BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

NYRSTAR

NANISIVIK MINE, NUNAVUT

2020 WATER QUALITY MONITORING

FINAL

PROJECT NO.: 0255032 DATE: March 24, 2021

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March 24, 2021
Project No.: 0255032

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Lebel-sur-Quévillon, Québec J0Y 1X0
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Dear Zied,

Re: Nanisivik Mine 2020 Water Quality Services

Please find attached our above captioned report on the 2020 Water Quality Monitoring 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

This report provides a summary of the 2020 water quality monitoring results for the Nanisivik Mine located on the Borden Peninsula of northern Baffin Island in Nunavut, Canada. The 2020 water quality monitoring program has been conducted as required under the Mine's Water Licence 1AR-NAN2030, which included a single one-time event completed on August 21, 2020 and in parallel with the geotechnical monitoring program. The effectiveness and adequacy of mine reclamation is to be demonstrated through monitoring of key water quality parameters at six identified monitoring stations (i.e., Stations 159-4, 159-6, 159-14, NML-23, NML-29, and NML-30), with comparison to specific criteria. Two additional voluntary stations were sampled in 2020, as recommended from previous studies and monitoring at the Mine (i.e., Stations 159-6 Temp and ELO).

Results for the Final Discharge Point of the West Twin Disposal Area, monitored at Station 159-4, are compared to the authorized criteria stated in the Water Licence. Results from the five remaining monitoring stations outlined in the Water Licence are compared to non-regulatory, station-specific 99th percentile Action Levels, as referenced in the *Contingency Plan for Water Quality Exceedances* (Stantec, March 27a, 2020).

The results indicated compliance with all maximum authorized concentrations at Station 159-4, and there were no exceedances of the station-specific Actions Levels at Stations 159-6, 159-14, and NML-23 located within the Twin Lakes Creek and Chris Creek watersheds. Sampling near the Landfill and within the Landfill watershed reported no exceedances at Station NML-30; however, a single exceedance of the site-specific Action Level for sulphate was observed at Station NML-29. A similar exceedance was observed in 2019 and an investigation was conducted during 2020 monitoring, in accordance with the Mine's *Contingency Plan for Water Quality Exceedances* (under the previous Water Licence 1AR-NAN1419). The site investigation included measurement of field parameters along the water course upstream of Station NML-29, which suggests the source of the sulphate exceedances is likely associated with thawing conditions observed along a south-facing slope (to the north of the drainage channel), as opposed to a source originating from the Landfill (located on the south side of the drainage channel).

As outlined in the current Contingency Plan for the Mine's existing Water Licence 1AR-NAN2030, if a non-regulatory Action Level is exceeded for any key parameters at the same monitoring station on one occasion, an investigation will be initiated to determine the cause of the exceedance. Therefore, a secondary investigation related to the potential source of Station NML-29 sulphate exceedances is recommended for the 2021 monitoring event, which should include the collection of samples for chemical analysis as well as field parameters.

Overall, water quality monitoring of the decommissioned Nanisivik Mine in 2020 indicates that the mine decommissioning is meeting its objectives.

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LIMITATIONS

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1.0 INTRODUCTION

The Nanisivik Mine (the Mine) was an underground lead and zinc mine located on the northern tip of Baffin Island, Nunavut that operated from 1976 to 2002, following which reclamation activities began. CanZinco Mines Ltd., a wholly owned subsidiary of Breakwater Resources Ltd., took possession of the Mine in 1998 and Nyrstar Sales and Marketing AG (Nyrstar) acquired Breakwater Resources Ltd. in 2011.

BGC Engineering Inc. (BGC) has provided geotechnical engineering, mine waste and mine closure support to the Mine since 2000, including the development and implementation of the reclamation plan for tailings deposits, waste rock piles, portals and open pits. Additionally, 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 and 2005.

In August 2020, BGC was retained by Nyrstar to carry out the water quality monitoring program in parallel with geotechnical and geothermal monitoring at the Mine (BGC, August 17, 2020). The water quality monitoring program is required under Water Licence 1AR-NAN2030 (Nunavut Water Board (NWB), January 9, 2020) to assess the overall performance of reclamation and closure activities at the former Nanisivik Mine.

The approved 2020 water quality monitoring scope of services (BGC, August 17, 2020) included three tasks:

1. A single water quality sampling program and associated analysis.
2. Data review and interpretation.
3. Reporting.

This technical report reflects Task 03 by summarizing the details of Tasks 01 and 02 and represents the first year of reporting under Water Licence 1AR-NAN2030.

1.1. Regulatory Framework

Since 1976, the Mine has operated under six different Water Licences issued by the Northwest Territories Water Board and the NWB:

1. Northwest Territories Water Licence N5L3-0159 – Northwest Territories Water Board (July, 1976); renewed in 1978, 1983, 1988, and 1991.
2. Nunavut Water Licence NWB1NAN9702 – NWB (July 1997; the original term of five years was extended until closure in September 2002.
3. Nunavut Water Licence NWB1NAN0208 – NWB (October 2002 to May 2008).
4. Nunavut Water Licence NWB1AR-NAN0914 – NWB (April 2009 to December 2014).
5. Nunavut Water Licence 1AR-NAN1419 – NWB (December 2014 to December 2019).
6. Nunavut Water Licence 1AR-NAN2030 – NWB (January 9, 2020 through January 8, 2030) – current approved Water Licence.

The current, approved Water Licence 1AR-NAN2030 authorizes and establishes the conditions for continued post-closure monitoring that may be needed to ensure the continued integrity and

functionality of completed reclamation works. The water quality monitoring conditions of Water Licence 1AR-NAN2030 represent a reduction in sampling locations, frequency and parameters required for analysis relative to the previous licences (as listed above). These changes are consistent with the progression of the decommissioning and post-closure monitoring period at the Mine. As indicated in the Schedule H (Table 1) of the Water Licence 1AR-NAN2030, water quality monitoring in 2020 encompasses a single annual monitoring event, which is to be completed in parallel with the Mine's geotechnical monitoring program. The monitoring schedule for the approved period of the Water Licence 1AR-NAN2030 (i.e., 2020 to 2029 inclusive) includes annual (one-time yearly) monitoring in years 2021, 2022, 2024, 2026, and 2029 (Schedule H, Table 1). Water quality monitoring is not required in years 2023, 2025 and 2027 to 2028, unless results from previous years necessitate a change to this monitoring schedule.

The Water Licence 1AR-NAN203 (Part D, Item 2) documents maximum authorized concentrations of select water quality parameters associated with discharge from the decommissioned West Twin Disposal Area (WTDA), as monitored at Station 159-4 (Table 1-1; Drawing 01).

Table 1-1. Effluent quality requirements for the WTDA monitored at Station 159-4.

Parameter	Maximum Authorized Concentration (mg/L)
Total Arsenic (mg/L)	0.25
Total Cadmium (mg/L)	0.005
Total Copper (mg/L)	0.10
Total Lead (mg/L)	0.10
Total Nickel (mg/L)	0.50
Total Zinc (mg/L)	0.25
Total Suspended Solids (mg/L)	15.0
pH (pH units)	6.0 – 9.5
Hydrocarbons (Oil and grease)	15.0[1]

Note:

1. As per Part D, Item 3 of the Water Licence 1AR-NAN2030, guideline to be applied if visible sheen observed.

Data for the remaining five water quality monitoring stations documented in the Water Licence 1AR-NAN2030 (i.e., NML-23, NML-29, NML-30, 159-6, 159-14) are to be compared to station-specific Action Levels for select parameters (i.e., cadmium, lead, zinc, sulphate, total suspended solids (TSS), pH and hydrocarbons), which are described in the Mine's *Contingency Plan for Water Quality Exceedances.* The Contingency Plan was recently updated by Stantec Consulting Ltd. (Stantec, March 27a, 2020) as required by the Water Licence 1AR-NAN2030 (Part H, Item 10), whereby Action Levels (for metals, sulphate and TSS) were provided for each station based on 99th percentile concentrations, calculated from station-specific monitoring data collected over the period 1996 to 2019 (Table 1-2). Previous versions of Action Levels (Stantec, March 24, 2015) were based on 95th percentile values from the 1996 to 2014 dataset. These

Action Level revisions in 2020 were provided to reflect the decrease in monitoring frequency (to annually) as part of the Water Licence 1AR-NAN2030 (Stantec, March 27a, 2020).

Action Levels for pH continue to reflect the permissive range listed for Station 159-4 in the Water Licence 1AR-NAN2030 (i.e., pH 6.0 to pH 9.5, as shown in Table 1-1). In accordance with the Water Licence 1AR-NAN2030 (Part H, Item 3), hydrocarbons (i.e., oil and grease) are also included with the station-specific Action Levels, whereby any observed hydrocarbon sheen necessitates the collection of additional water samples for hydrocarbon analysis and results are assessed against a 15.0 mg/L concentration (as shown below).

Table 1-2. Station-specific Action Levels (as presented in Stantec, March 27a, 2020).

Parameter	Units	Station				
		Twin Lakes Creek Watershed		Chris Creek Watershed	Landfill Watershed	
		159-6	NML-23	159-14	NML-29[1]	NML-30
Total Cadmium	mg/L	0.0297	0.0135	0.0010	0.0017	0.0017
Total Lead	mg/L	0.0893	0.0553	0.0115[2]	0.0062	0.0062
Total Zinc	mg/L	8.9	0.23	0.68	0.09	0.09
Total Sulphate	mg/L	614	118	960	340	340
Total Suspended Solids (TSS)	mg/L	140	20	158	113	113
pH[3]	pH units	6.0 – 9.5				
Hydrocarbons (Oil and grease)[4]	mg/L	15.0				

Note: Concentrations shown above are based on 99th percentile values (Stantec, March 27a, 2020).

1. NML-29 flow is intermittent. Action Levels in case of flow are the same as at NML-30.
2. BGC received notification from Nyrstar that, as part of a conversation between Nyrstar and Stantec on March 22, 2021, an error in the reporting of the Action Level for Total Lead at station 159-14 was identified in the Contingency Plan (Stantec, March 27a, 2020). The reported value (in the Contingency Plan) was 0.0015 mg/L; however, the correct Action Level value is 0.0115 mg/L, as shown in the table.
3. pH values are not calculated from historic ranges, but instead reflect the acceptable range listed for Station 159-4 noted in the Water Licence 1AR-NAN2030 (Table 1-1) (Stantec, March 27a, 2020).
4. Part H, Item 3 of the Water Licence 1AR-NAN2030 establishes the maximum concentration of oil and grease in water at any station where a petroleum hydrocarbon sheen may have been visually observed.

Details of the monitoring requirements are discussed in Section 3.0.

2.0 BACKGROUND

2.1. Site Description

The Nanisivik Mine is located 750 kilometres (km) north of the Arctic Circle at an approximate latitude of 73 degrees north and is approximately 33 km (by road) from the hamlet of Arctic Bay, in northern Baffin Island (Drawing 01).

Prior to decommissioning, the Mine facilities consisted of an underground mine and a 2,200 tonne per day concentrator that used conventional crushing, rod and ball mill grinding, differential lead and zinc flotation, and concentrate drying. Between 1976 and 2002, the underground facility extracted and shipped zinc and lead concentrates. Ore concentrates were shipped from a concentrate storage shed located adjacent to Strathcona Sound, where a deep-water wharf allowed ocean-going vessels to moor. Concentrates were transferred to ships using a ship-loader. Process tailings were transported to and deposited at the West Twin Disposal Area (WTDA), where resulting effluent was discharged into Twin Lakes Creek. The Mine was in operation from its opening 1976 until closure in September 2002 (Stantec, March 10, 2020).

Reclamation activities began at the Mine in 2002. On July 30, 2006, Environment Canada approved the Nanisivik Mine as having achieved “recognized closed mine” status under the *Metal Mining Effluent Regulations* and therefore, mine effluent and environmental effects monitoring requirements under those regulations were no longer required. On October 1, 2008, reclamation of the site was completed, and a post-closure monitoring period began (Stantec, March 10, 2020).

2.2. Previous Water Quality Monitoring Programs

Water quality monitoring in post-closure have previously been carried out by Stantec and results from the 2019 monitoring and prior periods have been summarized as follows (Stantec, March 10, 2020):

- The 2019 monitoring report states “the Mine decommissioning appears to have achieved its objectives with respect to overall water quality. Key areas that were decommissioned, such as the WTDA, Chris Creek, and Landfill watersheds have showed consistently good water quality results over the period 2008 to 2018”.
- Monitoring in 2019 occurred in July, August and September and results continue to generally show similar trends as previous years. Station 159-4 results did not exceed the maximum authorized concentrations for discharge. However, Action Level exceedances were noted at Stations 159-14, NML-23, NML-29 and NML-30, as summarized below.
    - Station 159-14: An Action Level TSS exceedance in July (only), which was not repeated in subsequent monitoring events in 2019 and interpreted to be associated with local erosion during freshet conditions. Action Level exceedances of sulphate and total zinc were also observed in September (only), which were suggested to be associated with seasonal thawing of near-surface permafrost.
    - Station NML-23: An Action Level sulphate exceedance was noted in July and September, with a similar elevated concentration at the nearby Station ELO, which

was interpreted as originating from the East Twin Lake watershed, as opposed to the former Nanisivik Mine, and likely promoted by the warmer climate in 2019.

  - Station NML-29: Action Level exceedances of sulphate and total zinc were observed at NML-29 over two consecutive monitoring events (i.e., August and September for sulphate, July and August for total zinc). A follow up site investigation was recommended for 2020 monitoring to assess the potential source of these exceedances at this station (to be discussed in Section 4.4.2)
  - Station NML-30: An Action Level exceedance of total zinc was observed in July. Total zinc values were below detection for the subsequent two monitoring events (in August and September), and Stantec (March 10, 2020) indicated "*no further action*" was recommended.

- The general Mine area is sensitive to warmer climatic temperatures, whereby thawing conditions promote the release of typically frozen water (held in permafrost) and have been interpreted to contribute to increases in concentrations of select parameters (e.g., sulphate) not related to the former Mine, as discussed above.

Past monitoring programs have typically included multiple water quality monitoring events. However, the Water Licence 1AR-NAN2030 required only one monitoring event to be completed in 2020.

3.0 2020 SAMPLING PROGRAM

3.1. Field Program

Water samples were collected at the Mine from the Twin Lakes Creek, Chris Creek and Landfill watersheds on August 21, 2020 by two BGC staff, Scott Garrison, P.Eng., and Jason Abboud, G.I.T. Mr. Garrison has collected water samples at the Mine since 2019, on behalf of Stantec and as part of previous year's water quality monitoring programs. The 2020 water quality monitoring program was carried out in conjunction with annual geotechnical monitoring, as required by the Water Licence 1AR-NAN2030.

Eight stations were sampled as part of the 2020 water quality monitoring program, which included the six stations identified in the Water Licence 1AR-NAN2030 (i.e., NML-23, 159-4, 159-6, 159-14, NML-29, NML-30) as well as two voluntary stations within the Twin Lakes Creek watershed for the reasons described below.

1. ELO station: As part of 2019 water quality monitoring annual reporting, Stantec (March 10, 2020) recommended water quality monitoring be continued at the ELO station in the Twin Lakes Creek Watershed as several, naturally occurring, water quality anomalies had been detected previously and continued monitoring will provide an improved understanding of the natural variations of water quality in this area. It is noted that Stantec provided an earlier, contradictory recommendation that sampling be suspended at this voluntary station, along with 159-6 Temp (described in the following bullet), which was documented in the Pre-Hearing Conference Decision Report regarding the Mine's Water Licence application for renewal and amendment (NWB, September 20, 2019). Although this discrepancy exists, BGC applied the recommendation from the more recent water quality reporting at the Mine and sampling was conducted at ELO station in 2020.
2. 159-6 Temp station: The 2019 water quality monitoring program included sampling at the 159-6 Temp station, located approximately 120 m upstream of 159-6 and 30 m upstream of a laydown area (Stantec, March 10, 2020). The 159-6 Temp station was established in 2016 to assess the potential for contamination due to construction activities, which ceased in 2019.

The location of these stations are shown in Drawing 01.

Photographs of the stations sampled, along with a qualitative description of the flow conditions (i.e., flowing or stagnant/ponding) are provided in Appendix A-1. Station markers are present at select but not all stations, with the remaining monitoring locations defined by coordinates on a map provided to BGC by Stantec. Flowing conditions were observed at six of the eight stations, with stagnant conditions observed at Station 159-4 and Station NML-29. Field parameters were also collected at each sampling station, which are discussed in Section 3.2.

3.2. Water Quality Analysis

Water quality monitoring at the Mine involved the following prescribed parameter suites, as described in in the Water Licence 1AR-NAN2030 (Schedule H, Table 2):

- NAN-1[1]: Trace (total) metal analysis (arsenic, cadmium, copper, lead, nickel and zinc), major cations (calcium, magnesium, sodium, potassium, and hardness), major anions (chloride, sulphate, bicarbonate, carbonate, nitrate + nitrite (as N), and alkalinity), ammonia ($N\text{-}NH_3$), TSS, field parameters (specific conductivity, temperature, pH, and visual observation for hydrocarbon sheen).
- NAN-2: petroleum hydrocarbon analysis of F2 to F4 hydrocarbons

Samples did not require filtration and samples collected for trace (total) metal analysis were dispensed into laboratory-provided sample bottles containing the necessary acid preservative (i.e., nitric acid).

