Table 4 Cont.: Summary of Lab Test Results - Surface Cell

				Nanisivik Mine Lab				Almor Laboratory Testing							
Borehole	Location	Depth Below Grade (m)	Soil Type	Bulk Density (kg/m³)	Moisture Content (%)	% Sand and Gravel	% Silt and Clay	Moisture Content (%)	% Gravel	% Sand	% Silt	% Clay	Gs	$Is_{(50)}$ Diametral/ Axial (MPa)	Atterberg Limits
BGC03-13	Surface Cell	0.8	Tailings	2462	15.7	76.3	23.7								
		2.9	Tailings		11.4	89.2	10.8								
		3.5	Tailings		16.3	81.9	18.1								
		5.0	Tailings		13.3	81.1	18.9								
		7.2	Tailings					17.8							
		16.1	Tailings	2562	23.0	31.3	68.8								
		16.3	Lake Bed Sediments					10.9							
		16.4	Dolostone												
BGC03-14		1.1	Tailings		13.8	41.9	58.1								
		2.9	Tailings		15.1	83.5	16.5								
		4.7	Tailings		14.7	91.2	8.8								
		8.1	Tailings			75.9	24.1								
		13.0	Tailings		18.6	86.5	13.6								
BGC03-15		2.3	Tailings		14.6	85.3	14.7								
		2.9	Tailings		14.5	88.5	11.5								
		10.6	Tailings		16.3	84.6	15.4								
		11.4	Tailings	2744	19.6	44.2	55.8								
		14.3	Tailings		19.0	53.0	47.0								
		16.3	Tailings	2608	18.8	25.8	74.2								
		16.5	Dolostone												
BGC03-20		1.8	Tailings			80.5	19.6								
		2.1	Tailings		17.9	57.5	42.5								
		4.5	Tailings		21.2	31.9	68.1								
		5.3	Tailings			36.3	63.7								
		5.6	Tailings					14.0							
		8.7	Tailings		24.3	16.0	84.0								
		8.4	Tailings		21.9	16.1	83.9								
		10.6	Tailings					15.7	0.0	25.0	73.4	1.6	3.9		
		19.7	Lake Bed Sediments		21.1	92.8	7.2								
		20.0	Lake Bed Sediments		19.0	83.7	16.3								
BGC03-21		1.5	Ice and Tailings			67.5	32.5								
		1.7	Ice and Tailings		69.9	17.1	82.9								
		4.1	Tailings		15.1	89.2	10.8								
		5.0	Tailings		17.4	69.1	30.9								
		5.6	Tailings		19.3	66.2	33.8								
		8.8	Tailings		30.4	30.2	69.9								
		10.3	Tailings					18.5	0.0	7.5	90.1	2.4	3.9		
		14.5	Tailings					12.0	81.6		18.4				
BH 10		4.75	Tailings			30.3	69.7								
		14.4	Tailings			81.2	18.8								
		30.2	Lake Bed Sediments			96.4	3.6								
BGC02-08	Toe of WT Dike	1.5	Tailings	3366	18.5	34.2	65.8								
		3.0	Tailings	2748	31.3	18.6	81.4		0.0	5.3	92.7	2.0	4.14		
		4.0	Tailings		17.1	15.9	84.1								
		4.6	Lake Bed Sediments		9.0	85.6	14.4								
		6.1	Lake Bed Sediments		9.9	84.7	15.3								
BGC02-10		4.9	Tailings	3102	23.9	10.1	89.9								
		5.2	Tailings	3190	21.5	28.7	71.3								
BGC03-18		1.7	Tailings		16.8	83.5	16.5								
		2.9	Tailings		26.2	89.1	10.9								
		4.1	Tailings		16.7	84.6	15.4								
		6.0	Tailings		22.9	45.5	54.5								
		6.9	Lake Bed Sediments		31.6	81.1	18.9								
		8.4	Dolostone												
BGC03-19		1.4	Tailings			29.8	70.2								
		2.7	Tailings		17.1	81.0	19.0								
		3.5	Tailings		19.2	83.2	16.8								
		4.2	Tailings		23.4	98.9	1.1								
		5.1	Tailings		24.2	30.8	69.2								
		5.9	Tailings		16.5	84.2	15.8								
		7.5	Tailings		15.8	80.9	19.1								
		9.3	Tailings		16.3	47.6	52.4								
		9.6	Lake Bed Sediments					36.7							
BGC02-09	TC Dike	7.0	Tailings	2988	15.0	93.9	6.1								
		8.8	Tailings	3062	14.9	95.9	4.1								
		10.1	Tailings	3192	15.6	95.6	4.4								
		13.7	Tailings	2141	15.4	68.2	31.8								
		14.3	Tailings	2128	17.2	16.7	83.3								
		29.9	Tailings		13.3	67.3	32.7								
BGC03-22		4.1	Tailings		10.4	88.7	11.3								
		4.4	Tailings		5.2	93.0	7.0								
		5.3	Tailings		12.0	71.5	28.5								
		7.0	Tailings			83.3	16.7								
		9.0	Tailings		11.0	92.3	7.8								
		11.7	Tailings		11.0	84.6	15.4								
		16.3	Tailings												
		17.8	Tailings		14.5	65.4	34.6								
		27.4	Lake Bed Sediments		50.8	77.4	22.7								

