



**Detailed Design Report for the
Improvements to the Water Reservoir,
Sewage Lagoon, and Solid Waste Disposal Facility
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

February 2006

File No: N-O 09439.0

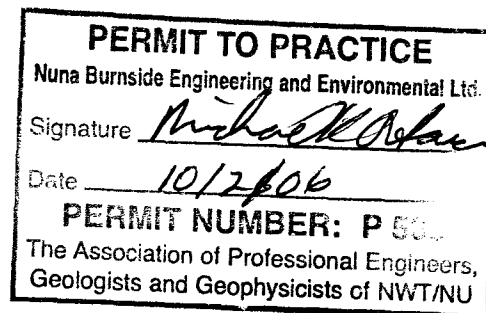
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An Inuit Company ᐃᓄᐃᑦ ᐅᑦᑭᐅᑦᑭᑦ

February 10, 2006

Government of Nunavut
Community and Government Services
P.O. Box 379
Pond Inlet, Nunavut X0A 0S0



Attention: Mr. Brian Duguay
Project Officer
Community and Government Services- Baffin Region

Re: Detailed Design Report
Water, Sewage, and Solid Waste Disposal Facilities
Hamlet of Qikiqtarjuaq, Nunavut
File No. N-0 09439.0

Dear Mr. Duguay,

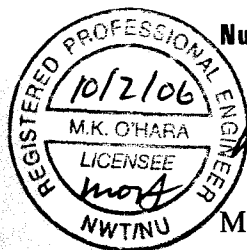
It is with much pleasure that Nuna Burnside Engineering and Environmental Ltd. (Nuna Burnside) respectfully submits to you our Detailed Design Report for the Improvements to the Water, Sewage, and Solid Waste Disposal Facilities in the Hamlet of Qikiqtarjuaq. This report is provided to you both in electronic "PDF" format on compact disc and paper format.

Upon written approval and acceptance of this Detailed Design Report, Nuna Burnside will submit the design documents to begin the regulatory approval process. We will also begin the construction document phase.

If there are any questions or concerns, please do not hesitate to contact us.

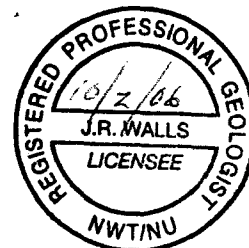
Yours truly,

Nuna Burnside Engineering and Environmental Ltd.



Michael K. O'Hara, P.Eng.


James R. Walls, P.Geo.



Attachments

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- 13 Landfill Development 3 1st Waste Cell Completed
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- C Nunavut Water Board License
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1.0 Introduction

The Department of Community and Government Services, Government of Nunavut (GN-CGS) retained Nuna Burnside Engineering and Environmental Ltd. (Nuna Burnside) to undertake the evaluation of and the design of remediation and/or replacement of the water reservoir, sewage lagoon, and solid waste disposal facility for the Hamlet of Qikiqtarjuaq, Nunavut. Nuna Burnside was retained on June 23, 2005 to complete this work as outlined in our proposal dated May 2005. We undertook a three-day site visit both in July and September of 2005 for the purpose of gathering information through site investigations in order to complete the Schematic Design Report and Geotechnical Evaluation. The Final Schematic Design Report for this project was submitted to the GN-CGS on September 7, 2005. Approval to move forward with this project and to complete the detailed design of these facilities was provided by Mr. Brian Duguay, Project Officer with the GN-CGS by email on December 22, 2005 (Appendix A).

The purpose of this Detailed Design Report is to expand upon the selected alternatives outlined in the Final Schematic Design Report (Schematic Design Report). Upon acceptance by the GN-CGS, this Design Report, along with the Operations and Maintenance Plans for each of the facilities and the Canadian Environmental Assessment Act (CEAA) Screening Report included in the appendices, will be submitted for regulatory approvals. This Detailed Design Report and Design Drawings will also serve as the basis for the preparation of documents for the Tender of the construction phase.

1.1 Scope of Work

The scope of work that corresponds to the preparation of the Detailed Design Report includes:

- Take part in reviews of the Schematic Design Report and develop detailed designs of the selected preferred alternative for each facility based on these reviews
- Prepare all necessary documentation necessary to explain the proposed detailed design to all involved individuals; the detailed design to consist of drawings, specifications, and other relevant documents
- Coordinate work with authorities and agencies having jurisdiction
- Prepare and present a Class “B” cost estimate.

1.2 Changes to the Scope

Revising design report and final design to incorporate an adjustment to the design period to 2027.

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1.3 Purpose

As stated in the Terms of Reference (TOR), the immediate priorities for the Hamlet are to ensure that ample safe drinking water is available to the community. Furthermore, the community would like to implement improved waste management strategies that will comply with applicable laws, and will comply with foreseeable legislated amendments. This document is intended to provide the Hamlet and the GN-CGS with the design of upgrades and/or addition of new facilities to meet these goals over a 20-year planning period.

1.4 Description of Selected Preferred Alternatives

A schematic design report was prepared for the Hamlet, which outline options to expand, replace the water supply, sewage disposal, and solid water disposal infrastructure that would meet the needs of the community over a 20 year planning period.

The water supply and storage options presented included:

- Maintain status quo – not acceptable, as it does not meet the future needs
- Three (3) options to provide additional storage but maintain the current level of service (trucked water system).

The sewage treatment and disposal options presented included:

- Maintain status quo – not acceptable, as it does not meet the future needs
- Two (2) options to provide additional storage and treatment but maintain the current level of service (trucked sewage system).

The solid waste disposal options presented included:

- Maintain status quo – not acceptable, as it does not meet the future needs
- Two (2) options to expand/replace the solid waste facilities to meet the 20 year projected needs of the community were evaluated.

The Schematic Design Report was presented to the Hamlet and the GN-CGS. Following the presentation and further evaluation of the options, Nuna Burnside received authorization to proceed with the detailed design for:

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- **Water – Option #3:** Expand the existing reservoir towards the community, so that the total volume of the reservoir would provide the necessary capacity to meet the 20 year demand presented in the report.
- **Sewage – Option #2:** Construct a second sewage lagoon adjacent to the existing lagoon, to provide the necessary capacity to meet the 20 year sewage volumes presented in the report.
- **Solid Waste – Option #2:** Remediation of the existing facility and continued operation at the same site.

During the Detailed Design, Nuna Burnside was authorized to update the 20 year projections using the projected 2007 population, when the works are anticipated to be completed, as the base year.

This also required revising the design to accommodate the increased water demands and sewage volumes. The reservoir volume was also revised to include 360 m³ of storage for fire protection. It was also determined that the existing truck fill pumps would need to be replaced with pumps capable of providing a minimum flow to the trucks of 1,000 L/m into transfer water to the community for use in fighting a fire.

1.5 Outline of Detailed Design Report

Section 1 – Provides an introduction to the project, a description of the scope of work involved and briefly summarizes the selected preferred alternatives.

Section 2 – Summarizes the pertinent background information from previous reports, provides a description of the community, discusses historical climate data, presents historical and projected population data, defines common design criteria for the three facilities, and discusses the agency review process.

Section 3 – Summarizes the existing water storage and treatment facility including a synopsis of concerns identified in the Schematic Design Report and describes in detail the design of the selected preferred alternative.

Section 4 – Outlines the existing sewage storage and treatment system with a summary of its condition based on the site assessments. Furthermore, this section presents the anticipated effluent discharge criteria, and the treated effluent parameters prior to discharge from the lagoon. Section 4 also describes the details of an additional sewage lagoon and the concept of including a wetland area that provides both storage and some treatment of the sewage.

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Section 5 – Provides a synopsis of the existing solid waste management facilities and identifies current deficiencies. The section also presents the design details of the selected preferred alternative for solid waste management.

Section 6 – Presents the Class ‘B’ estimates for the capital costs associated with constructing the three facilities. The corresponding estimates of the operation and maintenance costs are also presented.

Section 7 – Provides a summary of the environmental screening process and of the outcome.

It is important to note that throughout the main report there are design drawings that provide a general overview of location and characteristics of the proposed design of the preferred alternatives related to the existing infrastructure. Larger detailed design drawings of each facility including typical details also accompany this report. Furthermore, the appendices to this report provide detailed design calculations, as well as the Operation and Maintenance Plans for the proposed facilities, which include:

- Environmental Emergency Contingency Plan
- Quality Assurance/Quality Control Monitoring Plan.

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2.0 Background Information

2.1 Previous Reports

The following is a list of background information that was reviewed as part of the preparation of the Detailed Design Report.

Schematic Design Report – completed by Nuna Burnside Engineering and Environmental Ltd. in September 2005. This study established population projections and the corresponding servicing capacity required for this community. This report presented and evaluated several options that were considered for these facilities.

Geotechnical Report – also completed by Nuna Burnside Engineering and Environmental Ltd. in October 2005. This study was completed in support of the Schematic Design Report. The Geotechnical Report focused on the suitability of the sites considered in the Schematic Design Report for each of the proposed facilities along with the availability of aggregate material, it is appended to this report in Appendix B.

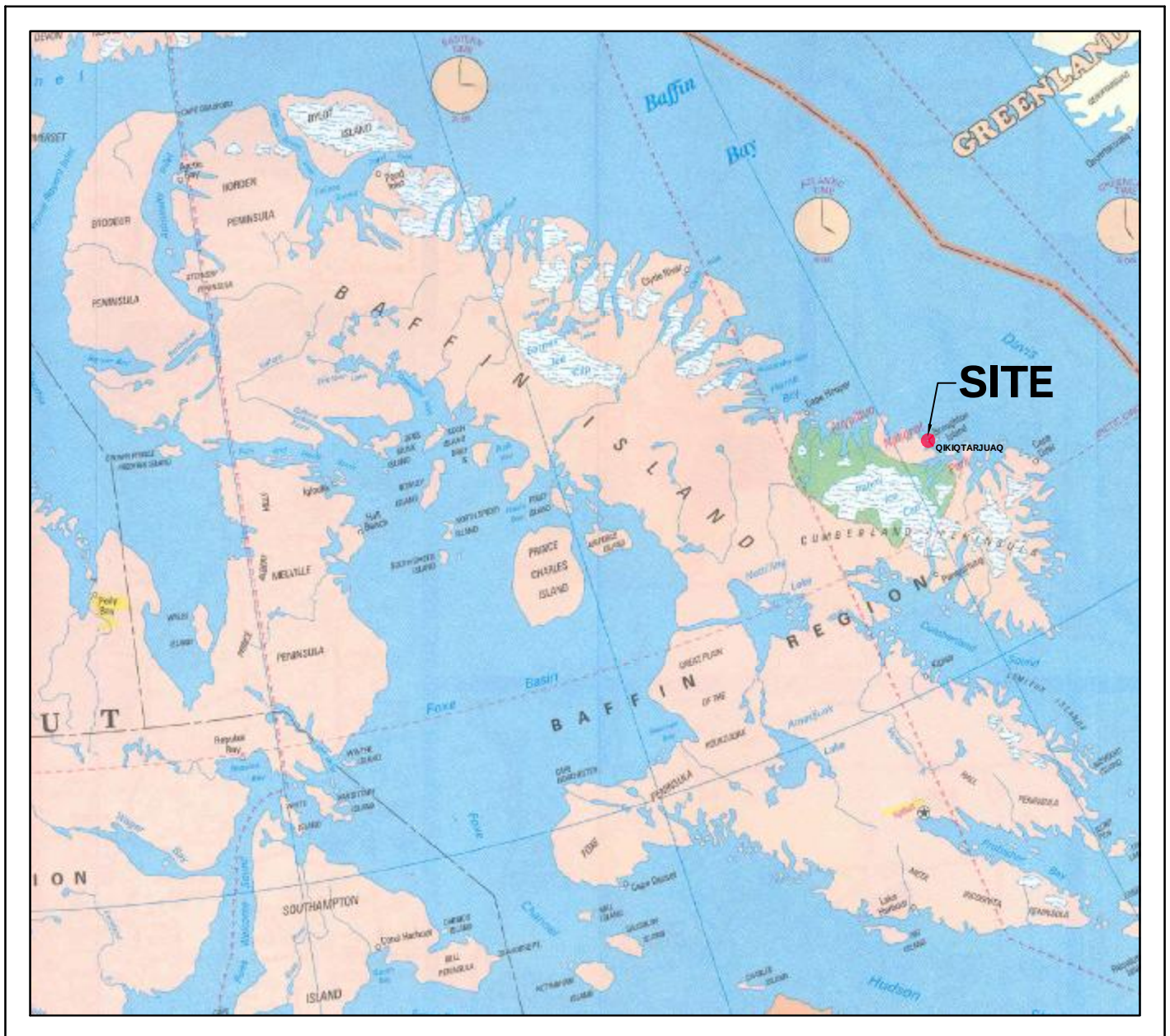
Water License (NWB3QIK0106) – provided by the Nunavut Water Board, stipulates the terms and conditions that the Hamlet must follow in the construction, monitoring, and operation and maintenance of the water supply and solid waste facility sewage infrastructure (Appendix C).

Inspection Reports – prepared by Indian and Northern Affairs Canada (INAC) assessing the current facilities and their compliance with the issued Water License along with any additional health and safety concerns that were observed.

2.2 Community Information

2.2.1 Location

As described in the Schematic Design Report, the Hamlet of Qikiqtarjuaq (meaning “Big Island”), is a community of approximately 599 people (TOR) located in Nunavut, on the eastern coast of Baffin Island and on an island known as Broughton Island. As illustrated in Figure 1, the community is located approximately 470 kilometers northeast of the Capital City of Iqaluit, a distance that is covered by plane in about one hour. The geographic coordinates for Qikiqtarjuaq are 67°33’ north latitude and 64°02’ west longitude. As indicated on Figure 2, the community is situated on the northwest portion of Broughton Island.



Map Reference:
Map of Canada
Published by the CAA

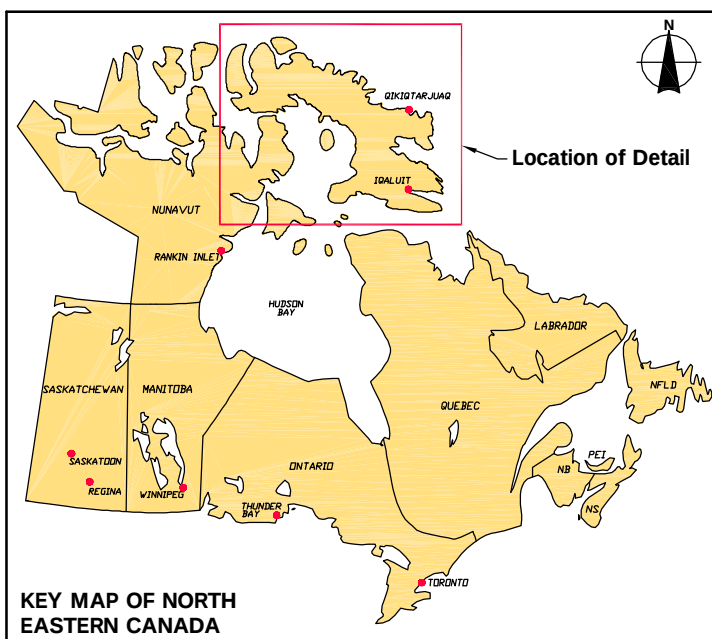


FIGURE 1 - SITE LOCATION MAP

THE HAMLET OF
QIKIQTARJUAQ, NUNAVUT

DETAILED DESIGN

January 2006
Project Number: N-O 09439.0

Prepared by: K. Pridham

Verified by: M. Paznar

Burnside

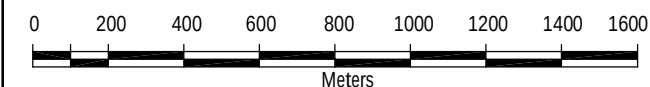
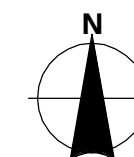


FIGURE 2

THE HAMLET OF QIKIQTARJUAQ
DETAILED DESIGN

SATELLITE IMAGERY OF
ENTIRE COMMUNITY AND
EXISTING INFRASTRUCTURE

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



1:20,000
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: M. Paznar

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2.2.2 Existing Infrastructure and Facilities

The Hamlet provides trucked water and sewage services, along with regular solid waste collection for the residents, businesses and institutions. Historically, water is drawn from the Tulugak River during the summer, and from the lined earthen reservoir for the remainder of the year. Sewage is collected by truck from individual holding tanks at each building and discharged to the unlined sewage lagoon located to the east of the community north of the DEW Line Access Road. Sewage treatment is provided by a facultative lagoon. Effluent from the lagoon is discharged north towards the ocean through a naturally occurring wetland treatment area. Solid waste is disposed of at a facility located adjacent to the sewage lagoon. This solid waste disposal facility includes areas for bulky metals/derelict vehicles, barrels, metal dump borrow, secondary metal, and residential solid waste.

Other infrastructure and facilities located within the Hamlet include:

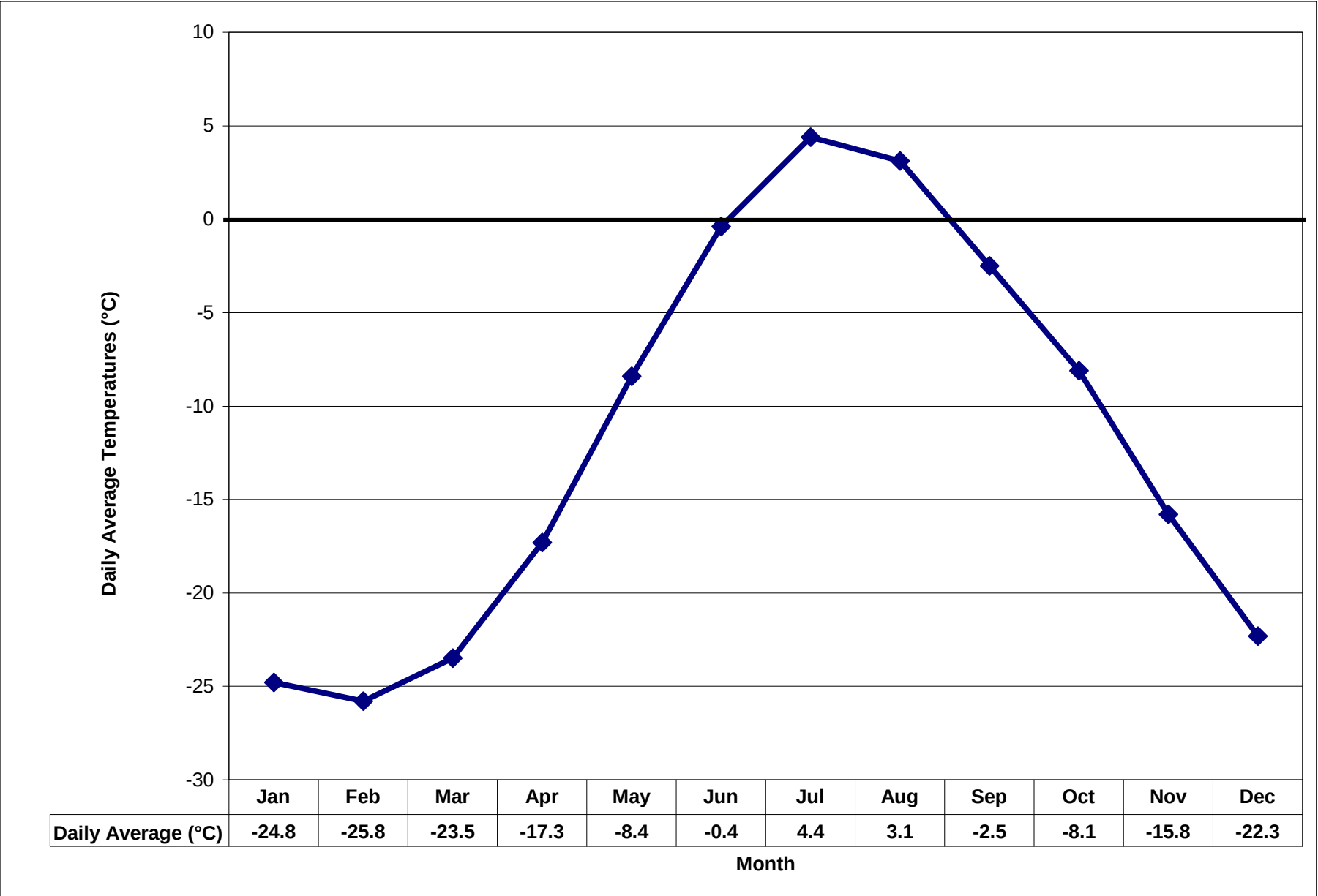
- Diesel power generators
- Barge landing area
- Gravel airstrip.

2.2.3 Climate Data

Qikiqtarjuaq receives an average of 39 mm of rainfall and 223 mm of snowfall per annum. July mean high and low temperatures are 7°C and 1°C, respectively. January's mean high and low temperatures measure -21°C and -28°C, respectively. July and August are the only two months of the year that historically have had average daily temperatures above the freezing mark. Prevailing winds are generally from north-northeast with an annual average velocity of 8.3 km/h. Climate information was obtained from Environment Canada's web site and is available in Appendix D.

The mean temperature during the summer months is an important parameter to be considered in the design process, as it will affect the days that will be available for the decanting of the sewage lagoon and for the filling of the water reservoir. As shown in Figure 3 the mean temperature is above the freezing point only during the months of July and August.

Figure 3: Mean Monthly Temperatures for the Hamlet of Qikiqtarjuaq



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2.2.4 Population Data

As stated in the Terms of reference (TOR), the population is expected to reach 668 people by 2010 and 822 people by 2020. This corresponds to an annual population growth rate of 3.3 percent over the next five years and a 1.9 percent growth rate over the subsequent ten years. The GN has requested that the planning cycle for the facilities extend for 20-years based on the facilities berming commissioned in 2007. Based on a growth rate of 2 percent and a 2005 base population of 599 people, Nunavut Bureau of Statistics provides the 20-year (2027) design population to be used for sizing all facilities in this project is 937 people. Table 1 compares the population data provided in the TOR with the calculated values presented in Figure 4. Although there are some slight differences, there is a good correlation of the data that was provided in the TOR.

Table 1: Comparison between Provided and Calculated Population Data

Planning Year	Year	TOR Population	Calculated Population
Schematic Design	2005	566	599 (GN statistics)
3	2010	668	663
13	2020	811	813
18	2025	Not Provided	900
20	2027	Not Provided	937

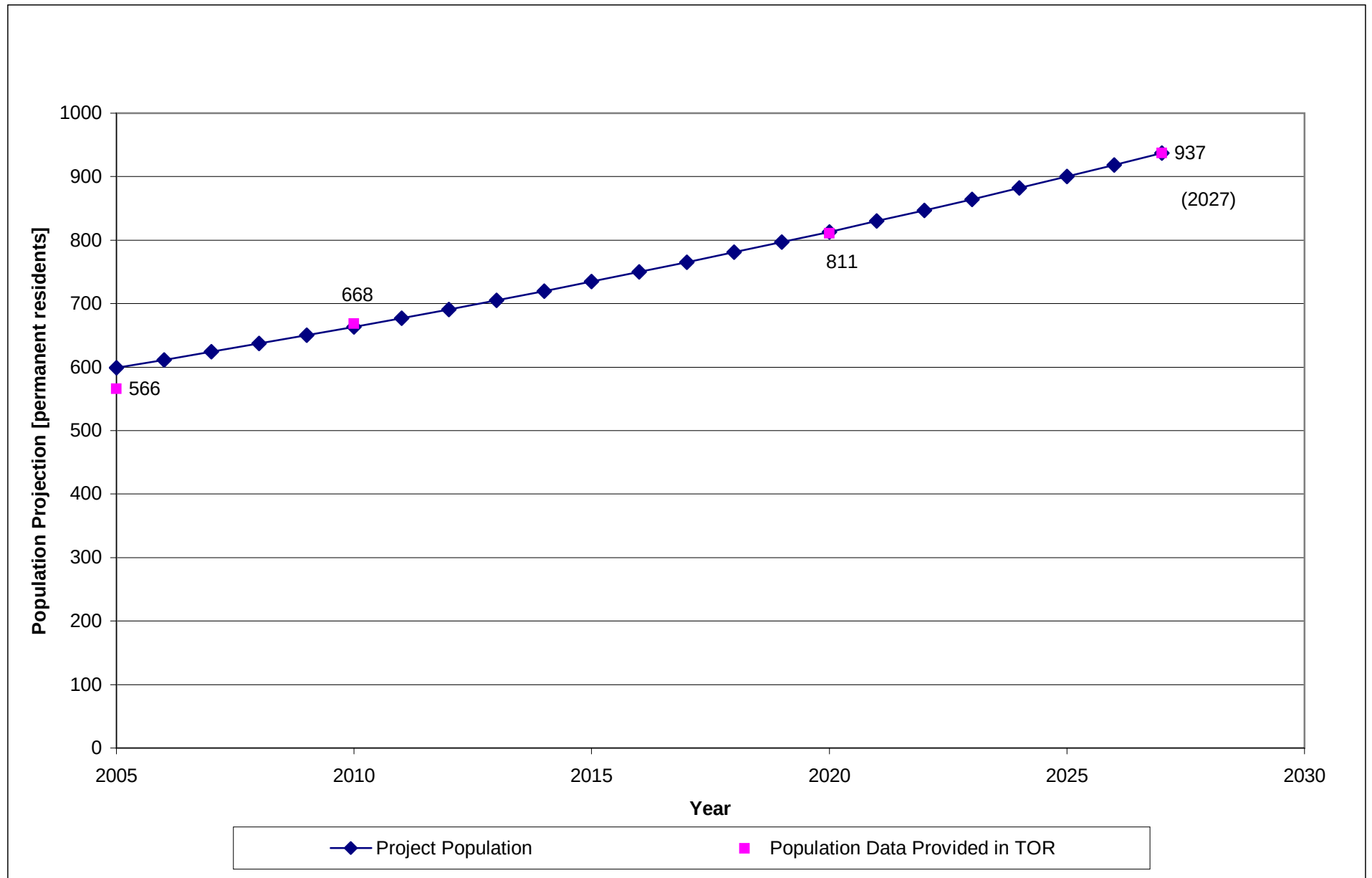
2.3 Design Criteria

All three facilities have common design criteria that must be satisfied when implementing improvements. The common criteria is as follows:

Population Projection – The upgrades to the facilities must meet the projected needs of the community for a 20 year design life following commissioning of the works (projected to be 2007).

Water Use Projections – A determination of historical consumption along with the projection of future water use is essential to properly determine the capacity of the treatment and storage components of the water supply system. The analysis of historical and projected water use also provides the basis for the design of the sewage treatment system, as sewage generation is typically similar to water consumption in communities with trucked services.

Figure 4: Population Projection for the Hamlet of Quikiqtarjuaq, Nunavut



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Arctic Conditions – The facilities must be designed to operate in and withstand extreme cold temperatures and other harsh climatic conditions such as prolonged daylight during the summer months, which may degrade, installed liners.

Cost Effective – All designs must be cost effective to implement, both in terms of the capital and operation and maintenance costs.

Simplicity – The upgrades must be simple to operate yet effective.

Environmentally Sound – The proposed design solutions should reduce environmental impact and ideally enhance the conditions at the proposed sites and surrounding areas

2.4 Agency Review

The following agencies have been contacted during the design process, and continue to provide comments on the proposed design as part of the approval process for this project:

- Indian and Northern Affairs Canada (INAC)
- Nunavut Water Board (NWB)
- Office of the Fire Marshall, Nunavut
- Department of Community and Government Services – Technical Services Division, Government of Nunavut.

The project also conforms to the requirements of the following regulatory agencies:

- Environment Canada (EC)
- Department of Fisheries and Oceans Canada (DFO).

A Water License is required by the Nunavut Water Board for the construction and operation of water, sewage, and solid waste facilities in the territory of Nunavut. The Hamlet is operating the facilities under the current water license NWB3Q1K0106 which expires on December 31, 2006. An application will be submitted to the Nunavut Water Board upon acceptance of the design brief by the GN.

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3.0 Water Supply, Storage and Treatment Reservoir Facility

The Hamlet of Qikiqtarjuaq provides trucked water from the storage reservoir located to the east of the main community (Figure 5) and south of the access road. Hamlet staff operates the water supply system.

The purpose of this section is to describe the details of the existing water supply infrastructure and to review and summarize the concerns noted in the Schematic Design Report. The preferred alternative that was selected by the Hamlet and GN-CGS will be described in greater detail. The design will address all of the noted concerns to ensure that a safe and reliable water supply is available for the community.

3.1 Existing Conditions

The Hamlet of Qikiqtarjuaq obtains its raw water supply from the Tulugak River, which flows in a northwest direction toward Davis Strait. The water is conveyed from the river to the seasonal earthen water storage reservoir using a gravity fill pipe. The Tulugak River flows only during the summer months hence the Hamlet fills the reservoir in order to store water for the remainder of the year. The water is then pumped out of the reservoir and through a truck fill facility into tanker trucks for distribution to all residences and buildings in the community. It is important to note that the water is chlorinated at the truck fill station as it is pumped from the reservoir and into the tanker truck.

The reservoir shown in Figure 5 was expanded in 1978/1979 and lined with a geosynthetic fabric to its current assumed size of approximately 90 m x 90 m x 9 m based on design drawings provided by the Hamlet. Originally, water was supplied directly to the community by a gravity feed line. This arrangement was problematic because the supply line would freeze. To correct the problem, the truck fill station was constructed in 1984. Based on the 2004 water records, the useable storage volume of the existing lagoon is equivalent to approximately 90 percent of the 10-month consumption.

