Appendix A
Pertinent Correspondence

Matt Paznar

From: "Duguay, Brian" <BDuguay@GOV.NU.CA>
To: "Matt Paznar" <mpaznar@nunaburnside.com>
Cc: "Wall, Jim" <jwall@nunaburnside.com>; "Mike O'Hara" <mo'hara@rjburnside.com>
Sent: Thursday, December 22, 2005 1:46 PM
Attach: 1222 Qikiqtarjuaq.pdf
Subject: Formal Notice to Proceed to Design Development Stage

Dear Matt,

As discussed with Mike today, I understand your estimate (attached) is a Class "C" or better and includes the following Options:

Solid Waste Cost Estimate: Option 2
Water Reservoir Cost Estimate: Option 3
Sewage Cost Estimate: Option 2

FYI, I set aside $169,250 (including CO1 & CO2) for this FY which is enough to bring us past the Bidding and Negotiation phase.

When you have a moment in the New Year we must talk about the "liner" and required approval(s) from external authorities, e.g., NWB

We'll need to settle the "liner" early - in case the GN orders it - because I'll need to follow lengthy internal ordering processes and perhaps secure more funds.

Look forward to speaking with you in the New Year!

Merry Christmas!

Qujannamii
Brian Duguay
Project Officer - Project Management Division

From: Matt Paznar [mailto:mpaznar@nunaburnside.com]
Sent: Thursday, December 22, 2005 9:19 AM
To: Duguay, Brian
Cc: Wall, Jim; Mike O'Hara
Subject: Updated Cash projections and Schedule (N-)O 09439.0/FOE-08983.0.410)

Dear Brian,

As discussed yesterday, please find attached the revised schedule and estimated cash flow projections regarding the Water Reservoir, Sewage Lagoon, and Landfill Site Improvements for the Hamlet of Qikiqtarjuaq, Nunavut. As always, if you have any questions or concerns, please do not hesitate to contact us.

Regards,
Matt

Matthew (Matt) Paznar, E.I.T., C.E.P.I.T.
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Appendix B
Geotechnical Evaluation

Geotechnical Evaluation of Options for Improvements to the Water Reservoir, Wastewater Lagoon, and Solid Waste Disposal Facility Supplement to the Schematic Design Report (September 2005) The Hamlet of Qikiqtarjuaq, Nunavut

Prepared by

Nuna Burnside Engineering and Environmental Ltd.
Box 175, 25 Third Avenue Rankin Inlet NU X0C 0G0 Canada
15 Townline Orangeville ON L9W 3R4 Canada

November 2005

File No: N-O 09439

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Figures

Appendices

1.0 Introduction

Nuna Burnside Engineering and Environmental Ltd. (Nuna Burnside) was retained by the Government of Nunavut (GN), to conduct a design for improvement to the water reservoir, wastewater lagoon, and solid waste disposal facilities for the Hamlet of Qikiqtarjuaq, Nunavut. In order to evaluate the various options for expansion/rehabilitation or relocation of the facilities, a geotechnical evaluation was undertaken.

The geotechnical evaluation outlined in this report is presented as a supplement to the report entitled "Schematic Design for the Improvements to the Water Reservoir, Wastewater Lagoons, and Solid Waste Disposal Facility, the Hamlet of Qikiqtarjuaq", dated September 2005.

The geotechnical evaluation focused on the existing sites and the optional sites outlined in the Schematic Design Report, to assist in evaluating the viability and potential construction/rehabilitation costs for the various options.

2.0 Background

The original proposal for this study submitted to the Government of Nunavut (GN) dated May 2005, included a Geotechnical Analysis as a supplement to the Schematic Design Phase.

Nuna Burnside staff conducted an initial site investigation of all three facilities during a field visit July 7th to 11th, 2005.

The information obtained during the fieldwork and background review were evaluated, and potential options for each facility were prepared. The results were documented in a report entitled "Schematic Design for the Improvements of the Water Reservoir, Wastewater Lagoon, and Solid Waste Disposal facility, the Hamlet of Qikiqtarjuaq, Nunavut" by Nuna Burnside dated September 2005.

The geotechnical evaluation was conducted to support the Schematic Design Report and to assist with the evaluation of the options presented.

3.0 Current Work Program

During the period of September 13th through 17th, 2005, Nuna Burnside staff visited the Hamlet of Qikiqtarjuaq. The following work was conducted:

- Presentation of the Schematic Design Report to the Hamlet of Qikiqtarjuaq administration staff and GN staff
- Field reconnaissance of the facilities
- Geotechnical studies and acquisition of surficical and subsurface rock and soil samples
- Terrain mapping
- Arrangements for detailed topographic surveying of the sites
- Submission of representative soil samples for laboratory analysis
- Evaluation of background data and collection of samples from drums of liquid waste relating to the former tannery facility.

The findings of the liquid waste evaluation are presented in a separate document.

4.0 Geotechnical Evaluation

4.1 Overview

The Schematic Design Report identified potential options to rehabilitate or relocate the existing facilities. The potential feasibility and costs for each option is partially dependent on the physical characteristics of the site. Each facility has specific siting requirements and will need specific quantities of construction materials. The geotechnical evaluation focused on the suitability of the site for the proposed facility and the availability of the required construction materials.

4.2 Bedrock Geology

The Hamlet is located on the east side of Broughton Island as shown on Figure 1.

The area lies within the Churchill Province of the Canadian Shield. The east side of Broughton Island is predominately underlain by the Middle Paleo-Proterozoic (Precambrian) Age intrusive sequences of the Cumberland Batholith. Locally, as shown on Figure 2, the area has been mapped as charnockite within a unit of felsic and mafic plutonic rocks. An older unit of migmatite has also been mapped within the plutonic rocks. Field examination of hand specimens found predominately medium to coarse-grained reddish brown quartz and feldspar rich rocks matching the description of the mapped charnockite.

Very little outcrop was observed in the immediate vicinity of the existing facilities being evaluated and in the optional areas for relocation as outlined in the Schematic Design Report (Figure 2).

Excavation through the overburden was restricted to approximately 2.0 m by permafrost. Bedrock was not encountered in the test-pitting program.

4.3 Surficial Geology

The available surficial geology mapping is displayed on Figure 3. The mapping was conducted at a coarse scale and provides only a broad overview of the surficial conditions. In general, the surficial geology in the areas of interest consists of tightly spaced cobbles and boulders armoring the surface underlain by mixed medium to coarse sand and gravel with varying amounts and of sizes of cobbles and boulders. An increasing amount of silt was noted near the permafrost contact (at approximately 2.0 m) in several areas.

4.4 Quarry Area

Several areas northwest of the Hamlet have been used as a quarry for sand and gravel resources for the community. Quarry areas are visible as surfacial disturbances and excavations in the tundra on Figures 2 and 3. Excavations are also evident in the immediate vicinity of the wastewater lagoon (Figure 4), landfill (Figure 5), and water reservoir (Figure 6).

Currently an area north of the water reservoir (quarry site) is being used for excavation, sorting, and stockpiling of sand and gravel resources for various road and construction requirements.

The quarry has been excavated sufficiently to create vertical excavation faces exceeding 2.0 m, which can be excavated easily as water drains and the permafrost melts back. See photographs in Appendix B.

Screening equipment, an excavator, a loader, and a dump truck were noted in operation at the quarry site.

The quarry site has sufficient available resources to supply the Hamlet for the foreseeable future.

5.0 Existing Wastewater Lagoon

Figure 4 displays the existing wastewater lagoon and surrounding area. The existing lagoon currently operates by discharging from an outfall through the berm in the late summer. The discharge is confined to a meandering stream and shows strong green vegetation growth around its course.

The Schematic Design Report indicates the wastewater lagoon capacity needs to be increased. This could be accomplished at the existing site or a new site. A potential location for constructing additional capacity south of the existing lagoon is displayed on Figure 4.

A geotechnical investigation in the area of the existing site was undertaken to determine the potential depth below surface to which a new lagoon could be excavated and the availability of suitable on site construction materials.

The entire area was traversed on foot and features examined. The surface is typically covered with scattered boulders and cobbles. An examination of the topography and slope faces identified several meters of poorly sorted glacially deposited coarse sand and gravel with abundant cobbles and boulders.

Two test pits were excavated using a rubber-tired backhoe as shown on Figure 4. Test pit logs are included in Appendix A. The test pits revealed poorly sorted medium to coarse sand and gravel, with cobbles and small boulders to approximately 2.0 m where digging was halted by permafrost. Photographs are included in Appendix B. The results of the laboratory analysis for a representative soil sample (Soil 2) are included in Appendix C.

Surficial material in the area south of the existing wastewater lagoon appears to be very similar to the material used to construct the existing lagoon. Sufficient resources of overburden material are available on site to create a second similar sized lagoon using a similar construction technique.

6.0 Existing Landfill Site

A description of the landfill site and solid waste management is included in the Schematic Design Report.
The landfill and area around the landfill was traversed, and the soil and topography mapped. See Figure 5 for site details and Appendix B for photographs.

The site is operated in two parts. The putresable waste disposal area is enclosed by a fence, and an open bulky metals disposal area is located immediately to the north of the fenced area. This results in two active fill faces. Both areas operate by filling outwards on a down slope on top of the original ground surface.

The landfill currently has operational issues with exposed waste and steep tipping faces. The landfill site and the surrounding area consists of boulder and cobble armored tundra surface, underlain by a poorly sorted till consisting of medium to coarse sand and gravel, with abundant cobbles and small boulders.

The excavated slope face east of the bulky metal waste disposal area was examined. This area has been excavated into the hillside to acquire cover material for the landfill. An estimated 2.0 m of overburden is able to be quarried above the permafrost line. Excavation into the hillside indicates the soil is coarse and well drained. It appears the permafrost retreats as the excavation advances. Although the material is coarse with many boulders, it is easily excavated and is suitable for landfill cover. There appears to be an abundant amount of available cover material, as the hillside can be excavated eastwards for many hundreds of meters. The results of the laboratory analysis of a representative soil sample (Soil 1) is included in Appendix C.

Within the landfill enclosure, the unfilled areas on the south side and the west side (in front of the waste face) are the original ground surface. Based on local test pitting, these areas could be excavated to approximately 2.0 m to the top of the permafrost. Excavation of a fill footprint below surface would greatly increase the vertical thickness of deposited waste without creating a steep slope face.

From a geotechnical point, the site can be rehabilitated fairly easily as there are no significant land availability and cover availability constraints.

The landfill site area is on a long slope, which tends to be well drained. The upgradient slope to the east was observed to be covered with sheet flow during spring run off. This requires effective ditching to control the flow around the landfill rather than across it.

An examination of the existing ditching and surface water flow indicates that interception and diversion of the upgradient overland flow can be accomplished.

Sufficient excavatable material is available on site to create berms to better enclose the fill area and reduce problems such as:

- Blown litter
- Steep tipping face
- Expanding footprint of the waste
- Visual appearance.

The fencing could be established on top of the berms to increase the height of the fence and achieve better capture of wind blown litter.

From the geotechnical view point the site can be effectively redeveloped and managed to serve the long-term needs of the Hamlet.

If keeping the landfill and bulky metals disposal area in its current location is the option selected by the Hamlet, there are a number of different layout and operational scenarios, which could be developed. These would be evaluated in concert with the Hamlet during the Detailed Design stages. The Operations and Development Plan will be created as part of the Detailed Design, and will need to be vetted by the Hamlet's public works and landfill operations staff, to ensure the proposed operational methodology and layout is suitable of the equipment, staff, and budget that is available

7.0 Existing Water Reservoir

7.1 Reservoir

Figure 6 displays the existing water reservoir and surrounding area. The Schematic Design Report outlines three potential viable options to address the need for expanded reservoir capacity. All of the options involve developing increased storage capacity at the existing site. Regardless of whether the existing reservoir is expanded in some fashion or if an entire new reservoir is constructed, berm material and a suitable base is required.

The area around the reservoir was traversed and the soil and bedrock mapped.

The existing reservoir was created by excavation of the footprint area to obtain maximum depth and the creation of berms using the excavated material and bulldozing material from the surrounding tundra. The area north west of the existing lagoon was examined. Test pits and bulldozed piles of overburden from previous quarrying activities indicates the availability of up to 2 m of poorly sorted medium to coarse grained sand and gravel, with varying amounts of cobbles and small boulders.

The area slopes towards the northwest away from the existing reservoir. Sufficient area exists to place another similar sized reservoir next to the existing reservoir. An examination of the soil around the potential new reservoir identified sufficient suitable overburden material to create the berms, and provide the raw material that could be crushed and sorted to provide the needed sand and gravel. The laboratory results of the analysis of a representative soil sample (Soil-3) are included in Appendix C.

Geotechnical conditions are favourable for the construction of a second reservoir at the site using the same techniques as was used to construct the first reservoir.

7.2 Water Supply to the Reservoir

Currently the reservoir is filled during the summer by laying pipe over the ground up hill to the Tulugak River as shown on Figure 6. Filling was observed underway September 15, 2005, however the flow in the river and resulting flow through the pipe was low. Hamlet staff indicated the river should continue to flow sufficiently to fill the reservoir until early October.

Discussions were held with Government of Nunavut staff and Hamlet staff regarding the filling process. The following were discussed:

- Continue using the current method of filling

- Establish a reservoir or filling area in the stream itself with a permanent intake in a created pool. This was considered difficult due to the violence of spring run-off with rafted ice moving down hill.

Possible modifications to the filling procedure will be addressed further as part of the detailed design phase of the project.

8.0 Alternative Locations for the Wastewater Lagoon and Landfill

The Schematic Design Report identified one new potential site for relocating the wastewater lagoon, and three potential sites for relocating the landfill (A, B, and C) as shown on Figures 2 and 3.

A potential new wastewater lagoon site is located in the same area as Potential Landfill Site A. This location is on the south side of the Dew Line site access road.

The area was traversed and examined. On the surface the tundra is covered with abundant moderate to large boulders and bedrock float. The large float is derived from a steep ridge of bedrock to the southeast. The site is sloped to a similar degree as the existing landfill and wastewater lagoon site. The underlying overburden could not be examined in detail due to the rough boulder covered surface. What could be determined from field examination and traverse, was that this area would be very difficult to work with heavy equipment due to the preponderance of boulders and large bedrock float. Construction would be difficult, and Operation and Maintenance (O&M) costs for the landfill would be high due to the difficulty of excavating cover material.

This site is geotechnically less favourable than the existing site and still within sight of the community.

Potential Landfill Site B is located approximately 1.7 km further up the Dew Line site access road than the existing landfill site.

Although the area is mapped as bedrock on Figure 3, Potential Site B consists of overburden above permafrost. Depth to bedrock is unknown. The area slopes to the northwest, and is constrained to the south by a northeast trending ridge and a boulder choked run off channel at the base of the slope. Site B is the only potential location examined that is out of sight of the community.

The area is covered with cobbles and small boulders. The underlying overburden is predominately coarse grained sand and gravel with poorly sorted cobbles and boulders.

The site is sufficiently large enough to host a landfill.

Geotechnically there is sufficient area and available cover material to create and operate a landfill. There are concerns with spring runoff at the base of the ridge, and overland flow from up gradient. This could be controlled with ditching.

From an O&M cost perspective, the site requires traveling a further 1.7 km from the existing landfill access road and up a significant grade. See topographic contours on

Figure 3. While the site may be geotechnically possible, the economics and O&M issues make it less suitable than the existing site.

Potential Landfill Site C is located north of the Dew Line site access road. The site is not visible to the community and would require the construction of approximately 1 km of new access road.

The site is located on a shallow slope with boulder-covered tundra. Access was not possible with test pitting equipment at the time of the fieldwork due to the distance from the existing road network.

Development of a landfill site in this location appears geotechnically feasible, however the capital and O&M costs would be much higher than for the other sites, with no significant advantages.

In summary, based on the geotechnical evaluation the most suitable option for the landfill site is the rehabilitation of the existing site. The most suitable option for the wastewater lagoon is adding additional lagoon capacity at the existing location through construction of another lagoon.

Maintaining the wastewater lagoon and landfill in their current locations in close proximity to each other, minimizes the need for additional roads and minimizes the land area required for infrastructure development, and minimizes the footprint of environmental impacts.

9.0 Summary

The geotechnical evaluation found the existing wastewater lagoon site, landfill site, and water reservoir site to be suitable for rehabilitation and/or expansion.

No compelling geotechnical reasons were found to relocate the landfill or wastewater lagoons. A qualitative evaluation of capital costs and O&M indicates the current locations are the most favourable, due to:

- No new access road needed
- No new site development needed
- No new disturbance of the natural tundra required other than in the immediate vicinity of existing disturbed areas
- Sufficient construction material resources have been identified at each location for the type of construction that is planned..

10.0 Recommendations

1. No further geotechnical study is required at this time.

2. Detailed topographic contours are required for the areas selected for rehabilitation/ expansion in order to develop the Detailed Designs and Operation and Maintenance Plans.

