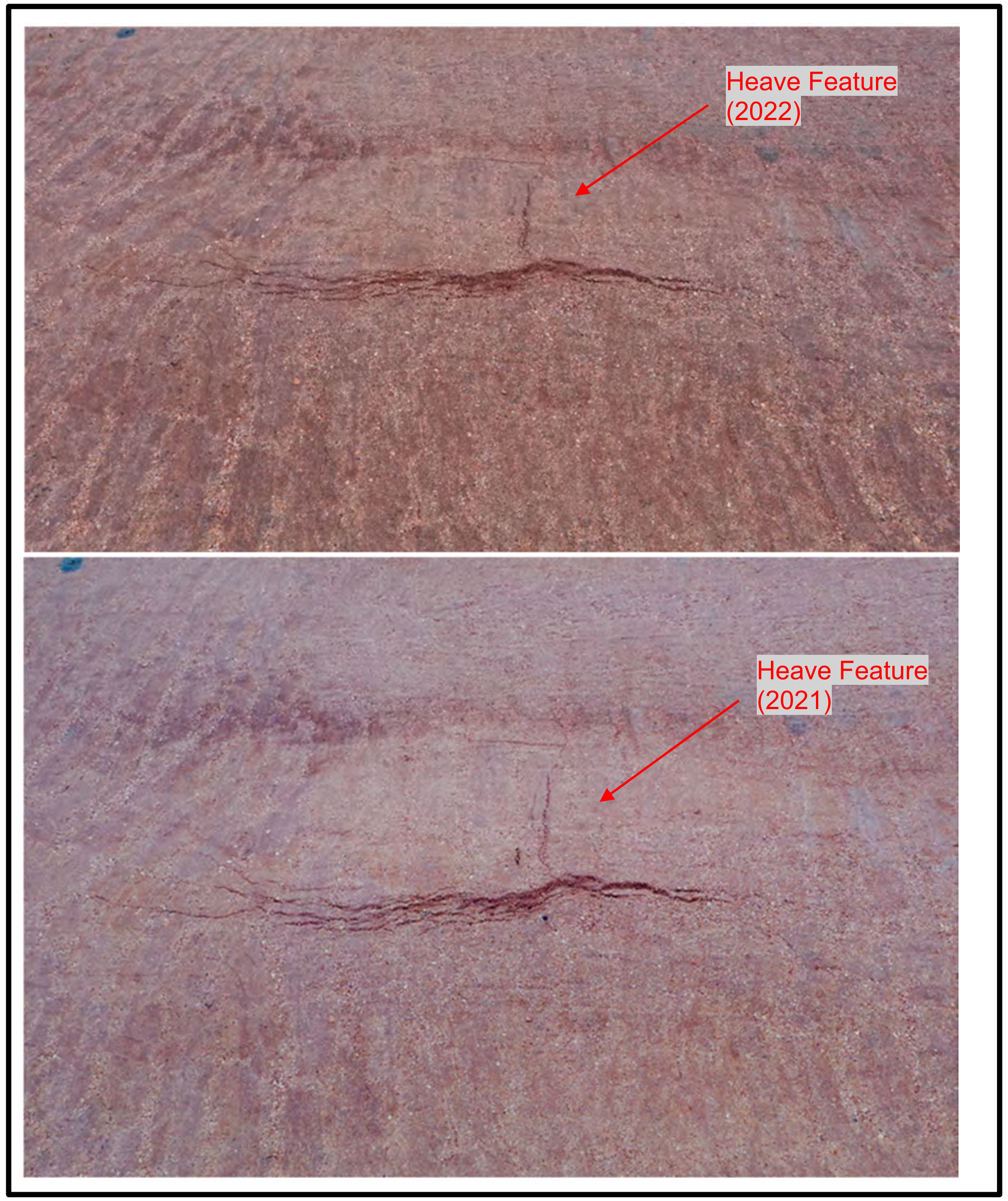

Photo 21. **Surface Cell Cover System – Heave feature in 2022 (above) and 2021 (below), looking northeast.**

Photo 22. **Surface Cell Cover System – Maximum crack width at the crest of the heave feature (2.8 m wide, 0.6 m deep).**

Photo 23. **Surface Cell Cover System – Exposed shale within the cracking at the crest of the heave feature (0.3 m in thickness).**

Photo 24. West Twin Dyke – Thermistor datalogger installed at instrument BGC05-15, prior to weatherproofing.