The Water Licence 1AR-NAN2030 does not require pH nor conductivity to be measured by the laboratory as part of the NAN-1 parameter suite; however, the inclusion of these parameters as part of laboratory measurements was based on recommendations from Stantec (March 10, 2020), to allow for an assessment of the robustness of field sampling methods. Further details of the data quality assessment are provided in Section 4.1.

For the two voluntary stations (i.e., ELO and 159-6 Temp), samples were submitted for the same parameter suite(s) as its nearest station(s). A summary of the sampling conducted at each station is provided in Table 3-1.

Table 3-1. Analytical schedule 2020 monitoring.

Station	Station Description	Parameter Suite[1,2]
Twin Lakes Creek Watershed		
159-4	Outflow from WTDA; final discharge point	NAN-1
159-6	Outlet of Twin Lakes Creek into Strathcona Sound	NAN-1, NAN-2
159-6 Temp	Outlet of Twin Lakes Creek into Strathcona Sound, upstream of the wharf construction laydown area and ground disturbing activities and upstream of 159-6; voluntary station	NAN-1, NAN-2
ELO	Outflow of East Twin Lake upstream of NML-23; voluntary station	NAN-1
NML-23	Outflow from East Twin Lake	NAN-1

[1] The Water Licence 1AR-NAN2030 (Schedule H, Table 2) does not include total arsenic, copper and nickel; however, these parameters were measured by the laboratory as they reflect parameters with regulated conditions and comparison criteria for the Mine (Part D, Item 2 and Part H, Item 10).

Station	Station Description	Parameter Suite[1,2]
Chris Creek Watershed		
159-14	Chris Creek downstream of K-Baseline[3]	NAN-1
Landfill Watershed		
NML-29	Downstream of Landfill – East Drainage System	NAN-1, NAN-2
NML-30	Downstream of Landfill – West Drainage	NAN-1, NAN-2

Note: For the six stations regulated by the Water Licence 1AR-NAN2030 (i.e., 159-4, 159-6, 159-14, NML-23, NML-29, NML-30), the above is in accordance with details provided therein in Schedule H, Table 3.

1. Field parameters also recorded at each station (i.e., specific conductivity, temperature, pH, visual observations for hydrocarbon sheen).
2. Trace (total) metals as part of the NAN-1 analytical suite were also analyzed for arsenic, copper and nickel.
3. K-baseline understood by BGC to refer to historical mine workings, as shown in Drawing 01.

Field parameters were recorded at the time of sampling at the eight stations using an Aqua TROLL 600[2], which included measurements of the following parameters: conductivity, temperature, and pH. The presence of a hydrocarbon sheen (if observed) was also noted at the time of sampling.

3.3. Quality Assurance and Quality Control

Five additional samples were collected for the purposes of quality assurance and quality control (QA/QC), which included three field duplicate samples collected at stations 159-4, 159-6, and 159-14, as well as one travel blank and one field blank. Duplicate samples were submitted for the same analytical suite as its parent sample and were collected in sequence. The field blank and travel blank were analyzed for the NAN-1 and NAN-2 parameter suite.

The Water Licence 1AR-NAN2030 indicates sampling methods are to be in accordance with the Mine's recently updated QA/QC Plan (Stantec, March 27b, 2020). As a result of the expedient timeline between the time of BGC's approved proposal (BGC, August 17, 2020) and field work on August 21, 2020, the QA/QC Plan was not available for review prior to sampling. Hence, BGC collected samples in accordance with:

- Guidance provided by other provincial jurisdictions (e.g., British Columbia Field Sampling Manual, 2013; CCME, 2016)
- Methods prescribed in the current edition of "*Standard Methods for the Examination of Water and Wastewater*" (APHA AWWA ,2017)
- BGC and typical analytical laboratory practices.

Review of the QA/QC Plan (Stantec, March 27b, 2020) after the August 2020 sampling was completed and confirmed the field and sampling practices carried out by BGC were in agreement with these QA/QC requirements and consistent with the previous years' monitoring. However, it is noted that BGC submitted three field duplicates, one field blank and one travel blank, which

[2] The multiparameter sonde was calibrated prior to travel to the field, with an acceptable pH calibration slope (from a three-point calibration) of -55.68 mV/pH and measurements of the conductivity meter were within ±3% of the 1,413 µS/cm calibration solution. Spot checks, using a single pH buffer solution, were performed in the field.

exceeded the recommended one field duplicate and one field blank in the QA/QC Plan (Stantec, March 27b, 2020).

The 13 samples (i.e., eight station samples and five QA/QC samples) were shipped in coolers with cold packs and a chain-of-custody to Eurofins Environment Testing Inc. (Eurofins) in Ottawa, Canada for analysis. Samples were received by Eurofins on August 28, 2020 with an acceptable shipment temperature of 8^{o}C.

4.0 RESULTS

Laboratory certificates of analysis are provided in Appendix B, with time-series figures of select parameters from the six monitoring stations identified in the Water Licence 1AR-NAN2030 shown in Appendix C.

4.1. QA/QC Results

Upon receipt of the laboratory results, the quality of the data was checked using the following QA/QC methods and data quality objectives (DQOs):

- Field pH versus laboratory pH: DQO of less than +/- 0.5 pH unit difference between field and laboratory measurements.
- Field conductivity vs laboratory conductivity: DQO of less than 20% relative percent difference (RPD)[3].
- Cation/anion percent different: DQO of within +/- 10% percent difference.
- Field duplicate sample comparison: DQO less than 20% RPD for those parameters with values greater than five times (5x) the detection limit for both the parent and duplicate sample. Values that are less than 5x the parameter-specific detection limit are considered below its practical quantification limit (PQL) whereby measurements may not be reproducible and RPD values may not be valid. For duplicate samples collected in sequence, more than 70% of the parameters should meet this DQO.
- Field and travel blank measurements: DQO of measured parameters to contain concentrations below 5x the parameter-specific detection limit.

These DQOs are based on BGC standard of practice, as well as guidance provided from the BC MOE (2013) and typical QA/QC practices from analytical laboratories. The goal of a DQO is to provide a threshold whereby data is scrutinized for robustness should the DQO not be met. This QA/QC assessment is completed to review the accuracy of field and laboratory methods used as part of the 2020 water quality monitoring program and to provide an appraisal of the representativeness of samples results to site conditions.

4.1.1. pH

The results of the comparison of field versus laboratory pH values are shown in Figure 4-1. Three (of 8) samples meet the pH DQO of +/-0.5 units, with the remainder between 0.5 pH unit and 1.0 pH unit difference. No samples have a field to laboratory pH discrepancy greater than 1.0 pH units.

[3] Relative Percent Difference (RPD) % = |Original Sample – Duplicate Sample|/Average (Original Sample, Duplicate Sample) * 100.

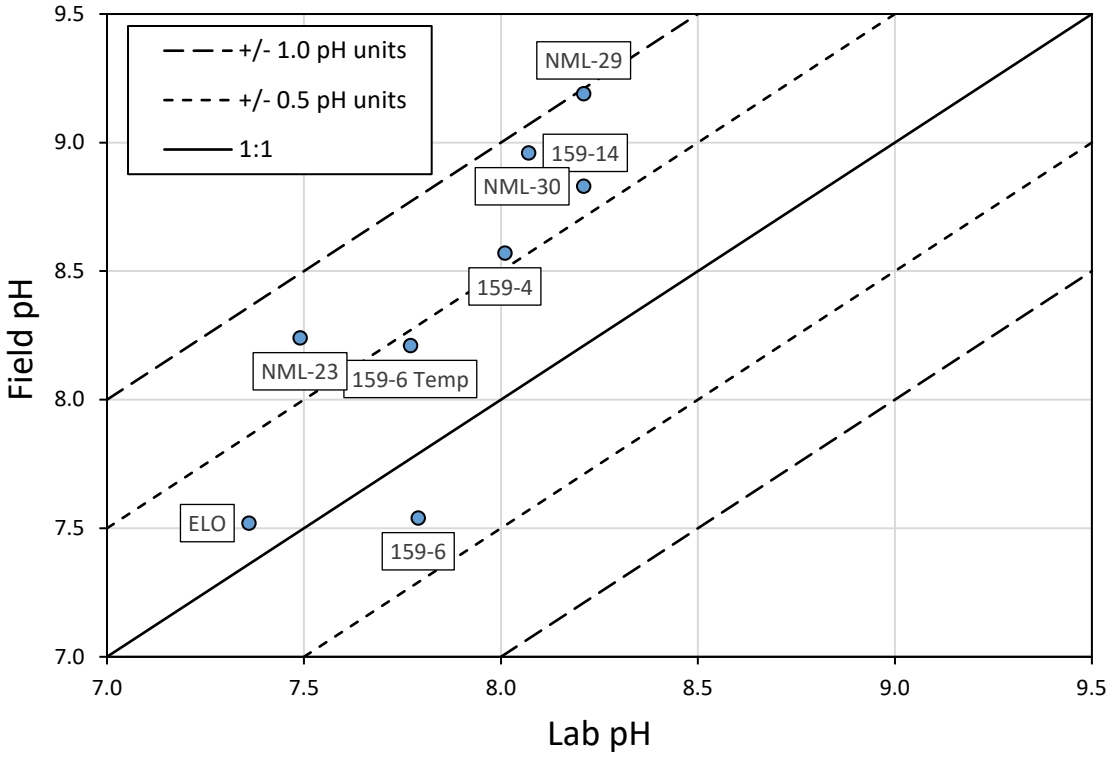

Figure 4-1. Comparison of field versus laboratory pH.

Figure 4-1 shows that most samples (i.e., 7 of 8) contain higher field pH measurements relative to values recorded by the laboratory. The five samples that do not meet the pH DQO have pH values within the typical range observed at the site (Appendix C). Hence, field measured pH values are considered to be representative of site conditions at the time of sampling.

4.1.2. Specific Conductance

Field conductivity values were temperature-corrected to 25^{o}C to allow for a comparison to laboratory-measured conductivity values. The field versus laboratory measured specific conductance values are shown in Figure 4-2, which are comparable and meet the DQO (of RPD < 20%) for all samples collected.

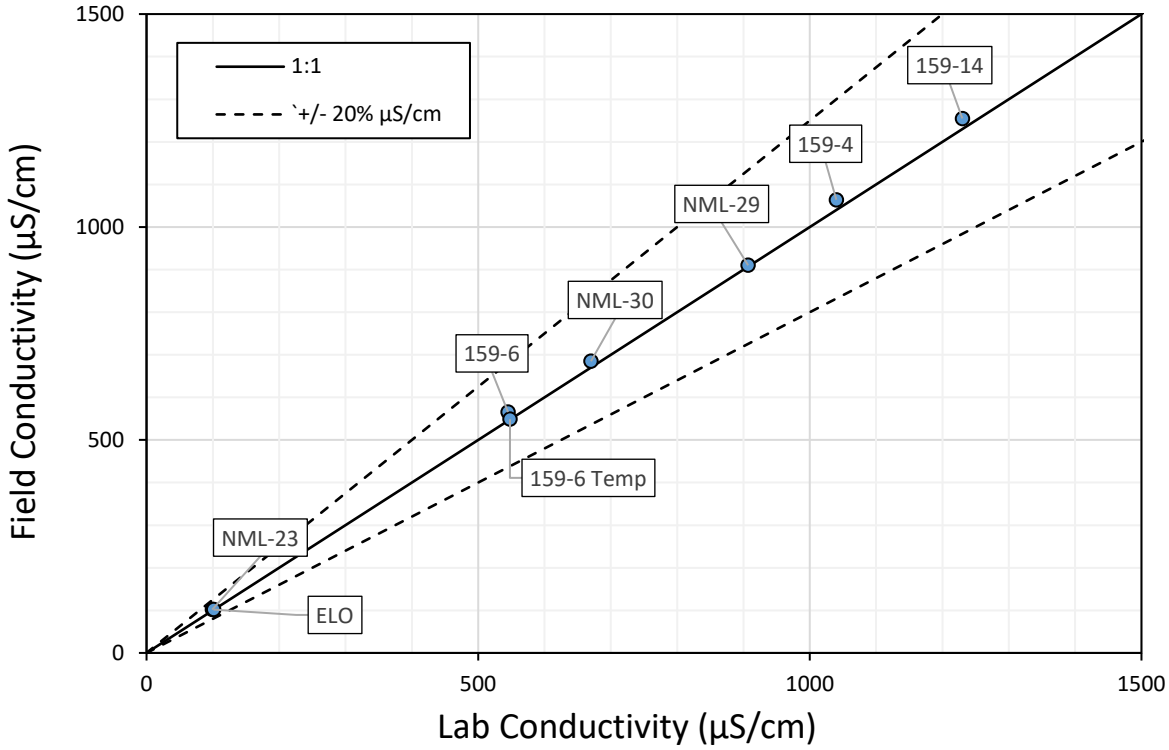

Figure 4-2. Comparison of field versus laboratory conductivity.

4.1.3. Cation-Anion Percent Balance

The cation-anion percent balance is an assessment of electrical neutrality and the completeness of a sample's chemical results, and is calculated based on the soluble major cation and anion constituents present in solution. The cation-anion percent balance was conducted using the hydrogeochemical speciation software PHREEQC (Parkhurst and Appelo, 2013) as it was not provided by the laboratory. All eight samples are within the DQO of +/- 10%.

4.1.4. Duplicate, Field Blank, and Travel Blank Samples

Comparison of the field duplicate samples taken, in sequence, at 159-4, 159-6, and 159-14 to its parent samples collected at these three stations shows RPD values of less than or equal to 20% for all parameters with values greater than 5x its DL, thereby meeting the DQO for duplicates (Table 4-1).

Table 4-1. Field duplicate QA/QC assessment.

Parameter	Units	Station 159-14			Station 159-4			Station 159-6		
		Parent sample	Duplicate Sample	RPD (%)	Parent sample	Duplicate Sample	RPD (%)	Parent sample	Duplicate Sample	RPD (%)
Conductivity	uS/cm	1230	1240	0.81	1040	1030	0.97	545	545	0.00
Alkalinity as $CaCO_3$	mg/L	109	109	0.00	83	94	12.43	56	66	16.39
HCO_3 as $CaCO_3$	mg/L	109	109	0.00	83	94	12.43	56	66	16.39
Hardness as $CaCO_3$	mg/L	723	726	0.41	567	567	0.00	275	275	0.00
TSS	mg/L	<2	3	-	<2	7	-	<2	<2	-
NO_2 + NO_3 (as N)	mg/L	0.25	0.26	3.92	0.14	0.14	0.00	0.36	0.36	0.00
$N\text{-}NH_3$	mg/L	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-
Total Sulphate	mg/L	506	505	0.20	505	506	0.20	218	222	1.82
Calcium	mg/L	128	129	0.78	123	123	0.00	54	54	0.00
Potassium	mg/L	1	1	0.00	6	6	0.00	2	2	0.00
Magnesium	mg/L	98	98	0.00	63	63	0.00	34	34	0.00
Sodium	mg/L	3	3	0.00	3	3	0.00	2	2	0.00
Total Arsenic	mg/L	<0.001	<0.001	-	<0.001	<0.001	-	<0.001	<0.001	-
Total Cadmium	mg/L	0.0001	<0.0001	-	0.0002	0.0002	0.00	0.0008	0.0009	11.76
Chloride	mg/L	7	7	0.00	9	9	0.00	4	4	0.00
Total Copper	mg/L	<0.001	<0.001	-	0.001	0.001	0.00	<0.001	<0.001	-
Total Nickel	mg/L	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-
Total Lead	mg/L	<0.001	<0.001	-	0.002	0.002	0.00	<0.001	<0.001	-
Total Zinc	mg/L	0.19	0.19	0.00	0.05	0.05	0.00	0.38	0.38	0.00

Notes: RPD = relative percent difference, refer to Section 3.1 for equation.

1. RPD = relative percent difference, refer to Section 3.1 for equation.
2. (-) = RPD not calculated as one or both duplicate and parent samples contain values less than 5x the detection limit.

The field blank and travel blank results are all below the parameter-specific detection limit for all measured parameters, thereby meeting the DQO. Field blank and travel blank results are provided in Appendix B.

4.1.5. QA/QC Summary

Overall, the QA/QC procedures implemented by BGC as part of the 2020 water quality monitoring program generally meet the various DQOs to support the accuracy of field and laboratory methods used as part of this monitoring program. Sample results associated with the sampled stations are considered robust and reflective of site conditions.

4.2. Twin Lakes Creek Watershed

4.2.1. Station 159-4 (Final Discharge Point)

Water quality data collected at Station 159-4 are compared to the maximum authorized water quality limits for discharge from the WTDA, as provided in Part D, Items 2 and 3 of the Water Licence. The water quality data for the parameters specified in the Water Licence 1AR-NAN2030 at Station 159-4 are presented in Table 4-2, with complete data provided in Appendix B and time-series figures of the station's historical dataset provided in Appendix C (Figure C-1).