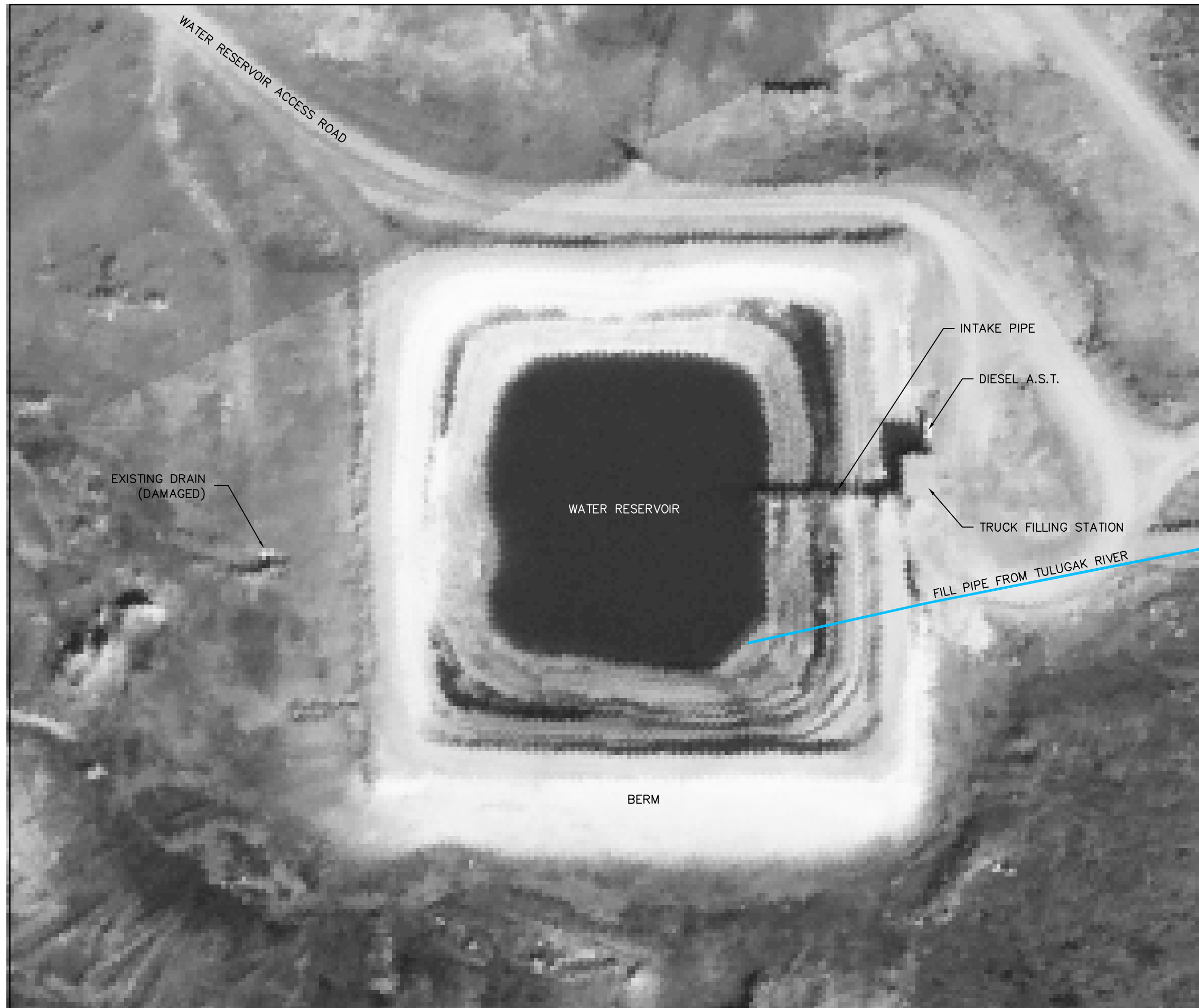
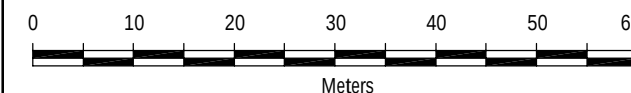
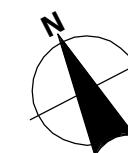


FIGURE 5

THE HAMLET OF QIKIQTARJUAQ
DETAILED DESIGN

EXISTING WATER STORAGE
AND TREATMENT FACILITY

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



1:750
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: M. Paznar

ᑎᓄᓐᓐ **BURNSIDE**

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Figure 5: Existing Water Reservoir and Truck fill Station

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January 2007

The reservoir has a gross volume of approximately 37,910 m³. Assuming that the reservoir is full at the beginning of the winter and allowing for 1.5 metres of ice and 1.5 meters at the bottom for pump submergence, the useable volume of the reservoir is calculated to be approximately 18,000 m³.

The Schematic Design Report indicated that the on-site assessment carried out by Nuna Burnside determined that there was no significant concerns with the truck fill station or the equipment that is incorporated within its structure. Documented minor concerns include the need to calibrate the water meter and the need to install the stand-by pump to fill the tanker truck.

Our site assessment did not observe evidence of leakage from the water storage reservoir. This is likely due to permafrost re-aggrading into the berms. There were however, numerous areas where the liner had failed and where attempts had been made to repair the liner. The outlet drain for the reservoir did not appear to be working as intended. It was also noted that slumping of the material under the liner was occurring, as well as the sand cover material over the liner had been eroded away and was likely in the bottom of the reservoir.

A water quality sampling program was completed by Nuna Burnside staff during the on-site assessment. This program included sampling the raw water supply from the Tulugak River and the reservoir. The details of the analysis are available in the Schematic Design Report, however, to summarize, the key findings were:

- The water quality from the Tulugak river is excellent with no parameters that exceed the values specified by *Canadian Drinking Water Guidelines*, nor do they exceed the more stringent *Ontario Drinking Water Quality Standards*
- The water quality from the reservoir was below the values of the *Canadian Drinking Water Guidelines*, however, the turbidity parameter of the *Ontario Drinking Water Quality Standards* was exceeded.

Other concerns identified in the Schematic Design Report include:

- The concrete anchors for the intake pipes are deteriorated
- The intake pipes had separated from the truck fill station
- The fence around the reservoir is in need of repair
- The access road is located beside the reservoir and road dust was being blown into the reservoir
- The aboveground fuel storage tank is a single wall tank and is showing signs of deterioration (rusting). Secondary containment was inadequate.

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Due to the high risk potential, the GN authorized the replacement of the fuel tank with a double walled tank and upgrades to the spill containment, which was completed in 2005.

3.2 Required Capacity

The average water consumption for the community is approximately 1,900 m³/month for a total of 22,800 m³/year. Based on a 2005 population of 599, the annual per capita consumption is 38 m³/person/year or 104 L/person/day. A breakdown of water consumption for residential, commercial, and institutional was not available. Therefore, the per capita consumption includes allowances for commercial and institutional uses. These design parameters were used to calculate the projected capacity of the reservoir and to estimate the capital costs for the expansion described in the Schematic Design Report.

During the Design Development Phase of this project Nuna Burnside has learned that the Government of the Northwest Territories (NWT) Department of Municipal and Community Affairs (MACA) has developed a design standard for water consumption in communities of less than 2000 residents on trucked services. Since the NWT is the territory adjacent to Nunavut, and the NWT Water Board was previously responsible for licensing for these facilities with funding from the NWT Government, the NWT design standard is considered appropriate for Qikiqtarjuaq. Therefore, the projected water consumption can be estimated using the following formula:

$$\text{Water Use (L/person/day)} = 90 \text{ L/person/day} \times (1.0 + 0.00023 \times \text{population} \{ \text{allowance for commercial and institutional use} \})$$

This formula together with the population projection described in Section 2.0 is used to determine the projected water consumption, which is detailed in Table 2.

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Table 2: Projected Water Consumption

Planning Year	Calendar Year	Projected Population	Projected Water Consumption	Projected Total Consumption Volume				10 Month Storage Requirement	Additional Capacity Required
			[Lpcd]	[Litres/day]	[Litres/year]	[m ³ /day]	[m ³ /year]	[m ³ /year]	[m ³]
Schematic	2005	599	102.4	61337	22388071	61	22388	18657	657
Detailed	2006	611	102.6	62718	22891977	63	22892	19077	1077
0	2007	624	102.9	64220	23440330	64	23440	19534	1534
	2008	637	103.2	65729	23991238	66	23991	19993	1993
	2009	650	103.5	67246	24544699	67	24545	20454	2454
	2010	663	103.7	68769	25100714	69	25101	20917	2917
	2011	677	104.0	70417	25702355	70	25702	21419	3419
5	2012	691	104.3	72074	26306958	72	26307	21922	3922
	2013	705	104.6	73738	26914522	74	26915	22429	4429
	2014	720	104.9	75531	27568771	76	27569	22974	4974
	2015	735	105.2	77333	28226420	77	28226	23522	5522
	2016	750	105.5	79144	28887469	79	28887	24073	6073
10	2017	765	105.8	80964	29551917	81	29552	24627	6627
	2018	781	106.2	82916	30264410	83	30264	25220	7220
	2019	797	106.5	84879	30980772	85	30981	25817	7817
	2020	813	106.8	86852	31701001	87	31701	26418	8418
	2021	830	107.2	88960	32470484	89	32470	27059	9059
15	2022	847	107.5	91080	33244334	91	33244	27704	9704
	2023	864	107.9	93212	34022551	93	34023	28352	10352
	2024	882	108.3	95483	34851305	95	34851	29043	11043
	2025	900	108.6	97767	35684955	98	35685	29737	11737
	2026	918	109.0	100064	36523501	100	36524	30436	12436
20	2027	937	109.4	102504	37413945	103	37414	31178	13178

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Table 2 indicates that for 2027, the average consumption rate is projected to be 109.4 L/c/d and that the Hamlet will require a supply of 37,414 m³. Assuming that the filling of the reservoir is performed annually during July and August, the total volume required to supply the remaining 10 months of the year would be 31,178 m³. This differs from the Schematic Design Report as it includes for one additional month of storage capacity. This additional storage is recommended so that the Hamlet has sufficient water available for extreme situations such as when winter conditions are prolonged or should the filling operations be delayed due to an equipment failure (pump failure or a pipe break). The Operation Plan will indicate that the fill operation should begin as soon as the Tulugak River begins to flow each year and continue until the reservoir is at full capacity. The Hamlet should also “top up” the reservoir near the end of the summer before winter conditions set in.

The reservoir must also provide water storage to fight fires within the community. The NWT Water Board has published a *Good Engineering Practice Guideline* dated April 2004. This document recommends that a minimum of 60,000 L of storage for fire protection be provided in the reservoir for a community that is serviced by a truck haul system, if the source is not available throughout the year.

In addition, the pumping facility should be capable of supplying a minimum of 1,000 L/min from the reservoir to the trucks for delivery of water for fire protection to the community.

This is a remote site that relies totally on the availability of water from the reservoir for 10 months of the year. Based on this, the reservoir capacity has been increased by 360 m³ for fire protection. This would be equivalent to six (6) fires, assuming each fire required the minimum volume of 60,000 L (60 m³).

Therefore, the projected 20-year storage volume required at the reservoir is as follows:

10 Month Annual Consumption	31,178 m ³
<u>Fire Storage</u>	<u>360 m³</u>
Total Required Volume (rounded)	31,500 m³

Since the existing reservoir already has 18,000 m³ in useable volume, an additional useable volume of 13,500 m³ is required.

3.3 Reservoir Design

The water storage reservoir will be designed and constructed following the same approach used for the existing facility. This will involve:

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- Expanding the existing reservoir by constructing a new berm for the expanded reservoir
- Removal of existing berm along the northwest fence
- Relining the entire reservoir with a new liner.

Figure 6 illustrates the location and configuration of the reservoir expansion relative to the existing facilities based on detailed design calculations presented in Appendix E.

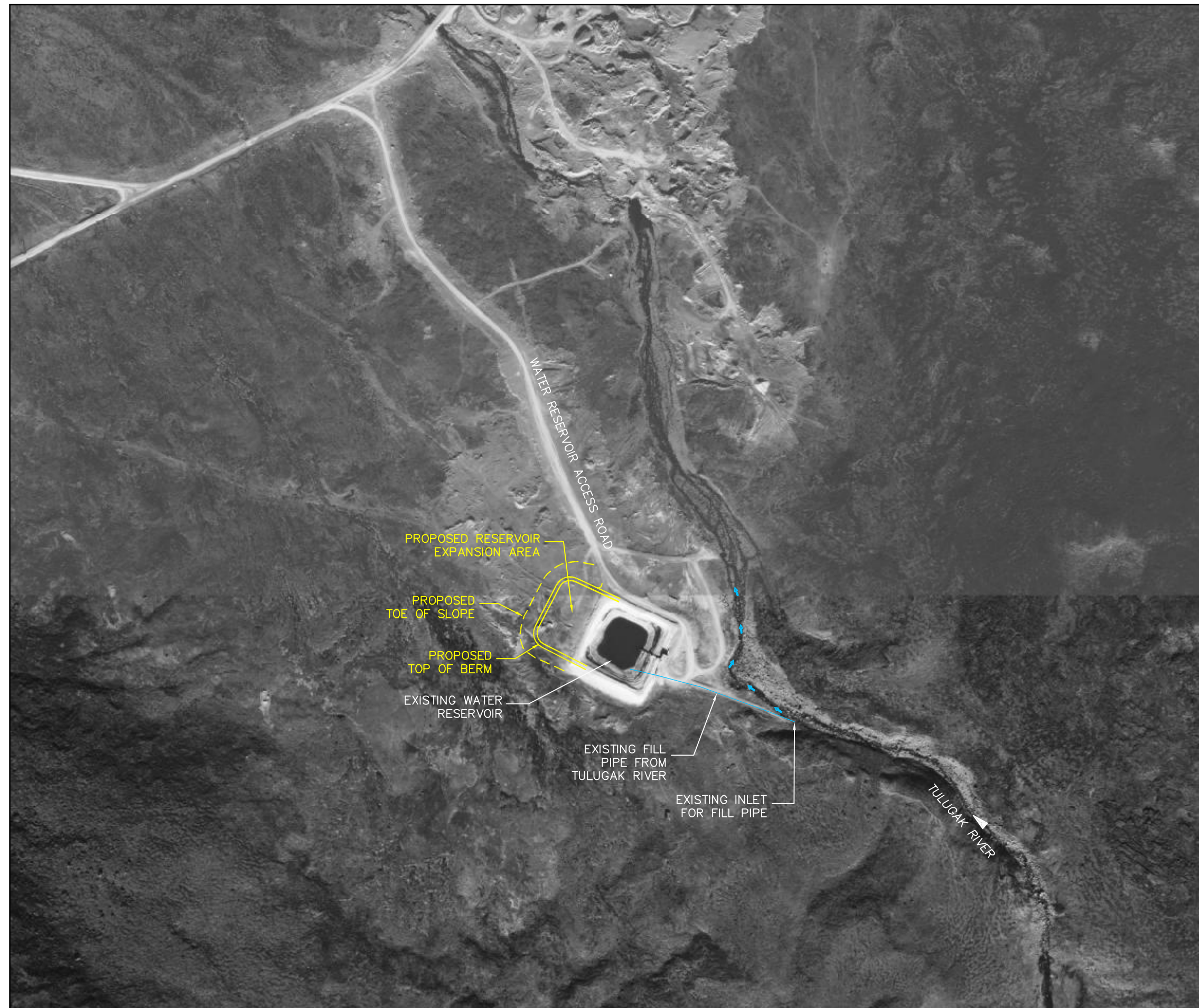
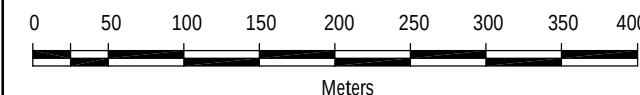
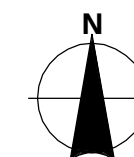


FIGURE 6
THE HAMLET OF QIKIQTARJUAQ
DETAILED DESIGN
PROPOSED WATER
RESERVOIR DESIGN

Legend

→ → → → INTERPRETED SURFACE WATER FLOW DIRECTION

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



1:5,000
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: M. Paznar

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**Figure 6: Location and Size of Designed Improvements to the Water Reservoir and
Truck fill Station**

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The dimensions and important design parameters for the expanded reservoir are as follows:

- Length – 156 m
- Width – 90 m (to match existing)
- Total depth – 9 m (to match existing)
- Required free board allowance – 1.0 m
- Allowance for ice – 1.5 m
- Intake allowance – 1.5 m
- Slope of berms inside of the reservoir – 3:1
- Slope of berms outside of lagoon at 3:1 or to match existing
- Top width of berm – 4.5 m (to match existing).

The implementation of the expansion to the reservoir is to occur in two phases. During the first year of construction, the addition to the reservoir is to be constructed without affecting the integrity of the existing reservoir. In the subsequent construction season, the common berm will be removed, the old liner removed, a new liner system installed, and the reservoir filled to ensure water is available for the next 10 months.

3.3.1 Liner System

The liner system will consist of a non-woven geotextile with a nominal thickness of approximately 155 mil overlying a 300 mm layer of 19 mm gravel. The non-woven geotextile will provide protection for the liner during installation. An 80 mil high-density polyethylene, potable grade geomembrane liner that is able to withstand the cold temperatures and resistant to UV degradation will be installed on top of the non-woven fabric. The purpose of the liner system is to assist in decreasing the risk of any leakage that may occur over the winter so there is an adequate supply available to service the needs of the Hamlet.

During the preparation of the Detailed Design Report, the design considered installing two layers of non-woven geotextile with 300 mm of 19 mm gravel in between, on top of the floor and berms of the reservoir and then a HDPE liner over the entire surface. The intent was to provide a layer that would not be impacted by freeze and thaw cycles. Upon further consideration, the active layer would be limited to the side slopes of the berms and discussions with the liner supplier indicated that the second layer of geotextile would not be required. Therefore the design was modified to only provide the gravel layer on the berm slopes and to only provide one layer of geotextile. This also resulted in a considerable cost savings to the project.

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3.3.2 Reservoir Piping

The existing double intake piping housing the truck fill pumps is to be replaced. A new double intake pipe system will be installed in a common trench surrounded with 19 mm gravel and liner.

The intake pipes will be 300 mm diameter HDPE insulated pipe. Submersible pumps will be installed in the intake pipes into the reservoir. The submersible pumps will be mounted on skids with runners and connected to a 100 mm HDPE diameter pipe. The pump skid will be attached to an aircraft grade stainless steel cable for the removal of the pumps. There will be no check valve on the discharge of the submersible pumps to ensure that the pipes drain after the pump shuts down. This will also protect the line that feeds the truck fill station from freezing.

HDPE pipe material was selected because it eliminates the potential for corrosion. It also allows for some minor adjustments in alignment in the field during construction and to adapt to the grades specified on the design drawings. To protect the carrier pipe from freezing, the pipe will be insulated and open ended in the truck fill station. For all sections where the carrier pipe is to be installed aboveground, the insulated carrier pipe will be wrapped in a 22 gauge, galvanized, spiral wrapped jacket to provide UV protection and to protect the pipe from damage due to surface hazards.

A new 300 mm HDPE gravity fill pipe will be installed at grade from the intake location in the Tulugak River to the reservoir.

The 300 mm diameter pipe will be installed in a swale alongside the access road heading to the intake location at the Tulugak River east of the Water Storage and Treatment Facility.

This pipe will be wrapped in a minimum 22 gauge, galvanized, spiral wrapped jacket to provide UV protection and to protect the pipe from normal mechanical damage. The pipe is to be laid on a continuous downhill grade from the intake to the reservoir. The intake is to be permanently installed in the riverbed.

3.3.3 Submersible Truck Fill Pumps (TFP's)

As stated previously, the truck fill pumps are required to provide a minimum flow of 1,000 L/min, to allow for efficient filling of the tanker trucks in the case of providing water for fire protection. Based on information obtained during the site assessment, the existing TFP's are rated for 644 L/min @ 30 m TDH.

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To satisfy the fire requirements, the truck fill pumps will need to be replaced with units capable of supplying 1,000 L/min.

3.3.4 Miscellaneous Items

Other improvements to the water storage and treatment system for the Hamlet include:

- Replacement of the existing single walled fuel tank with a double walled tank and the installation of a lined secondary containment for spills that many occur during filling operations (completed in 2005)
- Inspection of the two on-site generators and carrying out the necessary repairs as identified by the inspections
- Electrical upgrades as identified by the A.D. Williams Report (Appendix F)
- Upgrades and extension to the perimeter fence to limit access to the water reservoir by both wildlife and people
- Re-grading of the site to ensure positive drainage of all surface water away from the water reservoir and truck fill station
- Construction of the access road so that dust does not blow into the reservoir and to simplify the access for the water truck to and from the truck fill station (i.e. larger turning radius).

3.3.5 Signage at the Water Treatment and Storage Facility

This proposed design also includes the provision of proper site signage. A sign will be posted on the fence at the entry to the water storage and treatment facility indicating the following:

- Name of the Facility (i.e. Hamlet of Qikiqtarjuaq Water Treatment and Storage Facility)
- Trespassing Prohibited
- Health Hazard
- Emergency Contact Information (Hamlet of Qikiqtarjuaq Operations Department, phone number, etc.).

All signs will include English and Inuktitut along with the logos of the Hamlet and of the Government of Nunavut.

4.0 Sewage Storage and Treatment Facility

Currently, the Hamlet of Qikiqtarjuaq operates a single cell sewage lagoon with the effluent discharged to a natural wetland, which eventually discharges into the Davis Strait. This existing sewage lagoon is located approximately 2 km east of the community (Figure 7) and is accessed by the “Landfill Access Road.” The lagoon is located adjacent to the solid waste disposal facility. There are no documented complaints of related odours.

Sewage is collected daily by a vacuum truck from holding tanks located at the houses, and at the commercial and institutional buildings. The truck transports the sewage to the lagoon and the operator discharges the sewage onto a spillway, which is used to prevent bank erosion during the discharge operation.

Currently, decanting of the lagoon takes place at the end of the summer, just prior to freeze up. Effluent is discharged directly onto the ground at the base of the lagoon berm. This is considered to be the point of discharge under the Operating License. The only treatment provided for determining compliance with the Water Board guidelines takes place within the lagoon itself.

The Schematic Design Report indicated that considering access, site constraints, the remoteness of the site, availability of suitable soils, simplicity of operation, and anticipated costs, the community should continue to use a lagoon based system for sewage treatment.



FIGURE 7

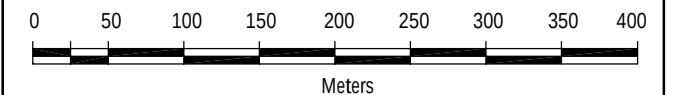
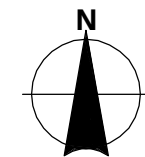
THE HAMLET OF QIKIQTARJUAQ
DETAILED DESIGN

REGIONAL VIEW OF EXISTING
WASTEWATER LAGOON &
SOLID WASTE DISPOSAL
FACILITY (LANDFILL)

Legend

→ → → → INTERPRETED EXISTING SURFACE WATER
FLOW DIRECTION

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



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4.1 Requirements for a Sewage Lagoon in Nunavut

The requirements for the design and operation of lagoons in Nunavut can be found in the following documents:

- G. W. Heinke, D. W. Smith and R. Gerard, 1990. *Guidelines for Disposal of Sewage in Coastal communities of the NWT*
- *Nunavut Water Board Guidelines for the Discharge of Treated Municipal Waste Water in the NWT*, 1992
- *Cold Regions Monograph*, 3rd Ed., 1992
- G.W. Heinke, D. W. Smith and R. Finch, 1998. *Guidelines for the Planning, Design and Operation and Maintenance of Sewage Lagoon Systems in the NWT*.

It should be noted that, although these documents were developed prior to the division of Nunavut from the NWT, they are generally accepted by the regulatory agencies in Nunavut.

4.2 Existing Conditions

The facultative lagoon at Qikiqtarjuaq was originally designed to hold sewage for 365 days, with an annual discharge at the end of summer. The existing unlined earthen lagoon was constructed in 1992 (Figure 8). The design intent was for a 20-year lagoon to be constructed as two independent cells, however, only one cell was built. The current single-cell lagoon is assumed from design drawings provided by the Hamlet to approximately 90 m x 70 m x 4 m, with a volume of 10,558 m³. This assumes that a 1 m freeboard, which is required by the Nunavut Water Board, will be maintained. The lagoon volume is not sufficient to provide the appropriate storage and treatment of the sewage that is generated by the Hamlet of Qikiqtarjuaq.

The current effluent quality criteria for sewage discharged by the Hamlet of Qikiqtarjuaq are prescribed in the Water License NWB3QIK0106. The effluent criteria are presented in Table 3.

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Table 3: Nunavut Water Board Effluent Discharge Quality Criteria

Parameters	NWB License Limits (mg/L)
Biological Oxygen Demand (BOD)	120
Total Suspended Solids (TSS)	180
pH	6-9
Fecal Coliforms (FC)	1 x 10 ⁴ C.F.U./ dL

4.3 Sewage Quantity and Projected Quality Generation Rates

In trucked service communities, it is normally assumed that the sewage generated is equivalent to water consumption. Accordingly, the daily and annual sewage generation rates for the Hamlet of Qikiqtarjuaq are assumed to be equal to the rates of water consumption rates.

As referenced previously, the Government of the Northwest Territories Department of Municipal and Community Affairs has developed a standard for water consumption in communities of less than 2,000 residents on trucked services. This consumption rate can be estimated with the following formula:

$$\text{Water Use (L/person/day)} = 90 \text{ L/person/day} \times (1.0 + 0.00023 \times \text{population})$$

Where the factor 0.00023 multiplied by the population represents the commercial and industrial water use. The rate of 90 L/person/day is used, as recommended for a community of less than 2,000 people.

Based on the above criteria,. The projected annual volume of sewage generated at the end of 10 years (2017) is 29,552 m³, while the 20-year (2027) annual volume is 37,414 m³. Table 4 provides a summary of the sewage generation rate for the Hamlet of Qikiqtarjuaq.

The design objective is to establish an appropriate design for the treatment of the sewage, the amount of sludge that will be produced and the concentrations of the treated discharge. Table 5 summarizes the assumptions made in the calculations.

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Table 4: Projected Sewage and Sludge Generation Rates

Planning Year	Calendar Year	Projected Population	Projected Sewage Generation	Projected Volume		Projected Sludge Volume	Cumulative Sludge Volume	BOD	TSS	T-PO ₄	TKN	Faecal Coliforms
			[Lpcd]	[Litres/day]	[Litres/year]	[m ³ /year]	[m ³]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[CFU/100 mL]
Schematic	2005	599	102.4	61,337	22,388,071	10.9	10.9	439.5	468.8	22.5	117.2	9.28E+07
Design 0	2006	611	102.6	62,718	22,891,977	11.2	22.1	438.4	467.6	22.4	116.9	9.25E+07
	2007	624	102.9	64,220	23,440,330	11.4	33.5	437.2	466.4	22.3	116.6	9.23E+07
	2008	637	103.2	65,729	23,991,238	11.6	45.1	436.1	465.2	22.3	116.3	9.21E+07
	2009	650	103.5	67,246	24,544,699	11.9	57.0	435.0	464.0	22.2	116.0	9.18E+07
	2010	663	103.7	68,769	25,100,714	12.1	69.1	433.8	462.8	22.2	115.7	9.16E+07
5	2011	677	104.0	70,417	25,702,355	12.4	81.4	432.6	461.5	22.1	115.4	9.13E+07
	2012	691	104.3	72,074	26,306,958	12.6	94.0	431.4	460.2	22.1	115.0	9.11E+07
	2013	705	104.6	73,738	26,914,522	12.9	106.9	430.2	458.9	22.0	114.7	9.08E+07
	2014	720	104.9	75,531	27,568,771	13.1	120.0	429.0	457.6	21.9	114.4	9.06E+07
	2015	735	105.2	77,333	28,226,420	13.4	133.4	427.7	456.2	21.9	114.1	9.03E+07
10	2016	750	105.5	79,144	28,887,469	13.7	147.1	426.4	454.9	21.8	113.7	9.00E+07
	2017	765	105.8	80,964	29,551,917	14.0	161.1	425.2	453.5	21.7	113.4	8.98E+07
	2018	781	106.2	82,916	30,264,410	14.3	175.3	423.9	452.1	21.7	113.0	8.95E+07
	2019	797	106.5	84,879	30,980,772	14.5	189.9	422.5	450.7	21.6	112.7	8.92E+07
	2020	813	106.8	86,852	31,701,001	14.8	204.7	421.2	449.3	21.5	112.3	8.89E+07
15	2021	830	107.2	88,960	32,470,484	15.1	219.9	419.9	447.8	21.5	112.0	8.86E+07
	2022	847	107.5	91,080	33,244,334	15.5	235.3	418.5	446.4	21.4	111.6	8.83E+07
	2023	864	107.9	93,212	34,022,551	15.8	251.1	417.1	444.9	21.3	111.2	8.81E+07
	2024	882	108.3	95,483	34,851,305	16.1	267.2	415.7	443.4	21.2	110.8	8.78E+07
	2025	900	108.6	97,767	35,684,955	16.4	283.6	414.3	441.9	21.2	110.5	8.75E+07
20	2026	918	109.0	100,064	36,523,501	16.8	300.4	412.8	440.4	21.1	110.1	8.72E+07
	2027	937	109.4	102,504	37,413,945	17.1	317.5	411.3	438.8	21.0	109.7	8.68E+07

Table 5: Assumptions for the Calculation of Effluent Concentrations of BOD, TSS, T-PO₄, TKN and Fecal Coliforms

Parameter	Generation Rate
Sludge	50 grams/person/day
Biological Oxygen Demand (BOD)	45 grams/ person/day
Total Suspended Solids (TSS)	48 grams/ person/day
Total Phosphate (T-PO ₄)	2.3 grams/ person/day
Total Kjeldahl Nitrogen (TKN)	12 grams/ person/day
Fecal Coliform (FC)	9.50×10^{10} CFU/100 mL/ person/day

Based on these assumed parameters, the projected annual and cumulative sludge volumes and the design concentrations of Biological Oxygen Demand (BOD), Total Suspended Solids (TSS), Total phosphate (T-PO₄), Total Kjeldahl Nitrogen (TKN) and fecal coliforms (FC) in the lagoon effluent can be calculated, as shown in Table 3.

4.4 Lagoon Storage Volumes Required

A lagoon with sufficient capacity to retain the estimated annual generated sewage volume for projected 20th year is required.

In addition to sewage, the volume of precipitation, and rates of evaporation, must also be considered in establishing the capacity of the lagoon. It may be assumed that water evaporates from a sewage lagoon at the same rate as from a lake. It is also assumed that sublimation rates, evaporation from a frozen surface, are not a significant factor. The impact of runoff is not considered a factor, as the lagoon berms will be above grade.

The annual evaporation rate for the Hamlet of Qikiqtarjuaq is estimated at approximately 200 mm/year. Climate normal data from the Environment Canada website was obtained, indicating that the average annual precipitation for the Hamlet of Qikiqtarjuaq is 262 mm/year (Appendix A). This net addition of approximately 62 mm/year of precipitation over the surface of the lagoon will contribute to the total volume requirement. This volume needs to be accounted for in the lagoon design.

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The volume of accumulated sludge must also be considered in determining the total storage. Calculations are presented in Table 3. The projected accumulated sludge volume at year 20 is approximately 318 m³.

The total lagoon volume required in year 20, with allowances for net precipitation and cumulative sludge accumulation over 20 years is:

Volume of sewage in year 20 (12 months retention)	37,414 m ³
Volume of accumulated sludge by year 20	318 m ³
<u>Annual volume of precipitation</u>	<u>1,205 m³</u>
Total Volume Required (Rounded)	38,900 m³
Less volume available in existing lagoon	10,558 m ³
Volume to be added	28,342 m ³

The volume calculated above differs from the value indicated in the Schematic Design Report because the actual depth of the existing lagoon was significantly less than assumed during the Schematic Design Phase. The “As-Built” drawings obtained by Nuna Burnside from the Hamlet indicate that the actual depth of the existing reservoir is only 4 m, and not the 8 m assumed in the Schematic Design Report. As a result, a larger addition is required and is proposed as indicated on Figure 9. The proposed lagoon expansion has average dimensions of 110 m x 115 m x 4 m.

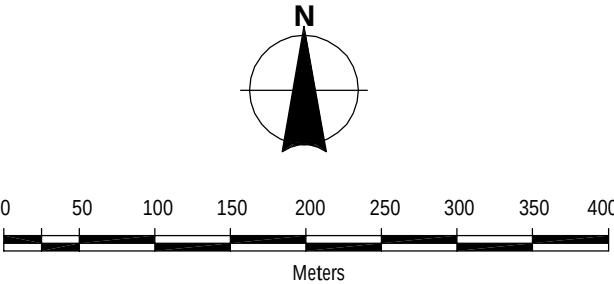


FIGURE 8
THE HAMLET OF QIKIQTARJUAQ
DETAILED DESIGN

PROPOSED SEWAGE
TREATMENT FACILITY DESIGN

Legend
— — — — — INTERPRETED EXISTING SURFACE WATER
FLOW DIRECTION

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



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4.5 Meeting Effluent Discharge Criteria

The following assessment is provided with regards to meeting the effluent criteria specified in the existing NWB license.

Two scenarios are considered. The first scenario looks at the quality of effluent that is expected when a new lagoon is commissioned. The second scenario considers the effluent quality at the end of the design period.

