Final 2012 Annual Water Quality Monitoring Report – Nanisivik Mine, Nunavut.

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Executive Summary

This document presents a review of the 2012 water quality monitoring results for the Nanisivik Mine located on the Borden Peninsula of Northern Baffin Island in Nunavut Territory. The monitoring program is being conducted as required under *Nunavut Water Licence NWB1AR–NAN0914* and is intended to assess the overall performance of reclamation and closure activities. The effectiveness and adequacy of mine reclamation is to be demonstrated through monitoring key parameters at key sampling stations. Results for the Final Discharge Point (Station 159–4) are compared to the authorized criteria stated in the active Water Licence, while parameters at the remaining sampling stations are compared to their non–regulatory station–specific 95th percentile action levels (calculated from historical data) as indicated in the *Contingency Plan for Water Quality Exceedances, Former Nanisivik Mine Site*, submitted to Breakwater Resources Ltd. in September, 2009.

During the 2012 monitoring season, water samples collected from Station 159–4 (the "Final Discharge Point") met the authorized criteria set out in the 2009 Water Licence. Concentrations of several key parameters have been declining since 2005, and since the issuance of the 2009 Water Licence, most key parameters observed (arsenic, cadmium, copper, nickel and total suspended solids) have remained near or below laboratory detection limits, which are typically one or more orders of magnitude below the limits stated in the Water Licence.

Sulphate concentrations above the station-specific action level were reported during consecutive sampling events at Stations NML–23 in Twin Lakes Creek during the 2012 Water Quality Monitoring Program (June, August and September). Similar observations were also made for NML–23 during the 2011 Water Quality Monitoring Program.

Investigations conducted during the 2011 monitoring season revealed evidence of water seeping from the former polishing pond to Twin Lakes Creek, slightly upstream of Station NML–23. This was investigated both during the 2011 and 2012 monitoring seasons. During the 2011 monitoring season, water samples were collected from the seepage area, as well as from Station NML–23 and at a location approximately 30 m upstream of Station NML–23. These demonstrated generally similar concentrations of key indicator substances, including sulphate. This investigation was further pursued during the 2012 monitoring season with the establishment of a new sampling station, Station ELO, upstream of the seepage at the Twin Lake outflow. Concentrations of key indicator substances were generally similar at Station NML–23 and ELO during the 2012 monitoring season. The correlation of concentrations between Stations NML–23 and ELO in 2012 further demonstrates that the seepage appears inconsequential to the water quality at Station NML–23.

Based on the 2011 investigation sulphate entering East Twin Lake may originate from an area that was used as a quarry source for shale during mine decommissioning. Mineralization is

commonly found along the contact between shale and the underlying dolostone. Therefore, it is possible that shale quarrying has resulted in minor disturbance of sulphide mineralization in or near the quarry. However, the source is not known and should be investigated.

Elsewhere, trace metal, TSS and sulphate concentrations as well as pH were generally below or within their respective station–specific action levels, with some exceptions, particularly for sulphate and zinc. Specifically, sulphate concentrations above the station–specific action levels have been reported at stations 159–6 and NML–23 (as discussed above) located in the Twin Lakes watershed, at stations 159–14, 159–15 and 159–17 in the Chris Creek watershed and at station NML–30 in the landfill area. Zinc concentrations above the station–specific action levels were encountered at stations 159–14, 159–15 and 159–17 located in the Chris Creek watershed. Exceedances of station–specific sulphate and zinc action levels were encountered either in June, following the spring freshet, or more typically in August/September 2012.

Increases in sulphate and zinc concentrations appear to be a generalized observation for the 2012 Water Quality Monitoring Program. According to the Contingency Plan for Water Quality Exceedances (Stantec, 2009), further investigation of potential areas of mineral weathering that could release sulfphate and/or zinc should be initiated in 2013 to determine the cause of the exceedance in the following areas:

- Twin Lakes watershed, upstream of East Twin Lake; and
- Chris Creek watershed, in the area from upstream of Area 14 to K–Baseline.

The statements made in this Executive Summary are subject to the same limitations included in Section 5.0 (Closing), and are to be read in conjunction with the remainder of this report.

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1.0 Introduction

1.1 GENERAL INTRODUCTION

Stantec Consulting Ltd. (Stantec) is pleased to present Nyrstar with a review of the 2012 water quality monitoring data for Nanisivik Mine on the Borden Peninsula of Northern Baffin Island in the Nunavut Territory. The monitoring program is being conducted as required under *Nunavut Water Licence NWB1AR–NAN0914* (2009 Water Licence) and is intended to assess the overall performance of reclamation and closure activities.

1.2 SITE DESCRIPTION

The former Nanisivik Mine, herein referred to as the "Mine", is located in Nunavut on the Borden Peninsula, part of northern Baffin Island (Figure A-1, Appendix A). Specifically, the Mine is located on the southern shore of Strathcona Sound, approximately 33 kilometers by road from the nearest settlement, the hamlet of Arctic Bay. The Mine is located 750 kilometres north of the Arctic Circle at an approximate latitude of 73 degrees north. In 1998, CanZinco Ltd., a wholly owned subsidiary of Breakwater Resources Ltd., took possession of the Mine, and operated it until 2002. Breakwater Resources was acquired by Nyrstar in 2011.

The Mine facilities, which are now decommissioned, 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 deepwater 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 is discharged into Twin Lakes Creek. The Mine was in full operation from its opening in 1976 until closure in September, 2002.

Reclamation activities began at Nanisivik in 2002. On July 30, 2006, Environment Canada approved Nanisivik as having achieved "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. Water quality monitoring continues under *Nunavut Water Licence NWB1AR–NAN0914*, issued by the Nunavut Water Board. On October 1, 2008, reclamation of the site was completed and a post–closure monitoring period began.

1.3 SAMPLING LOCATIONS

The main sampling locations used historically for water quality monitoring near the Mine are generally described in Table 1. Sampling locations are shown in Figure A-2 (Appendix A). As

recommended in the 2011 Water Quality Monitoring Report (Stantec 2011), a new sampling station at the outlet of East Twin Lake, upstream of NML–23 was added to confirm that elevated sulphate concentrations originate from the watershed of East Twin Lake, and not from seepage proximal to NML–23. This station is identified as ELO.

Table 1 Surface Water Quality Sampling Locations

Group	Station	Distance Downstream of Headwaters (m)	Description
Twin Lakes Watershed	NML–23	0	Outflow of East Twin Lake
	ELO	N/A	Outflow of East Twin Lake upstream of NML–23
	159–4B	700	Upstream of Final Tailings Discharge at 159–4
	159–4	750	Outflow from West Twin Disposal Area
	159–4A	800	Downstream of Final Tailings Discharge at 159–4
	159–9	1,750	Twin Lakes Creek stream crossing
	200–7	2,400	Twin Lakes Creek upstream of waste rock piles
	159–11	3,300	Twin Lakes Creek downstream of waste rock piles
	200–3	3,400	Twin Lakes Creek downstream of natural sulphide outcrop
	159–10	3,500	Twin Lakes Creek upstream of west townsite tributary
	159–6	7,250	Outlet of Twin Lakes Creek into Strathcona Sound
Chris Creek Watershed	159–15	100	Chris Creek upstream of Area 14
	159–16	1,000	Chris Creek downstream of Area 14
	159–14	2,600	Chris Creek downstream of K–Baseline
	159–13	3,100	Chris Creek downstream of East Adit
	159–17	4,200	Chris Creek outlet into Strathcona Sound
East Adit Treatment Facility	159–12	–	Discharge from East Adit Retention Pond
Oceanview Pit	159–18	–	Runoff from Oceanview Open Pit area
	159–19	–	Discharge from Oceanview Sump
Landfill Watershed	NML–30	75	Downstream of Landfill – west drainage system

Sampling locations as detailed by Gartner Lee Ltd., 2004, wth the exception of Station ELO implemented during the 2012 monitoring season.

1.4 PREVIOUS WATER QUALITY MONITORING PROGRAMS

1.4.1 Water Licences

Since 1976, Nanisivik Mine has operated under four different Water Licences. The licences were issued by the Northwest Territories Water Board and the Nunavut Water Board and are listed with their issuance dates as follows:

- *Northwest Territories Water Licence N5L3–0159* – Northwest Territories Water Board (July, 1976; renewed in 1978, 1983, 1988 and 1991);

- *Nunavut Water Licence NWB1NAN9702* – Nunavut Water Board (July, 1997; the original term of five years was extended until closure in September, 2002);
- *Nunavut Water Licence NWB1NAN0208* – Nunavut Water Board (October, 2002 to May, 2008); and
- *Nunavut Water Licence NWB1AR–NAN0914* – Nunavut Water Board (April, 2009 to present, expiring March 31, 2014, see Appendix B).

The current Water Licence contains requirements for maximum authorized concentrations of various water quality parameters at final discharge points (Table 1 of the Water Licence, see Appendix B). As defined in the licence, a final discharge point in respect of an effluent is "an identifiable discharge point of a mine beyond which the operator of the mine no longer exercises control over the quality of the effluent". Currently the only final discharge point for mine effluent at the Nanisivik Mine is Station 159–4, where effluent from the WTDA is released. Table 2 summarizes the effluent quality requirements for the final discharge point as listed in the Water Licence.

Table 2 Effluent Quality Requirements for Final Discharge Point

Substance	Maximum Authorized Monthly Mean Concentration	Maximum Authorized Concentration in a Composite Sample	Maximum Authorized Concentration in a Grab Sample
Total Arsenic (mg/L)	0.25	0.375	0.50
Total Copper (mg/L)	0.10	0.15	0.20
Total Lead (mg/L)	0.10	0.15	0.20
Total Nickel (mg/L)	0.50	0.75	1.00
Total Zinc (mg/L)	0.25	0.375	0.50
Total Suspended Solids (mg/L)	15.00	22.50	30.00
Total Radium 226 (Bq/L)	0.37	0.74	1.11
Total Cadmium (mg/L)	0.005	0.008	0.01
pH (units)	6.0 – 9.5		

As per the recommendations set forth in the *Contingency Plan for Water Quality Exceedances* (Stantec, 2009; included in Appendix C), data for the remaining stations are compared to station–specific 95th percentile values (non-regulatory values calculated from historical data) for each key parameter (see Table 3). When the 95th percentile value is exceeded for any key parameter at the same monitoring station on two consecutive occasions, an investigation will be triggered to determine the cause of the exceedance. Action levels have not been identified for supporting parameters because they are of less concern from a toxicological perspective (*e.g.*, major ion concentrations such as calcium and chloride), or because there is insufficient data to develop an estimate of the 95th percentile value. For pH, values have been compared to the acceptable range listed in the Water Licence limits for Station 159–4 (*i.e.,* 6.0 to 9.5). Summary data tables and temporal trend graphs for selected parameters (*i.e.,* total cadmium, total lead, total zinc, total sulphate, total suspended solids (TSS) and pH) are displayed in Appendix D and

Appendix E respectively for Stations 159–4 (Twin Lakes Disposal Area), 159–6 (outlet of Twin Lakes Creek to Strathcona Sound), 159–10 (Twin Lakes Creek, upstream of the west town site tributary), NML–23 (Outflow from East Twin Lake), ELO (Outflow from East Twin Lake upstream of NML–23), 159–14 (Chris Creek, downstream of K–Baseline), 159–15 (Chris Creek, upstream from Area 14), 159–17 (Chris Creek, outlet into Strathcona Sound) and NML–30 (Downstream of Landfill) Sound).

Table 3 Non-Regulatory Station-Specific Action Levels for the 2012 Water Quality Monitoring Program

Parameter	Station							
	159–6	159–10	NML–23	ELO	159–15	159–14	159–17	NML–30
Total Cadmium (mg/L)	0.018	0.037	0.0058	0.0058	0.00085	0.0005	0.0012	0.000245
Total Lead (mg/L)	0.063	0.14	0.046	0.046	0.00725	0.0022	0.028	0.0055
Total Zinc (mg/L)	6.3	13	0.014	0.014	0.17	0.13	0.38	0.015
Total Sulphate (mg/L)	509	651	25	25	269	408	499	240
Total Suspended Solids (mg/L)	63	15	11	11	4	33	53	22
pH		6.0 – 9.5						

Note:
Action levels based on 95th percentile calculated from station–specific historical data. For further information, see the *Contingency Plan for Water Quality Exceedances, Former Nanisivik Mine Site*, provided in Appendix C of this report.
During the 2012 Water Quality Program, no flow conditions were encountered at Station NML–29.
Although it is recognized that Stations NML–23 and ELO are distinct stations, they share Action levels due to their proximity.

1.4.2 Recommended Water Quality Monitoring for Post–Closure Period, Nanisivik Mine

On May 30, 2008, Jacques Whitford submitted a letter report to Breakwater Resources Ltd. containing a review of the February 2004 Monitoring Plan and a review of the water quality collected from 1996 to 2007. Based on the review of data, a revised Water Quality Monitoring Schedule was developed for a Post-Closure Period (2008 to 2014). The amended monitoring schedule subsequently issued in the 2009 Water Licence listed sampling locations, parameters to be sampled and sampling frequency as presented in Table 4. It should be noted that Station ELO was added to this list during the 2012 Monitoring Season. Parameters to be measured and monitoring frequency were set to replicate Station NML–23.

The recommended sampling locations for 2009-2014 presented here were strategically identified as either background sampling locations, or in the immediate area of, or downgradient of former mine activities. Further it was expected that these locations along with the suggested frequencies and parameters, would provide the required information to ensure the reclamation objectives are being met.

1.4.3 Summary and Follow–Up of the 2011 Water Quality Monitoring Program

The 2011 Water Quality Monitoring Program was the third sampling season of the post-closure monitoring at the Mine. Trace metal concentrations, TSS concentrations and pH at the WTDA

discharge location (*i.e.*, Station 159–4) were below, or in the case of pH within, the limits set forth in the 2009 Water Licence. Sulphate concentrations at the same location were below the action level based on the 95th percentile of historical values which was set forth in the *Contingency Plan for Water Quality Exceedances* (Stantec, 2009). Elsewhere, trace metal, TSS and sulphate concentrations as well as pH were generally below or within their respective station-specific action levels, with the following exceptions. Sulphate concentrations above the station-specific action levels were reported during consecutive sampling events at Station 159–14 and 159–15 both located in Chris Creek. According to the *Contingency Plan for Water Quality Exceedances* (Stantec, 2009), further investigation was recommended in 2012 to determine the cause of the exceedance. This follow-up was not undertaken as part of the 2012 Water Quality Program but is recommended as part of the 2013 Water Quality Program. However, fluctuations of sulphate concentration were a generalized observation for the 2011 Water Quality Monitoring Program and may be a consequence of generally warm temperatures experienced during the previous two monitoring years.

Table 4 Recommended Water Quality Monitoring Schedule for Post Closure Period

Water Quality Monitoring Stations 2009–2014				
Monitoring Information				
Station Number	**Station Description**	**Purpose**	**Parameters to be Measured**	**Monitoring Frequency**
Twin Lakes Creek Watershed				
NML–23	Outflow from East Twin Lake	Upstream Control Station	Group 1	Bi–weekly
159–4	Outflow from West Twin Disposal Area	Final Discharge Point	Group 1 Group 4	Bi–weekly Twice Annually
159–10	Twin Lakes Creek upstream of West Townsite tributary	General Monitoring	Group 1	Bi–weekly
159–6	Outlet of Twin Lakes Creek into Strathcona Sound	General Monitoring	Group 1 Group 3 Group 4	Bi–weekly Bi–weekly Twice Annually
Chris Creek				
159–15	Chris Creek upstream of Area 14	Upstream Control Station	Group 1	Monthly
159–14	Chris Creek downstream of K–Baseline	K–Baseline Monitoring	Group 1	Monthly
159–17	Chris Creek Outlet into Strathcona Sound	General monitoring	Group 1 Group 4	Monthly Twice Annually

Table 4 Recommended Water Quality Monitoring Schedule for Post Closure Period

Water Quality Monitoring Stations 2009–2014				
Monitoring Information				
Station Number	**Station Description**	**Purpose**	**Parameters to be Measured**	**Monitoring Frequency**
Landfill				
NML–29	Downstream of Landfill – East Drainage System	Landfill Monitoring	Group 1 Group 2 Group 3	Monthly
NML–30	Downstream of Landfill – West Drainage	Landfill Monitoring	Group 1 Group 2 Group 3	Monthly

Notes:
Monitoring frequency applies during periods of flow.
Group 1 includes: Metals analysis (total cadmium, total lead, total zinc); major cations (calcium, magnesium, sodium, potassium, ammonia, and the derived parameter hardness); major anions (chloride, sulphate, bicarbonate, carbonate, nitrate+nitrite, and the derived parameter alkalinity); TSS; and field parameters (specific conductivity, temperature and pH)
Group 2 includes: Total petroleum hydrocarbons (TPH)
Group 3 includes: Oil and grease (Note: as TPH analysis is more sensitive, and as it provides quantitative results pertaining to hydrocarbons, it is proposed that analysis for oil and grease be replaced by TPH analysis in future sampling events)
Group 4 includes: Trace metal scan

2.0 Review of 2012 Water Quality Data

Water samples were collected in 2012 from the Twin Lakes Watershed, Chris Creek Watershed and Landfill Watershed. A summary of the 2012 water quality monitoring results, along with the sampling frequency is presented in tabular format in Appendix D for the various watersheds noted above.

Only the data for Station 159–4 are compared to the effluent quality requirements for final discharge points (from the Water Licence), as only Station 159–4 is a final discharge point. Concentrations of various parameters measured at other sampling stations are compared to their non–regulatory station–specific action levels, presented in Table 3 and derived in the Contingency Plan included in Appendix C of this report.

Water quality data are not compared to the CCME water quality guidelines for the protection of aquatic life. There are two main reasons why the CCME water quality guidelines are not considered to be relevant to the data collected at Nanisivik.

First, the Mine is located in an area where there are highly mineralized outcrops related to the mineral resources that originally attracted mining activity. The Environmental Effects Monitoring (EEM) Study Design report, prepared for CanZinco Ltd. by Jacques Whitford Environment Limited (dated January 27, 2004) provides a summary of the local geological conditions, and their effects on stream water quality. The mineralized outcrops extend from Oceanview in the east, where there was open pit mining of surface deposits, through the Chris Creek drainage to the East Adit area, where mining extended underground to the West Adit and main portal areas in the Twin Lakes Creek drainage, and by natural extension to the west side of the Twin Lakes

Creek drainage towards the landfill and STOL airstrip. Twin Lakes Creek cuts through a large mineral outcrop between Stations 159–11 (upstream) and 200–3 (downstream). Additional satellite mineral deposits are located throughout the area, and some of these, such as Area 14 in the headwaters of Chris Creek, were also mined. The CCME guidelines acknowledge that natural background conditions for trace elements in various regions of Canada may exceed the guideline values, and that this should not be construed negatively. Background data collected before mining activities began in 1975 show that concentrations of iron, cadmium, lead and zinc in Chris Creek, Twin Lakes Creek, and in the vicinity of the East Adit were sporadically elevated throughout the area. Spikes in trace metal concentrations are still observed today in response to weather events (*i.e.,* periods of rain can cause spikes in metal concentrations as weathered salts are mobilized from mineral outcrops) or in response to natural erosional processes.

Second, the watercourses in the region, including Twin Lakes Creek, East Twin Lake, Chris Creek, and watercourses in proximity to the East Adit, Oceanview, and the Landfill, are all naturally fishless, with a very sparse benthic invertebrate community, even in areas that have not been disturbed by mining. The barren characteristics of the aquatic ecosystems are discussed in the EEM Study Design report (Jacques Whitford Environment Limited, 2004). The fishless condition of the streams is attributable to multiple factors including the naturally–occurring mineralized zones, the presence of waterfalls that are impassable to fish, and the general climatic conditions that cause the creeks to completely freeze during the winter months.

Therefore, the principal consideration when evaluating the water quality monitoring results, which will be a test of whether reclamation and closure activities have been successful, will be whether the conditions that are recorded demonstrate that trace element concentrations are stable or declining, at concentrations that are consistent with pre–mining levels. Such trends are expected to become apparent over a period of years (*i.e.,* between 2009 and 2014).

2.1 STATION 159–4 (FINAL DISCHARGE POINT)

The water quality data for Station 159–4 are presented in Table 5 for the parameters specified in the Water Licence. Raw data are provided in Table D1, Appendix D, while temporal trend graphs are in Appendix E (Figure E1). The maximum authorized grab, composite, and monthly mean concentrations were not exceeded in any sample collected at the WTDA final discharge point (*i.e.*, Station 159–4) in 2012. Concentrations of most key parameters observed (*i.e.*, arsenic, cadmium, copper, nickel and TSS) generally remained near or below laboratory detection limits, which are typically one or more orders of magnitude below the Water Licence Limits. Measured pH values were within the acceptable range listed in the Water Licence limits for Station 159–4 (*i.e.,* 6.0 to 9.5). Sulphate concentrations were below the action level based on station–specific 95th percentile values.

Table 5 Monthly Mean Concentrations of Selected Parameters (Specified in the Water Licence) at Station 159–4 in 2012

Parameter	Authorized Licence Limit	159–4		
		June	July	August
Total Suspended Solids (mg/L)	15	2	< 2	< 2
Total Arsenic (mg/L)	0.25	< 0.001	—–	< 0.001
Total Cadmium (mg/L)	0.0050	0.0001	0.0001	0.0004
Total Copper (mg/L)	0.1	<0.001	—–	0.001
Total Lead (mg/L)	0.1	0.002	0.001	0.003
Total Nickel (mg/L)	0.5	<0.005	—–	< 0.005
Total Zinc (mg/L)	0.25	0.05	0.04	0.11

Notes:
Authorized Licence Limit – Monthly Mean (most conservative).
Freezing conditions occurred earlier in the year than usual; therefore, sampling was not conducted in September.
Note that some parameters (*e.g.* arsenic) are only measured twice annually. As such, some months will have no data for such parameters.