Measured concentrations of the regulated parameters (i.e., arsenic, cadmium, copper, lead, nickel, zinc and total suspended solids) are below the maximum authorized concentrations and pH is within the authorized range of pH 6.0 to pH 9.5. A visible hydrocarbon sheen was not observed in 2020 sampling program at Station 159-4.

Table 4-2. Comparison of Station 159-4 chemistry to water quality limit criteria (from Water Licence 1AR-NAN2030).

Parameter	Units	Maximum Authorized Concentration[1]	Station 159-4 (Aug. 21, 2020)
Total Arsenic	mg/L	0.25	<0.001
Total Cadmium	mg/L	0.005	0.0002
Total Copper	mg/L	0.1	0.001
Total Lead	mg/L	0.1	0.002
Total Nickel	mg/L	0.5	<0.005
Total Zinc	mg/L	0.25	0.05
Total Suspended Solids	mg/L	15	<2
pH	pH units	6.0-9.5	8.57
Hydrocarbons (Oil and grease)	mg/L	15.0[2]	-[3]

Notes: **Bolded** text reflects exceedance of Maximum Authorized Concentration criteria.

1. From Part D, Items 2 and 3 of the Water Licence 1AR-NAN2030.
2. Criteria applied if visible sheen observed.
3. No visible sheen observed as part of 2020 monitoring, therefore samples were not collected for hydrocarbon analysis (i.e., NAN-2 parameter suite; refer to Section 3.2).

Sulphate is not included in the criteria parameter list for Station 159-4, but is typically reviewed to assess the presence of acid rock drainage (ARD) conditions. Sulphate concentration at Station 159-4 is 505 mg/L and within the historical range observed at this station (Appendix C). Additionally, concentrations of sulphate, as well as other metals (e.g., Cd, Pb, Zn), present a visually interpreted decreasing trend with time from operations to post-closure periods, suggestive of improving conditions.

4.2.2. Other Stations

In addition to Station 159-4, four other stations present in the Twin Lakes Creek watershed were sampled in 2020 (i.e., 159-6, NML-23, 159-6 Temp, and ELO). Station 159-6 is located along Twin Lakes Creek, prior to discharging into Strathcona Sound, and Station NML-23 is located in the upper reach of the Twin Lakes Creek watershed near the outlet of East Twin Lake (Drawing 01). Both of these stations are identified in the Water Licence 1AR-NAN2030 for post-closure monitoring. The remaining two stations reflect stations that are not noted in the Water Licence 1AR-NAN2030, which are located near the two regulated stations in this watershed: Station 159-6 Temp (located immediately upstream of Station 159-6 and upstream of historic construction that was the impetus for this temporary location) and ELO (located at the outlet to East Twin Lake, upstream of NML-23). BGC understands ELO was established to investigate previously noted increasing sulphate concentrations at NML-23.

Select water quality data for these four stations (i.e., 159-6, 159-6 Temp, NML-23, and ELO) are presented in Table 4-3 along with the comparison station-specific action levels (where applicable). Action Levels are not applied to voluntary stations (i.e., 159-6 Temp and ELO).

Results shown in Table 4-3 indicate there are no exceedances of the station-specific Action Levels identified at either Station 159-6 or NML-23 as part of the 2020 monitoring program. A visible sheen from petroleum hydrocarbons was not observed at any of these five monitoring stations in the Twin Lakes Creek watershed and, for those stations whereby samples were submitted for petroleum hydrocarbon analysis (i.e., NAN-2 parameter suite; 159-6, 159-6 Temp), measured concentrations were below laboratory detection.

Table 4-3. Select data from Twin Lakes Creek watershed stations, collected August 21, 2020.

Parameter	Units	Monitoring Stations in Water Licence 1AR-NAN2030[1]				Voluntary Monitoring Stations[2]	
		Action Level - Station 159-6	Station 159-6	Action Level - Station NML-23	Station NML-23	Station 159-6 Temp	Station ELO
Total Cadmium	mg/L	0.0297	0.0008	0.0135	<0.0001	0.0008	<0.0001
Total Lead	mg/L	0.0893	<0.001	0.0553	<0.001	<0.001	<0.001
Total Zinc	mg/L	8.9	0.38	0.23	<0.01	0.37	<0.01
Total Sulphate	mg/L	614	218	118	28	217	28
Total Suspended Solids	mg/L	140	<2	20	<2	<2	<2
pH	pH units	6.0-9.5	7.54	6.0-9.5	8.24	8.21	7.52
Hydrocarbons (Oil and grease)	mg/L	15.0[3]	b.d.[4,5]	15.0[3]	n.a.[4]	b.d.[4,5]	n.a.[4]

Notes: **Bolded** text reflects exceedance of station-specific Action Levels. "b.d." = below detection; "n.a." = not analyzed, in accordance with Schedule H, Table 3 of the Water Licence 1AR-NAN2030.

1. Action Levels have been recently updated as part of the approval of Water Licence 1AR-NAN2030, which were provided in Stantec (March 27a, 2020); refer to Section 1.1 for details.
2. Action Levels apply to monitoring stations identified in the Water Licence 1AR-NAN2030 only.
3. Criteria applied if visible sheen observed.
4. No visible hydrocarbon sheen observed.
5. Samples were submitted for hydrocarbon analysis (i.e., NAN-2 parameter suite; Section 3.2); results are below analytical detection limits for the hydrocarbon fractions analyzed, which are 0.020 mg/L and 0.050 mg/L (refer to Appendix B) and below the 15.0 mg/L Action Level.

A comparison of the chemistry at Station 159-6 versus Station 159-6 Temp and NML-23 versus ELO shows results are similar between the paired stations (Appendix B), which is supported by the geospatial proximity of these sample stations to each other (refer to Drawing 01). The comparison of Station 159-6 Temp to its downstream Station 159-6 suggests potential impacts from previous construction activities upstream are not observed. Similarly, the comparable chemistry at Station NML-23 and Station ELO indicate water quality is not noted to vary considerably between these locations.

4.3. Chris Creek Watershed

Station 159-14 is located in Chris Creek approximately 1.6 km upstream of its discharge to Strathcona Sound and downstream of the historic mine workings (K-baseline, East Trench, and East Open Pit, shown on Drawing 01). Select water quality data (i.e., those parameters with Action Levels) for Station 159-14 are presented in Table 4-4 along with the comparison station-specific Action Levels, with the complete data provided in Appendix B. Time-series figures of the full dataset are provided in Appendix C. No Action Level exceedances are reported at Station 159-14 in 2020.

Table 4-4. Select data from Chris Creek watershed station –Station 159-14.

Parameter	Units	Action Level - Station 159-14[1]	Station 159-14 (Aug. 21, 2020)
Total Cadmium	mg/L	0.0010	0.0001
Total Lead	mg/L	0.0115	<0.001
Total Zinc	mg/L	0.68	0.19
Total Sulphate	mg/L	960	506
TSS	mg/L	158	<2
pH (field)	pH units	6.0-9.5	8.96
Hydrocarbons (Oil and grease)	mg/L	15.0[2]	-[3]

Notes: **Bolded** text reflects exceedance of station-specific Action Levels.

1. Action Levels have been recently updated as part of the approval of Water Licence 1AR-NAN2030, which are provided in Stantec (March 27a, 2020); refer to Section 1.1 for details.
2. Criteria applied if visible sheen observed.
3. No visible hydrocarbon sheen observed.

It is noted that exceedances of the previous Action Level concentrations (i.e., based on 95th percentile values) were observed in 2019 for TSS, sulphate and total zinc (Stantec, March 10, 2020). The 2019 sulphate and total zinc exceedances (i.e., sulphate: 742 mg/L (measured) versus 408 mg/L Action Level; total zinc: 0.25 mg/L (measured) versus 0.13 mg/L Action Level) were observed during the September 4, 2019 monitoring event and were interpreted to be suggestive of natural weathering of sulphide minerals within the Chris Creek watershed (Stantec, March 10, 2020). Concentrations of sulphate and total zinc measured in 2020 (shown above in Table 3-4) are noted to have decreased from the September 2019 Action Level exceedance values and

review of time-series figures (in Appendix C) at this station are not suggestive of a visually interpreted increasing or decreasing trend.

As noted in Stantec (March 10, 2020), the July 5, 2019 elevated TSS value (of 41 mg/L, versus the 2019 Action Level of 32 mg/L) is typical of spring freshet conditions and TSS values returned to values below the applied Action Level for the remainder of the year (i.e., August 10, 2019: <2 mg/L; September 4, 2019: 6 mg/L). Measured TSS in August 2020 is below detection (i.e., < 2 mg/L), which is similar to the results noted in August 2019 (of <2 mg/L).

4.4. Landfill Watershed

The former Landfill is located west of the Mine and has been reclaimed with a cover system. A water diversion berm that was constructed during operation of the facility extends along the south to the west side of the facility (Drawing 02). Seepage and runoff (i.e., thawing porewaters from the active layer and/or snowmelt/precipitation) from the Landfill area migrates radially northwards towards either a west-flowing or east/northeast-flowing (naturally occurring) drainage system. Monitoring stations NML-29 and NML-30 are located along the east/northeast and west -flowing drainages, respectively (Drawing 01). Runoff from areas upslope of the Landfill is generally conveyed towards the west-flowing drainage system located to the north of the Landfill. Flow has only occasionally been observed at Station NML-29 but is regularly observed at Station NML-30. In 2020, water was observed to be stagnant at Station NML-29 and flowing at Station NML-30 (refer to Appendix A-1).

Select water quality data (i.e., those parameters with Action Levels) for Stations NML-29 and NML-30 are presented in Table 4-5 along with comparison to station-specific action levels, with the complete data provided in Appendix B. Time-series figures of these datasets are provided in Appendix C.

Table 4-5. Select data from Landfill watershed stations - Stations NML-29 and NML-30.

Parameter	Units	Action Level - Station NML-29, NML-30[1]	NML-29 (Aug. 21, 2020)	NML-30 (Aug. 21, 2020)
Total Cadmium	mg/L	0.0017	<0.0001	<0.0001
Total Lead	mg/L	0.0062	<0.001	<0.001
Total Zinc	mg/L	0.09	0.01	<0.01
Total Sulphate	mg/L	340	**346**	209
TSS	mg/L	113	15	<2
pH (field)	pH units	6.0-9.5	9.19	8.83
Hydrocarbons (Oil and grease)	mg/L	15.0[2]	b.d.[3,4]	b.d.[3,4]

Notes: **Bolded** text reflects exceedance of station-specific Action Levels."b.d." = below detection

1. Action Levels have been recently updated as part of the approval of Water Licence 1AR-NAN2030, which are provided in Stantec (March 27a, 2020); refer to Section 1.1 for details. Action Levels are the same for both NML-29 and NML-30.
2. Criteria applied if visible sheen observed.
3. No visible hydrocarbon sheen observed.

4. Samples were submitted for hydrocarbon analysis (i.e., NAN-2 parameter suite; Section 3.2); results are below analytical detection limits for the hydrocarbon fractions analyzed, which are 0.020 mg/L and 0.050 mg/L (refer to Appendix B) and below the 15.0 mg/L Action Level.

A single exceedance of the site-specific Action Level for sulphate is noted at NML-29, whereby the measured sulphate value of 346 mg/L slightly exceeds the Action Level of 340 mg/L. Further details as to the potential source of this exceedance is discussed below in Section 4.4.2.

4.4.1. Previous (2019) Exceedances

Several exceedances of station-specific Action Levels were detected at stations within the Landfill watershed in 2019. Specifically, total sulphate values measured at NML-29 on August 12, 2019 and September 4, 2019 at NML-29 exceeded the (previous) Action Level value of 240 mg/L (i.e., 467 mg/L and 347 mg/L, respectively). Additionally, total zinc measured at NML-29 exceeded the (previous) Action Level value of 0.03 mg/L on July 5, 2019 and August 12, 2019 (i.e., 0.96 mg/L and 0.04 mg/L). At NML-30, a single exceedance of total zinc was observed from the July 5, 2019 monitoring event (i.e., 0.09 mg/L (measured) versus 0.03 mg/L (Action Level)).

It was postulated that the warm temperatures at the Mine in 2019 may have promoted seasonal thawing of surface permafrost and allowed for the release of water containing elevated zinc and sulphate from either the Landfill, and/or native materials located upgradient of or adjacent of NML-29. However, inspection of the Landfill and its cover in 2019 indicated no abnormal geotechnical conditions and monitoring of thermistors and frost gauges supported a comparable cover performance and conditions as previous years (BGC, February 24, 2020). A recommendation to carry out an investigation near Station NML-29 was included as part of 2019 annual reporting (Stantec, March 10, 2020), which is discussed below.

4.4.2. Station NML-29 Site Investigation

Given the exceedances denoted at NML-29 in 2019 (and described in Section 4.4.1), an investigation using a hand-held conductivity meter was performed to assess if water quality exceedances at Station NML-29 may have originated from the Landfill and/or other nearby inputs/sources. This investigation was completed in accordance with the *Contingency Plan for Water Quality Exceedances* (Stantec, March 24, 2015) which recommends such an investigation is conducted following occurrences of Action Levels exceedances over two consecutive occasions.

Nine investigation points near to and upstream of Station NML-29 (Drawing 02) were sampled for field parameters (only), with results shown in Table 4-6 and Appendix A-2. All nine investigation points present conductivities and TDS concentrations greater than those measured at NML-29. The nine investigation points include seeps adjacent the main channel as well as locations within the drainage channel (but upstream of NML-29).

Review of the climate data from 2020 indicates the Mine experienced colder winter months and warmer summer months, relative to the historical average (i.e., from data collected between 1977 and 2020; BGC, March 23, 2021). Although these warmer temperatures were noted, no seepage

at the toe of the Landfill was observed in 2020 and monitoring data (i.e., one thermistor and one frost gauge) from the Landfill cover[4] indicates the active layer thaw did not penetrate into the underlying waste material such that the thaw depth was comparable to measurements in 2019 (BGC, March 23, 2021).

Table 4-6. Field parameters measured at NML-29 investigation points.

Location ID[1]	Flow conditions/ Description	pH (pH units)	Conductivity (µS/cm)[2]	Temperature (ºC)	TDS (mg/L)
GPS Pt. 6	Clear, stagnant	7.44	802.5	4.89	530
GPS Pt. 7	Clear, stagnant	7.63	1047.0	3.97	680
GPS Pt. 8	Clear, stagnant	7.98	797.9	3.17	490
GPS Pt. 9	Clear, stagnant	8.07	771.0	3.06	500
GPS Pt. 10	Clear, stagnant	7.94	833.1	3.22	550
GPS Pt. 11	Clear, stagnant; north side drainage, minor flow from N side downslope towards confluence toward S side of landfill	7.96	1159.9	2.66	750
GPS Pt. 12	Clear, flowing	8.25	811.6	2.74	530
GPS Pt. 13	Clear, stagnant	8.38	1330.3	2.41	870
GPS Pt. 14	Clear, stagnant; drainage from natural S slope and access road	8.30	1187.2	2.67	700
NML-29	Clear, stagnant	9.19	576.4	6.80	430

Notes:
1. NML-29 investigation points shown in Drawing 02, with photographs and field parameter results provided in Appendix A-2.
2. Conductivities shown were collected in the field and do not reflect temperature corrected (to 25ºC) values that may be compared to laboratory conductivity measurements.

A localized area of seepage, likely associated with active layer thaw, was observed on a south-facing slope to the northside of the drainage channel (i.e., opposite of the Landfill), approximately 150 m upstream of NML-29 (approximately 180 m NNE of the toe of the Landfill) and near GPS Pt. 11 (Figure 4-4). Clear water was observed emanating from the base of the slope and entering the valley before reporting to Station NML-29. Field conductivity at GPS Pt. 11 (i.e., 1159.9 µS/cm) and the two downstream locations, GPS Pt. 13 and GPS Pt. 14 (i.e., 1330.3 µS/cm and 1187.2 µS/cm, respectively), show the highest values of the NML-29 investigation points. Additionally, given the topography of the local area it is unlikely that much if any surface flow that reports to NML-29 originates from the landfill facility, suggesting the source of the elevated conductivity values is the natural ground in close proximity to Station NML-29.

[4] Constructed over the Nanisivik Landfill in 2005; consists of a 2 m thick layer (minimum thickness) of granular shale overlain by a 0.25 m thick layer of armour material comprised of sand, gravel and cobbles (BGC, March 23, 2021.

