BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

NYRSTAR

NANISIVIK MINE, NUNAVUT

2020 UPDATE TO GEOTECHNICAL INSTRUMENTATION CONTINGENCY PLAN

PROJECT NO.: 0255030 DATE: March 13, 2020

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March 13, 2020
Project No.: 0255030

Mr. Johan Skoglund
Nyrstar
Tessinerplatz 7
8002 Zurich, Switzerland

Dear Johan,

Re: Nanisivik Mine, Nunavut: 2020 Update to Geotechnical Instrumentation Contingency Plan

Please find attached our above captioned report on the Nanisivik geotechnical instrumentation contingency plan requested in support of water license 1AR-NAN2030. 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

This document provides an updated instrumentation record and contingency plan for the post closure geotechnical monitoring program at the Nanisivik Mine site for the duration of the current Water Licence (1AR-NAN2030), effective January 8, 2020 through January 8, 2030. The geotechnical monitoring program consists of monitoring and analysis of geotechnical instruments and visual inspections of reclamation measures by a geotechnical engineer. This report documents the location of geotechnical monitoring instruments installed as part of the post closure geotechnical monitoring program and provides a summary of their current functionality. The document outlines a decision-making process for possible replacement of instruments that become inoperative during the course of the monitoring program. The decision-making process reviews the current state of the geothermal conditions within the covers and underlying waste prior to determining the need for replacement of inoperative instruments. For contingency planning regarding geotechnical issues, refer to the separate BGC report titled *2020 Update to Post Closure Geotechnical Monitoring Contingency Plan*, to be issued concurrently with this report (February 28, 2020).

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LIMITATIONS

BGC Engineering Inc. (BGC) prepared this document for the account of Nyrstar. The material in it reflects the judgment of BGC staff in light of the information available to BGC at the time of document preparation. Any use which a third party makes of this document or any reliance on decisions to be based on it is the responsibility of such third parties. BGC accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this document.

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1.0 INTRODUCTION

Nanisivik Mine is currently owned by Nyrstar, who obtained the property through its purchase of Breakwater Resources Ltd. (Breakwater) in 2011. The Nanisivik Mine began production of zinc and lead concentrates in 1976. After 27 years of successful operations, the economic mineral deposit was depleted in 2002 and the mine entered the Closure and Reclamation phase in September 2002. The Final Closure and Reclamation Plan (FCRP) for the Nanisivik Mine was submitted to the Nunavut Water Board (NWB) by CanZinco in March 2004 (CanZinco, March 2004). The NWB conveyed its approval of the FCRP for Nanisivik Mine in a letter to Breakwater dated July 6, 2004 (NWB, July 6, 2004). The reclamation of the mine site began in August 2004, with the bulk of reclamation completed between 2004 and 2008. Refer to the most recent annual geotechnical inspection report (BGC, February 24, 2020) for further detail on reclamation activities.

Post closure geotechnical and water quality monitoring programs, including annual geotechnical inspections, have been undertaken annually as outlined in a number of previous water licences issued to Nyrstar by the NWB. A new Licence, 1AR-NAN2030 TYPE “A”, (the New Licence) water licence was issued by the NWB effective January 8, 2020 through January 8, 2030 (NWB, January 9, 2020). Future geotechnical site inspections will be conducted under the terms of the New Licence. In the New Licence, there is a requirement (Part H, Item 10c.) to update the Geotechnical Monitoring Instrument Installation Record and Contingency Plan (BGC, March 17, 2015) previously developed as a condition of the prior Water Licence. To address this License requirement, Mr. Johan Skoglund, Group Environment Manager for Nyrstar requested that BGC Engineering Inc. (BGC) update the noted document. This document addresses this requirement of the New Licence and provides an updated geotechnical monitoring instrument installation record and contingency plan.

2.0 MONITORING PROGRAM

The approved post-closure geotechnical monitoring program (Schedule H, Table 4 in the New Licence) consists of regular monitoring of selected geotechnical instruments (thermistors, frost gauges and piezometers) and visual inspections of reclamation measures by a geotechnical engineer.

The results of the monitoring program are assessed by a qualified geotechnical engineer and are summarized in an annual geotechnical monitoring report. The annual geotechnical monitoring report includes a comprehensive review of observations recorded during the geotechnical site inspection, as well as a detailed assessment of the geotechnical monitoring data collected that year. The annual geotechnical monitoring report is forwarded to the NWB by Nyrstar as part of their annual environmental monitoring report. The most recent annual geotechnical inspection was conducted by BGC in August 2019 and is detailed in a report to Nyrstar (BGC, February 24, 2020).

3.0 INSTRUMENTATION INSTALLATION RECORD

3.1. Instrumentation Types

Several types of instruments have been installed at various locations around the Nanisivik Mine site. The following sections provide some commentary on the types of instrumentation present at the site.

3.1.1. Thermistor Strings

A thermistor string is a cable that consists of a number of thermistor nodes to record subsurface temperatures. A thermistor comprises a thermally sensitive resistor that is calibrated for temperature. The cable reads resistance (ohms), which can then be converted to a temperature. Typically, thermistor beads are accurate within +/- 0.2°C.

The thermistor strings that are installed at Nanisivik were fabricated by M-Squared Instruments of Cochrane, AB. Each thermistor is type YSI44007 with a MS3106A20-29P termination. The accuracy of the thermistors, as noted by the manufacturer, is +/- 0.2°C. Each cable was ice-bath calibrated by the manufacturer prior to shipment to site.

The primary purpose of the thermistors is to monitor freeze-back of the underlying mine waste materials and monitor the active layer thaw depths within the cover materials. 23 thermistors remain active.

3.1.2. Thermocouple Strings

Thermocouple strings are similar to thermistor strings in that numerous nodes are installed on one line, to record subsurface temperatures. The primary purpose of the thermocouples was to monitor freeze-back of the underlying mine waste materials and monitor the active layer thaw depths within the cover materials. However, none of the thermocouples remain functional, as many were installed over twenty years ago when the mine was in operation.

3.1.3. Vibrating Wire Piezometers

A vibrating wire piezometer consists of a metallic diaphragm that measures pore water pressures at a specific depth within the substrate. The diaphragm has a tensioned wire across it and pore pressure changes across the diaphragm alter the tension in the wire. The read-out box provides a means of exciting the wire and reading the resultant frequency of the wire. This type of instrument provides ease of use in cold temperatures and long piezometer leads can be used.

The vibrating wire piezometers that were installed at Nanisivik were fabricated by RST Instruments of Coquitlam, BC. Each instrument is a VW2100-type vibrating wire piezometer. Each instrument was calibrated by the manufacturer prior to shipment. The stated accuracy for these instruments is +/- 0.1% of the full-scale reading. The instruments are monitored using the portable readout unit (VW2102), also manufactured by RST.