2.2 TWIN LAKES WATERSHED (EXCLUDING STATION 159–4)

The upper reach of the Twin Lakes Watershed includes East Twin Lake (represented by Stations NML–23 and ELO) which was not disturbed by mining activities. Station 159–10 is located downstream of a major natural mineral outcrop that undergoes active erosion from the Twin Lakes Creek. The natural mineral outcrop is a feature of great importance to the chemistry of Twin Lakes Creek, as it can release acidity and heavy metals (particularly cadmium, lead and zinc) to the water as a result of weathering and erosion. Station 159–6 is located in Twin Lakes Creek, immediately upstream of its outlet into Strathcona Sound. Station 159–6 is also periodically influenced by metals released by the natural mineral outcrop. However, the baseline studies carried out before mining activities began indicate that pockets of mineralization can be found throughout the region, and that background concentrations of cadmium, lead and zinc in water were frequently found to be elevated (BC Research, 1975). Baseline concentrations of cadmium (0.004 mg/L), lead (0.0016 mg/L) and zinc (15 mg/L) were measured near Station 159–6, at the mouth of Twin Lakes Creek in 1975 (BC Research, 1975), however, these concentrations are inherently variable depending upon weather conditions.

Raw data from the 2012 monitoring season are presented in Tables D2-1 to D2-3, Appendix D, while temporal trend figures for selected parameters are provided in Appendix E (Figures E2 to E4). A summary of the water quality observed in Twin Lakes Creek during 2012 follows.

- Cadmium concentrations were consistently below their action level. The maximum measured concentration of total cadmium was 0.01 mg/L, recorded at Station 159–10 on September 14, 2012.

- Lead concentrations were consistently below their action level. The maximum measured concentration of total lead was 0.008 mg/L, recorded at Station 159–6 on June 18, 2012.

- Zinc concentrations were consistently below their action level. The maximum measured concentration of total zinc was 4.4 mg/L, recorded at Station 159–10 on September 14, 2012.

- Sulphate concentrations recorded at Station 159–10 were consistently below its action level. Sulphate concentrations at Station 159–6 were also generally below its action level, with the exception of one sampling event on September 25, 2012. Sulphate Concentrations at stations NML–23 and ELO were above the station specific action level on five sampling dates: June 18, 2012, as well as consecutively on August 14, August 22, August 30 and September 14, 2012.

- TSS measurements were consistently below their action level. The maximum measured concentration of TSS was 36 mg/L, recorded at Station 159–6 on June 18, 2012.

- pH values fell within the recommended range of 6.0 to 9.5 during the 2012 monitoring season.

- Petroleum hydrocarbon concentrations at Station 159–6 remained below the laboratory detection limits throughout the 2012 monitoring season.

The high correlation of sample concentrations (sulphate exceedances in particular) between Stations NML–23 (East Twin Lake Outlet) and ELO (Upstream of NML–23) during the 2012 Water Quality Monitoring Program supports the theory that seepage located slightly upstream of NML–23 appears to be inconsequential to water quality in Twin Lakes Creek. Investigation of inflows to East Twin Lake in 2011 revealed that concentrations of parameters at Station NML–23 appear to be within concentrations observed for the East Twin Lake inflows. Inflows investigated all contribute to the chemical composition of East Twin Lake, although it is not currently possible to determine their relative contribution. Based on these observations, and available data, sulphate entering East Twin Lake may originate from an area that was used as a quarry source for shale during mine decommissioning. Mineralization is commonly found along the contact between shale and the underlying dolostone. Therefore, it is possible that shale quarrying has resulted in minor disturbance of sulphide mineralization in or near the quarry. However, the source is not known and should be investigated.

2.3 CHRIS CREEK WATERSHED

Chris Creek extends approximately 5 km from its headwaters to its mouth at Strathcona Sound. There are mineralized outcrops throughout the watershed, including Area 14, K Baseline, and parts of Oceanview, the East Open Pit, and the East Adit. BC Research measured concentrations of cadmium (0.028 mg/L), lead (0.02 mg/L) and zinc (15 mg/L) in Chris Creek prior to mining activities taking place. Trace metal concentrations within the Chris Creek Watershed in 2012 were generally within the range of natural background levels recorded prior to the Mine development.

Raw data from the 2012 monitoring season are presented in Tables D3–1 to D3–3, Appendix D, while temporal trend figures for selected parameters are provided in Appendix E (Figures E5 to E7). A summary of the water quality observed in the Chris Creek watershed during 2012 follows.

- Cadmium concentrations were consistently below their action level. The maximum concentration of total cadmium was 0.0005 mg/L, measured at Station 159–14 on August 9, 2012.

- Lead concentrations were consistently below their action level. The maximum concentration of total lead measured was 0.003 mg/L at Station 159–17 on June 29, 2012.

- Zinc concentrations at Station 159–14 were above the action level on three consecutive sampling events on June 28, July 14, and August 9, 2012, with a maximum concentration of 0.66 mg/L on August 9, 2012. Zinc concentrations at Station 159–15 were above the station–specific action level on July 14, 2012. Zinc concentrations at Station 159–17 were above the station–specific action level, on August 9, 2012.

- Sulphate concentrations at Station 159–14 were above the action level on three consecutive sampling events on July 14, August 9 and September 17, 2012. Sulphate concentrations at Station 159–15 were above its action level on July 14, 2012. Sulphate concentrations at Station 159–17 were above its action level on August 9, 2012.

- TSS at Stations 159–14, 159–15 and 159–17 were consistently below their action levels.

- pH levels recorded at these three stations fell within the preferred range of 6.0 to 9.5.

Zinc and sulphate concentrations above the station–specific action levels have been reported at each station investigated within the Chris Creek watershed towards the completion of the monitoring season. Similar observations were also encountered during previous two monitoring seasons and also reflect trends observed at other stations throughout the study area during 2012. It should be noted however, that zinc concentrations encountered at each stations during the 2012 monitoring season are within the range of natural background levels recorded in Chris Creek prior to mine development.

2.4 LANDFILL WATERSHED

The landfill is located west of Nanisivik, with primary drainage systems that flow intermittently to the east and west, monitored at Stations NML–29 and NML–30, respectively. The landfill has been decommissioned with thermal cover, and will become entombed in permafrost. In addition to metals, water quality monitoring at the landfill includes hydrocarbons. There do not appear to be any historical water quality data relevant to the landfill area. However, water quality data collected by BC Research (1975) for areas outside the Nanisivik Mines property showed cadmium concentrations to 0.0002 mg/L, lead concentrations to 0.002 mg/L, and zinc concentrations to 0.09 mg/L.

Raw data from the 2012 monitoring season are presented in Table D4, Appendix D, while temporal trend graphs of selected parameters are provided in Appendix E (Figure E8). Results for 2012 are summarized below.

- No sampling was conducted at Station NML–29 as no flow was observed during the 2012 monitoring season. Samples were collected from Station NML–30 from late June to early August 2012 when water flow was present.
- Cadmium concentrations were below the laboratory detection limit of 0.0001 mg/L.
- Lead concentrations were below the laboratory detection limit of 0.001 mg/L.
- Zinc concentrations were below the laboratory detection limit of 0.01 mg/L.
- Sulphate concentrations at Station NML–30 were above the station–specific action level on one sampling event on August 8, 2012.
- TSS concentrations were below the laboratory detection limit of 2 mg/L.
- The measured pH levels fell within the acceptable range of 6.0 to 9.5.
- Petroleum hydrocarbon fractions remained below laboratory detection limits throughout the 2012 monitoring season.

2.5 QUALITY ASSURANCE / QUALITY CONTROL (QA/QC) DISCUSSION

The Quality Assurance/Quality Control (QA/QC) sampling program consisted of the collection and analysis of several samples for quality assurance. This program permits the evaluation of the representativeness of the samples. Ten field duplicate samples were collected at the Mine (Station 159–6) and submitted for analysis of key parameters during the 2012 Water Quality Monitoring Program. Relative Percent Difference (RPD) of each duplicate parameter measured is provided in Table 6.

Table 6 Results of QA/QC Samples and Associated Relative Percent Differences

Parameter	Station	TSS (mg/L)	Sulphate (mg/L)	Cadmium total (mg/L)	Lead total (mg/L)	Zinc total (mg/L)	Alkalinity (as $CaCO_3$) (mg/L)	Chloride (mg/L)	Ammonia (as nitrogen) (mg/L)	NO_2 + NO_3 as N (mg/L)	Hardness (as $CaCO_3$) (mg/L)	HCO_3 as $CaCO_3$ (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	F2 ($C_{>10}$–C_{16}) (mg/L)	F3 ($C_{>16}$–C_{34} (mg/L)	F4 ($C_{<34}$–C_{50}) (mg/L)
Sampling Date	**Reporting Limit**	2	1	0.0001	0.001	0.01	5	1	0.02	0.1	1	1	1	1	1	2	0.1	0.2	0.2
Jun. 18, 2012	159–6	36	143	0.0012	0.008	0.54	50	9	0.06	0.17	213	50	44	25	2	3	<0.1	<0.2	<0.2
	159–6 (FD)	34	144	0.0011	0.008	0.56	50	7	0.01	0.17	217	50	44	26	2	3	<0.1	<0.2	<0.2
	RPD%	**5.71**	**0.70**	**8.70**	**0.00**	**3.64**	**0.00**	**25.00**	**142.86**	**0.00**	**1.86**	**0.00**	**0.00**	**3.92**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Jun. 28, 2012	159–6	<2	26	0.0004	0.002	0.15	21	3	<0.02	<0.10	50	21	10	6	<1	<2	<0.1	<0.2	<0.2
	159–6 (FD)	<2	25	0.0004	0.002	0.15	24	3	<0.02	<0.10	50	24	10	6	<1	<2	<0.1	<0.2	<0.2
	RPD%	**0.00**	**3.92**	**0.00**	**0.00**	**0.00**	**13.33**	**0.00**	**0.00**	**0.00**	**0.00**	**13.33**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Jul. 05, 2012	159–6	<2	46	0.0004	<0.001	0.15	27	3	<0.02	0.1	74	27	15	9	<1	<2	<0.1	<0.2	<0.2
	159–6 (FD)	<2	45	0.0004	<0.001	0.16	27	2	<0.02	0.05	79	27	15	10	<1	<2	<0.1	<0.2	<0.2
	RPD%	**0.0**	**2.2**	**0.0**	**0.0**	**6.5**	**0.0**	**40.0**	**0.0**	**66.7**	**6.5**	**0.0**	**0.0**	**10.5**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Jul. 13, 2012	159–6	3	54	0.0003	<0.001	0.13	28	3	<0.02	0.14	81	28	16	10	<1	<2	<0.1	<0.2	<0.2
	159–6 (FD)	1	54	0.0004	<0.001	0.13	30	3	<0.02	0.16	81	30	16	10	<1	<2	<0.1	<0.2	<0.2
	RPD%	**100**	**0.0**	**28.6**	**0.0**	**0.0**	**6.9**	**0.0**	**0.0**	**13.3**	**0.0**	**6.9**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Jul. 30, 2012	159–6	<2	235	0.0008	<0.001	0.35	49	6	<0.02	0.41	266	49	52	33	2	2	<0.1	<0.2	<0.2
	159–6 (FD)	<2	236	0.0008	<0.001	0.35	49	6	<0.02	0.42	275	49	54	34	2	2	<0.1	<0.2	<0.2
	RPD%	**0.00**	**0.42**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.41**	**3.33**	**0.00**	**3.77**	**2.99**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Aug. 08, 2012	159–6	<2	196	0.0009	<0.001	0.49	45	5	<0.02	0.32	240	45	45	31	2	<2	<0.1	<0.2	<0.2
	159–6 (FD)	<2	194	0.0009	<0.001	0.48	45	5	<0.02	0.3	238	45	44	31	2	<2	<0.1	<0.2	<0.2
	RPD%	**0.00**	**1.03**	**0.00**	**0.00**	**2.06**	**0.00**	**0.00**	**0.00**	**6.45**	**0.84**	**0.00**	**2.25**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Aug. 14, 2012	159–6	<2	198	0.0009	<0.001	0.51	41	5	0.04	0.4	244	41	45	32	1	2	<0.1	<0.2	<0.2
	159–6 (FD)	<2	205	0.0009	<0.001	0.52	42	5	<0.02	0.39	240	42	45	31	1	2	<0.1	<0.2	<0.2
	RPD%	**0.00**	**3.47**	**0.00**	**0.00**	**1.94**	**2.41**	**0.00**	**60.00**	**2.53**	**1.65**	**2.41**	**0.00**	**3.17**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Aug. 22, 2012	159–6	22	121	0.0011	0.006	0.58	33	4	<0.02	0.34	189	33	36	24	1	<2	<0.1	<0.2	<0.2
	159–6 (FD)	23	122	0.0011	0.005	0.56	34	4	<0.02	0.35	182	34	35	23	1	<2	<0.1	<0.2	<0.2
	RPD%	**4.44**	**0.82**	**0.00**	**18.18**	**3.51**	**2.99**	**0.00**	**0.00**	**2.90**	**3.77**	**2.99**	**2.82**	**4.26**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Aug. 30, 2012	159–6	<2	298	0.0021	<0.001	1	54	7	<0.02	0.54	382	54	72	49	2	5	<0.1	<0.2	<0.2
	159–6 (FD)	<2	298	0.0019	<0.001	1	53	7	<0.02	0.55	384	53	73	49	2	3	<0.1	<0.2	<0.2
	RPD%	**0.00**	**0.00**	**10.00**	**0.00**	**0.00**	**1.87**	**0.00**	**0.00**	**1.83**	**0.52**	**1.87**	**1.38**	**0.00**	**0.00**	**50.00**	**0.00**	**0.00**	**0.00**
Sep. 14, 2012	159–6	<2	463	0.0032	<0.001	2.3	68	10	0.02	0.94	588	68	107	78	3	4	<0.1	<0.2	<0.2
	159–6 (FD)	<2	464	0.0032	<0.001	2.4	69	10	0.02	0.92	591	69	108	78	3	4	—	—	—
	RPD%	**0.00**	**0.22**	**0.00**	**0.00**	**4.26**	**1.46**	**0.00**	**0.00**	**2.15**	**0.51**	**1.46**	**0.93**	**0.00**	**0.00**	**0.00**	**—**	**—**	**—**

Notes:
FD – Field Duplicate N/A – Not Applicable RPD – Relative Percent Difference
Concentrations of parameters are reported in mg/L unless otherwise specified.
Where concentrations were below the laboratory detection limit, ½ the detection limit was used in the calculation of RPD.

In general, the duplicate results agree closely with their corresponding samples and confirm the representativeness of sampling procedures. For most of the samples the relative percent difference (RPD) from the mean for individual parameters ranged between 0% and 5% for field duplicates. Five outliers with a RPD of greater than 40% were observed for various parameters when sample values were close to or at the laboratory detection limits. Higher RPDs are typically observed when analyte concentrations are very low (*i.e.* close to their respective laboratory detection limit). There are no firm guidelines for the degree of correlation expected between duplicates due to the potential for natural heterogeneity within the sample, as well as potential contaminant distribution. However, the values noted above are considered to indicate an acceptable duplicate correlation. Individual parameters in the duplicates were classified the same (either above or below the respective action levels). The overall data quality is considered acceptable.

A detailed QA/QC plan outlining up–to–date sampling methods, field sampling personnel requirements, field documentation and record keeping requirements and guidelines for the labeling, packaging and shipping of samples has been included in Appendix C.

3.0 Discussion

The effectiveness and adequacy of mine reclamation will be evaluated through monitoring key parameters at key sampling stations subsequent to the completion of decommissioning in 2008. Concentrations of indicator substances should be stable or declining, and should be consistent with conditions that existed prior to mining activities (subject to the constraints that high baseline levels of heavy metals impose on the site). As site reclamation activities were largely completed in 2008, 2012 represents the fourth monitoring season free of substantial anthropogenic disturbance of the surrounding landscape. It is expected that water quality will continue to stabilize in the coming years. Temporal trends for key water quality parameters (*i.e.*, cadmium, lead, zinc, sulphate, TSS and pH) at selected sampling stations are shown in Figures E1 to E8 in Appendix E.

Since the majority of disturbance in the area of the WTDA ceased with the completion of reclamation activities in 2005, concentrations of key parameters such as arsenic, cadmium, copper, lead, nickel and zinc have been declining and/or stabilizing, a trend that has continued throughout the 2012 monitoring season. Concentrations of cadmium, lead, zinc and TSS observed in 2012 are among the lowest on record at Station 159–4, suggesting that the Tailings Disposal Area is functioning as intended, and that reclamation at WTDA have been successful.

At Stations NML–23 and ELO (Figure E4), outflow from East Twin Lake (considered upstream control station), concentrations of cadmium, lead and zinc have been declining since 2008 and generally reported as below or slightly above the laboratory detection limits. During the 2012 monitoring season, concentrations of key water quality parameters recorded at Station NML–23 and station ELO remained below their respective action levels, with the exception of sulphate levels which were above the station–specific action level for both stations on five sampling

events; June 18, 2012 as well as consecutively on August 14, August 22, August 30 and September 14, 2012.

The areas draining to these inflows contain quarries that were used as a source of shale for reclamation and decommissioning activities, and it is possible that the quarrying activity is responsible for the elevated sulphate concentrations. However, the source is not known and should be investigated. To further resolve water quality status at NML–23, a new sampling station, ELO was added in Twin Lakes Creek (see Figure A-2), upstream of NML–23, so that the influence of potential seepage from the former polishing pond could be distinguished from water quality originating at East Twin Lake outlet. The high correlation of sample concentrations between stations ELO and NML–23 during the 2012 Water Quality Monitoring Program further confirmed that potential seepage did not influence water quality at Station NML–23.

Station 159–10 (Figure E3) is located at in Twin Lakes Creek upstream of west townsite tributary. Concentrations of key parameters such as cadmium and zinc have been declining at this station since 2008, and appear to have stabilized. All key parameters such as sulphate, TSS and pH have remained below, or within, their respective action levels throughout the 2012 Water Quality Monitoring Program.

At Station 159–6 (Figure E2), located in Twin Lakes Creek near Strathcona Sound, concentrations of key indicators such as cadmium and zinc have been generally declining since 2008, remaining well below their respective action levels. Lead concentrations at this station have remained consistently low since the beginning of the 2006 monitoring season. Other key parameters such as sulphate and TSS have also remained below their respective action levels throughout 2012 with the exception of sulphate during one sampling event (September 25, 2012) and petroleum hydrocarbon concentrations remained below the laboratory detection limits. The pH levels recorded during this past season remained within the preferred range of 6 to 9.5.

For the Chris Creek watershed, Stations 159–15 and 159–17 represent the headwaters and mouth of Chris Creek (Figures E5 and E7, respectively), while Station 159–14 (Figure E6) represents the area located just downstream of K–Baseline. Although it is still early to attempt to evaluate Post Closure period trends, 2009, 2010, 2011, and 2012 concentrations of most parameters have generally been lower than their respective action levels. Exceptions were noted for sulphate and zinc which periodically exceeded the station–specific action levels. Sulphate concentrations above the station–specific action levels were reported during consecutive sampling events at Station 159–14. According to the *Contingency Plan for Water Quality Exceedances* (Stantec, 2009), further investigation should be initiated to determine the cause of the exceedance. Similar consecutive exceedances occurred in the 2011 Water Quality Monitoring Program and further investigation was recommended. This investigation was not pursued in 2012 but should be carried out in 2013.

Single exceedances also occurred at Stations 159–15 and 159–17. Station 159–15 is located upstream of Area 14 and similarly to Station NML–23 is considered to be an upstream control

station. Station 159–17 is located downstream of K–baseline. Similarly to Station NML–23, the high variability of sulphate concentrations encountered at these stations during the 2012 Water Quality Monitoring programs suggests that mineral weathering of a yet to be identified and possibly previously frozen mineral outcrop may be occurring. Warmer weather may be causing some melting of surface permafrost, which would preferentially release meltwater that was enriched in dissolved salts (such as sulphate) due to freezing point depression effects.

Zinc concentrations above the station–specific action levels were also reported during consecutive sampling events at Stations 159–14, and single exceedances were reported at both 159–15 and 159–17. However, zinc concentrations encountered at these stations remain within the range of natural background levels recorded in Chris Creek prior to mine development. Surface water samples collected in Chris Creek in the vicinity of 159–14 and 159–17 prior to mine development exhibited zinc concentrations of 0.7 mg/L and 15 mg/L, respectively (BC Research 1975). During the 2012 Water Quality Monitoring Program zinc concentrations encountered at Station 159–14 ranged from 0.13 to 0.66 mg/L, lower than the pre–mining level of 0.7 mg/L. Zinc concentrations encountered at Station 159–17 ranged from 0.02 to 0.62 mg/L, well below the pre–mining level of 15 mg/L. Station 159–15, located upstream of Station 159–14, exhibited zinc concentrations ranging from 0.02 to 0.4 mg/L, within the range of pre–mining levels.

Representing the landfill watershed, Station NML–30 (Figure E8) has shown stable concentrations of most key parameters at or below their respective laboratory detection limits throughout 2009, 2010, 2011, and 2012. The single exception for the 2012 Water Quality Monitoring Program is a single occasion when the sulphate action level was exceeded at this station. As with the 2011 Water Quality Monitoring Program, fluctuations of sulphate concentrations appear to be a generalized observation for the 2012 Water Quality Monitoring Program and appear to correspond to generally warm temperatures encountered during the past three monitoring years. As such, it appears likely that sulphate stems from a natural origin with concentrations subjected to seasonal variability and/or environmental and meteorological conditions. No petroleum hydrocarbon compounds were detected in the drainage from the landfill area.

