FINAL REPORT

2008 Annual Water Quality Monitoring Report
Nanisivik Mine, Nunavut

BREAKWATER RESOURCES LTD.

PROJECT NO. 1039597

Jacques Whitford

Final Report No. 1039597

REPORT TO

Mr. Robert Carreau
Vice President, CSR and Sustainability
Breakwater Resources Ltd.
Suite 2000
95 Wellington Street West
Toronto, ON
M5J 2N7

ON

2008 Annual Water Quality Monitoring Report

FOR

Nanisivik Mine, Nunavut

January 30, 2009

Jacques Whitford, now Stantec
711 Woodstock Road
Fredericton, New Brunswick
E3A 5N8

Phone: 506-457-3200
Fax: 506-452-7652

www.jacqueswhitford.com

Jacques Whitford

Table of Contents

List of Tables

List of Appendices

2008 ANNUAL WATER QUALITY MONITORING REPORT

1.0 INTRODUCTION

1.1 General Introduction

Jacques Whitford Limited (Jacques Whitford, now Stantec) is pleased to present Breakwater Resources Ltd. with a review of the 2008 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 License NWB1NAN0208 and is intended to assess the overall performance of reclamation activities.

1.2 Site Description

The Nanisivik Mine, herein referred to as the "Mine", is located in Nunavut on the Borden Peninsula, part of northern Baffin Island (Figure A1, 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 and operated the Mine.

The Nanisivik Mine facilities, which are presently decommissioned, consisted of an underground mine and a 2,200 tonne per day concentrator using conventional crushing, rod and ball mill grinding, differential lead and zinc flotation, and concentrate drying. Between 1976 and 2002, the underground mine 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 allows 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), and 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 Mines Effluent Regulations and therefore monitoring requirements under those regulations were no longer required. Water quality monitoring continues under License NWB1NAN0208. On October 1, 2008 reclamation of the site was completed and a post-closure monitoring period began.

1.3 Sampling Locations

Sampling locations used historically for water quality monitoring near the Mine are generally described in Table 1. Sampling locations are shown in Figure A2 (Appendix A).

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
	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	1750	Twin Lakes Creek stream crossing
	200-7	2400	Twin Lakes Creek upstream of waste rock piles
	159-11	3300	Twin Lakes Creek downstream of waste rock piles
	200-3	3400	Twin Lakes Creek downstream of natural sulphide outcrop
	159-10	3500	Twin Lakes Creek upstream of west townsite tributary
	159-6	7250	Outlet of Twin Lakes Creek into Strathcona Sound
Chris Creek Watershed	159-15	100	Chris Creek upstream of Area 14
	159-16	1000	Chris Creek downstream of Area 14
	159-14	2600	Chris Creek downstream of K-Baseline
	159-13	3100	Chris Creek downstream of East Adit
	159-17	4200	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

1.4 Previous Water Quality Monitoring Programs

1.4.1 Water Licenses

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

- Water License N5L3-0159 – Northwest Territories Water Board (July, 1976; renewed in 1978, 1983, 1988 and 1991);
- Water License NWB1NAN9702 – Nunavut Water Board (July, 1997; the original term of five years was extended until closure in September, 2002); and
- Water License NWB1NAN0208 – Nunavut Water Board (October, 2002 to present, see Appendix B).

The current license document contains requirements for maximum authorized concentrations of various water quality parameters at final discharge points (Table 1). As defined in the license, 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 points as listed in the license document.

Table 2 Effluent Quality Requirements for Final Discharge Points

Substance	Maximum Authorized Monthly Mean Concentration	Maximum Authorized Concentration in a Composite Sample	Maximum Authorized Concentration in a Grab Sample
Arsenic (mg/L)	0.25	0.375	0.50
Copper (mg/L)	0.10	0.15	0.20
Lead (mg/L)	0.10	0.15	0.20
Nickel (mg/L)	0.50	0.75	1.00
Zinc (mg/L)	0.25	0.375	0.50
Total Suspended Solids (mg/L)	15.00	22.50	30
Radium 226 (Bq/L)	0.37	0.74	1.11
Cadmium (mg/L)	0.005	0.008	0.01

Note: License Requirements as listed in License NWB1NAN0208, Part D

1.4.2 Nanisivik Mine Reclamation and Closure Monitoring Plan

In February 2004, the rationale for proposed monitoring activities was provided to CanZinco Ltd. by Gartner Lee Limited in the Nanisivik Mine Reclamation and Closure Monitoring Plan. The goal of the Monitoring Plan was to provide information related to two fundamental objectives:

1) Identification of the immediate needs for site management and the provision of duly diligent environmental protection activities; and
2) Assessment of the overall performance of reclamation.