Photo 25. West Twin Dyke – Thermistor datalogger installed at instrument BGC05-15, after weatherproofing.

Photo 26. West Twin Dyke – Looking northeast from instrument BGC03-33, showing the smooth dyke face.

Photo 27. West Twin Dyke - UAV photo of right abutment (southwestern abutment).

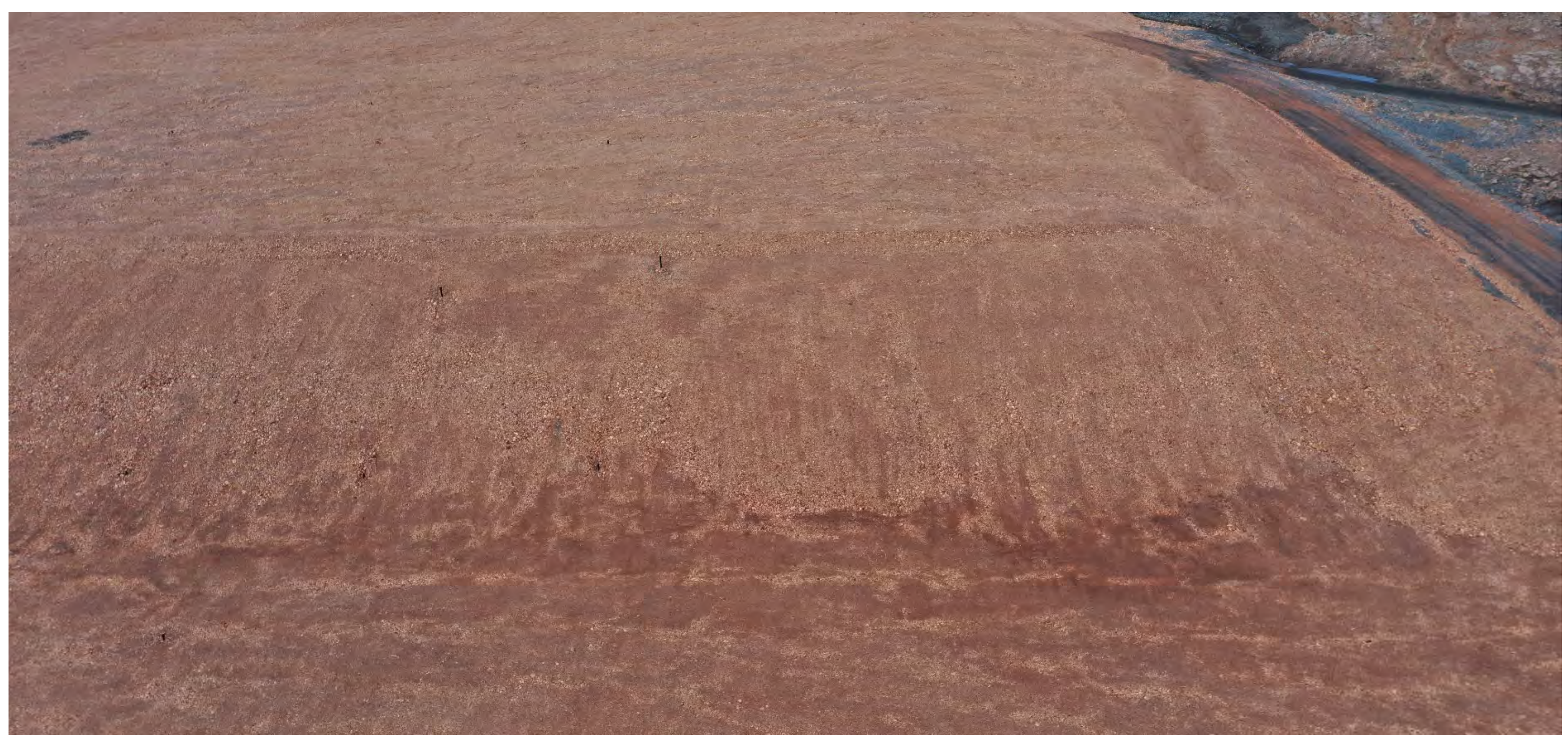