Table 5: Results of pH/Conductivity Testing on Pore Water samples from Surface Cell

	Jul-99		2001		September 2002		19-Aug-03	
Monitoring Well/ Station	**pH**	**Conductivity (μS/cm)**	**pH**	**Conductivity (μS/cm)**			**pH**	**Conductivity (μS/cm)**
BGC02-04					10.7	> 20,000		
BGC02-05					10.4	>20,000		
BGC03-12							9.17	4110
BGC03-14							10.36	6230
TC13 (seepage)	6.7	3700						
TC18 (seepage)	6.6	5350						
Station 159-2 (Reclaim Pump House)			8.8 to 12.2	3450 to 5500				

Table 6: Summary of Water Quality Testing

	Water	Ice
pH	8.73 to 10.7	-
SO_4	575 mg/L to 1390 mg/L	<1 mg/L to 14 mg/L
$Cu_{(T)}$	0.014 mg/L to 0.09 mg/L	0.842 mg/L
$Cu_{(D)}$	<0.006 mg/L	-
$Fe_{(T)}$	1.68 mg/L to 30 mg/L	38.3 mg/L
$Fe_{(D)}$	<0.006 mg/L to 0.013 mg/L	-
$Pb_{(T)}$	0.517 mg/L to 3.32 mg/L	14.0 mg/L
$Pb_{(D)}$	<0.025 mg/L	-
$Zn_{(T)}$	0.250 mg/L to 4.75 mg/L	5.36 mg/L
$Zn_{(D)}$	0.013 mg/L to 0.025 mg/L	-

Note: **(D) – Dissolved Value**
(T) – Total Value

Table 7: Summary of Boreholes Drilled and Instrumentation Installed

Area	Number of Boreholes Drilled in 2002/2003	Number of Thermocouples Installed	Number of Thermistors Installed	Number of Piezometers/ Monitoring Wells Installed
Surface Cell	38	11	16	7
Toe of West Twin Dike	4	3	1	0
Test Cell Area and Test Cell Dike	2	0	2	0
Total	44	14	19	7

Table 8: Geotechnical Issue Identification

Issue	Root Cause	Possible Consequence	Reasons For	Reasons Against	Likelihood
Increase in pore water pressures	Permafrost aggradation into talik (closed vs. open system)	• Heave • Elevated pore pressures in talik • Expulsion movement of pore water from talik potentially towards Reservoir.	• Have documented permafrost aggradation already. • Observed artesian pore pressures in talik currently • Probably have closed system due to low hydraulic gradient to Reservoir • Normal cryoconcentration already noted.	• No specific information against.	• It is likely that pore pressures in the talik will continue to rise as permafrost continues to aggrade into the Surface Cell talik. • It is unlikely that the Surface Cell talik water will report to the Reservoir immediately after freezing at surface. • It is likely that pore water expulsion will occur from the Test Cell talik to the Reservoir.
Cryoconcentration	Solute rejection during permafrost aggradation around talik in a closed system	• Remnant cryopeg remains at depth in Surface Cell	• Probably have closed system due to low hydraulic gradient to Reservoir. • Nominal cryoconcentration already noted.	• No specific information at the current time. • If open system freezing occurs, then solute levels should stay level or decline.	• It is likely that cryoconcentration will occur in the Surface Cell talik resulting in a cryopeg. • It is unlikely that cryoconcentration will occur in the Test Cell talik due to seepage into the Reservoir.
Frost Heave	9% expansion due to pore water freezing in closed system. No heave if frozen in an open system. Variable heave if due to segregated ice or pingo formation.	• Surface deformation and cover cracking	• Permafrost aggradation will occur. • Probably have closed system due to low hydraulic gradient to reservoir. • Artesian pore pressure already noted.	• No specific information.	• It is likely that some amount of frost heave will occur, either due to 9% expansion or due to frost heave and segregated ice.