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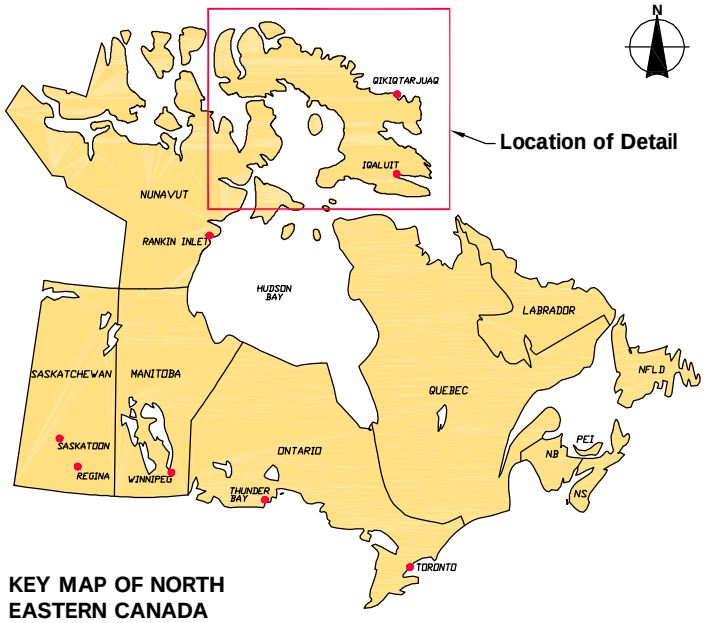
Figures

Map Reference:
Map of Canada
Published by the CAA



KEY MAP OF NORTH EASTERN CANADA

FIGURE 1 - SITE LOCATION MAP

THE HAMLET OF QIKIQTARJUAQ, NUNAVUT

GEOTECHNICAL EVALUATION

September 2005
Project Number: N-O 09439.0

Prepared by: C. Sheppard

Verified by: J. Walls

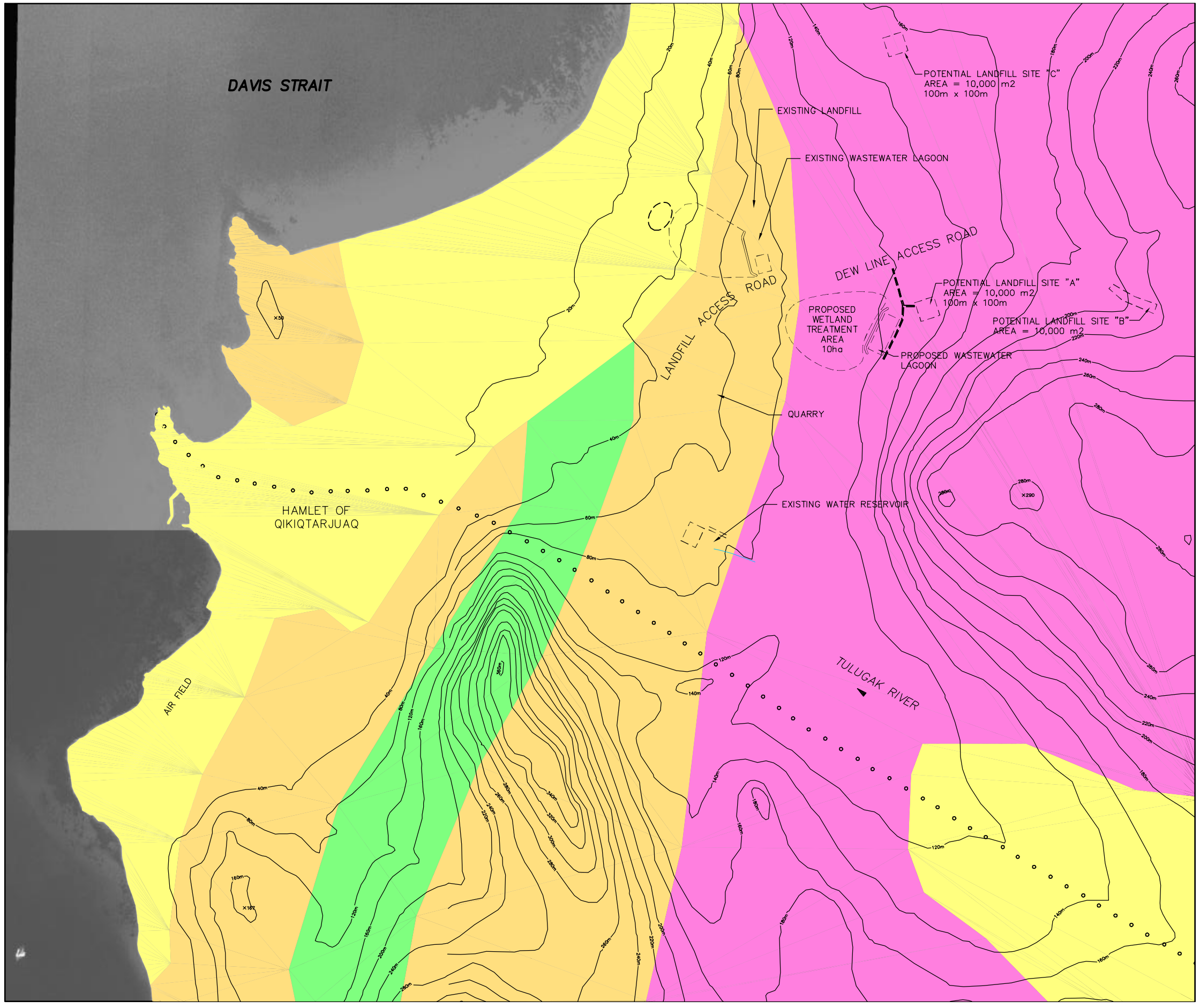
BURNSIDE

FOE08983 GEOTECH SL.DWG

FIGURE 2

THE HAMLET OF QIKIQTARJUAQ
GEOTECHNICAL EVALUATION

SATELLITE IMAGERY OF ENTIRE COMMUNITY AND BEDROCK GEOLOGY



Legend

- CHARNOCKITE
- FELSIC & RARE MAFIC PLUTONIC ROCKS
- MIGMATITE
- CLAY TO COARSE GRAVEL & BOULDERS
- DIP
- LINEAMENT
- DYKE

Satellite Imagery Source:
September 2004 Satellite Image obtained from DigitalGlobe Inc.

Geology
Bedrock Geology data obtained from Jackson, G.D., 1998, Okoa Bay - Padloping Island Area, District of Franklin, Northwest Territories, Geological Survey of Canada, Open File 3532, Scale 1:250,000

N

0 200 400 600 800 1000 1200 1400 1600
Meters

1:20,000
September 2005
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: J. Walls

BURNSIDE

FOE08983 GEOTECH BEDROCK GEOLOGY.DWG

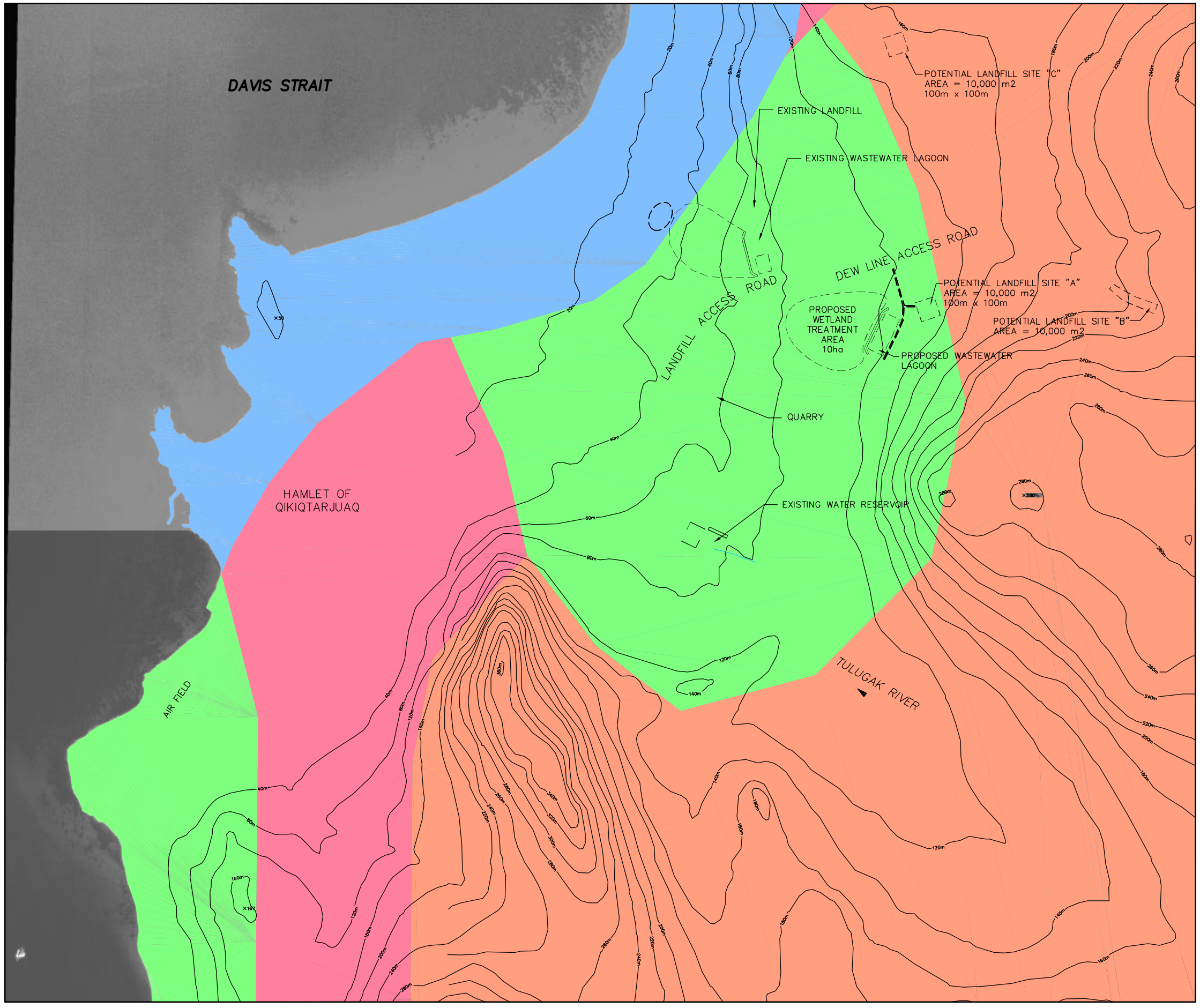


FIGURE 3

THE HAMLET OF QIKIQTARJUAQ
GEOTECHNICAL EVALUATION

SATELLITE IMAGERY OF ENTIRE COMMUNITY AND SURFICIAL GEOLOGY

Legend

- EMERGED MARINE SEDIMENT
- TILL
- BEDROCK
- RESIDUUM

Satellite Imagery Source:
September 2004 Satellite Image obtained from DigitalGlobe Inc.

Geology
Surficial Geology data obtained from Geological Survey of Canada, Surficial Materials and Landforms, Cumberland Penninsula, Baffin Island, Map 1536A.

N

0 200 400 600 800 1000 1200 1400 1600
Meters

1:20,000
September 2005
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: M. Paznar

BURNSIDE

FOE08983 GEOTECH SURFICIAL GEOLOGY.DWG

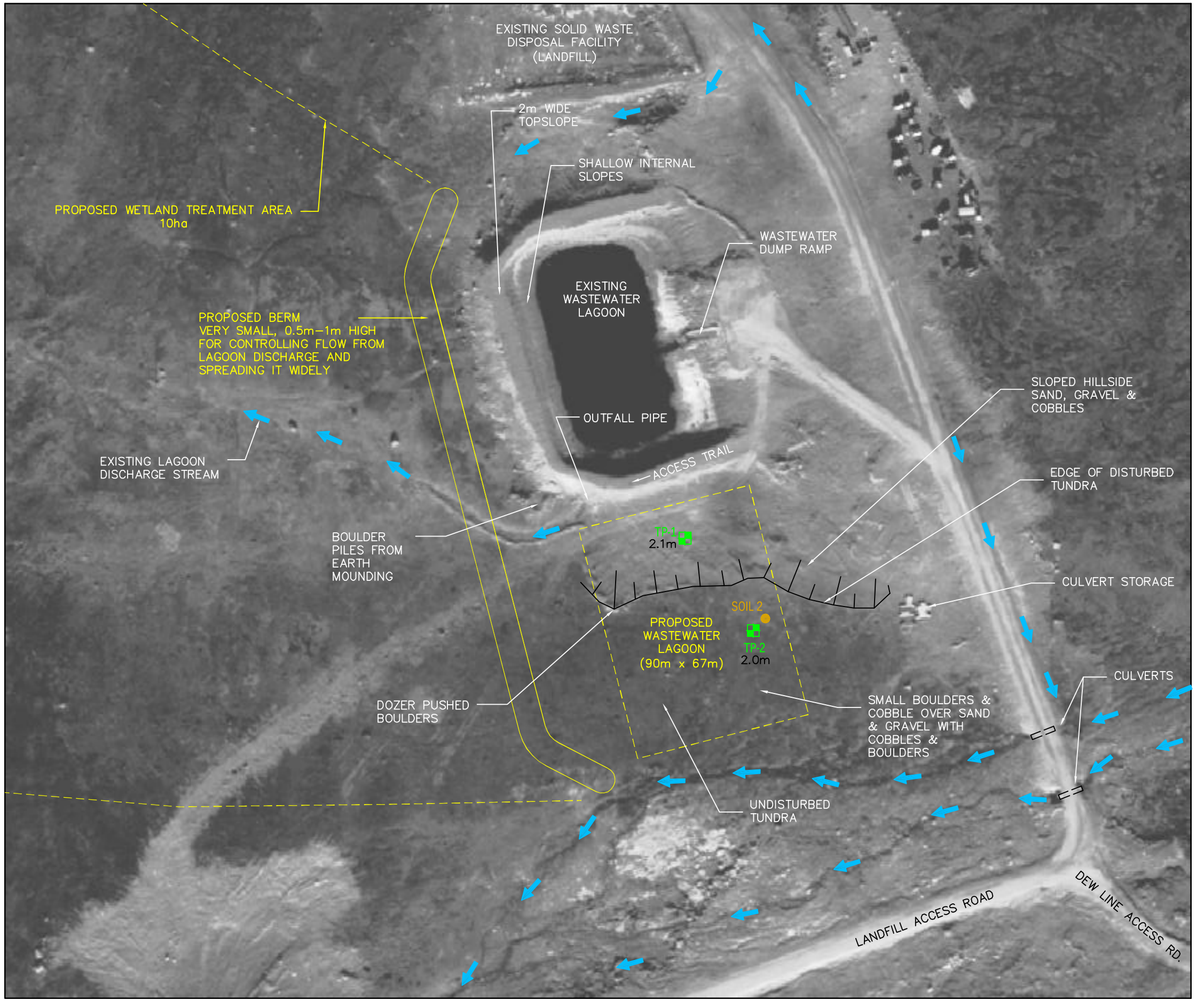


FIGURE 4

THE HAMLET OF QIKIQTARJUAQ
GEOTECHNICAL EVALUATION

EXISTING WASTEWATER LAGOON

Legend

- INTERPRETED EXISTING SURFACE WATER FLOW DIRECTION
- TP-1 2.1m — TEST PIT LOCATION & DEPTH IN METRES
- SOIL 1 — SOIL SAMPLE LOCATION

Satellite Imagery Source:
September 2004 Satellite Image obtained from DigitalGlobe Inc.