The primary purpose of the piezometers is to monitor pore pressures generated by freeze-back of the Surface Cell and Test Cell taliks and to provide insight into the stability of the West Twin Dyke. The piezometer tips also include a thermistor node to monitor temperature of the ground surrounding the tip area. Due to the progression of the downward migration of the freezing front, all piezometers in the Surface Cell and all but two piezometers in the Test Cell are now frozen and not able to measure pore water pressure. However, replacement of the piezometers is not considered necessary at this time. Further discussion on piezometers and piezometric implications to dyke stability is contained in BGC's 2020 Update to Post Closure Geotechnical Monitoring Contingency Plan Report (BGC, February 28, 2020).

3.1.4. Frost Gauges

Frost gauges consist of a transparent plastic tube filled with methylene blue solution, which is blue when thawed and colourless when frozen. The plastic tube is removed from a casing in the ground and the depth to colour change is easily and accurately noted.

The primary purpose of the frost gauges is to measure the active layer thaw depth within the various thermal covers constructed around the site. 14 frost gauges remain active.

3.1.5. Monitoring Wells/Standpipe Piezometers

The primary purpose of the monitoring wells is to provide ability to monitor pore water quality within the Surface Cell and Test Cell taliks as freeze-back of both taliks occurred. A secondary purpose is to measure pore pressures within the taliks.

Due to the freeze-back of the tailings, combined with the age of the heat trace wires, which were installed 15 years ago, the monitoring wells in the Surface Cell and Test Cell are no longer functioning and water sample collection from them is no longer possible. Considering the hydraulic confinement of the Surface Cell talik and the positive water quality monitoring results from the WTDA, replacement of the monitoring wells is not considered necessary at this time.

3.2. Installation Record and Performance

The various tailings, waste rock and other mine waste covers constructed during reclamation of the mine site contain the instruments described in Section 3.1 to monitor performance of the covers and freeze-back of the underlying mine wastes. The instruments were installed between 2003 (pre-reclamation) and 2008 (post-reclamation). The location and type of each instrument is provided in Appendix A and illustrated on Drawings 1 through 8. Despite the age of most instruments, the majority remain functioning and provide valuable monitoring data. Though all but two piezometers have frozen back and no longer read pore water pressures, the temperature at the piezometer tips is still able to be measured from these instruments and are considered active. As per the approved monitoring schedule included in the New Licence, 23 thermistor strings, 12 vibrating wire piezometers and 14 frost gauges are actively monitored at site, as noted in Table 3-1.

Table 3-1. Summary of instrumentation installations.

Mine Area	Instrument Type				
	Thermistor String	Thermocouple String	Vibrating Wire Piezometer	Frost Gauge	Monitoring Well
WTDA	17 A / 5 I	0 A / 7 I	12 A / 1 I	9 A / 1 I	0 A / 4 I
East Open Pit	2 A / 0 I			1 A / 1 I	
West Open Pit	1 A / 0 I				
Oceanview Open Pit	1 A / 0 I			1 A / 0 I	
Landfill	1 A / 0 I			1 A / 0 I	
Area 14		0 A / 1 I		1 A / 0 I	
Upper Dump Pond				1 A / 0 I	
Industrial Complex	1 A / 0 I				

Notes: A = Active, I = Inactive

4.0 CONTINGENCY PLAN

Monitoring instrumentation is subject to failure due to a variety of reasons. If instrumentation is rendered inoperative, monitoring data will no longer be available from that particular location. Without the monitoring data, a comprehensive assessment of the reclamation measures cannot be undertaken. If the data is regarded as critical to assessing the effectiveness of reclamation measures, the instrument may need to be replaced. As such, it is necessary to formulate a contingency plan to repair or replace instruments which become inoperative and which are deemed as critical. Exploring remote sensing methods may be a possible alternative to instrument replacement, under specific circumstances. The following sections outline the contingency plan for assessing if an instrument needs to be replaced and how critical, inoperative instruments will be replaced.

4.1. Inoperative Instruments

Monitoring instruments may be rendered inoperative due to the following circumstances:

- Extreme climatic conditions that impact the instruments
- Damage from animals or humans
- Damage due to construction equipment or other human activity during the post closure monitoring period
- Instrument drift (electronics)
- Corrosion of metallic elements by pore fluids

The process by which monitoring data is collected, reviewed, and functionality of the instrument assessed is illustrated on Drawing 9. The current monitoring system involves collection of the data from the instrument by a geotechnical engineer during the inspection. The data is then reviewed by the geotechnical engineer. A determination on the functionality and associated data quality from each instrument can be made by two means:

- Visual observations of the instrument in the field.
- Review of the data by the geotechnical engineer.

Some instruments around the mine site have been functioning for over 15 years, providing reliable and accurate geothermal monitoring data. That being said, all of these instruments will have a finite life span and their eventual cessation should be expected. It is also possible instruments may become redundant with time. As the underlying mine waste freezes back and eventually reach thermal equilibrium, collecting additional data from these instruments will add only marginal value. Since the data has shown slowing of the freeze-back, the New Licence has approved the reduction of monitoring frequency to six monitoring events within ten years (Schedule H, Table 4 in the New Licence).

4.2. Replacement of Instruments

4.2.1. General

In such a case where the instrument becomes inoperative, a decision will be made by the Geotechnical Engineer as to the importance of the individual instrument. If the instrument is considered to be non-critical or redundant, replacement may not be necessary. Instruments may be considered to be non-critical if they indicate the majority of the borehole profile has frozen back or another instrument exists nearby which may provide similar data. If the instrument is considered critical to assessing the effectiveness of reclamation works or stability of earth structures, the instrument will require replacement. If an instrument is deemed to require replacement by the geotechnical engineer, as appropriate timeline for replacement will be determined, as immediate replacement may not necessarily be required.

Replacement of instrumentation, may occur by one of two means:

- Placing a new instrument in an adjacent existing “contingency” borehole
- Drilling a new borehole and installing a new instrument.

If instrument replacement in a borehole is not feasible, remote sensing methods could be explored as a possible substitute, under select circumstances.

4.2.2. Contingency Boreholes

As discussed in Section 3.0, a number of “contingency” boreholes were completed during the 2005 instrumentation installation program. These contingency boreholes contain a PVC pipe and a heat trace wire. Due to the frozen nature of the contingency boreholes and the age of the heat trace wire, the contingency boreholes may not reliably provide instrument installation capabilities within the Surface Cell and Test Cell. However, it remains preferable to attempt instrument replacement in a contingency borehole before drilling a new borehole.

4.2.3. Drilling New Boreholes

If the heat trace in the contingency borehole should malfunction, or an instrument is required in a location that no contingency borehole is available, instrument replacement will require a new borehole to be drilled. There is no drilling equipment currently on site. As such, a drill would have to be mobilized to site to permit installation of additional instrumentation. The potential sources of a drill may include the following, if available:

- A Baffin Island community (e.g., Iqaluit or Pond Inlet)
- Arctic Bay
- A nearby exploration camp.