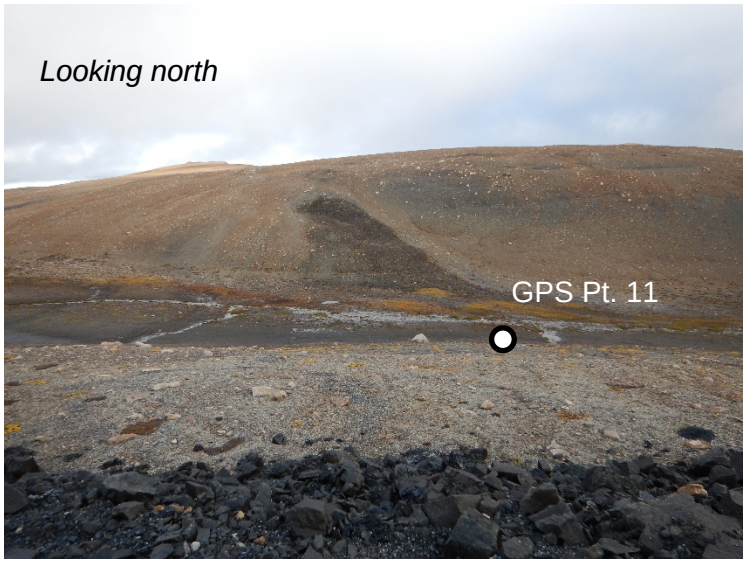

Figure 4-3. Photograph showing localized seepage, upstream of Station NML-29, near GPS Pt. 11.

Based on these observations, the sulphate Action Level exceedances at NML-29 are likely associated with seepage and (potentially) thawing conditions from the north side of the drainage channel, or an area(s) other than the Landfill that discharge to the drainage channel (along which NML-29 is located).

As outlined in the *Contingency Plan for Water Quality Exceedances* (Stantec, March 27a, 2020), if a station-specific Action Level is exceeded for any key parameters at the same monitoring station once in a season, an investigation is to be initiated to determine the cause of the exceedance[5]. Therefore, a secondary investigation is recommended for Station NML-29, which should include additional baseline points as well as more detailed mapping of any observed seepage where elevated conductivities (i.e., > 1,000 µS/cm) are observed, including investigation of evidence accounting for these values (e.g., erosion of mineralized outcrops, erosion, sources of turbidity). Similar to 2020, measurement of field parameters along the water course and at defined intervals upstream of NML-29 should be conducted in 2021, with collection of samples for chemical analysis.

[5] For reference, the previous Contingency Plan (Stantec, March 10, 2015) required a follow-up site investigation to be initiated if Action Level exceedances were exceeded over *two* consecutive events.

5.0 SUMMARY AND RECOMMENDATIONS

5.1. Summary

Water quality monitoring in accordance with the Water Licence 1AR-NAN2030 for the decommissioned Nanisivik Mine was completed in a single, annual event conducted on August 21, 2020. Eight stations were sampled, which included the six monitoring stations outlined in the Water Licence 1AR-NAN2030 (i.e., Stations 159-4, 159-6, 159-14, NML-23, NML-29, and NML-30) and two voluntary stations (i.e., Station 159-6 Temp and ELO). In addition, three field duplicates (collected in sequence), one field blank and one travel blank were collected to assess the quality of field sampling and laboratory analytical methods.

Results from the five QA/QC samples demonstrate the sample collection and analysis methods are robust and results associated with the eight monitoring stations are representative of the conditions at the time of sampling. A comparison of the 2020 results show compliance with maximum authorized concentrations at Station 159-4 (i.e., the final discharge point of the WTDA) and site-specific Action Levels at Station 159-6, Station 159-14, Station NML-23, and Station NML-30.

A single Action Level exceedance of sulphate is observed at Station NML-29, whereby the measured value of 346 mg/L is slightly greater than the Action Level sulphate concentration of 340 mg/L. The chemistry measured at voluntary stations Station ELO and Station 159-6 Temp are similar to their adjacent monitoring stations (i.e., NML-23 and Station 159-6); therefore, these results suggest limited variability is observed between Stations NML-23 and ELO and potential impacts from construction (prior to 2019 and upstream of Station 159-6) are not observed.

Sulphate and total zinc exceedances of Station NML-29 Action Levels were noted in 2019 for two of the three monitoring events conducted that year. As recommended in Stantec (March 10, 2020) and in accordance with the Mine's 2015 Contingency Plan (Stantec, March 24, 2015), a site investigation was carried out near Station NML-29 to assess the potential source of the 2019 Action Level exceedances. Nine investigation points were visited in 2020 and sampled for field parameters (only). These results, along with visual observations during the inspection, review of the 2020 climate and geothermal monitoring completed at the Landfill cover as part of geotechnical monitoring (BGC, March 23, 2021), suggests the source of the exceedance is from sources from the north side of the NML-29 drainage channel and not likely originating from the Landfill.

5.2. Recommendations for 2021

The following outlines recommendations for 2021 water quality monitoring at the Mine, based on the results presented in this report.

- The QA/QC sampling to be carried out in 2021 is recommended to be similar to the number and types of QA/QC samples collected as part of 2020, with two to three field duplicates, one field blank and one travel blank.

- The two voluntary stations monitored in 2020, Station ELO and Station 159-6 Temp, show similar chemistries to those from the nearby stations outlined in the Water Licence 1AR-NAN2030 (i.e., Station NML-23 and Station 159-6). Results from Station 159-6 Temp suggest potential impacts to the Twin Lakes Creek from construction activities (prior to 2019) are not observed. Similarly, the natural variability along the upper reaches of the Twin Lakes Creek watershed are not observed by the chemistries collected at Stations NML-23 and ELO. Therefore, these two voluntary stations do not need to be sampled as part of the 2021 monitoring program.
- Results from the Station NML-29 investigation indicate seepage from the Landfill is not likely contributing to the observed Action Level exceedances, whereas thawing conditions observed on the south-facing slope (from the north side of the channel) draining towards the NML-29 drainage system are interpreted to be a more likely influence on the exceedances noted at Station NML-29. As NML-29 sulphate Action Level exceedances are again noted in 2020, further investigation along this drainage is required in 2021 in accordance with the Mine's Contingency Plan. Specifically, a secondary investigation is recommended for Station NML-29, which should include additional baseline monitoring points and detailed mapping of locations where observed seepage from nearby facilities or slopes are observed, along with reviewing the Landfill watershed boundaries. Measurement of field parameters along the water course at defined intervals upstream of NML-29 should be conducted in 2021, with collection of samples for laboratory chemical analysis.

6.0 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,

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APPENDIX A-1
WATER QUALITY MONITORING STATION PHOTOGRAPHS

Station ID	159-14
Latitude	73.047278 N
Longitude	-84.418062 W
Sample Date	August 21, 2020
Temperature (°C)	6.9
Conductivity (uS/cm)[1]	797.1
pH (pH units)	8.96
Total Dissolved Solids (mg/L)	790
Visible Hydrocarbons?	No
Flow condition[2]	Flowing

Notes:

1. Conductivity measurements reflect conductivity measured in the field (i.e., not temperature-corrected to 25°C).
2. Flow conditions were qualitatively documented as “stagnant” for standing or pooled water, or “flowing” if water movement was observed.

Station ID	159-4
Latitude	73.025644 N
Longitude	-84.477130 W
Sample Date	August 21, 2020
Temperature (°C)	6.7
Conductivity (uS/cm)[1]	671.8
pH (pH units)	8.57
Total Dissolved Solids (mg/L)	670
Visible Hydrocarbons?	No
Flow condition[2]	Stagnant

Notes:

1. Conductivity measurements reflect conductivity measured in the field (i.e., not temperature-corrected to 25^{o}C).
2. Flow conditions were qualitatively documented as “stagnant” for standing or pooled water, or “flowing” if water movement was observed.

Station ID	159-6
Latitude	73.069603 N
Longitude	-84.557824 W
Sample Date	August 21, 2020
Temperature (°C)	6.0
Conductivity (uS/cm)[1]	349.5
pH (pH units)	7.54
Total Dissolved Solids (mg/L)	400
Visible Hydrocarbons?	No
Flow condition[2]	Flowing

Notes:

1. Conductivity measurements reflect conductivity measured in the field (i.e., not temperature-corrected to 25^{o}C).
2. Flow conditions were qualitatively documented as “stagnant” for standing or pooled water, or “flowing” if water movement was observed.

Station ID	159-6 Temp
Latitude	73.069141 N
Longitude	-84.556367 W
Sample Date	August 21, 2020
Temperature (°C)	5.3
Conductivity (uS/cm)[1]	331.9
pH (pH units)	8.21
Total Dissolved Solids (mg/L)	350
Visible Hydrocarbons?	No
Flow condition[2]	Flowing

Notes:

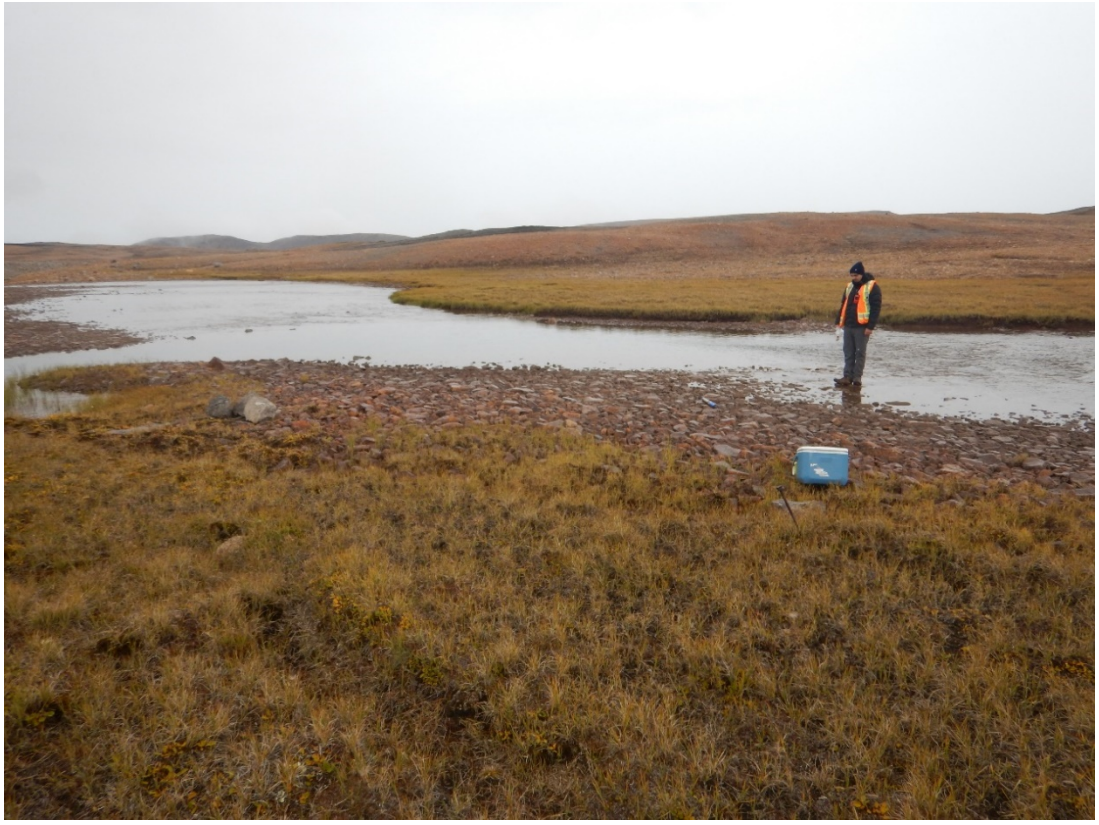
1. Conductivity measurements reflect conductivity measured in the field (i.e., not temperature-corrected to 25°C).
2. Flow conditions were qualitatively documented as “stagnant” for standing or pooled water, or “flowing” if water movement was observed.

Station ID	NML-23
Latitude	73.022970 N
Longitude	-84.472946 W
Sample Date	August 21, 2020
Temperature (°C)	7.4
Conductivity (uS/cm)[1]	65.6
pH (pH units)	8.24
Total Dissolved Solids (mg/L)	60
Visible Hydrocarbons?	No
Flow condition[2]	Flowing

Notes:

1. Conductivity measurements reflect conductivity measured in the field (i.e., not temperature-corrected to 25^{o}C).
2. Flow conditions were qualitatively documented as “stagnant” for standing or pooled water, or “flowing” if water movement was observed.

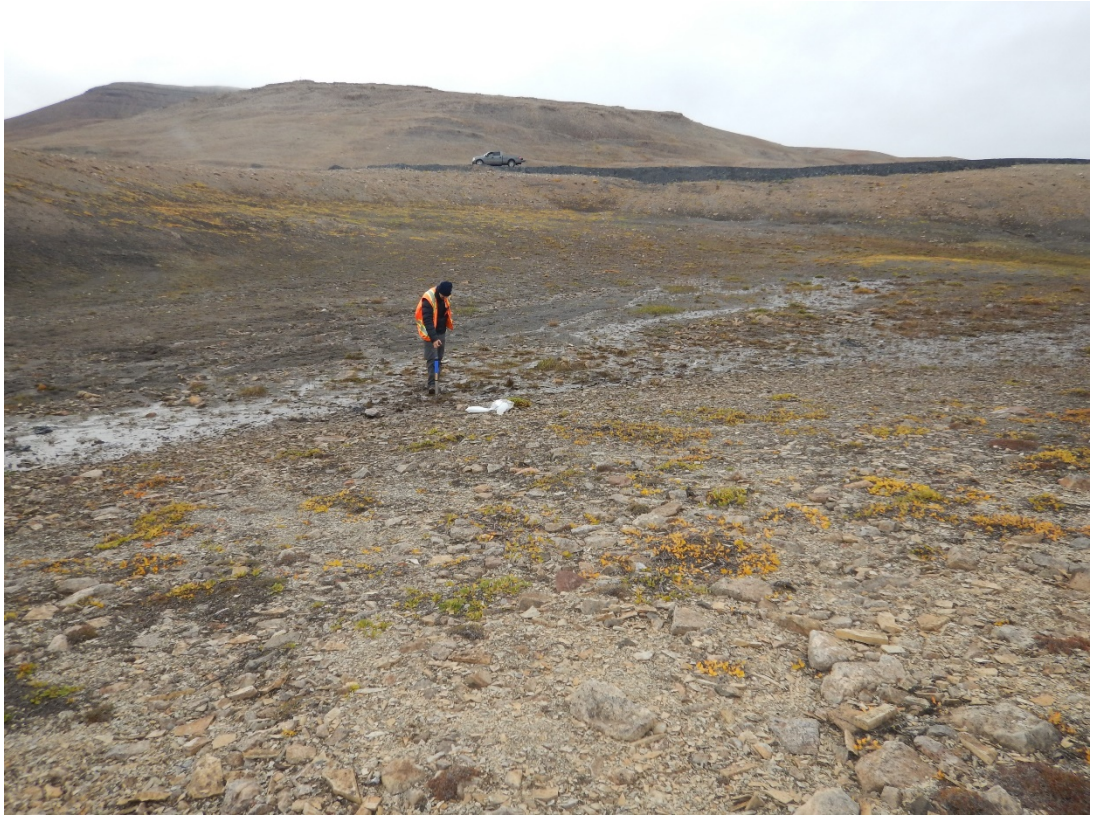
Station ID	ELO
Latitude	73.022543 N
Longitude	-84.470025 W
Sample Date	August 21, 2020
Temperature (°C)	7.6
Conductivity (uS/cm)[1]	66.0
pH (pH units)	7.52
Total Dissolved Solids (mg/L)	60
Visible Hydrocarbons?	No
Flow condition[2]	Flowing



Notes:

1. Conductivity measurements reflect conductivity measured in the field (i.e., not temperature-corrected to 25^{o}C).
2. Flow conditions were qualitatively documented as “stagnant” for standing or pooled water, or “flowing” if water movement was observed.