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Meters

1:1,500
September 2005
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: J. Walls

BURNSIDE

FOE08983 GEOTECH EXISTING WWL.DWG

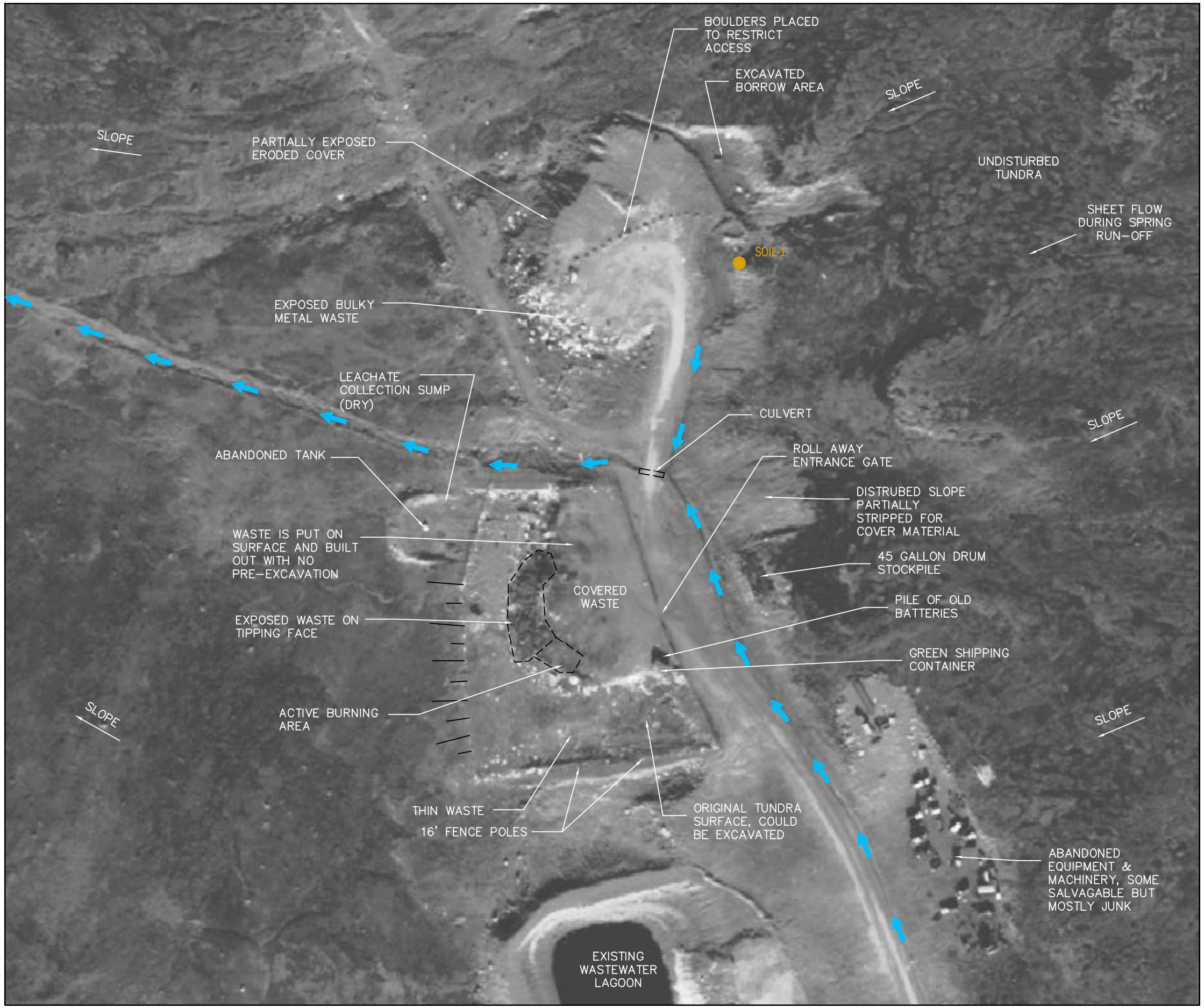

FIGURE 5

THE HAMLET OF QIKIQTARJUAQ
GEOTECHNICAL EVALUATION

EXISTING LANDFILL

Legend

INTERPRETED EXISTING SURFACE WATER FLOW DIRECTION

SOIL-1 SOIL SAMPLE LOCATION

Satellite Imagery Source:
September 2004 Satellite Image obtained from DigitalGlobe Inc.

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Meters

1:1,500
September 2005
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: J. Walls

BURNSIDE

FOE08983 GEOTECH EXISTING LF.DWG

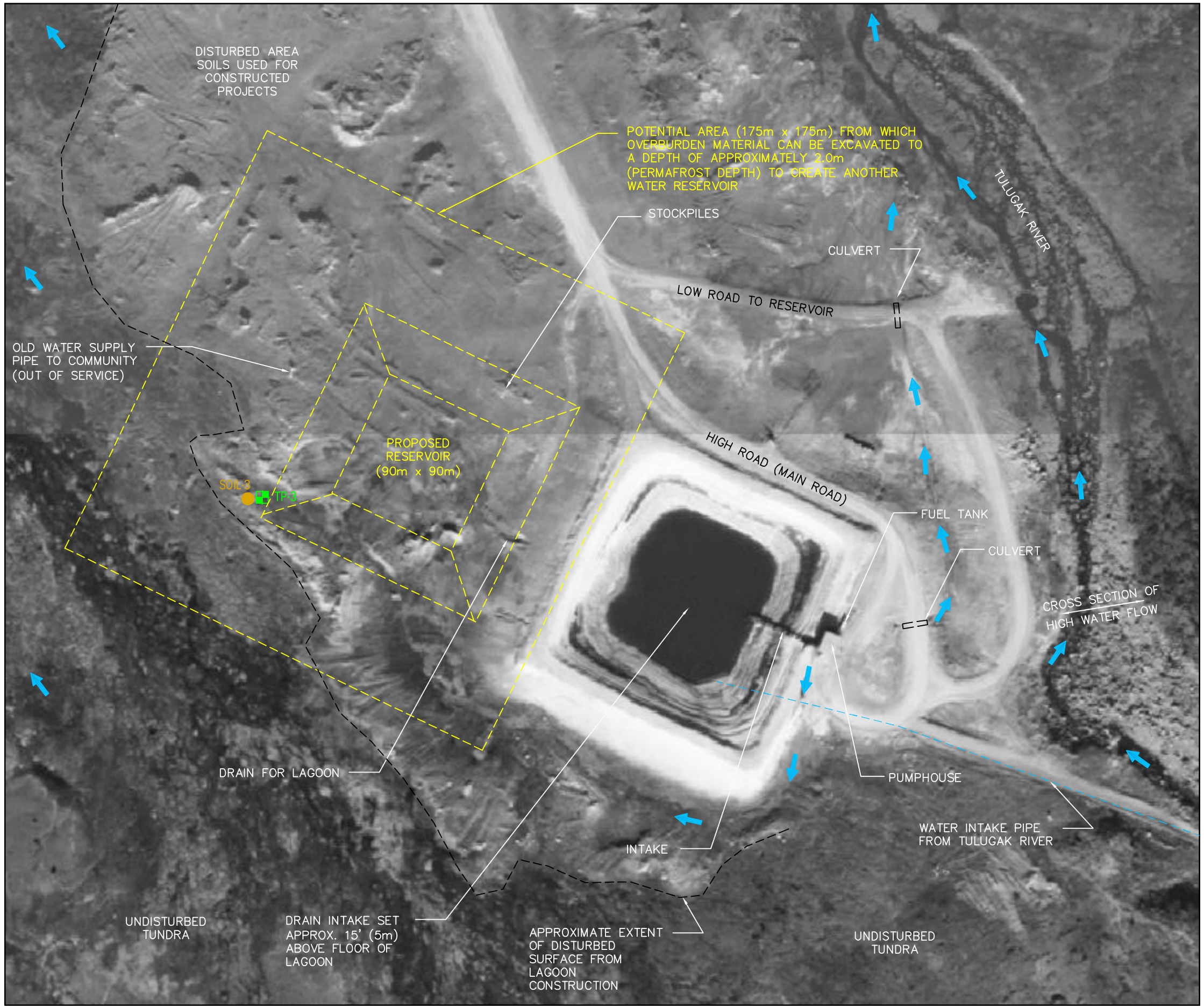

FIGURE 6

THE HAMLET OF QIKIQTARJUAQ
GEOTECHNICAL EVALUATION

EXISTING WATER RESERVOIR

Legend

- INTERPRETED EXISTING SURFACE WATER FLOW DIRECTION
- TP-3 — TEST PIT LOCATION & DEPTH IN METRES
- SOIL-1 — SOIL SAMPLE LOCATION

Satellite Imagery Source:
September 2004 Satellite Image obtained from DigitalGlobe Inc.

N

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Meters

1:1,500
September 2005
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: J. Walls

BURNSIDE

FOE08983 GEOTECH EXISTING WR.DWG

Appendix A
Test Pit Logs

Appendix A
Test Pit Logs

FOE 08983
Field Program September 13 – 16, 2005
Qikiqtarjuaq, Nunavut

Test Pit 1 – next to sewage lagoon

Tundra surface covered with cobble and small boulders.

0 – 1.0 m	Sand, medium to coarse grained with scattered gravel, cobbles, and small boulders. Loose, damp, poorly sorted. Hard digging for backhoe.
1.0 – 2.1 m	Sand, medium to coarse grained with various sized gravel and cobbles. Less cobbles and boulders. Loose, damp easier digging with backhoe.
2.1 m	Refusal – Perma Frost. Slightly more sility near perma frost contact. Wet and frozen hard. Unable to dig with backhoe.

Embankment Face in Quarry

Cobble and boulder armored surface of tundra.

0 – 0.2 m	Topsoil and humic horizon with boulders. Band dark black with roots.
0.2 – 2.0 m	Sand and gravel with cobbles and boulders. Medium brown, loose, damp, poorly sorted mixture. Some angular fragments of weathered bedrock float.
2.0 m	Bedrock – weathered charnockite. Medium to coarse grained, quartz, feldspar and pyroxene. Weathers readily to coarse sand and gravel.

Test Pit 2 – proposed waste water lagoon

Cobble and boulder tundra surface.

0 – 0.5 m	cobbles and small boulders. Dry loose, fines have been winnowed away.
0.5 – 2.0 m	Sand and gravel with scattered cobbles and small boulders. Poorly sorted, loose, dark brown, damp. Small amount of silty 1.8 – 2.0 m. Water seeping into hole at approximately 1.8 m and poorly.
2.0 – 2.1 m	Refusal on permafrost.

Test Pit 3 – in area of proposed water reservoir

Tundra surface armoured with cobbles and small boulders. Some local disturbance caused by bulldozing for water reservoir.

0 – 2.0 m	Medium to coarse grained sand and gravel with various sized cobbles and odd small boulder. Medium brown, poorly sorted, loose, damp.
2.0 m	Refusal – permafrost – water seepage into hole just above contact with permafrost.

Appendix B
Photographs

Photo 1 Overburden stockpiled in quarry area.

Photo 2 Close up of broken bedrock float weathering to sand and gravel at the quarry site.

Photo 3 Screening equipment at the quarry site.

Photo 4 Typical excavation face at the quarry site.
Permafrost at approximately 2.0 m below surface.

Photo 5 Test Pit #1 near existing wastewater lagoon.

Photo 6 Face of borrow area behind landfill.

Photo 7 South side of landfill site.

Photo 8 South side of landfill site.

Photo 9 Looking south across tipping face of landfill.

Photo 10 Dry leachate collection pond at base of landfill.

Photo 11 South side of wastewater lagoon.

Photo 12 Bull dozed surface and test pits west of the water reservoir. Approximately 2.0 m of overburden to permafrost.

Photo 13 Looking west from wastewater lagoon across disturbed area of overburden from which existing lagoon berms were constructed.

Appendix C

Soil Testing Results

alston associates inc.
consulting engineers

EMAIL

Fax to	:	Jim Walls, R.J. Burnside & Associates Limited	Fax Number	:	(519) 941-8120
From	:	Jonathan Bond	Date	:	3 November 2005
Ref. No.	:	05-090	Page 1 of 4		
Subject	:	Laboratory Results Burnside File No. FEO 09439 Qikiqtarjuaq			

We enclose the Grain Size Distribution Test Reports for the samples received in our office on 17 October 2005. Originals will follow by mail.

If you have any questions please do not hesitate to contact our office.

Regards

J Bond

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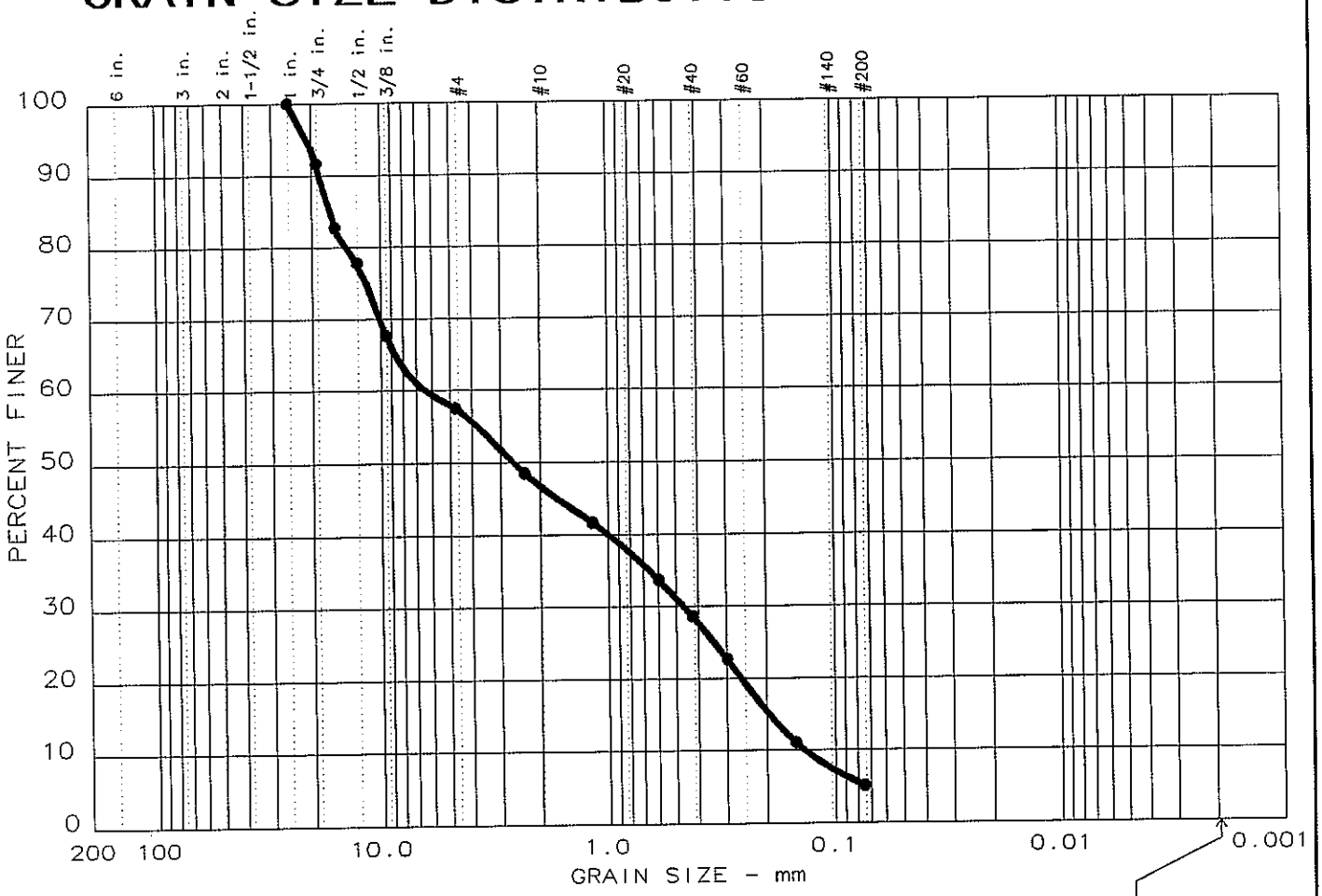
markham, ontario
L6G 1A8

telephone (905) 474-5265
fax (905) 474-2825
e-mail alston@alston.ca

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	5	0.0	42.5	52.4	5.1	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			16.71	6.43	2.62	0.460	0.1941	0.1358	0.24	47.3

MATERIAL DESCRIPTION	USCS	AASHTO
● SAND and GRAVEL, trace silt	SP-SM	

Project No.: 05-090
Project: Burnside File FEO 09439 Qikiqtarjuaq
● Location: Soil 1

Date: 3 November 2005

GRAIN SIZE DISTRIBUTION TEST REPORT

alston associates inc.