The Plan was developed in the context of two time periods: the Reclamation Period (estimated 2004 to 2005) and the Closure Period (estimated duration of 5 years).

1.4.3 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 2012). The revised monitoring schedule included recommended sampling locations, parameters to be sampled, and sampling frequency as presented in Table 3.

Table 3 Recommended Water Quality Monitoring Schedule for Post Closure Period

Proposed Water Quality Monitoring Stations 2009-2012				
Monitoring Information			Post-Closure Monitoring Period (2009-2012)	
Station Number	Station Description	Purpose	2009 - 2010 Monitoring Frequency	2011 - 2012 Monitoring Frequency
Twin Lakes Creek Watershed				
NML-23	Outflow from East Twin Lake	Upstream Control Station	Bi-weekly	Monthly
159-4	Outflow from West Twin Disposal Area	Final Discharge Point	Bi-weekly	Monthly
159-10	Twin Lakes Creek upstream of west townsite tributary	General Monitoring	Bi-weekly	Monthly
159-6	Outlet of Twin Lakes Creek into Strathcona Sound	General Monitoring	Bi-weekly	Monthly
Chris Creek				
159-15	Chris Creek upstream of Area 14	Upstream Control Station	Monthly	Monthly
159-14	Chris Creek downstream of K-Baseline	K-Baseline Monitoring	Monthly	Monthly
159-17	Chris Creek Outlet into Strathcona Sound	Final Discharge Point	Monthly	Monthly
Landfill				
NML-29	Downstream of Landfill - East Drainage System	Landfill Monitoring	Monthly	Monthly

Notes:
1. Field parameters include: pH, conductivity, and temperature, while laboratory parameters include: total metals, sulphate, and totals suspended solids. It should be noted that all metal analyses to comprise hardness, cadmium, lead, and zinc.
2. The recommended sampling locations for 2009-2012 presented have been strategically identified as either background sampling locations or in the immediate area and/or downgradient of former mine activities. Further it is expected that these locations along with the suggested frequencies and parameters, will provide the required information to ensure the reclamation objectives are being met.

2.0 REVIEW OF 2008 WATER QUALITY DATA

Water samples were collected in 2008 from the Twin Lakes Watershed, Chris Creek Watershed, former East Adit Treatment Facility area, Landfill Watershed, and Oceanview Watershed. A summary of the 2008 water quality monitoring results, along with the sampling frequency is presented in tabular format in Appendix C 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 license), as only Station 159-4 is a final discharge point. Data for the other stations are considered individually, and are not directly compared to data collected during the mine's operational period, since such a comparison (of post-closure data to operating data) would be meaningless. However, temporal trends for selected parameters (i.e., cadmium, lead, zinc and pH) are displayed graphically in Appendix D for Stations 159-4 (Twin Lakes Disposal Area), 159-6 (outlet of Twin Lakes Creek to Strathcona Sound), 159-15 (Chris Creek upstream of Area 14), 159-17 (outlet of Chris Creek to Strathcona Sound), 159-12 (formerly discharge from East Adit Retention Pond) and NML-30 (Downstream of Landfill).

Water quality data for stations other than Station 159-4 will be monitored to identify trends during the Post Closure period, but 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 time.

Therefore, the principal consideration when evaluating the water quality monitoring results, which will be a test of whether reclamation 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 2008 and 2012).

2.1.1 Station 159-4

The water quality data for Station 159-4 are presented in Table 4 for the parameters specified in the license document. 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 2008.

Water samples were collected at Station 159-4 on two occasions in 2008 (June 23 and July 27) for toxicity testing with rainbow trout and *Daphnia magna*. There was no mortality of test organisms in either test on either date. The laboratory reports on the toxicity tests are included in Appendix E.