Photo 28. West Twin Dyke – UAV photo of left abutment (northeastern abutment).

Photo 29. Test Cell Cover System – Overview of cover system as seen from UAV.

Photo 30. Test Cell Cover System – Minor settlement trough along N/S arm of Test Cell Dyke.

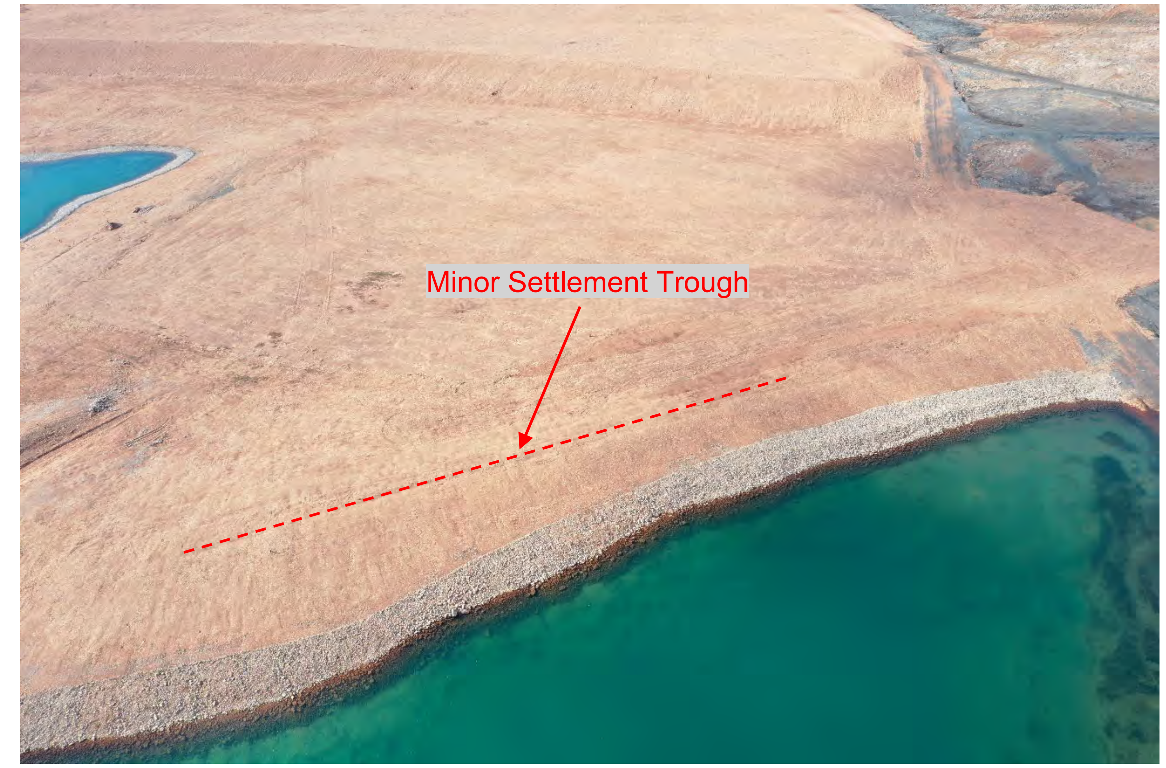

Photo 31. Test Cell Cover System – N/S arm of Test Cell Dyke, as seen from UAV. Note minor settlement trough.