4.0 Conclusions and Recommendations

The year 2012 represents the fourth sampling season of the Post Closure Monitoring at the Mine. Trace metal and TSS concentrations at the WTDA discharge location (*i.e.*, Station 159–4) were below the limits set forth in the 2009 Water Licence. pH levels at this station were within the limits set forth in the 2009 Water Licence. Sulphate concentrations at the same location were below the action level based on the 95th percentile of historical values which was set forth in the *Contingency Plan for Water Quality Exceedances* (Stantec, 2009). Trace metal concentrations at the WTDA discharge location are among the lowest on record,

well below the limits set forth in the 2009 Water Licence, suggesting that the WTDA is functioning as intended and that reclamation activities have been successful to date.

Within the Twin Lakes watershed, Stations NML–23, 159–6 and 159–10 exhibited trace metals and TSS concentrations below their respective station-specific action level as well as pH values within the preferred range. Although sulphate concentrations at Station 159–10 met its action level, exceedances for this parameter were encountered during one sampling event at Station 159–6 (September 25, 2012) and both single and consecutive sampling events at Stations NML–23, and similarly ELO (June 18, 2012 and consecutively August 14, August 22, August 30 and September 14, 2012).

Elsewhere, trace metal, TSS and sulphate concentrations as well as pH were generally below or within their respective station-specific action levels, with the following exceptions. Sulphate concentrations above the station-specific action levels were also reported during consecutive sampling events at Station 159–14 located in Chris Creek. According to the *Contingency Plan for Water Quality Exceedances* (Stantec, 2009), further investigation should be initiated during 2013 to determine the cause of the exceedance. However, as noted in the 2011 Water Quality Monitoring Program, fluctuations of sulphate concentration appear to be a generalized observation for the 2012 Water Quality Monitoring Program. This may be causing some melting of surface permafrost, which would preferentially release meltwater that was enriched in dissolved salts (such as sulphate) due to freezing point depression effects.

Additionally, zinc concentrations above the station–specific action levels were reported during consecutive sampling events at Station 159–14 located in Chris Creek. However, zinc concentrations encountered at this station are within the range of natural background levels recorded in Chris Creek prior to mine development.

Recommendations for 2013 Water Quality Monitoring Program include:

- implementation of the standard monitoring program as implemented since 2009 (with the inclusion of Station ELO as in 2012); and
- investigation of the cause of elevated sulphate concentrations observed within Twin Lakes and Chris Creek watersheds. This may include:
    - identification of potential areas of mineral weathering that could release sulphate and/or zinc to:
        - Twin Lakes watershed, upstream of East Twin Lake; and
        - Chris Creek watershed, in the area from upstream of Area 14 to K–Baseline.

5.0 Closing

This report has been prepared for the sole benefit of Nyrstar. The report may not be used by any other person or entity, other than for its intended purposes, without the consent of Nyrstar and Stantec Consulting Ltd.

The information and conclusions contained in this report are based upon work undertaken in accordance with generally accepted engineering and scientific practices current at the time the work was performed. The information provided in this report was compiled from existing documents, design information provided by Nyrstar, data provided by regulatory agencies and others. Information obtained from these sources has been assumed to be correct; Stantec Consulting Ltd. accepts no responsibility for damages or liability that may arise from use of this data.

The conclusions presented in this report represent the best technical judgment of Stantec based on the data obtained from the work. The conclusions are based on samples collected by field personnel contracted by Nyrstar at the time the work was performed at the specific testing and/or sampling locations, and can only be extrapolated to an undefined limited area around these locations. Samples were obtained from others and submitted directly to Exova Accutest for analysis, and as a result Stantec cannot comment on whether the sample adequately represents site conditions. Due to the nature of the investigation and the limited data available, Stantec cannot warrant against undiscovered environmental liabilities.

If any conditions become apparent that deviate from our understanding of conditions as presented in this report, Stantec Consulting Ltd. requests that we be notified immediately, and permitted to reassess the conclusions provided herein.

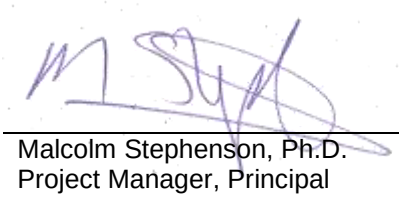
This report was prepared by Anne Somers M.Eng., and was reviewed by Annick St–Amand, Ph.D and Malcolm Stephenson, Ph.D. Should you have any questions or comments on the contents of this report, please contact the undersigned.

We trust that the above information fulfills your needs at this time. Should you require additional information, please do not hesitate to contact us.

Sincerely,

STANTEC CONSULTING LTD.

Anne Somers, M.Eng
Environmental Engineer–in–Training



Malcolm Stephenson, Ph.D.
Project Manager, Principal

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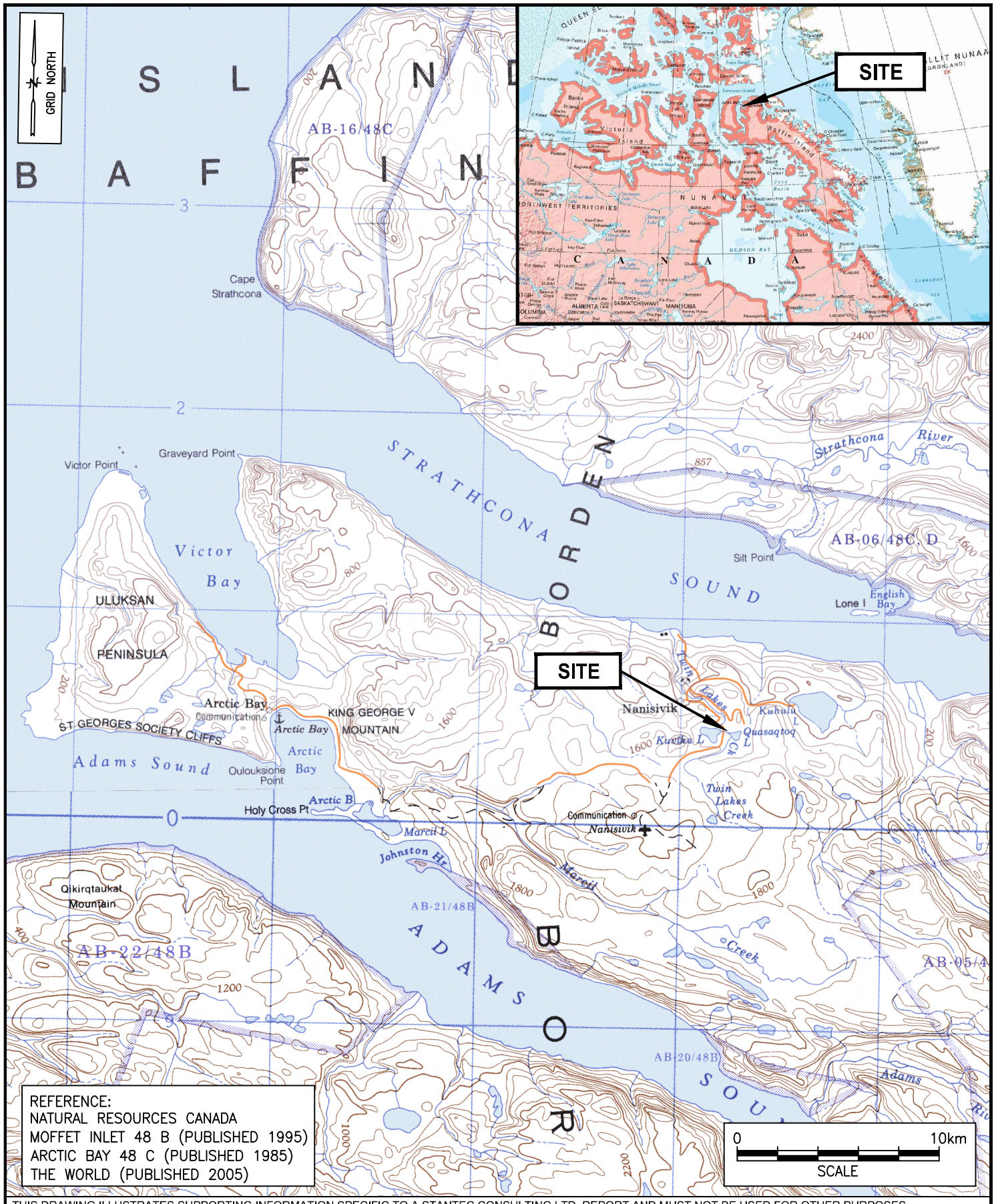
APPENDIX A

Drawings

Stantec



THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

SITE LOCATION

WATER QUALITY MONITORING

NANISIVIK MINE, NUNAVUT

Client: BREAKWATER RESOURCES LTD.

Job No.:	121810952
Scale:	1 : 250,000
Date:	2013 03 11
Dwn. By:	JL
App'd By:	MS

Dwg. No.: A-1

Stantec

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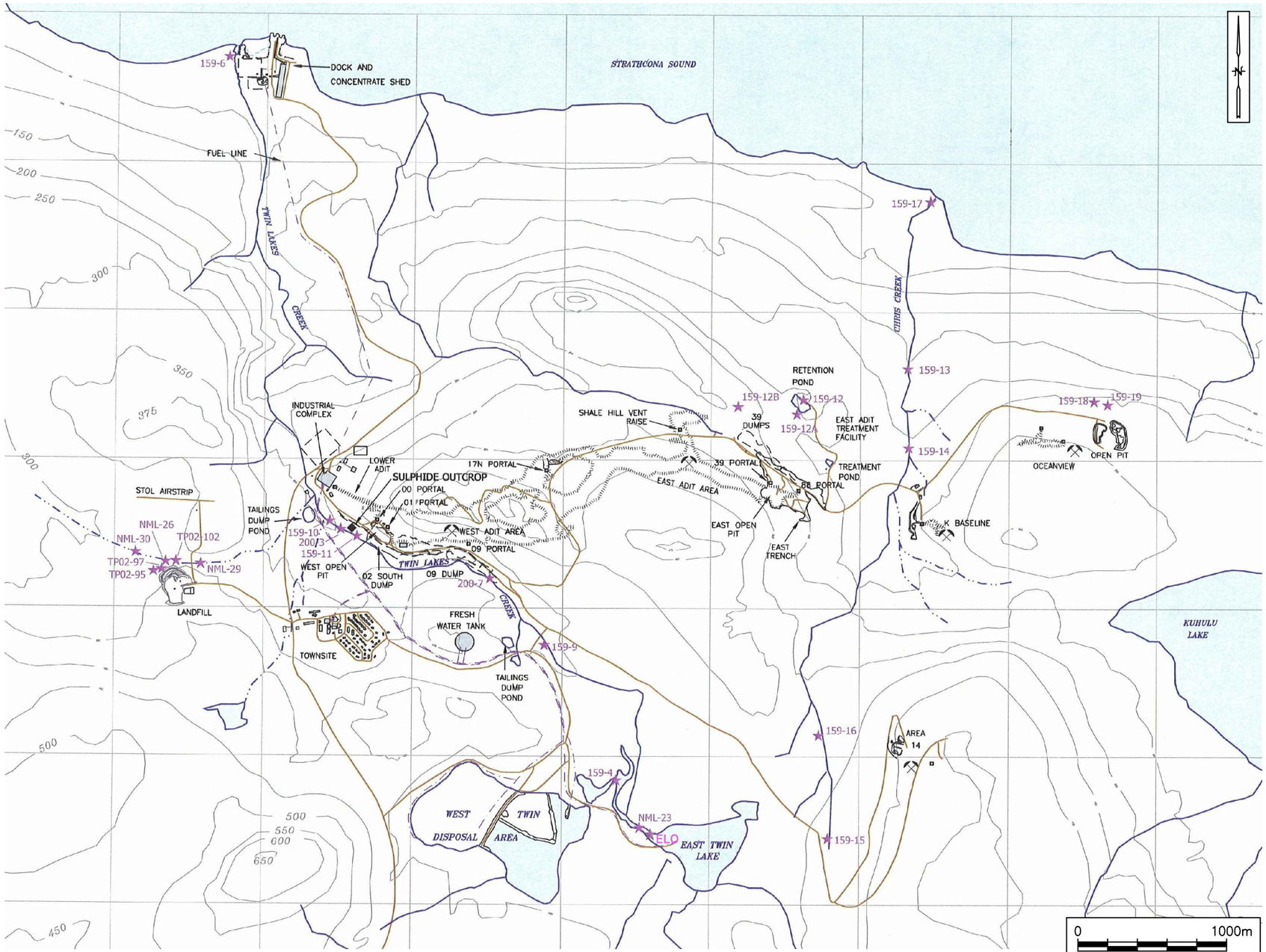

LEGEND:

- ROAD
- GROUND CONTOUR (50 m INTERVAL)
- SHORELINE, DRAINAGE, STREAMS
- INTERMITTENT DRAINAGE
- HIGH TIDE LINE – SURVEYED
- TOP OF BANK
- PIPELINE
- EXTENT OF UNDERGROUND WORKINGS
- MINING AREA
- ADIT, RAISE
- ★ NML-16 WATER SAMPLING LOCATION

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THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

Reference:
ORIGINAL FIGURES PROVIDED BY NANISIVIK MINE

WATER SAMPLING LOCATIONS - MINE AREA

WATER QUALITY MONITORING
NANISIVIK MINE, NUNAVUT

Client: BREAKWATER RESOURCES LTD.

Job No.:	121810952
Scale:	1 : 30,000
Date:	2013 02 19
Dwn. By:	JL
App'd By:	MS

Dwg. No.: A-2

Stantec

APPENDIX B

Nunavut Water Licence NWB1AR–NAN0914

Stantec

WATER LICENCE NO: 1AR-NAN0914

LICENCE NO: 1AR-NAN0914

TABLE OF CONTENTS

NUNAVUT WATER BOARD

WATER LICENCE

Pursuant to the Nunavut Waters and Nunavut Surface Rights Tribunal Act and the Agreement Between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada, the Nunavut Water Board, hereinafter referred to as the Board, hereby grants to

CANZINCO LTD, A WHOLLY-OWNED SUBSIDARY OF BREAKWATER RESOURCES LTD.

(Licensee)

95 WELLINGTON STREET WEST, SUITE 950
TORONTO, ONTARIO
M5J 2N7

(Mailing Address)

hereinafter called the Licensee, the right to alter, divert or otherwise use water or dispose of waste for a period subject to restrictions and conditions contained within this Licence:

Licence Number/Type:	1AR-NAN0914 Type "A"
Water Management Area:	NUNAVUT 05
Location:	NANISIVIK MINE QIKIQTANI REGION, NUNAVUT
Classification:	INDUSTRIAL
Purpose:	RECLAMATION AND CLOSURE ACTIVITIES AND POST CLOSURE MONITORING
Quantity of Water use not to Exceed:	ONE HUNDRED (100) CUBIC METRES PER DAY
Date of Licence Issuance:	APRIL 1, 2009
Expiry of Licence:	MARCH 31, 2014

This Licence, issued and recorded at Iqaluit, Nunavut, includes and is subject to the annexed conditions.

Thomas Kabloona,
Nunavut Water Board
Chair

APPROVED BY:

Minister of Indian and Northern Affairs Canada

DATE LICENCE APPROVED:

PART A: SCOPE, DEFINITIONS AND ENFORCEMENT

1. SCOPE

a. This Licence authorizes CanZinco Ltd. ("Licensee") to conduct closure and reclamation activities and post-closure monitoring, associated with the Industrial undertakings at the Nanisivik Mine in the Qikiqtani Region of Nunavut, (73°02' N, 84°32' W) as follows:

Post-closure monitoring commencing in 2009 and continuing for a period of five years unless otherwise approved by the Board, including;

i. Water quality monitoring;
ii. Geotechnical monitoring;
iii. Inspection and maintenance of engineered structures and earthworks;
iv. Closure and reclamation of the Fuel Tank Farm and associated hydrocarbon contaminated soils; and
v. Completion of any further reclamation and closure activities approved by the Board in writing.

b. This Licence is issued subject to conditions contained herein with respect to the taking of Water and the depositing of Waste of any type in any Waters or in any place under any conditions where such Waste or any other Waste that results from the deposits of such Waste may enter any Waters. Whenever new Regulations are made or existing Regulations are amended by the Governor in Council under the Act, or other statutes imposing more stringent conditions relating to the quantity, type or manner under which any such Waste may be so deposited, this Licence shall be deemed to be subject to such requirements.

c. Compliance with the terms and conditions of this Licence does not absolve the Licensee from responsibility for compliance with all applicable legislation, guidelines and directives.

2. DEFINITIONS

The Licensee shall refer to Schedule A for definitions of terms used in this Licence.

3. ENFORCEMENT

a. Failure to comply with this Licence will be a violation of the Act, subjecting the Licensee to the enforcement measures and the penalties provided for in the Act.

b. All inspection and enforcement services regarding this Licence will be provided by Inspectors appointed under the Act.

c. For the purpose of enforcing this Licence and with respect to the use of Water and Deposit or Discharge of Waste by the Licensee, Inspectors appointed under the Act, hold all powers, privileges and protections that are conferred upon them by the Act or by other applicable law.

PART B: GENERAL CONDITIONS

1. The amount of Water use fees shall be determined in accordance with section 9(b) of the *Regulations*.

2. Payment of fees shall be made in accordance with section 9(6)(b) of the *Regulations.*

3. The Licensee shall file an Annual Report with the Board no later than March 31 in the year following the calendar year being reported. The Annual Report shall be developed in accordance with Schedule B.

4. Compliance dates specified in the Licence may be modified at the discretion of the Chief Executive Officer.

5. The Licensee shall ensure a copy of this Licence, all records, books of account, or other documents are maintained at any place in Canada for a period of not less than five years from the effective date of this licence.

6. Any communication with respect to this Licence shall be made in writing to the attention of:

   Manager of Licensing
   Nunavut Water Board
   P. O. Box 119
   Gjoa Haven, NU X0B 1J0
   Telephone: (867) 360-6338
   Fax: (867) 360-6369
   Email: licensing@nunavutwaterboard.org

7. Any notice made to an Inspector shall be made in writing to the attention of:

   Water Resources Officer
   Nunavut District, Nunavut Region
   P.O. Box 100
   Iqaluit, NU X0A 0H0
   Telephone: (867) 975-4295
   Fax: (867) 979-6445

8. The Licensee shall submit one (1) paper copy and one (1) electronic copy of all reports, studies, and plans to the Board or as otherwise requested by the Board. Reports or studies submitted to the Board by the Licensee shall include an executive summary in English and

Inuktitut.

9. The Licensee shall ensure that any document(s) or correspondence submitted by the Licensee to the Board is received by the Manager of Licensing.

10. The Licensee shall install and maintain signs that identify Water Supply Facilities, and Waste Disposal Facilities. The signs shall be posted in English and Inuktitut.

11. The Licensee shall, for all plans submitted under this Licence, include a proposed timetable for implementation. Plans submitted cannot be undertaken without subsequent written Board approval and direction. The Board may alter or modify a plan if necessary to achieve the legislative objectives and will notify the Licensee in writing of acceptance, rejection or alteration of the plan.

12. In the event that a plan is not found acceptable to the Board, the Licensee shall provide a revised version to the Board for review within thirty (30) days of notification by the Board.

13. Every plan to be carried out pursuant to the terms and conditions of this Licence shall, once approved become a part of this Licence, and any additional terms and conditions imposed upon approval of a plan by the Board become part of this Licence. All terms and conditions of the Licence shall be contemplated in the development of a plan where appropriate.

14. The Licensee shall review the plans and manuals referred to in this Licence as required by changes in operation, site conditions, monitoring and/or technology and modify the plans and manuals to reflect these changes. Revisions to plans and manuals are to be submitted as an Addendum with the Annual Report required in Part B, Item 3, and include a complete list of revisions detailing where significant content changes have been made.

15. Licence is assignable as provided in section 44 of the Act.

16. The expiry or cancellation of this Licence does not relieve the Licensee from any obligation imposed by the Licence as provided in section 45 of the Act.

PART C: CONDITIONS APPLYING TO SECURITY

1. The Licensee shall furnish and maintain security with the Minister, in the amount of $2.0 million dollars, in the form that is satisfactory to the Minister.

2. The Licensee shall furnish and maintain such further or other amounts as may be required by the Board, based on updated annual estimates of current mine reclamation liability.

3. The Licensee may submit to the Board for approval in writing, a request for a reduction to the amount of security. The submission shall include supporting evidence to justify the request.

4. Subject to Part C, Item 2 and Part C, Item 3, the security referred to in Part C, Item 1 shall

be maintained until such time as it is fully or in part refunded by the Minister pursuant to sub section 76(5) of the Act. This clause shall survive the expiry of this Licence or renewals thereof and until full and final reclamation has been completed to the satisfaction of the Minister.

PART D: CONDITIONS APPLYING TO CONSTRUCTION

1. The Licensee shall prevent any chemicals, fuel or wastes associated with the undertaking from entering any water body.

2. The Licensee shall minimize disturbance to terrain, permafrost and drainage during movement of contractor's equipment and personnel around the site during construction activities.

3. The Licensee shall not store material on the surface of frozen streams or lakes except what is for immediate use.

4. The Licensee shall locate equipment storage areas on gravel, sand or other durable land, a distance of at least thirty (30) metres above the ordinary high water mark of any water body in order to minimize impacts on surface drainage and water quality.

5. The Licensee shall undertake necessary corrective measures to mitigate impacts on surface drainage resulting from the Licensee's activities.