After the lagoon expansion is commissioned, the sewage generation is anticipated to be approximately 63 percent of the 20 year design flow, and therefore there will be a higher efficiency of treatment.

Table 6 compares a 70 percent reduction in the sewage characteristic parameters, based on published treatment efficiencies for similar systems. These values are compared to the levels specified by the operating license. Based on these assumptions, additional treatment is warranted.

Table 6: Estimated Effluent Quality Assuming a 70 Percent Lagoon Carbon-Removal Efficiency (2005)

Regulatory Parameter	Raw Sewage (2005)	Expected Lagoon Effluent Quality (2005)	Expected Lagoon Effluent Quality Prior to Wetland Treatment with 70 Percent Carbon Removal	NWB License Limits
BOD (mg/L)	439.5	439.5	< 131.9	120
TSS (mg/L)	468.8	468.8	< 140.6	180
T-PO ₄ (mg/L)	22.5	22.5	< 6.8	N/A
TKN (mg/L)	117.2	117.2	< 35.2	N/A
FC (CFU/dL)	9.28 x 10 ⁷	9.28 x 10 ⁷	< 2.8 x 10 ⁷	1 x 10 ⁴

As the sewage volume increases, so will the depth of storage along with the volume of sludge accumulation within the lagoons. Treatment efficiencies will be correspondingly reduced. Conservatively, the rates of reduction for carbon based parameters could be as low as 25 percent. Under these conditions, the effluent quality shown in Table 7 is expected.

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Table 7: Estimated Effluent Quality Assuming a 25 Percent Lagoon Carbon-Removal Efficiency (2027)

Regulatory Parameter	Predicted Raw Sewage (2027)	Expected Lagoon Effluent Quality (2027)	NWB License Limits
BOD (mg/L)	411.3	< 308.5	120
TSS (mg/L)	438.8	< 329.1	180
T-PO ₄ (mg/L)	21.0	< 15.8	N/A
TKN (mg/L)	109.7	< 82.3	N/A
FC (CFU/dL)	8.7 x 10 ⁷	< 6.5 x 10 ⁷	1 x 10 ⁴

In order to meet the licensing requirements, additional treatment is warranted. This can be provided by means of a wetland treatment area that can be established between the lagoon system and Davis Strait.

It is anticipated that during the period between 2005 and 2027, the wetland treatment area will evolve into a functioning microbial, and terrestrial plant environment capable of providing additional treatment with some effluent evaporation and disinfection.

It is anticipated that this wetland treatment area will be capable of providing treatment to the concentrations shown in Table 8. The predictive model describing the assimilative capability of this wetland treatment area, developed by the Alberta Department of the Environment is illustrated in Appendix F. The model accounts for a temperature correction to an average temperature of 5°C.

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Table 8: Estimated Wetland Treatment Area Effluent Quality at Final Discharge Point Compared to Nunavut Water Board License Limits and Anticipated Guidelines

Regulatory Parameter	Expected Lagoon Effluent Quality (2027)	NWB License Limits	Anticipated NWB Guidelines	Minimum Wetland Area Required to Meet Anticipated NWB Guidelines (Ha)	Expected Effluent Quality from 22 ha Wetland Treatment Area
BOD (mg/L)	308.5	130	45	7.1	< 45
TSS (mg/L)	329.1	180	45	0.3	< 45
T-PO ₄ (mg/L)	15.8	N/A	1	22.0	< 1
TKN (mg/L)	82.3	N/A	10	9.9	< 5
FC (CFU/dL)	6.5×10^7	1×10^4	2×10^2	16.3	$< 2 \times 10^2$

The areas required to provide the level of treatment of the effluent to the anticipated Nunavut Water Board regulatory parameters, based on the Alberta Wetland Predictive Model, are given in Table 8. It should be noted that T-PO₄ reduction to the anticipated Nunavut Water Board Guideline levels requires a significantly greater wetland treatment area in comparison to other parameters of interest. Based on the above, the minimum wetland treatment area is about 22 ha.

4.6 Preferred Design Alternative

The preferred design alternative to upgrade the current sewage treatment system for the Hamlet of Qikiqtarjuaq includes the development of an additional lagoon cell and the addition of a wetland treatment area. The following section describes the design details of this alternative and identifies the differences in the Schematic Design Report. Similar to the Water Supply and Storage Reservoir Facility section, detailed calculations are provided in Appendix E.

4.7 Sewage Storage and Treatment System detailed Design

4.7.1 Sewage Lagoon

The additional lagoon cell will be sited immediately south of the existing lagoon. A common berm will be shared between the two cells thereby providing an optimum configuration and minimizing the land and construction requirements.

In Appendix E, a description of the calculations to determine the capacity required in addition to the existing lagoon are provided. A lagoon with 27,339 m³ usable capacity is required and this can be achieved with the following configuration:

- Length – 110 m
- Width – 115 m
- Total Depth – 4 m
- Required free board allowance – 1.0 m
- Allowance for solids accumulation at bottom of lagoon – 0.3 m
- Slope of berms inside of lagoon – 3:1
- Slope of berms outside of lagoon – to match the existing ground elevations as indicated on drawings
- Top width of berm – 3.0 m.

This additional lagoon cell will be of similar construction as the existing lagoon. The material excavated will be used to construct the berms. This should reduce the amount of material to be imported. This proposed lagoon cell will remain unlined.

4.7.2 Lagoon Effluent Discharge

The effluent from the lagoons will be decanted each year as per the Operation and Maintenance Plans. The effluent will be decanted by gravity evenly across the tundra to create an engineered wetland area for final treatment.

4.7.3 Wetland Treatment Area and Exfiltration Berm

A wetland treatment area of 22 ha as previously described is an essential component of the proposed treatment system. Since a naturally occurring wetland already exists in the area, the intention is to allow the lagoon effluent to discharge over land in a sheet flow fashion and allow vegetation and other biological systems characteristic to wetland areas develop. This is similar to the approach used by the existing system.

The wetland area will be achieved by the construction of an exfiltration berm made of native rock type material located approximately 10 m west of the berms of the lagoons.

At the toe of the slope of this exfiltration berm will be 200 mm perforated drainage pipe capped on either ends. Note that the perforations will be spaced further apart where the piping connects into the outlet piping and closer together on either end as detailed in the drawings. This is designed to achieve the desired sheet flow pattern and will enhance the treatment effectiveness of the wetland.

4.7.4 Tanker Truck Offloading Area

The truck off loading area will be reconstructed in order to allow the tanker trucks to back-up and discharge to either lagoon cell. A 3,000 mm diameter smoothed wall culvert will be cut into half and laid down on the berm of the new lagoon cell to act as a spillway and prevent erosion of the berm during the offloading of the trucks. A cut off drainage trench will be constructed around the perimeter of both lagoon cells to ensure the diversion of surface water around the site and minimize the potential for surface water from flowing into the lagoon cells.

4.7.5 Site Drainage and Grading

The entire site will be re-graded to ensure that there is positive drainage away from the sewage lagoons. This will ensure that surface water does not enter into the lagoon with the exception of the truck discharge area. The natural drainage patterns will be utilized as much as possible in order to reduce the amount of excavation required in the existing ground. The elevation of the berm located to the east will be increased to a minimum of 0.5 metres above the elevation of the existing ground in order to create a drainage pattern for all surface water run-off coming from the access road. This will be done using excess material excavated from the construction of the lagoon.

4.7.6 Signage

This design also includes the provision of proper site signage. A sign will be posted at the entry to the facility indicating the following:

- Name of the Facility (i.e. Hamlet of Qikiqtarjuaq Sewage Treatment Facility)
- Trespassing Prohibited
- Health Hazard
- Emergency Contact Information (Hamlet of Qikiqtarjuaq Operations Department, phone number, etc.).

Signs will be posted at appropriately spaced intervals along the perimeter of the proposed wetland treatment area. These signs will indicate the following:

- Name and Purpose of the Facility (i.e. Wetland Treatment Area)

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- Trespassing Prohibited
- Health Hazard
- Emergency Contact Information (Hamlet of Qikiqtarjuaq Operations Department, phone number, etc.).

Finally, a sign will be placed at the final discharge point of the sewage treatment facility. This will be at the location where sampling will occur in order to monitor the compliance of effluent from the sewage treatment system to the regulations imposed by the NWB water license. It is anticipated that the sign will include the following information:

- Name of Facility
- Surveillance Network Monitoring Program Location Code.

All signs will be in both English and Inuktitut, and will include the logos of the Hamlet and of the Government of Nunavut.

5.0 Solid Waste Disposal Facility

5.1 Overview

5.1.1 Background

Meetings with Hamlet staff indicated they wish to continue their current method of solid waste collection and transportation to the disposal site. This involves Hamlet staff doing house to house collection on a weekly basis with a truck. They also wish to keep the disposal facilities open to community members to use on an as needed basis. Because the community is small and isolated, Hamlet staff had no concerns with controlling waste disposal.

Staff was relatively happy with the current process of waste streaming and disposal, but wanted a long term effective plan for the future. As per the Terms of Reference for the project, waste disposal capacity will be designed to accommodate the Hamlet until end of year 2030.

Existing conditions are displayed on Figure 9.

The facility currently operates under Nunavut Water Board License No. NW133Q1K0106, issued November 28, 2000 (Appendix C). The license was issued for five years to allow the licensee to properly carry out the terms and conditions of the license. The license includes water use and waste disposal (sewage and solid waste). With respect to solid waste the license requires:

- An Annual Report
- An Operations and Maintenance Manual (O & M)
- Abandonment and Restoration (A & R) of the abandoned waste disposal facility (now used as the Bulky Metals Disposal Area)
- Surveillance Network Program (as part of the sewage system and solid waste disposal area monitoring requirements)
- Studies for long term planning.

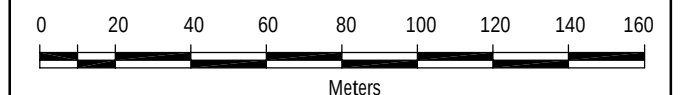
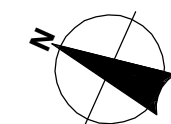


FIGURE 9
THE HAMLET OF QIKIQTARJUAQ
DETAILED DESIGN
EXISTING SOLID WASTE
DISPOSAL FACILITY (LANDFILL)

Legend

  **EXISTING SURFACE WATER FLOW DIRECTION**

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



1:2,000
 January 2006
 Project Number: N-O 09439.0

Projection: UTM Zone 20
 Datum: NAD83

Prepared by: C. Sheppard

Verified by: M. Paznar

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5.1.2 Solid Waste Disposal Regulations

Solid waste disposal in Nunavut is regulated by the Water Board. The following guidelines are applicable:

- Northwest Territories, Municipal and Community Affairs, “Guidelines for the Planning, Design, Operations, and Maintenance of Modified Solid Waste Sites in the Northwest Territories”, dated April 2003
- Public Health Act, “Consolidation of General Sanitation Regulations”, R.R.N.W.T., 1990.

5.2 Waste Streams

Due to the isolated nature of the Hamlet, the waste stream is divided into the following components:

1. **Hazardous Wastes** – including batteries, waste oil, waste antifreeze, and other materials not suitable for landfilling
2. **Bulky Metals** – equipment machinery and metal materials no longer deemed salvageable or recyclable by the Hamlet
3. **Municipal Solid Waste** – the remaining waste materials.

A storage area is provided near the landfill for equipment, machinery and metal materials that are deemed to have potential reuse/recycle value. These are kept out of the waste stream until they are no longer deemed usable, then they are transferred to the bulky metals disposal area.

5.3 Hazardous Wastes

5.3.1 Hazardous Waste Materials

Wastes such as oils, fuels, batteries, antifreeze, and solvents that cannot be rendered safe for landfilling or cannot be reused, must be removed from the community and shipped to a proper disposal facility, usually in the south.

The most cost effective backhaul is by sea, once there is a sufficient stockpile of the materials to warrant a shipment. In a community the size of the Hamlet of Qikiqtarjuaq, this could be once every five years depending on the amount accumulated. Materials must be contained, manifested, and arrangements made with a shipper to back haul the

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materials to a licensed waste disposal site. In between backhauls the wastes must be safely stored.

Based on previous studies and discussions with Hamlet staff, the following amounts of waste materials are anticipated to be accumulated between shipping periods:

- 40 – 205 L drums of waste oil, waste fuels, and similar products (10 skids)
- 20 – 205 L drums of waste antifreeze and similar materials (5 skids)
- 50 waste batteries of various sizes (2 skids)
- 6 – 205 L drums of miscellaneous waste unsuitable for landfilling (2 skids).

These materials will be stockpiled at the landfill site in a contained and controlled area, until a sufficient quantity has accumulated to warrant a backhaul shipment.

Some materials such as fuels and oils may be disposed of by using a mobile incinerator. The incinerator can be mobilized to the community and operated for a period of time to consume selected wastes that are suitable for incineration. A cost benefit analysis will be required once a stockpile has been accumulated.

5.3.2 Regulatory Guidelines for Hazardous Waste

Management of hazardous waste must be in accordance with:

- “Environmental Guideline for General Management of Hazardous Waste in Nunavut”, Government of Nunavut, January 2002
- “Environmental Guidelines for Waste Batteries”, Government of Nunavut, January 2002
- “Environmental Guidelines for Waste Antifreeze”. Government of Nunavut, January 2002.

5.3.3 Hazardous Waste Storage Area

Currently there is an approximate 10 m long green shipping container located near the entrance to the municipal solid waste disposal area, which is used to store wastes unsuitable for landfilling. A pile of old batteries sits on the ground next to the container. The rehabilitated area will consist of the following:

- A 15 m x 15 m fenced area with a 1 m high surrounding berm topped with a 1.8 m fence
- A 3 m wide lockable swing gate to provide access

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- Base and interior sides will be lined with a 40 mil HDPE arctic liner
- Liner would be held in place by keying it into the berm and armoring the top of the berm with stone
- Floor for the containment area would include 10 cm of sand and gravel over the liner for protection
- Berms would be 1 m high with 3:1 slopes, except for the 3 m wide access ramp, which would have 5:1 slopes to allow easy access for equipment.

The green shipping container would be placed outside the fenced area to receive the weekly volume of hazardous wastes. On a monthly (or other suitable interval as needed) the materials would be bulked into 205 L drums, and stored on pallets in the fenced enclosure to await backhaul.

The floor of the shipping container should include a 0.2 m high lip at the door, and be lined with 40 m HDPE over the floor and 0.2 m up the sides for spill containment. The shipping container will also be equipped with vents to prevent the buildup of odours and vapours.

The container would be equipped with shelves to hold small quantities of hazardous wastes until they can be bulked in drums.

The hazardous waste storage facility will have signs clearly outlining the operations, acceptable materials, and warnings of inherent hazards. A spill kit, emergency kit, and fire extinguisher would be stored in the shipping container for dealing with emergencies.

The proposed upgraded layout of the Hazardous Waste Storage Area is displayed on Drawing 12.

5.4 Recyclable Storage Area

Machinery, equipment, and metal materials that may have reuse/recycle value will be stored in the staging area near the landfill (Figure 2). Materials in this area no longer deemed to have any reuse/recycle value will be disposed of at the bulky metals disposal area.

The reusable storage area requires no modifications other than a sign describing the use of the area and warning of the inherent hazards.

5.5 Bulky Metals Disposal Area

Due to the high cost of removing metals from the community by sea lift backhaul, the disposal strategy has been to dispose of the material by burial in a designated bulky

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metals disposal area. By segregating the material from the other waste streams, it provides the possibility for future excavation and backhaul for scrap. In addition, the bulky metals are deemed to have very low potential for an environmental impact, and are considered virtually inert materials. Disposal practices must include scrutiny to ensure oils, fuels, and other items that could cause an environmental impact are removed from the bulky metals waste stream prior to disposal. Based on the historic quantities of metals placed in the bulky metals area and discussions with Hamlet staff, it is anticipated the bulky metals disposal volume with a 4:1 ratio of metals to cover material (20 percent cover by volume) will be approximately 24,000 m³. This assumes continued use of the recyclable storage area and regular disposal until 2030.

The final estimated footprint for the Bulky Waste Disposal Area is shown on Drawing 13.

The existing ditching in the northeast corner will be improved so that surface erosion of the area is minimized. Areas of existing surface erosion will be repaired with additional cover material.

No operational improvements are recommended regarding the Bulky Metals Disposal Area. The operation method is described in the Operation and Maintenance Report, which is included as Appendix H3.

5.6 Municipal Solid Waste Disposal Area

Currently, when waste arrives at the site, hazardous material is removed. The remaining waste is tipped over a large embankment within the fenced enclosure and periodically lit on fire to reduce volume, breeding sites for flies and potential for scavenging (i.e., bears). The ash and non-burnt material is subsequently pushed over the embankment. Periodically the tipped waste is covered with local soils.

With regards to these practices, we note the following two issues:

- The existing ‘working face’ is approaching a gradient of 1:1, which is generally not stable and therefore potentially dangerous
- The landfill is currently being developed in an uncontrolled manner without an overall strategy to minimize its footprint and minimize its potential to cause an environmental impact.

The current practice of burning the waste is not considered a good management practice, and is illegal in many parts of Canada. However, we understand that it is accepted in Nunavut. Section 27 of the Public Health Act for Nunavut states “*Every incorporated municipality shall provide adequate waste disposal grounds for the disposal of all*

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garbage...and shall cause such waste materials to be burned, buried or covered with a layer of earth", and the process has been approved by the Regional Engineer of the Government of Nunavut. Given the site conditions, most notably the climate and the potential for scavengers (i.e., bears) we understand the Hamlet's position that options other than burning are not practicable. Options could be supplied at a later time, if requested.

The preferred alternative involves both initial improvements of the site and overall improvements in the operational procedures to address the issues noted above, and to accommodate the waste in a more efficient and environmentally friendly period during the 24 year design period. Calculations for the expected municipal solid waste quantity required for the Hamlet solid waste landfill site are displayed on Table 5.1.

Quantity calculations are based upon:

- A generation rate of 0.014 m³/person/day, which is a standard for NWT and Nunavut
- A projected population growth rate of 2 percent
- An estimate of approximately 16 percent of all wastes being non-combustibles, based on typical waste composition rates in NWT
- A 40 percent reduction in combustible waste due to open burning, based on estimates used throughout the NWT
- A volume reduction of 25 percent due to compaction of the waste, based on observations of the waste
- Application of cover material at 4:1 fill to cover ratio (or 20 percent by volume).

5.6.1 Recommended Design Improvements

The recommended design improvements are summarized on Drawing 12, Figures 10 through 16, and described below.

The tipping face will be cut back from the current 1:1 slope, such that it does not exceed a 3:1 slope. This is necessary to reduce the risk of slope failure and facilitate future site development. It is envisioned that this will involve progressively blading the landfill waste from the top of the landfill to the bottom, using appropriate equipment, such as dozers. As necessary and to facilitate a working surface, intermediate cover may be applied.

A 2 m high landfill perimeter berm will be constructed around the entire estimated extent of the waste cells in areas where a berm does not exist (Drawing 12, Detail A). This will demarcate the final extent of the waste and cover and allow for controlled and organized development of the area. The landfill perimeter berm will be constructed using sand, gravel and cobble material from any convenient borrow source, preferably from within

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the landfill cell itself. Topsoil materials will be removed and not used in construction. The top of the landfill perimeter berm will be 1 m wide, and the inside slope (landfill side) will be at 2:1, while the outside slope is at a 3:1. In areas where a berm currently exists (i.e., along the southeastern boundary), the inside slopes will be cut back to a 2:1 where practicable.

A water retention area (similar to that which currently exists) will be constructed west of the landfill cell to facilitate temporary storage and testing of any potentially impacted runoff from the facility. The water retention area has been sized to contain a 100 mm storm event or snow runoff. Native materials (sand, cobble and gravel) will be excavated to a depth of 1 m and banked up around the perimeter. A 2 m deep invert (i.e., gap) will be cut into the landfill perimeter berm at the lowest point (See Drawing Detail B), to facilitate water drainage into the effluent retention area.

The 4 m high 50 mm fence posts and associated wire mesh will be removed and disposed of. The existing fence along the western side of the site will be removed and relocated or replaced further to the west along the perimeter landfill berm. Diagonal risers, angled towards the landfill area, will be installed on the top of the fence to provide additional capture of windblown litter (Drawing 12, Detail D). The fence will be constructed along the north and south landfill perimeter berms at a height of 1.8 m, and excavated into the native materials a distance of at least 0.5 m. A 0.5 m deep drainage invert will be constructed at the west side of the berm.

An intermediate berm will be constructed at a distance of 30 m from the top or crest of the tip. This will delineate the interim phase of the landfill development (development until approximately year 6). The cross section of intermediate berm will be constructed in a manner similar to that of the landfill perimeter berm.

The sequence of landfill development is displayed on Figures 9 through 17.

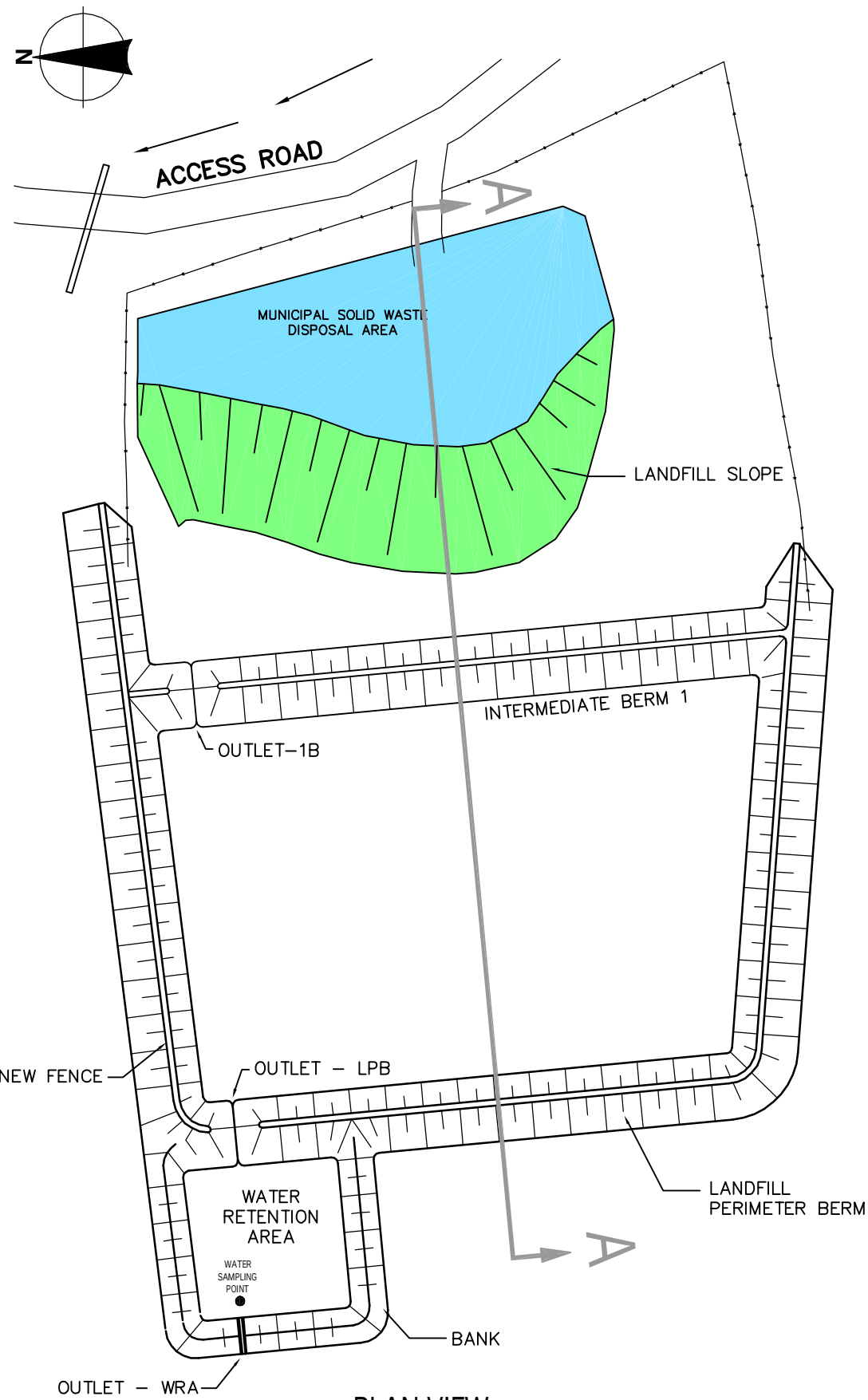
The existing ditch located on the east side of the access road will be extended to a depth of 1.5 m. A 1200 mm diameter culvert will be installed from the eastern ditch to the drainage swale located south of the municipal solid waste disposal area.

Signs shall be posted within the Solid Waste Disposal Area that describe the operations of the site and identify restrictions such as salvaging, waste types and uncontrolled burning.

Table 5.1
Waste Quantity Calculations

Planning Year	Calendar Year	Projected Population [people]	Annual Volume of Solid Waste [m³]	Cumulative Volume of Solid Waste [m³]	Annual Volume of Combustible Solid Waste [m³]	Annual Volume of Combustible Solid Waste After Burning [m³]	Annual Volume of Uncombustible Solid Waste [m³]	Total Annual Volume of Uncombustible and Combusted (Burned) Solid Waste [m³]	Annual Volume of Compacted Waste [m³]	Annual Volume of Cover Material [m³]	Total Annual Volume of Compacted Waste and Cover Material [m³]	Cumulative Landfill Volume [m3]
0	2006	599	3060.9	3060.9	2571.1	1542.7	489.7	2032.4	1524.3	304.9	1829.2	1,829.19
	2007	611	3122.2	6183.1	2622.7	1573.6	499.6	2073.1	1554.9	311.0	1865.8	3,695.02
	2008	624	3188.6	9371.7	2678.5	1607.1	510.2	2117.3	1587.9	317.6	1905.5	5,600.55
	2009	637	3255.1	12626.8	2734.3	1640.6	520.8	2161.4	1621.0	324.2	1945.2	7,545.78
	2010	650	3321.5	15948.3	2790.1	1674.0	531.4	2205.5	1654.1	330.8	1984.9	9,530.71
5	2011	663	3387.9	19336.2	2845.9	1707.5	542.1	2249.6	1687.2	337.4	2024.6	11,555.34
	2012	677	3459.5	22795.7	2906.0	1743.6	553.5	2297.1	1722.8	344.6	2067.4	13,622.72
	2013	691	3531.0	26326.7	2966.0	1779.6	565.0	2344.6	1758.4	351.7	2110.1	15,732.85
	2014	705	3602.6	29929.3	3026.1	1815.7	576.4	2392.1	1794.1	358.8	2152.9	17,885.73
	2015	720	3679.2	33608.5	3090.5	1854.3	588.7	2443.0	1832.2	366.4	2198.7	20,084.42
10	2016	735	3755.9	37364.3	3154.9	1892.9	600.9	2493.9	1870.4	374.1	2244.5	22,328.92
	2017	750	3832.5	41196.8	3219.3	1931.6	613.2	2544.8	1908.6	381.7	2290.3	24,619.22
	2018	765	3909.2	45106.0	3283.7	1970.2	625.5	2595.7	1946.8	389.4	2336.1	26,955.33
	2019	781	3990.9	49096.9	3352.4	2011.4	638.5	2650.0	1987.5	397.5	2385.0	29,340.30
	2020	797	4072.7	53169.6	3421.0	2052.6	651.6	2704.3	2028.2	405.6	2433.8	31,774.12
15	2021	813	4154.4	57324.0	3489.7	2093.8	664.7	2758.5	2068.9	413.8	2482.7	34,256.81
	2022	830	4241.3	61565.3	3562.7	2137.6	678.6	2816.2	2112.2	422.4	2534.6	36,791.41
	2023	847	4328.2	65893.5	3635.7	2181.4	692.5	2873.9	2155.4	431.1	2586.5	39,377.93
	2024	864	4415.0	70308.5	3708.6	2225.2	706.4	2931.6	2198.7	439.7	2638.4	42,016.35
	2025	882	4507.0	74815.5	3785.9	2271.5	721.1	2992.7	2244.5	448.9	2693.4	44,709.75
20	2026	900	4599.0	79414.5	3863.2	2317.9	735.8	3053.7	2290.3	458.1	2748.4	47,458.11
	2027	918	4691.0	84105.5	3940.4	2364.3	750.6	3114.8	2336.1	467.2	2803.3	50,261.44
	2028	937	4788.1	88893.6	4022.0	2413.2	766.1	3179.3	2384.5	476.9	2861.4	53,122.79
	2029	956	4885.2	93778.7	4103.5	2462.1	781.6	3243.7	2432.8	486.6	2919.4	56,042.16
Design criteria	2030	976	4987.4	98766.1	4189.4	2513.6	798.0	3311.6	2483.7	496.7	2980.4	59,022.61

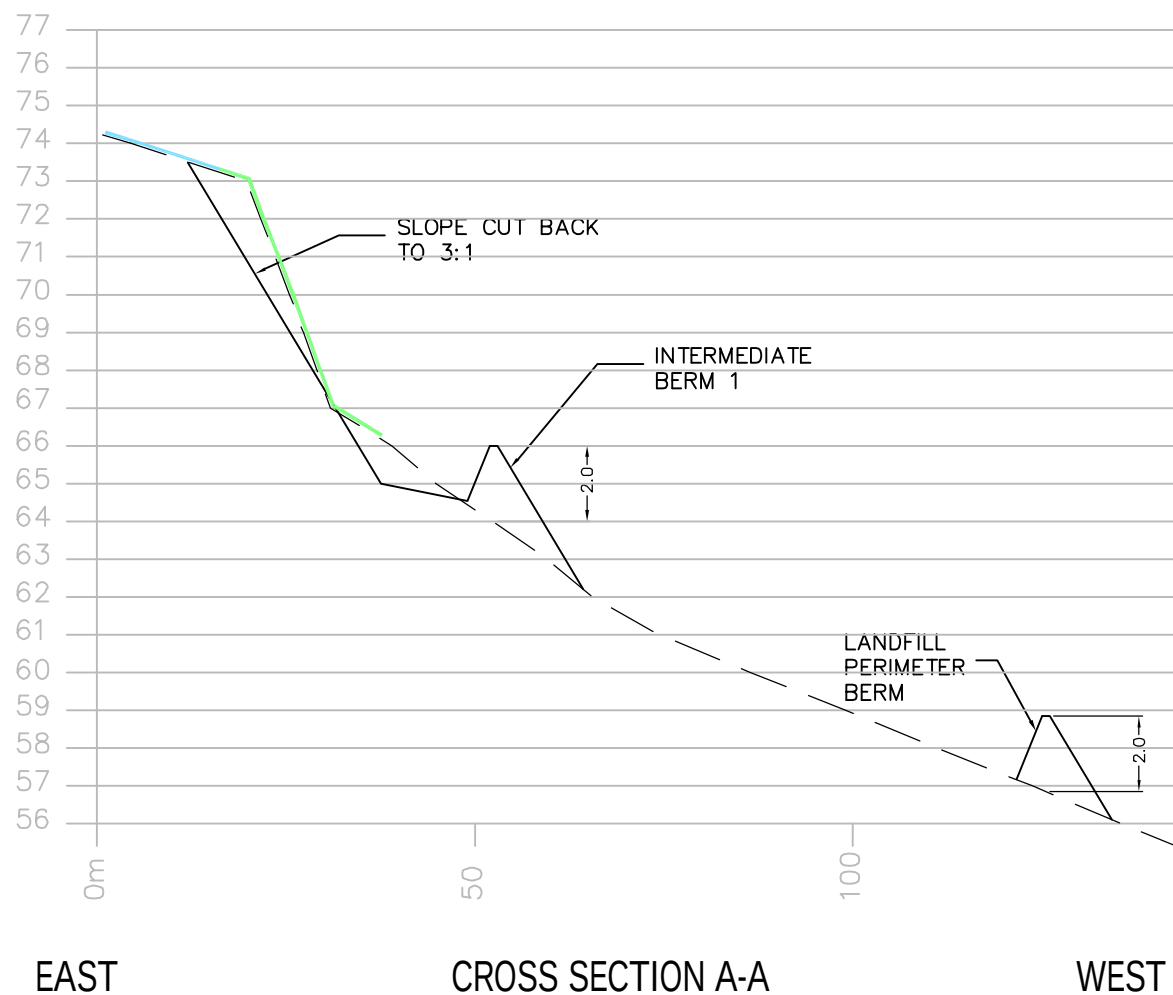
percentage remaining after burning 0.6



PLAN VIEW

SCALE 1:1000

ELEVATION
(m amsl)