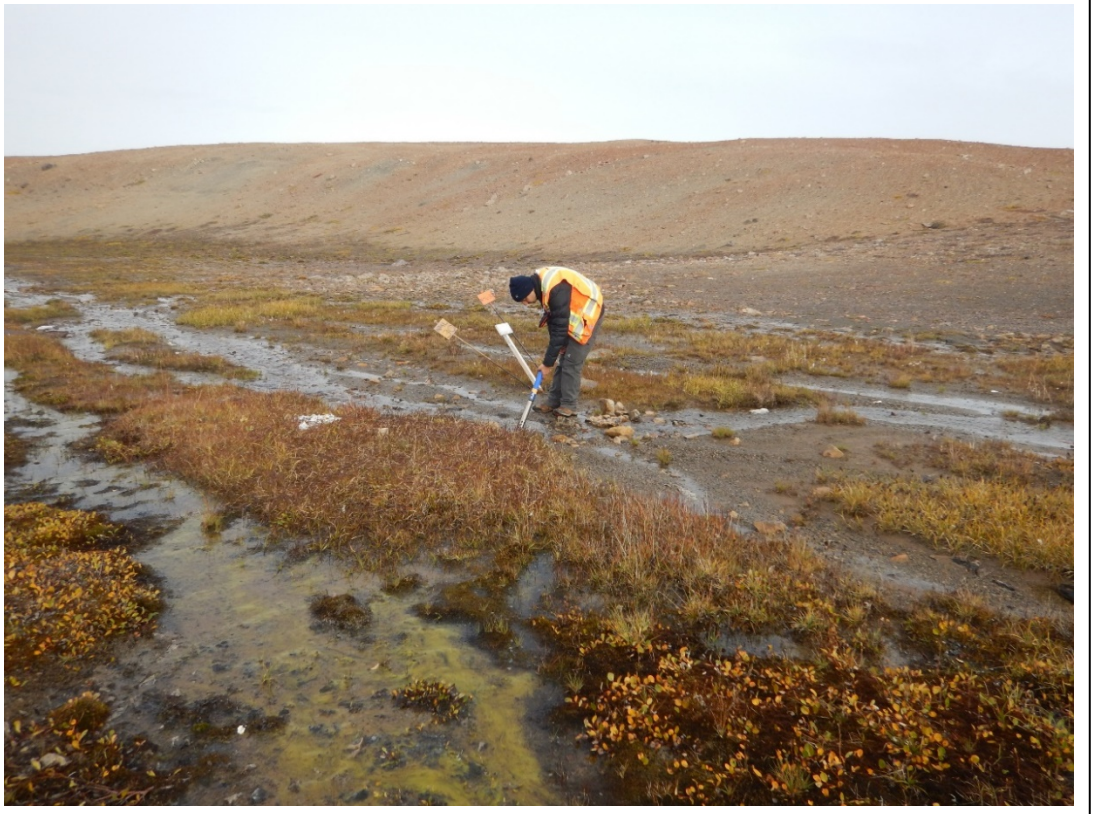
Station ID	NML-29
Latitude	73.038523 N
Longitude	-84.555158 W
Sample Date	August 21, 2020
Temperature (°C)	6.8
Conductivity (uS/cm)[1]	576.4
pH (pH units)	9.19
Total Dissolved Solids (mg/L)	430
Visible Hydrocarbons?	No
Flow condition[2]	Stagnant



Notes:

1. Conductivity measurements reflect conductivity measured in the field (i.e., not temperature-corrected to 25^{o}C).
2. Flow conditions were qualitatively documented as “stagnant” for standing or pooled water, or “flowing” if water movement was observed.

Station ID	NML-30
Latitude	73.038580 N
Longitude	-84.574106 W
Sample Date	August 21, 2020
Temperature (°C)	5.9
Conductivity (uS/cm)[1]	421.9
pH (pH units)	8.83
Total Dissolved Solids (mg/L)	430
Visible Hydrocarbons?	No
Flow condition[2]	Flowing

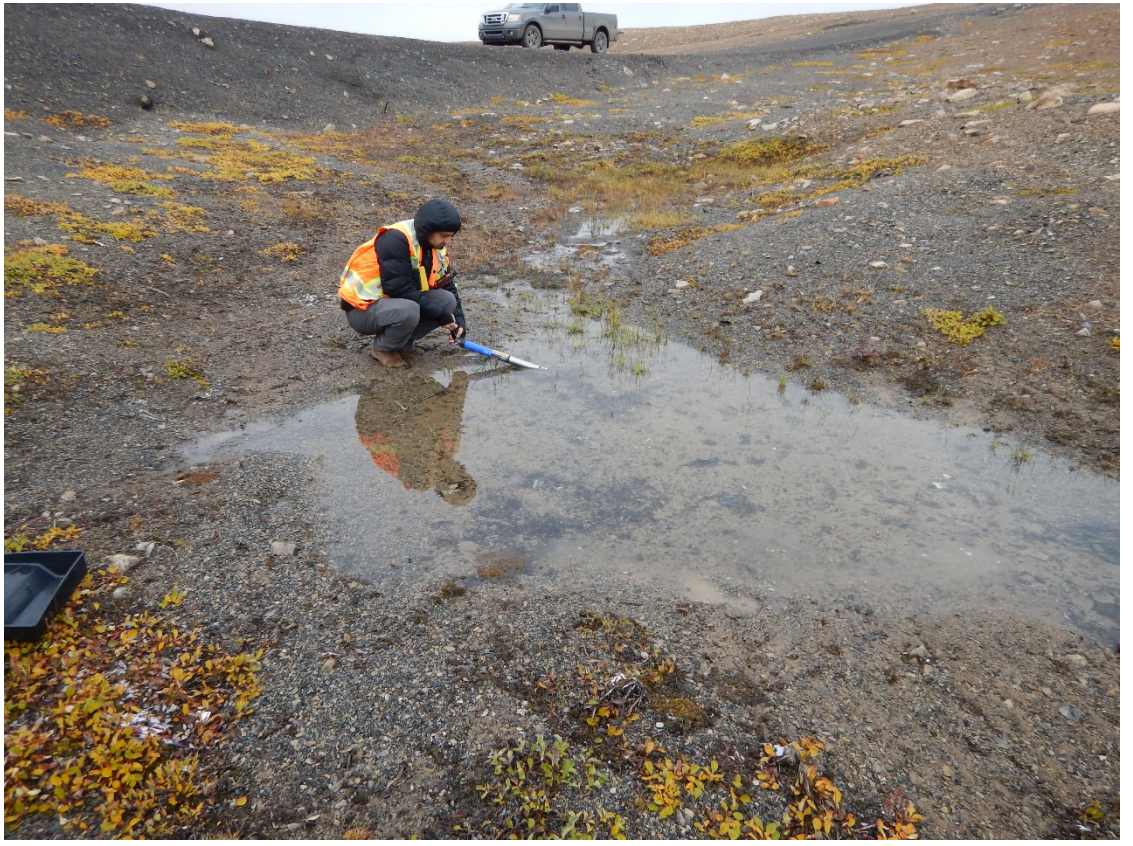


Notes:

1. Conductivity measurements reflect conductivity measured in the field (i.e., not temperature-corrected to 25^{o}C).
2. Flow conditions were qualitatively documented as “stagnant” for standing or pooled water, or “flowing” if water movement was observed.

APPENDIX A-2
NML-29 SITE INVESTIGATION PHOTOGRAPHS

GPS Point	6
Latitude	73.03865 N
Longitude	-84.56332 W
Temperature (°C)	4.89
Conductivity (uS/cm)[1]	445.8
pH (pH units)	7.44
Total Dissolved Solids (mg/L)	530
Flow conditions[2]	Clear, stagnant water



Notes:

1. Conductivity measurements reflect conductivity measured in the field (i.e., not temperature corrected to 25°C).
2. Flow conditions were qualitatively documented as “stagnant” for standing or pooled water, or “flowing” if water movement was observed.

GPS Point	7
Latitude	73.03857 N
Longitude	-84.56250 W
Temperature (°C)	3.97
Conductivity (uS/cm)[1]	627
pH (pH units)	7.63
Total Dissolved Solids (mg/L)	680
Flow conditions[2]	Clear, stagnant water

Notes:

1. Conductivity measurements reflect conductivity measured in the field (i.e., not temperature corrected to 25°C).
2. Flow conditions were qualitatively documented as “stagnant” for standing or pooled water, or “flowing” if water movement was observed.

GPS Point	8
Latitude	73.03866
Longitude	-84.56136 W
Temperature (°C)	3.17
Conductivity (uS/cm)[1]	443.84
pH (pH units)	7.98
Total Dissolved Solids (mg/L)	490
Flow conditions[2]	Clear, stagnant water

Notes:

1. Conductivity measurements reflect conductivity measured in the field (i.e., not temperature corrected to 25ºC).
2. Flow conditions were qualitatively documented as “stagnant” for standing or pooled water, or “flowing” if water movement was observed.

GPS Point	9
Latitude	73.03851 N
Longitude	-84.56070 W
Temperature (°C)	3.06
Conductivity (uS/cm)[1]	447.11
pH (pH units)	8.07
Total Dissolved Solids (mg/L)	500
Flow conditions[2]	Clear, stagnant water

Notes:

1. Conductivity measurements reflect conductivity measured in the field (i.e., not temperature corrected to 25°C).
2. Flow conditions were qualitatively documented as “stagnant” for standing or pooled water, or “flowing” if water movement was observed.

GPS Point	10
Latitude	73.03844 N
Longitude	-84.55933 W
Temperature (°C)	3.22
Conductivity (uS/cm)[1]	489.81
pH (pH units)	7.94
Total Dissolved Solids (mg/L)	550
Flow conditions[2]	Clear, stagnant water

Notes:

1. Conductivity measurements reflect conductivity measured in the field (i.e., not temperature corrected to 25^{o}C).
2. Flow conditions were qualitatively documented as “stagnant” for standing or pooled water, or “flowing” if water movement was observed.

GPS Point	11
Latitude	73.03862 N
Longitude	-84.55893 W
Temperature (°C)	2.66
Conductivity (uS/cm)[1]	668.68
pH (pH units)	7.96
Total Dissolved Solids (mg/L)	750
Flow conditions[2]	Clear, stagnant, north side drainage, minor flow from north side dam slope towards confluence with south side of landfill

Notes:

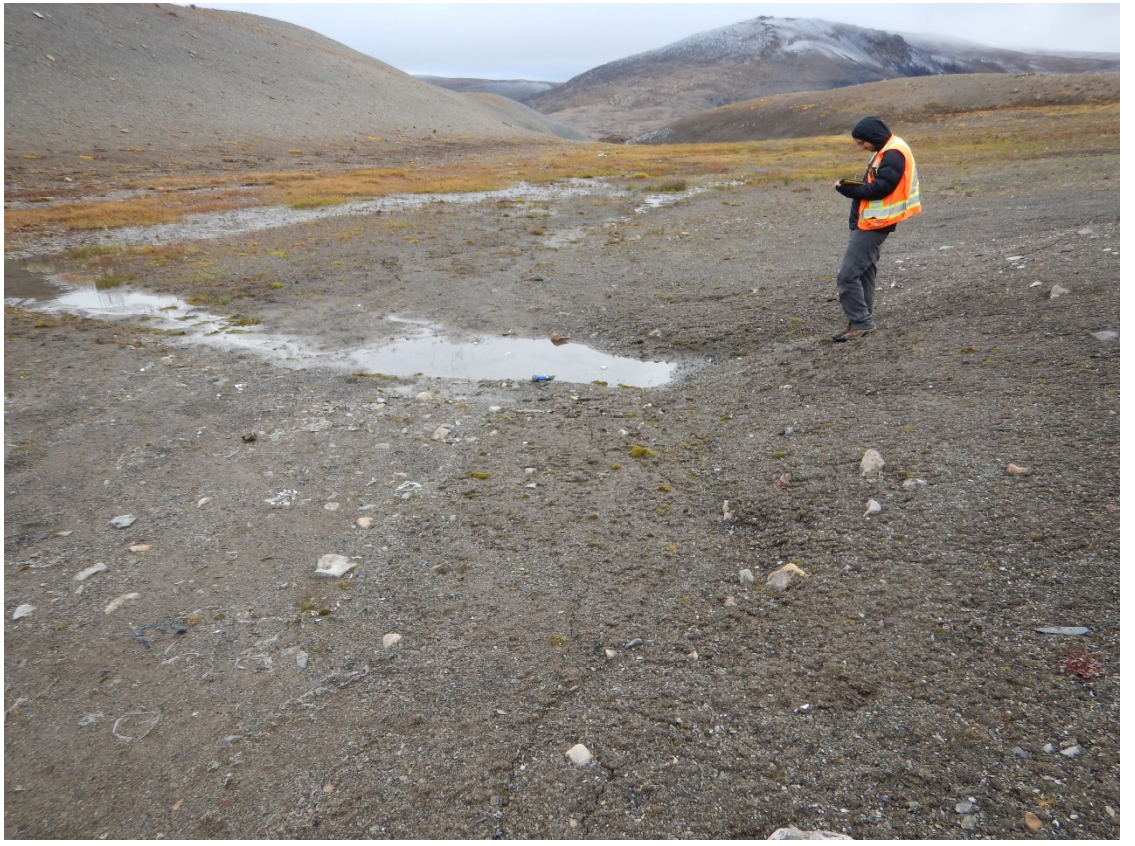
1. Conductivity measurements reflect conductivity measured in the field (i.e., not temperature corrected to 25°C).
2. Flow conditions were qualitatively documented as “stagnant” for standing or pooled water, or “flowing” if water movement was observed.

GPS Point	12
Latitude	73.03868 N
Longitude	-84.55748 W
Temperature (°C)	2.74
Conductivity (uS/cm)[1]	497.7
pH (pH units)	8.25
Total Dissolved Solids (mg/L)	530
Flow conditions[2]	Clear, flowing water

Notes:

1. Conductivity measurements reflect conductivity measured in the field (i.e., not temperature corrected to 25°C).
2. Flow conditions were qualitatively documented as “stagnant” for standing or pooled water, or “flowing” if water movement was observed.

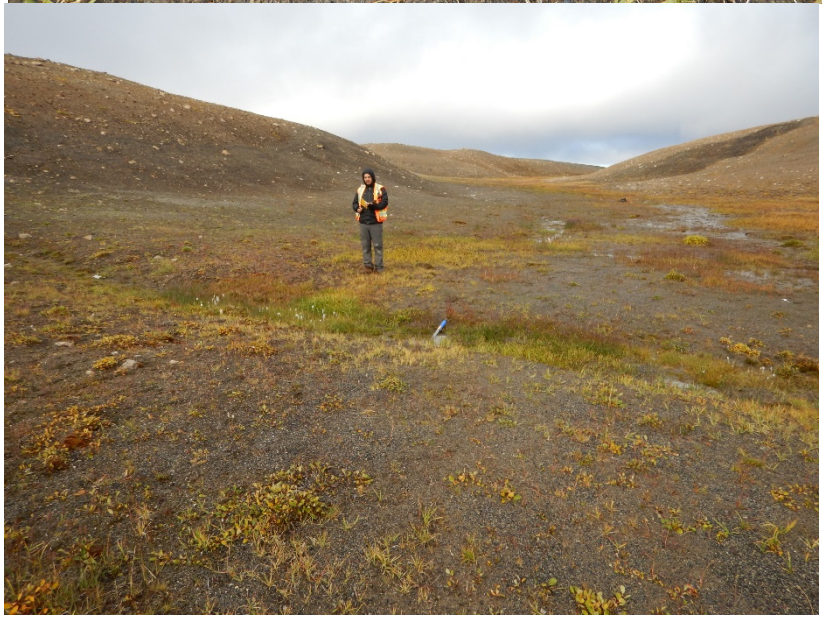
GPS Point	13
Latitude	73.03856 N
Longitude	-84.55752 W
Temperature (°C)	2.41
Conductivity (uS/cm)[1]	758.48
pH (pH units)	8.38
Total Dissolved Solids (mg/L)	870
Flow conditions[2]	Clear, stagnant water. Garbage debris in water.



Notes:

1. Conductivity measurements reflect conductivity measured in the field (i.e., not temperature corrected to 25^{o}C).
2. Flow conditions were qualitatively documented as “stagnant” for standing or pooled water, or “flowing” if water movement was observed.

GPS Point	14
Latitude	73.03858 N
Longitude	-85.55608 W
Temperature (°C)	2.67
Conductivity (uS/cm)[1]	678.04
pH (pH units)	8.3
Total Dissolved Solids (mg/L)	700
Flow conditions[2]	Clear, stagnant water.



Notes:

1. Conductivity measurements reflect conductivity measured in the field (i.e., not temperature corrected to 25ºC).
2. Flow conditions were qualitatively documented as “stagnant” for standing or pooled water, or “flowing” if water movement was observed.

APPENDIX B
LABORATORY CERTIFICATES OF ANALYSIS (COAs)

Certificate of Analysis

Client: Nyrstar (c/o BGC Engineering)
Suite 500 - 1000 Centre St NE
Calgary, AB
V6B 4N8
Attention: Mr. Scott Garrison
PO#: ENV/2012/0
Invoice to: Canzinco Ltd.

Report Number: 1937596
Date Submitted: 2020-08-28
Date Reported: 2020-09-11
Project: Nanisivik
COC #: 862035

Dear Scott Garrison:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: _____
Rebecca Koshy, Project Manager

All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise indicated.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accreditation. The scope is available at: http://www.cala.ca/scopes/2602.pdf.

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Certificate of Analysis

eurofins | Environment Testing

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Invoice to: Canzinco Ltd.