Table 8: Geotechnical Issue Identification Continued

Issue	Root Cause	Possible Consequence	Reasons For	Reasons Against	Likelihood
Hydraulic Fracturing	Elevated pore pressures exceed tensile strength and overburden pressure of frozen ground	• Transport of pore water (from talik or cryopeg) or tailings to surface	• Elevated pore pressures noted already.	• High specific gravity tailings provide comparatively high overburden pressures to counteract pore pressures.	• It is unlikely that hydraulic fracturing of the tailings will occur.
Pingo Formation	Gradual freezing below lake (pond) bottom traps expulsion pore pressures and begins to heave.	• Surface deformations and possible cover cracking.	• Removal of pond (lake) leading to permafrost aggradation. • Noted elevated pore pressures	• No residual pond left after draining. • No differential aggradation since no residual pond. • High rate of initial frost penetration in tailings.	• Unlikely, but will monitor for occurrence of heave and excess pore pressure.

Table 9: Freezeback Monitoring of Taliks and West Twin Dike

Monitoring Methods	Monitoring Component	Determinator	Purpose
Existing thermistors and thermocouples plus additional deep thermistors.	Surface Cell and Test Cell Taliks	Ground Temperatures	Slower (or faster) than anticipated talik freezeback.
Existing vibrating wire piezometers plus additional installations.		Pore Pressures	Could lead to pingo formation, dike instability or transport of tailings or pore water to surface.
Existing monitoring wells plus additional installations.		Water Quality	Pore water expulsion and cryoconcentration of solutes could have impact on Reservoir water quality
Visual monitoring. Topographic surveys of selected points in the Surface Cell and Test Cells.	Surface Deformation	Frost Heave and Pingo/Frost Mound Formation	Cracking and deformation of cover would allow for release of talik pore water, release of tailings and damage to the cover.
Visual monitoring. Topographic surveys of dike slope and crest. Vibrating wire piezometers. Existing thermistors and thermocouples in the dike.	West Twin Dike	Dike Instability • Heave deformations • Cracking • Pore pressures • Thawing at depth	Dike instability may release talik pore water and tailings into the Reservoir.

Table 10: Reclamation Period Freezeback Monitoring Schedule

Monitoring Method	Year of Reclamation Activities	
	1	2
Thermistors and Thermocouples	Monthly	Monthly
Vibrating Wire Piezometers	Monthly	Monthly
Monitoring Wells (Water Quality Samples)	Twice in Summer Period	Twice in Summer Period
Visual Inspections (by site or local staff)	Weekly (June - October) Every Two Weeks (November - May)	Weekly (June - October) Every Two Weeks (November - May)
Geotechnical Inspections	Twice/year (Spring/ Fall)	Twice/year (Spring/ Fall)
Topographic Survey	Twice/year (of selected points)	Twice/year (of selected points)