CROSS SECTION A-A

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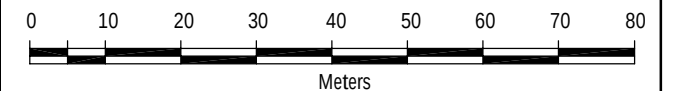
VERTICAL SCALE 1:200

FIGURE 10

THE HAMLET OF QIKIQTARJUAQ
DETAILED DESIGN

LANDFILL DEVELOPMENT 1 INITIAL SITE REDEVELOPMENT

Legend

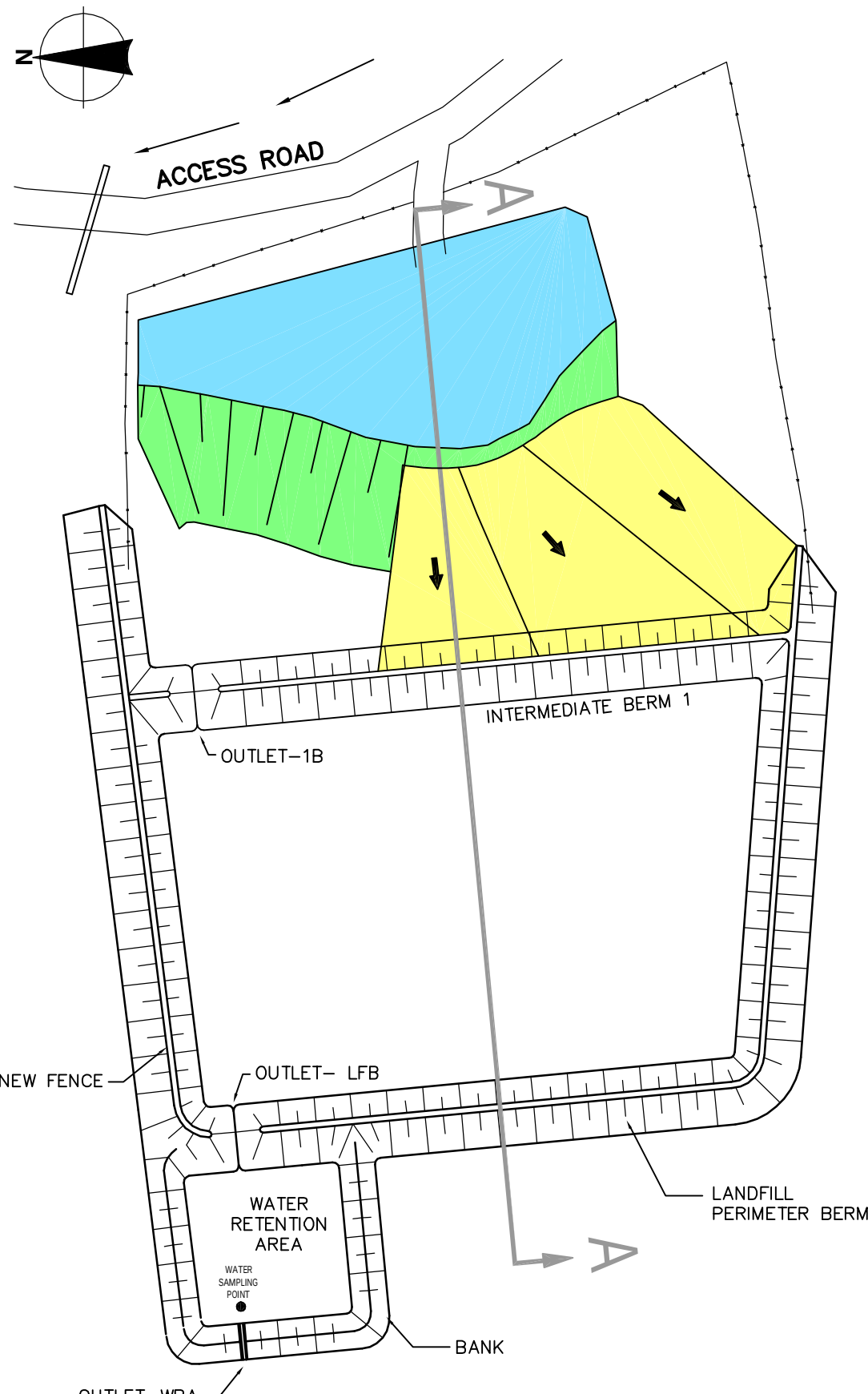


February 2006
Project Number: FOE 08 983

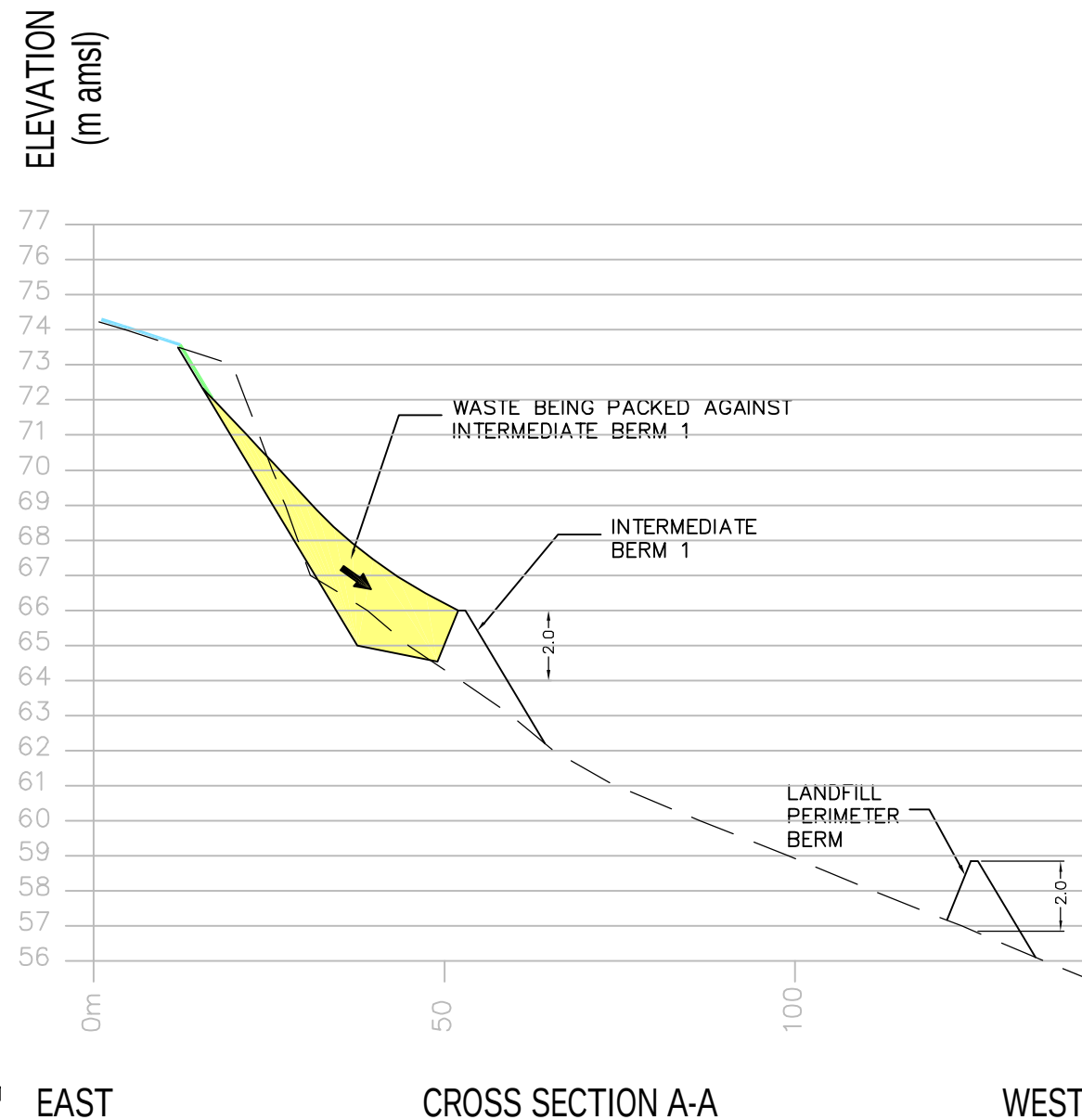
Prepared by: C. Sheppard

Verified by: K. Hunter

nuuna BURNSIDE



PLAN VIEW
SCALE 1:1000

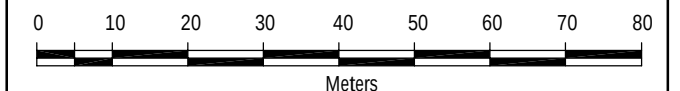


CROSS SECTION A-A
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:200

FIGURE 11
THE HAMLET OF QIKIQTARJUAQ
DETAILED DESIGN
LANDFILL DEVELOPMENT 2
FILL TO INTERMEDIATE BERM 1

Legend

- LANDFILL TIPPING AREA**
- LANDFILL SIDE SLOPE**
- WASTE CELLS No. 1**

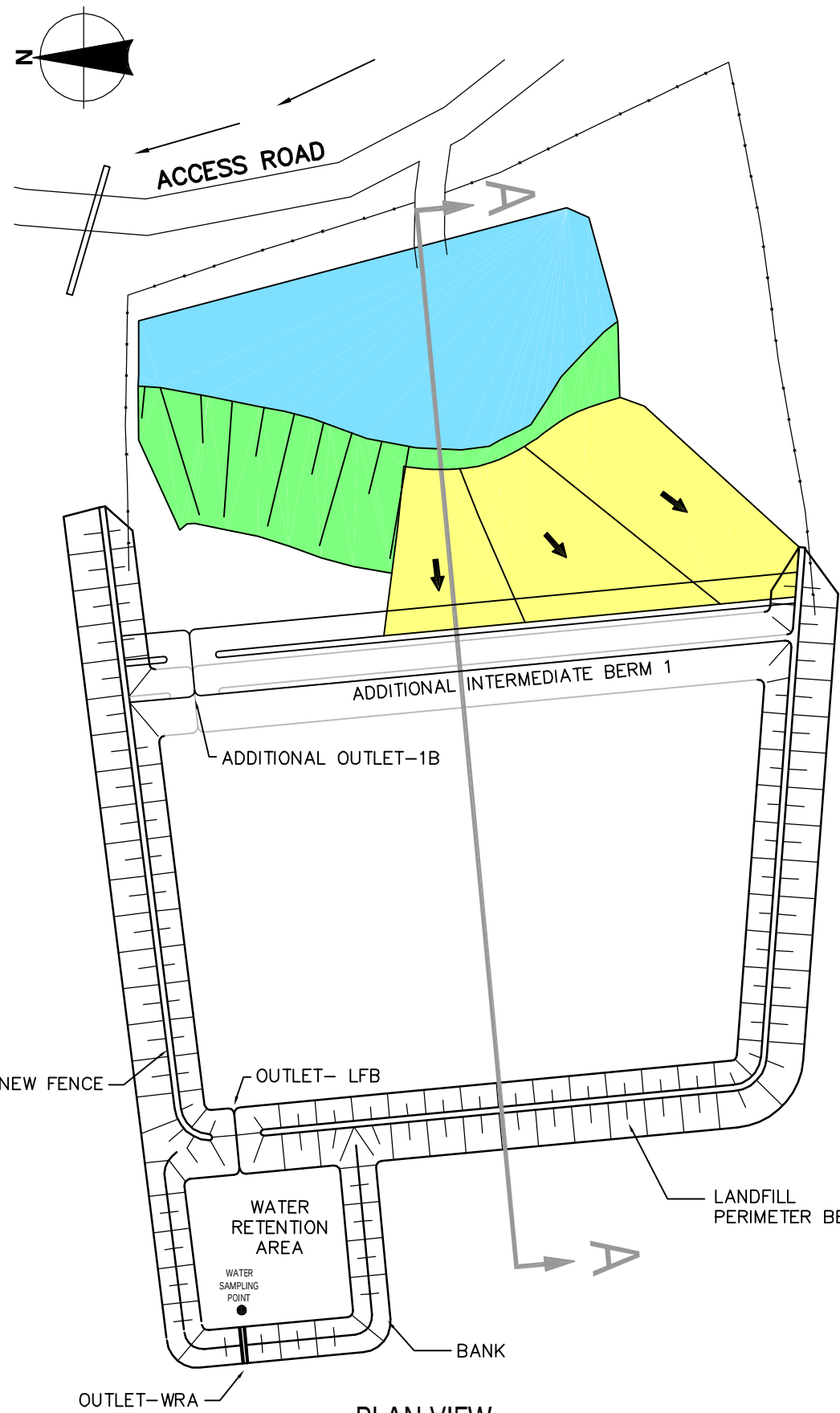


February 2006
Project Number: FOE 08 983

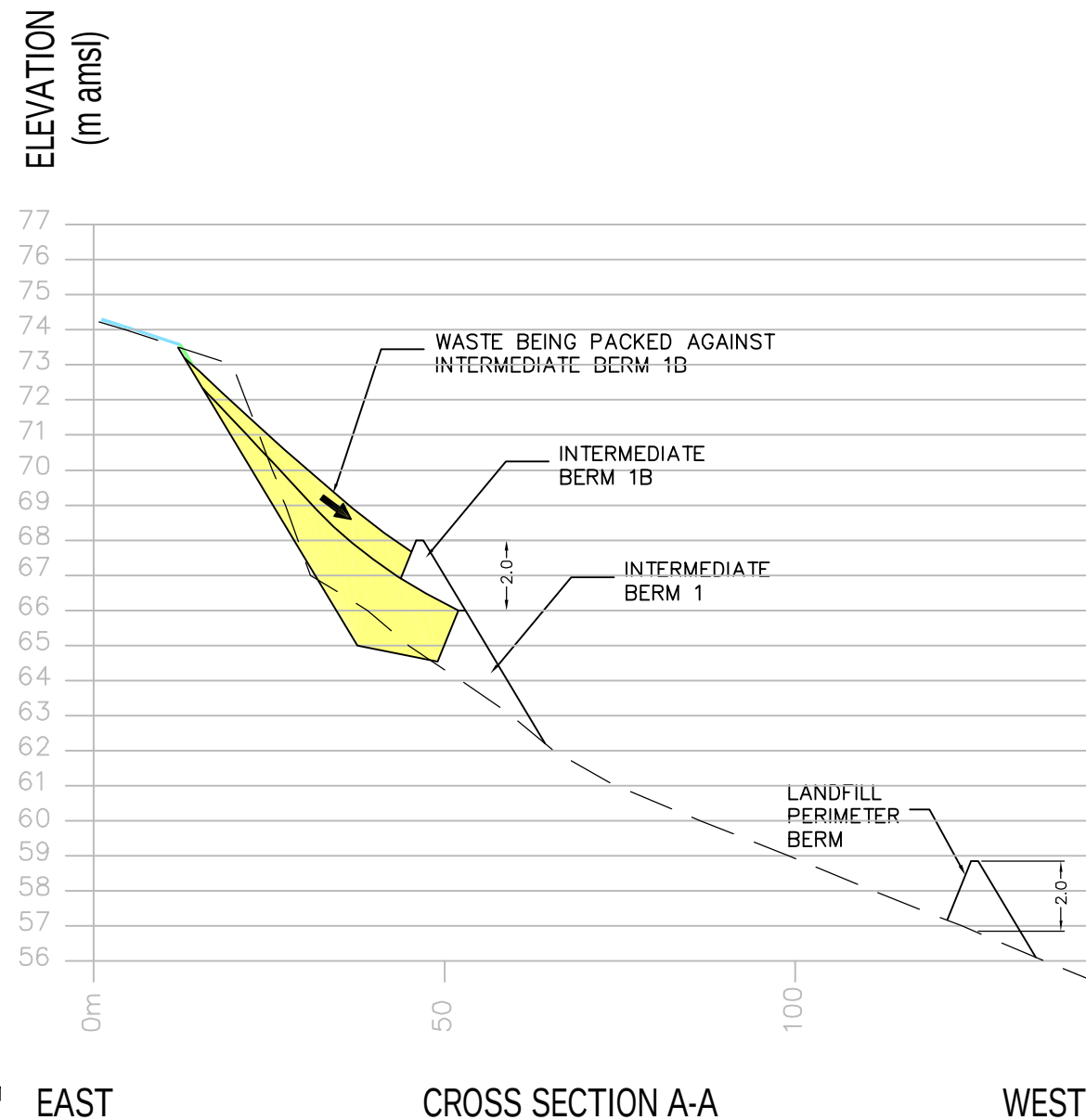
Prepared by: C. Sheppard

Verified by: K. Hunter





PLAN VIEW
SCALE 1:1000



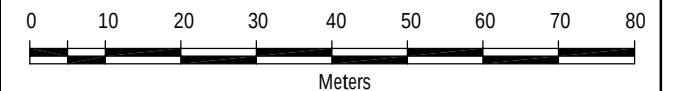
CROSS SECTION A-A
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:200

NOTE
SITE OPERATORS MAY ELECT TO INSTALL AN ADDITIONAL VERTICAL BERM
IF CONSTRUCTION WASTES WITH 3:1 SLOPE IS PROBLEMATIC

FIGURE 12
THE HAMLET OF QIKIQTARJUAQ
DETAILED DESIGN
LANDFILL DEVELOPMENT 2B
OPTIONAL CONSTRUCTION OF
ADDITIONAL BERM

Legend

- LANDFILL TIPPING AREA**
- LANDFILL SIDE SLOPE**
- WASTE CELLS No. 1**

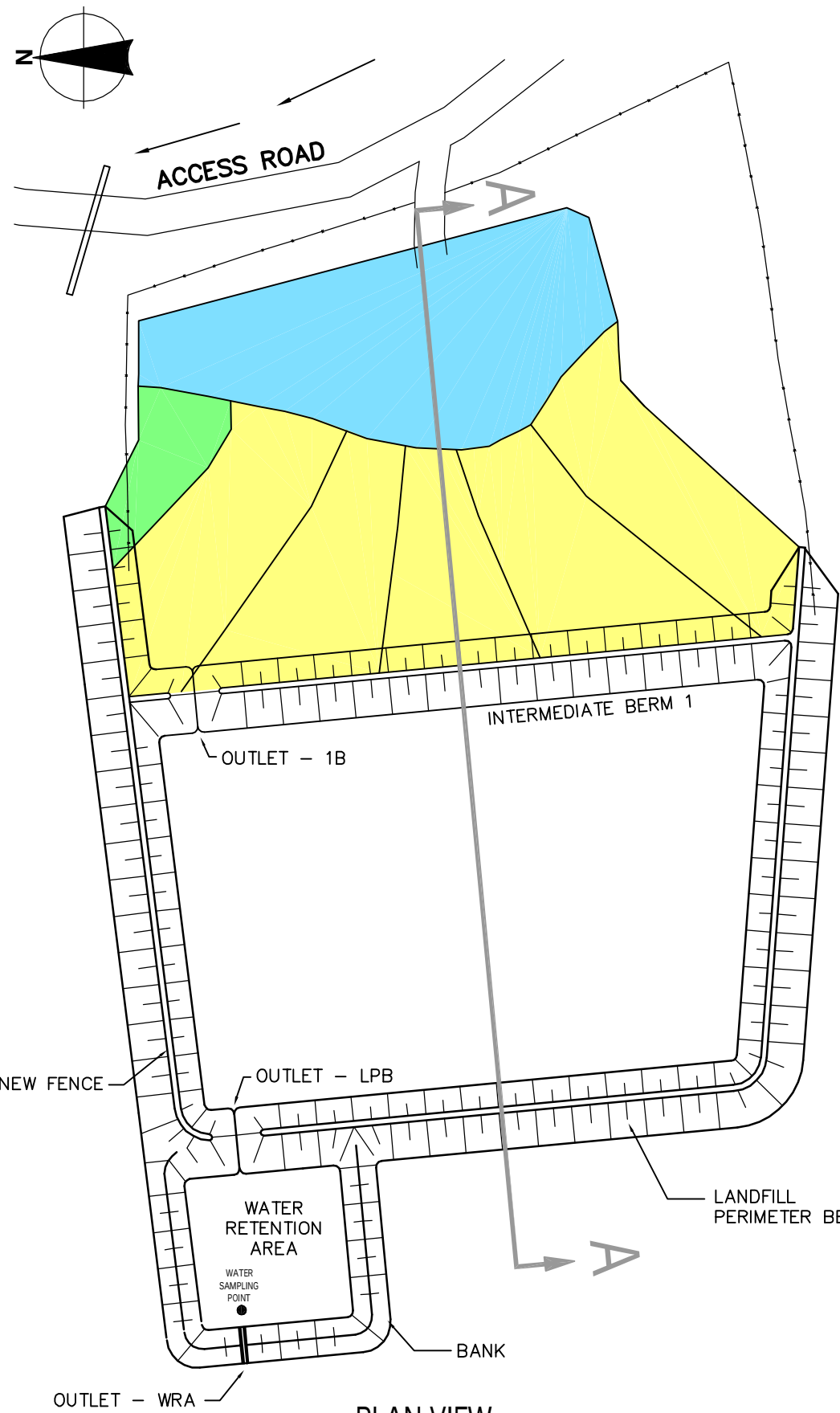


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Project Number: F0E 08 983

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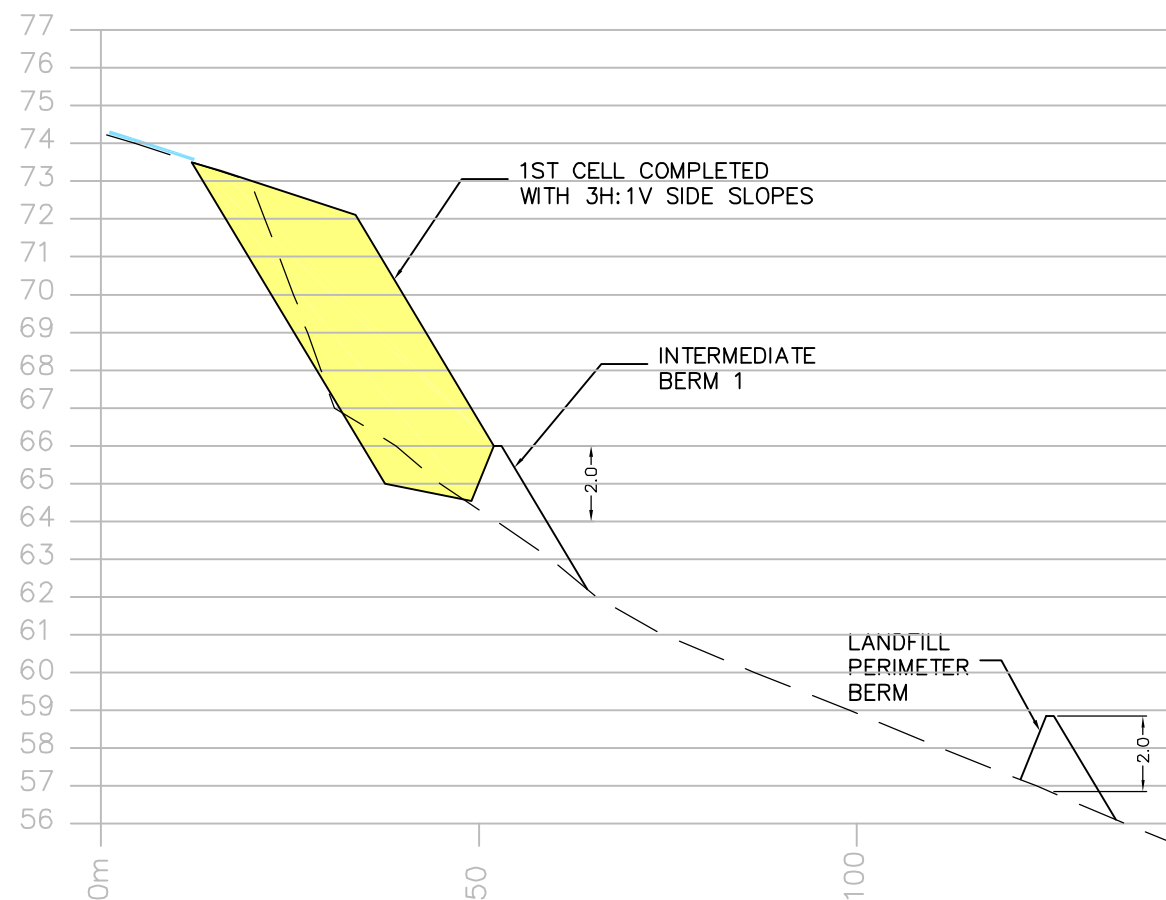
ᑎᓄᓐᑎᓐ BURNSIDE



PLAN VIEW

SCALE 1:1000

ELEVATION
(m amsl)



CROSS SECTION A-A

HORIZONTAL SCALE 1:1000

VERTICAL SCALE 1:200

EAST

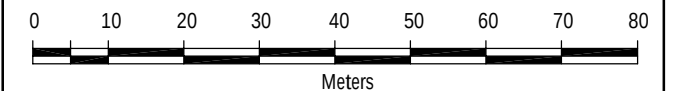
WEST

FIGURE 13

THE HAMLET OF QIKIQTARJUAQ
DETAILED DESIGN

LANDFILL DEVELOPMENT 3
1ST WASTE CELL COMPLETED

Legend



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Verified by: K. Hunter

nuña BURNSIDE

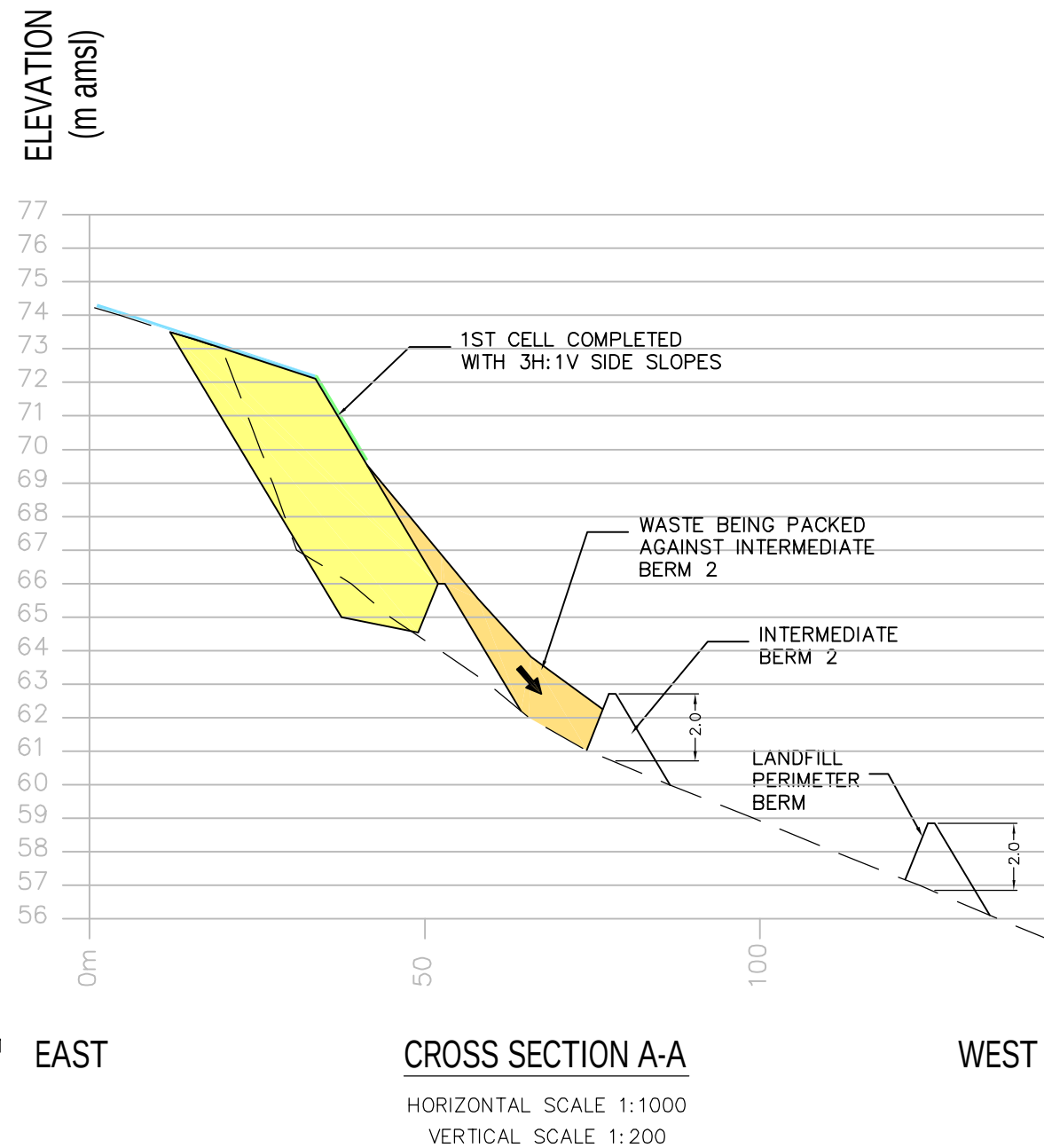
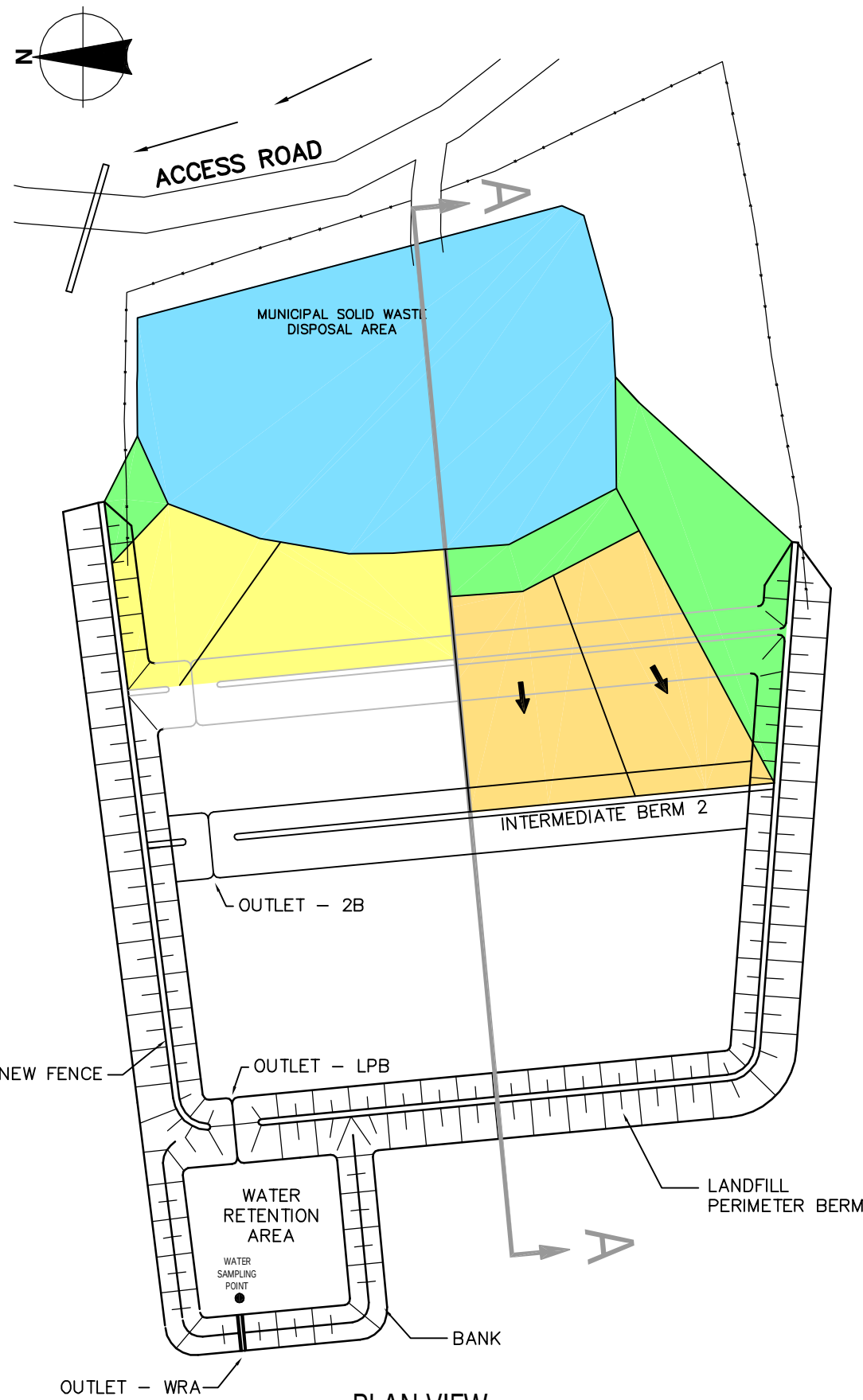
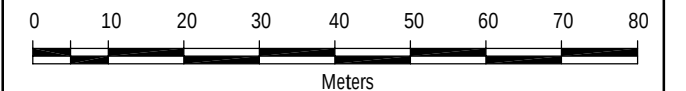