Report Number: 1937596
Date Submitted: 2020-08-28
Date Reported: 2020-09-11
Project: Nanisivik
COC #: 862035

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1513307 Water 2020-08-21 159-6	1513308 Water 2020-08-21 159-6-TEMP	1513309 Water 2020-08-21 Travel Blank	1513310 Water 2020-08-21 159-6-Field-Dup
Anions	Cl	1	mg/L			4	4	<1	4
	NO2 + NO3 as N	0.10	mg/L			0.36	0.34	<0.10	0.36
	SO4	1	mg/L			218	217	<1	222
General Chemistry	Alkalinity as CaCO3	5	mg/L			56	57	<5	66
	CO3 as CaCO3	1	mg/L			N/A-PH	N/A-PH	N/A-PH	N/A-PH
	Conductivity	5	uS/cm			545	548	<5	545
	HCO3 as CaCO3	1	mg/L			56	57	<1	66
	pH	1.00				7.79	7.77	6.55	7.76
	Total Suspended Solids	2	mg/L			<2	<2	<2	<2
Hardness	Hardness as CaCO3	1	mg/L			275	277	<1	275
Hydrocarbons	F2 (C10-C16)	20	ug/L			<20	<20	<20	<20
	F3 (C16-C34)	50	ug/L			<50	<50	<50	<50
	F4 (C34-C50)	50	ug/L			<50	<50	<50	<50
Metals	As	0.001	mg/L			<0.001	<0.001	<0.001	<0.001
	Ca	1	mg/L			54	55	<1	54
	Cd	0.0001	mg/L			0.0008	0.0008	<0.0001	0.0009
	Cu	0.001	mg/L			<0.001	<0.001	0.002	<0.001
	K	1	mg/L			2	2	<1	2
	Mg	1	mg/L			34	34	<1	34
	Na	2	mg/L			2	2	<2	2
	Ni	0.005	mg/L			<0.005	<0.005	<0.005	<0.005
	Pb	0.001	mg/L			<0.001	<0.001	<0.001	<0.001
	Zn	0.01	mg/L			0.38	0.37	<0.01	0.38
Subcontract-Inorg	N-NH3	0.05	mg/L			<0.05	<0.05	<0.05	<0.05

Guideline = *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

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Client: Nyrstar (c/o BGC Engineering)
Suite 500 - 1000 Centre St NE
Calgary, AB
V6B 4N8
Attention: Mr. Scott Garrison
PO#: ENV/2012/0
Invoice to: Canzinco Ltd.

Report Number: 1937596
Date Submitted: 2020-08-28
Date Reported: 2020-09-11
Project: Nanisivik
COC #: 862035

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1513311 Water 2020-08-21 Field Blank at NML-29	1513312 Water 2020-08-21 NML-29	1513313 Water 2020-08-21 NML-30
Anions	Cl	1	mg/L			<1	5	5
	NO2 + NO3 as N	0.10	mg/L			<0.10	<0.10	0.55
	SO4	1	mg/L			<1	346	209
General Chemistry	Alkalinity as CaCO3	5	mg/L			<5	169	159
	CO3 as CaCO3	1	mg/L			N/A-PH	N/A-PH	N/A-PH
	Conductivity	5	uS/cm			<5	907	670
	HCO3 as CaCO3	1	mg/L			<1	169	159
	pH	1.00				5.85	8.21	8.21
	Total Suspended Solids	2	mg/L			<2	15	<2
Hardness	Hardness as CaCO3	1	mg/L			<1	507	362
Hydrocarbons	F2 (C10-C16)	20	ug/L			<20	<20	<20
	F3 (C16-C34)	50	ug/L			<50	<50	<50
	F4 (C34-C50)	50	ug/L			<50	<50	<50
Metals	As	0.001	mg/L			<0.001	<0.001	<0.001
	Ca	1	mg/L			<1	104	79
	Cd	0.0001	mg/L			<0.0001	<0.0001	<0.0001
	Cu	0.001	mg/L			<0.001	<0.001	<0.001
	K	1	mg/L			<1	2	1
	Mg	1	mg/L			<1	60	40
	Na	2	mg/L			<2	2	3
	Ni	0.005	mg/L			<0.005	<0.005	<0.005
	Pb	0.001	mg/L			<0.001	<0.001	<0.001
	Zn	0.01	mg/L			<0.01	0.01	<0.01
Subcontract-Inorg	N-NH3	0.05	mg/L			<0.05	<0.05	<0.05

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PO#: ENV/2012/0
Invoice to: Canzinco Ltd.

Report Number: 1937596
Date Submitted: 2020-08-28
Date Reported: 2020-09-11
Project: Nanisivik
COC #: 862035

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 388582 **Analysis/Extraction Date** 2020-08-31 **Analyst** MOS **Method** C SM2540			
Total Suspended Solids	<2 mg/L	94	90-110
Run No 388606 **Analysis/Extraction Date** 2020-08-31 **Analyst** Z S **Method** M SM3120B-3500C			
Calcium	<1 mg/L	105	90-110
Potassium	<1 mg/L	96	87-113
Magnesium	<1 mg/L	103	76-124
Sodium	<2 mg/L	101	82-118
Run No 388636 **Analysis/Extraction Date** 2020-08-31 **Analyst** QT **Method** SM2320,2510,4500H/F			
Alkalinity (CaCO3)	<5 mg/L	104	90-110
Conductivity	<5 uS/cm	99	90-110
pH		99	90-110
Run No 388638 **Analysis/Extraction Date** 2020-08-31 **Analyst** SKH **Method** SM 4110			
Chloride	<1 mg/L	100	90-110
NO2 + NO3 as N			
SO4	<1 mg/L	100	90-110

Guideline = *** = Guideline Exceedence**

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V6B 4N8
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Report Number: 1937596
Date Submitted: 2020-08-28
Date Reported: 2020-09-11
Project: Nanisivik
COC #: 862035

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 388641 **Analysis/Extraction Date** 2020-09-01 **Analyst** AET **Method** SM 2320B			
CO3 as CaCO3			
Hardness as CaCO3			
HCO3 as CaCO3			
Run No 388670 **Analysis/Extraction Date** 2020-09-01 **Analyst** H_D **Method** EPA 200.8			
Arsenic	<0.001 mg/L	95	80-120
Cadmium	<0.0001 mg/L	102	80-120
Copper	<0.001 mg/L	105	80-120
Nickel	<0.005 mg/L	106	80-120
Lead	<0.001 mg/L	103	80-120
Zinc	<0.01 mg/L	107	80-120
Run No 388681 **Analysis/Extraction Date** 2020-09-01 **Analyst** SKH **Method** SM 4110			
SO4	<1 mg/L	100	90-110
Run No 388687 **Analysis/Extraction Date** 2020-09-02 **Analyst** MOS **Method** C SM2540			
Total Suspended Solids	<2 mg/L	96	90-110

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Report Number: 1937596
Date Submitted: 2020-08-28
Date Reported: 2020-09-11
Project: Nanisivik
COC #: 862035

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 388689 **Analysis/Extraction Date** 2020-09-02 **Analyst** C M **Method** CCME O.Reg 153/04			
Petroleum Hydrocarbons F2	<20 ug/L	88	60-140
Petroleum Hydrocarbons F3	<50 ug/L	88	60-140
Petroleum Hydrocarbons F4	<50 ug/L	88	60-140
Run No 389172 **Analysis/Extraction Date** 2020-09-10 **Analyst** R_K **Method** LONGUEUIL			
N-NH3	<0.05 mg/L		

Guideline = *** = Guideline Exceedence**

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Certificate of Analysis

Client: Nyrstar (c/o BGC Engineering)
Suite 500 - 1000 Centre St NE
Calgary, AB
V6B 4N8
Attention: Mr. Scott Garrison
PO#: ENV/2012/0
Invoice to: Canzinco Ltd.

Report Number: 1937582
Date Submitted: 2020-08-28
Date Reported: 2020-09-11
Project: Nanisivik
COC #: 862036

Dear Scott Garrison:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: _____
Rebecca Koshy, Project Manager

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Certificate of Analysis

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Suite 500 - 1000 Centre St NE
Calgary, AB
V6B 4N8
Attention: Mr. Scott Garrison
PO#: ENV/2012/0
Invoice to: Canzinco Ltd.

Report Number: 1937582
Date Submitted: 2020-08-28
Date Reported: 2020-09-11
Project: Nanisivik
COC #: 862036

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1513255 Water 2020-08-21 NML-23	1513257 Water 2020-08-21 159-4-Field-Dup	1513258 Water 2020-08-21 159-4
Anions	Cl	1	mg/L			2	9	9
	NO2 + NO3 as N	0.10	mg/L			0.18	0.14	0.14
	SO4	1	mg/L			28	506	505
General Chemistry	Alkalinity as CaCO3	5	mg/L			13	94	83
	CO3 as CaCO3	1	mg/L			N/A-PH	N/A-PH	N/A-PH
	Conductivity	5	uS/cm			101	1030	1040
	HCO3 as CaCO3	1	mg/L			13	94	83
	pH	1.00				7.49	8.01	8.01
	Total Suspended Solids	2	mg/L			<2	7	<2
Hardness	Hardness as CaCO3	1	mg/L			41	567	567
Metals	As	0.001	mg/L			<0.001	<0.001	<0.001
	Ca	1	mg/L			8	123	123
	Cd	0.0001	mg/L			<0.0001	0.0002	0.0002
	Cu	0.001	mg/L			0.002	0.001	0.001
	K	1	mg/L			<1	6	6
	Mg	1	mg/L			5	63	63
	Na	2	mg/L			<2	3	3
	Ni	0.005	mg/L			<0.005	<0.005	<0.005
	Pb	0.001	mg/L			<0.001	0.002	0.002
	Zn	0.01	mg/L			<0.01	0.05	0.05
Subcontract-Inorg	N-NH3	0.05	mg/L			<0.05	<0.05	<0.05

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MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

eurofins | Environment Testing

Client: Nyrstar (c/o BGC Engineering)
Suite 500 - 1000 Centre St NE
Calgary, AB
V6B 4N8
Attention: Mr. Scott Garrison
PO#: ENV/2012/0
Invoice to: Canzinco Ltd.

Report Number: 1937582
Date Submitted: 2020-08-28
Date Reported: 2020-09-11
Project: Nanisivik
COC #: 862036

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.		
					1513259 Water 2020-08-21 ELO	1513260 Water 2020-08-21 159-14	1513261 Water 2020-08-21 159-14-Field Dup
Anions	Cl	1	mg/L		2	7	7
	NO2 + NO3 as N	0.10	mg/L		0.18	0.25	0.26
	SO4	1	mg/L		28	658	680
General Chemistry	Alkalinity as CaCO3	5	mg/L		12	109	109
	CO3 as CaCO3	1	mg/L		N/A-PH	N/A-PH	N/A-PH
	Conductivity	5	uS/cm		99	1230	1240
	HCO3 as CaCO3	1	mg/L		12	109	109
	pH	1.00			7.36	8.07	8.09
	Total Suspended Solids	2	mg/L		<2	<2	3
Hardness	Hardness as CaCO3	1	mg/L		41	723	726
Metals	As	0.001	mg/L		<0.001	<0.001	<0.001
	Ca	1	mg/L		8	128	129
	Cd	0.0001	mg/L		<0.0001	0.0001	<0.0001
	Cu	0.001	mg/L		0.002	<0.001	<0.001
	K	1	mg/L		<1	1	1
	Mg	1	mg/L		5	98	98
	Na	2	mg/L		<2	3	3
	Ni	0.005	mg/L		<0.005	<0.005	<0.005
	Pb	0.001	mg/L		<0.001	<0.001	<0.001
	Zn	0.01	mg/L		<0.01	0.19	0.19
Subcontract-Inorg	N-NH3	0.05	mg/L		0.09	<0.05	<0.05

Guideline = *** = Guideline Exceedence**

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Report Number: 1937582
Date Submitted: 2020-08-28
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Project: Nanisivik
COC #: 862036

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 388582 **Analysis/Extraction Date** 2020-08-31 **Analyst** MOS **Method** C SM2540			
Total Suspended Solids	<2 mg/L	94	90-110
Run No 388606 **Analysis/Extraction Date** 2020-08-31 **Analyst** Z S **Method** M SM3120B-3500C			
Calcium	<1 mg/L	105	90-110
Potassium	<1 mg/L	96	87-113
Magnesium	<1 mg/L	103	76-124
Sodium	<2 mg/L	101	82-118
Run No 388636 **Analysis/Extraction Date** 2020-08-31 **Analyst** QT **Method** SM2320,2510,4500H/F			
Alkalinity (CaCO3)	<5 mg/L	104	90-110
Conductivity	<5 uS/cm	99	90-110
pH		99	90-110
Run No 388638 **Analysis/Extraction Date** 2020-08-31 **Analyst** SKH **Method** SM 4110			
Chloride	<1 mg/L	100	90-110
NO2 + NO3 as N			
SO4	<1 mg/L	100	90-110

Guideline = *** = Guideline Exceedence**

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

Certificate of Analysis

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Attention: Mr. Scott Garrison
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Invoice to: Canzinco Ltd.

Report Number: 1937582
Date Submitted: 2020-08-28
Date Reported: 2020-09-11
Project: Nanisivik
COC #: 862036

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 388641 **Analysis/Extraction Date** 2020-09-01 **Analyst** AET **Method** SM 2320B			
CO3 as CaCO3			
Hardness as CaCO3			
HCO3 as CaCO3			
Run No 388670 **Analysis/Extraction Date** 2020-09-01 **Analyst** H_D **Method** EPA 200.8			
Arsenic	<0.001 mg/L	95	80-120
Cadmium	<0.0001 mg/L	102	80-120
Copper	<0.001 mg/L	105	80-120
Nickel	<0.005 mg/L	106	80-120
Lead	<0.001 mg/L	103	80-120
Zinc	<0.01 mg/L	107	80-120
Run No 388681 **Analysis/Extraction Date** 2020-09-01 **Analyst** SKH **Method** SM 4110			
SO4	<1 mg/L	100	90-110
Run No 388744 **Analysis/Extraction Date** 2020-09-02 **Analyst** SKH **Method** SM 4110			
SO4	<1 mg/L	100	90-110

Guideline = *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

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Invoice to: Canzinco Ltd.

Report Number: 1937582
Date Submitted: 2020-08-28
Date Reported: 2020-09-11
Project: Nanisivik
COC #: 862036

QC Summary

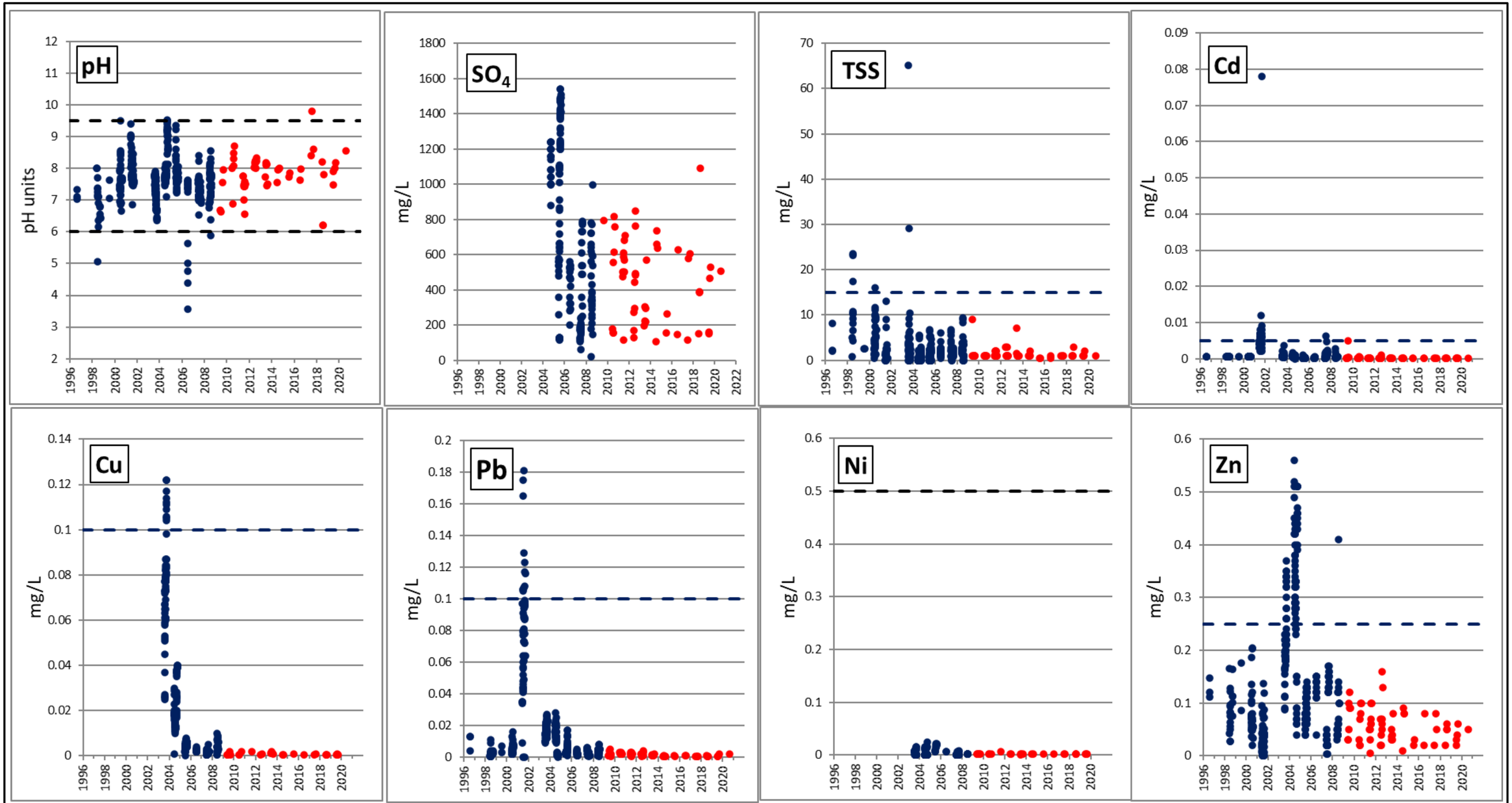
Analyte	Blank	QC % Rec	QC Limits
Run No 389172 **Analysis/Extraction Date** 2020-09-10 **Analyst** R K **Method** LONGUEUIL			
N-NH3	<0.05 mg/L		

Guideline = *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

APPENDIX C
CHEMICAL TIME-SERIES FIGURES



NOTES

1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine, Nunavut - 2020 Water Quality Monitoring", and dated March 2021.
2. Blue dots represent samples collected prior to closure; red dots represent samples collected in post-closure.
3. Dashed lines indicate the maximum authorized concentrations (MAC) of specific water quality parameters, as defined in the Water Licence 1AR-NAN2030 for Station 159-4.
4. Data for total As not presented; however, values remain <0.003 mg/L and have not exceeded the MAC of 0.25 mg/L over its period of record (i.e., 2003 - 2020).
5. All results reported below the detection limit (DL) are presented as half the associated DL.