Photo 32. Test Cell Cover System – Flat surface of cover system, looking North from instrument BGC05-29.

Photo 33. Test Cell Cover System – Low lying area at the toe of the left abutment of the West Twin Dyke.

Photo 34. Test Cell Cover System – Breach in Test Cell Dyke as seen from UAV.

Photo 35. Test Cell Cover System – Toe of the test cell dyke.

Photo 36. Test Cell Cover System – Erosion protection along the toe of the Test Cell Dyke, view looking East.

Photo 37. Test Cell Cover System – Thermistor datalogger placed inside protective casing at instrument BGC05-04.

Photo 38. Test Cell Cover System – Thermistor datalogger installed at instrument BGC05-04.

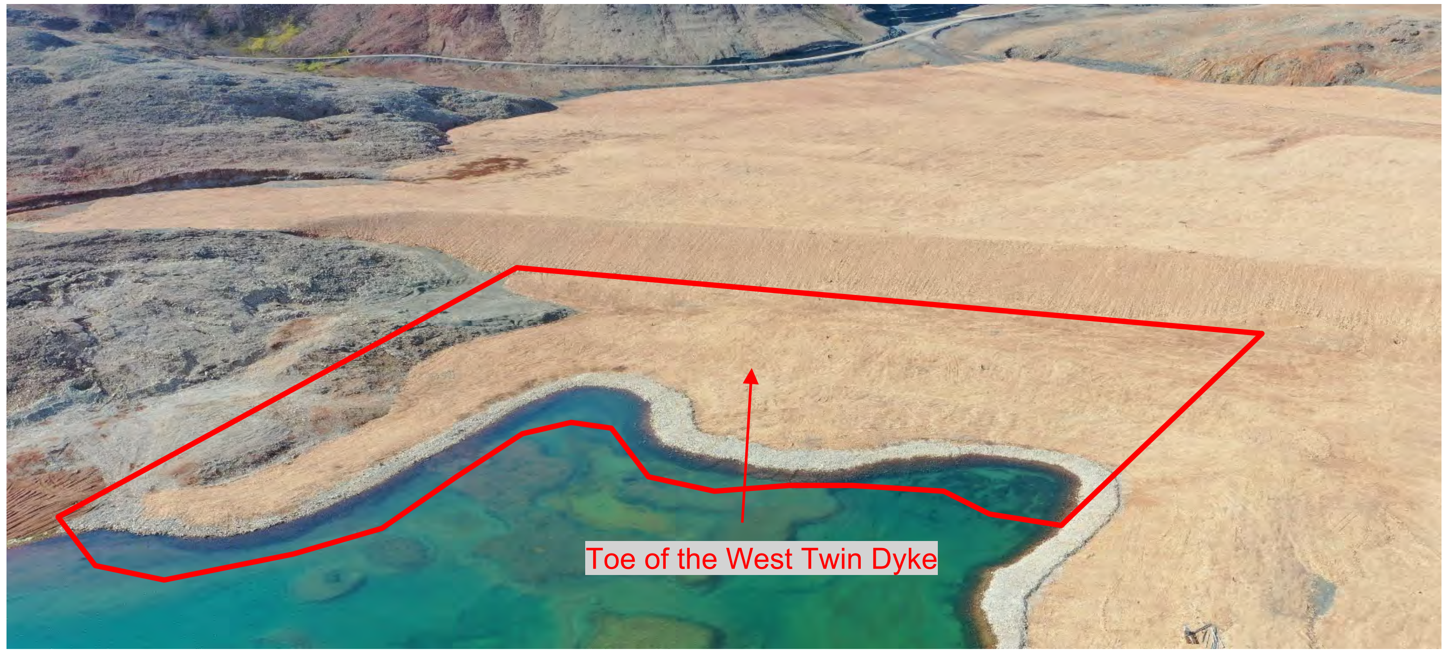

Photo 39. Toe of West Twin Dyke Tailings Cover – Overview as seen from UAV.