Due to the remoteness of the site, mobilization of an appropriate drill to site may not occur immediately upon realization that an instrument has become inoperative. Advance planning and coordination would be required before any drilling could occur at site.

4.2.4. Monitoring Continuity Assurance

It should be noted that the number of instruments installed at each location will ensure that some instrumentation will remain operational during the entire post closure monitoring period. If an instrument becomes inoperative for some portion of the post closure monitoring period before it can be replaced, data can be retrieved from one or more of the nearby instruments. The number of instruments ensure sufficient monitoring data will be collected during the closure period such that an accurate assessment of the reclamation measures can be undertaken.

5.0 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
Mar 13/20
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PERMIT TO PRACTICE
BGC ENGINEERING INC.
Signature
Date 13 - March - 2020
PERMIT NUMBER: P 285
NT/NU Association of Professional Engineers and Geoscientists

REFERENCES

BGC Engineering Inc. (2004, November). *Instrument installation and Contingency Plan – Nanisivik Mine, Nunavut* [Report]. Prepared for Breakwater Resources Ltd.

BGC Engineering Inc. (2015, March 17). *Geotechnical Monitoring Instrumentation Installation Record and Contingency Plan – Nanisivik Mine, Nunavut* [Report]. Prepared for Nyrstar.

BGC Engineering Inc. (2020, February 24). *2019 Annual Geotechnical Inspection – Nanisivik Mine, Nunavut* [Report]. Prepared for Nyrstar.

BGC Engineering Inc. (2020, February 28). *2020 Update to Post Closure Geotechnical Monitoring Contingency Plan* [Report]. Prepared for Nyrstar.

CanZinco Ltd. (2004, March). *Reclamation and Closure Plan*. Prepared for Nunavut Water Board.

Nunavut Water Board. 2004, July 6). *Nunavut Water Board's Letter of Approval for Terms and Conditions Applying to the Nanisivik Mine 2004 Reclamation Plan and Closure Plan*. Memorandum addressed to Breakwater Resources Ltd.

Nunavut Water Board. (2020, January 9). *Nunavut Water Board Licence 1AR-NAN2030 Type "A"* [Report].

APPENDIX A
GEOTECHNICAL MONITORING INSTRUMENT LOCATION TABLE

Instrument ID	Type of Instrument	Longitude	Latitude	Easting UTM 16	Northing UTM 16	Status of Instrument
West Twin Dyke						
TC12	Thermocouple	84° 30' 12.08" W	73° 1' 17.73" N	581353	8104584	Not functioning
TC13A	Thermocouple	84° 30' 8.00" W	73° 1' 19.98" N	581387	8104655	Not functioning
TC31	Thermocouple	84° 30' 9.08" W	73° 1' 20.15" N	581377	8104660	Not functioning
TC32	Thermocouple	84° 30' 10.39" W	73° 1' 20.26" N	581365	8104663	Not functioning
TC33	Thermocouple	84° 30' 13.29" W	73° 1' 19.78" N	581339	8104647	Not functioning
BGC03-33	Thermistor	84° 30' 14.87" W	73° 1' 19.90" N	581325	8104650	Not functioning
BGC03-34	Thermistor	84° 30' 14.87" W	73° 1' 19.90" N	581325	8104650	Functioning
BGC05-09	Thermistor	84° 30' 0.11" W	73° 1' 26.50" N	581450	8104860	Functioning
BGC05-15	Thermistor	84° 30' 8.36" W	73° 1' 22.89" N	581380	8104745	Functioning
BGC05-17	Vibrating Wire Piezometer	84° 30' 13.01" W	73° 1' 20.52" N	581341	8104670	Functioning, Frozen
Surface Cell						
BGC02-03	Thermistor	84° 30' 28.11" W	73° 1' 20.06" N	581205	8104650	Not functioning
BGC03-07	Thermistor	84° 30' 0.91" W	73° 1' 28.61" N	581440	8104925	Functioning
BGC03-09	Thermistor	84° 30' 10.38" W	73° 1' 24.20" N	581360	8104785	Functioning
BGC03-10	Thermistor	84° 30' 12.38" W	73° 1' 25.68" N	581340	8104830	Functioning
BGC03-11	Thermistor	84° 30' 21.72" W	73° 1' 22.24" N	581260	8104720	Functioning
BGC03-12	Vibrating Wire Piezometer	84° 30' 14.66" W	73° 1' 20.70" N	581326	8104675	Functioning, Frozen
BGC03-14	Vibrating Wire Piezometer	84° 30' 24.25" W	73° 1' 19.98" N	581240	8104649	Functioning, Frozen
BGC03-15	Thermistor	84° 30' 22.59" W	73° 1' 19.25" N	581256	8104627	Functioning
BGC03-20	Thermistor	84° 30' 44.76" W	73° 1' 23.49" N	581050	8104750	Functioning
BGC03-21	Thermistor	84° 30' 27.39" W	73° 1' 28.93" N	581200	8104925	Not functioning
BGC03-32	Vibrating Wire Piezometer	84° 30' 11.60" W	73° 1' 23.41" N	581350	8104760	Functioning, Frozen
BGC03-35	Vibrating Wire Piezometer	84° 30' 34.32" W	73° 1' 19.01" N	581150	8104615	Functioning, Frozen
BGC03-36	Thermocouple	84° 30' 34.32" W	73° 1' 19.01" N	581150	8104615	Not functioning
BGC03-37	Thermistor	84° 29' 55.18" W	73° 1' 29.99" N	581490	8104970	Not functioning
BGC05-05	Thermistor	84° 30' 17.30" W	73° 1' 26.06" N	581295	8104840	Functioning
BGC05-06	Vibrating Wire Piezometer	84° 30' 15.74" W	73° 1' 25.40" N	581310	8104820	Not functioning
BGC05-07	Vibrating Wire Piezometer	84° 30' 22.78" W	73° 1' 22.58" N	581250	8104730	Functioning, Frozen
BGC05-08	Contingency	84° 30' 21.63" W	73° 1' 22.89" N	581260	8104740	N/A