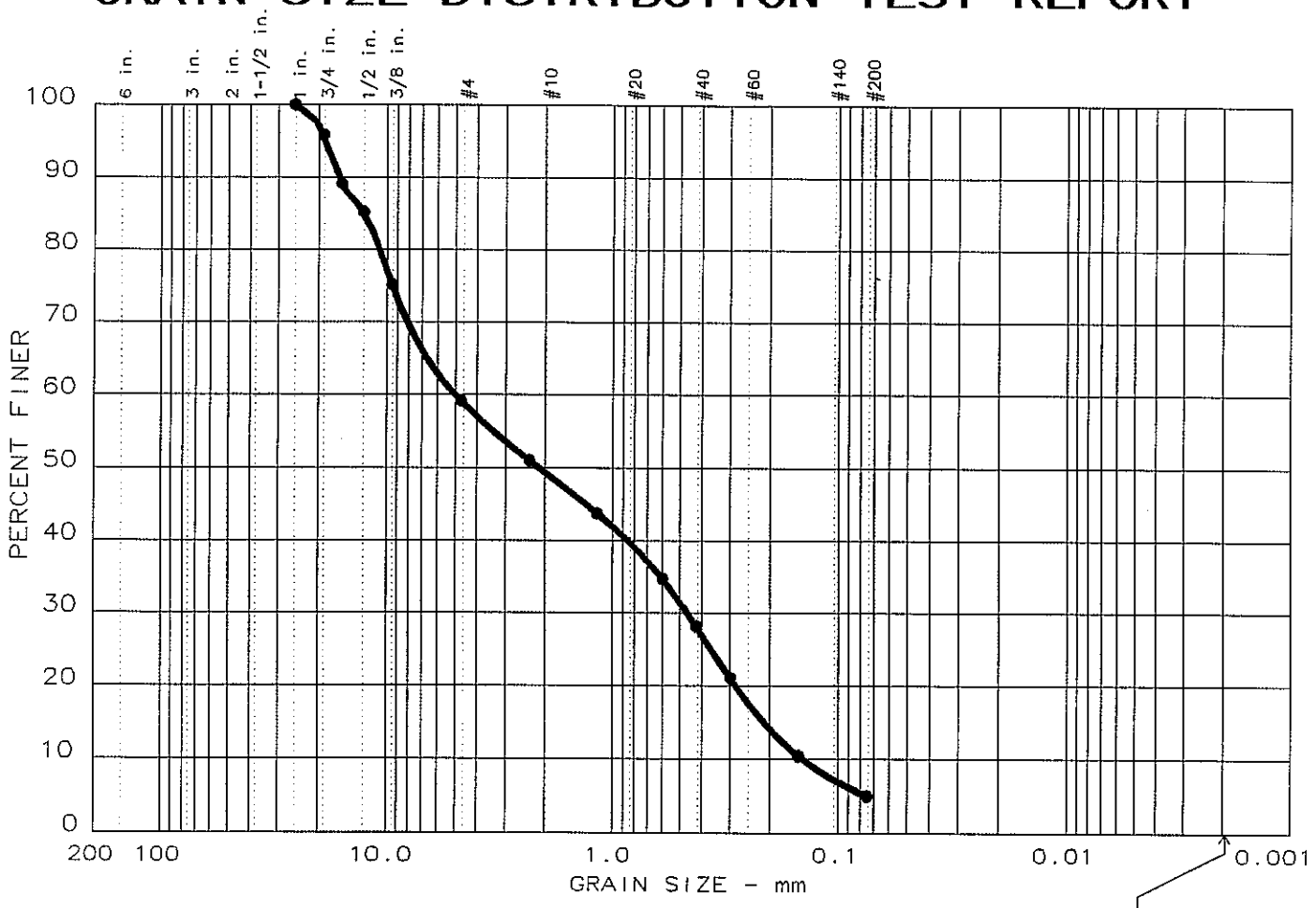
Remarks:

Prepared for:

Burnside

Figure No. 1

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	6	0.0	40.8	54.2	5.0	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			12.59	4.95	2.14	0.462	0.2113	0.1429	0.30	34.7

MATERIAL DESCRIPTION	USCS	AASHTO
● SAND and GRAVEL, trace silt	SP-SM	

Project No.: 05-090
Project: Burnside File FEO 09439 Qikiqtarjuaq
● Location: Soil 2

Date: 3 November 2005

GRAIN SIZE DISTRIBUTION TEST REPORT

alston associates inc.

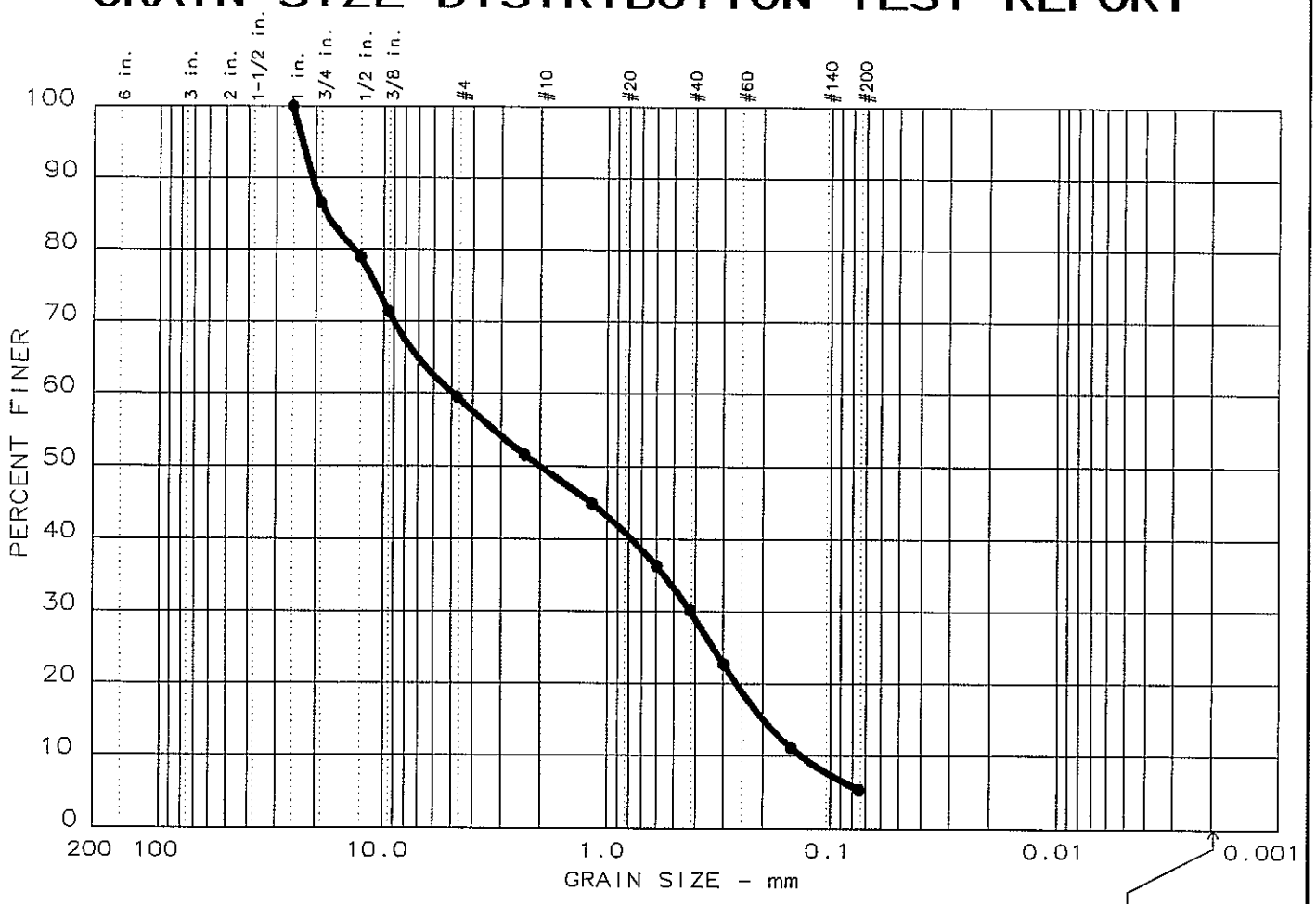
Remarks:

Prepared for:

Burnside

Figure No. 2

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	7	0.0	40.5	54.2	5.3	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			17.99	4.90	2.00	0.417	0.1972	0.1334	0.27	36.7

MATERIAL DESCRIPTION	USCS	AASHTO
● SAND and GRAVEL, trace silt	SP-SM	

Project No.: 05-090
Project: Burnside File FEO 09439 Qikiqtarjuaq
● Location: Soil 3

Date: 3 November 2005

Remarks:

Prepared for:
Burnside

GRAIN SIZE DISTRIBUTION TEST REPORT

alston associates inc.

Figure No. 3

Appendix C

Nunavut Water Board License

P.O. Box 119
Gjoa Haven, NT X0E 1J0
Tel: (867) 360-6338
Fax: (867) 360-6369

ᓄᓇᕗᑦ ᐃᒪᓕᕆᔨᒃᑯᑦ ᑲᑎᒪᔨᖏᑦ
NUNAVUT WATER BOARD
NUNAVUT IMALIRIYIN KATIMAYINGI

File No. NWB3QIK0106

November 28, 2000

Mr. Don Pickle
Senior Administrative Officer
Municipality of Qikiqtarjuaq
P.O. Box 4
Qikiqtarjuaq, Nunavut X0A 0B0
Email: pickle@nunanet.com

RE: NWB Licence No. NWB3QIK0106

Dear Mr. Pickle:

Please find attached Licence No. NWB3QIK0106 issued **(Motion: #2000-09-06)** by the Nunavut Water Board (NWB) pursuant to its authority under Article 13 of the *Agreement between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in Right of Canada.* The terms and conditions of the attached Licence related to water use and waste disposal are an integral part of this approval.

Any communication with respect to this licence shall be made in writing to the attention of:

Chief Administrative Officer
Nunavut Water Board
P. O. Box 119
Gjoa Haven, NU. X0B 1J0
Telephone No: (867) 360-6338
Fax No: (867) 360-6369

Inspection and enforcement of the terms and conditions of this licence are performed by:

Water Resources Officer
Nunavut District Office
Northern Affairs Program
Department of Indian Affairs
and Northern Development
P. O. Box 100
Iqaluit, NU. X0A 0H0
Telephone No: (867) 979-4405
Fax No: (867) 979-6445

The licensee shall submit all reports, plans and studies in quantities as required by the Chief Administrative Officer, contact the NWB for additional details.

Sincerely,

P. di Pizzo

Philippe di Pizzo
Chief Administrative Officer

Enclosure: Licence No. NWB3QIK0106

cc: R. Beavers, Indian and Northern Affairs Canada
P. Smith, Indian and Northern Affairs Canada
Qikiqtani Inuit Association
G. Joudrey, Nunavut Impact Review Board
P. Pacholek, Environment Canada
C. Nichols, Sustainable Development
L. Coady, Nunavut Planning Commission
J. deGroot, Fisheries and Oceans
B.Segal, Baffin Health & Social Services

DECISION

LICENCE NUMBER: NWB3QIK0106

This is the decision of the Nunavut Water Board (NWB) with respect to an application for a Licence renewal dated April 11, 2000, made by:

Municipality of Qikiqtarjuaq

to allow for the use of water and disposal of waste into water for municipal undertakings by the Municipality at Qikiqtarjuaq, Nunavut.

With respect to this application, the NWB gave notice to the public that the Municipality had filed an application for renewal of water licence N4L3-0640 issued by the Northwest Territories Water Board.

DECISION

After having been satisfied that the application was exempt from the requirement for screening by the Nunavut Impact Review Board in accordance with S.12.3.2 of the NLCA, the NWB decided that the application could go through the regulatory process. After reviewing the submission of the Applicant and the written and oral comments expressed by interested parties, the NWB, having given due regard to the facts and circumstances, the merits of the submissions made to it and to the purpose, scope and intent of the Nunavut Land Claims Agreement, decided to waive the requirement to hold a public hearing and furthermore to delegate its authority to approve the application to the Chief Administrative Officer pursuant to S. 13.7.5. of the NLCA and determined that:

Licence Number NWB3QIK0106 be issued subject to the terms and conditions contained therein. (Motion #:2000-09-06)

SIGNED this 28th day of November 2000 at Gjoa Haven, Nunavut.

Philippe di Pizzo
Chief Administrative Officer

TABLE OF CONTENTS

INTRODUCTION

Following an application for licence renewal filed by the Hamlet of Qikiqtarjuaq on April 11, 2000, the Nunavut Water Board conducted an initial assessment of the Municipality's submission and verified that the application was exempt from the requirement for screening by the Nunavut Impact Review Board in accordance with S.12.3.2 of the NLCA. The Board concluded that the application was complete and could go through the regulatory process.

In accordance with Article 13 of the Nunavut Land Claims Agreement (NLCA), the Board shall conduct a public hearing before approving an application, and shall accordingly give public notice of the application. Public notice of the application was given on April 12, 2000, and the application was distributed concurrently to local, territorial, and federal organizations and agencies. Submissions were made by Environment Canada (EC), Department of Indian and Northern Affairs (DIAND), and the Department of Community Government and Transportation (CGT). However, no public concerns were expressed, and the NWB waived the requirement to hold a public hearing in accordance with Section 13.7.2 of the NLCA. The authority to approve the application was delegated to the Chief Administrative Officer of the Board pursuant to S. 13.7.5 of the NLCA. After considering the submissions of interested parties, the NWB decided to issue licence NWB3QIK0106.

II. GENERAL CONSIDERATIONS

Term of the Licence

Consistent with the powers of the Northwest Territories Water Board under the Northern Inland Waters Act, the NWB may issue a licence for a term not exceeding twenty-five years. The Municipality requested a 10-year licence from the Board, whereas the Department of CGT suggested that issuing a shorter-term licence would allow the Hamlet and CGT to undertake the various studies and provide a plan of action to upgrade municipal facilities. The Board agrees with CGT, and furthermore believes that a shorter-term licence will allow the Municipality to establish a consistent compliance record. Consequently, the Board decides to issue a 5-year licence, which will allow the licensee to properly carry out the terms and conditions of the licence and to ensure that sufficient time is given to permit the licensee to develop, submit, and implement the plans required under the licence to the satisfaction of the NWB.

Annual Report

The requirements imposed on the licensee in this licence are for the purpose of ensuring that the NWB has an accurate annual update of municipal activities during a calendar year. This information is maintained on the public registry and is available to any interested parties upon request.

Operation and Maintenance Manual (O&M)

Under the previous water licence (N4L3-0640), the Municipality was required to submit for Board approval an Operation and Maintenance plan for waste disposal operations. At the time of application, the Board's Public Registry indicated that the Municipality had not complied with this licence condition.

The purpose of an Operation and Maintenance Manual is to assist the Municipality's staff in the proper operation and maintenance of the waste disposal facilities. The manual should demonstrate to the Nunavut Water Board that the Municipality is capable of operating and maintaining all waste disposal sites adequately. The Board decides to maintain the requirement for the submission of an Operation and Maintenance plan for all Sewage and Solid Waste Disposal Facilities. The plan shall be in accordance with the "*Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories, October 1996*"

Abandonment and Restoration (A&R)

Under the previous water licence (N4L3-0640) the Municipality was required to submit for Board approval an abandonment and restoration plan for the abandoned Waste Disposal Facility. At the time of application, the Board's Public Registry indicated that the Municipality had not complied with this licence condition. However, the Board's Public Registry contains evidence that some reclamation of the site was undertaken in accordance with the "Sanitary Site Clean Up Broughton Island, NWT Report"[1]. In its submission to the Board, Environment Canada noted that the Municipality's application indicated that erosion is beginning to expose the old dumpsite again. The Board accepts this evidence and orders the Municipality to ensure that sufficient cover is placed on the site and that erosion control measures will be implemented as required.

The Board also notes that based on population growth estimates and the remaining capacity of the current waste disposal site, planning for a new facility may be required within the term of this licence. In this event, the planning study shall also contemplate the reclamation of the current facility, and accordingly the NWB decides to include in this licence a requirement to include in such a study a separate section on the Abandonment and Restoration Plan for the current site.

Surveillance Network Program

The Surveillance Network Program is a monitoring program established to collect data on water quality to assess the effectiveness of waste treatment and detect any impact of waste disposal activities on water.

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[1] Sanitary Site Clean Up, Broughton Island, NWT Report. Prepared by M.M. Dillon Limited for the Government of the Northwest Territories, Municipal and Community Affairs. December 1993.

The Board notes that there is a stream located between the solid waste disposal facility and the Sewage Disposal Facilities, and that runoff from the solid waste site may enter water. To ensure the protection of water, the Board requests the establishment of a SNP station (SNP Station 0640-8) in the stream above the waste disposal facilities and another (SNP Station 0640-9) in the stream below the waste disposal facilities.

The Board notes that this application does not include the disposal of tannery effluent to the Sewage Disposal Facilities and consequently removes from SNP station 0640-4 parameters normally associated with tannery effluents.

The application states that discharge from the lagoon occurs once per year for a short period. The Board requests that the licensee take three samples, one at the beginning, one midway through and one near the end of the discharge of effluent from the sewage lagoon. These samples shall be taken at SNP station 0640-6 and SNP station 0640-6A.

Studies

In their submission to the Board, the Department of Community Government and Transportation states that both the water reservoir and the Sewage Disposal Facilities would seem to be approaching their useful life and will require improvements to meet the needs of the community for the next 20 years. The Board accepts this evidence and decides to order the Municipality to submit for Board approval the Terms of Reference for conducting an assessment of the water reservoir and sewage disposal facility. The planning study results shall be submitted for Board approval at least 8 months prior to the expiration of this licence.

III. LICENCE NWB3QIK0106

Pursuant to 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

MUNICIPALITY OF QIKIQTARJUAQ

(Licensee)

of **QIKIQTARJUAQ, NUNAVUT, X0A 0B0**

(Mailing Address)

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

Licence Number	**NWB3QIK0106**
Water Management Area	**04**
Location	**QIKIQTARJUAQ, NUNAVUT**
Purpose	**WATER USE AND WASTE DISPOSAL**
Description	**MUNICIPAL UNDERTAKINGS**
Quantity of Water Not to be Exceeded	**35,000 CUBIC METRES ANNUALLY**
Date of Licence	**January 1, 2001**
Expiry Date of Licence	**December 31, 2006**

Dated this 28th of November 2000 at Gjoa Haven, Nunavut.