6. The Licensee shall limit any in-stream activity to low water periods. In-stream activity is prohibited during periods when fish migration may be expected.

7. Prior to the construction of any dams, dykes or structures intended to contain, withhold, divert or retain Water or Wastes, final design and construction drawings signed and stamped by an Engineer shall be submitted to the Board, for approval in writing.

8. The construction of engineered earthworks shall be supervised and field checked by a qualified Engineer. Construction records shall be maintained and made available at the request of the Board.

9. The Licensee shall submit a Construction Summary Report, to the Board for review, within ninety (90) days following completion of all new structures designed to contain, withhold divert or retain Water or Wastes. The Report shall be prepared by a qualified Engineer(s) in accordance with Schedule D, Item 1.

10. The Licensee shall use fill material for construction from an approved source, which has been demonstrated not to produce Acid Rock Drainage and to be non-Metal Leaching.

11. The Licensee shall implement sediment and erosion control measures prior to and during Construction and Operations where necessary, to prevent entry of sediment into Water.

12. The Licensee shall inspect daily all construction activities for signs of erosion.

13. The Licensee shall minimize disturbance to terrain, permafrost and drainage during movement of the Licensee's and its contractor's equipment and personnel around the site during construction activities.

PART E: CONDITIONS APPLYING TO WATER USE AND MANAGEMENT

1. The Licensee shall obtain all fresh Water for domestic use from East Twin Lake, and Water use for the purposes of mitigation may be obtained from East Twin Lake, West Twin Creek and/or Chris Creek, or as otherwise approved by the Board in writing.

2. The total volume of fresh Water for all uses shall not exceed one-hundred (100) cubic metres per day.

3. The Licensee shall equip all Water intake hoses with a screen of an appropriate mesh size to ensure that fish are not entrained and shall withdraw Water at a rate such that fish do not become impinged on the screen.

4. Streams cannot be used as a water source unless authorized and approved by the Board in advance in writing.

5. If the Licensee requires water in sufficient volume that the source water body may be drawn down the Licensee shall, at least thirty (30) days prior to commencement of use of water, submit to the Board for approval in writing, the following: volume required, hydrological overview of the water body, details of impacts, and proposed mitigation measures.

6. The Licensee shall not remove any material from below the ordinary high water mark of any water body unless authorized.

7. The Licensee shall implement measures to prevent the generation and deposition of dust and/or sediment into Water arising from road use.

PART F: CONDITIONS APPLYING TO WASTE DISPOSAL AND MANAGEMENT

1. Effluent being discharged from the West Twin Disposal Area at monitoring station 159-4 shall be directed to Twin Lakes Creek and not exceed the following Effluent quality limits:

Substance	Monthly Mean	Composite Sample	Grab Sample
	Maximum Authorized Concentration (mg/L)	Maximum Authorized Concentration (mg/L)	Maximum Authorized Concentration (mg/L)
Total Arsenic (As)	0.25	0.375	0.50

Substance	Monthly Mean	Composite Sample	Grab Sample
	Maximum Authorized Concentration (mg/L)	Maximum Authorized Concentration (mg/L)	Maximum Authorized Concentration (mg/L)
Total Copper (Cu)	0.10	0.15	0.20
Total Lead (Pb)	0.10	0.15	0.20
Total Nickel (Ni)	0.50	0.75	1.00
Total Zinc (Zn)	0.25	0.375	0.50
Total Suspended Solids (TSS)	15.00	22.50	30.00
Total Radium 226 (^{226}Ra)	0.37 Bq/L	0.74 Bq/L	1.11 Bq/L
Total Cadmium (Cd)	0.005	0.008	0.01
pH	6.0-9.5		

2. Where a visible sheen of Oil and Grease has been observed under Part I, Item 2, the Maximum Authorized Concentration in a Grab Sample shall not exceed 30 mg/L.

3. The Licensee shall remove from the project site, all hazardous Wastes generated through the course of the undertaking, for disposal at an approved hazardous waste disposal facility.

4. The Licensee shall maintain records of all Waste backhauled.

PART G: CONDITIONS APPLYING TO MODIFICATIONS

1. The Licensee may, without written consent from the Board, carry out Modifications provided that such Modifications are consistent with the terms of this Licence and the following requirements are met:

    a. The Licensee has notified the Board in writing of such proposed Modifications at least sixty (60) days prior to beginning the Modifications to include requirements of Part G, Item 3;
    b. Such Modifications do not place the Licensee in contravention of the Licence or the Act;
    c. Such Modifications are consistent with the NIRB Screening Decision;
    d. The Board has not, within sixty (60) days following notification of the proposed Modifications, informed the Licensee that review of the proposal will require more than sixty (60) days; and
    e. The Board has not rejected the proposed Modifications.

2. Modifications for which any of the conditions referred to in Part G, Item 1 have not been met can be carried out only upon approval from the Board in writing.

3. Applications for modifications shall contain:

a. A description of the facilities and/or works to be constructed;
b. The proposed location of the structure(s);
c. Identification of any potential impacts to the receiving environment;
d. A description of any monitoring required, including sampling locations, parameters measured and frequencies of sampling;
e. Schedule for construction;
f. Drawings of engineered structures stamped by a Professional Engineer; and
g. Proposed sediment and erosion control measures.

4. The Licensee shall provide as-built plans and drawings of the Modifications referred to in this Licence within ninety (90) days of completion of the Modification. These plans and drawings shall be stamped by an Engineer.

PART H: CONDITIONS APPLYING TO EMERGENCY RESPONSE AND SPILL CONTINGENCY PLANNING

1. The Licensee shall prevent any chemicals, petroleum products or unauthorized Wastes associated with the project from entering Water.

2. The Licensee shall provide secondary containment for fuel and chemical storage as required by applicable standards and acceptable industry practice.

3. The Licensee shall prevent any chemicals, petroleum products or Wastes associated with the project from entering into Water.

4. All sumps and fuel caches shall be located at a distance of at least thirty (30) metres from the ordinary high water mark of any adjacent water body and inspected on a regular basis.

5. Licensee shall ensure that any equipment maintenance and servicing be conducted only in designated areas and shall implement special procedures (such as the use of drip pans) to manage motor fluids and other waste and contain potential spills.

6. If, during the period of this Licence, an unauthorized Discharge of Waste and or Effluent occurs, or if such Discharge is foreseeable, the Licensee shall:

   a. Employ as required, Emergency Response and Spill Contingency measures;
   b. Report the incident immediately via the 24-Hour Spill Reporting Line (867) 920-8130 and to the Inspector at (867) 975-4295; and
   c. For each discharge occurrence, submit a detailed report to the Inspector, no later than thirty (30) days after initially reporting the event, which includes the reference spill report number and a summary of information provided during initial reporting, the final estimated amount and type of spilled product, the GPS location of the spill, and the measures taken to contain, clean up and restore the spill site.

PART I: CONDITIONS APPLYING TO THE MONITORING PROGRAM

1. The Licensee shall undertake the Monitoring Program as provided in Tables 1, 2, and 3 of Schedule I.

2. If a visible sheen of Oil and Grease is present upon inspection at all sampling locations, during each sampling date, the Licensee shall obtain additional samples to be analysed for Oil and Grease to comply with Part F, Item 2.

3. The Licensee shall confirm the locations and GPS coordinates for all monitoring stations referred to in Schedule I with an Inspector.

4. The Licensee shall install and maintain signs that identify the monitoring stations. The signs shall be posted in English and Inuktitut.

5. The Licensee shall undertake a geotechnical inspection, to be carried out annually by a Geotechnical Engineer, during the months of July, August or September and reported as set out in Part I, Item 6. The inspection shall be conducted in accordance with the *Canadian Dam Safety Guidelines,* where applicable and be consistent with the "2008 Annual Geotechnical Inspection" (BGC Engineering Inc., January 30, 2009), taking into account all major earthworks and any changes to the project.

6. The Licensee shall submit to the Board, within the Annual Report required by Part B, Item 3, a report of the Geotechnical Engineer's Inspection carried out under Part I, Item 5. The Report shall include a cover letter from the Licensee, outlining an implementation plan to address the recommendations of the Geotechnical Engineer.

7. The Licensee shall submit to the Board, within the Annual Report required by Part B, Item 3, a detailed "Annual Water Quality Review" which includes, analysis of results and comparison to regulatory standards, approved plans, and demonstration of stability for termination of post-closure monitoring program where merited.

8. The Licensee shall submit to the Board for approval in writing, within three (3) months of issuance of the Licence, a "Comprehensive Contingency Plan" to include:

    a. Consolidation of contingency measures as provided in the Appendices to the 2004 Reclamation Plan and Closure Plan(s);
    b. Levels established and the methodology used in the establishment of contingency levels for water quality monitoring parameters and the geotechnical monitoring program, must be established whereby defined abatement and mitigation actions would be undertaken for any exceedance of such levels or criteria, taking into account historical background conditions;
    c. Mitigation and monitoring that addresses any environmental issues that may develop during reclamation of the Main Fuel Tank Farm; and
    d. Reporting requirements.

9. All sampling, sample preservation and analyses shall be conducted in accordance with the methods prescribed in the current edition of "*Standard Methods for the Examination of Water and Wastewater*" or by other such methods approved by an Analyst.

10. All analyses shall be performed in an accredited laboratory according to ISO/IEC Standard 17025. The accreditation shall be current and in good standing.

11. The Licensee shall submit a revised "Quality Assurance/ Quality Control (QA/QC) Plan". The QA/QC Plan shall be modified to include up to date sampling methods to all applicable standards, acceptable to an accredited laboratory as required by Part I, Item 9 and Part I, Item 10. The Plan shall include a covering letter from the accredited laboratory confirming acceptance of the Plan for analyses to be performed under this Licence.

12. The Monitoring Program may be modified, without a public hearing, at the discretion of the Chief Executive Officer. Requests for changes to the Program must be forwarded to the NWB in writing and include a comprehensive trend and comparative analysis to previously collected data, including background monitoring data for all sample parameters and locations, and provide a rationale acceptable to the NWB to support the request.

PART J: CONDITIONS APPLYING TO ABANDONMENT, RECLAMATION AND CLOSURE

1. The Licensee shall continue to implement the Nanisivik Mine 2004 Reclamation Plan and Closure Plan as approved by the Board on July 6, 2004 including the monitoring requirements to confirm objectives, or as subsequently revised to incorporate design changes and adaptive engineering required and implemented during Construction and on the basis of actual site conditions and monitoring results over the implementation period or as otherwise required by this Licence. The plan included:

    a. Nanisivik Mine 2004 Reclamation Plan and Closure Plan;
    b. Engineering Design of Surface Reclamation Covers Report;
    c. Surface Cell and Test Cell Taliks Report;
    d. Quarry Development and Reclamation Plan;
    e. Detailed Design of the West Twin Dyke Spillway Report;
    f. Rock Piles and Open Pits Closure Plan;
    g. Closure Monitoring Plan;
    h. 2003 Phase III Environmental Site Assessment Report;
    i. Human Health and Ecological Risk Assessment Report;
    j. West Twin Disposal Area Closure Plan;
    k. Waste Disposal Plan; and
    l. Landfill Closure Plan.

2. The Licensee shall submit to the Board for approval in writing, by September 30, 2009, Abandonment and Reclamation Plan specific to the Fuel Tank Farm, prepared in accordance with the *Mine Site Reclamation Guidelines for the Northwest Territories, 2007*

and consistent with the INAC *Mine Site Reclamation Policy for Nunavut, 2002*. The Plan shall include:

a. Detailed engineering designs, stamped by an Engineer, for the closure (where applicable);
b. Details on the collection and disposal of hydrocarbon residues within all tanks and pipes;
c. The process of dismantling and disposing of all tanks, pipes, pumps and liners including final disposal location;
d. Description of the final desired landscape;
e. Discuss potential closure issues and liabilities including anticipated costs of all remediation activities;
f. Identify a plan to delineate, treat and dispose of hydrocarbon contaminated soils located within, beneath and adjacent to the Fuel Tank Farm;
g. Confirmation of Soil Quality Remediation Objectives (SQRO's) for the tank farm area;
h. Consideration for disposal of liquid and/or hazardous waste in accordance with Government of Nunavut requirements or guidelines;
i. Confirmatory soil analysis for Total Petroleum Hydrocarbons (TPH);
j. Decontamination and removal procedures for the tank and liner;
k. Spill Contingency measure in accordance with *Spill Contingency Planning and Reporting Regulations* developed under the *Environmental Protection Act (Nunavut)*; and
l. Detailed implementation schedule for all tasks and activities.

SCHEDULES

Schedule A – Scope, Definitions and Enforcement
Schedule B – General Conditions
Schedule D – Conditions Applying to Construction
Schedule I – Conditions Applying to the Monitoring Program

Schedule A – Scope, Definitions, and Enforcement

In this Licence: 1AR-NAN0914

"**Abandonment**" means the permanent dismantlement of a facility so it is permanently incapable of its intended use. This includes the removal of associated equipment and structures;

"**Act**" means the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*;

"**Acid Rock Drainage (ARD)**" means the production of acidic leachate, seepage or drainage from underground workings, open pits, ore piles, waste rock, construction rock that can lead to the release of metals to groundwater or surface water during the life of the Project and beyond closure;

"**Addendum**" means the supplemental text that is added to a full plan or report usually included at the end of the document and is not intended to require a full resubmission of the revised report. Also considered to be an appendix or supplement;

"**Amendment**" means a change to any terms and conditions of this Licence, through application to the NWB, requiring a change, addition, or deletion of specific terms and conditions of the Licence;

"**Analyst**" means an Analyst designated by the Minister under section 85 (1) of the *Act*;

"**Bi-weekly**" means, in the context of monitoring frequency, one sampling event occurring every two (2) weeks with a minimum of eight (8) days between sampling events;

"**Board**" means the Nunavut Water Board established under Article 13 of the *Nunavut Land Claims Agreement* and under section 14 of the Act;

"**Chief Executive Officer**" means the Chairman of the Nunavut Water Board;

"**Closure**" means when an Operator ceases operations at a facility without the intent to resume mining activities in the future;

"**Closure-period**" means the period immediately following the Reclamation Period where maintenance and monitoring is to be undertaken with respect to the monitoring program commencing in 2009;

"Composite Sample" means

(a) a quantity of effluent consisting of not less than three equal volumes proportionate to flow that have been collected at approximately equal time intervals over a sampling period of not less than seven hours and not more than 24 hours; or
(b) a quantity of effluent collected continuously at a constant rate or at a rate

proportionate to the rate of flow of the effluent over a sampling period of not less than seven hours and not more than 24 hours.

"**Construction**" means any activities undertaken to construct or build or remediate any component of, or associated with, the undertaking Nanisivik Mine post-closure;

"**Dam Safety Guidelines**" means the *Canadian Dam Association (CDA) Dam Safety Guidelines (DSG), January 1999* or subsequent approved editions;

"**Deposit**" means the placement of waste rock, tailings or other solids materials on land or in water;

"**Discharge**" means the release of any water or waste to the receiving environment;

"**Effluent**" means the liquid discharge from all site water management facilities;

"**Engineer**" means a professional engineer registered to practice in Nunavut in accordance with the *Engineering, Geological and Geophysical Act (Nunavut)* S.N.W.T. 1998, c.38, s.5;

"**Engineered Structure**" means any facility, which was designed and approved by a Professional Engineer registered with the Association of Professional Engineers, Geologists and Geophysicists of Nunavut;

"**Final Discharge Point**" in respect of an effluent, means an identifiable discharge point of a mine beyond which the Operator of the mine no longer exercises control over the quality of the effluent;

"Fuel Tank Farm" compromises the fifteen steel tanks of various sizes and all associated facilities including, piping, pumping equipment, containment structures, liners, and berms located in the dock area;

"**Geotechnical Engineer**" means a professional engineer registered with the Association of Professional Engineers, Geologist and Geophysicists of Nunavut and whose principal field of specialization with the engineering properties of earth materials in dealing with man-made structures and earthworks that will be built on a site. These can include shallow and deep foundations, retaining walls, dams, and embankments;

"**Grab Sample**" means an undiluted quantity of material collected at a particular time and place that may be representative of the total substance being sampled at the time and place it was collected;

"**Hazardous Materials**" means a contaminant which is a dangerous good that is no longer used for its original purpose and is intended for recycling, treatment, disposal or storage;

"**ICP Metals Scan**" means, for the purpose of the Licence, elements detected in an inductively coupled plasma (ICP) mass spectrometer. Metal parameters should be consistent with baseline data previously collected and include any other metals of concern or interest;

"**Inspector**" means an Inspector designated by the Minister under section 85 (1) of the Act;

"**Interim Closure and Reclamation Plan**" means a conceptual detailed plan on the reclamation of mine components which will not be closed until the end of the mining operations, and operational detail for components which are to be progressively reclaimed throughout the mine life;

"Landfill" consists of the facilities described in S. 5.4 as identified in the Nanisivik Mine Closure and Reclamation Plan (February 2002), Figure 1-2 titled "Mine General Arrangement";

"**Licence**" means this Type "A" Water Licence 1AR-NAN0914, issued by the Nunavut Water Board in accordance with the *Act*, to CanZinco Ltd. for the Nanisivik mine;

"**Licensee**" means to whom Licence 1AR-NAN0914 is issued to or assigned;

"**Maximum Authorized Monthly Mean Concentration**" means the average concentration of all samples collected over a thirty day period from the identical sampling location;

"**Metal Leaching**" means the mobilization of metals into solution under neutral, acidic or alkaline conditions;

"**Minister**" means the Minister of Indian and Northern Affairs Canada;

"**Modification**" means an alteration to a physical work that introduces a new structure or eliminates an existing structure and does not alter the purpose or function of the work;

"**Monitoring Program**" means the program to collect report and analyze, Water quality and geotechnical data used to assess impacts to the environment of an appurtenant undertaking;

"**Monthly**" means, in the context of monitoring frequency, one sampling event occurring every thirty (30) days with a minimum of twenty-one (21) days between sampling events;

"**Nunavut Land Claims Agreement**" **(**NLCA) means the "*Agreement Between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in Right of Canada*," including its preamble and schedules, and any amendments to that agreement made pursuant to it;

"**Operator**" means the person who operates, has control or custody of, or is in charge of a mine or recognized closed mine;

"**Project**" means the Nanisivik mine Project as outlined in the Final Environmental Impact Statement and supplemental information submitted by CanZinco Ltd. to the Nunavut Impact

Review Board (NIRB) as well as the Water Licence Application, Supporting Documents, and Technical Meeting Information Supplement documents submitted by the CanZinco Ltd. to the Nunavut Water Board throughout the regulatory process;

"**Quality Assurance / Quality Control (QA/QC)**" Quality Assurance means the system of activities designed to better ensure that quality control is done effectively; Quality Control means the use of established procedures to achieve standards of measurement for the three principle components of quality: precision, accuracy and reliability;

"**Quarterly**" means, in the context of monitoring frequency, one (1) sampling event occurring every three (3) months with a minimum of ninety (90) days between sampling events;

"**Reclamation**" means the process of returning the mine sites and affected areas to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and with human activities;

"**Receiving Environment**" means both the aquatic and terrestrial environments that receive any discharge resulting from the Project;

"**Regulations**" means the *Northwest Territories Water Regulations SOR/93-303 8 June, 1993*;

"**Soil Quality Remediation Objectives (SQRO's)**" means the numerical concentration established as target value for soil quality remediation for contaminated sites as determined with guidance provided by the *Canadian Council of Ministers of the Environment (CCME);*

"**Surface Cell**" means the tailings, dike, shale and armour cover in the West Twin Disposal Area Surface Cell as detailed in the document *Surface Reclamation Covers As-Built Report; Nanisivik Mine, NU; Final Report.* BGC Engineering Inc. dated, April 14, 2008;

"**Test Cell**" means the tailings, shale and armour cover in the West Twin Disposal Area Test Cell as detailed in the document *Surface Reclamation Covers As-Built Report; Nanisivik Mine, NU; Final Report.* BGC Engineering Inc., dated, April 14, 2008;

"**Upper Dump Pond**" means the tailings, shale and armour cover in the West Twin Disposal Area Upper Dumb Pond as detailed in the document *Surface Reclamation Covers As-Built Report; Nanisivik Mine, NU; Final Report.* BGC Engineering Inc., dated, April 14, 2008;

"**Use**" means use as defined in section 4 of the Act;

"**Waste**" means waste as defined in section 4 of the Act;

"**Waste Rock**" means all unprocessed rock materials that are or were produced as a result of mining operations and have no current economical value;

"**Waste Water**" means the water generated by site activities or originates on-site that requires treatment or any other water management activity;

"**Water**" means water as defined in section 4 of the Act;

"**Water Licence Application**" means the amendment application and supporting information received September 26, 2006 and the renewal application dated February 15, 2008 with supporting documentation received by the NWB during the regulatory review to close of the public hearing record;

"**Weekly**" means, in the context of monitoring frequency, one (1) sampling event occurring every seven (7) days with a minimum of five (5) days between sampling events; and

"**West Twin Disposal Area**" means the facility consisting of the tailings impoundment area known as the Surface Cell, the structures designed to contain tailings, and West Twin Reservoir and Test Cell Area as identified in the West Twin Disposal Area Closure Plan, dated March 4, 2004".

The Annual Report referred to in Part B Item 3, shall include:

1. An executive summary of the Annual Report shall be provided in English and Inuktitut to summarize the activities and reclamation progress achieved under this Licence.

PART D – CONDITIONS APPLYING TO CONSTRUCTION

2. For the dikes and dams:
   a. As-built drawings of all mitigation works undertaken;
   b. Any changes in the design and/or as-built condition and respective consequences of any changes to safety, water balance and water quality; and
   c. A summary of maintenance work undertaken as a result of settlement or deformation of dikes and dams.