Instrument ID	Type of Instrument	Longitude	Latitude	Easting UTM 16	Northing UTM 16	Status of Instrument
BGC05-10	Vibrating Wire Piezometer	84° 30' 6.93" W	73° 1' 25.13" N	581390	8104815	Functioning, Frozen
BGC05-11	Monitoring Well	84° 30' 18.11" W	73° 1' 24.30" N	581290	8104785	Not functioning
BGC05-12	Monitoring Well	84° 30' 14.91" W	73° 1' 23.45" N	581320	8104760	Not functioning
BGC05-13	Vibrating Wire Piezometer	84° 30' 27.00" W	73° 1' 19.34" N	581216	8104628	Partially functioning
BGC05-14	Contingency	84° 30' 7.14" W	73° 1' 23.68" N	581390	8104770	N/A
BGC05-16	Contingency	84° 30' 11.92" W	73° 1' 21.15" N	581350	8104690	N/A
FG-1	Frost Gauge	84° 29' 59.69" W	73° 1' 29.40" N	581450	8104950	Functioning
FG-2	Frost Gauge	84° 30' 13.74" W	73° 1' 23.92" N	581330	8104775	Functioning
FG-3	Frost Gauge	84° 30' 23.18" W	73° 1' 19.99" N	581250	8104650	Functioning
FG-4	Frost Gauge	84° 30' 47.63" W	73° 1' 22.72" N	581025	8104725	Functioning
FG-5	Frost Gauge	84° 30' 24.41" W	73° 1' 30.51" N	581225	8104975	Functioning
FG-6	Frost Gauge	84° 30' 39.51" W	73° 1' 29.24" N	581090	8104930	Functioning
Toe of West Twin Dyke						
BGC03-18	Thermocouple	84° 30' 2.14" W	73° 1' 20.06" N	581440	8104660	Not functioning
BGC03-19	Thermistor	84° 29' 59.34" W	73° 1' 21.03" N	581464	8104691	Functioning
BGC05-26	Thermistor	84° 30' 6.82" W	73° 1' 18.19" N	581400	8104600	Functioning
Test Cell						
BGC05-04	Thermistor	84° 29' 49.75" W	73° 1' 26.24" N	581544	8104856	Functioning
BGC05-18	Vibrating Wire Piezometer	84° 29' 45.17" W	73° 1' 25.83" N	581586	8104845	Functioning, Frozen
BGC05-19	Thermistor	84° 29' 35.60" W	73° 1' 23.94" N	581675	8104790	Functioning
BGC05-20	Vibrating Wire Piezometer	84° 29' 35.67" W	73° 1' 23.46" N	581675	8104775	Functioning
BGC05-21	Monitoring Well	84° 29' 37.39" W	73° 1' 22.99" N	581660	8104760	Not functioning
BGC05-22	Vibrating Wire Piezometer	84° 29' 39.92" W	73° 1' 20.76" N	581640	8104690	Functioning, Frozen
BGC05-23	Monitoring Well	84° 29' 39.95" W	73° 1' 20.54" N	581640	8104683	Not functioning
BGC05-24	Vibrating Wire Piezometer	84° 29' 45.35" W	73° 1' 21.48" N	581590	8104710	Functioning, Frozen
BGC05-25	Contingency	84° 29' 46.99" W	73° 1' 21.98" N	581574	8104725	N/A
FG-7	Frost Gauge	84° 29' 51.43" W	73° 1' 25.30" N	581530	8104826	Functioning
FG-8	Frost Gauge	84° 29' 26.15" W	73° 1' 25.05" N	581759	8104828	Functioning
Test Cell Dyke						
BGC02-09	Thermistor	84° 29' 41.16" W	73° 1' 20.58" N	581629	8104684	Not functioning
BGC03-22	Thermistor	84° 29' 34.63" W	73° 1' 19.71" N	581689	8104659	Functioning
BGC05-29	Thermistor	84° 29' 41.20" W	73° 1' 21.10" N	581628	8104700	Functioning
Toe of Test Cell Dyke						
BGC05-27	Thermistor	84° 29' 31.91" W	73° 1' 18.82" N	581715	8104633	Functioning
BGC05-28	Vibrating Wire Piezometer	84° 29' 41.16" W	73° 1' 19.81" N	581630	8104660	Functioning

Instrument ID	Type of Instrument	Longitude	Latitude	Easting UTM 16	Northing UTM 16	Status of Instrument
FG-9	Frost Gauge	84° 29' 41.80" W	73° 1' 20.01" N	581624	8104666	Not functioning
FG-10	Frost Gauge	84° 29' 19.23" W	73° 1' 22.45" N	581825	8104750	Functioning
Oceanview Pit						
BGC05-01	Thermistor	84° 22' 26.76" W	73° 2' 47.88" N	585440	8107555	Functioning
FG-16	Frost Gauge	84° 22' 26.63" W	73° 2' 48.68" N	585440	8107580	Functioning
East Open Pit						
BGC05-02	Thermistor	84° 26' 31.17" W	73° 2' 34.48" N	583250	8107045	Functioning
BGC05-03	Thermistor	84° 26' 22.28" W	73° 2' 35.78" N	583329	8107088	Functioning
FG-13	Frost Gauge	84° 26' 31.10" W	73° 2' 34.87" N	583250	8107057	Functioning
FG-14	Frost Gauge	84° 26' 21.82" W	73° 2' 37.77" N	583330	8107150	Not functioning
Landfill						
BGC05-30	Thermistor	84° 33' 56.87" W	73° 2' 16.05" N	579246	8106306	Functioning
FG-11	Frost Gauge	84° 34' 6.37" W	73° 2' 16.13" N	579160	8106305	Functioning
Area 14						
TC7	Thermocouple	84° 25' 4.78" W	73° 1' 38.87" N	584105	8105356	Not functioning
FG-15	Frost Gauge	84° 25' 6.51" W	73° 1' 39.33" N	584088	8105370	Functioning
Upper Dump Road						
FG-17	Frost Gauge	84° 29' 42.01" W	73° 2' 0.19" N	581570	8105910	Functioning
West Open Pit						
BGC08-01	Thermistor	84° 31' 27.88" W	73° 2' 25.83" N	580580	8106664	Functioning
Mill Cover						
BGC08-02	Thermistor	84° 32' 13.50" W	73° 2' 36.93" N	580154	8106991	Functioning

DRAWINGS

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, NUNAVUT: 2020 UPDATE TO GEOTECHNICAL INSTRUMENTATION CONTINGENCY PLAN" AND DATED MAR 2020.
3. CONTOUR INTERVAL IS 0.5 m.
4. PROJECTION IS UTM NAD 83, Z16N.
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SCALE:	1:5,000
DATE:	MAR 2020
DRAWN:	KI
CHECKED:	SG
APPROVED:	GKC

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CLIENT: nyrstar

PROJECT: NANISIVIK MINE, NUNAVUT: 2020 UPDATE TO GEOTECHNICAL INSTRUMENTATION CONTINGENCY PLAN

TITLE: WEST TWIN DISPOSAL AREA: GEOTECHNICAL MONITORING INSTRUMENT LOCATIONS

PROJECT No.: 0255-030

DWG No.: 01

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N

E 582,800
E 583,000
E 583,200
E 583,400
E 583,600

N 8,107,200
N 8,107,000

EDGE OF
THERMAL COVER

DIRECTION OF SURFACE
WATER FLOW

NATIVE
GROUND

SURFACE WATER
DEFLECTION BERM

REMNANT HIGHWALL

FG-14

BGC05-03

FG-13

BGC05-02

88 PORTAL

270
275
260
285
290
295
300
305
310
315
320
325

SCALE 1:2,000

25 0 25 50 75

METRES

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

- THERMISTOR
- FROST GAUGE

NOTES:

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SCALE:	1:2,000
DATE:	MAR 2020
DRAWN:	KI
CHECKED:	SG
APPROVED:	GKC

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AN APPLIED EARTH SCIENCES COMPANY

CLIENT: nyrstar

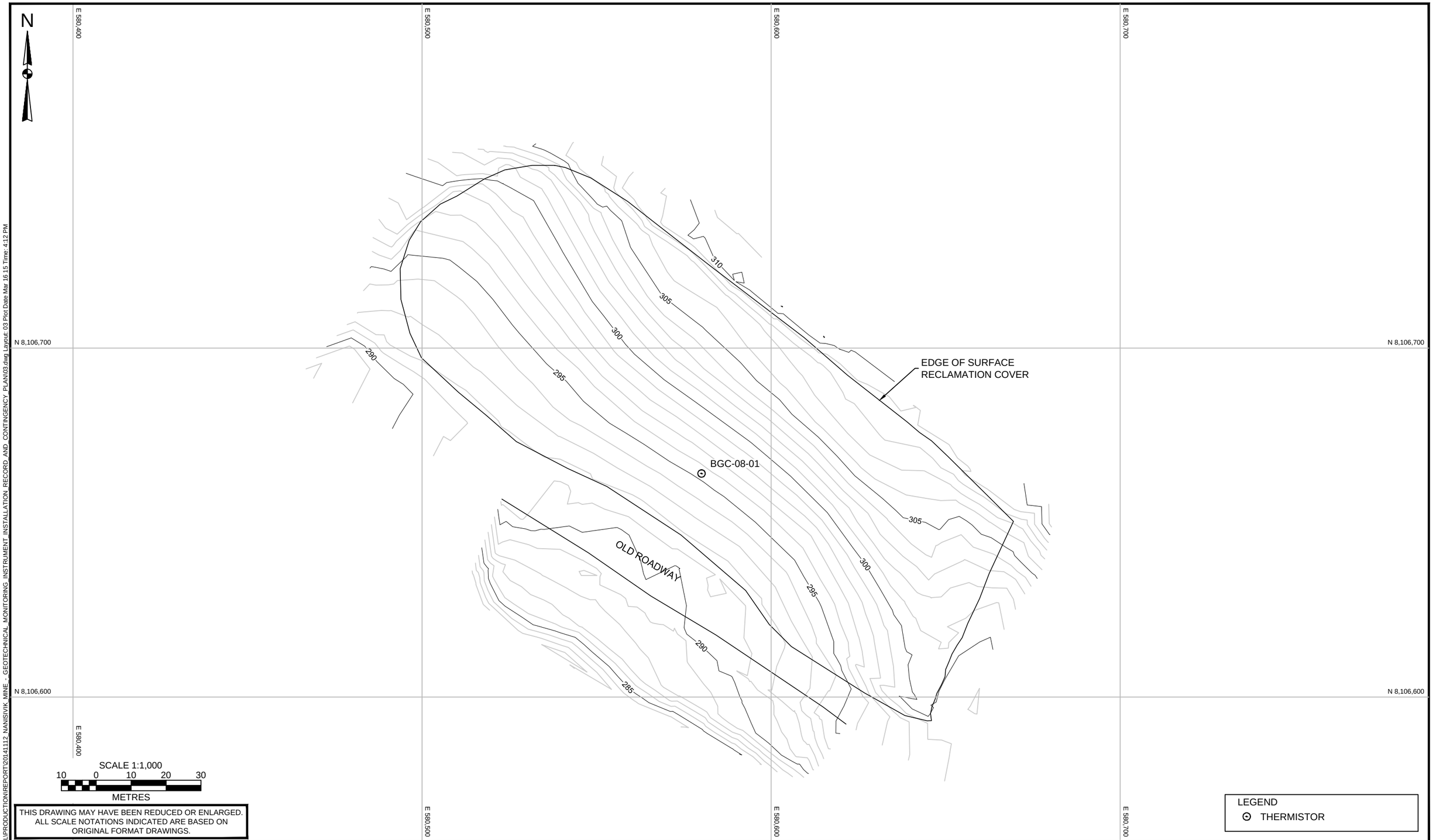
PROJECT: NANISIVIK MINE, NUNAVUT: 2020 UPDATE TO GEOTECHNICAL INSTRUMENTATION CONTINGENCY PLAN

TITLE: EAST OPEN PIT WASTE ROCK COVER: GEOTECHNICAL MONITORING INSTRUMENT LOCATIONS

PROJECT No.: 0255-030

DWG No.: 02

X:\Projects\0255\02\#CAD\Production\Reports\20150316_NANISIVIK_MINE_GEOTECHNICAL_MONITORING_INSTRUMENT_INSTALLATION_RECORD_AND_CONTINGENCY_PLAN\02.dwg Layout: 02 Plot Date: Mar 17, 15 Time: 2:55 PM



SCALE 1:1,000

10 0 10 20 30

METRES

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LEGEND

⊙ THERMISTOR

NOTES:

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3. CONTOUR INTERVAL IS 1 m.
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APPROVED:	GKC

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CLIENT: nyrstar

PROJECT: NANISIVIK MINE, NUNAVUT: 2020 UPDATE TO GEOTECHNICAL INSTRUMENTATION CONTINGENCY PLAN

TITLE: WEST OPEN PIT WASTE ROCK COVER: GEOTECHNICAL MONITORING INSTRUMENT LOCATIONS

PROJECT No.: 0255-030

DWG No.: 03

Y:\Projects\0255\02\GENERAL\PRODUCTION\REPORT\20141112_NANISIVIK_MINE_-_GEOTECHNICAL_MONITORING_INSTRUMENT_INSTALLATION_RECORD_AND_CONTINGENCY_PLAN\03.dwg Layout: 03 Plot Date: Mar 16 15 Time: 4:12 PM

N

E 585,300
E 585,400
E 585,500
E 585,600

N 8,107,600

N 8,107,500

EDGE OF
THERMAL COVER

FG-16

BGC05-01

275

280

285

290

NATIVE GROUND

SURFICIAL
COVER ONLY

DIRECTION OF SURFACE
WATER FLOW

DIRECTION OF SURFACE
WATER FLOW

SURFACE WATER
DEFLECTION BERM

SCALE 1:1,000

10 0 10 20 30

METRES

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

LEGEND

- THERMISTOR
- FROST GAUGE

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, NUNAVUT: 2020 UPDATE TO GEOTECHNICAL INSTRUMENTATION CONTINGENCY PLAN" AND DATED MAR 2020.
3. CONTOUR INTERVAL IS 1 m.
4. PROJECTION IS UTM NAD 83, Z16N.
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SCALE:	1:1,000
DATE:	MAR 2020
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CLIENT: nyrstar