Philippe di Pizzo
Chief Administrative Officer

PART A: SCOPE, ENFORCEMENT & DEFINITIONS

1. Scope

a. This Licence allows for the use of water and the disposal of waste into water for municipal undertakings at the Municipality of Qikiqtarjuaq, Nunavut (67°33'N, 64°02'W);

b. This Licence is issued subject to the 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 amended by the Governor in Council under a future Nunavut Waters Act, or other statues imposing more stringent conditions relating to the quantity or type of waste that may be so deposited or under which any such waste may be so deposited this Licence shall be deemed, upon promulgation of such Regulations, to be automatically amended to conform with such Regulations; and

c. Compliance with the terms and conditions of this Licence does not absolve the Licensee from responsibility for compliance with the requirements of all applicable Federal, Territorial and Municipal legislation.

2. Enforcement

a. Subject to Part A, item 2 (d), failure to comply with this licence will be a violation of the *Northwest Territories Waters Act*, exposing the licensee to the enforcement measures and the penalties provided for in the Act.

b. Subject to Part A, Item 2 (d), all inspection and enforcement services regarding this licence will be provided by inspectors appointed under the *Northwest Territories Waters Act*.

c. Subject to Part A, Item 2 (d), inspectors appointed under the *Northwest Territories Waters Act* enjoy - with respect to this licence, and for the purpose of enforcing this licence, and with respect to the use of water and deposit or discharge of waste by the licensee - all powers, privileges and protections that are conferred upon them by the *Northwest Territories Waters Act* or by other applicable law.

d. To the extent that the *Northwest Territories Waters Act* is, subsequent to the issuance of this licence, replaced with respect to water management in Nunavut by other federal legislation (including, without limitation, a regulation or order referred to in Section 10.10.2 of the *Nunavut Land Claims Agreement*), and to the extent that the other federal legislation is

consistent with the *Nunavut Land Claims Agreement*, the other federal legislation shall apply with respect to this licence and the *Northwest Territories Waters Act* shall cease to apply with respect to this licence.

3. Definitions

In this Licence: **NWB3QIK0106**

"Amendment" means a change to original terms and conditions of this licence requiring correction, addition or deletion of specific terms and conditions of the licence: medications inconsistent with the terms and conditions of this licence;

"Average Concentration" means the arithmetic mean of any four consecutive analytical results submitted to the Board in accordance with the sampling and analysis requirements specified in the "Surveillance Network Program";

"Average Concentration For Faecal Coliform" means the running geometric mean of any four consecutive analytical results submitted to the Board in accordance with the sampling and analysis requirements specified in the "Surveillance Network Program";

"Board" means the Nunavut Water Board established under the Nunavut Land Claims Agreement;

"Commercial Waste Water" means water and associated waste generated by the operation of a commercial enterprise, but does not include toilet wastes or greywater;

"Freeboard" means the vertical distance between water line and crest on a dam or dyke's upstream slope;

"Grab Sample" means a single water or wastewater sample taken at a time and place representative of the total discharge;

"Greywater" means all liquid wastes from showers, baths, sinks, kitchens and domestic washing facilities, but does not include toilet wastes;

"Honey Bags" A plastic or heavy paper bag that fits into a bucket toilet used to contain toilet waste.

"Inspector" means an Inspector designated by the Minister of Indian and Northern Affairs Canada in a manner consistent the *Northwest Territories Waters Act*;

"Licensee" means the holder of this Licence;

"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, but does not include an expansion; changes to the operating system that are consistent with the terms of this Licence and do not require amendment;

"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;

"Pumpout Sewage" means all toilet wastes and/or greywater collected by means of a vacuum truck for disposal at an approved facility;

"Sewage" means all toilet wastes and greywater;

"Sewage Disposal Facilities" comprises the area and engineered structures designed to contain sewage;

"Solid Waste Disposal Facilities" comprises the area and associated structures designed to contain solid wastes;

"Toilet Wastes" means all human excreta and associated products, but does not include greywater;

"Waste" means any substance that, by itself or in combination with other substances found in water, would have the effect of altering the quality of any water to which the substance is added to an extent that is detrimental to its use by people or by any animal, fish or plant, or any water that would have that effect because of the quantity or concentration of the substance contained in it or because it has been treated or changed, by heat or other means;

"Waste Disposal Facilities" means all facilities designated for the disposal of waste, and includes the Sewage Disposal Facilities, Solid Waste Disposal Facilities, and Bagged Toilet Wastes Disposal Facilities; and

"Water Supply Facilities" comprises the area and associated intake infrastructure at the Municipality's reservoir and primary source, the Tulugak River.

PART B: GENERAL CONDITIONS

1. The Licensee shall file an Annual Report with the Board no later than March 31st of the year following the calendar year reported which shall contain the following information:

a. tabular summaries of all data generated under the "Surveillance Network Program";

b. the monthly and annual quantities in cubic metres of fresh water obtained from all sources;

c. the monthly and annual quantities in cubic metres of each and all waste discharged;

d. the monthly and annual quantities of Sewage Solids removed from the Sewage Disposal Facilities for disposal;

e. a summary of modifications and/or major maintenance work carried out on the Water Supply and Waste Disposal Facilities, including all associated structures and facilities;

f. a list of unauthorized discharges and summary of follow-up action taken;

g. a summary of any abandonment and restoration work completed during the year and an outline of any work anticipated for the next year;

h. a summary of any studies requested by the Board that relate to waste disposal, water use or reclamation, and a brief description of any future studies planned;

i. updates or revisions to the approved Operation and Maintenance Plans; and

j. any other details on water use or waste disposal requested by the Board by November 1st of the year being reported.

2. The Licensee shall comply with the "Surveillance Network Program" annexed to this Licence, and any amendment to the said "Surveillance Network Program" as may be made from time to time, pursuant to the conditions of this Licence.

3. The "Surveillance Network Program" and compliance dates specified in the Licence may be modified at the discretion of the NWB Chief Administrative Officer.

4. Meters, devices or other such methods used for measuring the volumes of water used and waste discharged shall be installed, operated and maintained by the Licensee to the satisfaction of an Inspector.

5. The Licensee shall by September 1, 2001, post the necessary signs, where possible, to identify the stations of the "Surveillance Network Program." All postings shall be located and maintained to the satisfaction of an Inspector.

6. The Licensee shall by September 1, 2001, post signs in the appropriate areas to inform the public of the location of the Water Supply and Waste Disposal Facilities. All postings shall be located and maintained to the satisfaction of an Inspector.

7. The Licensee shall immediately report to the 24-Hour Spill Report Line (867-920-8130) any spills of Waste, which are reported to or observed by the Licensee, within the municipal boundaries or in the areas of the Water Supply or Waste Disposal Facilities.

8. The Licensee shall ensure a copy of this Licence is maintained at the municipal office at all times.

PART C: CONDITIONS APPLYING TO WATER USE

1. The Licensee shall obtain all fresh water from the Water Supply Facilities or as otherwise approved by the Board.

2. The annual quantity of water used for all purposes shall not exceed 35,000 cubic metres.

3. The Licensee shall maintain the Water Supply Facilities to the satisfaction of the Inspector.

4. The water intake hose used on the water pumps shall be equipped with a screen with a mesh size sufficient to ensure no entrainment of fish.

PART D: CONDITIONS APPLYING TO WASTE DISPOSAL

1. The Licensee shall direct Sewage to the Sewage Disposal Facilities or as otherwise approved by the Board.

2. All Sewage effluent discharged from the Sewage Disposal Facilities at "Surveillance Network Program" Station Number 0640-6 shall meet the following effluent quality standards:

Parameter	Maximum Average Concentration
Faecal Coliforms	1 x 10^4CFU/100 ml
BOD_5	120 mg/L
Total Suspended Solids	180 mg/L

The Waste discharged shall have a pH between 6 and 9, and no visible sheen of oil and grease.

3. A Freeboard limit of 1.0 metre, or as recommended by a qualified geotechnical engineer and as approved by the Board, shall be maintained at all dykes and earthfill structures.

4. All honey bags shall be disposed of to the satisfaction of an Inspector.

5. The Licensee shall advise an Inspector at least ten (10) days prior to initiating the decant of the Sewage Disposal Facilities.

6. The Sewage Disposal Facilities shall be maintained and operated in such a manner as to prevent structural failure.

7. The Licensee shall maintain the Sewage Disposal Facilities to the satisfaction of an Inspector.

8. The Licensee shall dispose of and contain all solid wastes at the Solid Waste Disposal Facilities or as otherwise approved by the Board.

PART E: CONDITIONS APPLYING TO MODIFICATIONS

1. The Licensee may, without written approval from the Board, carry out modifications to the Water Supply and Waste Disposal Facilities 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;

   b. such modifications do not place the Licensee in contravention of the Licence;

c. the Board has not, during the 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

d. the Board has not rejected the proposed modifications.

2. Modifications for which all of the conditions referred to in Part E, Item 1, have not been met may be carried out only with written approval from the Board.

3. The Licensee shall provide to the Board site plans of the modifications referred to in this Licence within ninety (90) days of completion of the modifications.

PART F: CONDITIONS APPLYING TO CONSTRUCTION

1. Prior to construction of any dams, dykes or structures intended to contain, withhold, divert or retain water or wastes, the Licensee shall submit to the Board for review design drawings stamped by a qualified Engineer registered in Nunavut

PART G: CONDITIONS APPLYING TO OPERATION AND MAINTENANCE

1. The Licensee shall, within six (6) months of the issuance of this Licence, submit to the Board for approval, a plan for the Operation and Maintenance of the Sewage and Solid Waste Disposal Facilities in accordance with *"Guidelines for preparing an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities"* October 1996.

2. The Licensee shall implement the plan specified in Part G, Item 1 as and when approved by the Board.

3. If, during the period of this Licence, an unauthorized discharge of waste occurs, or if such a discharge is foreseeable, the Licensee shall:

a. employ the appropriate contingency plan as provided for in the Operation and Maintenance Plan;

b. report the incident immediately via the 24-Hour Spill Reporting Line, (867) 920-8130; and

c. submit to an Inspector a detailed report on each occurrence not later than thirty (30) days after initially reporting the event.

PART H: CONDITIONS APPLYING TO ABANDONMENT AND RESTORATION

1. The Licensee shall submit to the Board for approval an Abandonment and Restoration Plan at least six (6) months prior to abandoning any facilities, including but not limited to:

   a. the water intake facilities;

   b. the water treatment and waste disposal sites and facilities;

   c. the petroleum and chemical storage areas;

   d. any site affected by waste spills;

   An Abandonment Plan shall include, among other things:

   i. measures to address leachate, if any;

   ii. an implementation schedule;

   iii. maps delineating all disturbed areas and site facilities;

   iv. consideration of altered drainage patterns;

   v. type and source of cover materials;

   vi. future area use;

   vii. hazardous wastes; and

   viii. a proposal identifying measures by which restoration costs will be financed by the Licensee upon abandonment.

3. The Licensee shall implement the plan specified in Part H, Item 1 as and when approved by the Board.

4. The Licensee shall revise the Plan referred to in Part H, Item 1 if not approved. The revised Plan shall be submitted to the Board for approval within six (6) months of receiving notification of the Board's decision.

5. The Licensee shall complete the restoration work within the time schedule specified in the Plan, or as subsequently revised and approved by the Board.

PART I: CONDITIONS APPLYING TO STUDIES

1. The Licensee shall submit to the Board for approval, the terms of reference for a planning study to address long-term needs of the community with respect to the Water Supply and Waste Disposal Facilities.

2. The Licensee shall, 8 months prior to expiry of the licence, submit to the Board for approval the planning study prepared in accordance with the terms of reference approved by the Board pursuant to Part I, Item 1.

3. The proposal described in Part I, Item 3 shall be implemented as and when approved by the Board.

SCHEDULE I: SURVEILLANCE NETWORK PROGRAM

A. Location, Description, Sampling and Analysis Requirements

Station	Description	Sampling Requirements	Analysis Requirements	
0640-1	Raw Water Supply intake at the Tulugak River	Not required	Not required	
0640-2	Raw Water Supply intake at the Reservoir truck fill station	Not required	Not required	
0640-3	Raw Sewage from pump-out truck	Not required	Not required	
0640-4	Runoff below the abandoned Sewage disposal area prior to discharge to ocean	Not required	Not required	
0640-5	Ocean water 5 metres from point where effluent enters ocean (abandoned site)	Not required	Not required	
0640-6	Discharge from the Sewage Disposal Facilities at the point of discharge following treatment	Once at the beginning, middle and end of discharge	BOD Total Suspended Solids Conductivity Oil and Grease Magnesium Sodium Chloride Total Hardness Ammonia Nitrogen Total Cadmium Total Cobalt Total Chromium Total Copper Total Aluminum	Faecal Coliform PH Nitrate-Nitrite Total Phenols Calcium Potassium Sulphate Total Alkalinity Total Zinc Total Iron Total Manganese Total Nickel Total Lead
0640-6A	Current Sewage Disposal Facilities effluent 5 meters prior to entering the ocean	Once at the beginning, middle and end of discharge	Same as STN 0640-6	

Station	Description	Sampling Requirements	Analysis Requirements	
0640-7	Runoff from the Solid Waste Disposal Facility	Annually during periods of open water	pH Total Suspended Solids Nitrate-Nitrite Total Phenols Sodium Magnesium Total Arsenic Total Copper Total Iron Total Mercury Total Zinc	Conductivity Ammonia Nitrogen Oil and Grease (Visual) Sulphate Potassium Calcium Total Cadmium Total Chromium Total Lead Total Nickel Total Organic Carbon
0640-8	Unnamed stream located between the Sewage Disposal Facilities and Solid Waste Disposal Facilities; sample site above the facilities	Annually during periods of open water	Same as STN 0640-7	
0640-9	Unnamed stream located between the Sewage Disposal Facilities and Solid Waste Disposal Facilities; sample site below the facilities	Annually during periods of open water	Same as STN 0640-7	
0640-10	Runoff below reclaimed Solid Waste Disposal Facility	Annually	Same as STN 0640-7	

B. General Requirements

1. The exact location of Surveillance Network Program stations can be developed with the assistance of the Inspector.

2. Additional sampling and analysis may be requested by an Inspector.

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

4. All analyses shall be performed in a laboratory approved by the Board.

C. Flow and Volume Measurement Requirements

1. The monthly and annual quantities of water pumped from Surveillance Network Program Station Number 0640-2 shall be measured and recorded in cubic metres.

2. The annual quantities of sewage solids removed from the Sewage Disposal Facilities shall be measured and recorded.

D. Reports

1. The Licensee shall, unless otherwise requested by an Inspector, include all of the data and information required by the Surveillance Network Program in the Licensee's Annual Report, which Report shall be submitted to the Board on or before March 31st of the year following the calendar year being reported.

E. Modifications To The Surveillance Network Program

1. Modifications to the Surveillance Network Program may be made only upon written approval of the Chief Administrative Officer of the Board.

FIGURE 1 - Municipality of Qikiqtarjuaq Surveillance Network Program Stations
(To be provided following first inspection)

APPENDIX I
CORRESPONDENCE

i. Letter received April 14 from the Municipality of Qikiqtarjuaq to the Nunavut Water Board, enclosing an application and supplemental questionnaire dated March 27, 2000 for the renewal of a municipal water licence for the Municipality of Qikiqtarjuaq.

ii. Letter dated April 12, 2000 from NWB to the Municipality of Qikiqtarjuaq, acknowledging receipt of the application for licence renewal.

iii. Letter dated April 18, 2000 from NWB to the Municipality of Qikiqtarjuaq, acknowledging receipt of additional information for the application for licence renewal.

iv. Letter dated April 12, 2000 from the NWB to the Distribution List, providing notice of the application for licence renewal in English and Inuktittut.

v. Letter dated May 29, 2000, from the Department of CGT, to the NWB, received May 30, 2000 regarding comments on the application for licence renewal in consideration for the proposed pilot project for a tannery in Qikiqtarjuaq.

vi. Letter dated/received May 30, 2000, from the Department of CGT to the NWB, regarding comments on the application for licence renewal.

vii. Letter dated May 29, 2000, from Environment Canada, to the NWB, received June 6, 2000, regarding comments on the application for licence renewal.

viii. Email dated June 5, 2000, from Indian and Northern Affairs Canada to the NWB, regarding comments on the application for licence renewal.