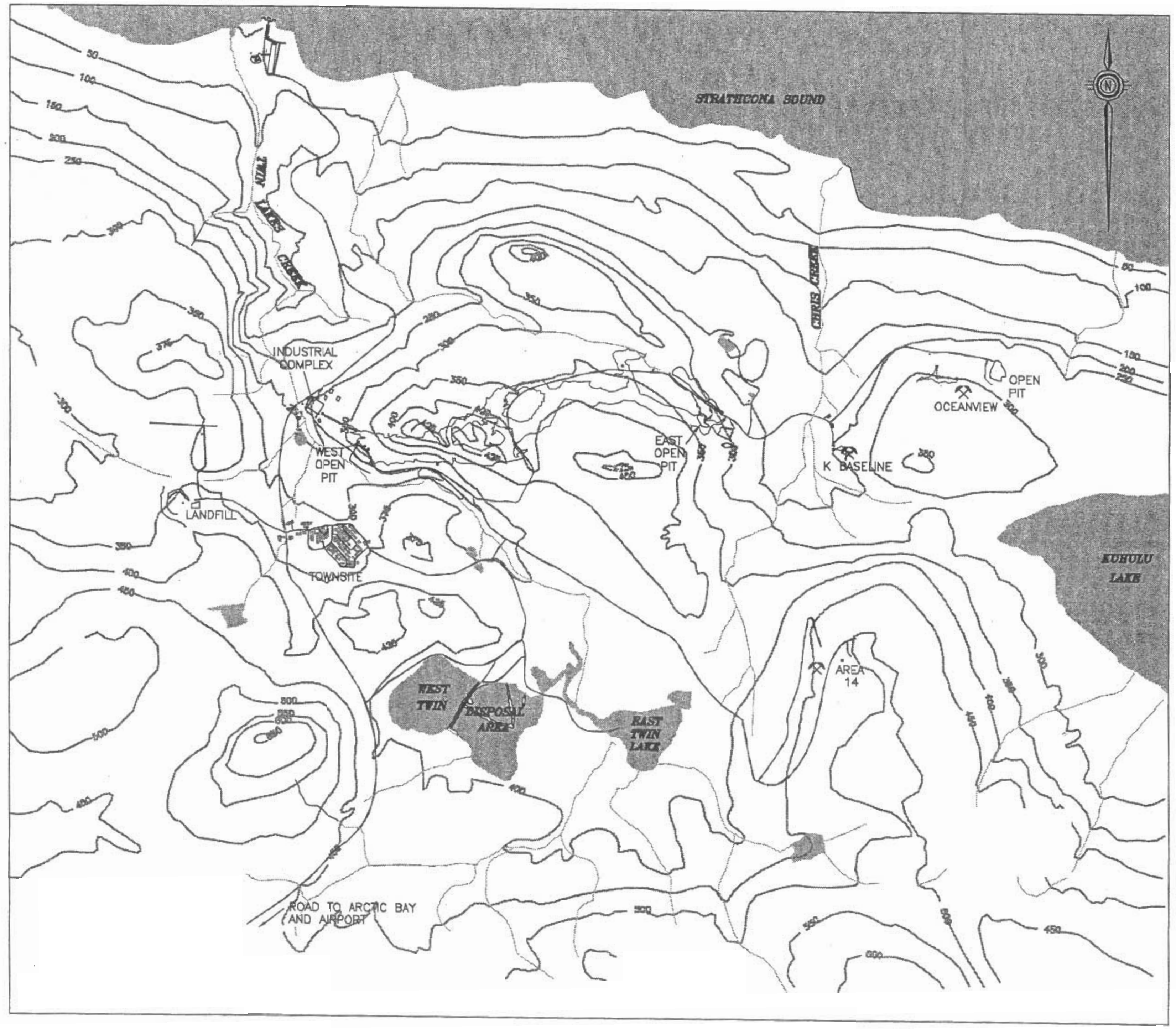
Table 11: Closure Freezeback Monitoring Schedule

Monitoring Method	Year Following Completion of Reclamation Activities				
	1	2	3	4	5
Thermistors and Thermocouples	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Vibrating Wire Piezometers	Quarterly until Frozen	Quarterly until Frozen	Quarterly until Frozen	Quarterly until Frozen	Quarterly until Frozen
Monitoring Wells (Water Quality Samples)	Once per Summer	Once per Summer	Once per Summer	Once per Summer	Once per Summer
Visual Inspections (by site or local staff)	Every two weeks (June - October) Monthly (November - May)	Every two weeks (June - October) Monthly (November - May)	Every two weeks (June - October) Monthly (November - May)	None	None
Geotechnical Inspections	Twice/ year (Spring/ Fall)	Once/year pending suitable performance	Once/year pending suitable performance	Once/year pending suitable performance	Once/year pending suitable performance
Topographic Survey of selected points	Once/year	Once/year	Once/year	None	None