FIGURE 14
THE HAMLET OF QIKIQTARJUAQ
DETAILED DESIGN
LANDFILL DEVELOPMENT 4
BEGIN FILLING TO
INTERMEDIATE BERM 2

Legend

- LANDFILL TIPPING AREA**
- LANDFILL SIDE SLOPE**
- WASTE CELLS No. 1**
- WASTE CELLS No. 2**

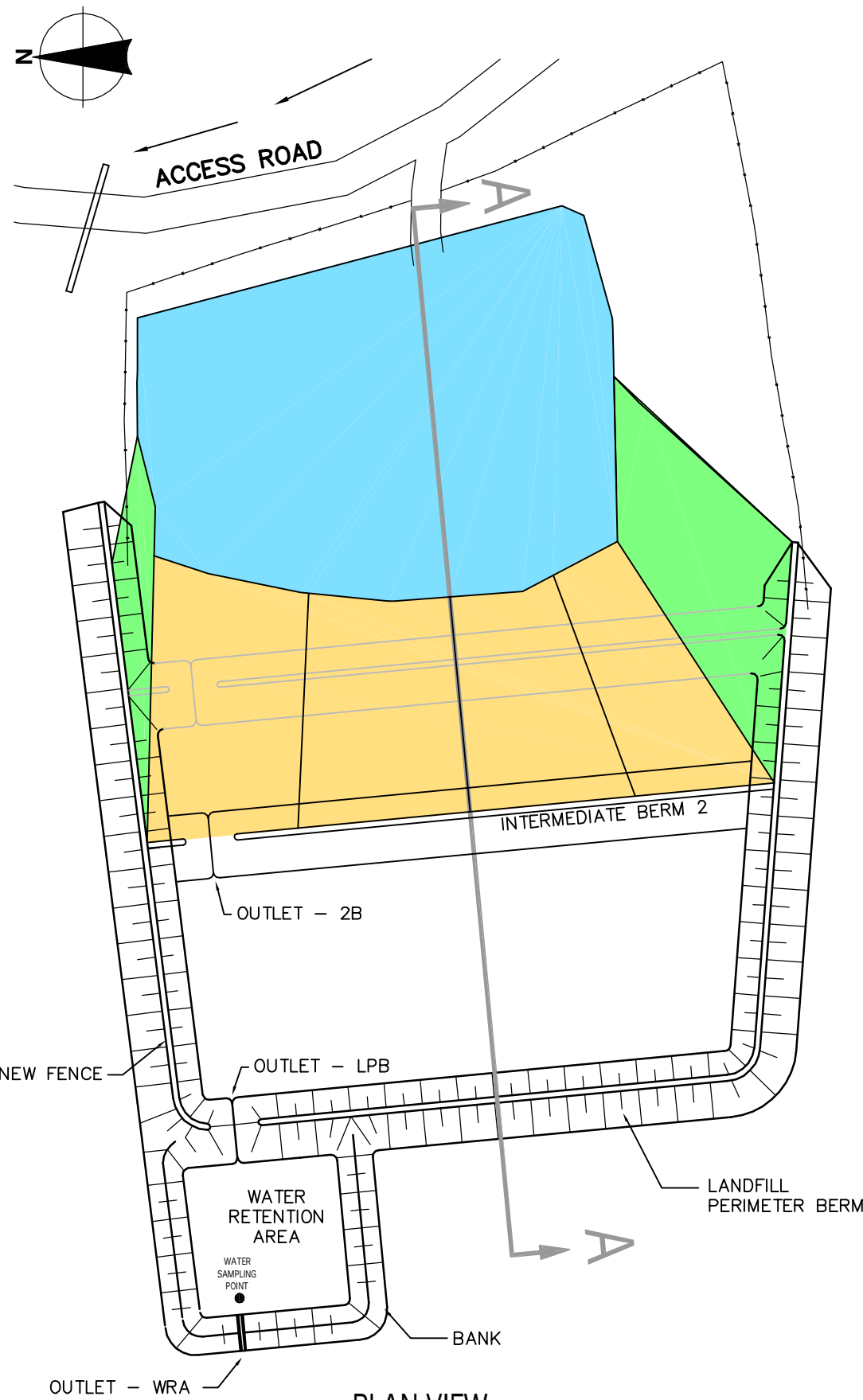


February 2006
Project Number: F0E 08 983

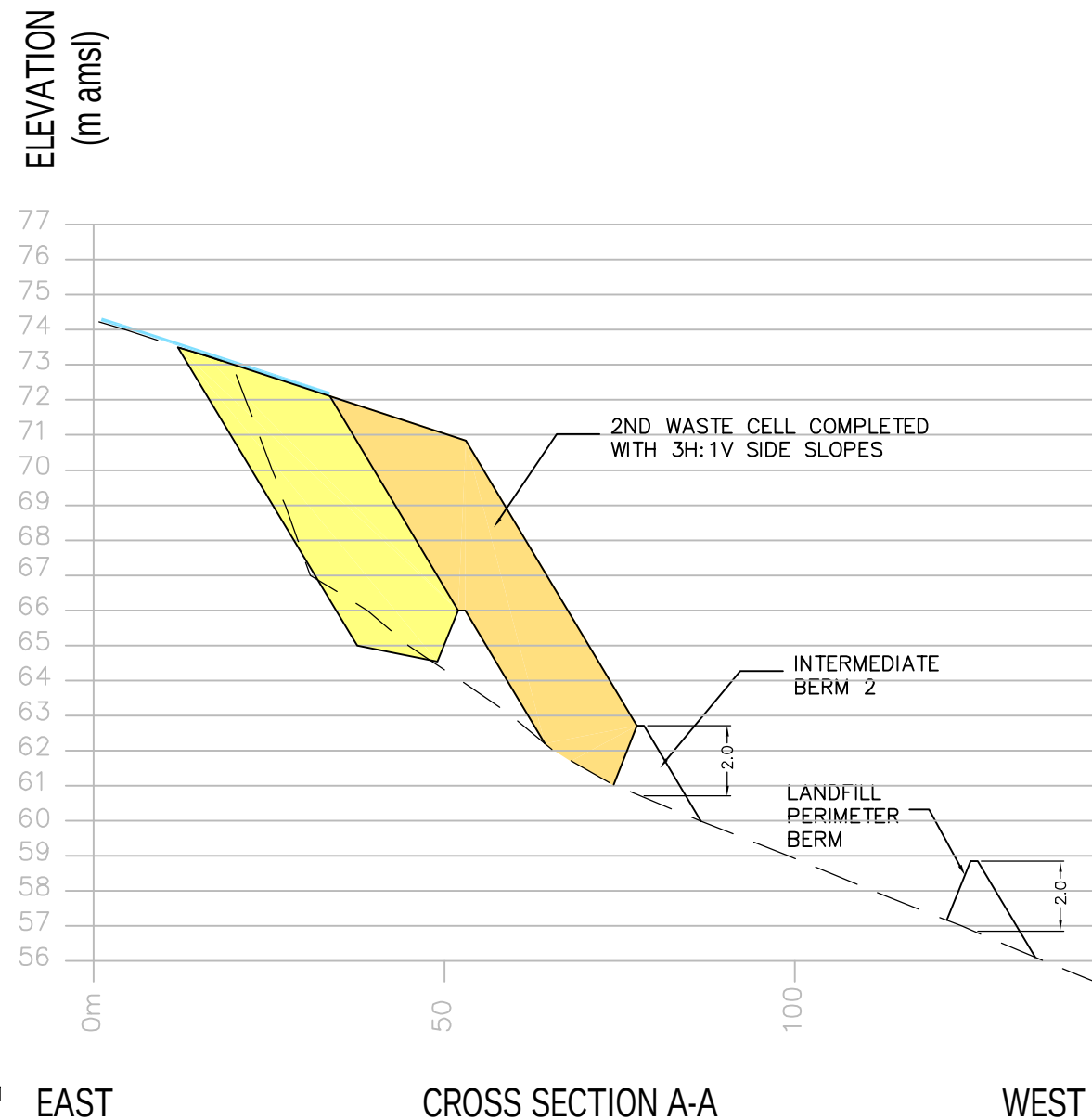
Prepared by: C. Sheppard

Verified by: K. Hunter





PLAN VIEW
SCALE 1:1000

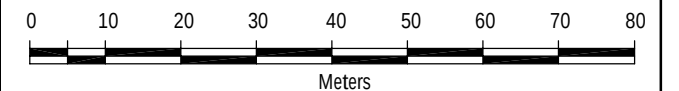


CROSS SECTION A-A
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:200

FIGURE 15
THE HAMLET OF QIKIQTARJUAQ
DETAILED DESIGN
LANDFILL DEVELOPMENT 5
2ND WASTE CELL COMPLETED

Legend

- LANDFILL TIPPING AREA**
- LANDFILL SIDE SLOPE**
- WASTE CELLS No. 1**
- WASTE CELLS No. 2**

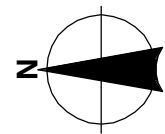


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Verified by: K. Hunter





ACCESS ROAD

A

A

NEW FENCE

OUTLET - LPB

WATER
RETENTION
AREA

WATER
SAMPLING
POINT

BANK

OUTLET - WRA

PLAN VIEW

SCALE 1:1000

ELEVATION
(m amsl)

77
76
75
74
73
72
71
70
69
68
67
66
65
64
63
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61
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59
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57
56

EAST

CROSS SECTION A-A

HORIZONTAL SCALE 1:1000

VERTICAL SCALE 1:200

WEST

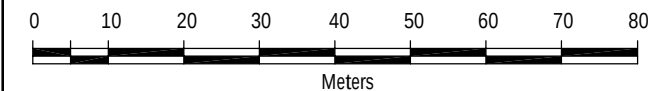
ALL WASTE CELLS COMPLETED
WITH 3H:1V SIDE SLOPES

LANDFILL
PERIMETER
BERM

2.0

Legend

- LANDFILL TIPPING AREA
- LANDFILL SIDE SLOPE
- WASTE CELLS No. 1
- WASTE CELLS No. 2
- WASTE CELLS No. 3
- WASTE CELLS No. 4



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Burnside

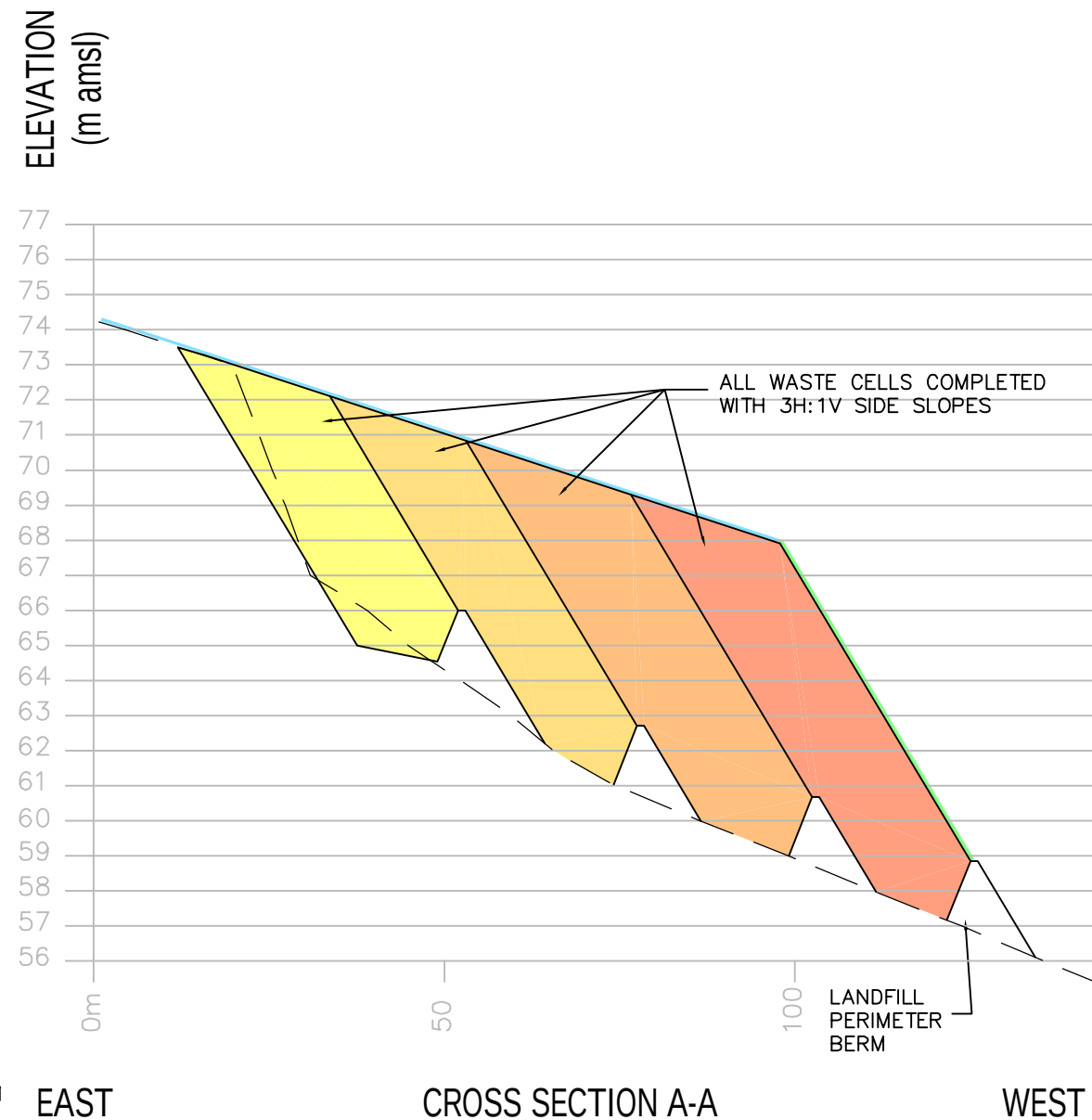
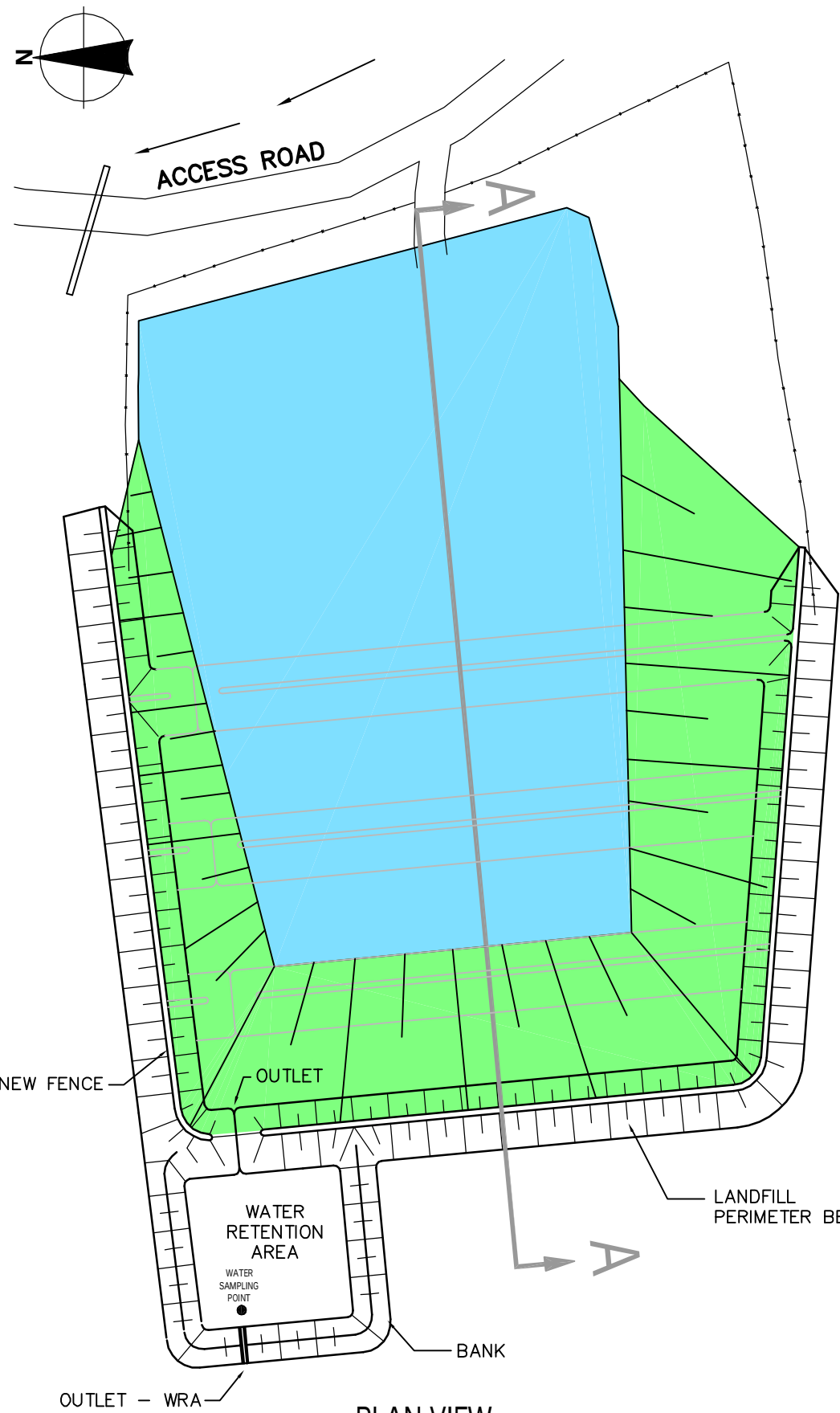
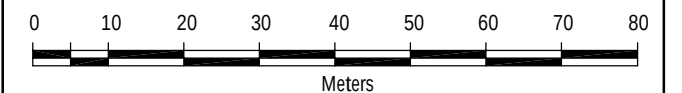


FIGURE 17
THE HAMLET OF QIKIQTARJUAQ
DETAILED DESIGN
LANDFILL DEVELOPMENT 7
FINAL SITE CONFIGURATION

Legend

- LANDFILL TIPPING AREA**
- LANDFILL SIDE SLOPE**
- WASTE CELLS No. 1**
- WASTE CELLS No. 2**
- WASTE CELLS No. 3**
- WASTE CELLS No. 4**



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Project Number: FOE 08 983

Prepared by: C. Sheppard

Verified by: K. Hunter

Burnside

5.6.2 Recommended Operational Improvements

Improved operational procedures are detailed in the Operation and Maintenance manual (Appendix H3), which achieve the following objectives:

- Provides higher level of safety than the current practice of dumping on the slope (reduced risk of slope failure and minimization of accident potential (i.e., falling over the edge))
- Organizes and controls development of the landfill to reduce the size and therefore the potential impacts
- Reduces the amount of cover required and the time to cover the material.

Instead of dumping wastes over the edge of the landfill, the wastes are pushing downslope using a dozer or loader for eventual lift development along a berm or working face. Once per year, for duration of approximately 1 to 2 weeks, the staff or sub-contractors will perform an annual shaping of the wastes. The purpose of this shaping is to:

- Fix any irregularities in the surface
- Ensure proper progressive development of the landfill
- Facilitate the placement of intermediate cover.

During this annual shaping, additional berms will be constructed as required to facilitate further development of the site.

General maintenance activities are required to ensure that the site remains in good operating order. This involves repairing damaged features, cleaning the site, and monitoring.

As per the requirements of the Water Board license report is to be prepared and submitted to the Nunavut Water Board once per year.

5.7 Water Board License Requirements

Nunavut Water Board License No. NW133Q1K0106 (Appendix C) technically expired November 28, 2005. The requirements of the license with respect to solid waste disposal are addressed as described in the following sections.

5.7.1 Annual Report

The requirements for annual reporting in 2005 were fulfilled in detail in the report entitled (Schematic Design for Improvement of the Water Reservoir, Wastewater Lagoon

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and Solid Waste Disposal Facility in the Hamlet of Qikiqtarjuaq, Nunavut by Nuna Burnside dated September 2005.

Future reporting will be conducted as per the Operations and Maintenance Plan included in this report.

5.7.2 Operations and Maintenance (O&M) Plan

The O&M Plan required by the License is included in Appendix H3.

5.7.3 Abandonment and Restoration

The work required to address the abandonment and restoration at the former waste disposal site now used as a Bulky Metals Disposal Area will consist of application of cover material and construction of ditching to reduce erosion of the cover. The work is described in this report as part of the Bulky Metals Disposal Area improvements.

5.7.4 Surveillance Network Program

The current Water Board license requires in Schedule 1 sampling and analysis of water from ten locations. Of these two (0640-7 and 0640-10) relate specifically to the solid waste disposal facility. One monitoring station will be established down gradient of the landfill at the water retention pond. Another monitoring station will be further down stream coincidental with the sewage lagoon down stream sampling location.

Sampling methodology and analysis parameters are included in the O&M Plan.

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Sewage Lagoon, and Solid Waste Disposal Facility
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6.0 Cost Estimates

A Class “B” cost estimate was determined based on the design of each of the facilities described in this document. Appendix I provides tables with the details of the cost estimates.

The following key assumptions were made to develop these cost estimates:

- Capital costs for each of the facilities include construction, supply, delivery and installation of necessary materials and equipment
- The capital cost estimates do not include other management expense such as operation and maintenance for the facilities, the collection and trucking of wastes to the sewage lagoon or landfill, the distribution of water via tanker truck nor do these include community, training, community liaison, etc.
- Costs are based on the equipment and manpower currently available in the community as per the Hamlet’s municipal service rates by-law and discussions with the Hamlet’s Senior Administrative Officer (SAO)
- All equipment and material on the site that are in good condition will be salvaged and incorporated or utilized in the construction to the fullest extent possible.

These assumptions together with the detailed design drawings were used to determine the corresponding costs estimates for each facility as presented below. The total estimated cost to undertake the improvements to the water reservoir, sewage lagoon, and solid waste facilities to meet the objectives of this project is \$3,350,000.

Class “B” Construction Cost Estimate of Improvements to the Hamlet’s Facilities

Facility	Cost Estimate
Schedule A – Miscellaneous	\$280,000
Water Storage and Treatment Facility	\$2,300,000
Sewage Storage and Treatment System	\$570,000
Solid Waste Disposal Facility	\$200,000

The above does not include engineering, contingences, or GST.

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It should be noted that the overall costs have increased substantially due to the increase in projected volumes for the water reservoir and sewage lagoon.

As indicated in this report, the schematic design costs for the sewage lagoon were based on the existing lagoon having a depth of 8 m. The lagoon depth is actually 4 m (including freeboard). This resulted in an expansion of the new lagoon to provide the additional capacity to meet the revised storage volume requirements.

The schematic design also carried costs for a water reservoir that was 90 x 127 m, which has been revised to 90 x 156 m. This has resulted in a 30 percent increase in the liner costs. The other increase in costs is due to the phasing of the construction. The original thought was to utilize the existing berm material to construct the new berm. Constructing a new berm and then excavating the inside berm results in additional costs to the project.

Detailed Design Report for the Improvements to the Water Reservoir,
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7.0 Environmental Screening

There are some potential environmental concerns directly associated with the implementation of improvements to the water, sewage, and solid waste facilities in the Hamlet of Qikiqtarjuaq. As such, the GN approved a Change Order to the original scope of the project in order for a Canadian Environmental Assessment Act (CEAA) Environmental Screening Report (ESR) could be completed. An ESR following INAC's 2005/2006 CEAA Screening Report format was undertaken to identify potential concerns and provide appropriate procedures to avoid or mitigate potential adverse effects on the environment. The Environmental Screening Decision Form for each of the facilities is presented in Appendix J.

The screening decision number for all three facilities (water, sewage, and solid waste) is "01" which means that the project may proceed since all potentially adverse effects are mitigable with known technology, and therefore will be rendered insignificant.

Detailed Design Report for the Improvements to the Water Reservoir,
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8.0 References

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Detailed Design Report for the Improvements to the Water Reservoir,
Sewage Lagoon, and Solid Waste Disposal Facility
The Hamlet of Qikiqtarjuaq, Nunavut

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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.
Nuna Burnside Engineering and Environmental Ltd.
Email: mpaznar@nunaburnside.com
Web: www.nunaburnside.com

15 Townline, Orangeville, Ontario L9W 3R4
Tel: (519) 941-0342 x.278 Fax: (519) 941-8120

Box 175, 25 Third Avenue, Rankin Inlet, Nunavut X0C 0G0
Tel: (867) 645-2762 Fax: (867) 645-2765



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

The material in this report reflects best judgement in light of the information available at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Neegan Burnside accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Government of Nunavut, Department of Community and Government Services

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

November 2005

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1	Site Location
2	Bedrock Geology
3	Surficial Geology
4	Existing Wastewater Lagoon
5	Existing Landfill
6	Existing Water Reservoir

Appendices

A	Test Pit Logs
B	Photographs
C	Soil Testing Results

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

November 2005

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.

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

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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.

Geotechnical Evaluation of Options for Improvements to the
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Supplement to the Schematic Design Report (September 2005)
The Hamlet of Qikiqtarjuaq, Nunavut

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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 surficial 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.

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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.

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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.

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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.

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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 putrescible 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.

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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

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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

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- 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.

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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

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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.

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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..