Photo 41. Toe of West Twin Dyke Tailings Cover – Note minor thermokarsting, looking North.

Photo 40. Toe of West Twin Dyke Tailings Cover – Note minor thermokarsting, looking south.

Photo 42. Landfill – Flat surface of cover system. View looking north.

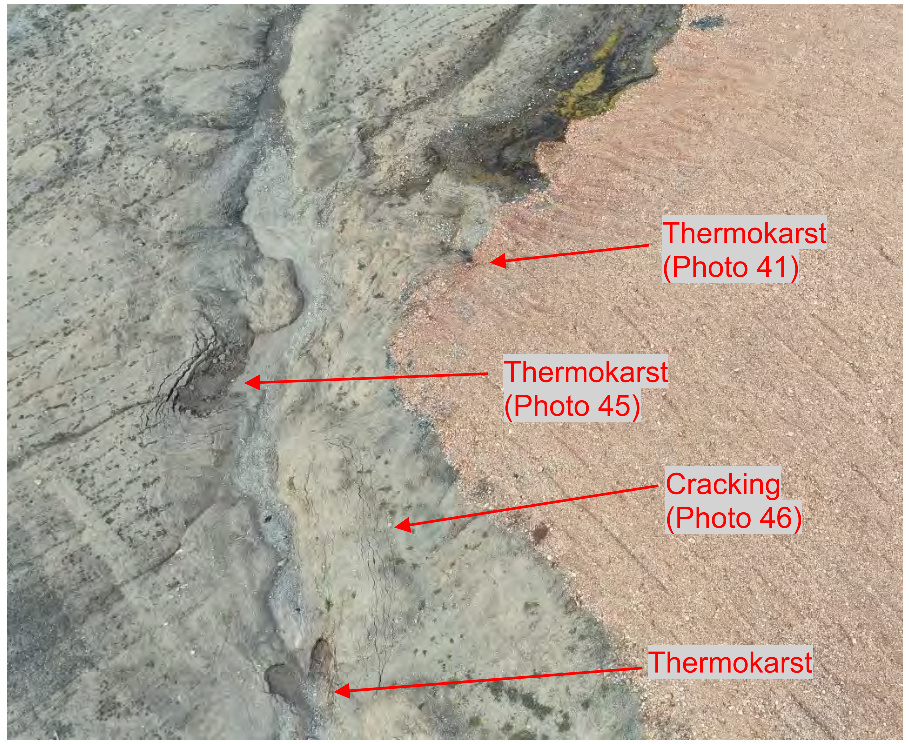

Photo 43. Landfill – Thermokarst area near the southwest corner of the landfill. View from UAV.

Photo 45. Landfill – Thermokarst along the diversion berm upslope of the landfill.

Photo 44. Landfill – Thermokarst encroaching on the southwest corner of the cover system. View looking north.

Photo 46. Landfill – Thermokarst cracking encroaching on the southwest corner of the cover system.