PROJECT: NANISIVIK MINE, NUNAVUT: 2020 UPDATE TO GEOTECHNICAL INSTRUMENTATION CONTINGENCY PLAN

TITLE: OCEANVIEW OPEN PIT WASTE ROCK COVER: GEOTECHNICAL MONITORING INSTRUMENT LOCATIONS

PROJECT No.: 0255-030

DWG No.: 04

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SCALE 1:1,000

10 0 10 20 30

METRES

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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, NUNAVUT: 2020 UPDATE TO GEOTECHNICAL INSTRUMENTATION CONTINGENCY PLAN" , AND DATED MAR 2020.
3. CONTOUR INTERVAL IS 1 m.
4. PROJECTION IS UTM NAD 83 ZONE 16N.
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SCALE:	1:1,000
DATE:	MAR 2020
DRAWN:	KI
CHECKED:	SG
APPROVED:	GKC

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CLIENT: nyrstar

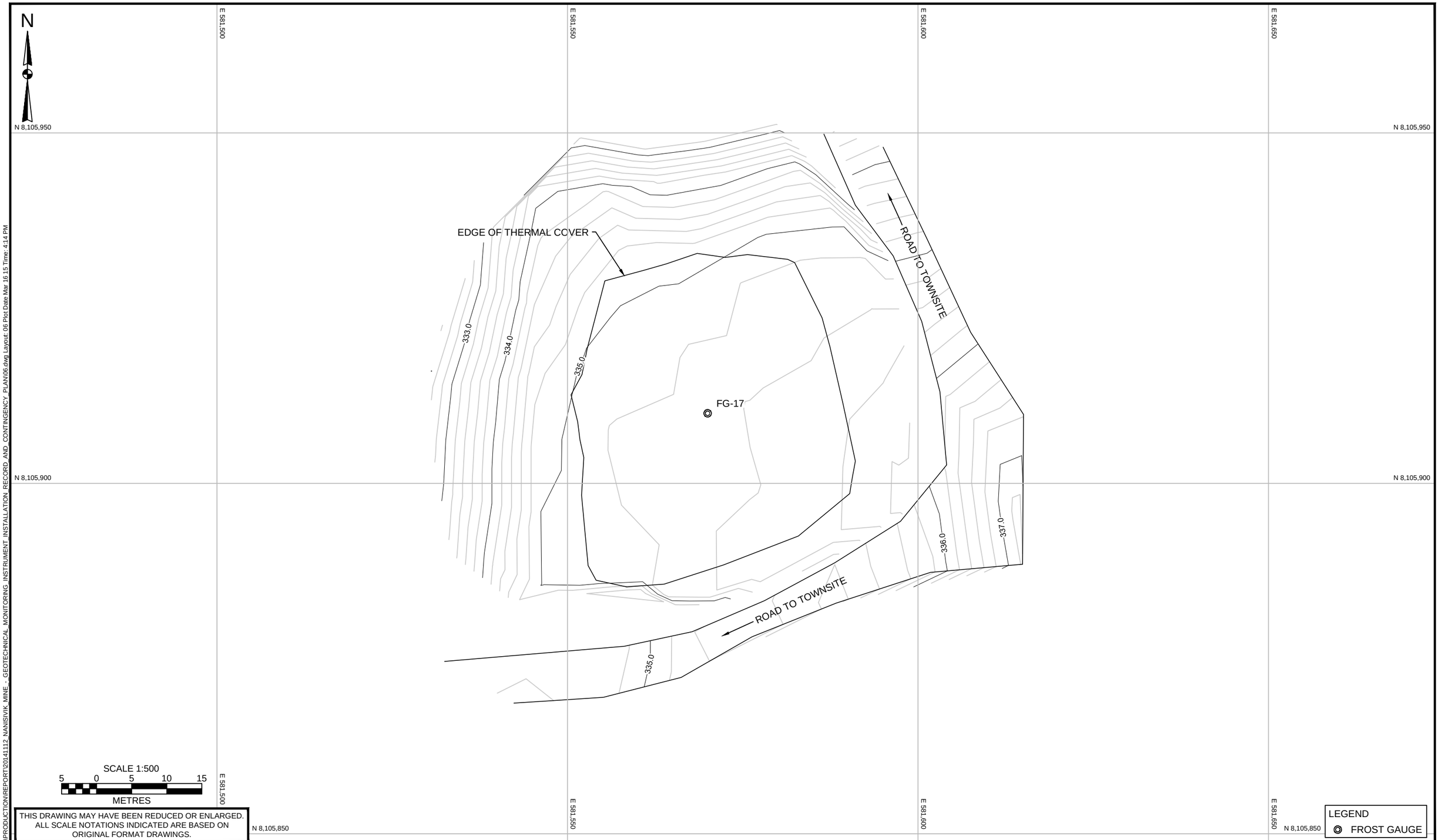
PROJECT: NANISIVIK MINE, NUNAVUT: 2020 UPDATE TO GEOTECHNICAL INSTRUMENTATION CONTINGENCY PLAN

TITLE: LANDFILL COVER: GEOTECHNICAL MONITORING INSTRUMENT LOCATIONS

PROJECT No.: 0255-030

DWG No.: 05

X:\Projects\0255\02\#CAD\Production\Reports\20150316_NANISIVIK_MINE_GEOTECHNICAL_MONITORING_INSTRUMENT_LOCATIONS\Landfill_Cover_Geotechnical_Monitoring_Instrument_Installation_Record_and_Contingency_Plan\05_LANDFILL_COVER_GEOTECHNICAL_MONITORING_INSTRUMENT_LOCATIONS.dwg Layout: 22 Plot Date: Mar 17 15 Time: 2:47 PM



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, NUNAVUT: 2020 UPDATE TO GEOTECHNICAL INSTRUMENTATION CONTINGENCY PLAN” AND DATED MAR 2020.
3. CONTOUR INTERVAL IS 0.2 m.
4. PROJECTION IS UTM NAD 83, Z16N.
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SCALE:	1:500
DATE:	MAR 2020
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CHECKED:	SG
APPROVED:	GKC