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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

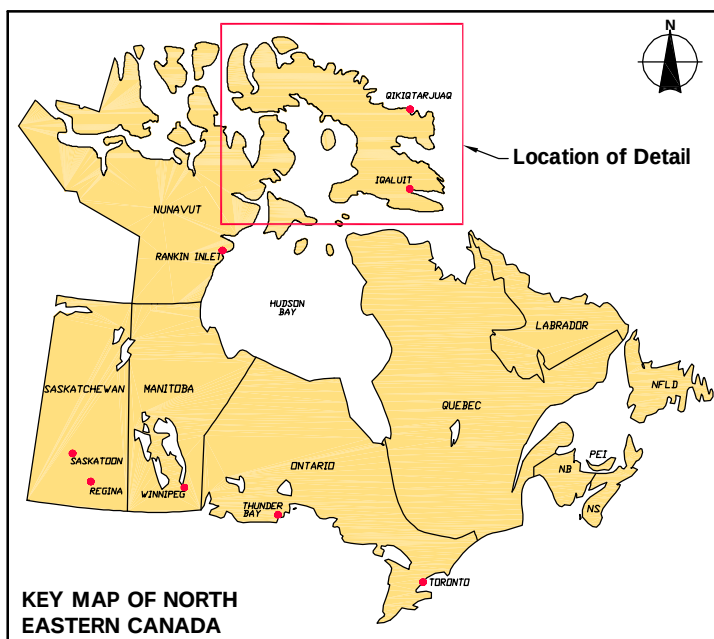
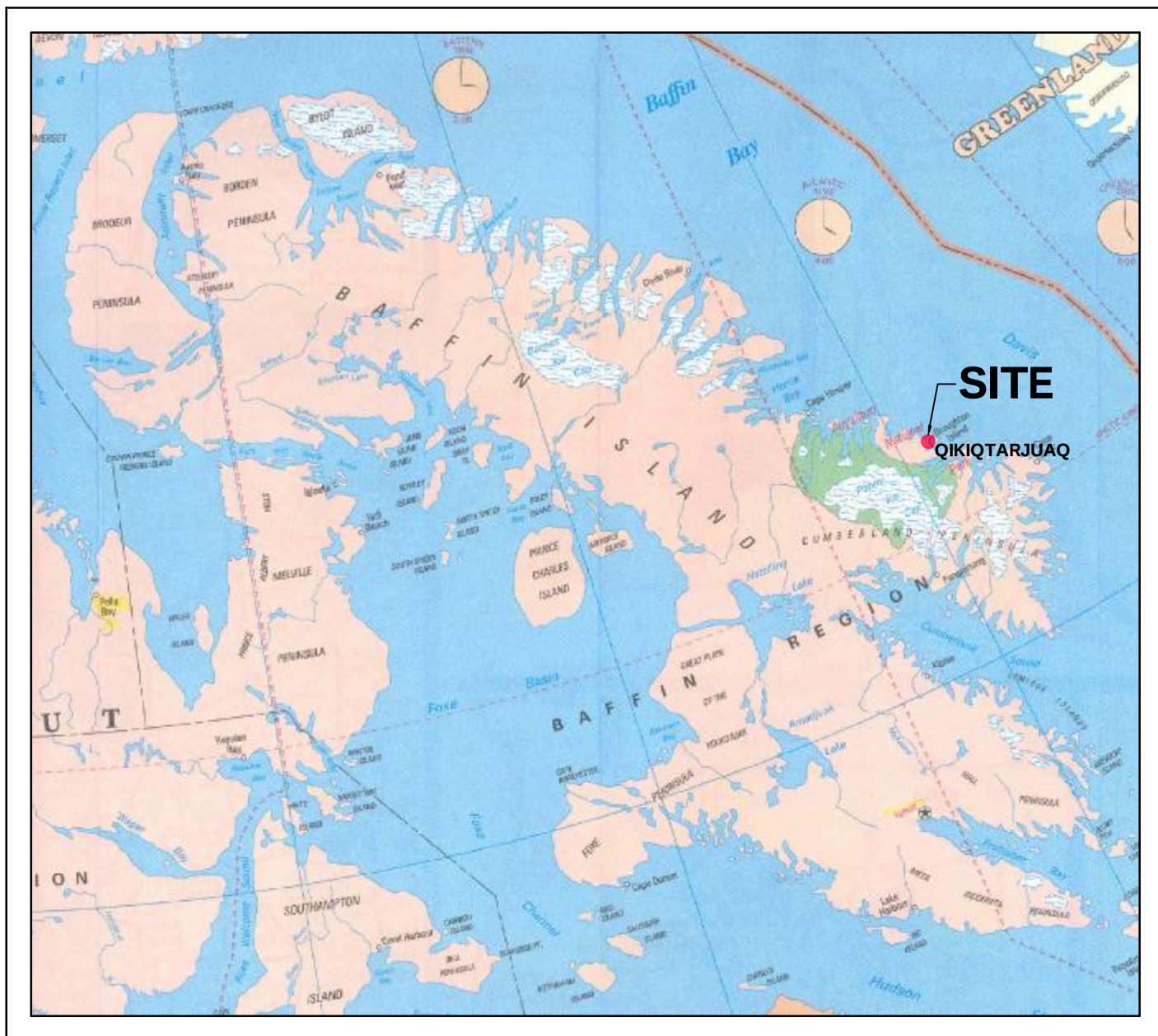


FIGURE 1 - SITE LOCATION MAP

THE HAMLET OF QIKIQTARJUAQ, NUNAVUT

GEOTECHNICAL EVALUATION

September 2005
 Project Number: N-O 09439.0

Prepared by: C. Sheppard

Verified by: J. Walls



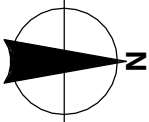
FIGURE 2

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, Okaa Bay - Padloping Island Area, District of Franklin, Northwest Territories, Geological Survey of Canada, Open File 3532, Scale 1:250,000



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

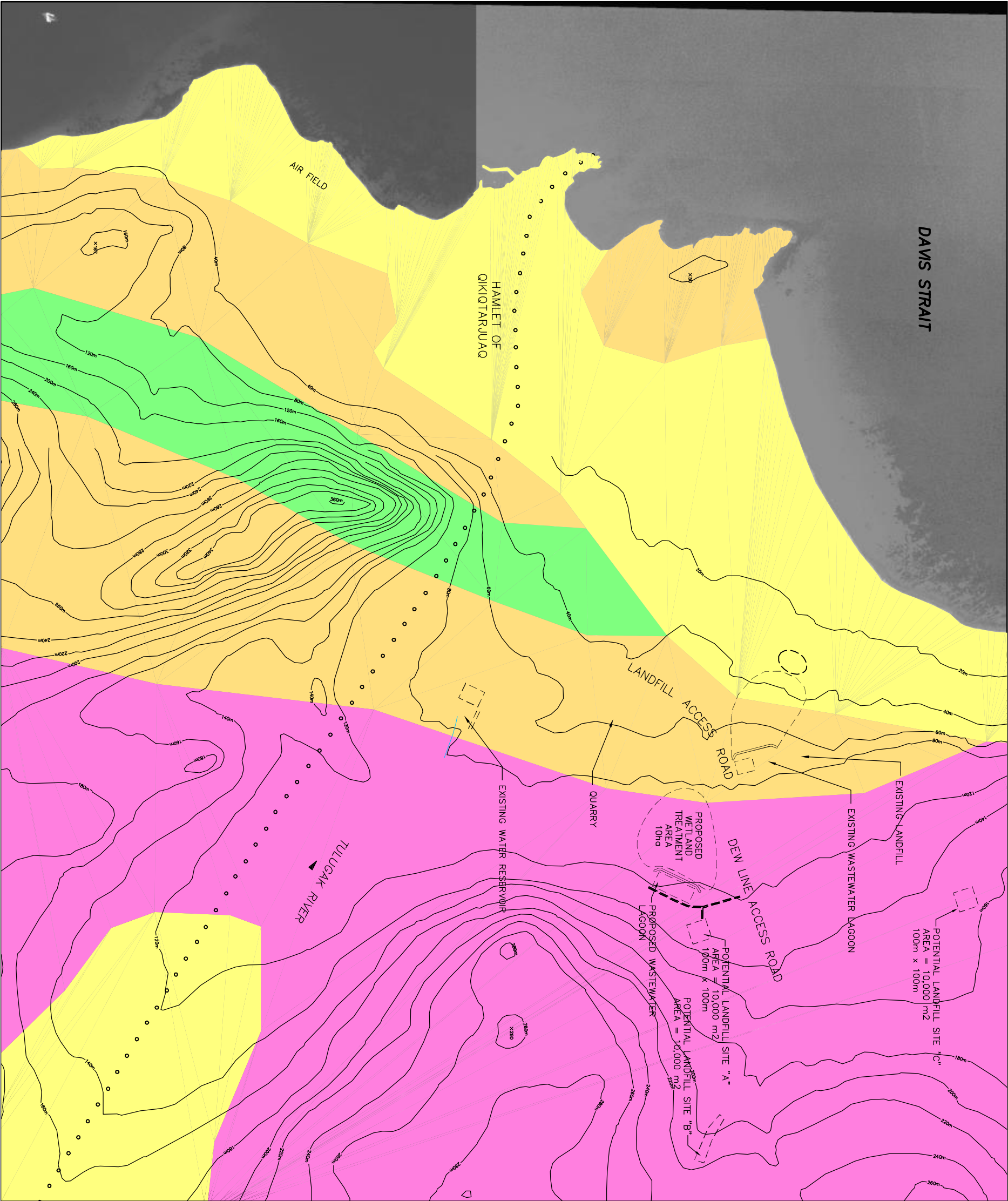
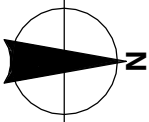


FIGURE 3
THE HAMLET OF QIKIQTARJUAQ
GEOTECHNICAL EVALUATION
SATELLITE IMAGERY OF
ENTIRE COMMUNITY AND
SURFICIAL GEOLOGY

- Legend
- EMERGED MARINE SEDIMENT
 - TILL
 - BEDROCK
 - RESIDUUM

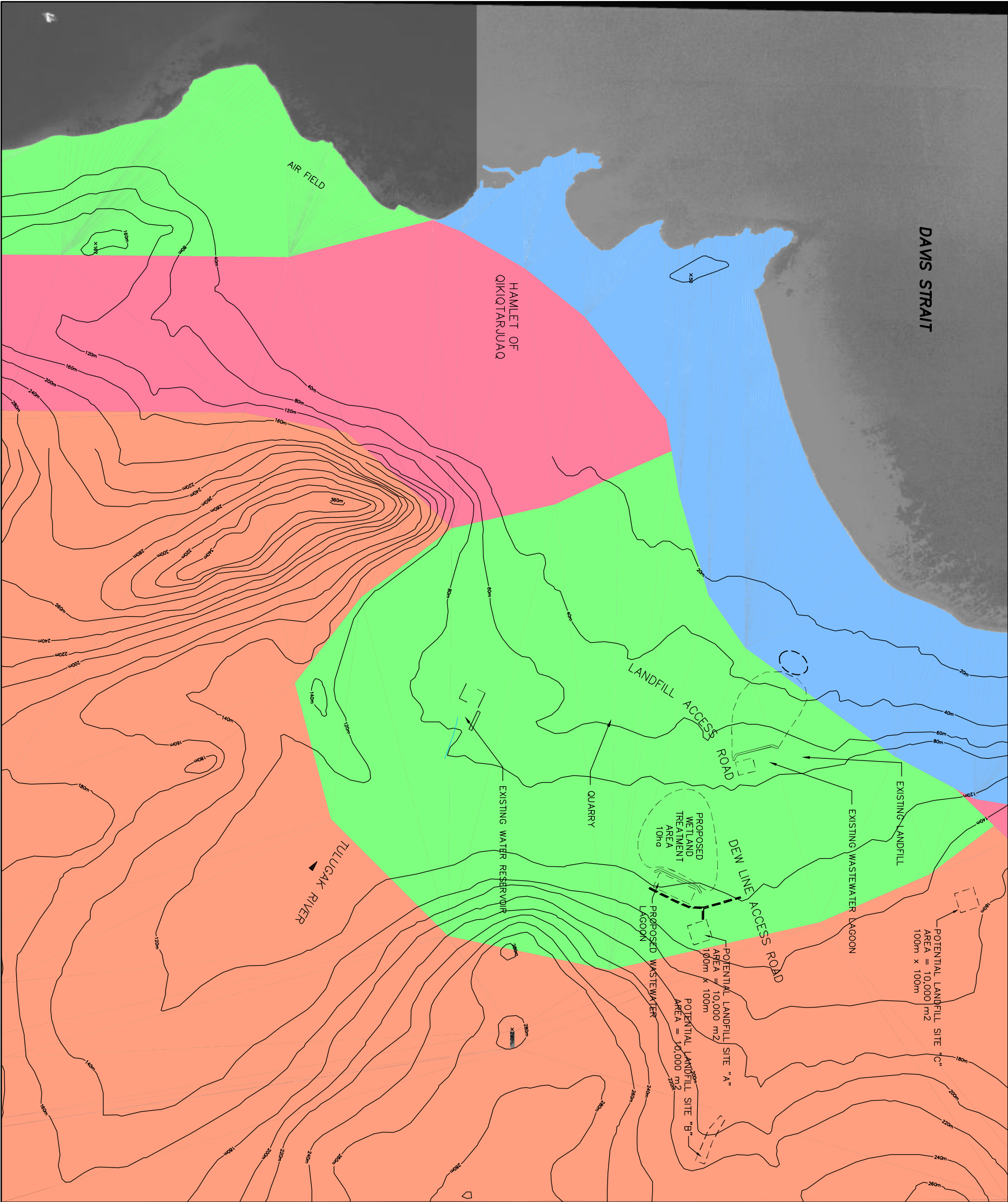
Satellite imagery Source:
September 2004 Satellite Image obtained from DigitalGlobe Inc.

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



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



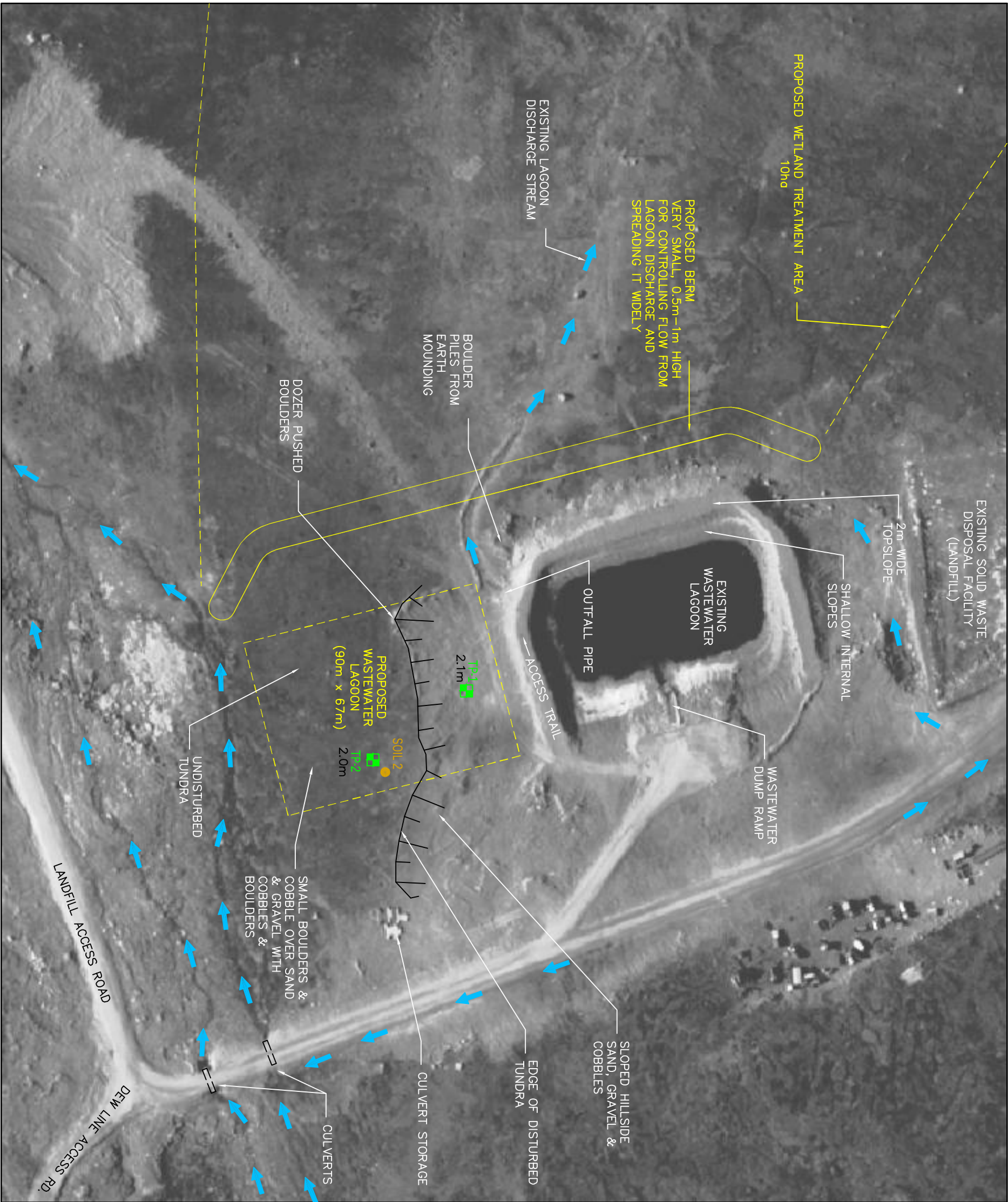
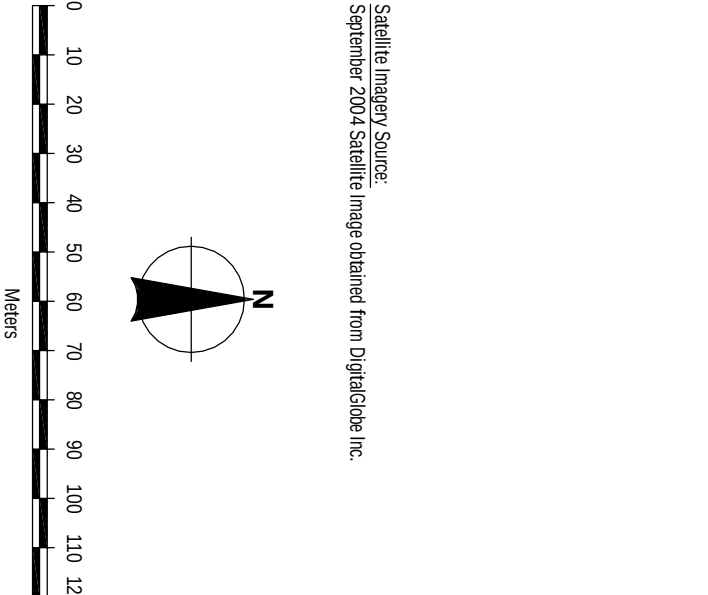


FIGURE 4
THE HAMLET OF QIKIQTARJUAQ
GEOTECHNICAL EVALUATION
EXISTING WASTEWATER
LAGOON

- Legend**
- INTERPRETED EXISTING SURFACE WATER FLOW DIRECTION
 - TEST PIT LOCATION & DEPTH IN METRES
 - SOIL SAMPLE LOCATION



1:1,500
September 2005
Project Number: N-0 09439.0
Projection: UTM Zone 20
Datum: NAD83
Prepared by: C. Sheppard
Verified by: J. Walls



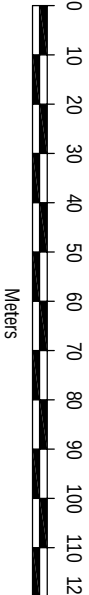
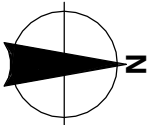
FIGURE 5
THE HAMLET OF QIKIQTARJUAQ
GEOTECHNICAL EVALUATION
EXISTING LANDFILL



Legend

- INTERPRETED EXISTING SURFACE WATER
FLOW DIRECTION
- SOIL-1
SOIL SAMPLE LOCATION

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

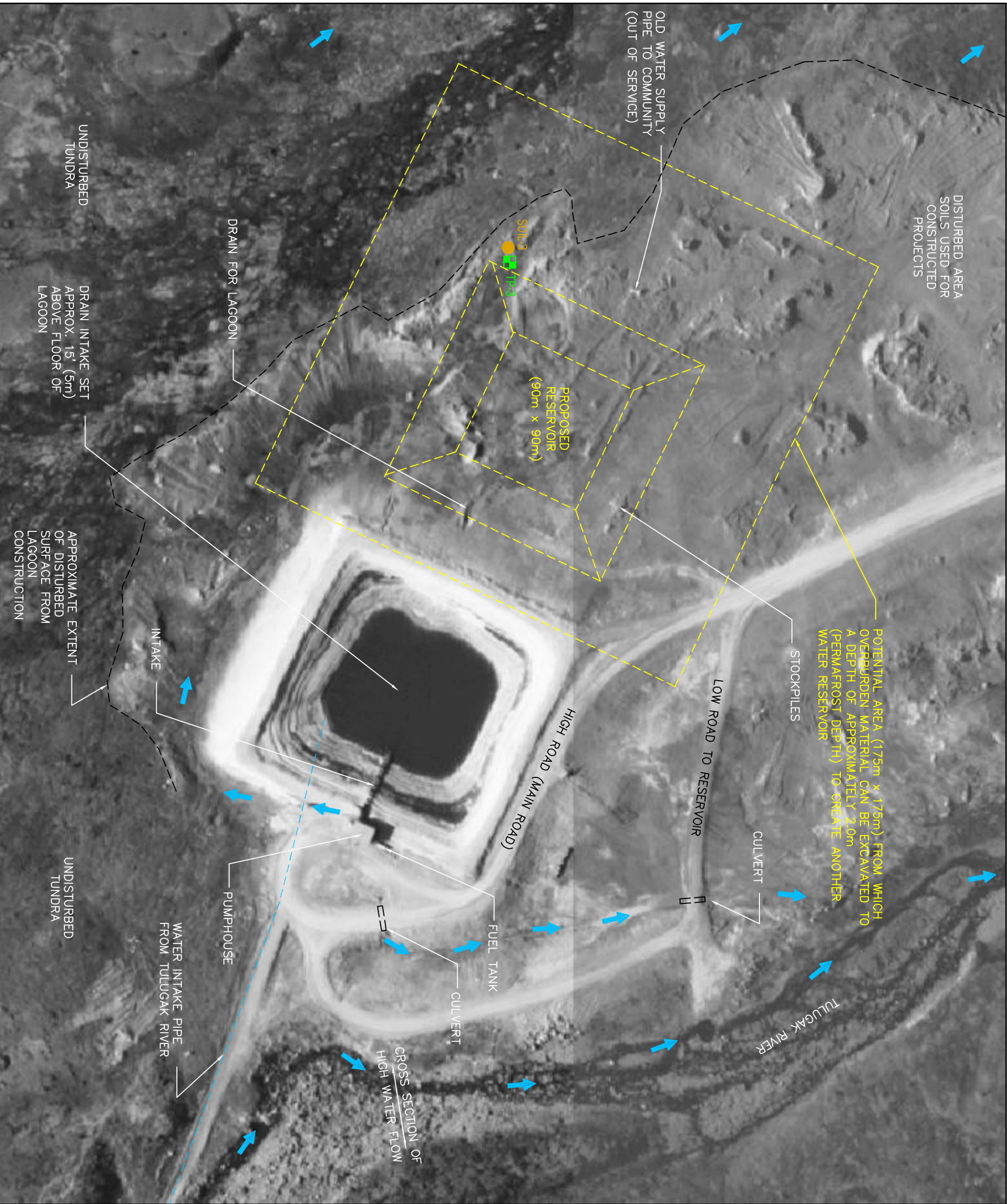


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September 2005
Project Number: N-0 09439.0
Projection: UTM Zone 20
Datum: NAD83
Prepared by: C. Sheppard
Verified by: J. Walls



FIGURE 6
THE HAMLET OF QIKIQTARJUAQ
GEOTECHNICAL EVALUATION

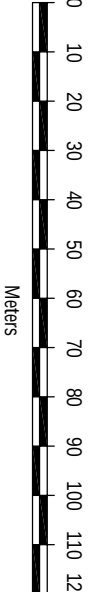
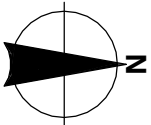
EXISTING WATER RESERVOIR



Legend

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

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



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September 2005
Project Number: N-0 09439.0
Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard
Verified by: J. Walls





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 silty 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.

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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

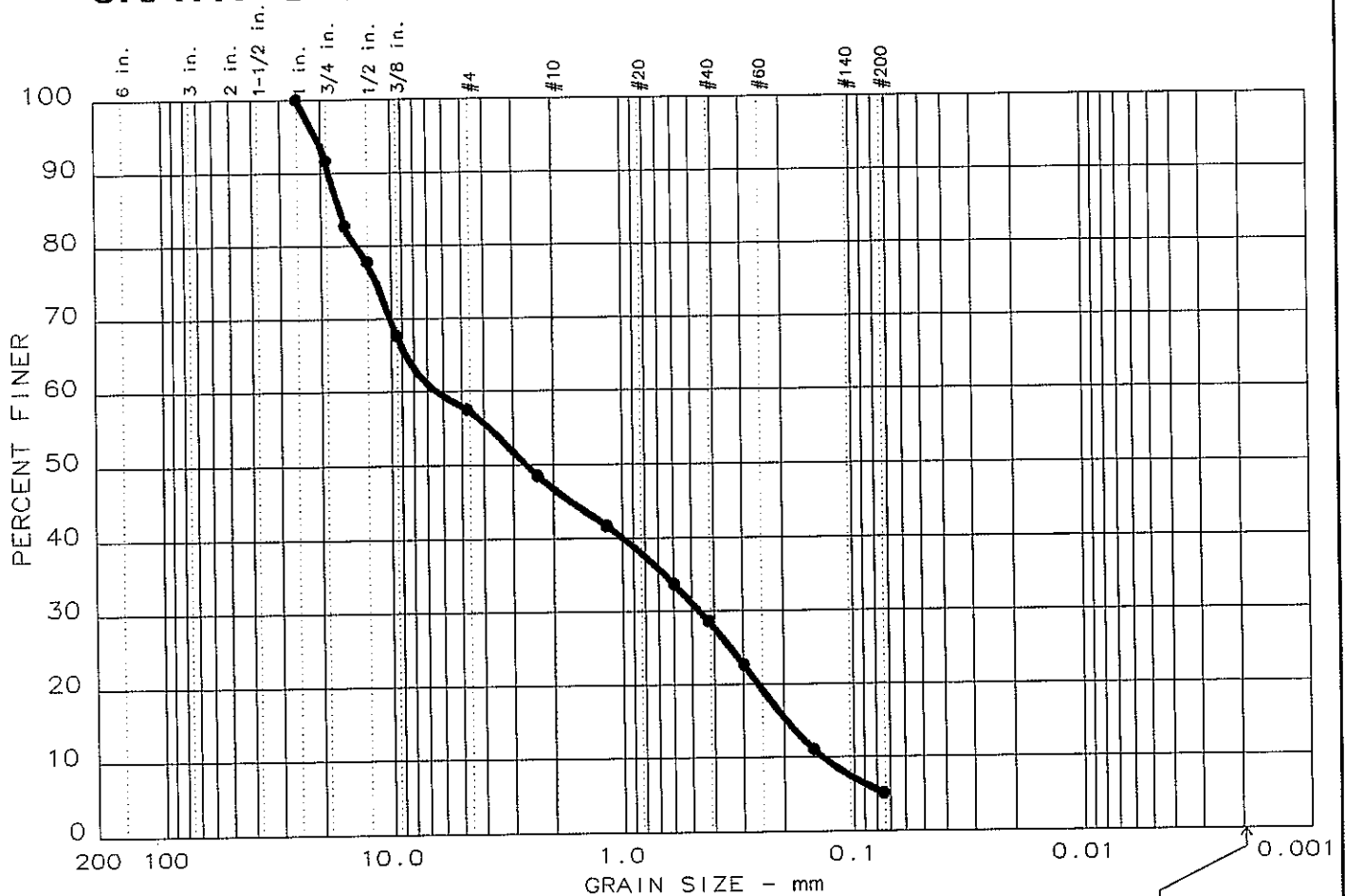
We enclose the Grain Size Distribution Test Reports for the samples received in our office on 17 October 2005. Originals will follow by mail.

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

Regards



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

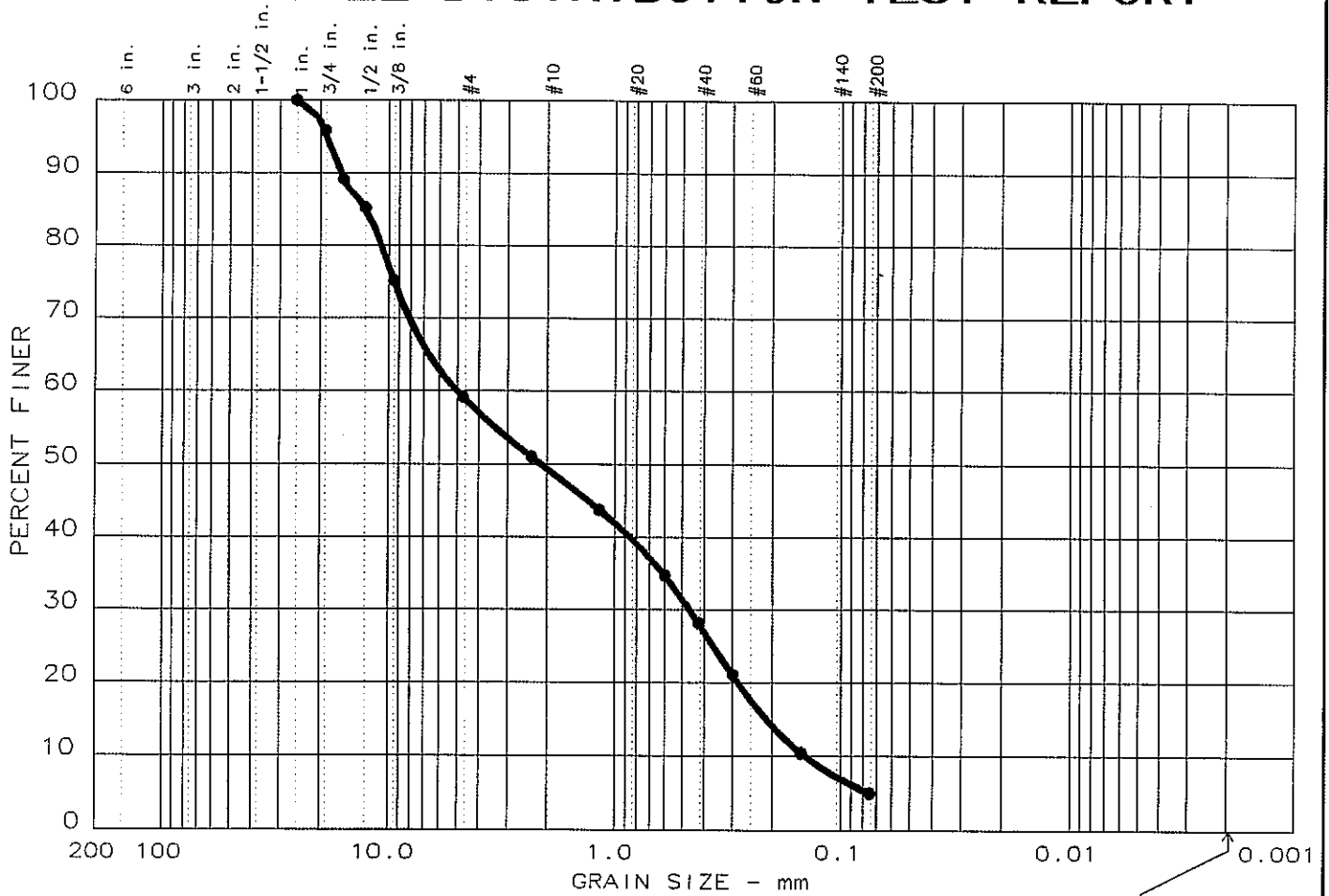
Date: 3 November 2005

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	

[illegible]

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

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

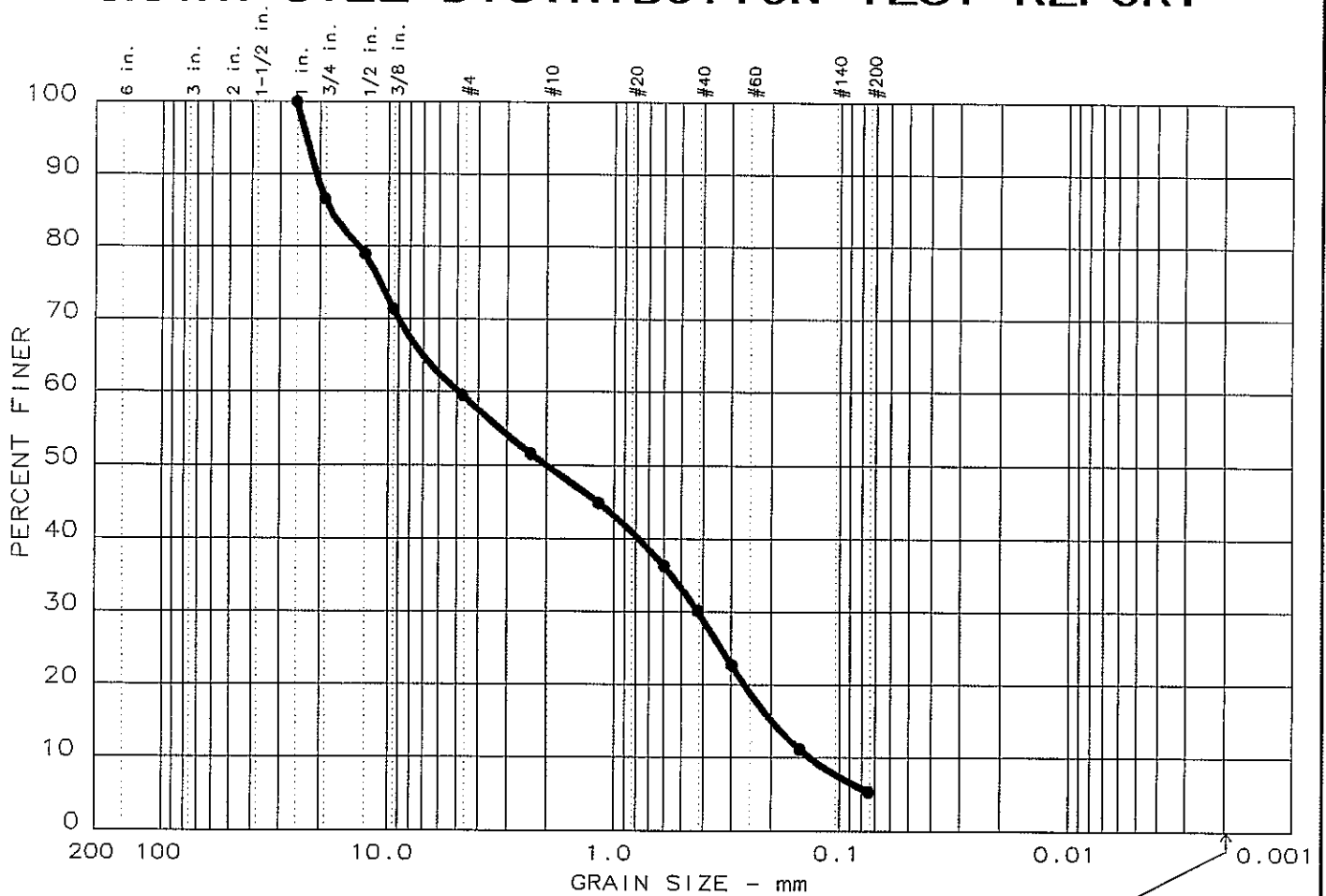
Date: 3 November 2005

GRAIN SIZE DISTRIBUTION TEST REPORT
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Remarks:
Prepared for:
Burnside

Figure No. 2

GRAIN SIZE DISTRIBUTION TEST REPORT



Appendix C

Nunavut Water Board License



P.O. Box 119
GJOA HAVEN, NT X0E 1J0

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TEL: (867) 360-6338
FAX: (867) 360-6369

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,

A handwritten signature in black ink, appearing to read 'P. di Pizzo', written over the printed name.