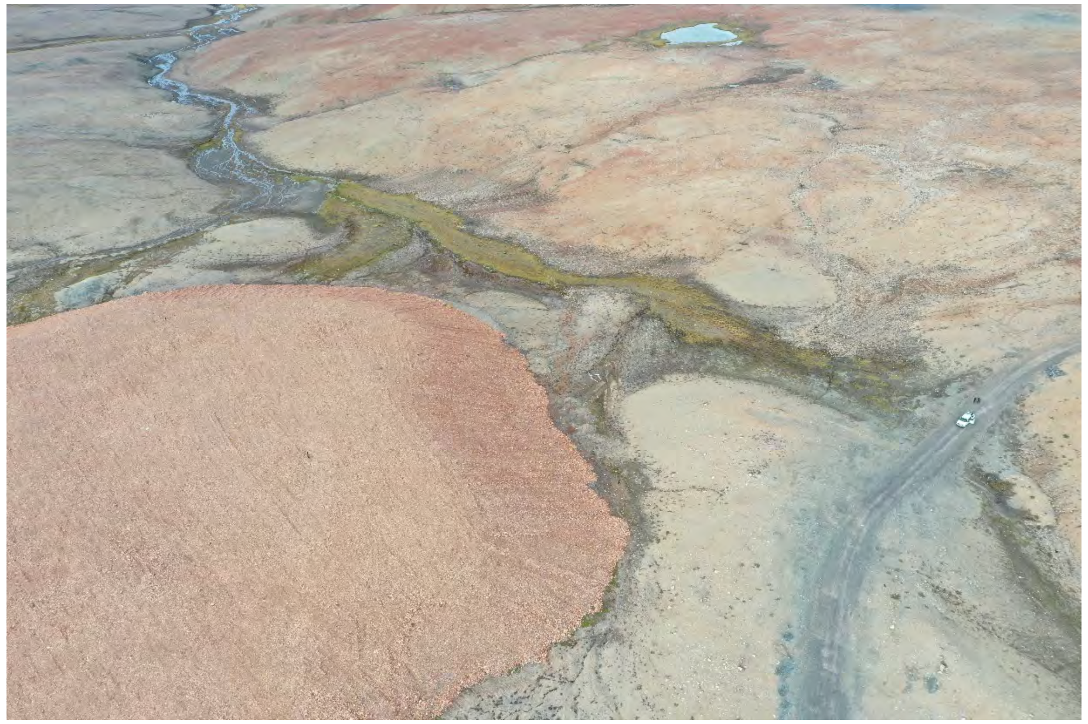

Photo 47. Landfill – Northern toe of cover system as seen from UAV.

Photo 49. West Open Pit – Tension cracking and deformation adjacent to the east of the edge of the West Open Pit cover system.

Photo 48. West Open Pit – Crack behind remnant highwall.

Photo 50. West Open Pit – Surface of cover system looking downslope (south).

Photo 51. West Open Pit – Surface of cover system looking upslope (north).

Photo 52. East Open Pit - Looking downslope at rilling on upper portion of cover. Note self-armouring.

Photo 53. East Open Pit - Cracking in crown pillar, as seen from UAV.

Photo 54. East Open Pit – Cracking in crown pillar.

Photo 55. East Open Pit – Overview of eastern portion of the cover system, as seen from UAV.

Photo 56. East Open Pit – Overview of western portion of the cover system, as seen from UAV.

Photo 57. East Trench – Overview as seen from UAV.

Photo 58. Oceanview Pit – Rilling on the south end of the cover system. Note self-armouring.

Photo 59. Oceanview Pit – Minor seepage flowing onto the cover system from upslope, as seen from the ground.