Appendix D
Climate Normal Data

Appendix D: Climate Normals for Qikiqtarjuaq, Nunavut

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Daily Average (°C)	-24.8	-25.8	-23.5	-17.3	-8.4	-0.4	4.4	3.1	-2.5	-8.1	-15.8	-22.3		D
Standard Deviation	4.4	3.4	2.9	1.9	1.6	2.3	1.7	1.8	1.0	1.8	2.7	3.4		D
Daily Maximum (°C)	-21.9	-22.8	-20.2	-13.8	-5.3	2.4	7.3	5.9	-0.4	-5.9	-13.2	-19.4		D
Daily Minimum (°C)	-27.7	-28.8	-26.7	-20.8	-11.4	-3.1	1.4	0.4	-4.5	-10.4	-18.3	-25.1		D
Extreme Maximum (°C)	3.9	1.1	4.0	7.8	11.1	17.8	18.3	**18.9**	14.4	10.6	7.5	5.0		
Date (yyyy/dd)	1958/23	1960/11	1980/23	1975/29	1991/31	1973/29	1965/22+	**1973/21**	1962/04+	1984/16	1985/03	1967/17		
Extreme Minimum (°C)	-41.7	**-42.8**	-40.7	-34.3	-26.1	-12.2	-8.9	-7.8	-13.9	-24.4	-33.3	-39.2		
Date (yyyy/dd)	1961/11	**1979/16**	1985/01	1984/05	1970/07	1963/03+	1972/03+	1972/22	1972/29	1986/27	1957/16	1982/31		
Precipitation: Precipitation:														
Rainfall (mm)	0.0	0.0	0.0	0.0	0.4	3.4	16.3	15.9	2.9	0.3	0.0	0.0		D
Snowfall (cm)	6.8	6.8	5.7	16.0	31.4	15.2	10.5	10.2	30.0	45.8	37.1	7.3		D
Precipitation (mm)	6.8	6.8	5.7	16.0	31.8	18.6	26.8	26.1	32.9	46.1	37.1	7.3		D
Average Snow Depth (cm)	82	79	77	74	65	32	4	1	8	37	76	85	52	C
Median Snow Depth (cm)	83	79	77	74	66	32	3	1	5	36	78	85	52	C
Snow Depth at Month-end (cm)	79	78	74	71	58	13	3	2	20	56	86	83		D
Extreme Daily Rainfall (mm)	0.0	0.0	0.0	0.0	8.6	**35.6**	15.0	25.4	14.5	5.1	0.0	0.0		
Date (yyyy/dd)	1958/30+	1959/01+	1960/01+	1959/01+	1973/25	**1966/27**	1972/26	1959/07	1971/07	1968/05	1958/01+	1958/01+		

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Extreme Daily Snowfall (cm)	31.8	14.0	7.0	22.6	28.2	35.6	17.0	17.8	33.0	**38.4**	33.0	22.4		
Date (yyyy/dd)	1963/22	1970/15	1977/17	1968/16	1981/27	1973/21	1984/31	1968/07+	1967/18	**1967/25**	1969/05	1967/22		
Extreme Daily Precipitation (mm)	31.8	14.0	7.0	22.6	28.2	35.6	17.0	25.9	33.0	**38.4**	33.0	22.4		
Date (yyyy/dd)	1963/22	1970/15	1977/17	1968/16	1981/27	1966/27+	1984/31	1959/07	1967/18	**1967/25**	1969/05	1967/22		
Extreme Snow Depth (cm)	157.0	146.0	152.0	157.0	164.0	150.0	117.0	25.0	81.0	**178.0**	175.0	157.0		
Date (yyyy/dd)	1965/02+	1988/29	1988/04+	1988/21	1977/06	1970/01+	1973/01	1973/01	1967/19+	**1964/31**	1964/06	1964/27+		
Days with Maximum Temperature: Days with Maximum Temperature:														
<= 0 °C	30.7	28.2	30.8	29.3	26.7	11.2	1.5	3.1	19.2	29.7	29.9	30.9		D
> 0 °C	0.35	0.0	0.24	0.67	4.3	18.9	29.5	27.9	10.8	1.3	0.15	0.11		D
> 10 °C	0.0	0.0	0.0	0.0	0.05	1.5	7.5	5.4	0.47	0.0	0.0	0.0		D
> 20 °C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		D
> 30 °C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		D
> 35 °C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		D
Days with Minimum Temperature: Days with Minimum Temperature:														
> 0 °C	0.0	0.0	0.0	0.0	0.25	5.8	18.3	14.2	2.0	0.0	0.0	0.0		D
<= 2 °C	31.0	28.2	31.0	30.0	31.0	27.2	18.2	22.4	29.3	31.0	30.0	31.0		D
<= 0 °C	31.0	28.2	31.0	30.0	30.8	24.2	12.7	16.8	28.0	31.0	30.0	31.0		D
< -2 °C	31.0	28.2	31.0	30.0	30.4	19.5	6.0	9.5	25.0	30.7	30.0	31.0		D
< -10 °C	30.4	28.2	30.7	28.8	19.9	0.67	0.0	0.0	0.72	15.3	28.2	30.7		D

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
< -20 °C	27.4	27.0	27.5	17.5	0.60	0.0	0.0	0.0	0.0	0.33	10.4	26.2		D
< - 30 °C	10.1	13.3	9.8	0.80	0.0	0.0	0.0	0.0	0.0	0.0	0.11	6.6		D
Days with Rainfall: Days with Rainfall:														
>= 0.2 mm	0.0	0.0	0.0	0.0	0.05	0.95	5.5	5.6	0.84	0.21	0.0	0.0		D
>= 5 mm	0.0	0.0	0.0	0.0	0.05	0.24	1.1	0.85	0.26	0.0	0.0	0.0		D
>= 10 mm	0.0	0.0	0.0	0.0	0.0	0.05	0.21	0.25	0.05	0.0	0.0	0.0		D
>= 25 mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		D
Days With Snowfall: Days With Snowfall:														
>= 0.2 cm	4.0	3.5	3.2	6.2	9.1	4.9	2.9	3.5	8.6	13.6	9.5	4.3		D
>= 5 cm	0.35	0.30	0.14	1.0	1.8	1.1	0.72	0.65	1.8	3.1	2.5	0.30		D
>= 10 cm	0.05	0.0	0.0	0.19	0.81	0.19	0.22	0.25	0.65	0.84	0.85	0.10		D
>= 25 cm	0.0	0.0	0.0	0.0	0.05	0.05	0.0	0.0	0.0	0.0	0.05	0.0		D
Days with Precipitation: Days with Precipitation:														
>= 0.2 mm	4.0	3.5	3.2	6.2	9.1	5.8	7.7	8.3	9.5	13.7	9.5	4.3		D
>= 5 mm	0.35	0.30	0.14	1.0	1.8	1.3	1.9	1.7	2.0	3.1	2.5	0.30		D
>= 10 mm	0.05	0.0	0.0	0.19	0.86	0.29	0.47	0.50	0.68	0.84	0.85	0.10		D
>= 25 mm	0.0	0.0	0.0	0.0	0.05	0.05	0.0	0.0	0.0	0.0	0.05	0.0		D

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Days with Snow Depth: Days with Snow Depth :														
>= 1 cm	31.0	28.2	31.0	30.0	31.0	27.8	11.0	6.3	20.1	31.0	30.0	31.0		D
>= 5 cm	31.0	28.2	31.0	30.0	31.0	25.7	6.2	3.2	13.9	30.7	30.0	31.0		D
>= 10	31.0	28.2	31.0	30.0	31.0	23.2	3.3	1.3	9.2	30.0	30.0	31.0		D
>= 20	31.0	28.2	31.0	30.0	30.6	16.9	1.7	0.25	3.9	25.1	29.7	31.0		D
Wind: Wind:														
Maximum Hourly Speed	130.0	122.0	104.0	93.0	77.0	74.0	121.0	74.0	**183.0**	102.0	111.0	92.0		
Date (yyyy/dd)	1988/16	1996/19	1989/29	1998/14	1972/23	1987/27+	1956/22	1984/22	**1997/24**	1989/27	1977/05	1974/01		
Direction of Maximum Hourly Speed	NW	S	NW	SW	W	NW	SW	NW	S	NW	W	W	S	
Degree Days: Degree Days:														
Above 24 °C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		D
Above 18 °C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		D
Above 15 °C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		D
Above 10 °C	0.0	0.0	0.0	0.0	0.0	0.3	4.0	1.7	0.0	0.0	0.0	0.0		D
Above 5 °C	0.0	0.0	0.0	0.0	0.0	5.5	37.5	20.4	1.4	0.0	0.0	0.0		D
Above 0 °C	0.0	0.0	0.0	0.1	2.0	40.8	141.0	100.1	16.5	0.2	0.0	0.0		D
Below 0 °C	759.6	739.9	730.2	520.4	264.9	56.9	6.8	12.3	91.5	258.4	465.5	701.0		D
Below 5 °C	914.6	881.1	885.2	670.3	417.9	171.7	58.3	87.6	226.4	413.2	615.5	856.0		D

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Below 10 °C	1069.6	1022.3	1040.2	820.3	572.9	316.4	179.8	223.9	375.0	568.2	765.5	1011.0		D
Below 15 °C	1224.6	1163.4	1195.2	970.3	727.9	466.1	330.8	377.2	525.0	723.2	915.5	1166.0		D
Below 18 °C	1317.6	1248.1	1288.2	1060.3	820.9	556.1	423.8	470.2	615.0	816.2	1005.5	1259.0		D
Humidex: Humidex:														
Extreme Humidex	1.5	0.0	2.7	6.1	8.6	18.6	**20.7**	19.9	13.6	7.0	3.5	3.9		
Date (yyyy/dd)	1979/27	1963/04	1980/23	1975/29	1991/31	1973/29	**1984/17**	1973/21	1967/04	1984/15	1985/03	1967/17		
Wind Chill: Wind Chill:														
Extreme Wind Chill	**-61.1**	-61.0	-57.1	-49.2	-35.8	-21.1	-18.6	-15.5	-23.9	-32.8	-45.2	-54.2		
Date (yyyy/dd)	**1961/11**	1979/16	1964/13	1997/08	1999/01	1978/01	1972/04	1972/22	1997/24	1986/26	1956/28	1971/27		
Humidity: Humidity:														
Average Relative Humidity - 0600LST (%)	77.6	75.6	76.3	81.2	86.8	86.6	79.0	81.4	90.4	89.0	83.5	78.5		

Appendix D: Summary of 2004 Monthly Climatological Information for the Hamlet of Qikiqtarjuaq, Nunavut

QIKIQTARJUAQ A
NUNAVUT

Latitude: 67° 33' N **Longitude**: 64° 1' W **Elevation**: 06.40 m

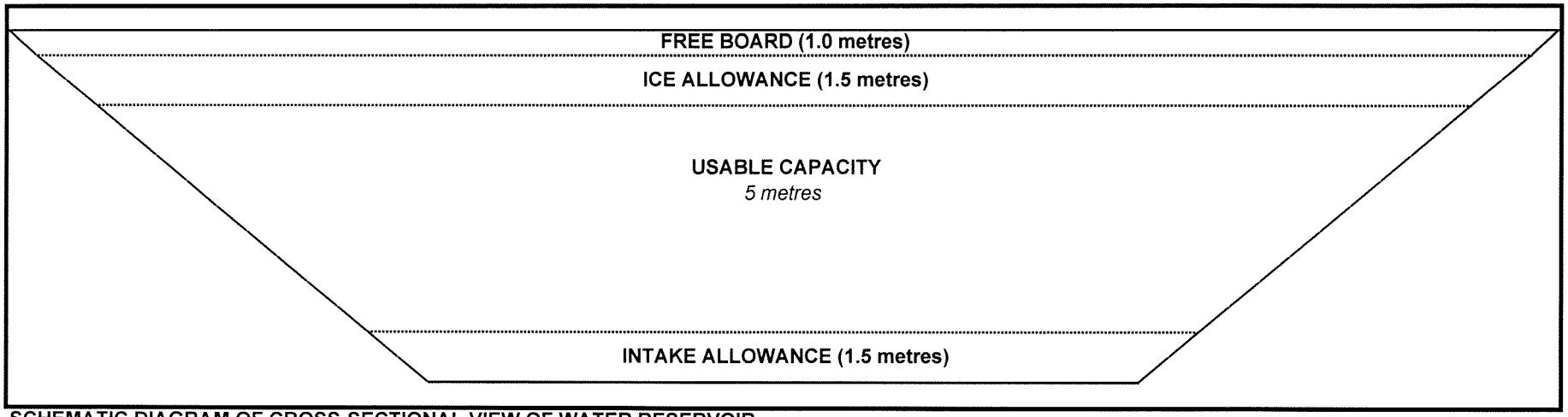
Climate ID: 2400572 **WMO ID**: 71338 **TC ID**: YVM

Monthly Data Report for 2004

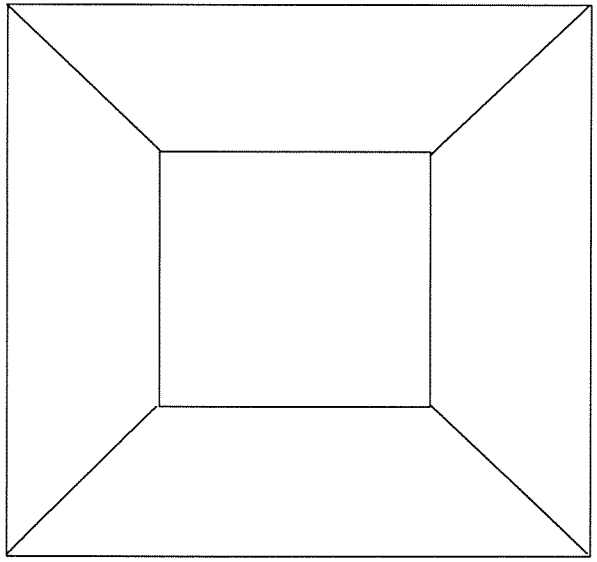
Month	Mean Max Temp °C	Mean Temp °C	Mean Min Temp °C	Extr Max Temp °C	Extr Min Temp °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow Grnd Last Day cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
Jan	-24.3	-28.7	-33.1	-15.5	-43.2	0.0	4.0	4.0	35		
Feb	-20.2	-24.9E	-29.4	-10.0	-40.2	0.0	5.0	5.0	41		
Mar	-24.3	-29.8	-35.2	-13.4	-45.5	0.0	6.2	6.2	47		
Apr	-11.4	-17.2	-22.9	-4.5	-31.5	0.0	34.0	34.0	61		
May	-1.2	-3.8	-6.4	6.5	-16.5	0.0	3.0	3.0	25		
Jun	4.7	1.8	-1.1	9.9	-7.2	Trace	Trace	Trace	0		
Jul	7.8	4.6	1.4	17.2	-1.7	1.0	6.0	7.0	0		
Aug	8.3	5.6	2.9	17.1	0.0	13.0	0.0	13.0	0		
Sep	4.4	2.0	-0.5	11.0	-11.0	6.0	13.0	19.0	4		
Oct	1.9	-1.0	-3.9	9.0S	-8.0	0.4	7.4	7.8	4		
Nov	-6.6	-10.6	-14.6	3.0	-24.5	0.0	91.0	91.0	54		
Dec	-22.4	-27.5	-32.6	-15.2	-40.8	0.0	2.0	2.0	48		
Sum						**20.4**	**171.6**	**192.0**			
Avg	**-6.9**	**-10.8**	**-14.6**								
Xtrm				**17.2**	**-45.5**						

Appendix E
Detailed Design Calculations

SCHEMATIC DIAGRAMS OF WATER RESERVOIR



SCHEMATIC DIAGRAM OF CROSS-SECTIONAL VIEW OF WATER RESERVOIR



SCHEMATIC DIAGRAM OF TOP VIEW OF WATER RESERVOIR

EXISTING WATER RESERVOIR

DESIGN ASSUMPTIONS AND PARAMETERS	
Slope	3 : 1
Length [meters]	90
Width [meters]	90
Height [meters]	9
Freeboard Allowance [meters]	1
Ice Allowance [meters]	1.5
Intake Allowance [meters]	1.5

SCENARIO SUMMARY

	Height [m]	Volume [m^3]
Freeboard	1.0	7,572
Ice	1.5	9,491
Usable	5.0	18,375
Intake	1.5	2,471
Total	9.0	37,908

Step 1: Determine the dimensions of an entire pyramid with a point

Length [meters]	Width [meters]	Height [meters]	Volume [metres^3]
90	90	15.0	40500.0

Step 2: Calculate the dimensions of the pyramid tip (does not exist physically)

New Length [meters]	New Width [meters]	Height [meters]	Volume [metres^3]
36	36	6.0	2592.0

Step 3: Calculate the dimensions of the freeboard area

Freeboard Volume [metres^3]	New Length [meters]	New Width [meters]	Height [meters]	Volume [metres^3]
7572.0	84	84	14.0	32928.0

Step 4: Calculate the dimensions of the ice allowance

Ice Allowance Volume [metres^3]	New Length [meters]	New Width [meters]	Height [meters]	Volume [metres^3]
9490.5	75	75	12.5	23437.5

Step 5: Determine the dimensions of the intake allowance

Intake Allowance Volume [metres^3]	New Length [meters]	New Width [meters]	Height [meters]	Volume [metres^3]
2470.5	45	45	7.5	5062.5

Step 6: Determine the dimensions of the usable area

Usable Reservoir Volume [metres^3]	New Length [meters]	New Width [meters]	Height [meters]	Volume [metres^3]
18375.0	75	75	12.5	23437.5