Table 4 Maximum Monthly Mean Concentration at Station 159-4 in 2008 (mg/L)

Substance	Authorized License Limit	159-4		
		June	July	August
Arsenic	0.25	0.0005	0.0005	-
Copper	0.10	0.0039	0.0050-	-
Lead	0.10	0.0211	0.0140	0.0050
Nickel	0.50	0.0025	0.0025	-
Zinc	0.25	0.0486	0.1064	0.1000
Total Suspended Solids	15.00	-	-	-
Radium 226 (Bq/L)	0.37	0.0300	0.0090	0.0050
Cadmium	0.005	0.0006	0.0005	0.0005

Notes:
Half detection limit was used calculations where sample concentrations were less than detection limit
- = Not measured

2.1.2 Twin Lakes Watershed Excluding Station 159-4

The upper reach of the Twin Lakes Watershed includes East Twin Lake (represented by Station NML-23) and Station 159-4B (upstream of the West Twin Lake tailings effluent discharge point), and was minimally disturbed by mining activities. Station 159-4A is located downstream of the West Twin Lake tailings effluent discharge point (i.e., Station 159-4). Stations 159-9 and 159-11 are also located downstream of Station 159-4, but upstream of a major natural mineral outcrop that undergoes active erosion from Twin Lakes Creek. Stations 200-3, 159-10, 159-11 and 159-6 are located downstream of the natural mineral outcrop, with Station 159-6 being located near the mouth of the creek at Strathcona Sound. 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. 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 (0.15 mg/L) were measured near the mouth of Twin Lakes Creek in 1975 (BC Research 1975), however, these concentrations are inherently variable depending upon weather conditions.

A summary of the water quality observed in Twin Lakes Creek during 2008 follows.

- Arsenic concentrations were less than the detection limit of 0.0001 mg/L.
- Cadmium concentrations up to 0.013 mg/L were measured. For the most part, cadmium concentrations were close to the analytical detection limit of 0.001 mg/L, however, the highest values were recorded downstream of the natural mineral outcrop at Stations 159-10 and 159-6.
- Copper concentrations up to 0.001 mg/L were measured.
- Lead concentrations up to 0.008 mg/L were measured. For the most part, lead concentrations were close to the analytical detection limit of 0.001 mg/L, however, the highest values were recorded downstream of the natural mineral outcrop at Stations 159-10 and 159-6.
- Zinc concentrations up to 4.6 mg/L were measured. For the most part, zinc concentrations were close to the analytical detection limit of 0.01 mg/L, however, the highest values were recorded downstream of waste rock and the natural mineral outcrop at Stations 159-10, 159-11, 200-3 and 159-6.

2.1.3 Chris Creek Watershed

Chris Creek runs 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 high 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 2008 were generally within the range of natural background levels recorded prior to the Mine development.

A summary of the water quality observed in the Chris Creek watershed during 2008 follows.

- Cadmium concentrations up to 0.0009 mg/L were measured. The highest values were observed at stations 159-13, 159-14, and 159-16.
- Lead concentrations up to 0.004 mg/L were measured. The highest values were observed at Stations 159-13, 159-14, and 159-17.
- Zinc concentrations up to 0.58 mg/L were measured. The highest values were observed at Stations 159-13, 159-14, 159-16, and 159-17.

2.1.4 Former East Adit Treatment Facility Area

A treatment/retention pond was located in a small drainage below the East Adit Treatment Facility, and Station 159-12 was located below the retention pond. Although the facilities have been decommissioned, Station 159-12 is still monitored during periods of flow. Results for 2008 are summarized below. There are no explicit historical data representing this location, however, natural conditions would be expected to be similar to conditions in the Chris Creek watershed.

- Arsenic concentrations were non-detectable.
- Cadmium concentrations ranged from 0.0001 mg/L to 0.0011 mg/L.

- Copper concentrations of <0.01 and 0.004 mg/L were recorded.
- Lead concentrations ranged from <0.001 mg/L to 0.071 mg/L.
- Zinc concentrations ranged from 0.06 t0 0.55 mg/L.

2.1.5 Landfill Watershed

The landfill is located west of Nanisivik, with a primary drainage system that flows intermittently to the west, monitored at Station NML-30. The landfill has been decommissioned with thermal cover, and is will become entombed in permafrost. Water quality monitoring at the landfill includes hydrocarbons, in addition to metals. 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. Results for 2008 are summarized below.

- Concentrations of benzene, toluene, ethylbenzene and xylenes (BTEX), and petroleum hydrocarbon fractions, were non-detectable.
- Cadmium concentrations of 0.0001 and 0.0002 mg/L were recorded.
- Lead concentrations of 0.002 and 0.005 mg/L were measured.
- Zinc concentrations of <0.01 and 0.02 mg/L were measured.