Table 12: Contingency Plans for Talik Freezeback Issues

Issues	Consequences	Mitigation Approach
Slower than anticipated freezeback of talik	• Freezeback has not progressed at rate predicted by geothermal modelling.	• Review of physical conditions and geothermal data by geotechnical engineer to recalibrate the model. • Continue to monitor freezeback rate beyond current anticipated closure monitoring period, with consideration of potential impacts.
Elevated pore pressures in talik	• Could lead to pingo formation, dike instability or transport of tailings or tailings to surface.	• Increase frequency of data collection and review. • Review of physical conditions and piezometric data by geotechnical engineer to identify root cause of pressures. • Install relief wells into high pressure areas.
Poor water quality talik that impacts Reservoir water quality	• Cryoconcentration of solutes related to pore water expulsion during freezeback of the taliks may have a negative impact on the Reservoir water quality.	• Increase water quality monitoring frequency. • Review of physical conditions and geothermal and water quality data to quantify volumes, water quality and expected duration. • Treat Reservoir water prior to release to environment
Formation of pingo or frost mound	• Cracking or deformation of cover possibly allowing release of tailings or water. • Possible interference with surface drainage grades.	• Review of physical conditions and geothermal data by geotechnical engineer to identify root cause of deformation. • Pressure relief wells into pingo or frost mound to reduce surface deformation. • Maintenance and repair of cover to achieve design specifications.
West Twin Dike Instability	• Potential to release talik pore water and tailings into the reservoir.	• Review of physical conditions and geothermal and piezometric data to identify root cause of observations noted. • Pressure relief wells to reduce pore pressures if appropriate. • Maintenance and repair of dike crest and slope if appropriate. • Continued vigilant monitoring.

FIGURES



800m 0 800m 1.6km 2.4km

CLIENT: NANISIVIK MINE, A DIVISION OF CANZINCO LTD.

LEGEND

- ROAD
- GROUND CONTOUR (50 m INTERVAL)
- CREEKS, DRAINAGE, STREAMS, SHORELINE
- EXTENT OF UNDERGROUND WORKINGS

REV.	DATE	REVISION NOTES	DRAWN	CHECKED	APPROVED

SCALE:	AS SHOWN
DATE:	JAN 2004
DRAWN:	CJT
DESIGNED:	GKC
CHECKED:	JWC
APPROVED:	JWC

PROJECT
ASSESSMENT OF SURFACE CELL AND TEST CELL TALIKS

TITLE
SITE LOCATION PLAN

PROJECT No.	DWG No.	REV.
0255-008-03	1	0

BGC ENGINEERING INC.
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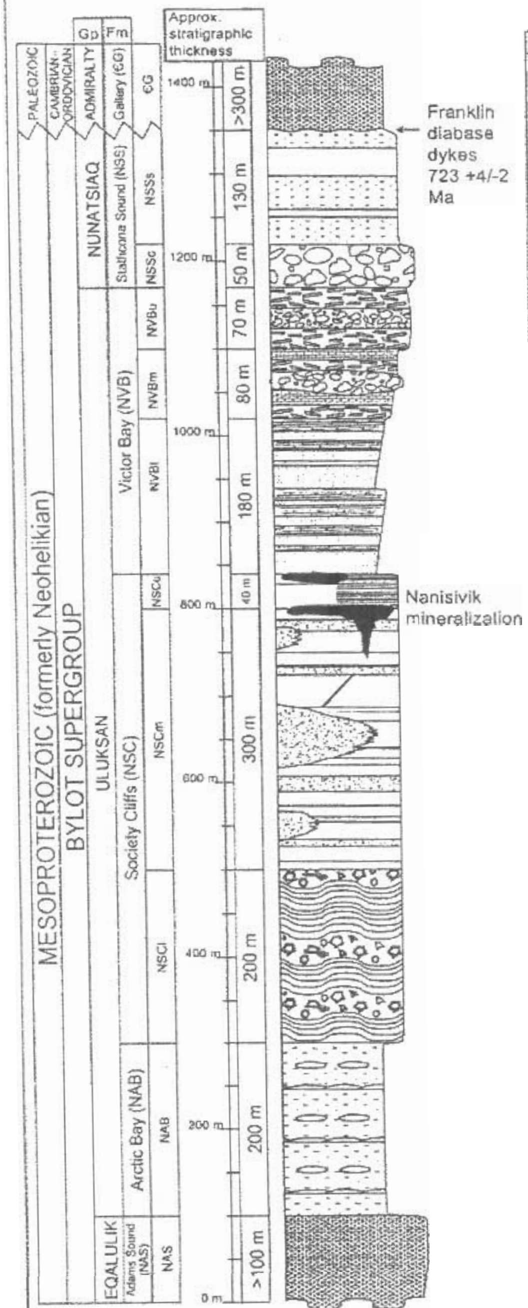
Calgary, AB Phone: (403) 250 5185