PART E – CONDITIONS APPLYING TO WATER USE AND MANAGEMENT

3. A summary of all water use activities in relation to the purpose of use and volumes required.

PART F – CONDITIONS APPLYING TO WASTE DISPOSAL AND MANAGEMENT

4. A summary of all general and hazardous Wastes generated through the course of the undertaking and their removal for disposal at an approved disposal facility.

PART G – CONDITIONS APPLYING TO MODIFICATIONS

5. A summary of all modifications and/or major maintenance work carried out on all water use and waste disposal related structures and facilities.

PART H – CONDITIONS APPLYING TO EMERGENCY RESPONSE AND SPILL CONTINGENCY PLANNING

6. A summary list and description of all unauthorized discharges including volumes, spill report line identification number and summaries of follow-up action taken as reported under Part H, Item 6(c).

PART I – CONDITIONS APPLYING TO THE MONITORING PROGRAM

7. Tabular summaries of all results of the Monitoring Program in accordance with Part I and Schedule I, Tables 2 and 3 including:

a. Water quality data; and
b. Data collected from instrumentation used to monitor earthworks and an interpretation of that data.

FOR DIKES, DAMS AND COVERS

8. An overview of methods and frequency used to monitor deformations, seepage and geothermal responses.

9. A comparison of measured versus predicted performance.

10. A discussion of any unanticipated observations including changes in risk and mitigation measures implemented to reduce risk.

11. Provide detailed map(s) of all geotechnical and water quality monitoring stations to accompany the reporting and interpretation of results.

12. The Geotechnical Engineer's Inspection Report required by Part I, Item 5, including the Annual Water Quality Review, required by Part I, Item 7.

PART J – CONDITIONS APPLYING TO ABANDONMENT, RECLAMATION AND CLOSURE

13. A summary of any closure and reclamation work undertaken on the Fuel Tank Farm, including photographic records of site conditions before and after completion of operations, and an outline of any work anticipated for the next year, including any changes to implementation and scheduling.

14. An updated estimate of the current reclamation liability, as required by Part J, Item 4, based on project development monitoring, results of reclamation research and any changes or modifications to the Appurtenant Undertaking. This estimate is to include a summary of expenditures during the year in relation to the ongoing mine site reclamation.

15. A summary of general remediation and reclamation work completed to date.

16. A revised implementation schedule.

GENERAL and PLANS/ REPORTS/ STUDIES

17. A summary of any studies requested by the Board that relate to Water Use, Waste disposal or Reclamation activities, and a brief description of any future studies planned.

18. Where applicable, submission of Addendums, with a revisions summary table giving an indication of the change, where they have been made and the date, for all plans, reports, and manuals.

19. An executive summary in English, Inuktitut of all plans, reports, or studies conducted under this Licence.

20. A summary of actions taken to address concerns or deficiencies listed in the inspection reports and/or compliance reports filed by an Inspector.

OTHER

21. A summary of public consultation and participation with local organizations and the residents of the nearby communities, including a schedule of upcoming community events and information sessions.

22. A detailed workplan of activities to be carried out in the subsequent year including dates of planned onsite inspection and sampling activities.

23. Any other details on Water use or Waste Disposal requested by the Board by November 1st of the year being reported.

Schedule D - Conditions Applying to Construction

1. The Construction Monitoring Report referred to in Part D, Item 9 shall include:

    a. A summary of construction activities including photographic records before, during and after construction;
    b. As-built drawings;
    c. Documentation of field decisions that deviate from original plans and any data used to support these decisions;
    d. Discussion of mitigation measures implemented during construction and effectiveness;
    e. Monitoring undertaken in accordance with Part D;
    f. Blast vibration monitoring for quarrying activity carried out in close proximity to fish bearing waters; and
    g. Monitoring for sediment release from construction areas.

Schedule I - Conditions Applying to General Monitoring: Tables 1, 2 and 3

TABLE 1 – Water Quality Monitoring Groups

Group	Included Parameters
1	Metals Analysis: Total cadmium, Total lead, Total zinc Major Cations: calcium, magnesium, sodium, potassium, ammonia, and the derived parameter hardness Major Anions chloride, sulphate, bicarbonate, carbonate, nitrate + nitrite, and the derived parameter alkalinity Total Suspended Solids (TSS) Field Parameters: specific conductivity, temperature pH Visual Oil and Grease (unless required by Part I, Item 2)
2	Total Petroleum Hydrocarbon (TPH) (when active layer deepest)
3	Oil and Grease
4	ICP Metal Scan (trace metal scan) to be, at a minimum, consistent with background water quality data previously collected including any other metals of concern or interest

TABLE 2 – Post-Closure (2009-2014) Active Water Quality Monitoring Program

Station	Description	Phase	Monitoring Parameters	Frequency[1]
Mine Site				
159-4	Final Discharge Point Effluent from the West Twin Disposal Area at decant structure	Post-closure	Group 1	Bi-weekly
			Group 4	Twice Annually
159-6	Twin Lakes Creek approximately 10 metres upstream from its mouth at high tide.	Post-closure	Group 1 Group 3	Bi-weekly
			Group 4	Twice Annually
159-10	Twin Lakes Creek, 10 metres upstream of the west tributary from Nanisivik townsite.	Post-closure	Group 1	Bi-weekly
159-14	Chris Creek, 50 metres upstream from the confluence of East Portal and Chris Creek.	Post-closure	Group 1	Monthly
159-15	Chris Creek, upstream from where Area 14 drainage enters Chris Creek (at the culvert).	Post-closure	Group 1	Monthly
159-17	Above the outflow of Chris Creek to Strathcona Sound	Post-closure	Group 1	Monthly
			Group 4	Twice Annually
159-20 (NML-23)	Outflow of East Twin Lake	Post-closure	Group 1	Bi-weekly
159-21 (NML-29)	Downstream of Landfill – East Drainage System	Post-closure	Group 1 Group 2 Group 3	Monthly
NML-30	Downstream of Landfill – West Drainage System	Post-closure	Group 1 Group 2 Group 3	Monthly

Note: [1] during periods of flow

TABLE 3 – Post –Closure Active Geotechnical Monitoring Program

Summary of Instrument Readings Requirements				
Instrument Information			Post Closure Monitoring	
Instrument Label	**Instrument Type**	**Location**	**Monitoring Frequency**	**No. of Monitoring Nodes**
West Twin Dike				
TC12	Thermocouple	Dike Face	Quarterly	2
TC13A	Thermocouple	Dike Face	Quarterly	5
TC31	Thermocouple	Dike Face	Quarterly	5
TC32	Thermocouple	Dike Face	Quarterly	7
TC33	Thermocouple	Dike Face	Quarterly	7
BGC03-33	Thermistor	Dike Crest	Quarterly	10
BGC03-34	Thermistor	Dike Crest	Quarterly	10
BGC05-09	Thermistor	Dike Crest	Quarterly/ Bi-weekly June 1-Sept 15	12
BGC05-15	Thermistor	Dike Crest	Quarterly/ Bi-weekly June 1-Sept 15	12
BGC03-17	Thermistor	Dike Crest	Quarterly/ Bi-weekly June 1-Sept 15	1
Surface Cell				
BGC02-03	Thermistor	Surface Cell	No longer functioning- discontinued	
BGC03-07	Thermistor	Surface Cell	Quarterly	9
BGC03-09	Thermistor	Surface Cell	Quarterly	10
BGC03-10	Thermistor	Surface Cell	Quarterly	8
BGC03-11	Thermistor	Surface Cell	Quarterly/ Bi-weekly June 1-Sept 15	10
BGC03-12	Vibrating Wire Piezometer	Surface Cell	Quarterly	1
BGC03-14	Vibrating Wire Piezometer	Surface Cell	Quarterly	1
BGC03-15	Thermistor	Surface Cell	Quarterly	10
BGC03-20	Thermistor	Surface Cell	Quarterly/ Bi-weekly June 1-Sept 15	10
BGC03-21	Thermistor	Surface Cell	Quarterly	10
BGC03-32	Vibrating Wire Piezometer	Surface Cell	Quarterly/ Bi-weekly June 1-Sept 15	1
BGC03-35	Vibrating Wire Piezometer	Surface Cell	Quarterly/ Bi-weekly June 1-Sept 15	1
BGC03-36	Thermocouple	Surface Cell	Quarterly	5
BGC03-37	Thermistor	Surface Cell	Quarterly/ Bi-weekly	9

Summary of Instrument Readings Requirements				
Instrument Information			Post Closure Monitoring	
Instrument Label	**Instrument Type**	**Location**	**Monitoring Frequency**	**No. of Monitoring Nodes**
			June 1-Sept 15	
BGC05-05	Thermistor	Surface Cell	Quarterly	12
BGC05-06	Vibrating Wire Piezometer	Surface Cell	Quarterly/ Bi-weekly June 1-Sept 15	1
BGC05-07	Vibrating Wire Piezometer	Surface Cell	Quarterly/ Bi-weekly June 1-Sept 15	1
BGC05-08	Contingency	Surface Cell	-	n/a
Surface Cell				
BGC05-10	Vibrating Wire Piezometer	Surface Cell	Quarterly/ Bi-weekly June 1-Sept 15	1
BGC05-11	Monitoring Well	Surface Cell	Once per summer	n/a
BGC05-12	Monitoring Well	Surface Cell	Once per summer	n/a
BGC05-13	Vibrating Wire Piezometer	Surface Cell	Quarterly/ Bi-weekly June 1-Sept 15	1
BGC05-14	Contingency	Surface Cell	-	n/a
BGC05-16	Contingency	Surface Cell	-	n/a
FG-1	Frost Gauge	Surface Cell	Bi-weekly June 1-Sept 15	n/a
FG-2	Frost Gauge	Surface Cell	Bi-weekly June 1-Sept 15	n/a
FG-3	Frost Gauge	Surface Cell	Bi-weekly June 1-Sept 15	n/a
FG-4	Frost Gauge	Surface Cell	Bi-weekly June 1-Sept 15	n/a
FG-5	Frost Gauge	Surface Cell	Bi-weekly June 1-Sept 15	n/a
FG-6	Frost Gauge		Bi-weekly June 1-Sept 15	n/a
Toe of West Twin Dike				
BGC03-18	Thermocouple	Toe of West Twin Dike	Quarterly	4
BGC03-19	Thermistor	Toe of West Twin Dike	Quarterly/ Bi-weekly June 1-Sept 15	8
BGC05-26	Thermistor	Toe of West Twin Dike	Quarterly/ Bi-weekly June 1-Sept 15	10
Test Cell				
BGC05-04	Thermistor	Test Cell	Quarterly/ Bi-weekly June 1-Sept 15	10
BGC05-18	Vibrating Wire Piezometer	Test Cell	Quarterly/ Bi-weekly	1

Summary of Instrument Readings Requirements				
Instrument Information			Post Closure Monitoring	
Instrument Label	**Instrument Type**	**Location**	**Monitoring Frequency**	**No. of Monitoring Nodes**
			June 1-Sept 15	
BGC05-19	Thermistor	Test Cell	Quarterly/ Bi-weekly June 1-Sept 15	12
BGC05-20	Vibrating Wire Piezometer	Test Cell	Quarterly/ Bi-weekly June 1-Sept 15	1
BGC05-21	Monitoring Well	Test Cell	Once per summer	n/a
BGC05-22	Vibrating Wire Piezometer	Test Cell	Quarterly/ Bi-weekly June 1-Sept 15	1
BGC05-23	Monitoring Well	Test Cell	Once per summer	n/a
BGC05-24	Vibrating Wire Piezometer	Test Cell	Quarterly/ Bi-weekly June 1-Sept 15	1
BGC05-25	Contingency	Test Cell	-	n/a
FG-7	Frost Gauge	Test Cell	Bi-weekly June 1-Sept 15	n/a
FG-8	Frost Gauge	Test Cell	Bi-weekly June 1-Sept 15	n/a
Test Cell Dike				
BGC02-09	Thermistor	Test Cell Dike	Quarterly	3
BGC03-22	Thermistor	Test Cell Dike	Quarterly	8
BGC05-29	Thermistor	Test Cell Dike	Quarterly/ Bi-weekly June 1-Sept 15	12
Toe of Test Cell Dike				
BGC05-27	Thermistor	Toe of Test Cell Dike	Quarterly/ Bi-weekly June 1-Sept 15	10
BGC05-28	Vibrating Wire Piezometer	Toe of Test Cell Dike	Quarterly/ Bi-weekly June 1-Sept 15	1
FG-9	Frost Gauge	Toe of Test Cell Dike	Bi-weekly June 1-Sept 15	n/a
FG-10	Frost Gauge	Toe of Test Cell Dike	Bi-weekly June 1-Sept 15	n/a
Oceanview Pit				
BGC05-01	Thermistor	Oceanview Pit	Quarterly/ Bi-weekly June 1-Sept 15	12
FG-16	Frost Gauge	Oceanview Pit	Bi-weekly June 1-Sept 15	n/a
East Open Pit				
BGC05-02	Thermistor	East Open Pit	Quarterly/ Bi-weekly June 1-Sept 15	12

Summary of Instrument Readings Requirements				
Instrument Information			Post Closure Monitoring	
Instrument Label	**Instrument Type**	**Location**	**Monitoring Frequency**	**No. of Monitoring Nodes**
BGC05-03	Thermistor	East Open Pit	Quarterly/ Bi-weekly June 1-Sept 15	12
FG-13	Frost Gauge	East Open Pit	Bi-weekly June 1-Sept 15	n/a
FG-14	Frost Gauge	East Open Pit	Bi-weekly June 1-Sept 15	n/a
Landfill				
BGC05-30	Thermistor	Landfill	Quarterly/ Bi-weekly June 1-Sept 15	10
FG-11	Frost Gauge	Landfill	Bi-weekly June 1-Sept 15	n/a
Area 14				
TC8	Thermocouple	Area 14	Quarterly	4
FG-15	Frost Gauge	Area 14	Bi-weekly June 1-Sept 15	n/a
Upper Dump Pond				
FG-17	Frost Gauge	Upper Dump Pond	Bi-weekly June 1-Sept 15	n/a

Notes:

1. Quarterly readings to be taken during December, Late April, Early July, and Late August.
2. Frost Gauges to be read weekly between June 1 and September 15.
3. Reproduced from document provided by BGC Engineering Inc. for CanZinco Ltd., a division of Breakwater Resources Ltd.

APPENDIX C

Supporting Documentation

Stantec

Contingency Plan for Water Quality Exceedances, Former Nanisivik Mine Site

Report Prepared for:
Breakwater Resources Ltd.
Wellington St. W., Suite 950
Toronto, ON
M5J 2N7

Project No. 1039597.01

September 9, 2009

Stantec

PROJECT NO: **1039597.01**

REPORT TO: **Mr. Bob Carreau**
Vice President, CSR and Sustainability
Breakwater Resources Ltd.
Wellington St. W., Suite 950
Toronto, ON
M5J 2N7

ON **Contingency Plan for Water Quality Exceedances, Former Nanisivik Mine Site**

September 9, 2009

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Executive Summary

A contingency plan for surface water quality monitoring is developed for the former Nanisivik Mine site, located near Arctic Bay, Nunavut. Sampling stations identified in the Water Licence issued by the Nunavut Water Board include 159-4 (for which there are specific maximum authorized concentrations for arsenic, cadmium, copper, lead, nickel, zinc, total suspended sediment, radium-226 and pH), as well as 159-6, 159-10, 159-14, 159-15, 159-17, NML-23, NML-29 and NML-30. Site-specific action levels are required for all stations except 159-4.

The contingency plan recommends the use of the 95th percentile value as the basis for specifying action levels for monitoring water quality in relation to concentrations of total cadmium, total lead, total zinc, sulfate, and TSS. For pH, values of 6.0 and 9.5 are recommended. Since the 95th percentile value is likely to be exceeded for one in every twenty observations by chance alone, it is recommended that a follow-up investigation should be initiated into the potential cause of water quality impairment if an action level is exceeded in two consecutive observations at any single location.

If an action level is exceeded for a key parameter in two consecutive water samples, a follow-up investigation will be triggered. The follow-up investigations will include the following:

- Visual reconnaissance of the watercourse upstream from the location where the exceedance was noted, looking for evidence of conditions that might account for the exceedance (*e.g.*, fresh erosion of mineralized outcrops; sources of turbidity; evidence of erosion or damage to any of the covers applied to waste disposal areas).

- Sampling of the watercourse at intervals upstream from the location where the exceedance was noted, using field instruments (pH, conductivity, temperature) and taking water samples for chemical analysis, to identify where the exceedance originates.

An annual report on water quality monitoring results will be submitted to the Nunavut Water Board no later than March 31 in the year following the calendar year being reported (as required by Part B, Item 3 of the Water Licence). The format and content of the report will be similar to those of the 2008 Annual Water Quality Monitoring Report.

Table of Contents

List of Tables

1.0 Introduction

This report outlines a Contingency Plan detailing actions to take in the event of water quality exceedances at the former Nanisivik Mine, near Arctic Bay, Nunavut. The Contingency Plan is a requirement of the Water Licence (No. 1AR-NAN0914, Part I, Item 8) issued for the site on April 1, 2009, by the Nunavut Water Board. As per the Water Licence, the Contingency Plan is to include:

a. Consolidation of contingency measures as provided in the Appendices to the 2004 Reclamation Plan and Closure Plan(s).

b. Levels established and the methodology used in the establishment of contingency levels for water quality monitoring parameters… must be established whereby defined abatement and mitigation actions would be undertaken for any exceedance of such levels or criteria, taking into account historical background conditions.

c. Mitigation and monitoring that addresses any environmental issues that may develop during reclamation of the Main Fuel Tank Farm.

d. Reporting requirements.

This report addresses items “a”, “b” and “d”. Item “c” will be addressed by Breakwater Resources Ltd. under separate cover, as part of the submission addressing reclamation of the Main Fuel Tank Farm.

2.0 Surface Water Quality Monitoring

The Water Licence (Schedule I, Tables 1 and 2) defines the required surface water quality monitoring program (analytical parameters and sampling frequency) at Nanisivik. In addition, for monitoring station 159-4 (the outlet from the West Twin Disposal Area), the Water Licence (Part F, Items 1 and 2) establishes maximum allowable concentrations of total arsenic, cadmium, copper, lead, nickel, zinc and radium-226, total suspended solids, and total petroleum hydrocarbons, and defines the permissible range of pH values.

For the remaining surface water monitoring stations (159-6, 159-10, 159-14, 159-15, 159-17, 159-20, 159-21 and NML-30), maximum allowable concentrations of substances in water are not defined within the Water Licence. The Water Licence, Part I, Item 8b indicates that action levels for water quality monitoring parameters are to be defined and justified within the Contingency Plan.

At any time when hydrocarbon sheens are observed at a water quality monitoring station, additional water samples must be collected to be analysed for hydrocarbons in compliance with the Water Licence, Part F, Item 2.

2.1 ESTABLISHING ACTION LEVELS FOR SURFACE WATER QUALITY PARAMETERS

Action levels for monitoring station 159-4 are defined in the Water Licence (Part F, Items 1 and 2), and are presented here in Table 1. For the remaining monitoring stations, action levels that would trigger further investigation and possible abatement or mitigation actions must be defined.

Table 1 Maximum Authorized Concentrations for Substances in Water at Monitoring Station 159-4

Substance	Maximum Authorized Concentration (mg/L)		
	Monthly Mean	Composite Sample	Grab Sample
Total Arsenic	0.25	0.375	0.50
Total Cadmium	0.005	0.008	0.01
Total Copper	0.1	0.15	0.20
Total Lead	0.1	0.15	0.2
Total Nickel	0.5	0.75	1
Total Zinc	0.25	0.375	0.5
Total Suspended Sediment	15	22.5	30
Total Radium-226	0.37 Bq/L	0.74 Bq/L	1.11 Bq/L
pH	6.0 – 9.5		
Hydrocarbons	Where a visible sheen of oil and grease has been observed under Part I, Item 2, the maximum authorized concentration in a grab sample shall not exceed 30 mg/L.		

The streams draining the Nanisivik area flow through terrain that is naturally mineralized with the metals that were mined, as well as a variety of other minerals. Although some areas such as East Twin Lake (represented by monitoring station 159-20) reliably provide water that meets most Canadian water quality guidelines, other areas (such as monitoring stations 159-6 and 159-10) are periodically influenced by natural mineral outcrops such that some of the Canadian water quality guidelines may not apply. In order to be meaningful, therefore, action levels must be developed in a site-specific manner for each relevant water quality parameter, at each monitoring station.

The statistical basis for developing action levels must depend on the statistical characteristics of the underlying water quality data. Experience shows that the underlying statistical distributions of many key water quality parameters (such as lead and zinc concentrations) are not reflective of a normal distribution. Therefore, parametric statistics (including measures such as the mean and standard deviation) are not meaningful and non-parametric statistics must be considered.

The simplest and most transparent non-parametric statistic to apply is the percentile. The 50^{th} percentile or median divides the data into two groups (those that are lower or higher than the median).

In a similar way, the 95th percentile is defined as the point where 95% of the data are lower, and 5% of the data are higher, and the 99th percentile is defined as the point where 99% of the observations are lower, and only 1% of the observations are higher.

The 95th percentile value is recommended here as the basis for establishing action levels since it represents a reasonable balance between responding to too many "false positive" signals (if the value is set too low), or failing to respond to a significant event (if the value is set too high). In a randomly varying dataset, one observation in every twenty would be expected to exceed the 95th percentile value, regardless of the underlying statistical distribution, without indicating that anything unusual is occurring. However, unless there was a fundamental change in the underlying data, it would be unlikely (one in four hundred) for two consecutive observations to exceed the 95th percentile value.