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.

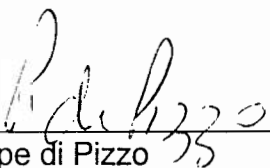
With respect to this application, the NWB gave notice to the public that the Municipality had filed an application for renewal of water licence N4L3-0640 issued by the Northwest Territories Water Board.

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

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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.

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

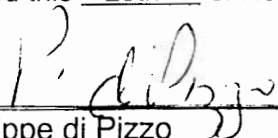
Date of Licence

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 statutes 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	1×10^4 CFU/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 Inuktitut.
- 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

<u>Temperature:</u>	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		
<u>Precipitation: Precipitation:</u>														
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+		

<u>Temperature:</u>	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+		
<u>Days with Maximum Temperature:</u> <u>Days with Maximum Temperature:</u>														
<= 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
<u>Days with Minimum Temperature:</u> <u>Days with Minimum Temperature:</u>														
> 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

<u>Temperature:</u>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
<u>Days with Snow Depth:</u> <u>Days with Snow Depth:</u>														
>= 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
<u>Wind:</u> <u>Wind:</u>														
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	
<u>Degree Days:</u> <u>Degree Days:</u>														
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

<u>Temperature:</u>	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
<u>Humidex:</u> <u>Humidex:</u>														
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		
<u>Wind Chill:</u> <u>Wind Chill:</u>														
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		
<u>Humidity:</u> <u>Humidity:</u>														
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
Climate ID: 2400572

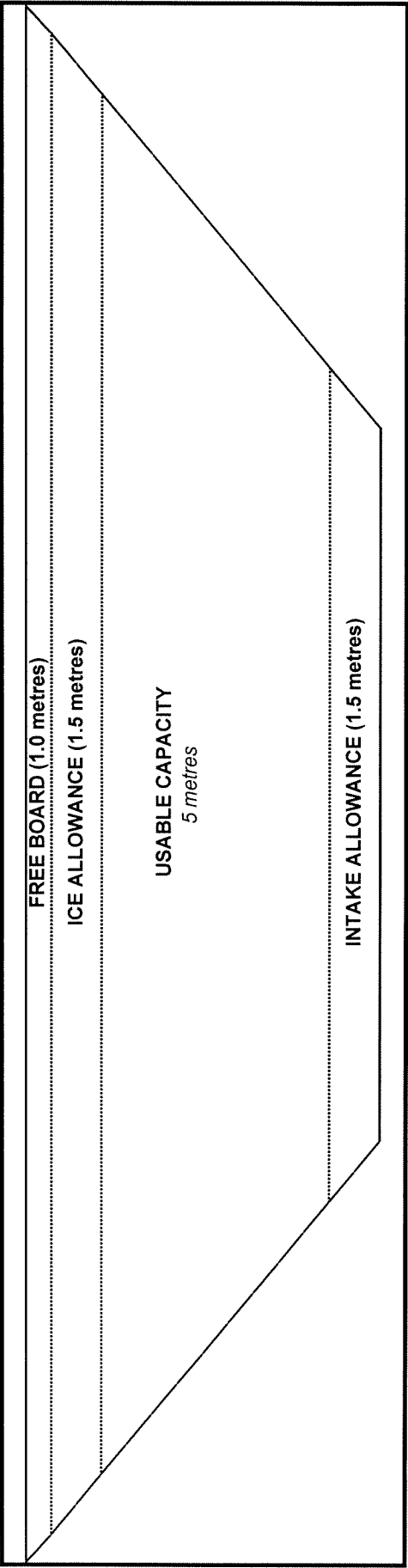
Longitude: 64° 1' W
WMO ID: 71338

Elevation: 06.40 m
TC ID: YVM

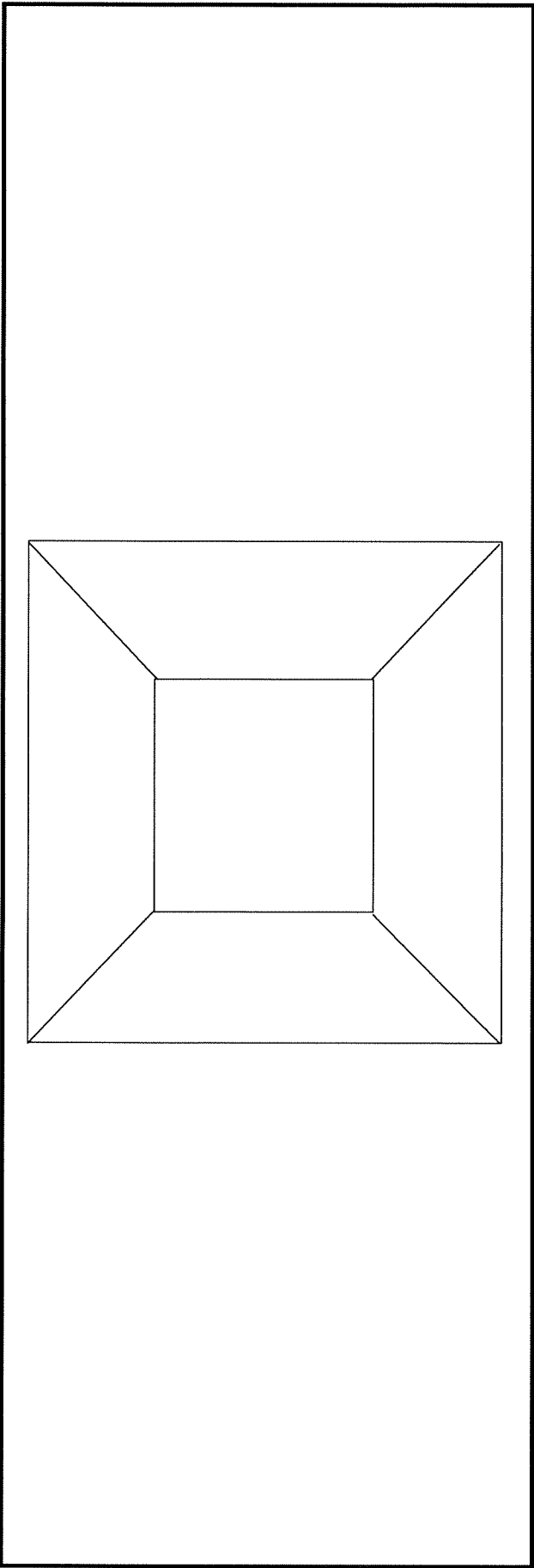
Monthly Data Report for 2004											
M o n t h	Mean Max Temp °C	Mean Temp °C	Mean Min Temp °C	Extr Max Temp °C	Extr Min Temp °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow Grnd Last Day cm	Dir of Max Gust 10's Deg	Spd of Max Gust km / h
<u>Jan</u>	-24.3	-28.7	-33.1	-15.5	-43.2	0.0	4.0	4.0	35		
<u>Feb</u>	-20.2	-24.9E	-29.4	-10.0	-40.2	0.0	5.0	5.0	41		
<u>Mar</u>	-24.3	-29.8	-35.2	-13.4	-45.5	0.0	6.2	6.2	47		
<u>Apr</u>	-11.4	-17.2	-22.9	-4.5	-31.5	0.0	34.0	34.0	61		
<u>May</u>	-1.2	-3.8	-6.4	6.5	-16.5	0.0	3.0	3.0	25		
<u>Jun</u>	4.7	1.8	-1.1	9.9	-7.2	Trace	Trace	Trace	0		
<u>Jul</u>	7.8	4.6	1.4	17.2	-1.7	1.0	6.0	7.0	0		
<u>Aug</u>	8.3	5.6	2.9	17.1	0.0	13.0	0.0	13.0	0		
<u>Sep</u>	4.4	2.0	-0.5	11.0	-11.0	6.0	13.0	19.0	4		
<u>Oct</u>	1.9	-1.0	-3.9	9.0S	-8.0	0.4	7.4	7.8	4		
<u>Nov</u>	-6.6	-10.6	-14.6	3.0	-24.5	0.0	91.0	91.0	54		
<u>Dec</u>	-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:

$$A_t = \quad \times W$$

$$A_b = L - 2 \times ES \times d) (W - 2 \times SS \times d)$$

$$A_m = L - ES \times d)(W - SS \times d)$$

Definitions:

$$V = \text{Volume}$$

$$D = \text{Depth of the lagoon}$$

$$A_t = \text{Area of the top of the lagoon}$$

$$A_b = \text{Area of the bottom of the lagoon}$$

$$A_m = \text{Area of the midsection of the lagoon}$$

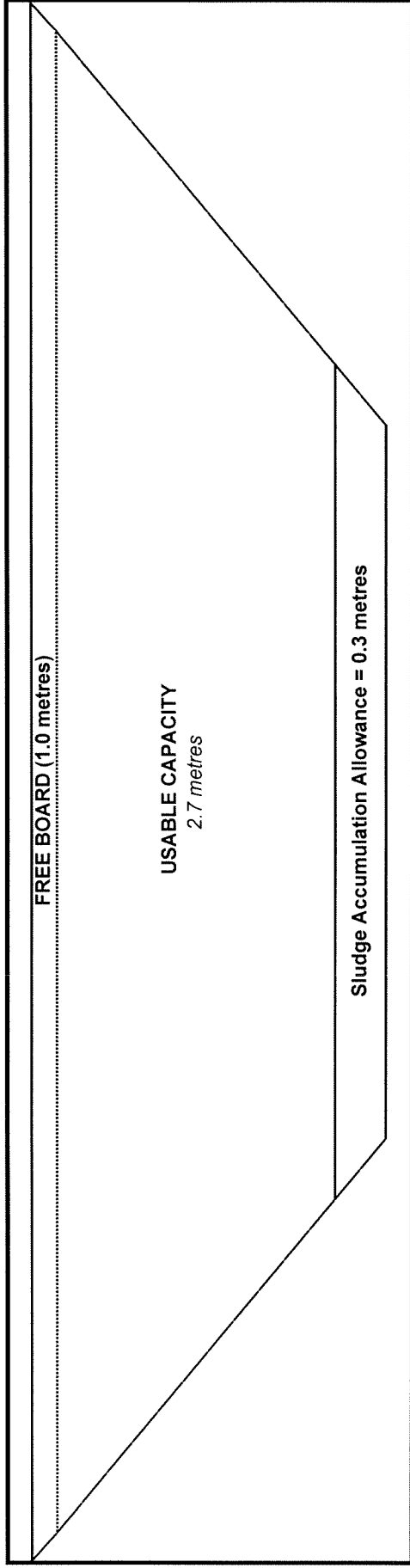
$$SS = \text{Slope of the sides of the lagoon}$$

$$ES = \text{Slope of the ends of the lagoon}$$

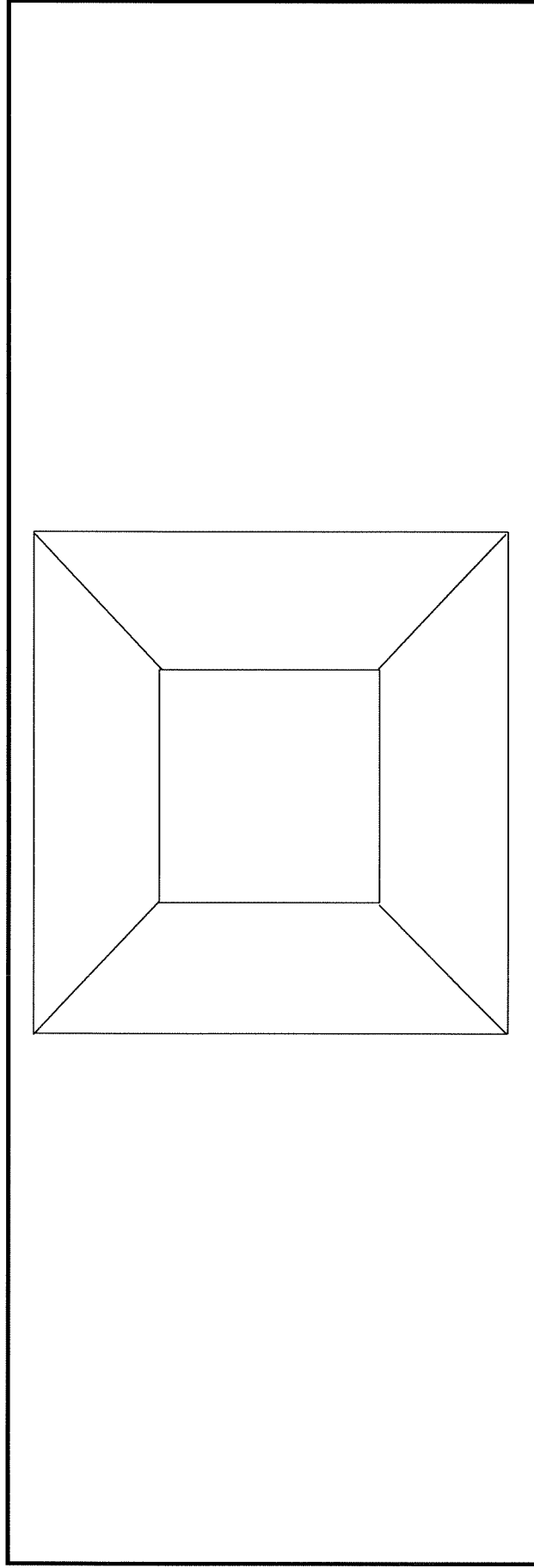
$$L = \text{Length of the top of the lagoon}$$

$$W = \text{Width of the top of the lagoon}$$

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

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

V = Total Volume

$$= 17127.2 \text{ m}^3$$

Assume

BERM

Length Berm

Width Berm

Total Berm

=	44	[metres ²]/m
=	4268	m ³
=	3036	m ³
=	14608	m ³

5 m Berm width around perimeter

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

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

V = Usable Volume

$$= 10558.2 \text{ m}^3$$

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

$A_t = L \times W$	=	12650
$A_b = (L - 2 \times ES \times d) (W - 2 \times SS \times d)$	=	7826
$A_m = (L - ES \times d)(W - SS \times d)$	=	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

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

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

$A_t = L \times W$	=	11336
$A_b = (L - 2 \times ES \times d) (W - 2 \times SS \times d)$	=	7826
$A_m = (L - ES \times d)(W - SS \times d)$	=	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



Appendix F
Electrical Site Review Report

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 Micheal O'Hara, Neegan Burnside
& DISTRIBUTION: 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.

q EDMONTON
10010 - 100 Street
Edmonton, AB T5J 0N3
Phone: (780) 424-2393
Fax: (780) 425-1520

q YELLOWKNIFE
Box 1529, 4903 - 47 Street
Yellowknife, NT X1A 2P2
Phone: (867) 873-2395
Fax: (867) 873-2547

q CALGARY
700, 1520 - 4th Street SW
Calgary, AB T2R 1H5
Phone: (403) 263-2393
Fax: (403) 262-9075

q WINNIPEG
500 - 321 McDermot Avenue
Winnipeg, MB R3A 0A3
Phone: (204) 943-2393
Fax: (204) 943-2251

- .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 feeds 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

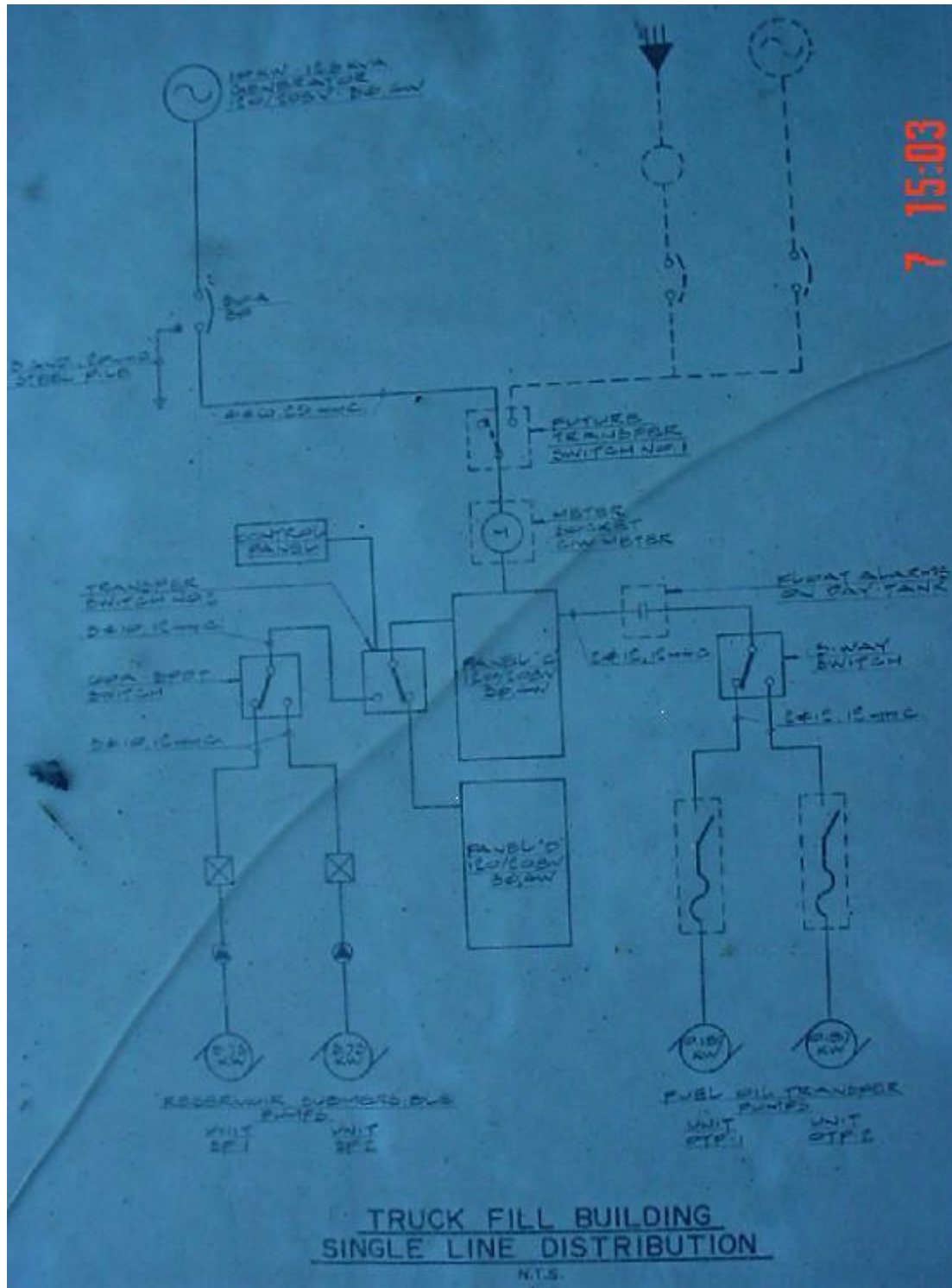


Figure E-3: Single Line Diagram



Figure E-4: Distribution Panels



Figure E-5: Submersible Pumps

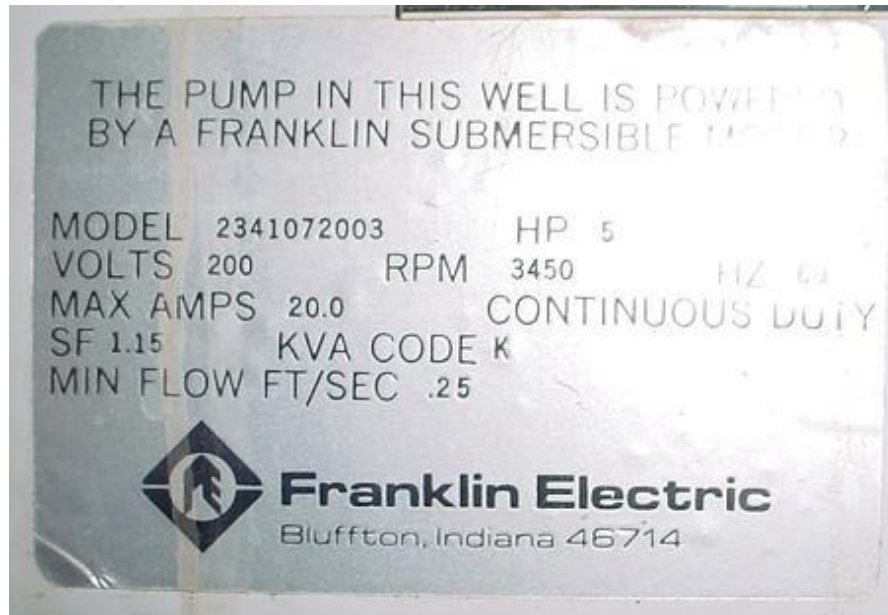


Figure E-6: Left Pump



Figure E-7: Right Pump



Figure E-8: Truck Fill Controls

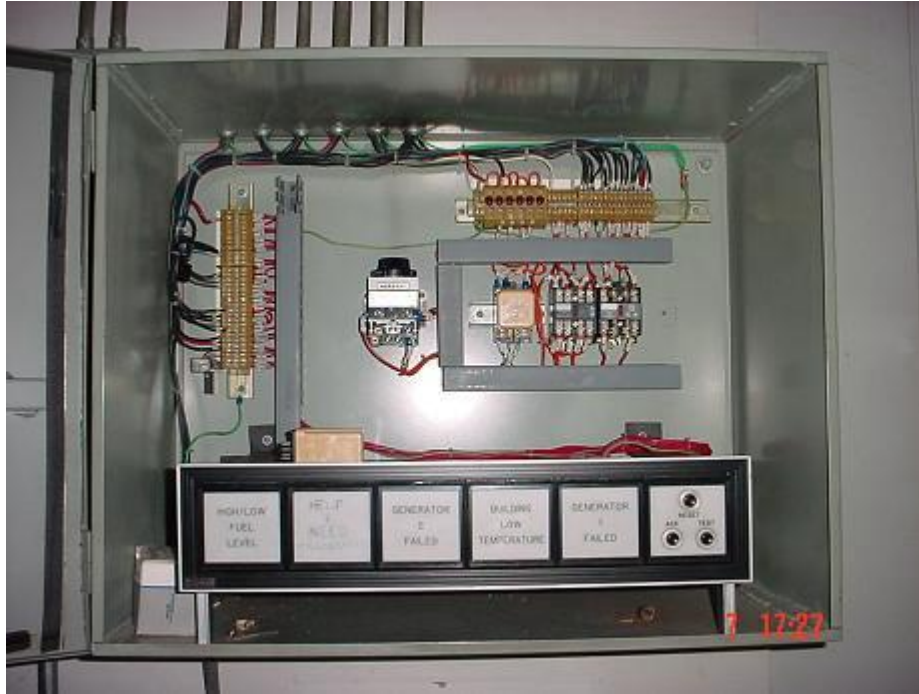


Figure E-9: Indication Control Panel



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

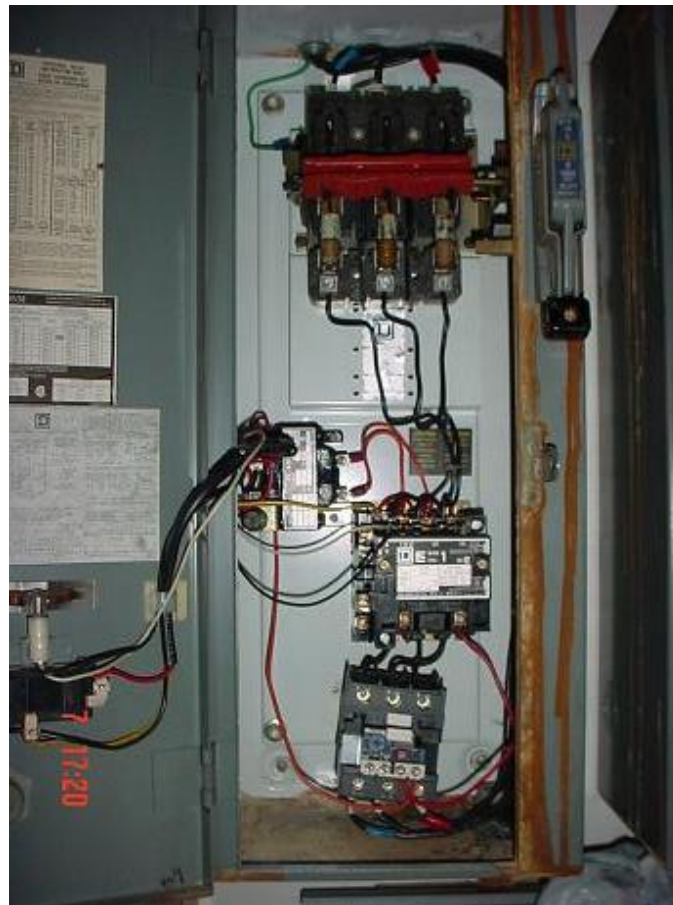


Figure E-18: Unattached Contactor



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 m³
- 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 3.75°C. For this specific site location 5°C 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 m³/day
- The wetland predictive model was designed for 20°C. To account for an average temperature of 5°C the Area Rate Constant has been charged as follows:

Parameter Area Rate Constant

	@ 20°C	@ 10°C	@ 5°C
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

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

	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 (m³/day)

Q= 644

	TSS	BOD	T-PO ₄	TKN	FC
Design Flow (Q)	643.55	643.55			
Wastewater Characterization (C _i)	308.5	329.1	15.8	82.3	6.51E+07
Target Effluent Quality (C _e)	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.



Appendix H
Operation & Maintenance Plans

Appendix H1
Water Reservoir



Water Storage and Treatment Facility Operation and Maintenance (O&M) Plan Hamlet of Qikiqtarjuaq, Nunavut

Prepared for

The Hamlet of Qikiqtarjuaq
P.O. Box 4, Qikiqtarjuaq NU X0A 0B0 Canada

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

Revision Date

February 2006

File No: N-O 09439.0

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Water Storage and Treatment Facility
Operation and Maintenance (O&M) Plan
Hamlet of Qikiqtarjuaq, Nunavut

February 2006

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- B Projected Water Requirements and Sewage Generation Rates
- C Nunavut Water Board License
- D Example Operation Log
- E Environmental Emergency Contingency Plan
- F Monitoring Program Quality Assurance/Quality Control Plan

February 2006

1.0 Introduction

The Hamlet of Qikiqtarjuaq (meaning “big island”), is a Community of approximately 599 people located on the eastern coast of Baffin Island and on an island known as Broughton Island in the territory of Nunavut. As illustrated in Figure 1, the Hamlet is located approximately 470 kilometers northeast of the Capital City of Iqaluit, a distance that is covered by plane in about one hour. The geographic coordinates for the Hamlet of Qikiqtarjuaq are 67°33’ north latitude and 64°02’ west longitude. As indicated on Figure 2, the community is situated on the northwest portion of Broughton Island.

Qikiqtarjuaq is located within the continuous permafrost zone. Maximal local depth of annual thaw of the active layer ranges from 0.6 to 1.6 meters, depending on the thickness and nature of the surface cover. Materials located beneath the thin active layer are perennially frozen to a substantial depth. Qikiqtarjuaq sits on glacial drift primarily composed of silty sand and gravels mixed with boulders.

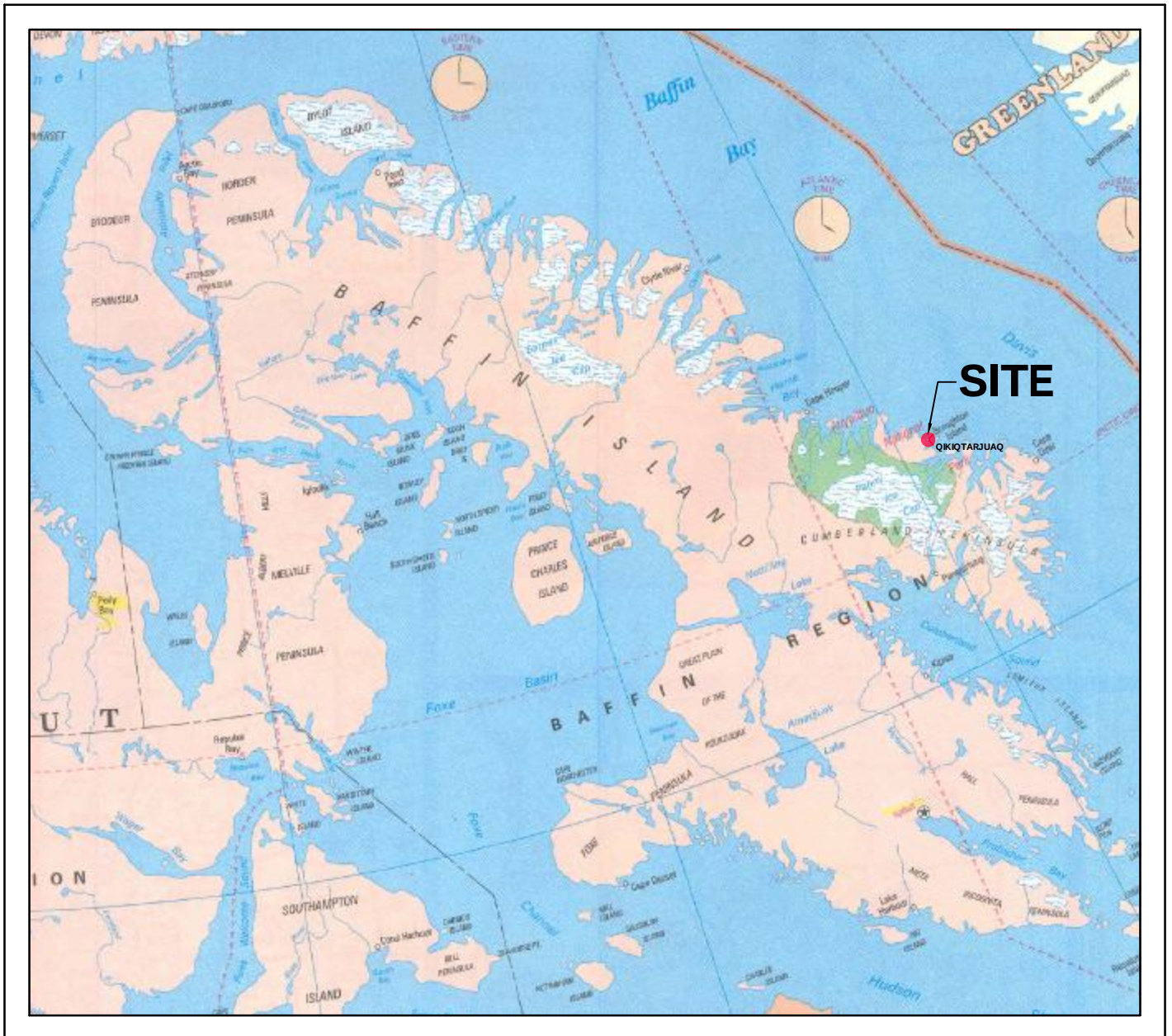
The vegetation present in Qikiqtarjuaq is typical of that evidenced on the Arctic tundra. Hardy grasses, mosses, and lichens sit in a thin organic layer on the surface, which is generally 0.2 m or less in thickness.