0255-008-03 008 FIGURE_01_REV1.dwg

GENERALIZED STRATIGRAPHIC SECTION – NANISIVIK AREA



UNIT	LITHOFACIES DESCRIPTION
Gallery Fm.	**Quartz arenite:** red and white, medium- to coarse-grained, friable **Mudstone:** light green, common synaeresis cracks
Strathcona Sound (wacke and shale)	**Subarkose to shale:** grey to brown, coarse-grained, 1 to 2 m thick beds **Quartz wacke:** dark green to grey, fine sand to mud
Strathcona Sound (conglomerate)	**Carbonate pebble to boulder conglomerate:** tan, silty dolostone clasts, olive-green sand to silt matrix
Upper Victor Bay	**Silty dolomitic mudstone:** light red to tan massive dolomitic mudstone **Intraclast rudstone:** white, substratiform oriented, 3 to 15 cm, tabular dolostone clasts, 1m+ thick beds
Middle Victor Bay	**Dolomitic mudstone:** dark grey, friable, 1 to 20 cm beds interbedded with shale **Intraclast floatstone:** white to grey, 5 to 15 cm tabular limestone +/- dolostone clasts
Lower Victor Bay	**Shale:** dark grey to black, fissile to unconsolidated, 2 to 4 mm thick laminae, organic-rich **Dolomitic mudstone:** dark grey, 1 to 20 cm beds interbedded with shale
Upper Society Cliffs	**Laminated dolomitic mudstone:** medium grey to light brown, planar to undulating, <1 to 2 mm laminae
Middle Society Cliffs	**Doloarenite:** light grey to white, massive, matrix-supported, 1 to 3 mm angular to subrounded clasts, irregular lenses 1 to 35 m thick **Sorted doloarenite:** planar, 3 to 30 cm thick, normal-graded beds, local crosslamination **Dolomitic mudstone:** medium grey to brown, 3 to 30 cm beds, massive to laminated, locally graded
Lower Society Cliffs	**Microbially laminated dolomitic boundstone:** light grey to pink, 3 to 15 cm beds of crinkly, planar to domal, <1 mm laminations; <2 cm laterally linked hemispheroid stromatolites **Clotted dolomitic boundstone:** Tan to light grey, 3 to 15 cm thick beds of amoeboid, holly-, or feather-shaped clots. Clots are rimmed by <1 mm thick isopachous cement
Arctic Bay	**Siltstone:** medium grey to brown, 1 to 2 cm thick beds, micaceous **Shale:** dark grey, <1 cm thick beds, micaceous, fissile
Adams Sound	**Quartz arenite:** light orange to brown, 5 to 50 cm thick planar-bedded, medium to coarse sand with rare quartz-pebble conglomerate

From: Patterson and Powis (2002)

SCALE:	As Shown	DESIGNED:	MJM
DATE:	JAN 2004	CHECKED:	MJM
DRAWN:	SLF	APPROVED:	JWC

CLIENT: NANISIVIK MINE, A DIVISION OF CANZINCO LTD.