Taking into consideration that in addition to monitoring station 159-4, there are eight (8) other monitoring stations for which action levels must be defined. There are on average six "key" monitoring parameters (*e.g.,* total cadmium, total lead, total zinc, sulphate, TSS and pH), as well as 15 to 20 additional supporting parameters that are measured. On any given sampling date, therefore, there will be roughly forty-eight (48) "tests" to determine whether any single value exceeds an action level. Based on chance alone, it would be typical for several parameters to exceed the 95th percentile values at one or more monitoring stations, without indicating any abnormal condition. It would be unusual, however, for the 95th percentile value to be exceeded, for the same parameter and monitoring station in two consecutive (biweekly or monthly) samples, by chance alone.

Therefore it is recommended that action levels be defined based upon the 95th percentile values (calculated from historical data) for each key parameter at each monitoring station. When the 95th percentile value is exceeded for any key parameter at the same monitoring station on two consecutive occasions, an investigation will be triggered to determine the cause of the exceedance. Action levels are not identified for the supporting parameters because they are of less concern from a toxicological perspective (*e.g.*, major ion concentrations such as calcium and chloride), or because there is not sufficient data to develop an estimate of the 95th percentile value. For pH, the action limits at all stations are proposed to be the same as the Water Licence limits for Station 159-4 (*i.e.,* 6.0 to 9.5).

The proposed action levels based on the 95th percentile values from historical data are presented in Table 2.

Table 2 Calculated 95th Percentile Values for Water Quality Parameters at Nanisivik Monitoring Stations

	Total Cd (mg/L)	Total Pb (mg/L)	Total Zn (mg/L)	Sulfate (mg/L)	TSS (mg/L)	pH
159-6	0.018	0.063	6.3	509	63	6.0 – 9.5
159-10	0.037	0.14	13	651	15	6.0 – 9.5
159-14	0.0005	0.0022	0.13	408	33	6.0 – 9.5
159-15	0.00085	0.0073	0.17	269	4.0	6.0 – 9.5
159-17	0.0012	0.028	0.38	499	53	6.0 – 9.5
NML-23	0.0058	0.046	0.14	25	11	6.0 – 9.5
NML-29	0.00025	0.0055	0.03	240	22	6.0 – 9.5
NML-30	0.00025	0.0055	0.03	240	22	6.0 – 9.5

Notes:
Values for NML-29 are based upon data from NML-30; zinc values for NML-29 and NML-30 are set equal to the CCME Guideline.
pH values are based on the Water Licence requirement (see Table 1).

2.2 CONTINGENCY PLAN FOR RESPONSE WHEN ACTION LEVELS ARE EXCEEDED

If an action level is exceeded for a key parameter in two consecutive water samples, a follow-up investigation will be triggered. The follow-up investigations will include the following:

- Visual reconnaissance of the watercourse upstream from the location where the exceedance was noted, looking for evidence of conditions that might account for the exceedance (*e.g.,* fresh erosion of mineralized outcrops; sources of turbidity; evidence of erosion or damage to any of the covers applied to waste disposal areas).

- Sampling of the watercourse at intervals upstream from the location where the exceedance was noted, using field instruments (pH, conductivity, temperature) and taking water samples for chemical analysis, to identify where the exceedance originates.

In the event that the cause of a water quality exceedance is identified, and is found to originate from mine infrastructure, a need for remedial action may be identified. It is beyond the scope of this contingency plan to identify what such remedial actions may be. Contingency plans for former mine infrastructure are provided under separate cover.

3.0 Reporting

An annual report on water quality monitoring results will be submitted to the Nunavut Water Board no later than March 31 in the year following the calendar year being reported (as required by Part B, Item 3 of the Water Licence). The format and content of the report will be similar to those of the 2008 Annual Water Quality Monitoring Report (prepared by Jacques Whitford, February 19, 2009). A proposed Table of Contents for the 2009 Annual Water Quality Monitoring Report is shown below.

2009 Annual Water Quality Monitoring Report, Nanisivik Mine, Nunavut

Draft Table of Contents

4.0 Closing

This report has been prepared by Malcolm Stephenson Ph.D., and was reviewed by Tania Noble Sharpe, M.Eng., P.Eng., for the sole benefit of Breakwater Resources Ltd./CanZinco Limited, and may not be relied upon by any other person or entity without the express written consent of Jacques Whitford Stantec Limited and Breakwater Resources Ltd./CanZinco Limited. Jacques Whitford Stantec Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

JACQUES WHITFORD STANTEC LIMITED

Original Signed By	*Original Signed By*
Malcolm Stephenson, Ph.D. Principal, Project Manager	Tania Noble Sharpe M.Eng., P.Eng. Group Leader

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October 20, 2009
File: 1039597.01

Mr. Bob Carreau
Vice President, CSR and Sustainability
Breakwater Resources Ltd.
Wellington St. W., Suite 950
Toronto, ON
M5J 2N7

Dear Mr. Bob Carreau:

Reference: Quality Assurance / Quality Control Plan for Surface Water Monitoring Samples, former Nanisivik Mine Site, Nunavut

This letter outlines the quality assurance / quality control (QA/QC) plan for water samples to be collected during surface water quality monitoring activities at the former Nanisivik Mine site, located near Arctic Bay, Nunavut. Also attached to this letter is a letter provided by Mr. Herbert Yu at Exova Accutest Laboratories, the performing analytical laboratory, confirming their acceptance of the QA/QC plan.

BACKGROUND

The surface water quality monitoring program is required by the Water Licence (1AR-NAN0914, Parts F and I) issued by the Nunavut Water Board. This QA/QC plan is a requirement of the Water Licence, Part I, Item 11, which states:

11. The Licensee shall submit a revised "Quality Assurance / Quality Control (QA/QC) Plan". The QA/QC Plan shall be modified to include up to date sampling methods to all applicable standards, acceptable to an accredited laboratory as required by Part I, Item 9 and Part I, Item 10. The Plan shall include a covering letter from the accredited laboratory confirming acceptance of the Plan for analyses to be performed under this Licence.

The water quality analyses required by the Water Licence are defined in Schedule I, Table 1, and include the following Water Quality Monitoring Groups:

Group	Included Parameters
1	Metals Analysis: total cadmium, total lead, total zinc Major Cations: calcium, magnesium, sodium, potassium, ammonia, and the derived parameter hardness Major Anions: chloride, sulphate, bicarbonate, carbonate, nitrate+nitrite, and the derived parameter alkalinity Total Suspended Solids (TSS) Field parameters: specific conductivity, temperature, pH Visual oil and grease

Group	Included Parameters
2	Total Petroleum Hydrocarbon
3	Oil and Grease
4	ICP Metal Scan (trace metal scan) to be, at a minimum, consistent with background water quality data previously collected including any other metals of concern or interest

QA/QC PLAN

Field Sampling and Measurement Personnel

No special training of field personnel is required for this activity. The sampling technician employed by Breakwater Resources (Mr. Claude Lavallee of Arctic Bay) has several years experience performing this task, and has completed health and safety training with Breakwater Resources.

Field Documentation and Records

Field collected data will be documented using a bound field notebook. This book will be kept on permanent file by Mr. Lavallee, and photocopies or electronic scans of the notebook will be made immediately following each sampling event. The photocopies or scanned files will be mailed (or e-mailed) to Breakwater Resources where they will also be kept on permanent file.

Field measured parameters include specific conductivity, water temperature, and pH. These measurements will be performed using field instruments, which will be calibrated in advance of each sampling event (in the case of pH and conductivity) according to the manufacturer's instructions, using standard calibration solutions. For pH, calibration will involve the use of two pH standards, having values of 4.0 and 7.0.

The field notes will record the sampling locations, date and time of sample collection, type of samples collected (e.g., water samples for general chemistry, hydrocarbon analysis, or ICP metal scan), field instruments used to collect field measurements, date of calibration of the field instruments, and results of field measurements (e.g., water temperature, pH, and conductivity). The results of a visual inspection of the sampling site will also be recorded (i.e., presence of any hydrocarbon sheens or other unusual observations).

Sampling Methods

For this program, all water samples will be collected as grab samples. Water samples should be collected at a depth of 15 cm below the water surface (where the depth of water permits). Bottles and caps will be rinsed three times with site water before filling, unless the bottle is pre-charged with a preservative, in which case rinsing must not be performed. After rinsing, the bottle should be filled by submerging it completely, facing into the current, until all air bubbles have been expelled.

Labels

All samples will be clearly labeled for proper identification in the field and for tracking in the laboratory. At a minimum the sample labels will include the sampling location or name, the date of collection, the initials of the sampler, the intended analytical parameters, and the method of preservation (if relevant).

Field Sampling Quality Control

Field QC samples (duplicates and blanks) will be submitted as part of the sampling program. Normally such samples comprise roughly 10% of the samples submitted. Due to the small number of samples to be collected on each sampling dated, one field duplicate and one field blank sample will be submitted for each relevant Water Quality Monitoring Group in conjunction with each sampling event. These samples will be provided with unique (fictitious) sample identification numbers, and will be submitted "blind" to the laboratory. The identity of these samples will be recorded in the field notebook.

Sample Containers and Preservatives

Sample containers will be provided pre-cleaned by the laboratory. In some cases, the laboratory will provide the sample bottles pre-treated with a preservative.

Sample Packaging and Shipping

All sample containers will be placed in a cooler, with bags of ice to ensure that they remain cool during shipping. Glass bottles will be wrapped with bubble-wrap before being placed in the cooler, and all bottles will be placed in plastic bags and protected with suitable materials (*e.g.,* bubble wrap) to ensure that movement of and potential damage to bottles during shipping is minimized.

The cooler will be sealed by the sample packer, using tape. The analytical laboratory will be notified of the shipment and provided with waybill information and the estimated date and time of arrival by e-mail.

Chain of Custody

Chain of custody forms will be provided by the analytical laboratory, and will be completed by the sampler prior to packing the samples in a cooler. The chain of custody document will include details of the samples shipped, date of collection, sampler, date of shipment, and analyses requested. The chain of custody document will be placed in the cooler in a plastic Ziploc bag, on top of the samples, prior to sealing the cooler.

Laboratory Analysis Methods

The analytical laboratory must be accredited with the Canadian Association for Laboratory Accreditation (CALA). Accreditation by this organization provides assurance of the quality and competence of the performing laboratory.

Analytical methods must follow either U.S. EPA approved methods or methods from the most recent edition of *Standard Methods for the Examination of Water and Wastewater*.

Laboratory QA/QC

The analytical laboratory will perform regular QA/QC during the analysis of field samples, including a program of method blanks, laboratory control samples, instrument calibration samples, matrix spikes, and duplicates.

Annual Reporting

An annual report on water quality monitoring results will be submitted to the Nunavut Water Board no later than March 31 in the year following the calendar year being reported (as required by Part B, Item 3 of the Water Licence). The format and content of the report will be similar to those of the 2008 Annual Water Quality Monitoring Report (prepared by Jacques Whitford, February 19, 2009). The annual report will include as appendices the original laboratory analysis certificates, as well as tables and figures as appropriate to identify

trends in the data, or exceedances of action levels as established in the *Contingency Plan for Water Quality Exceedances, Former Nanisivik Mine Site* (Stantec, 2009).

Within the annual report, the acceptability of samples will be evaluated qualitatively by examination of the field blanks, and field duplicate sample data. Reproducibility of samples will be expressed as relative percent difference (RPD):

$$RPD = 100 \times ((|X_1 - X_2|) / ((X_1 + X_2) / 2)) \ ,$$

where X_1 is the original sample concentration, X_2 is the duplicate sample concentration, and $|X_1 - X_2|$ denotes the absolute value of the difference between these two concentrations.

CLOSING

This letter has been prepared by Malcolm Stephenson PhD, and was reviewed by Tania Noble Sharpe, M.Eng., P.Eng., for the sole benefit of Breakwater Resources Ltd./CanZinco Limited, and may not be relied upon by any other person or entity without the express written consent of Jacques Whitford Stantec Limited and Breakwater Resources Ltd./CanZinco Limited. Jacques Whitford Stantec Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We trust that the above information fulfills your needs at this time. Should you require additional information, please do not hesitate to contact the undersigned.

Sincerely,

JACQUES WHITFORD STANTEC LIMITED

(Original signed by Malcolm Stephenson)

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Principal, Project Manager

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MS/TNS/ttb

cc. Robert Walker, Exova Accutest Laboratories
Herbert Yu, Exova Accutest Laboratories

Attachment

APPENDIX D

2012 Summary Data Tables

Stantec

Table D1: Final Discharge Point (Station 159-4)

Parameter	Authorized Licence Limit (mg/L; unless otherwise specified)	Concentration (mg/L; unless otherwise specified)								
		18-Jun-12	29-Jun-12	05-Jul-12	23-Jul-12	30-Jul-12	08-Aug-12	14-Aug-12	22-Aug-12	30-Aug-12
Field pH (units)	6 - 9.5	8.04	8.15	8.22	8.00	8.27	8.21	8.26	8.24	8.34
Field Conductivity (mS)	N/A	0.789	0.387	0.461	0.827	1.070	1.125	1.084	1.670	1.681
Temperature (°C)	N/A	1.7	6.2	11.5	10.7	10.1	NM	3.5	8	7.6
Total Suspended Solids	15	3	<2	<2	<2	<2	<2	3	<2	<2
Sulphate	N/A	271	130	171	297	444	491	485	764	846
Arsenic	0.25	---	<0.001	---	---	---	<0.001	---	---	---
Cadmium	0.005	0.0001	<0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	0.0009	0.0003
Copper	0.1	---	<0.001	---	---	---	<0.001	---	---	---
Lead	0.1	0.002	0.001	<0.001	0.001	0.001	0.002	0.003	0.004	0.001
Nickel	0.5	---	<0.005	---	---	---	<0.005	---	---	---
Zinc	0.25	0.07	0.02	0.02	0.04	0.05	0.06	0.07	0.16	0.13
Alkalinity (as $CaCO_3$)	N/A	45	28	34	47	58	64	64	83	85
Chloride	N/A	10	4	6	8	12	14	14	22	22
Ammonia (as N)	N/A	0.04	<0.02	0.06	0.04	<0.02	<0.02	0.02	<0.02	<0.02
Nitrate + Nitrite (as NO2+NO3)	N/A	0.25	0.16	0.14	0.23	0.34	0.3	0.35	0.61	0.58
Hardness (as $CaCO_3$)	N/A	369	171	216	394	481	567	574	986	994
Bicarbonate (as $CaCO_3$)	N/A	45	28	34	47	58	64	64	83	85
Calcium	N/A	80	37	47	87	107	123	126	215	210
Magnesium	N/A	41	19	24	43	52	63	63	109	114
Potassium	N/A	4	2	3	4	6	6	6	11	11
Sodium	N/A	4	<2	<2	3	4	4	4	8	8
F2 ($C_{>10}$-C_{16})	N/A	---	---	---	---	---	---	---	---	----
F3 ($C_{>16}$-C_{34})	N/A	---	---	---	---	---	---	---	---	----
F4 ($C_{>34}$-C_{50})	N/A	---	---	---	---	---	---	---	---	----

Notes:

Authorized Licence Limit – Monthly Mean (most conservative)

A station specific action level of 1471 mg/L is also available for sulphate based on 95th percentile calculated from Station specific historical data. For further information, see Appendix C of this report.

--- = Analysis not required.

FD = Field Duplicate

N/A = Not Applicable

NM = Not Measured in the Field

Bold = Value exceeds Authorized Licence Limit, as listed within the 2009 Water Licence requirements.

Table D2-1: Twin Lakes Creek Water Quality Data (Station 159-6)

Parameter	Action Level (mg/L; unless otherwise specified)	Concentration (mg/L; unless otherwise specified)										
		18-Jun-12	18-Jun-12 (FD)	28-Jun-12	28-Jun-12 (FD)	05-Jul-12	05-Jul-12 (FD)	13-Jul-12	18-Jul-12 (FD)	23-Jul-12	30-Jul-12	30-Jul-12 (FD)
Field pH (units)	6 - 9.5	8.30	---	7.90	---	8.30	---	7.00	7.10	7.90	8.10	---
Field Conductivity (mS)	N/A	0.483	---	0.123	---	0.181	---	0.190	0.194	0.352	---	---
Temperature (°C)	N/A	2.4	---	5.3	---	9.3	---	NM	---	10.7	7.8	NM
Total Suspended Solids	63	36	34	<2	<2	<2	<2	3	<2	<2	<2	<2
Sulphate	509	143	144	26	25	46	45	54	54	104	235	236
Arsenic	N/A	---	---	<0.001	---	---	---	---	---	---	---	---
Cadmium	0.018	0.0012	0.0011	0.0004	0.0004	0.0004	0.0004	0.0003	0.0004	0.0006	0.0008	0.0008
Copper	N/A	---	---	<0.000		---	---	---	---	---	---	---
Lead	0.063	0.008	0.008	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	N/A	---	---	<0.005	---	---	---	---	---	---	---	---
Zinc	6.3	0.54	0.56	0.15	0.15	0.15	0.16	0.13	0.13	0.24	0.35	0.35
Alkalinity (as $CaCO_3$)	N/A	50	50	21	24	27	27	28	30	35	49	49
Chloride	N/A	9	7	3	3	3	2	3	3	4	6	6
Ammonia (as N)	N/A	0.06	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nitrate + Nitrite (as NO_2+NO_3)	N/A	0.17	0.17	<0.10	<0.10	0.1	<0.10	0.14	0.16	0.27	0.41	0.42
Hardness (as $CaCO_3$)	N/A	213	217	50	50	74	79	81	81	166	266	275
Bicarbonate (as $CaCO_3$)	N/A	50	50	21	24	27	27	28	30	35	49	49
Calcium	N/A	44	44	10	10	15	15	16	16	32	52	54
Magnesium	N/A	25	26	6	6	9	10	10	10	21	33	34
Potassium	N/A	2	2	<1	<1	<1	<1	<1	<1	1	2	2
Sodium	N/A	3	3	<2	<2	<2	<2	<2	<2	<2	2	2
F2 ($C_{>10}$-C_{16})	N/A	<0.1	<0.1	<0.1	<0.1	<0.1	---	<0.1	<0.1	<0.1	<0.1	<0.1
F3 ($C_{>16}$-C_{34})	N/A	<0.2	<0.2	<0.2	<0.2	<0.2	---	<0.2	<0.2	<0.2	<0.2	<0.2
F4 ($C_{>34}$-C_{50})	N/A	<0.2	<0.2	<0.2	<0.2	<0.2	---	<0.2	<0.2	<0.2	<0.2	<0.2

Notes:

Station specific action levels based on 95th percentile calculated from Station specific historical data. For further information, see Appendix C of this report.

--- = Analysis not required.

FD = Field Duplicate

N/A = Not Applicable

NM = Not Measured in the Field

Bold = Value exceeds station action level.

Table D2-1: Twin Lakes Creek Water Quality Data (Station 159-6)

Parameter	Action Level (mg/L; unless otherwise specified)	Concentration (mg/L; unless otherwise specified)										
		8-Aug-12	08-Aug-12 (FD)	14-Aug-12	14-Aug-12 (FD)	22-Aug-12	22-Aug-12 (FD)	30-Aug-12	30-Aug-12 (FD)	14-Sep-12	14-Sep-12 (FD)	25-Sep-12
Field pH (units)	6 - 9.5	8.10	---	8.20	---	7.80	---	8.20	---	8.30	---	7.40
Field Conductivity (mS)	N/A	0.505	---	0.517	---	0.352	---	0.740	---	1.065	---	1.190
Temperature (°C)	N/A	7.3	---	4.3	---	6.6	---	5.0	---	0.2	---	NM
Total Suspended Solids	63	<2	<2	<2	<2	22	23	<2	<2	<2	<2	<2
Sulphate	509	196	194	198	205	121	122	298	298	463	464	**567**
Arsenic	N/A	<0.001	---	---	---	---	---	---	---	---	---	---
Cadmium	0.018	0.0009	0.0009	0.0009	0.0009	0.0011	0.0011	0.0021	0.0019	0.0032	0.0032	0.0009
Copper	N/A	<0.001	---	---	---	---	---	---	---	---	---	---
Lead	0.063	<0.001	<0.001	<0.001	<0.001	0.006	0.005	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	N/A	<0.005	---	---	---	---	---	---	---	---	---	---
Zinc	6.3	0.49	0.48	0.51	0.52	0.58	0.56	1	1	2.3	2.4	0.77
Alkalinity (as $CaCO_3$)	N/A	45	45	41	42	33	34	54	53	68	69	69
Chloride	N/A	5	5	5	5	4	4	7	7	10	10	14
Ammonia (as N)	N/A	<0.02	<0.02	0.04	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	0.02	0.04
Nitrate + Nitrite (as NO_2+NO_3)	N/A	0.32	0.3	0.4	0.39	0.34	0.35	0.54	0.55	0.94	0.92	0.64
Hardness (as $CaCO_3$)	N/A	240	238	244	240	189	182	382	384	588	591	703
Bicarbonate (as $CaCO_3$)	N/A	45	45	41	42	33	34	54	53	68	69	69
Calcium	N/A	45	44	45	45	36	35	72	73	107	108	133
Magnesium	N/A	31	31	32	31	24	23	49	49	78	78	90
Potassium	N/A	2	2	1	1	1	1	2	2	3	3	3
Sodium	N/A	<2	<2	2	2	<2	<2	5	3	4	4	5
F2 ($C_{>10}$-C_{16})	N/A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	---	<0.1	---	---	---
F3 ($C_{>16}$-C_{34})	N/A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	---	<0.2	---	---	---
F4 ($C_{>34}$-C_{50})	N/A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	---	<0.2	---	---	---

Notes:

Station specific action levels based on 95th percentile calculated from Station specific historical data. For further information, see Appendix C of this report.