PREPARED BY: CJ	FIGURE TITLE: Temporal trends at Station 159-4		
CHECKED BY: SB	CLIENT: Nyrstar		
APPROVED BY: SB	SCALE: NTS	PROJECT NO: 0255032	FIGURE NO: C-1

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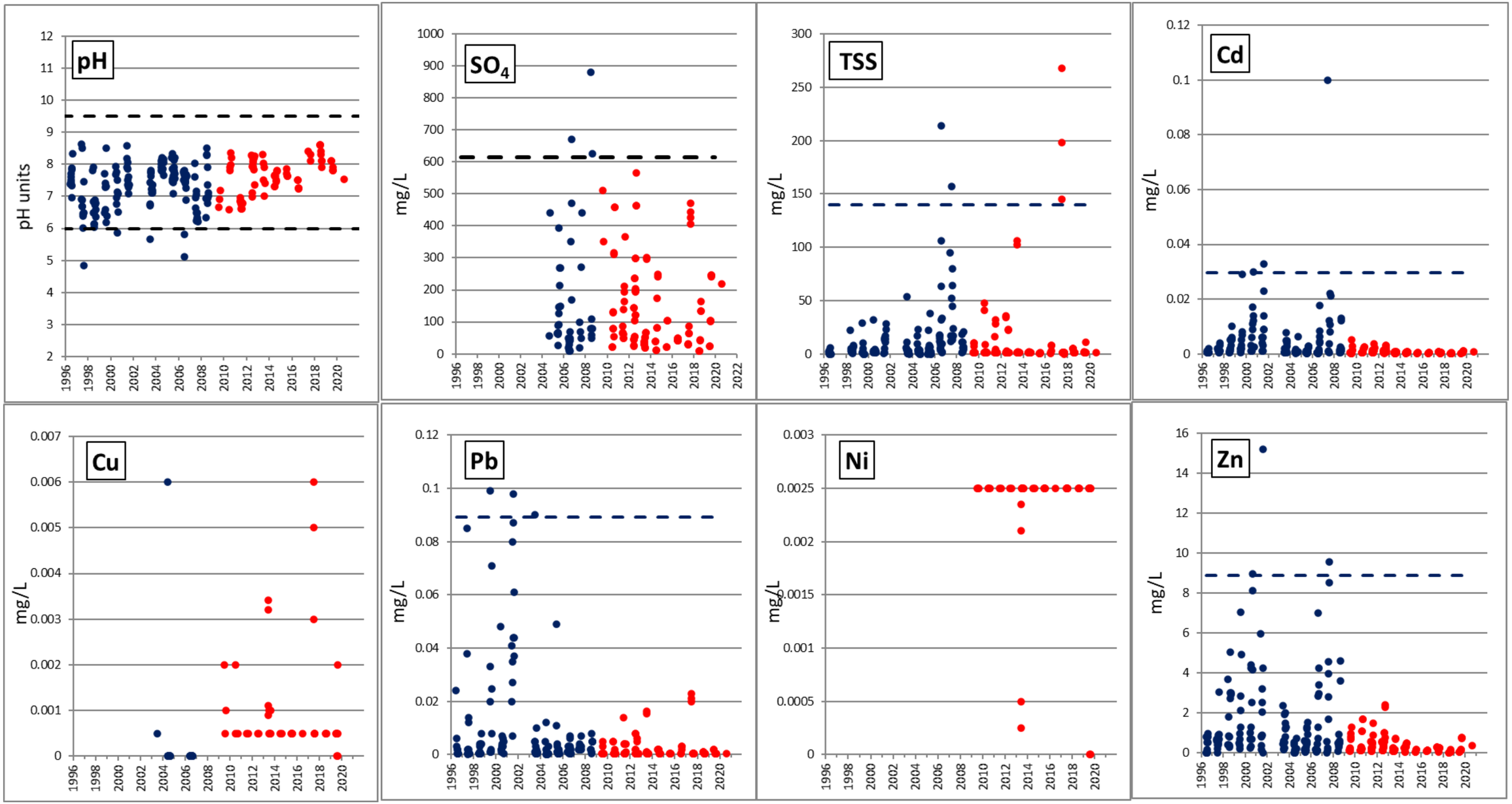


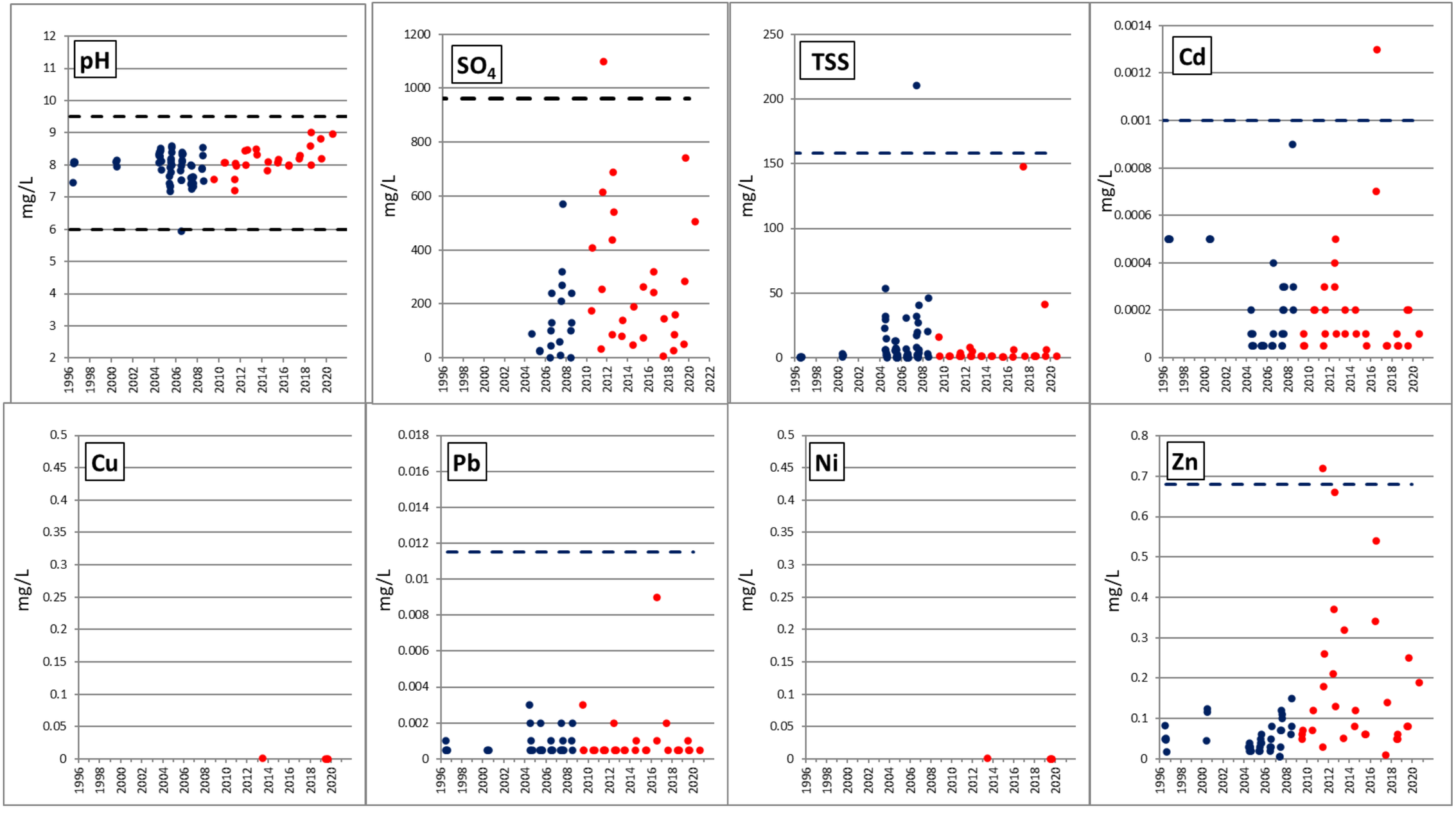
NOTES

1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine, Nunavut - 2020 Water Quality Monitoring", and dated March 2021.
2. Blue dots represent samples collected prior to closure; red dots represent samples collected in post-closure.
3. Dashed lines indicate the site-specific Action Levels for Station 159-6, as provided in the Mine's *Contingency Plan for Water Quality Exceedances* (Stantec, March 27a, 2020). However, pH guidance reflects the MAC range denoted in the Water Licence 1AR-NAN2030. For temporal plots where no dashed lines are present, no Action Levels are defined.
4. All results reported below the detection limit (DL) are presented as half the associated DL.

PREPARED BY: CJ	FIGURE TITLE: Temporal trends at Station 159-6		
CHECKED BY: SB	CLIENT: Nyrstar		
APPROVED BY: SB	SCALE: NTS	PROJECT NO: 0255032	FIGURE NO: C-2

0 5 10 mm in ANSI B sized paper

BGC ENGINEERING INC.



NOTES
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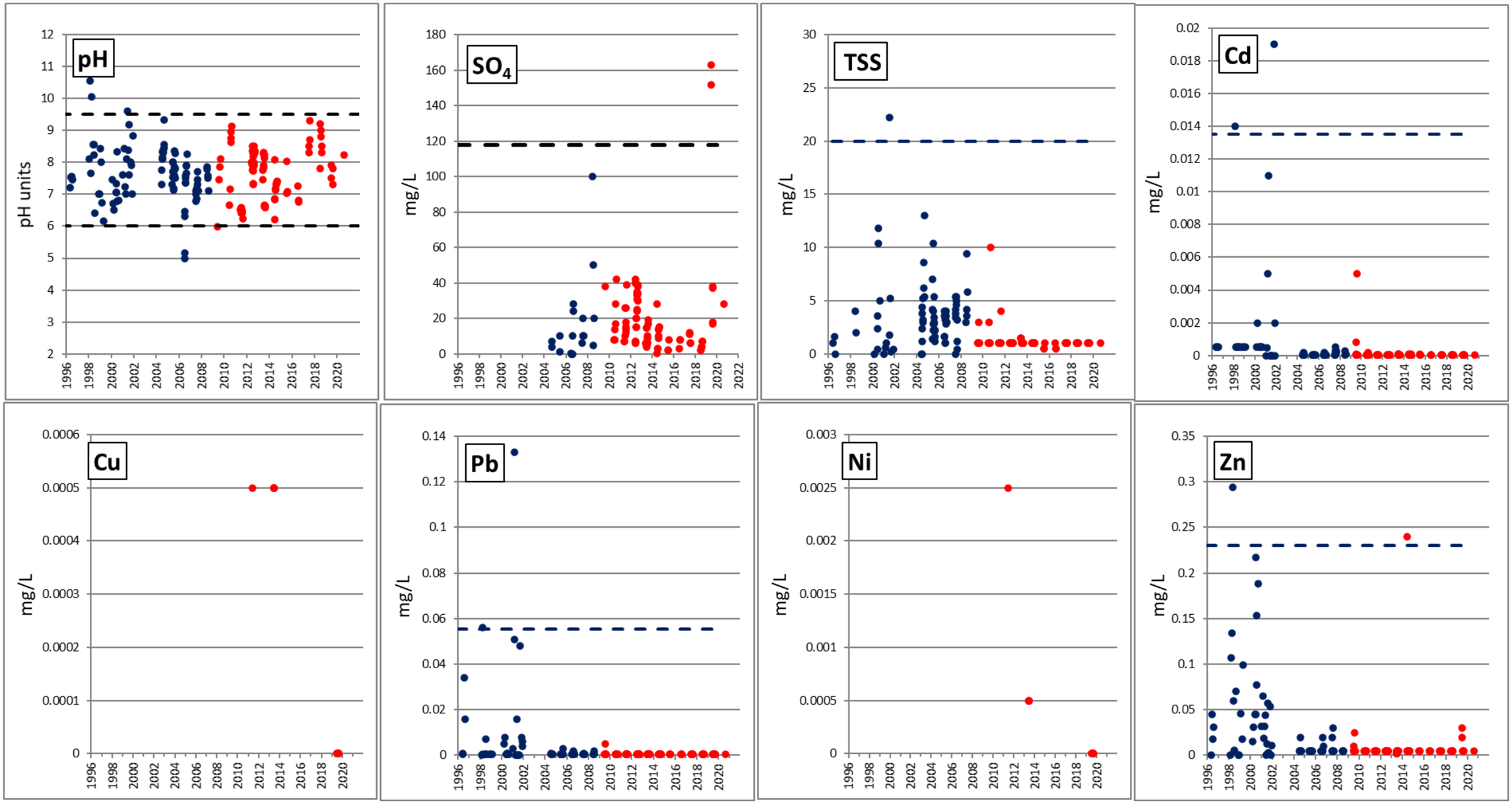
2. Blue dots represent samples collected prior to closure; red dots represent samples collected in post-closure.
3. Dashed lines indicate the site-specific Action Levels for Station 159-6, as provided in the Mine's *Contingency Plan for Water Quality Exceedances* (Stantec, March 27a, 2020). However, pH guidance reflects the MAC range denoted in the Water Licence 1AR-NAN2030. For temporal plots where no dashed lines are present, no Action Levels are defined.
4. All results reported below the detection limit (DL) are presented as half the associated DL.

PREPARED BY:	FIGURE TITLE		
CJ	Temporal trends at Station 159-14		
CHECKED BY:	CLIENT:		
SB	Nyrstar		
APPROVED BY:	SCALE:	PROJECT NO:	FIGURE NO:
SB	NTS	0255032	C-3

0 5 10 mm in ANSI B sized paper

BGC ENGINEERING INC.



NOTES

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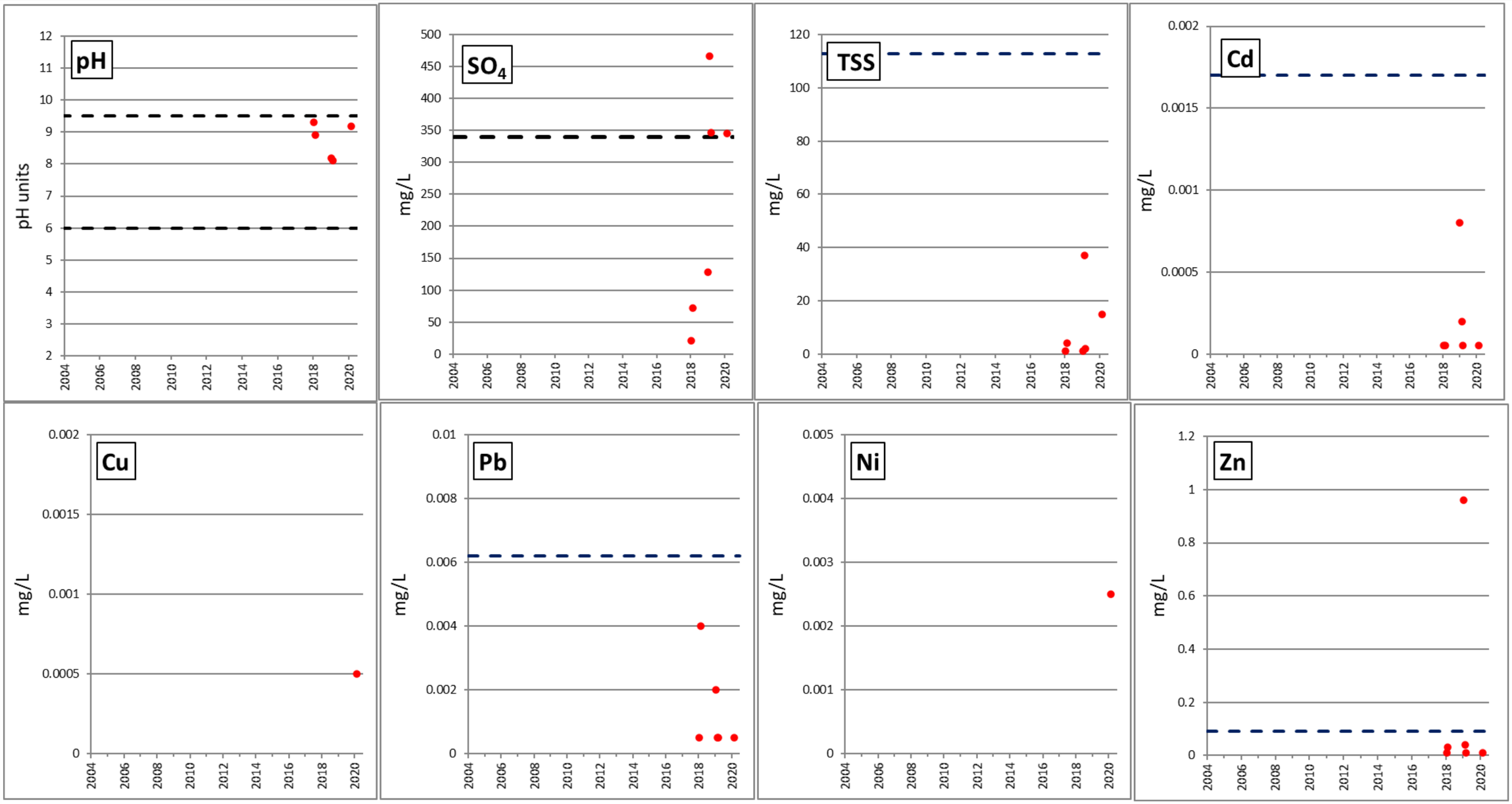
2. Blue dots represent samples collected prior to closure; red dots represent samples collected in post-closure.
3. Dashed lines indicate the site-specific Action Levels for Station 159-6, as provided in the Mine's *Contingency Plan for Water Quality Exceedances* (Stantec, March 27a, 2020). However, pH guidance reflects the MAC range denoted in the Water Licence 1AR-NAN2030. For temporal plots where no dashed lines are present, no Action Levels are defined.
4. All results reported below the detection limit (DL) are presented as half the associated DL.