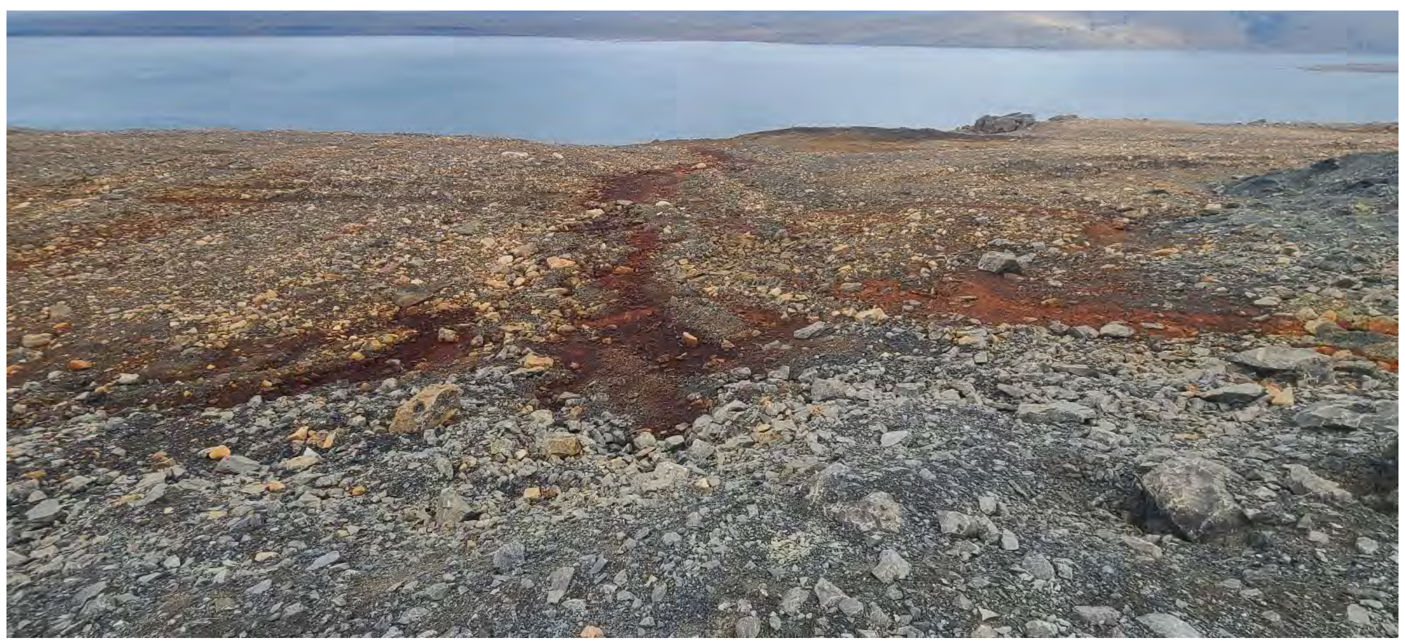

Photo 60. Oceanview Pit – Staining at toe of cover. No seepage was observed during the inspection.

Photo 61. Oceanview Pit – Overview of cover system.

Photo 62. Area 14 - Overview of flat surface of cover.

Photo 63. Upper Dump Pond – Flat surface of thermal cover system.

Photo 64. Upper Dump Pond - Looking north along the western toe of the cover system.

Photo 65. Industrial Complex – Flat surface of cover system.

Photo 66. Industrial Complex – Sloping face of cover system.

Photo 67. 17N Portal – As seen from road.

Photo 69. K-Baseline – As seen from UAV.

Photo 68. Oceanview Portal Cover – Looking upslope at cover.

Photo 70. 09S Portal – Looking along plug.

Photo 71. Lower Adit – Sloping face of cover system as seen from UAV.

Photo 73. Oceanview East Raise – Surface plug, view looking north.

Photo 72. Portal to Mill Foundation - As seen from UAV.

Photo 74. Oceanview West Raise – Surface plug, view looking east.

Photo 75. Mt. Fuji Shale Quarry – As seen from road.

Photo 76. Shale Hill Borrow Area – As seen from road.