DETAILED DESIGN CALCULATIONS OF PREFERRED OPTION

DESIGN ASSUMPTIONS AND PARAMETERS

Slope	3 : 1		
Length [meters]	90		
Width [meters]	156	Deepen [m]	
Height [meters]	9	0	
Freeboard Allowance [meters]	1		
Ice Allowance [meters]	1.5		
Intake Allowance [meters]	1.5		

SCENARIO SUMMARY

	Height [m]	Volume [m^3]
Freeboard	1.0	11,400.00
Ice	1.5	14,737.50
Usable	5.0	31,575.00
Intake	1.5	5,143.50
Total	9.0	62,856.00
Excavate		24,948.00

Step 1: Determine the dimensions of an entire pyramid with a point

Length [meters]	Width [meters]	Height [meters]	Volume [$metres^3$]
90	156	15	70200

Step 2: Calculate the dimensions of the pyramid tip (does not exist in reality)

New Length [meters]	New Width [meters]	Height [meters]	Volume [$metres^3$]
36	102	6	7344

Step 3: Calculate the dimensions of the freeboard area

Freeboard Volume [$metres^3$]	New Length [meters]	New Width [meters]	Height [meters]	Volume [$metres^3$]
11400.0	84	150	14	58800

Step 4: Calculate the dimensions of the ice allowance

Ice Allowance Volume [$metres^3$]	New Length [meters]	New Width [meters]	Height [meters]	Volume [$metres^3$]
14737.5	75	141	12.5	44062.5

Step 5: Determine the dimensions of the intake allowance

Intake Allowance Volume [$metres^3$]	New Length [meters]	New Width [meters]	Height [meters]	Volume [$metres^3$]
5143.5	45	111	7.5	12487.5

Step 6: Determine the dimensions of the usable area

Usable Reservoir Volume [$metres^3$]	New Length [meters]	New Width [meters]	Height [meters]	Volume [$metres^3$]
31575.0	75	141	12.5	44062.5

Appendix E – Detailed Design Calculations
Calculating Dimensions of Sewage Lagoon

The dimensions of the sewage lagoon may be calculated using the following formula for a prismoid of a given volume:

$$V = (d/6) \times (A_t + A_b + 4\ A_m)$$

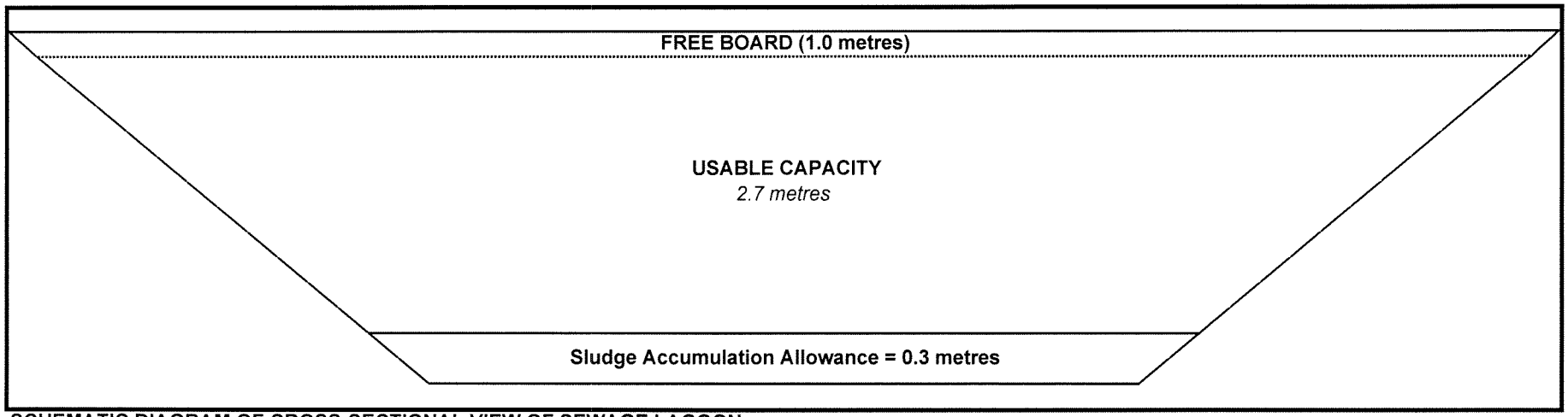
Where:

A_t = x W
A_b = L - 2 x ES x d) (W - 2 x SS x d)
A_m = L - ES x d)(W - SS x d)

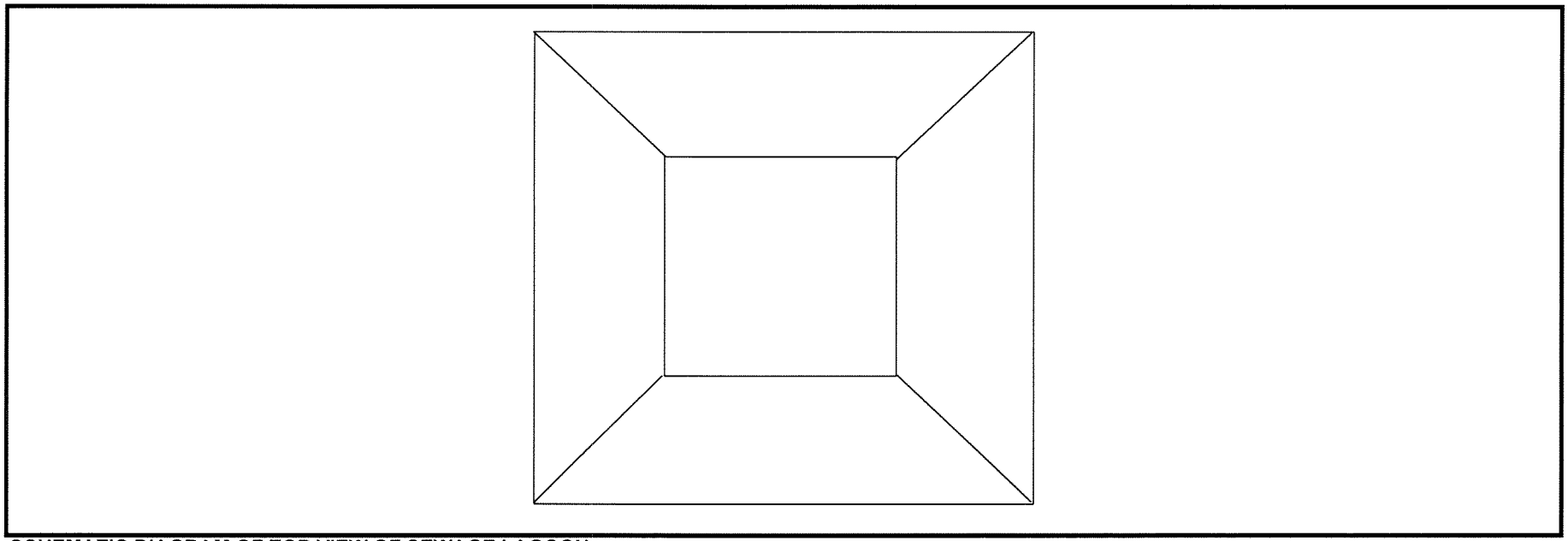
Definitions:

V = Volume
D = Depth of the lagoon
A_t = Area of the top of the lagoon
A_b = Area of the bottom of the lagoon
A_m = Area of the midsection of the lagoon
SS = Slope of the sides of the lagoon
ES = Slope of the ends of the lagoon
L = Length of the top of the lagoon
W = Width of the top of the lagoon

SCHEMATIC DIAGRAMS OF SEWAGE LAGOON



SCHEMATIC DIAGRAM OF CROSS-SECTIONAL VIEW OF SEWAGE LAGOON



SCHEMATIC DIAGRAM OF TOP VIEW OF SEWAGE LAGOON

EXISTING SEWAGE LAGOON

TOTAL LAGOON PARAMETERS		
d = depth of the lagoon (meter)	=	4
SS = slope of the sides of the lagoon	=	3.3
ES = slope of the ends of the lagoon	=	5.5
L = Length of the top of the lagoon (meter)	=	97
W = Width of the top of the lagoon (emter)	=	69
F = Freeboard Allowance (meter)	=	1

Calculations

A_t = L x W	=	6693
A_b = (L - 2 x ES x d) (W - 2 x SS x d)	=	2257.8
A_m = (L - ES x d)(W - SS x d)	=	4185

USABLE CAPACITY PARAMETERS		
Usable Depth =	=	3
New Top Length, L (meter)	=	90
New Top Width, L (meter)	=	58
Bottom Length, BL (meter)	=	70
Bottom Width, BW (meter)	=	26

Calculations

A_t = L x W	=	5220
A_b = (L - 2 x ES x d) (W - 2 x SS x d)	=	1755
A_m = (L - ES x d)(W - SS x d)	=	3535.35

V = Total Volume	=	17127.2	m^3
V = Usable Volume	=	**10558.2**	**m^3**

Assume

5 m Berm width around perimeter

BERM	=	44	[metres^2]/m
Length Berm	=	4268	m^3
Width Berm	=	3036	m^3
Total Berm	=	14608	m^3

DETAILED DESIGN CALCULATIONS OF NEW SEWAGE LAGOON

TOTAL NEW LAGOON PARAMETERS

d = depth of the lagoon (meter)	=	4
SS = slope of the sides of the lagoon	=	3
ES = slope of the ends of the lagoon	=	3
L = Length of the top of the lagoon (meter)	=	110
W = Width of the top of the lagoon (emter)	=	115
F = Freeboard Allowance (meter)	=	1

Calculations

A_t = L x W	=	12650
A_b = (L - 2 x ES x d) (W - 2 x SS x d)	=	7826
A_m = (L - ES x d)(W - SS x d)	=	10094

V = Total Volume New Lagoon	=	40568	m^3
V = Total Volume Existing Lagoon	=	17127.2	m^3
V = Total Volume BOTH Lagoons	=	57695.2	m^3

USABLE CAPACITY PARAMETERS

Usable Depth =	=	3
New Top Length, L (meter)	=	104
New Top Width, L (meter)	=	109
Bottom Length, BL (meter)	=	86
Bottom Width, BW (meter)	=	91

Calculations

A_t = L x W	=	11336
A_b = (L - 2 x ES x d) (W - 2 x SS x d)	=	7826
A_m = (L - ES x d)(W - SS x d)	=	9500

V = Total USABLE Volume New Lagoon	=	**28581**	**m^3**
V = Total USABLE Volume Existing Lagoon	=	**10558.2**	**m^3**
V = Total USABLE Volume BOTH Lagoons	=	**39139.2**	**m^3**

Assume

3 m Berm width around perimeter

BERM	=	36	[metres^2]/m
Length Berm	=	3960	m^3
Width Berm	=	4140	m^3
Total Berm Required (All four sides)	=	16200	
Total berm Supply Required (1 Length & 1 Width)	=	8100	m^3

Appendix F

Electrical Site Review Report

A.D.Williams Engineering Inc.
Consulting Engineers

ELECTRICAL SITE REVIEW REPORT NO. E-01

PROJECT:	Truck Water Fill Station, Qikitarjuaq, NU	**ADW NO.:**	10840- E1
CLIENT:	Neegan Burnside #FOE 08983	**REVIEW DATE:**	July 8, 2005
WEATHER:	10°C	**REVIEW TIME:**	Start: 17:00 Finish: 21:45

IN ATTENDANCE & DISTRIBUTION:
Micheal O'Hara, Neegan Burnside
Jim Wall, Neegan Burnside
Brian Duguay, Government of Nunavut CG&S
Phillip, Government of Nunavut CG&S

1.0 PURPOSE OF REVIEW

.1 Review installation conditions for purposes of potential upgrades.

.2 Review installation for code or equipment deficiencies.

2.0 OBSERVATIONS

.1 Facility separated into two rooms: Generator room and a pump room. Generator room contains electrical distribution equipment and controls. Pump room contains access to submersible pumps via winch mechanism, chlorination equipment and piping to truck fill connections. Refer to Figure E-1.

.2 The two Generator sets utilized are Kohler models # 20RE0ZJ, 120/208 V, 3ph, 60Hz, 26.00 kW / 33.00 kVA, pF 0.8, Service Duty: Standby. Each Generator utilizes a Napa 12 Volt battery, connected to wall mounted Thomson Technology Battery Chargers – model #BCM1220, 12VDC/10 Amp DC output, 120 VAC / 60Hz / 1.2 A AC input. Belimo 24VAC damper motors open louvers to provide exhaust and combustion air on generator startup. Fuel oil is fed from an exterior tank to an interior day tank via two fuel oil transfer pumps connected in parallel for redundancy.

.3 Generator operation is controlled via a Thomson technology transfer switch (Model # 853MCE-100A-208, 600 Amp Max, 100 Amp max rating for source 1 and 2). Provided both generators are on auto setting only one will run at a time. Refer to Figure E-2 for generator control panel. Manual generator selection can be utilized, although the facility operates in auto mode.

.4 The transfer switch is connected to the main distribution panel "C", a Square D model # QBL-424, 120/208V, 3Ph, 225 Amp, 24 circuit panel. Panel "C" feeds the Submersible pumps, fuel oil transfer pumps, generator room loads and "Transfer Switch #2" which feds Panel D. Panel 'D' is a Square D model # QBL-424, 120/208V, 3Ph, 225 Amp, 24 circuit panel which feeds the building heating loads and has a 3P-50 Amp circuit labelled "Outside Plug for Submersible Pump". Refer to Figure E-3 for Single Line Diagram and E-4 for the distribution panel layout.

.5 Submersible pumps are accessible via a winch mechanism in the pump room. Arrangement indicated in Figure E-5. 3P-25 Amp fused disconnects (Square D CL8538 Nema Size 1) in the Generator room feed 30 Amp twistlock receptacles in the pump room. Nameplates are located on the wall behind the pump piping indicated submersible pumps are Franklin electric with the left pump rated at 5HP and the right pump rated at 7.5HP. Refer to Figures E-6 and E-7. A spare pump rated at 7.5 HP was located in the pump room. Two 15 amp twistlock receptacles feed heat trace down each pump tube. A fractional 120V motor handles Chlorine Metering and a 120V fractional motor labelled "Chlorine Agitator" are located at two storage tanks in the pump room.

.6 A control panel on the exterior of the building (Figure E-8) controls truck fill operation.

.7 Heating in the Pump and generator rooms are provided via infrared radiant heaters. The pump room is equipped with two infrared radiant heaters, the generator side with one. The generator room heater breaker was turned off. This is likely due to sufficient heat being caused in the generator room during operation of the generator set.

.8 There is one exterior light complete with an integral photocell.

.9 An indication control panel (Figure E-9) was located in the generator room but was not operational due to a lack of battery power supply. An external alarm signal light was connected to this panel but was unable to be tested due to inoperative indication panel.

.10 A Lumacell RG-36 battery pack is provided above the distribution equipment in the generator set room. Remote lighting did not operate when power was disconnected, this is due to lack of charge in batteries as generators are only operational for pump operations during summer.

3.0 DEFICIENCIES AND ACTIONS REQUIRED

.1 Some rusting on screws of junction boxes attached to PVC conduit in submersible pump chutes. Recommend replacement with Nema 4X devices. Refer to Figure E-10.

.2 PVC conduit/fittings needs replacement for submersible pump chutes. Extra strapping is required to prevent this from happening again. Refer to Figure E-11 & E-12.

.3 Recommend that lids on chlorine mixing tanks are replaced to prevent possible circulation of chlorine fumes in the pump room. If left unchecked, corrosive nature could cause damage to electrical equipment over time. Refer to Figure E-13.

.4 Conduit for feeders from battery charger to battery on Genset #2 requires additional strapping very loose. Refer to Figure E-14. Recommend additional mechanical protection over battery terminals to protect connections.

.5 Replacement drip pan required beneath radiator for genset #1, currently some pooling of fluids caught by a drip rag.

.6 It appears that a battery pack located over the distribution equipment ruptured at some point in the past. Refer to Figure E-15 and E-16. The battery pack shown appears to be a replacement. This item effects the following:

.1 Indication panel needs battery connection for operation.

.2 Reservoir #2 disconnect has rusting on the side and inside cleaning is required. Some dust buildup on equipment lugs. Refer to figure E-17.

.3 Transfer switch #2 needs cleaning, damage to cover directly in line with past leak. Replacement wiring diagram required as leakage created a heat buildup which has burned diagram on inside cover of transfer switch.

.7 Reservoir 1 & 2 contactors require securing to back plate. Undue tension on wiring. Refer to Figure E-18.