BGC Engineering Inc.
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PROJECT: ASSESSMENT OF SURFACE CELL AND TEST CELL TALIKS

TITLE: NANISIVIK GEOLOGY STRATIGRAPHIC COLUMN

PROJECT No.	DWG. No.	REV.
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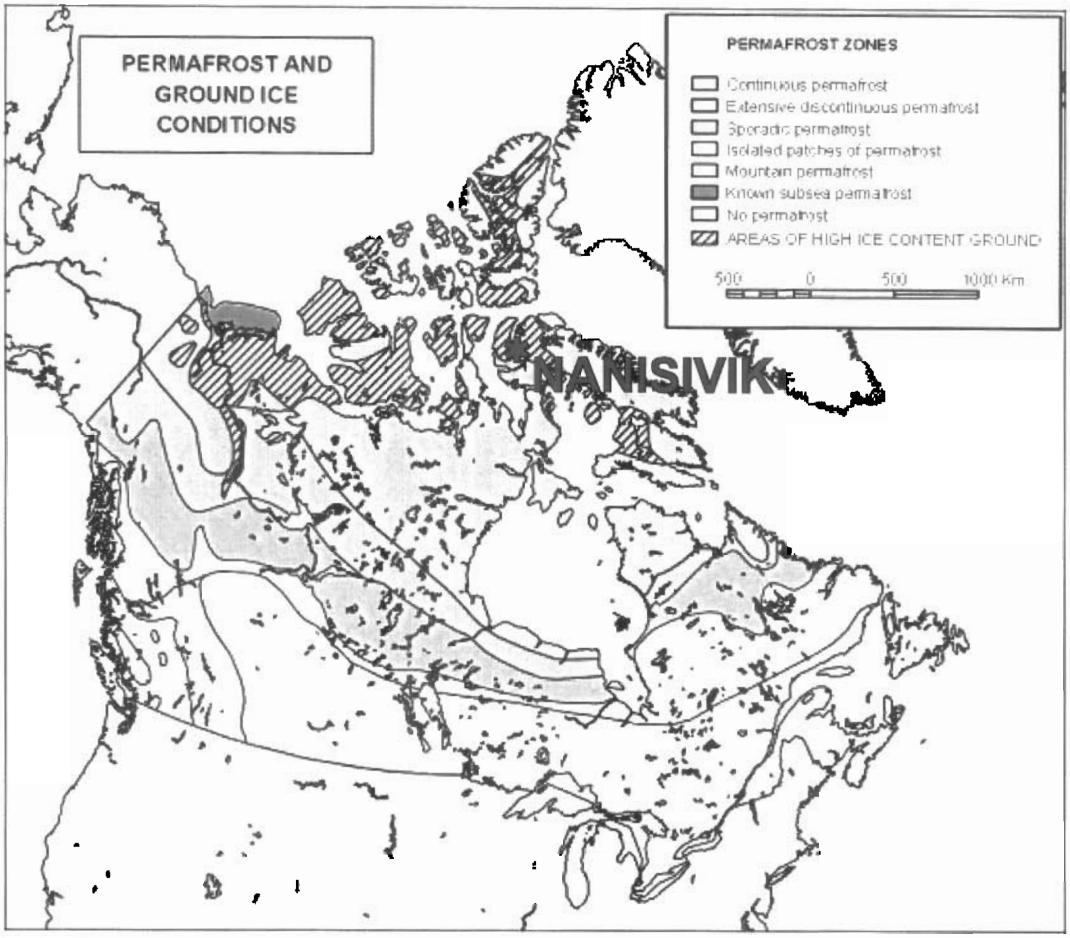

Note: figure derived from Natural Resources Canada
Website: http://sts.gsc.nrcan.gc.ca/permafrost

SCALE:	AS SHOWN	DESIGNED:	GKC
DATE:	JAN 2004	CHECKED:	JWC
DRAWN:	SLF	APPROVED:	JWC

CLIENT: NANISIVIK MINE, A DIVISION OF CANZINCO LTD.