--- = Analysis not required.

FD = Field Duplicate

N/A = Not Applicable

NM = Not Measured in the Field

Bold = Value exceeds station action level.

Table D2-2: Twin Lakes Creek Water Quality Data (Station 159-10)

Parameter	Action Level (mg/L; unless otherwise specified)	Concentration (mg/L; unless otherwise specified)									
		28-Jun-12	05-Jul-12	13-Jul-12	23-Jul-12	30-Jul-12	08-Aug-12	14-Aug-12	22-Aug-12	30-Aug-12	14-Sep-12
Field pH (units)	6 - 9.5	8.18	8.09	6.72	7.65	7.78	7.81	7.95	7.89	7.71	7.91
Field Conductivity (mS)	N/A	0.082	0.121	0.126	0.258	NM	0.324	0.346	NM	0.716	0.998
Temperature (°C)	N/A	4.8	8.9	NM	NM	NM	NM	4.4	7.2	10.1	0.2
Total Suspended Solids	15	<2	<2	<2	<2	<2	<2	<2	2	<2	3
Sulphate	651	16	29	35	76	185	108	120	90	263	431
Arsenic	N/A	---	---	---	---	---	---	---	---	---	---
Cadmium	0.037	0.0004	0.0006	0.0005	0.0011	0.003	0.0012	0.0014	0.001	0.0034	0.01
Copper	N/A	---	---	---	---	---	---	---	---	---	---
Lead	0.14	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001
Nickel	N/A	---	---	---	---	---	---	---	---	---	---
Zinc	13	0.17	0.28	0.24	0.45	1.2	0.6	0.75	0.54	1.8	4.3
Alkalinity (as $CaCO_3$)	N/A	10	14	16	24	35	29	27	24	40	54
Chloride	N/A	3	2	2	3	6	4	4	4	7	10
Ammonia (as N)	N/A	0.1	<0.02	<0.02	0.08	<0.02	<0.02	<0.02	<0.02	<0.02	0.04
Nitrate + Nitrite (as NO_2+NO_3)	N/A	<0.10	0.12	0.14	0.26	0.46	0.25	0.37	0.36	0.58	0.91
Hardness (as $CaCO_3$)	N/A	31	47	47	108	211	139	152	123	328	525
Bicarbonate (as $CaCO_3$)	N/A	10	14	16	24	35	29	27	24	40	54
Calcium	N/A	6	9	9	20	40	26	28	23	62	95
Magnesium	N/A	4	6	6	14	27	18	20	16	42	70
Potassium	N/A	<1	<1	<1	<1	2	<1	<1	<1	2	3
Sodium	N/A	<2	<2	<2	<2	<2	<2	<2	<2	2	3
F2 ($C_{>10}$-C_{16})	N/A	---	---	---	---	---	---	---	---	---	---
F3 ($C_{>16}$-C_{34})	N/A	---	---	---	---	---	---	---	---	---	---
F4 ($C_{>34}$-C_{50})	N/A	---	---	---	---	---	---	---	---	---	---

Notes:

Station specific action levels based on 95th percentile calculated from Station specific historical data. For further information, see Appendix C of this report.

--- = Analysis not required.

FD = Field Duplicate

N/A = Not Applicable

NM = Not Measured in the Field

Bold = Value exceeds station action level.

Table D2-3: Twin Lakes Creek Water Quality Data (Station NML-23)

Parameter	Action Level (mg/L; unless otherwise specified)	Concentration (mg/L; unless otherwise specified)											
		18-Jun-12	18-Jun-12 (ELO)	28-Jun-12	28-Jun-12 (ELO)	05-Jul-12	05-Jul-12 (ELO)	23-Jul-12	23-Jul-12 (ELO)	30-Jul-12	30-Jul-12 (ELO)	08-Aug-12	08-Aug-12 (ELO)
Field pH (units)	6 - 9.5	7.98	8.02	8.52	7.75	8.36	7.92	7.96	7.74	7.33	7.3	8.18	7.87
Field Conductivity (mS)	N/A	0.170	0.169	0.038	0.038	0.040	0.039	0.067	0.065	0.077	0.077	0.094	0.090
Temperature (°C)	N/A	2.5	2.8	3	4	5.6	7.7	10.4	11	10.1	10.3	NM	NM
Total Suspended Solids	11	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Sulphate	25	**42**	**40**	6	6	7	7	15	15	20	20	24	25
Arsenic	N/A	---	---	---	---	---	---	---	---	---	---	---	---
Cadmium	0.0058	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	N/A	---	---	---	---	---	---	---	---	---	---	---	---
Lead	0.046	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	N/A	---	---	---	---	---	---	---	---	---	---	---	---
Zinc	0.14	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Alkalinity (as $CaCO_3$)	N/A	22	21	10	5	7	7	12	10	13	12	12	13
Chloride	N/A	4	4	3	2	2	2	2	2	2	2	3	2
Ammonia (as N)	N/A	<0.02	0.07	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nitrate + Nitrite (as NO_2+NO_3)	N/A	0.2	0.16	<0.10	<0.10	<0.10	<0.10	0.13	0.12	0.12	0.12	0.15	0.14
Hardness (as $CaCO_3$)	N/A	65	65	9	16	16	16	27	27	31	31	41	41
Bicarbonate (as $CaCO_3$)	N/A	22	21	10	5	7	7	12	10	13	12	12	13
Calcium	N/A	13	13	2	3	3	3	6	6	6	6	8	8
Magnesium	N/A	8	8	1	2	2	2	3	3	4	4	5	5
Potassium	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sodium	N/A	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
F2 ($C_{>10}$-C_{16})	N/A	---	---	---	---	---	---	---	---	---	---	---	---
F3 ($C_{>16}$-C_{34})	N/A	---	---	---	---	---	---	---	---	---	---	---	---
F4 ($C_{>34}$-C_{50})	N/A	---	---	---	---	---	---	---	---	---	---	---	---

Notes:

Station specific action levels based on 95th percentile calculated from Station specific historical data. For further information, see Appendix C of this report.

--- = Analysis not required.

FD = Field Duplicate

N/A = Not Applicable

NM = Not Measured in the Field

Bold = Value exceeds station action level.

Table D2-3: Twin Lakes Creek Water Quality Da ta (Station NML-23)

Parameter	Action Level (mg/L; unless otherwise specified)	Concentration (mg/L; unless otherwise specified)							
		14-Aug-12	14-Aug-12 (ELO)	22-Aug-12	22-Aug-12 (ELO)	30-Aug-12	30-Aug-12 (ELO)	14-Sep-12	13-Sep-12 (ELO)
Field pH (units)	6 - 9.5	8.29	8.31	8.26	7.9	8.51	7.98	8.31	8.37
Field Conductivity (mS)	N/A	0.111	0.112	0.117	0.112	0.134	0.106	0.140	0.140
Temperature (°C)	N/A	5.1	5.6	5	6.3	7.3	6.6	0.2	0.3
Total Suspended Solids	11	<2	<2	<2	<2	<2	<2	<2	<2
Sulphate	25	**35**	**33**	**31**	**34**	**34**	**30**	**39**	**38**
Arsenic	N/A	---	---	---	---	---	---	---	---
Cadmium	0.0058	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	N/A	---	---	---	---	---	---	---	---
Lead	0.046	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	N/A	---	---	---	---	---	---	---	---
Zinc	0.14	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Alkalinity (as $CaCO_3$)	N/A	14	12	15	14	14	12	18	19
Chloride	N/A	3	3	2	3	3	2	2	2
Ammonia (as N)	N/A	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	0.03
Nitrate + Nitrite (as NO_2+NO_3)	N/A	0.19	0.19	0.18	0.28	0.21	0.16	0.18	0.16
Hardness (as $CaCO_3$)	N/A	47	47	50	56	56	47	63	63
Bicarbonate (as $CaCO_3$)	N/A	14	12	15	14	14	12	18	19
Calcium	N/A	9	9	10	11	11	9	12	12
Magnesium	N/A	6	6	6	7	7	6	8	8
Potassium	N/A	<1	<1	<1	<1	<1	<1	<1	<1
Sodium	N/A	<2	<2	<2	<2	<2	<2	<2	<2
F2 ($C_{>10}$-C_{16})	N/A	---	---	---	---	---	---	---	---
F3 ($C_{>16}$-C_{34})	N/A	---	---	---	---	---	---	---	---
F4 ($C_{>34}$-C_{50})	N/A	---	---	---	---	---	---	---	---

Notes:

Station specific action levels based on 95th percentile calculated from Station specific historical data. For further information, see Appendix C of this report.

--- = Analysis not required.

FD = Field Duplicate

N/A = Not Applicable

NM = Not Measured in the Field

Bold = Value exceeds station action level.

Table D3-1: Chris Creek Water Quality Data (Station 159-14)

Parameter	Action Level (mg/L; unless otherwise specified)	Concentration (mg/L; unless otherwise specified)			
		28-Jun-12	14-Jul-12	09-Aug-12	17-Aug-12
Field pH (units)	6 - 9.5	8.43	8.00	NM	8.47
Field Conductivity (mS)	N/A	0.322	0.959	1.394	1.206
Temperature (°C)	N/A	12.00	NM	10.00	0.90
Total Suspended Solids	33	8	<2	<2	5
Sulphate	408	87	**437**	**689**	**540**
Arsenic	N/A	---	---	---	---
Cadmium	0.0005	0.0003	0.0004	0.0005	0.0001
Copper	N/A	---	---	---	---
Lead	0.0022	0.002	<0.001	<0.001	<0.001
Nickel	N/A	---	---	---	---
Zinc	0.13	**0.21**	**0.37**	**0.66**	0.13
Alkalinity (as $CaCO_3$)	N/A	53	78	95	87
Chloride	N/A	3	7	9	8
Ammonia (as N)	N/A	<0.02	<0.02	<0.02	0.03
Nitrate + Nitrite (as NO_2+NO_3)	N/A	<0.10	0.22	0.32	0.3
Hardness (as $CaCO_3$)	N/A	155	494	818	703
Bicarbonate (as $CaCO_3$)	N/A	53	78	95	87
Calcium	N/A	29	89	138	128
Magnesium	N/A	20	66	115	93
Potassium	N/A	<1	1	1	1
Sodium	N/A	<2	2	3	2
F2 ($C_{>10}$-C_{16})	N/A	---	---	---	---
F3 ($C_{>16}$-C_{34})	N/A	---	---	---	---
F4 ($C_{>34}$-C_{50})	N/A	---	---	---	---

Notes:

Station specific action levels based on 95th percentile calculated from Station specific historical data.

For further information, see Appendix C of this report.

--- = Analysis not required.

FD = Field Duplicate

N/A = Not Applicable

NM = Not Measured in the Field

Bold = Value exceeds station action level.

Table D3-2: Chris Creek Water Quality Data (Station 159-15)

Parameter	Action Level (mg/L; unless otherwise specified)	Concentration (mg/L; unless otherwise specified)		
		29-Jun-12	14-Jul-12	09-Aug-12
Field pH (units)	6 - 9.5	8.62	8.06	8.5
Field Conductivity (mS)	N/A	0.1179	1.03	NM
Temperature (°C)	N/A	7.9	NM	NM
Total Suspended Solids	4	<2	<2	<2
Sulphate	269	12	**468**	130
Arsenic	N/A	---	---	---
Cadmium	0.00085	<0.0001	0.0003	<0.0001
Copper	N/A	---	---	---
Lead	0.00725	<0.001	<0.001	<0.001
Nickel	N/A	---	---	---
Zinc	0.17	0.02	**0.4**	0.02
Alkalinity (as $CaCO_3$)	N/A	43	87	119
Chloride	N/A	2	10	5
Ammonia (as N)	N/A	<0.02	<0.02	<0.02
Nitrate + Nitrite (as NO_2+NO_3)	N/A	<0.10	0.32	0.27
Hardness (as $CaCO_3$)	N/A	59	531	253
Bicarbonate (as $CaCO_3$)	N/A	43	87	119
Calcium	N/A	12	99	52
Magnesium	N/A	7	69	30
Potassium	N/A	<1	1	<1
Sodium	N/A	<2	3	<2
F2 ($C_{>10}$-C_{16})	N/A	---	---	---
F3 ($C_{>16}$-C_{34})	N/A	---	---	---
F4 ($C_{>34}$-C_{50})	N/A	---	---	---

Notes:

Station specific action levels based on 95th percentile calculated from Station specific historical data.

For further information, see Appendix C of this report.

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NM = Not Measured in the Field

Bold = Value exceeds station action level.

Table D3-3: Chris Creek Water Quality Data (Station 159-17)

Parameter	Action Level (mg/L; unless otherwise specified)	Concentration (mg/L; unless otherwise specified)		
		29-Jun-12	14-Jul-12	09-Aug-12
Field pH (units)	6 - 9.5	8.41	7.9	8.32
Field Conductivity (mS)	N/A	0.383	0.414	1.426
Temperature (°C)	N/A	12		8.1
Total Suspended Solids	53	8	3	3
Sulphate	499	110	134	**691**
Arsenic	N/A	<0.001	---	<0.001
Cadmium	0.0012	0.0003	<0.0001	0.0003
Copper	N/A	<0.001	---	<0.001
Lead	0.028	0.003	<0.001	<0.001
Nickel	N/A	<0.005	---	<0.005
Zinc	0.38	0.24	0.02	**0.62**
Alkalinity (as $CaCO_3$)	N/A	59	66	98
Chloride	N/A	12	3	13
Ammonia (as N)	N/A	<0.02	<0.02	<0.02
Nitrate + Nitrite (as NO_2+NO_3)	N/A	0.12	0.11	0.44
Hardness (as $CaCO_3$)	N/A	184	190	816
Bicarbonate (as $CaCO_3$)	N/A	59	66	98
Calcium	N/A	34	40	142
Magnesium	N/A	24	22	112
Potassium	N/A	<1	<1	1
Sodium	N/A	<2	<2	4
F2 ($C_{>10}$-C_{16})	N/A	---	---	---
F3 ($C_{>16}$-C_{34})	N/A	---	---	---
F4 ($C_{>34}$-C_{50})	N/A	---	---	---

Notes:

Station specific action levels based on 95th percentile calculated from Station specific historical data.

For further information, see Appendix C of this report.

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N/A = Not Applicable

NM = Not Measured in the Field

Bold = Value exceeds station action level.

Table D4: Landfill Water Quality Data (Station NML-30)

Parameter	Action Level (mg/L; unless otherwise specified)	Concentration (mg/L; unless otherwise specified)			
		29-Jun-12	23-Jul-12	23-Jul-12 (DUP)	08-Aug-12
Field pH (units)	6 - 9.5	8.49	8.31	NM	8.44
Field Conductivity (mS)	N/A	0.287	0.708	NM	0.865
Temperature (°C)	N/A	6	11.4	NM	9.1
Total Suspended Solids	22	<2	<2	<2	<2
Sulphate	240	57	239	234	**310**
Arsenic	N/A	---	---	---	---
Cadmium	0.000245	<0.0001	<0.0001	<0.0001	<0.0001
Copper	N/A	---	---	---	---
Lead	0.0055	<0.001	<0.001	<0.001	<0.001
Nickel	N/A	---	---	---	---
Zinc	0.015	<0.01	<0.01	<0.01	<0.01
Alkalinity (as $CaCO_3$)	N/A	80	122	123	140
Chloride	N/A	3	5	4	6
Ammonia (as N)	N/A	<0.02	<0.02	<0.02	<0.02
Nitrate + Nitrite (as NO_2+NO_3)	N/A	0.17	0.52	0.53	1.24
Hardness (as $CaCO_3$)	N/A	144	341	341	461
Bicarbonate (as $CaCO_3$)	N/A	80	122	123	140
Calcium	N/A	33	77	77	102
Magnesium	N/A	15	36	36	50
Potassium	N/A	<1	2	2	2
Sodium	N/A	<2	2	2	3
F2 ($C_{>10}$-C_{16})	N/A	NM	<0.1	<0.1	<0.1
F3 ($C_{>16}$-C_{34})	N/A	NM	<0.2	<0.2	<0.2
F4 ($C_{>34}$-C_{50})	N/A	NM	<0.2	<0.2	<0.2

Notes:

Station specific action levels based on 95th percentile calculated from Station specific historical data.

For further information, see Appendix C of this report.

--- = Analysis not required.

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N/A = Not Applicable

NM = Not Measured in the Field

Bold = Value exceeds station action level.

APPENDIX E

Temporal Trend Figures

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Figure E1: Temporal trends at Station 159-4