PREPARED BY:	FIGURE TITLE		
CJ	Temporal trends at Station NML-23		
CHECKED BY:	CLIENT:		
SB	Nyrstar		
APPROVED BY:	SCALE:	PROJECT NO:	FIGURE NO:
SB	NTS	0255032	C-4

0 5 10 mm in ANSI B sized paper

BGC ENGINEERING INC.



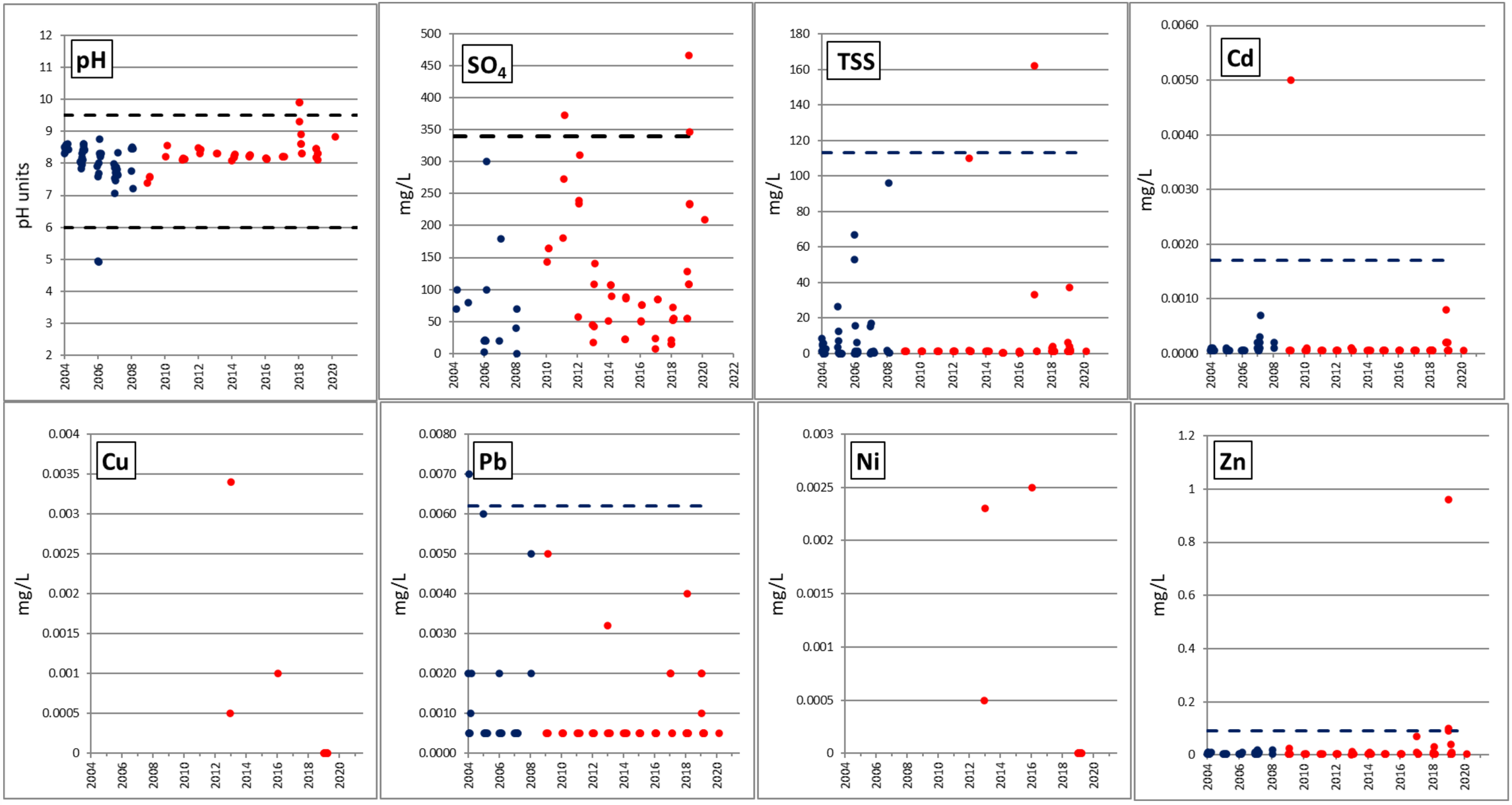
NOTES

1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine, Nunavut - 2020 Water Quality Monitoring", and dated March 2021.
2. Blue dots represent samples collected prior to closure; red dots represent samples collected in post-closure.
3. Dashed lines indicate the site-specific Action Levels for Station 159-6, as provided in the Mine's *Contingency Plan for Water Quality Exceedances* (Stantec, March 27a, 2020). However, pH guidance reflects the MAC range denoted in the Water Licence 1AR-NAN2030. For temporal plots where no dashed lines are present, no Action Levels are defined.
4. All results reported below the detection limit (DL) are presented as half the associated DL.
5. Samples are inconsistently collected at NML-29 due to insufficient water for sampling.

PREPARED BY: CJ	FIGURE TITLE: Temporal trends at Station NML-29		
CHECKED BY: SB	CLIENT: Nyrstar		
APPROVED BY: SB	SCALE: NTS	PROJECT NO: 0255032	FIGURE NO: C-5

0 5 10 mm in ANSI B sized paper

BGC ENGINEERING INC.



NOTES

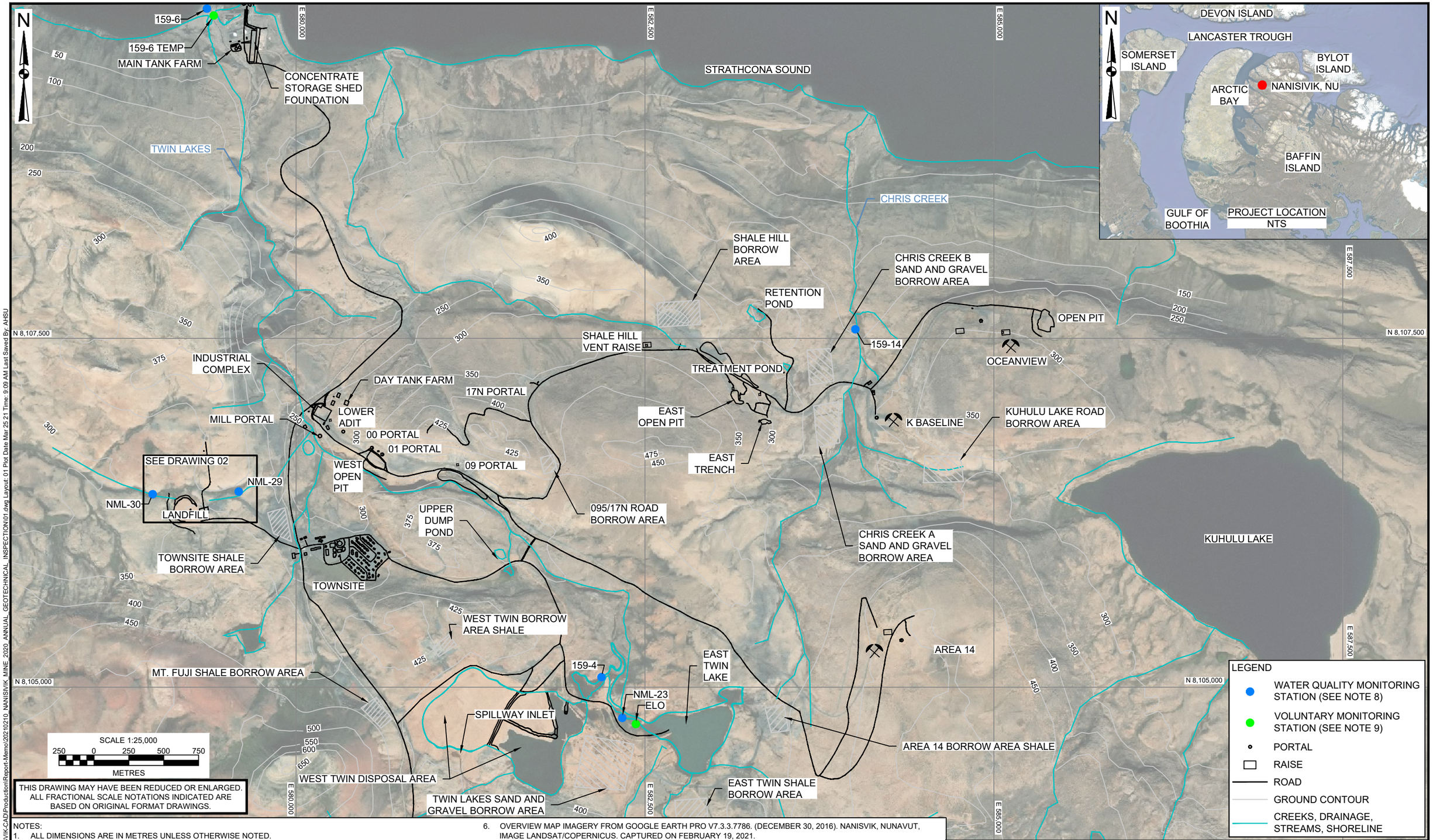
1. This Figure should be read in conjunction with BGC's report titled "Nanisivik Mine, Nunavut - 2020 Water Quality Monitoring", and dated March 2021.
2. Blue dots represent samples collected prior to closure; red dots represent samples collected in post-closure.
3. Dashed lines indicate the site-specific Action Levels for Station 159-6, as provided in the Mine's *Contingency Plan for Water Quality Exceedances* (Stantec, March 27a, 2020). However, pH guidance reflects the MAC range denoted in the Water Licence 1AR-NAN2030. For temporal plots where no dashed lines are present, no Action Levels are defined.
4. All results reported below the detection limit (DL) are presented as half the associated DL.

PREPARED BY:	FIGURE TITLE		
CJ	Temporal trends at Station NML-30		
CHECKED BY:	CLIENT:		
SB	Nyrstar		
APPROVED BY:	SCALE:	PROJECT NO:	FIGURE NO:
SB	NTS	0255032	C-6

0 5 10 mm in ANSI B sized paper

BGC ENGINEERING INC.

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 2020 WATER QUALITY MONITORING", AND DATED MARCH 2021.
3. BASE TOPOGRAPHIC DATA BASED ON STANTEC DRAWING NAMED "WATER SAMPLING LOCATIONS - MINE AREA - WATER QUALITY MONITORING: A-2, PROVIDED BY NYRSTAR CANADA (HOLDINGS) LTD., DATED FEBRUARY 21, 2020. CONTOUR INTERVAL IS 50.0 m.
4. COORDINATE SYSTEM IS NAD83 UTM ZONE 16N. VERTICAL DATUM IS UNKNOWN.
5. ORTHOIMAGE FROM ESRI WORLD IMAGERY SERVER RETRIEVED FROM GLOBAL MAPPER VER. 21.1 ON FEBRUARY 11, 2021. DATUM IS GOOGLE MAPS (SPHERE RADIUS 6378137).
6. OVERVIEW MAP IMAGERY FROM GOOGLE EARTH PRO V7.3.3.7786. (DECEMBER 30, 2016). NANISVIK, NUNAVUT, IMAGE LANDSAT/COPERNICUS. CAPTURED ON FEBRUARY 19, 2021.
7. BASE FEATURES ARE APPROXIMATE, DIGITIZED, AND ALIGNED MANUALLY BY ORTHOIMAGE AS REFERENCE.
8. WATER QUALITY MONITORING STATIONS IDENTIFIED IN WATER LICENCE 1AR-NAN2030.
9. VOLUNTARY MONITORING STATIONS ARE NOT IDENTIFIED IN THE WATER LICENCE 1AR-NAN2030, BUT HAVE BEEN INCLUDED IN THE 2020 MONITORING PROGRAM TO SUPPORT ASSESSMENT OF WATER QUALITY TRENDS.
10. UNLESS BGC AGREES OTHERWISE IN WRITING, THIS DRAWING SHALL NOT BE MODIFIED OR USED FOR ANY PURPOSE OTHER THAN THE PURPOSE FOR WHICH BGC GENERATED IT. BGC SHALL HAVE NO LIABILITY FOR ANY DAMAGES OR LOSS ARISING IN ANY WAY FROM ANY USE OR MODIFICATION OF THIS DOCUMENT NOT AUTHORIZED BY BGC. ANY USE OF OR RELIANCE UPON THIS DOCUMENT OR ITS CONTENT BY THIRD PARTIES SHALL BE AT SUCH THIRD PARTIES' SOLE RISK.

SCALE:	AS SHOWN
DATE:	MAR 2021
DRAWN:	AH
REVIEW:	SB
APPROVED:	BMA

CLIENT: nyrstar

BGC

PROJECT: **NANISIVIK MINE 2020 WATER QUALITY MONITORING**

TITLE: **SITE LOCATION PLAN**

PROJECT No.: **0255032**

DWG No.: **01**

C:\ Vault\Projects\0255-NANISVIK-CAD\Production\Report-Memo\20210210_NANISVIK_MINE_2020_ANNUAL_GEOTECHNICAL_INSPECTION\01.dwg Layout: 01 Plot Date: Mar 25 21 Time: 9:09 AM Last Saved By: AHSU

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

NOTES:
1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
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3. BASE TOPOGRAPHIC DATA BASED ON STANTEC DRAWING NAMED "WATER SAMPLING LOCATIONS - MINE AREA - WATER QUALITY MONITORING: A-2, PROVIDED BY NYRSTAR CANADA (HOLDINGS) LTD., DATED FEBRUARY 21, 2020. CONTOUR INTERVAL IS 50.0 m.
4. COORDINATE SYSTEM IS NAD83 UTM ZONE 16N. VERTICAL DATUM IS UNKNOWN.
5. ORTHOIMAGE FROM ESRI WORLD IMAGERY SERVER RETRIEVED FROM GLOBAL MAPPER VER. 21.1 ON FEBRUARY 17, 2021. DATUM IS GOOGLE MAPS (SPHERE RADIUS 6378137).
6. BASE FEATURES ARE APPROXIMATE, DIGITIZED, AND ALIGNED MANUALLY BY ORTHOIMAGE AS REFERENCE.
7. WATER QUALITY MONITORING STATIONS IDENTIFIED IN WATER LICENCE 1AR-NAN2030.
8. UNLESS BGC AGREES OTHERWISE IN WRITING, THIS DRAWING SHALL NOT BE MODIFIED OR USED FOR ANY PURPOSE OTHER THAN THE PURPOSE FOR WHICH BGC GENERATED IT. BGC SHALL HAVE NO LIABILITY FOR ANY DAMAGES OR LOSS ARISING IN ANY WAY FROM ANY USE OR MODIFICATION OF THIS DOCUMENT NOT AUTHORIZED BY BGC. ANY USE OF OR RELIANCE UPON THIS DOCUMENT OR ITS CONTENT BY THIRD PARTIES SHALL BE AT SUCH THIRD PARTIES' SOLE RISK.

SCALE:	1:2,000
DATE:	MAR 2021
DRAWN:	AH
REVIEW:	SB
APPROVED:	BMA

CLIENT: nyrstar

BGC

PROJECT: **NANISIVIK MINE 2020 WATER QUALITY MONITORING**

TITLE: **NML-29 SITE INVESTIGATION POINTS**

PROJECT No.: **0255032**

DWG No.: **02**

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