Prepared by,
A.D. WILLIAMS ENGINEERING INC.
Robin Ferguson, P.Eng.
Electrical Engineer
July 19, 2005
END OF CONSTRUCTION REVIEW NO. E-01

Figure E-1: Truck Fill Station (Pump Room on Left, Generator Room on Right)

Figure E-2: Generator Control/Indication Panel

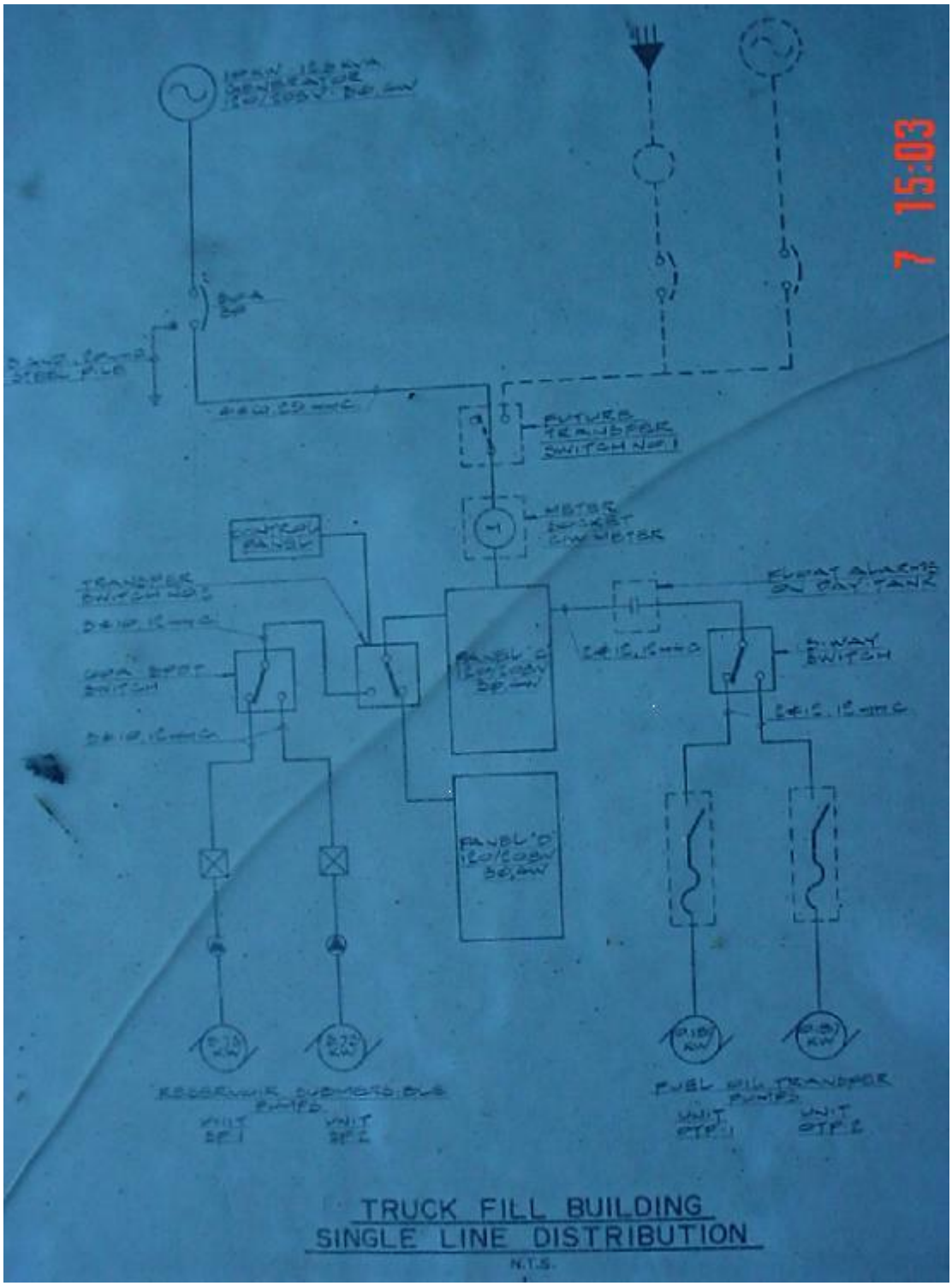


Figure E-3: Single Line Diagram

Figure E-4: Distribution Panels

Figure E-5: Sumbersible Pumps

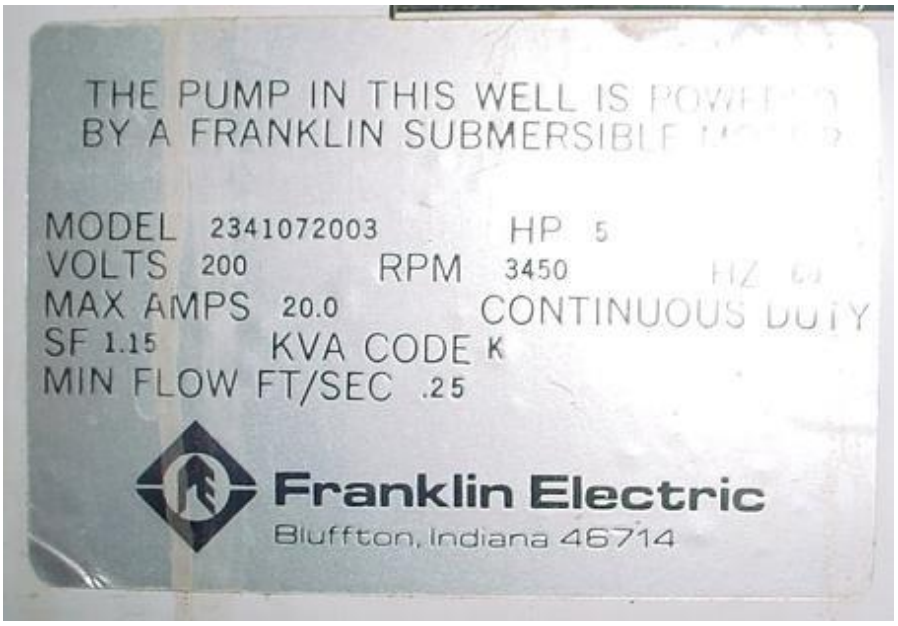


Figure E-6: Left Pump

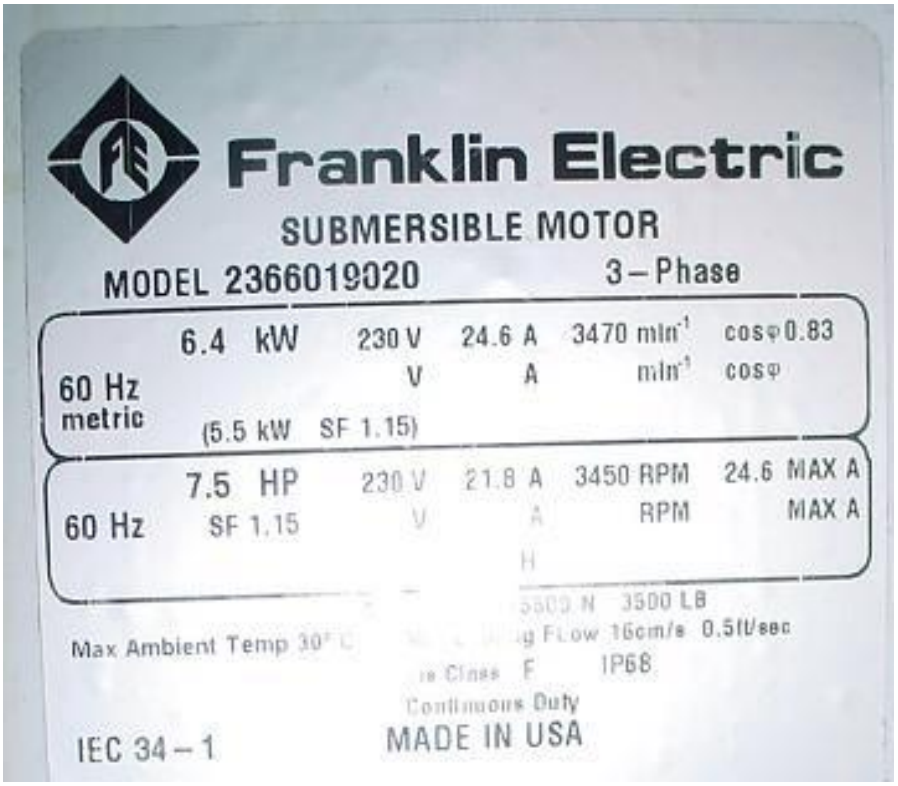


Figure E-7: Right Pump

Figure E-8: Truck Fill Controls

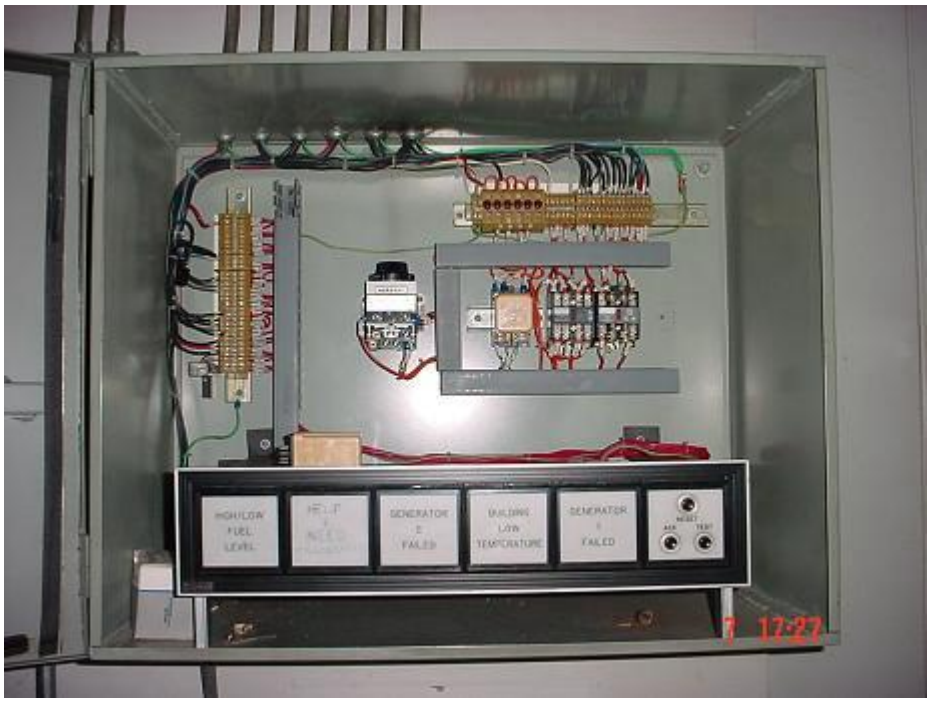


Figure E-9: Indication Control Panel

Figure E-10: Rusting Screws at Pump Chute Box

Figure E-11: Broken PVC Fittings

Figure E-12: Unprotected Conductors

Figure E-13: Broken Lids on Chlorine Mixing Tanks

Figure E-14: Generator Battery Connection

Figure E-15: Unused feeders from Indication Panel

Figure E-16: Corrosion Under Battery Pack

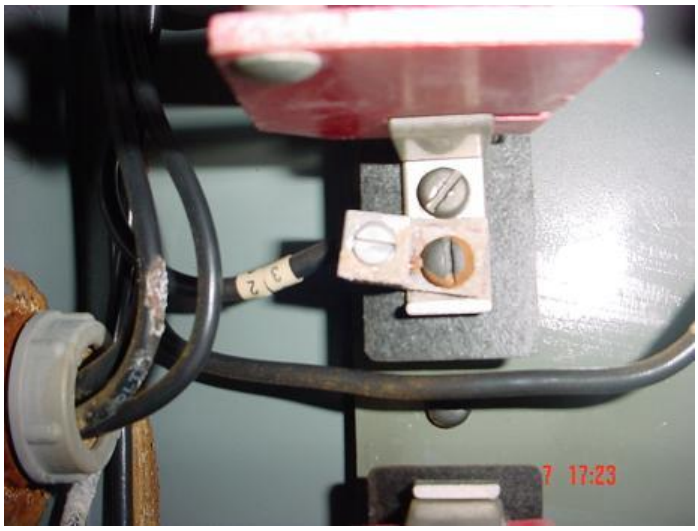


Figure E-17: Dust Build-Up on Lugs

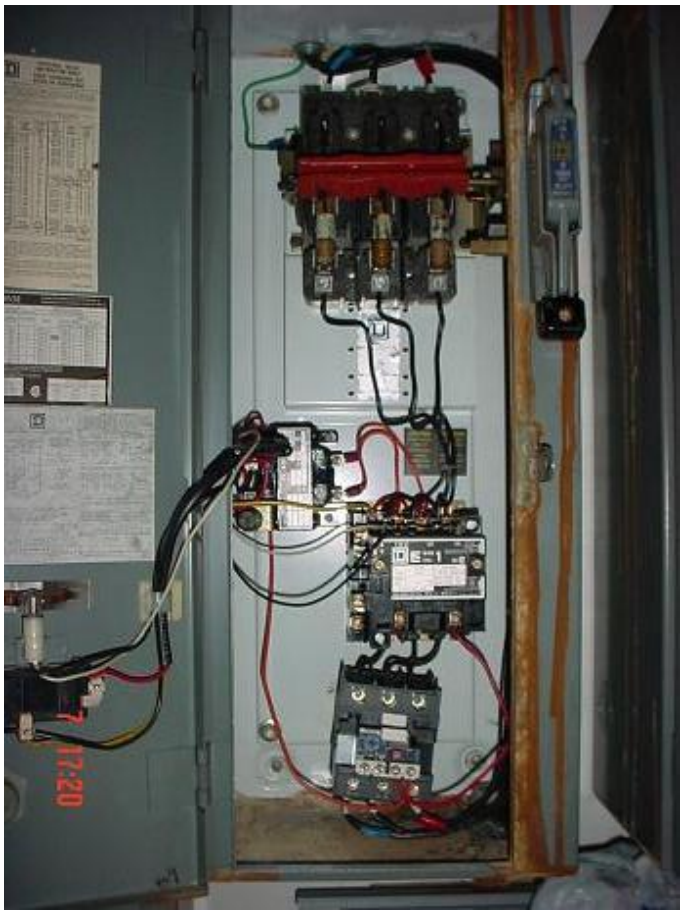


Figure E-18: Unattached Contactor

Appendix G
Wetland Treatment Predictive Model

Appendix G
Alberta Department of the Environment
Wetland Treatment Predictive Model

Assumptions

- Total year 20 discharge (including sewage and precipitation falling into the lagoon) – 38,615 m^3

- Expected sewage lagoon effluent quality prior to wetland treatment in year 2027, assuming 25 percent carbon removal efficiency:

BOD	308.5 mg/l
TSS	329.1 mg/l
T-PO_4	15.8 mg/l
TKN	82.3 mg/l
Fecal Coliforms	6.5 x10^7 CFU/100ml

- Nunavut guideline requirements for final effluent quality at discharge from the sewage treatment system

	Current Guidelines	**Anticipated Guidelines**
BOD mg/l	120	45
TSS mg/l	180	45
T-PO_4 mg/l	-	1
TKN	-	10
Fecal Coliforms CFU/100 ml	1,000,000	2,000

- Based on Qikiqatarjuaq climate data (Appendix A) the average temperature of the period July through August is 3.75ºC. For this specific site location 5ºC will be used in the predictive model

- Average daily discharge to the wetland during the 60 day biologically active period (July through August) is 620 m^3/day

- The wetland predictive model was designed for 20ºC. To account for an average temperature of 5ºC the Area Rate Constant has been charged as follows:

Parameter Area Rate Constant

	@ 20ºC	**@ 10ºC**	**@ 5ºC**
BOD	1,000	500	250
TSS	34	17	8.5
T-PO_4	12	6	3
TKN	22	11	5.5
Fecal Coliforms	77	38.5	19.25

Surface Flow Wetland Treatment - Preliminary Feasibility Calculations

Based upon:

- Predicted effluent volume in year 20
- Predicted effluent chemistry in year 20
- Anticipated future guideline requirements.

Predictive Model

$$\text{Required Area (ha)} = \frac{0.0365Q}{k} * \ln((Ci - C^*) / (Ce - C^*))$$

	L	m^3
Projected Effluent Volume	37,413,945	37,414
Precipitation	1,199,266	1,199
Total Volume	38,613,211	38,613

# of Days Available for Decanting		60
	L	**m^3**
Per Season	38,613,211	38,613
Per Day	643,554	644
Per Second	7.45	0.007

Design Flow (m^3/day) **Q= 644**

	TSS	BOD	T-PO_4	TKN	FC
Design Flow (Q)	**643.55**	**643.55**			
Wastewater Characterization (Ci)	308.5	329.1	15.8	82.3	6.51E+07
Target Effluent Quality (Ce)	45.00	45.00	1.00	10.00	2.00E+02
Wetland Background Input (C*)	**27.24**	**20.94**	0.05	2.00	100.00
Area Constant at 5°C (k)	250.00	8.50	3.00	5.50	19.25
Required Treatment Area (ha)	**0.26**	**7.05**	**21.97**	**9.85**	**16.34**

for TSS, C* **27.24**
for BOD, C* **20.94**

Predictive model from a "Guidelines for the Approval and Design of Natural and Constructed Treatment Wetlands for Water Quality Improvement", Alberta Department of the Environment, Program Development Branch, Environmental Services Division, March 2000.