APPENDIX III
2022 GEOTECHNICAL MONITORING

Instruement Name	Instrument Type	01-Jan	01-Feb	01-Mar	01-Apr	15-Apr	01-May	11-May	21-May	01-Jun	07-Jun	14-Jun	21-Jun	01-Jul	07-Jul	14-Jul	21-Jul	01-Aug	07-Aug	14-Aug	21-Aug	01-Sep	07-Sep	14-Sep	21-Sep	01-Oct	11-Oct	21-Oct	01-Nov	01-Dec	08-Dec	15-Dec	22-Dec	29-Dec
West Twin Dyke																																		
TC12	Thermocouple	Not functioning																																
TC13A	Thermocouple	Not functioning																																
TC31	Thermocouple	Not functioning																																
TC32	Thermocouple	Not functioning																																
TC33	Thermocouple	Not functioning																																
BGC03-33	Thermistor	Not functioning																																
BGC03-34	Thermistor																																	
BGC05-09	Thermistor																																	
BGC05-15	Thermistor																																	
BGC05-17	VW Piezo.																																	
Surface Cell																																		
BGC02-03	Thermistor	Not functioning																																
BGC03-07	Thermistor																																	
BGC03-09	Thermistor																																	
BGC03-10	Thermistor																																	
BGC03-11	Thermistor																																	
BGC03-12	Vibrating Wire																																	
BGC03-14	Vibrating Wire																																	
BGC03-15	Thermistor																																	
BGC03-20	Thermistor																																	
BGC03-21	Thermistor	Not functioning																																
BGC03-32	Vibrating Wire																																	
BGC03-35	Vibrating Wire																																	
BGC03-36	Thermocouple	Not functioning																																
BGC03-37	Thermistor	Not functioning																																
BGC05-05	Thermistor																																	
BGC05-06	VW Piezo.																																	
BGC05-07	VW Piezo.																																	
BGC05-08	Contingency																																	
BGC05-10	VW Piezo.																																	
BGC05-11	Monitoring Well	Not functioning																																
BGC05-12	Monitoring Well	Not functioning																																
BGC05-13	VW Piezo.	Not functioning																																
BGC05-14	Contingency																																	
BGC05-16	Contingency																																	
FG-1	Frost Gauge																																	
FG-2	Frost Gauge																																	
FG-3	Frost Gauge																																	
FG-4	Frost Gauge																																	
FG-5	Frost Gauge																																	
FG-6	Frost Gauge																																	

Annual Reading

Instruement Name	Instrument Type	01-Jan	01-Feb	01-Mar	01-Apr	15-Apr	01-May	11-May	21-May	01-Jun	07-Jun	14-Jun	21-Jun	01-Jul	07-Jul	14-Jul	21-Jul	01-Aug	07-Aug	14-Aug	21-Aug	01-Sep	07-Sep	14-Sep	21-Sep	01-Oct	11-Oct	21-Oct	01-Nov	01-Dec	08-Dec	15-Dec	22-Dec	29-Dec
Toe of West Twin Dyke																																		
BGC03-18	Thermocouple	Not functioning																																
BGC03-19	Thermistor																																	
BGC05-26	Thermistor																																	
Test Cell																																		
BGC05-04	Thermistor																																	
BGC05-18	VW Piezo.																																	
BGC05-19	Thermistor																																	
BGC05-20	VW Piezo.																																	
BGC05-21	Monitoring Well	Not functioning																																
BGC05-22	VW Piezo.																																	
BGC05-23	Monitoring Well	Not functioning																																
BGC05-24	VW Piezo.																																	
BGC05-25	Contingency																																	
FG-7	Frost Gauge																																	
FG-8	Frost Gauge																																	
Test Cell Dyke																																		
BGC02-09	Thermistor	Not functioning																																
BGC03-22	Thermistor																																	
BGC05-29	Thermistor																																	
Toe of Test Cell Dyke																																		
BGC05-27	Thermistor																																	
BGC05-28	VW Piezo.																																	
FG-9	Frost Gauge	Not functioning																																
FG-10	Frost Gauge																																	
Oceanview Pit																																		
BGC05-01	Thermistor																																	
FG-16	Frost Gauge																																	
East Open Pit																																		
BGC05-02	Thermistor																																	
BGC05-03	Thermistor																																	
FG-13	Frost Gauge																																	
FG-14	Frost Gauge	Not functioning																																
Landfill																																		
BGC05-30	Thermistor																																	
FG-11	Frost Gauge																																	
Area 14																																		
TC7	Thermocouple	Not functioning																																
FG-15	Frost Gauge																																	
Upper Dump Pond																																		
FG-17	Frost Gauge																																	
West Open Pit																																		
BGC08-01	Thermistor	Not functioning																																
Mill Cover																																		
BGC08-02	Thermistor																																	
Water Quality / Levels																																		
159-4	Water Level																																	
159-4	Water Quality																																	
Spillway Inlet	Water Quality																																	

Annual Reading