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CLIENT: nyrstar

PROJECT: NANISIVIK MINE, NUNAVUT: 2020 UPDATE TO GEOTECHNICAL INSTRUMENTATION CONTINGENCY PLAN

TITLE: UPPER DUMP POND TAILINGS COVER: GEOTECHNICAL MONITORING INSTRUMENT LOCATIONS

PROJECT No.: 0255-030

DWG No.: 06

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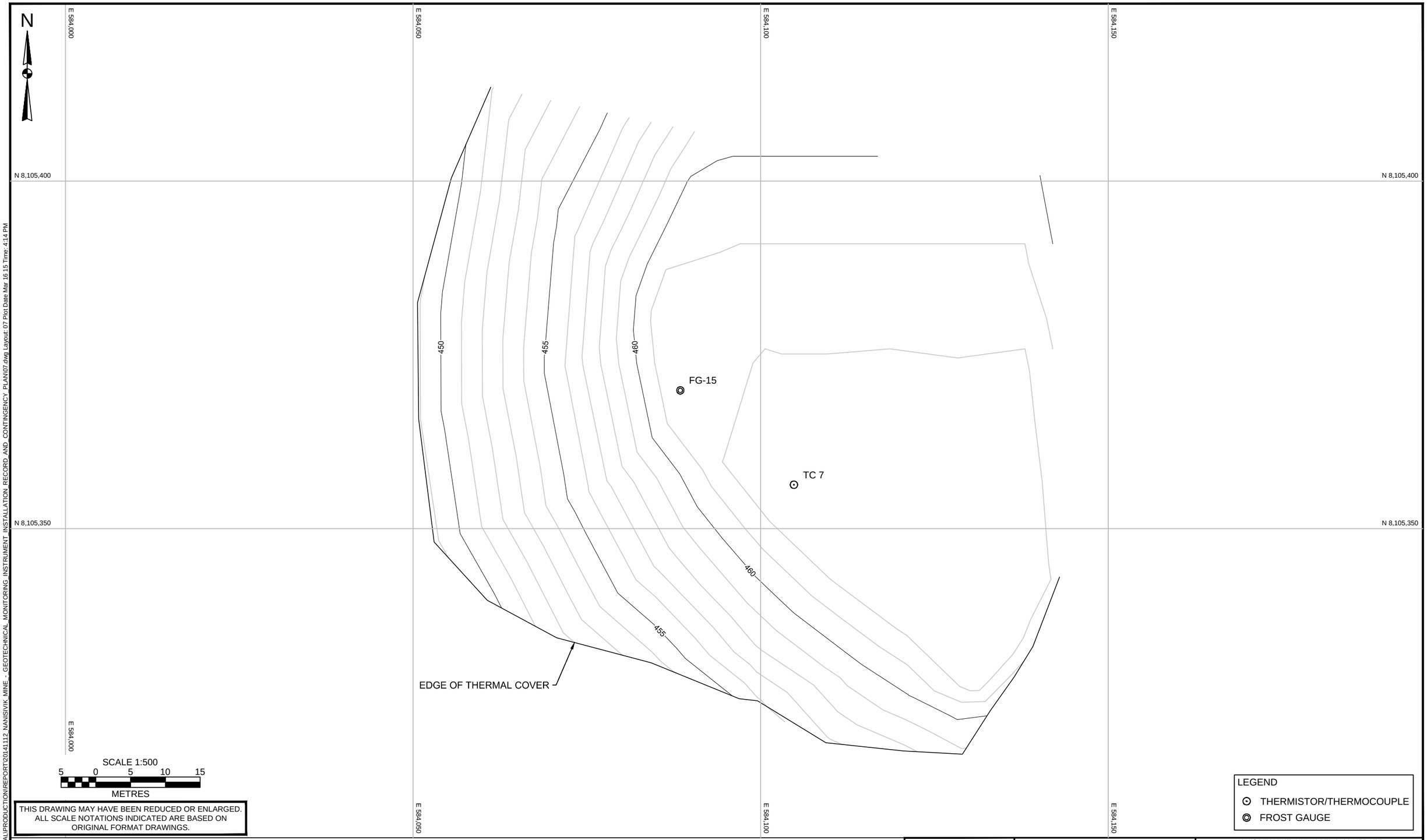

Y:\Projects\0255\02\4\GENERAL\PRODUCTION\REPORT\20141112_NANISIVIK_MINE_-_GEOTECHNICAL_MONITORING_INSTRUMENT_INSTALLATION_RECORD_AND_CONTINGENCY_PLAN\07.dwg Layout: 07 Plot Date: Mar. 16 15 Time: 4:14 PM

NOTES:
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3. CONTOUR INTERVAL IS 1 m.
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SCALE:	1:500
DATE:	MAR 2020
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CHECKED:	SG
APPROVED:	GKC

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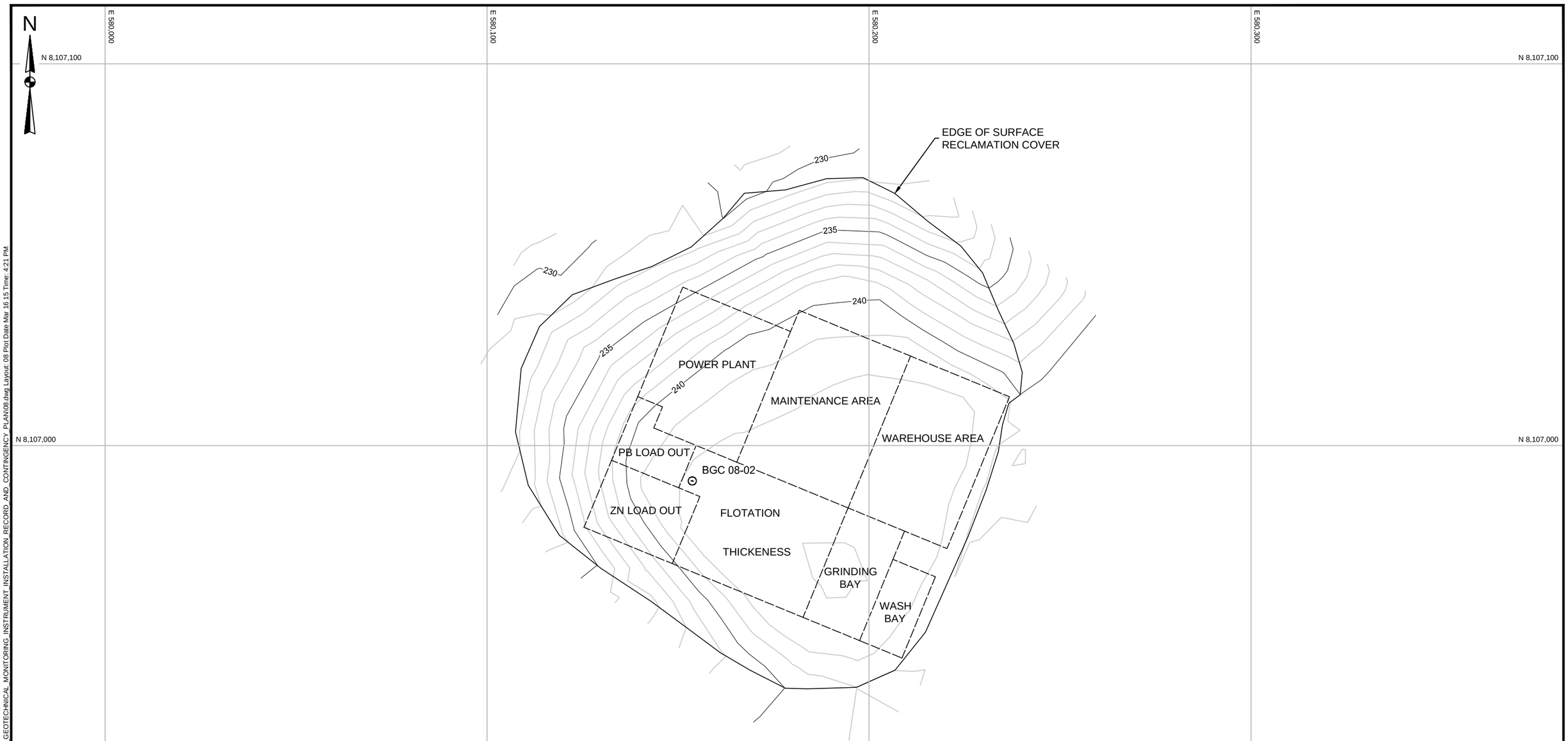
CLIENT: nyrstar