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TITLE: REGIONAL PERMAFROST MAP

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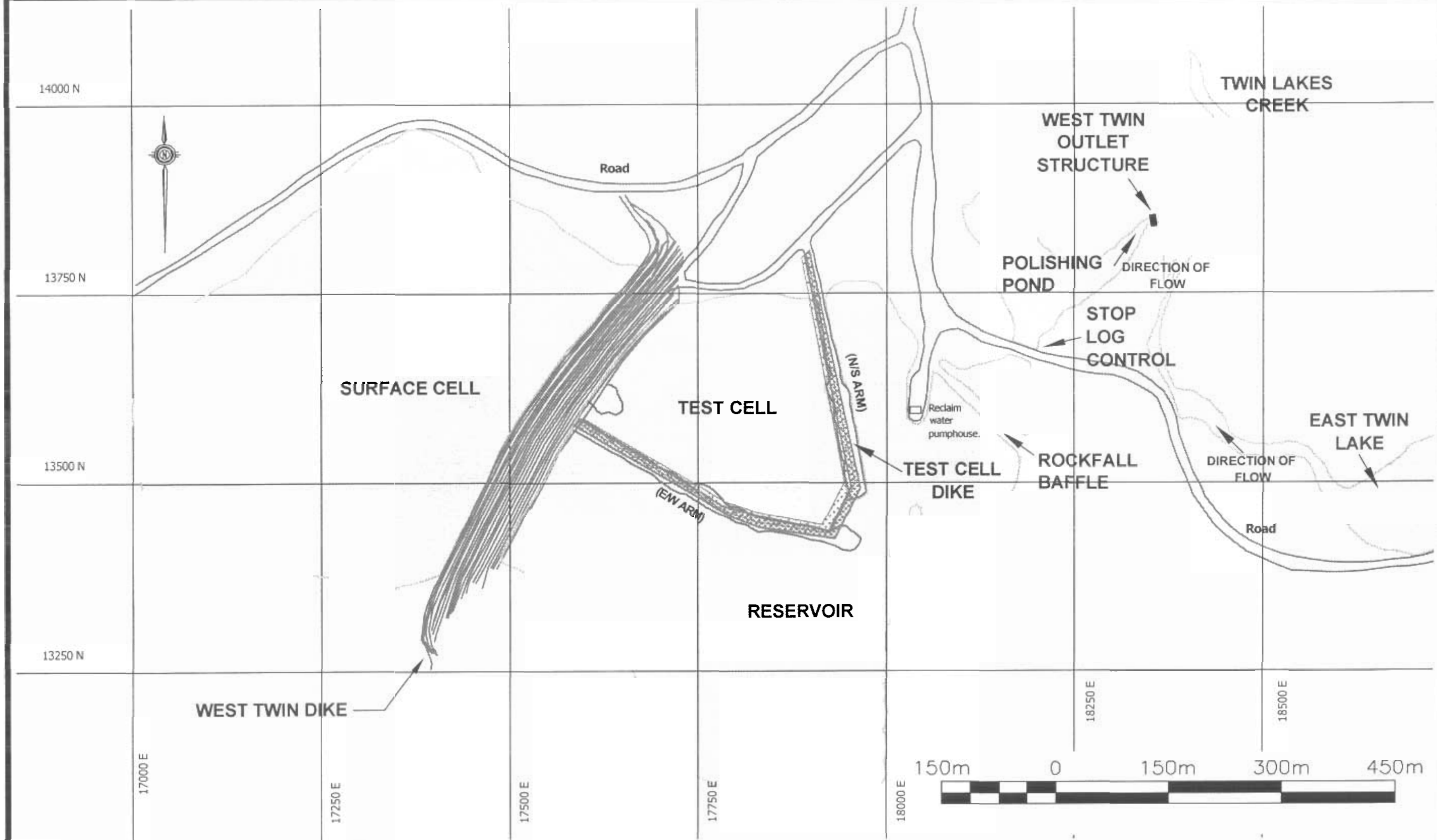
0255-008-03	3	0



SCALE: AS SHOWN	DATE: JAN 2004	DRAWN: CJT	DESIGNED: GKC	CHECKED: JWC	APPROVED: JWC		

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PROJECT: ASSESSMENT OF SURFACE CELL AND TEST CELL TALIKS

TITLE: WEST TWIN DISPOSAL AREA SITE PLAN

PROJECT No. 0255-008-03 | DWG No. 4 | REV. 0

0255-008-03 009 FIGURE_04.dwg