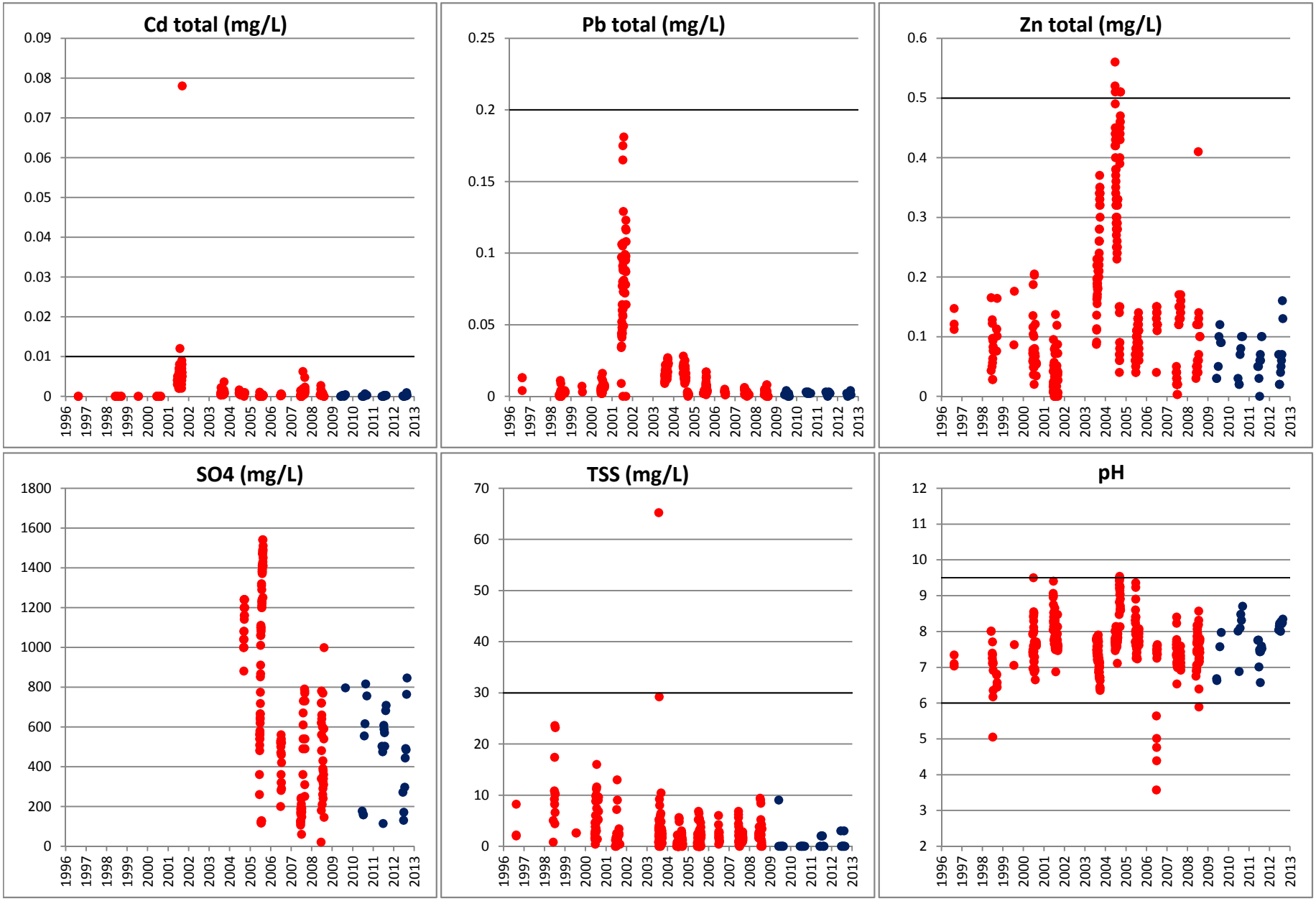

Figure E2: Temporal trends at Station 159-6

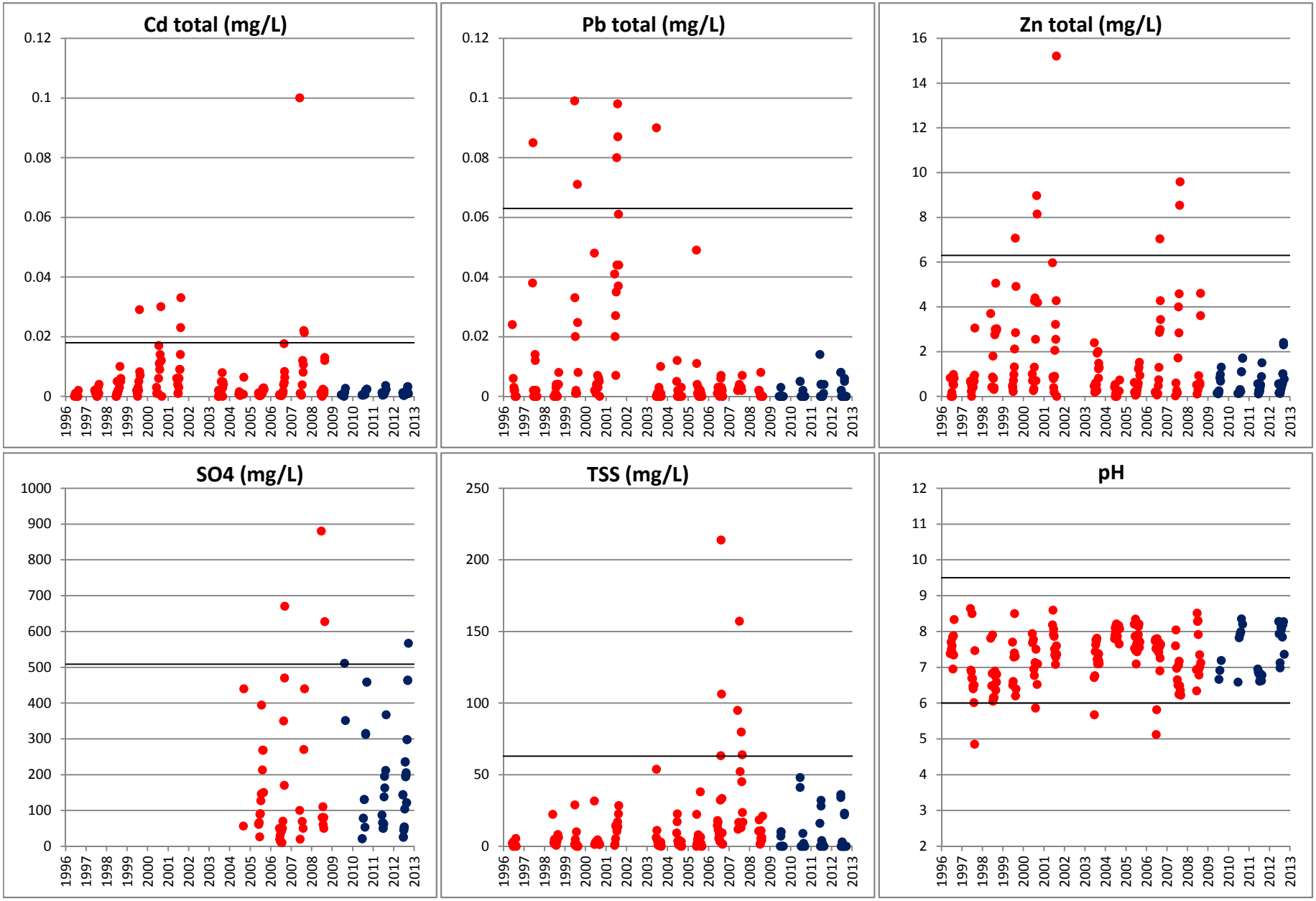

Figure E3: Temporal trends at Station 159-10

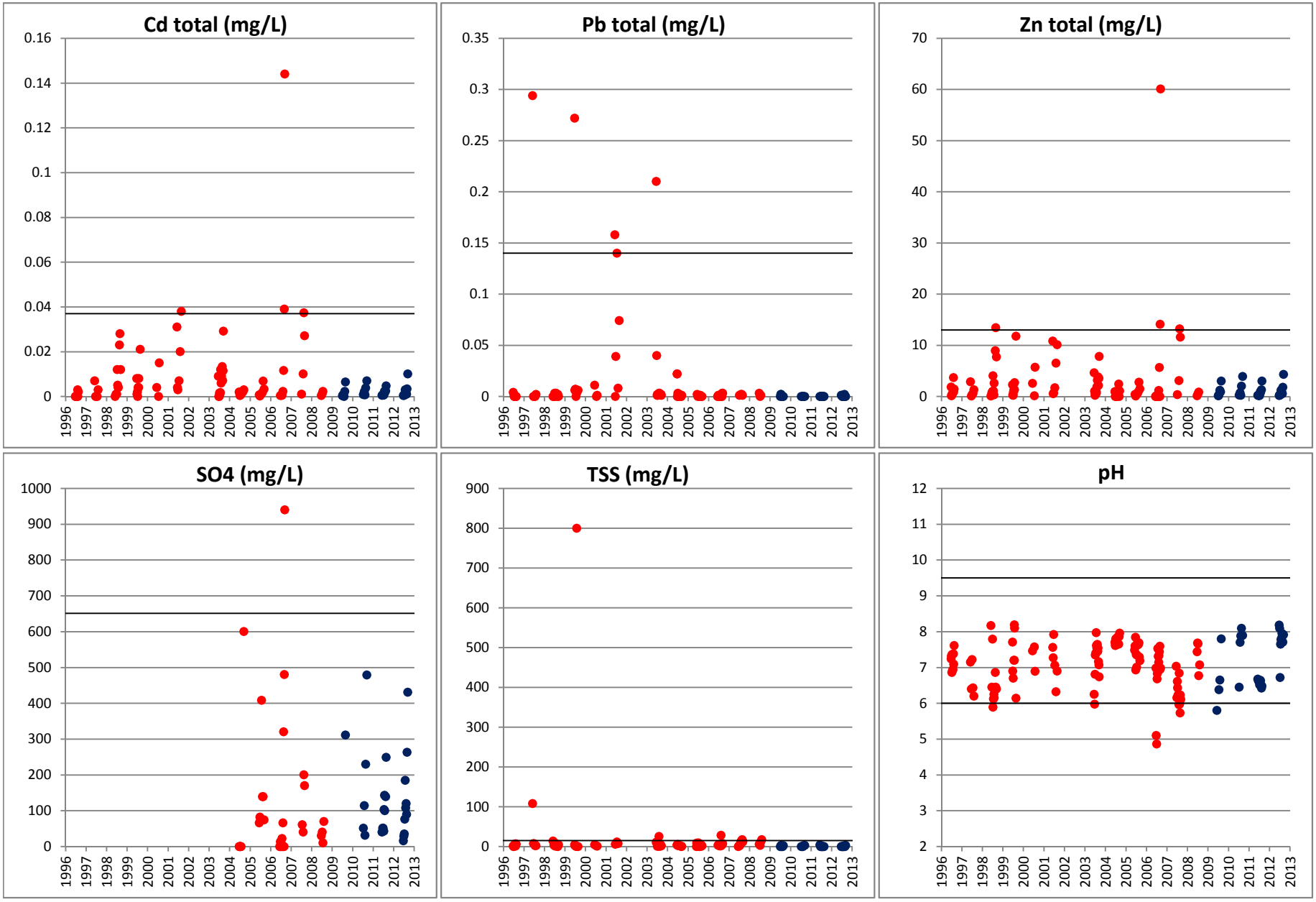

Figure E4: Temporal trends at Station NML-23

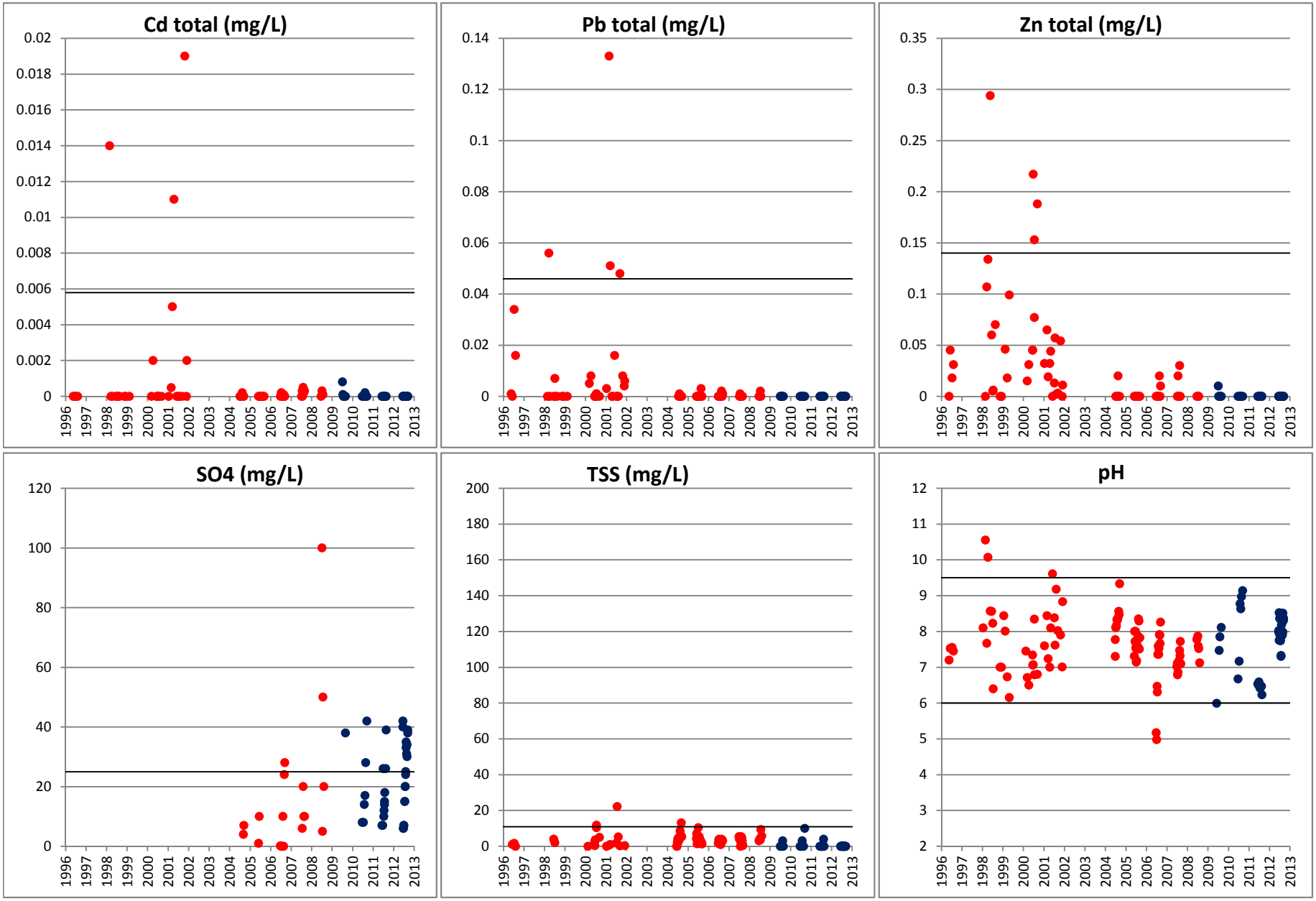

Figure E5: Temporal trends at Station 159-14

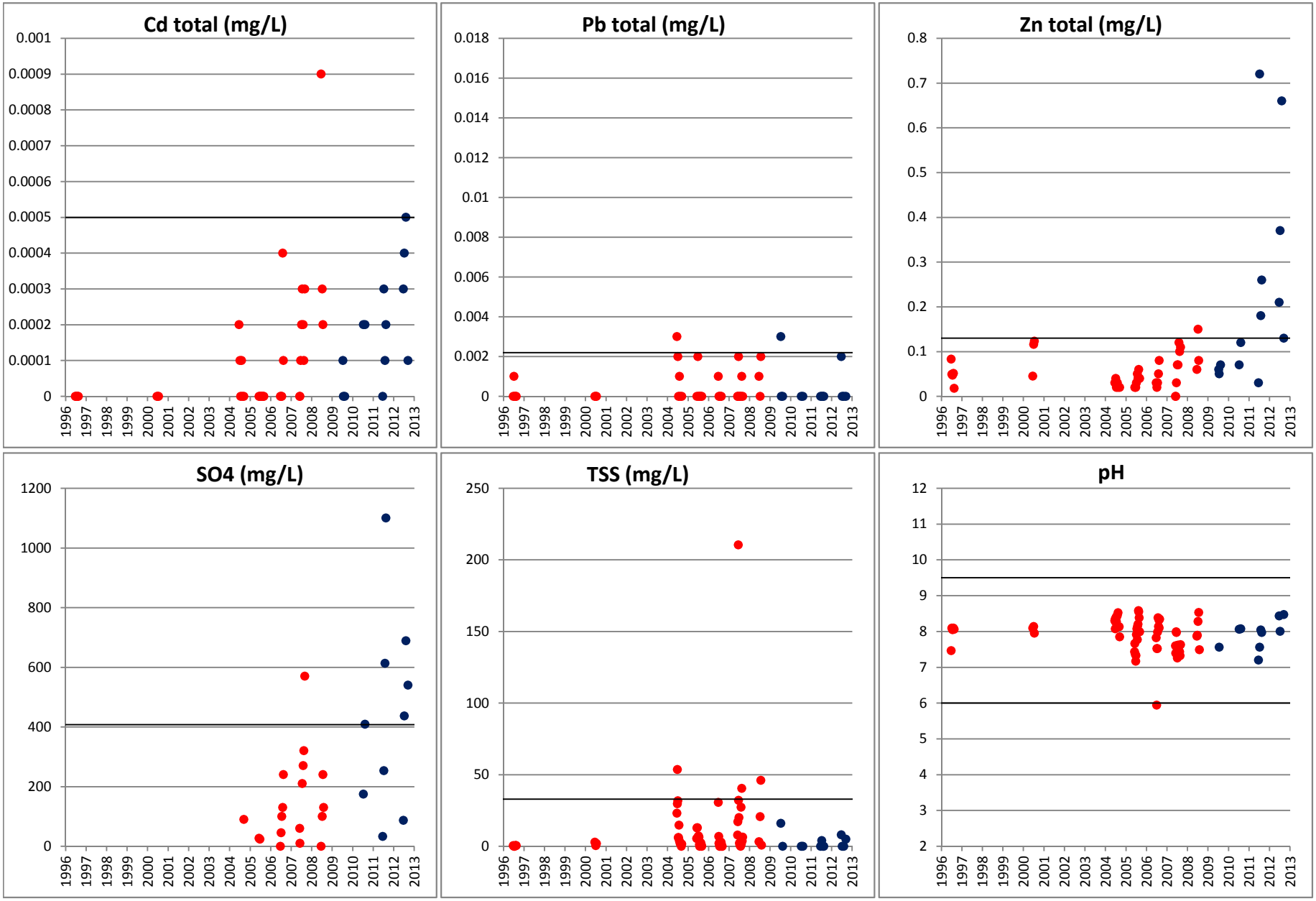

Figure E6: Temporal trends at Station 159-15

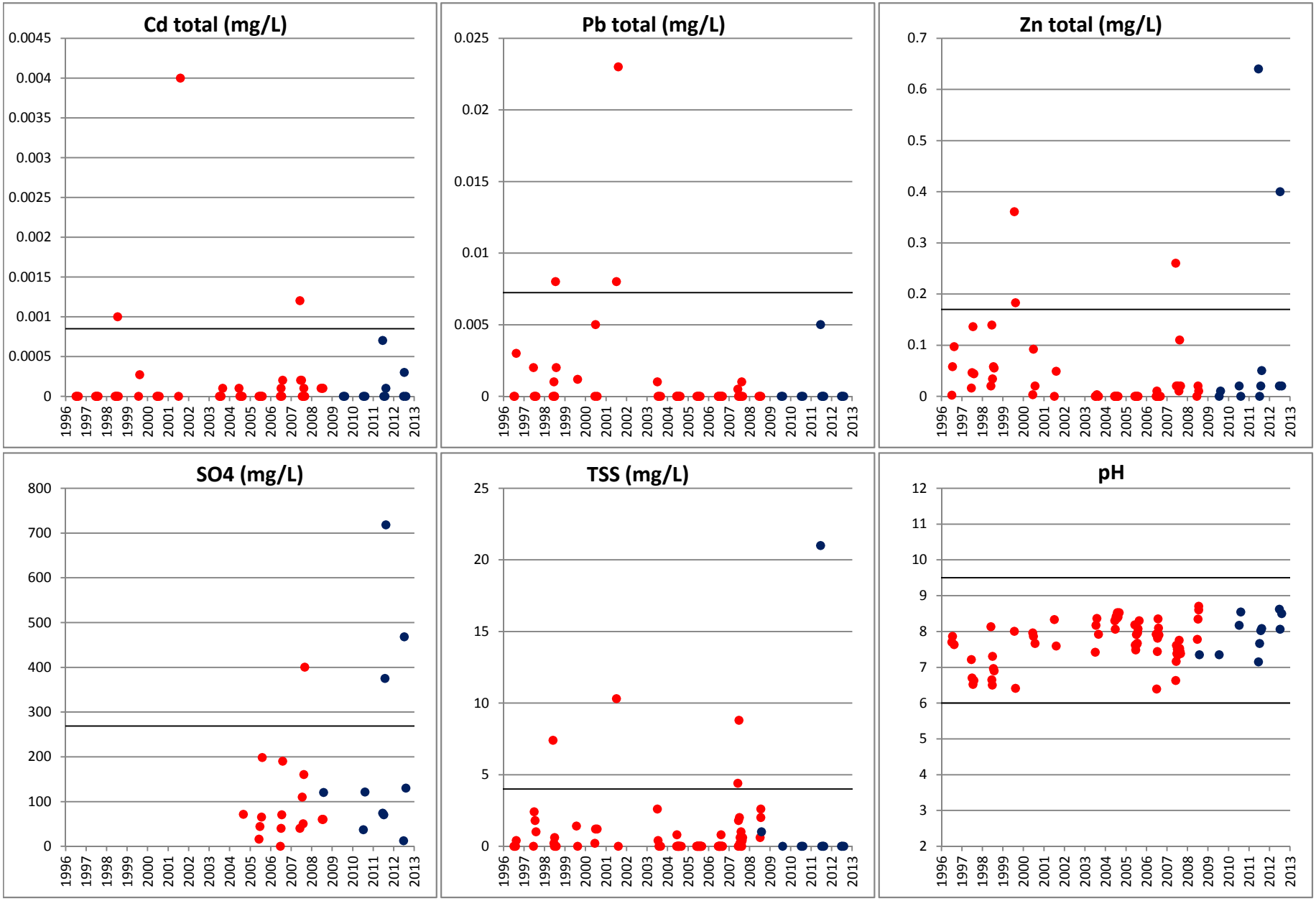

Figure E7: Temporal trends at Station 159-17

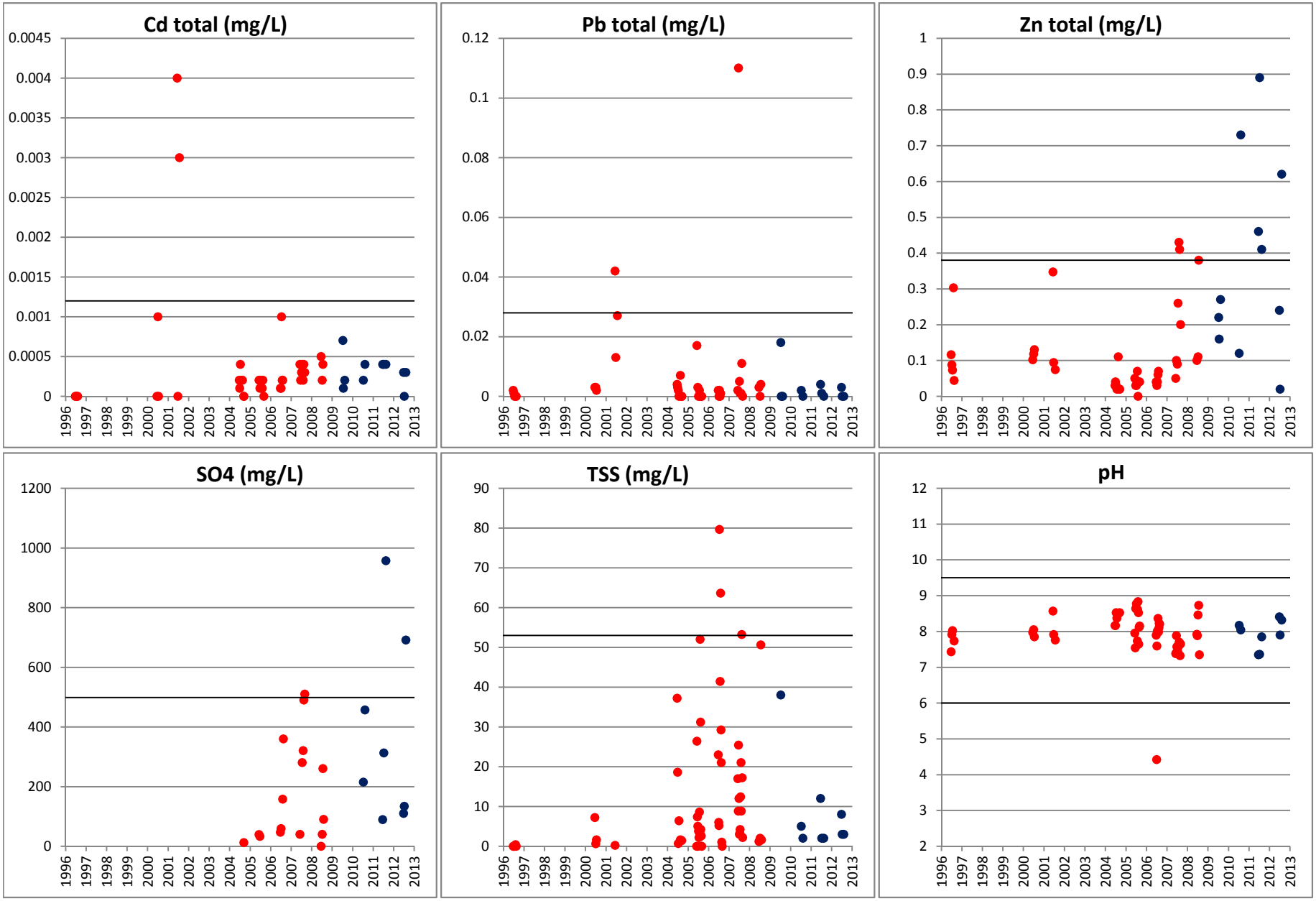

Figure E8: Temporal trends at Station NML-30