2.1.6 Oceanview

Oceanview was a small open pit development at the eastern end of the property, and there are two sampling stations (159-18 and 159-19) located downgradient. There do not appear to be any historical data from this area prior to mine development. 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. Results for 2008 are summarized below.

- Cadmium concentrations of 0.0002 and 0.0003 mg/L were measured.
- Lead concentrations were measured up to 0.002 mg/L.
- Zinc concentrations were of 0.02 and 0.05 mg/L were measured.

3.0 DISCUSSION

The effectiveness and adequacy of mine reclamation will be demonstrated through monitoring key parameters at key sampling stations over the next few years. Concentrations of indicator substances should be stable or declining, and should be consistent with conditions that existing prior to mining activities (subject to the constraints that high baseline levels of heavy metals impose on the site). Site reclamation activities involved heavy equipment re-engineering large portions of the site to recover waste rock, clean up areas of contamination, and place various types of cover material. These activities inherently have the potential to affect water quality on a short-term basis. However, reclamation activities were completed in 2008, and water quality should stabilize in the coming years.

Temporal trends for key water quality parameters (cadmium, lead, zinc and pH) at selected sampling stations are shown in Figures D1 to D6 in Appendix D. Signs of disturbance in the area of the WTDA between 2001 and 2004 are evident in the water quality data for Station 159 4 (Figure D1) as irregular spikes in metal concentrations, although in most cases, the License limits on metal concentrations were met. However, concentrations of the key indicator substances have substantially stabilized since 2005, and are expected to remain stable into the future.

At Station 159-6 (Figure D2), Twin Lakes Creek near Strathcona Sound, concentrations of lead and cadmium have been generally stable over the past few years, and concentrations of zinc tend to be more variable. However, all three of these metals are expected to be periodically elevated as a result of the effects of weathering and erosion on the major mineral deposit that is intersected by the creek.

Few recent data are available to characterize Station 159-12, downgradient of the East Adit (Figure D3). However, results for 2007 and 2008 are consistent and stable. Stations 159-15 and 159-17 represent the headwaters and mouth of Chris Creek (Figures D4 and D5, respectively). It is too early to try to evaluate trends in the Post Closure period for these sites, however, results for 2008 were generally good.

Station NML-30 (Figure D6) shows generally low concentrations of trace metals and stable pH at downgradient of the landfill. Again, it is too early to try to evaluate trends.

The year 2008 represents an important transition for the Nanisivik Mine. Site reclamation activities are now complete, and the period of Post Closure monitoring is beginning. Trace metal concentrations at the WTDA discharge location are low, meeting the Mine License conditions. Elsewhere, trace metal concentrations are generally consistent with conditions that existed naturally, before mine development.

4.0 CLOSURE

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

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 Breakwater Resources Ltd., data provided by regulatory agencies and others. Information obtained from secondary sources has been assumed to be correct; Jacques Whitford accepts no responsibility for damages or liability that may arise from use of this data.

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

This report was prepared by Anna Roy, MIT and Shereen Ismail, P.Eng., and was reviewed by Malcolm Stephenson, Ph.D. If 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,

JACQUES WHITFORD LIMITED

Original Signed By	*Original Signed By*
Shereen Ismail, P.Eng. Project Engineer	Malcolm Stephenson, Ph.D. Senior Scientist, Principal

AR/SI/MS/jll

P:\1039xxx\1039597\3-Reporting Information\Annual Report 2008\Nanisivik Annual Water Quality Report 2008 - Jan 30-09.doc

5.0 REFERENCES

BC Research. 1975. Terrestrial Environmental Studies at Strathcona Sound, N.W.T. Project 1552, Progress Report No. 2. March, 1975.

Gartner Lee Limited. 2004. Nanisivik Mine Reclamation and Closure Monitoring Plan. February, 2004.

Jacques Whitford Environment Limited. 2004. Nanisivik Mine Metal Mining Environmental Effects Monitoring Study Design, Nanisivik, Nunavut. January 27, 2004.

APPENDIX A

Sample Location Plan

APPENDIX B

License NWB1NAN0208

APPENDIX C

Summary Tables

APPENDIX D

Temporal Trend Figures
(Station 159-15, 159-17, 159-6, and 159-4)

Jacques Whitford

APPENDIX E

Laboratory Toxicity Results, 2008

Jacques Whitford