PROJECT: NANISIVIK MINE, NUNAVUT: 2020 UPDATE TO GEOTECHNICAL INSTRUMENTATION CONTINGENCY PLAN

TITLE: AREA 14 WASTE ROCK COVER: GEOTECHNICAL MONITORING INSTRUMENT LOCATIONS

PROJECT No.: 0255-030

DWG No.: 07



SCALE 1:1,000

10 0 10 20 30

METRES

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LEGEND

⊙ THERMISTOR INSTALLATION

NOTES:

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3. CONTOUR INTERVAL IS 1 m.
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SCALE:	1:1,000
DATE:	MAR 2020
DRAWN:	KI
CHECKED:	SG
APPROVED:	GKC

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CLIENT: nyrstar

PROJECT: NANISIVIK MINE, NUNAVUT: 2020 UPDATE TO GEOTECHNICAL INSTRUMENTATION CONTINGENCY PLAN

TITLE: INDUSTRIAL COMPLEX COVER: GEOTECHNICAL MONITORING INSTRUMENT LOCATIONS

PROJECT No.: 0255-030

DWG No.: 08

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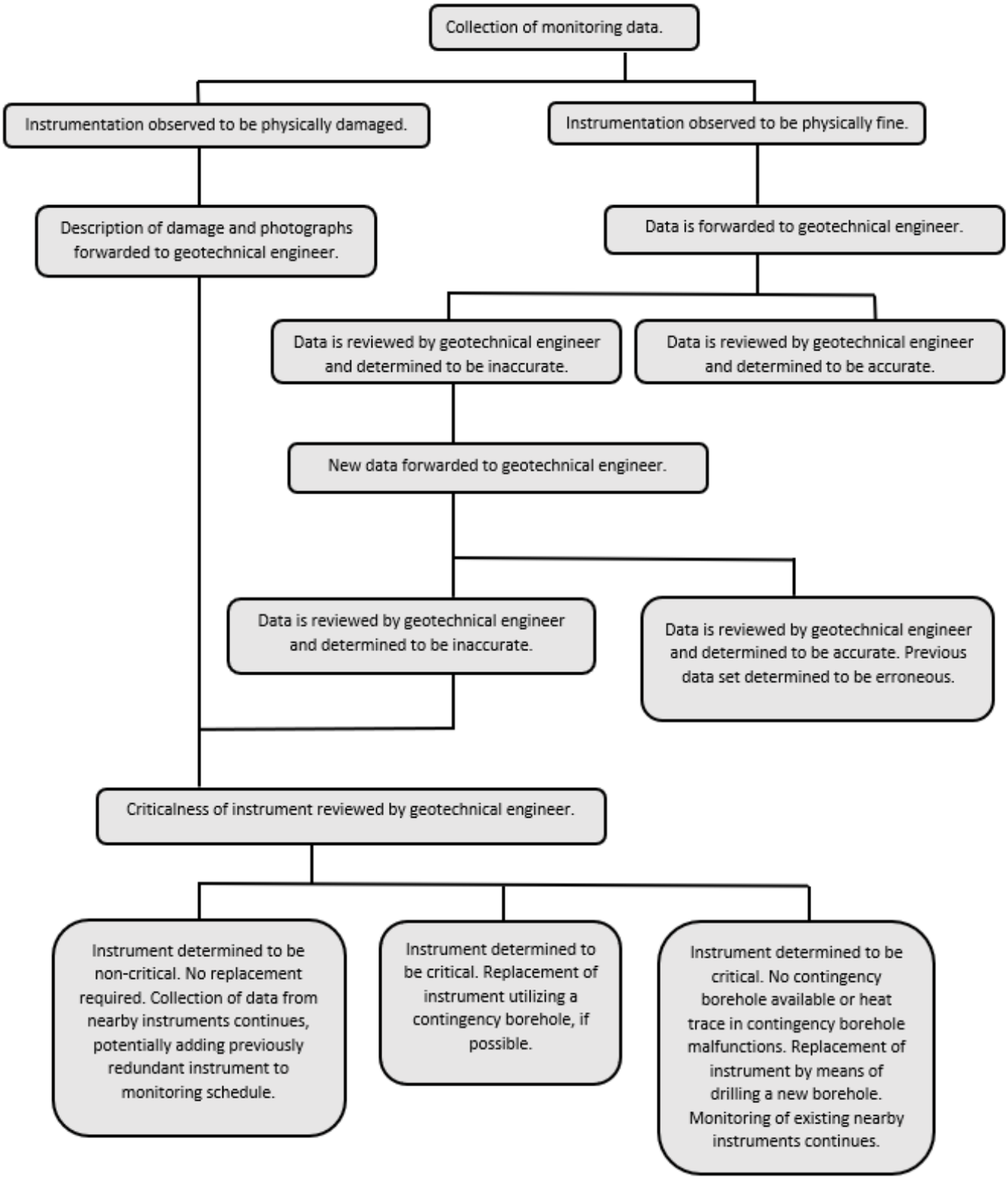

SCALE:	N/A
DATE:	MAR 2020
DRAWN:	KI
CHECKED:	SG
APPROVED:	GKC

BGC ENGINEERING INC.
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CLIENT: nyrstar

PROJECT: Nanisivik Mine, Nunavut: 2020 Update to Geotechnical Instrumentation Contingency Plan

TITLE: Inoperative Instrument Replacement Decision Tree

PROJECT No.: 0255030

DWG No: 9