Qikiqtarjuaq receives an average of 39 mm of rainfall and 223 mm of snowfall per annum. July mean high and low temperatures are 7°C and 1°C, respectively. January mean high and low temperatures measure -21°C and -28°C, respectively. July and August are the only two months of the year that historically have had average daily temperatures above the freezing mark. Prevailing winds are generally north-northeast with an annual average velocity of 8.3 km/h. Climate normal information was obtained from Environment Canada’s website, and is available in Appendix A.

The Detailed Design Report (Nuna Burnside, 2006) for the Improvements to the Water, Wastewater, and Solid Waste Facilities determined the projected population and associated water supply requirements using information from the Nunavut Bureau of Statistics. The tables with the detailed calculations are available for inspection in Appendix B.

1.1 Purpose

The Hamlet of Qikiqtarjuaq operates their municipal water, sewage, and solid waste facilities under the Nunavut Water Board (NWB) License NWB3Q1K0106, dated November 28, 2000 (Appendix C). Part G, Section 1 requires that an Operation and Maintenance (O&M) Plan be submitted for the facilities in accordance with all applicable regulations and following applicable guidelines. This document provides a list of tasks and procedures that will assist the Hamlet’s operations staff in the O&M of the facility.



Map Reference:
Map of Canada
Published by the CAA

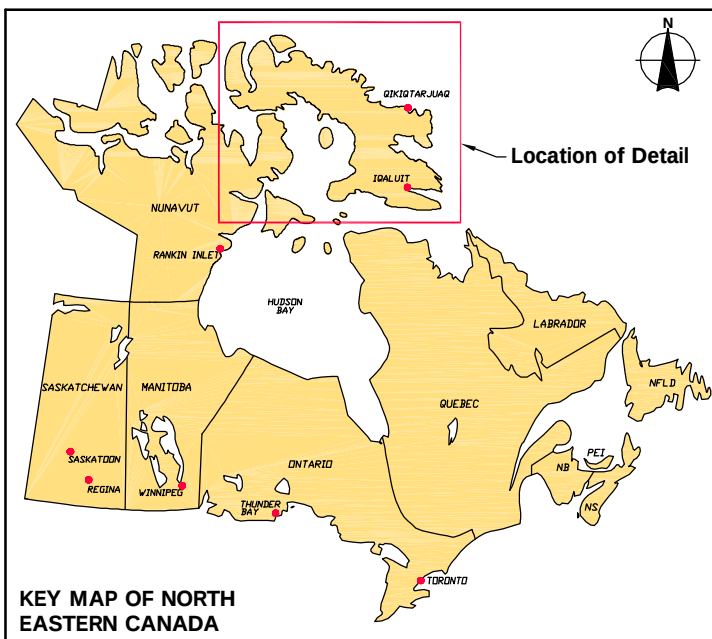


FIGURE 1 - SITE LOCATION MAP

THE HAMLET OF QIKIQTARJUAQ, NUNAVUT

WATER STORAGE & TREATMENT FACILITY

O&M PLAN

January 2006
Project Number: N-O 09439.0
Prepared by: K. Pridham

Verified by: M. Paznar

Burnside

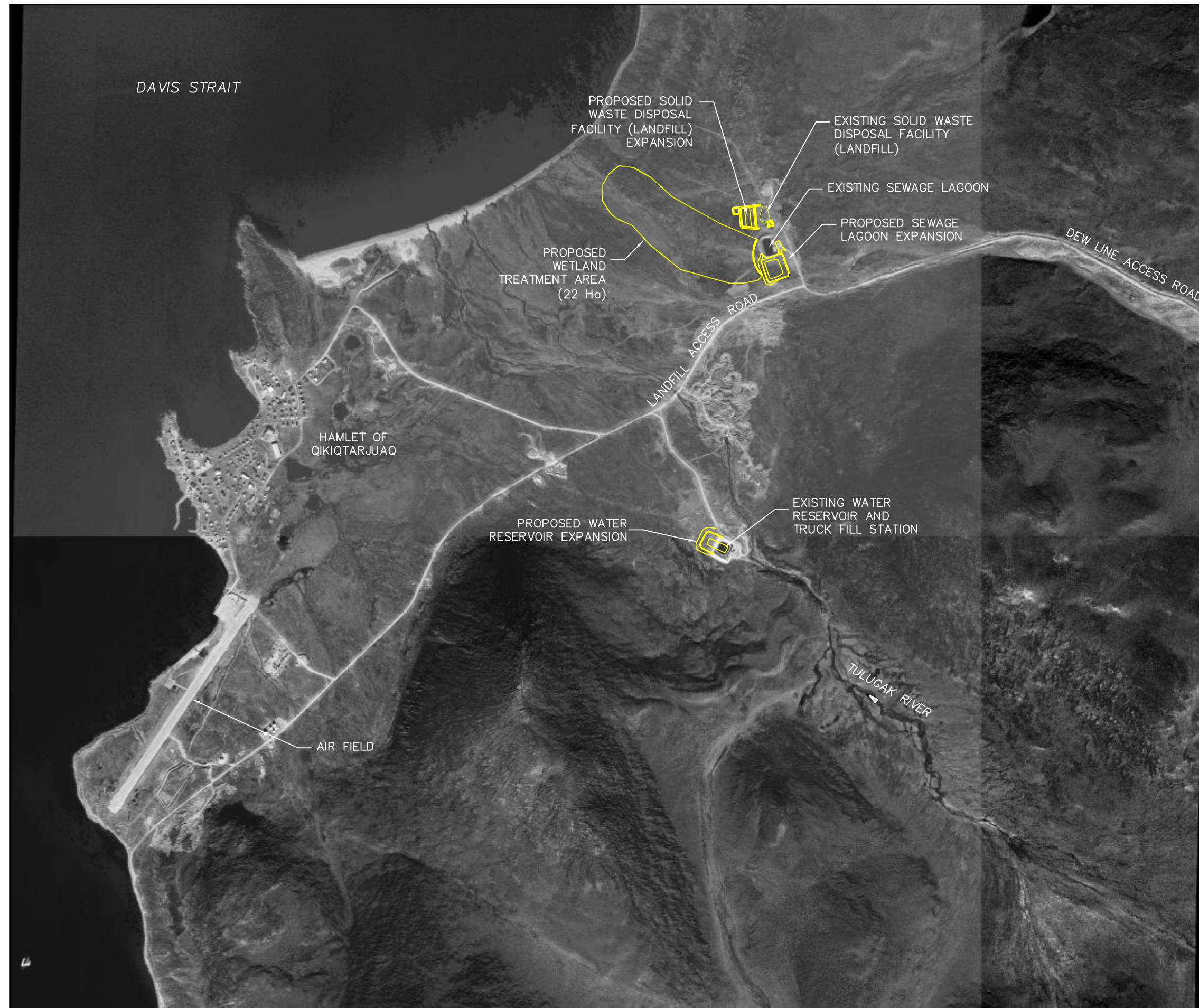
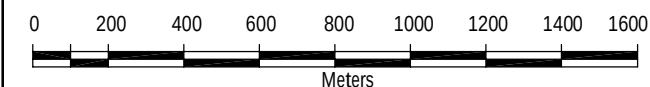
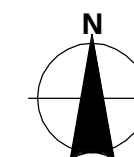


FIGURE 2
THE HAMLET OF QIKIQTARJUAQ
WATER STORAGE
& TREATMENT FACILITY
O&M PLAN

SATELLITE IMAGERY OF
ENTIRE COMMUNITY
AND INFRASTRUCTURE

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



1:20,000
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: M. Paznar

Water Storage and Treatment Facility
Operation and Maintenance (O&M) Plan
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The O&M Plan of the Water Storage And Treatment Facility will be used in conjunction with the normal operating procedures. This document provides a list of tasks and procedures that will assist the Hamlet's operations staff in the O&M of the facility.

Water Storage and Treatment Facility
Operation and Maintenance (O&M) Plan
Hamlet of Qikiqtarjuaq, Nunavut

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2.0 Background Information on Hamlet Operations

The Hamlet of Qikiqtarjuaq provides trucked water and sewage services, as well as regular solid waste pickup for the Community's residents, businesses, and institutions. Water is currently drawn from the Tulugak River during the summer, and from the reservoir, which is filled from the river during the remainder of the year (Figure 2). The earthen reservoir, which is located approximately 2.2 km from the Hamlet, was expanded in 1978/1979 to its current size of approximately 90 m x 90 m x 9 m and lined with a geosynthetic fabric.

The proposed water reservoir (Figure 3) will be approximately 90 m x 156 m x 9 m, and lined with a potable grade geomembrane liner system. This reservoir is designed to meet the projected needs of the community to the year 2027. Water is treated with chlorine prior to distribution to the Community via Hamlet owned tanker trucks. Water requirements for 2005 were 22,822 m³.



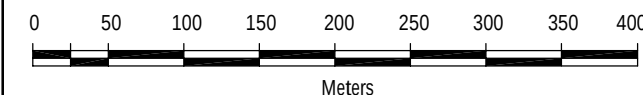
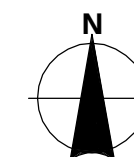
FIGURE 3
THE HAMLET OF QIKIQTARJUAQ
WATER STORAGE
& TREATMENT FACILITY
O&M PLAN

REGIONAL VIEW OF
WATER RESERVOIR

Legend

→ → → INTERPRETED SURFACE WATER FLOW DIRECTION

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



1:5,000
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: M. Paznar

BURNSIDE

Water Storage and Treatment Facility
 Operation and Maintenance (O&M) Plan
 Hamlet of Qikiqtarjuaq, Nunavut

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3.0 Operation and Maintenance of the Water Treatment Facility

Satellite imagery of the proposed upgraded Water Storage And Treatment Facility operated by the Hamlet of Qikiqtarjuaq, which is described above, is provided in Figure 2. This Figure illustrates both the drainage pathway of the treatment wetland and the proximity to adjacent water bodies (in this case, the Davis Strait). The boundaries of the treatment wetland area are also illustrated in this figure.

In the event of emergency, guidance regarding containment and site emergency response can be obtained from the following sources (Table 1):

Table 1 – Emergency Contacts

Contact	Location	Telephone Number	Fax Number
INAC – Manager, Water Resources	Iqaluit	(867) 975-4550	(867) 979-6445
Hamlet of Qikiqtarjuaq – SAO	Qikiqtarjuaq	(867) 927-8832	(867) 927-8120
Government of Nunavut (Regional Engineer)	Pond Inlet	(867) 975-7314	
Environment Canada – Inspector	Iqaluit	(867) 975-4644	(867) 975-4594
Fire Department	Qikiqtarjuaq	(867) 927-4422	
RCMP Detachment	Qikiqtarjuaq	(867) 927-0123	
Community Health Center	Qikiqtarjuaq	(867) 927-8916	

3.1 Water Distribution Procedures

The following water distribution operational procedures shall be carried out by the Hamlet of Qikiqtarjuaq on a daily basis (weather dependent):

- Residential, institutional, and commercial water storage tanks shall be filled from Hamlet-operated water delivery vehicles, with water obtained from the Hamlet Water Storage And Treatment Facility
- Daily water usage volumes obtained from the Hamlet Water Storage and Treatment Facility, as well as trip counts shall be recorded on the recording form attached in Appendix D
- In the event of an accident, a spill of petroleum products or a fire during water distribution operations, *the Hamlet of Qikiqtarjuaq Environmental Emergency Response Plan* (Appendix E) shall be implemented.

3.2 Water Storage Facility Refilling Operational Procedures

The following operational procedures are to be carried out by the Hamlet of Qikiqtarjuaq, during refilling operations at the Hamlet Water Supply Facility reservoir:

- At the beginning of the season, collect water samples from the Tulugak River, and submit for chemical and microbiological analysis to confirm level of treatment is still adequate
- Raw water from the Tulugak River shall be transferred by gravity from the intake location (Figure 2) to the water reservoir
- Water transfer operations shall commence on or about July 1st, and cease when the reservoir has been filled to the NWB mandated freeboard of 1 meter
- During water transfer operations, the fill pipe and associated intake structures shall be inspected twice daily for defects or blockages, and repaired as necessary
- Upon completion of water transfer operations, the fill pipe and intake structures shall be secured, the reservoir berms inspected, and any required maintenance (as described below) performed.

3.3 Water Supply Facility Truckfill Station Operational Procedures

The following operational procedures are to be carried out by the Hamlet of Qikiqtarjuaq, during water treatment and truckfill operations at the Hamlet Water Storage and Treatment Facility:

- Untreated water from the reservoir at the Facility shall be transferred by submersible pump to the water distribution vehicles through the truckfill station, at a rate of approximately 1,000 L/min (minimum recommended for fire protection)
- The monitoring level of treatment shall be primary and secondary disinfection, through the addition of sodium hypochlorite
- The chlorine feed system shall be inspected daily
- Water being transferred to the distribution vehicles shall be dosed with sodium hypochlorite at a rate sufficient that a free chlorine residual of 0.2 mg/L, after thorough mixing and 20 minutes of contact time is maintained, in accordance with the Public Health Act (1992) and associated Regulations

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- Chlorine residuals shall be monitored daily, or as directed by a Public Health Inspector (as defined by the Public Health Act (1992))
- Facility generators and associated fuel storage shall be monitored daily.

3.4 Periodic and Seasonal Maintenance Procedures

The following procedures shall be undertaken by the Hamlet of Qikiqtarjuaq during periodic and seasonal maintenance operations at the Water Supply Facility:

- The roadway and truck pad shall be maintained by snow clearing in the winter and grading in the summer, and repaired as necessary
- Ditches and drainage channels at the Water Supply Facility shall be inspected during the summer for erosion and repaired as necessary
- Site warning signage, which identifies the boundaries of the Water Supply Facility shall be inspected weekly, and repaired or replaced as necessary
- The Truckfill Station at the Water Supply Facility shall be inspected for damage or displacement weekly, and repaired as necessary
- Any airborne litter shall be removed from the Water Supply Facility to the Hamlet landfill weekly, or as required
- The berms at the Water Supply Facility shall be inspected during the summer for erosion and settlement weekly, and repaired as necessary
- The liner of the Water Supply Facility shall be inspected annually, and repaired as necessary.

The activities described above shall be completed by Hamlet staff and the details of any repairs shall be reported in the Annual Report submitted to the Nunavut Water Board, in compliance with the Hamlet's Water License.

3.5 Facility Monitoring Procedures

Regular monitoring of the water provided from the Potable Water Treatment Facility is required. The Monitoring Program shall also include samples collected from the Hamlet Water Supply (the Tulugak River) during water transfer operations. Water samples collected shall be analyzed for the following parameters:

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Operation and Maintenance (O&M) Plan
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- Ammonia Nitrogen (NH₃-N)
- pH
- Turbidity
- Total Suspended Solids (TSS)
- Nitrate-Nitrite (NO₃-NO₂)
- Total Phenols (Total-P)
- Total Hardness
- Magnesium (Mg)
- Sodium (Na)
- Total Arsenic (As)
- Total Copper (Cu)
- Total Cobalt (Co)
- Total Lead (Pb)
- Total Mercury (Hg)
- Total Coliforms (TC)
- *Escherichia coli* (*E.coli*)
- Colour
- Conductivity
- Chloride (Cl)
- Total Organic Carbon (TOC)
- Oil and Grease (OGG) (Visual)
- Total Alkalinity
- Calcium (Ca)
- Potassium (K)
- Sulphate (SO₄)
- Total Cadmium (Cd)
- Total Chromium (Cr)
- Total Iron (Fe)
- Total Manganese (Mn)
- Total Nickel (Ni)
- Heterotrophic Plat Count (HPC)

Any additional analytical parameters which are identified in the NWB water license, or by an Inspector (as defined in the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*) or by a Public Health Inspector (as defined by the *Public Health Act* (1992)) shall also have samples collected and analyzed.

Daily monitoring of residual chlorine levels shall be undertaken, to facilitate and confirm the maintenance of a free chlorine residual in treated water in accordance with the *Public Health Act* (1992) and associated *Regulations*.

Water sampling completed by the Hamlet of Qikiqtarjuaq shall be in accordance with the *Hamlet of Qikiqtarjuaq Monitoring Program Quality Assurance/Quality Control (QA/QC) Plan*, which is attached to this Plan (Appendix F).

A monitoring station will be established at the Water Supply Facility. Monthly and annual quantities of water utilized will be measured and recorded in an official log book (Appendix D)

3.6 Annual Reporting Procedures

Results of analytical testing and monitoring are to be recorded on a regular basis by the staff. Copies of the analytical certificates and Chain of Custody forms are to be kept for future reference to determine the effectiveness of the treatment facility.

Water Storage and Treatment Facility
Operation and Maintenance (O&M) Plan
Hamlet of Qikiqtarjuaq, Nunavut

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4.0 References

Department of Municipal and Community Affairs, Government of Northwest Territories, October 1996. *Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories*. Queen's Printer: Yellowknife, Northwest Territories.

Nuna Burnside Engineering and Environmental Ltd. January 2005. *Detailed Design of the Improvements to the Water Reservoir, Wastewater Lagoon and Solid Waste facility in the Hamlet of Qikiqtarjuaq*. Rankin Inlet, Nunavut.

Nunavut Water Board. September 2000. *Hamlet of Qikiqtarjuaq Water License NWB3QIK0106*. Gjoa Haven, Nunavut.

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Appendix A
Climate Normal Data

Appendix A: Climate Normals for Qikiqtarjuaq, Nunavut

<u>Temperature:</u>	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		
<u>Precipitation: Precipitation:</u>														
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+		

<u>Temperature:</u>	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+		
<u>Days with Maximum Temperature:</u> <u>Days with Maximum Temperature:</u>														
<= 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
<u>Days with Minimum Temperature:</u> <u>Days with Minimum Temperature:</u>														
> 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

<u>Temperature:</u>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
<u>Days with Snow Depth:</u> <u>Days with Snow Depth:</u>														
>= 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
<u>Wind:</u> <u>Wind:</u>														
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	
<u>Degree Days:</u> <u>Degree Days:</u>														
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

<u>Temperature:</u>	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
<u>Humidex:</u> <u>Humidex:</u>														
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		
<u>Wind Chill:</u> <u>Wind Chill:</u>														
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		
<u>Humidity:</u> <u>Humidity:</u>														
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 A: Summary of 2004 Monthly Climatological Information for the Hamlet of Qikiqtarjuaq, Nunavut

QIKIQTARJUAQ A NUNAVUT

Latitude: 67° 33' N
Climate ID: 2400572

Longitude: 64° 1' W
WMO ID: 71338

Elevation: 06.40 m
TC ID: YVM

Monthly Data Report for 2004											
M o n t h	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
<u>Jan</u>	-24.3	-28.7	-33.1	-15.5	-43.2	0.0	4.0	4.0	35		
<u>Feb</u>	-20.2	-24.9E	-29.4	-10.0	-40.2	0.0	5.0	5.0	41		
<u>Mar</u>	-24.3	-29.8	-35.2	-13.4	-45.5	0.0	6.2	6.2	47		
<u>Apr</u>	-11.4	-17.2	-22.9	-4.5	-31.5	0.0	34.0	34.0	61		
<u>May</u>	-1.2	-3.8	-6.4	6.5	-16.5	0.0	3.0	3.0	25		
<u>Jun</u>	4.7	1.8	-1.1	9.9	-7.2	Trace	Trace	Trace	0		
<u>Jul</u>	7.8	4.6	1.4	17.2	-1.7	1.0	6.0	7.0	0		
<u>Aug</u>	8.3	5.6	2.9	17.1	0.0	13.0	0.0	13.0	0		
<u>Sep</u>	4.4	2.0	-0.5	11.0	-11.0	6.0	13.0	19.0	4		
<u>Oct</u>	1.9	-1.0	-3.9	9.0S	-8.0	0.4	7.4	7.8	4		
<u>Nov</u>	-6.6	-10.6	-14.6	3.0	-24.5	0.0	91.0	91.0	54		
<u>Dec</u>	-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 B
Projected Water Requirements and
Sewage Generation Rates

Table 1 - Projected Water Consumption

Planning Year	Calendar Year	Projected Population	Projected Water Consumption	Projected Total Consumption Volume				10 Month Storage Requirement	Additional Capacity Required
			[Lpcd]	[Litres/day]	[Litres/year]	[m ³ /day]	[m ³ /year]	[m ³ /year]	[m ³]
Schematic	2005	599	102.4	61337	22388071	61	22388	18657	657
Detailed	2006	611	102.6	62718	22891977	63	22892	19077	1077
0	2007	624	102.9	64220	23440330	64	23440	19534	1534
	2008	637	103.2	65729	23991238	66	23991	19993	1993
	2009	650	103.5	67246	24544699	67	24545	20454	2454
	2010	663	103.7	68769	25100714	69	25101	20917	2917
	2011	677	104.0	70417	25702355	70	25702	21419	3419
5	2012	691	104.3	72074	26306958	72	26307	21922	3922
	2013	705	104.6	73738	26914522	74	26915	22429	4429
	2014	720	104.9	75531	27568771	76	27569	22974	4974
	2015	735	105.2	77333	28226420	77	28226	23522	5522
	2016	750	105.5	79144	28887469	79	28887	24073	6073
10	2017	765	105.8	80964	29551917	81	29552	24627	6627
	2018	781	106.2	82916	30264410	83	30264	25220	7220
	2019	797	106.5	84879	30980772	85	30981	25817	7817
	2020	813	106.8	86852	31701001	87	31701	26418	8418
	2021	830	107.2	88960	32470484	89	32470	27059	9059
15	2022	847	107.5	91080	33244334	91	33244	27704	9704
	2023	864	107.9	93212	34022551	93	34023	28352	10352
	2024	882	108.3	95483	34851305	95	34851	29043	11043
	2025	900	108.6	97767	35684955	98	35685	29737	11737
	2026	918	109.0	100064	36523501	100	36524	30436	12436
20	2027	937	109.4	102504	37413945	103	37414	31178	13178

Table 2 - Projected Sewage and Sludge Generation Rates

Planning Year	Calendar Year	Projected Population	Projected Sewage Generation	Projected Volume		Projected Sludge Volume	Cumulative Sludge Volume	BOD	TSS	T-PO ₄	TKN	Faecal Coliforms
			[Lpcd]	[Litres/day]	[Litres/year]	[m ³ /year]	[m ³]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[CFU/100 mL]
Schematic	2005	599	102.4	61,337	22,388,071	10.9	10.9	439.5	468.8	22.5	117.2	9.28E+07
Design	2006	611	102.6	62,718	22,891,977	11.2	22.1	438.4	467.6	22.4	116.9	9.25E+07
0	2007	624	102.9	64,220	23,440,330	11.4	33.5	437.2	466.4	22.3	116.6	9.23E+07
	2008	637	103.2	65,729	23,991,238	11.6	45.1	436.1	465.2	22.3	116.3	9.21E+07
	2009	650	103.5	67,246	24,544,699	11.9	57.0	435.0	464.0	22.2	116.0	9.18E+07
	2010	663	103.7	68,769	25,100,714	12.1	69.1	433.8	462.8	22.2	115.7	9.16E+07
	2011	677	104.0	70,417	25,702,355	12.4	81.4	432.6	461.5	22.1	115.4	9.13E+07
5	2012	691	104.3	72,074	26,306,958	12.6	94.0	431.4	460.2	22.1	115.0	9.11E+07
	2013	705	104.6	73,738	26,914,522	12.9	106.9	430.2	458.9	22.0	114.7	9.08E+07
	2014	720	104.9	75,531	27,568,771	13.1	120.0	429.0	457.6	21.9	114.4	9.06E+07
	2015	735	105.2	77,333	28,226,420	13.4	133.4	427.7	456.2	21.9	114.1	9.03E+07
	2016	750	105.5	79,144	28,887,469	13.7	147.1	426.4	454.9	21.8	113.7	9.00E+07
10	2017	765	105.8	80,964	29,551,917	14.0	161.1	425.2	453.5	21.7	113.4	8.98E+07
	2018	781	106.2	82,916	30,264,410	14.3	175.3	423.9	452.1	21.7	113.0	8.95E+07
	2019	797	106.5	84,879	30,980,772	14.5	189.9	422.5	450.7	21.6	112.7	8.92E+07
	2020	813	106.8	86,852	31,701,001	14.8	204.7	421.2	449.3	21.5	112.3	8.89E+07
	2021	830	107.2	88,960	32,470,484	15.1	219.9	419.9	447.8	21.5	112.0	8.86E+07
15	2022	847	107.5	91,080	33,244,334	15.5	235.3	418.5	446.4	21.4	111.6	8.83E+07
	2023	864	107.9	93,212	34,022,551	15.8	251.1	417.1	444.9	21.3	111.2	8.81E+07
	2024	882	108.3	95,483	34,851,305	16.1	267.2	415.7	443.4	21.2	110.8	8.78E+07
	2025	900	108.6	97,767	35,684,955	16.4	283.6	414.3	441.9	21.2	110.5	8.75E+07
	2026	918	109.0	100,064	36,523,501	16.8	300.4	412.8	440.4	21.1	110.1	8.72E+07
20	2027	937	109.4	102,504	37,413,945	17.1	317.5	411.3	438.8	21.0	109.7	8.68E+07

Appendix C

Nunavut Water Board License



P.O. Box 119
GJOA HAVEN, NT X0E 1J0

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TEL: (867) 360-6338
FAX: (867) 360-6369

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,

A handwritten signature in black ink, appearing to read 'P. di Pizzo', written over the printed name.

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.

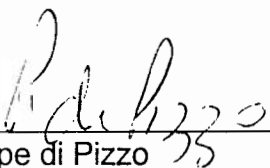
With respect to this application, the NWB gave notice to the public that the Municipality had filed an application for renewal of water licence N4L3-0640 issued by the Northwest Territories Water Board.

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

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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.

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

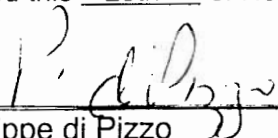
Date of Licence

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 statutes 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	1×10^4 CFU/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 Inuktitut.
- 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
Example Operation Log

Hamlet of Qikiqtarjuaq
Water Distribution Operations Log Sheet

Month: _____

Truck #: _____

Date	Number of Trips to the Water Reservoir	Quantity of Water Delivered (Liters)	Driver Signature
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
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24			
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31			



Appendix E
Environmental Emergency
Contingency Plan



Environmental Emergency Contingency Plan for Water, Sewage, and Solid Waste Operations in the Hamlet of Qikiqtarjuaq, Nunavut

Prepared for

The Hamlet of Qikiqtarjuaq
P.O. Box 4, Qikiqtarjuaq NU X0A 0B0 Canada

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

Revision Date

February 2006

File No: N-O 09439.0

The material in this report reflects best judgement in light of the information available at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Nuna Burnside accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

February 2006

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Water, Sewage, and Solid Waste Operations in the
Hamlet of Qikiqtarjuaq, Nunavut

February 2006

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Environmental Emergency Contingency Plan for
Water, Sewage, and Solid Waste Operations in the
Hamlet of Qikiqtarjuaq, Nunavut

February 2006

Preamble

This Environmental Emergency Contingency Plan relating to the collection, transportation, storage, and treatment operations of sewage for the Hamlet of Qikiqtarjuaq, Nunavut, is effective from *BEGINNING DATE OF WATER LICENSE until EXPIRY DATE OF NEW WATER LICENSE*. This plan applies to all operations and spill events relating to sewage and petroleum, oil, and lubricating (POL) products in the Hamlet of Qikiqtarjuaq, Nunavut (formerly known as Broughton Island).

The following formal distribution will be made after this document receives approval:

- Hamlet of Qikiqtarjuaq:
 - Mayor and Council
 - Senior Administrative Officer (SAO)
 - Hamlet Operations Staff
 - Fire Department
 - Community Health Centre
 - RCMP Detachment.
- Nunavut Water Board.

Additional copies and updates of this plan may be obtained by writing to:

Hamlet of Qikiqtarjuaq
Senior Administrative Officer (SAO)
P.O. Box 4
Qikiqtarjuaq, NU X0A 0B0

Environmental Emergency Contingency Plan for
Water, Sewage, and Solid Waste Operations in the
Hamlet of Qikiqtarjuaq, Nunavut

February 2006

1.0 Introduction

1.1 Purpose of Plan

The impacts of spills can be catastrophic and may threaten or damage the environment, especially water resources. As such, the Government of Nunavut (GN) requires contingency plans to be written and fully implemented. The purpose of this *Environmental Emergency Contingency Plan* is to provide a plan of action for all spills of sewage, solid waste, and petroleum products that may occur as a result of water supply and distribution, sewage collection and treatment, and solid waste collection and disposal operations undertaken within the Hamlet of Qikiqtarjuaq, Nunavut.

This *Environmental Emergency Contingency Plan* will assist in implementing corrective options quickly to minimize environmental damage. Furthermore, it defines the responsibilities of key personnel and outlines procedures to effectively and efficiently contain and recover spills of sewage, solid waste, and petroleum products arising from water, sewage, and solid waste; collection, transportation, storage, and treatment operations. It will assist the Hamlet in meeting the regulatory requirements related to reporting events to the appropriate authorities within the prescribed time period.

Sewage, solid waste, and petroleum, oil and lubricating (POL) products that currently, or potentially, fall within the Scope of this *Environmental Emergency Contingency Plan* are as follows:

- Sewage (as defined in the Nunavut Water Board (NWB) water license)
- Solid waste (as defined in the Nunavut Water Board (NWB) water license)
- Gasoline
- Diesel fuel
- Hydraulic fluid
- Lubricating oil.

1.2 Objectives

The objectives of this Emergency Spill Contingency Plan are to:

- Provide a plan including procedures so that the Hamlet and their Incident Spill Response Team can rapidly respond to a spill situation and minimize injury to individuals and environmental damage
- Comply with all existing regulations
- Cooperate with other groups and agencies

Environmental Emergency Contingency Plan for
Water, Sewage, and Solid Waste Operations in the
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February 2006

- Be prepared and able to provide an integrated team approach with all involved departments and agencies
- Keep staff, government officials, and Hamlet residents informed.

1.3 Hamlet of Qikiqtarjuaq Environmental Policy

It is the policy of the Hamlet of Qikiqtarjuaq to fully comply with all applicable legislation to ensure the protection of the environment of the territory of Nunavut. The legislation includes, but is not limited to, the:

- Environmental Protection Act, Section 34 – Spill Contingency Planning and Reporting Regulations
- Nunavut Waters and Nunavut Surface Rights Tribunal Act.

The Hamlet will cooperate with other groups committed to protecting the environment and shall ensure that Hamlet employees, regulatory authorities, and the public are informed on the policies and procedures developed to help protect the environment and the citizens of the Hamlet of Qikiqtarjuaq.

February 2006

2.0 Site Description

2.1 General Site Description

This *Environmental Emergency Contingency Plan* is to be implemented within the Municipal boundaries of the Hamlet of Qikiqtarjuaq, Nunavut.

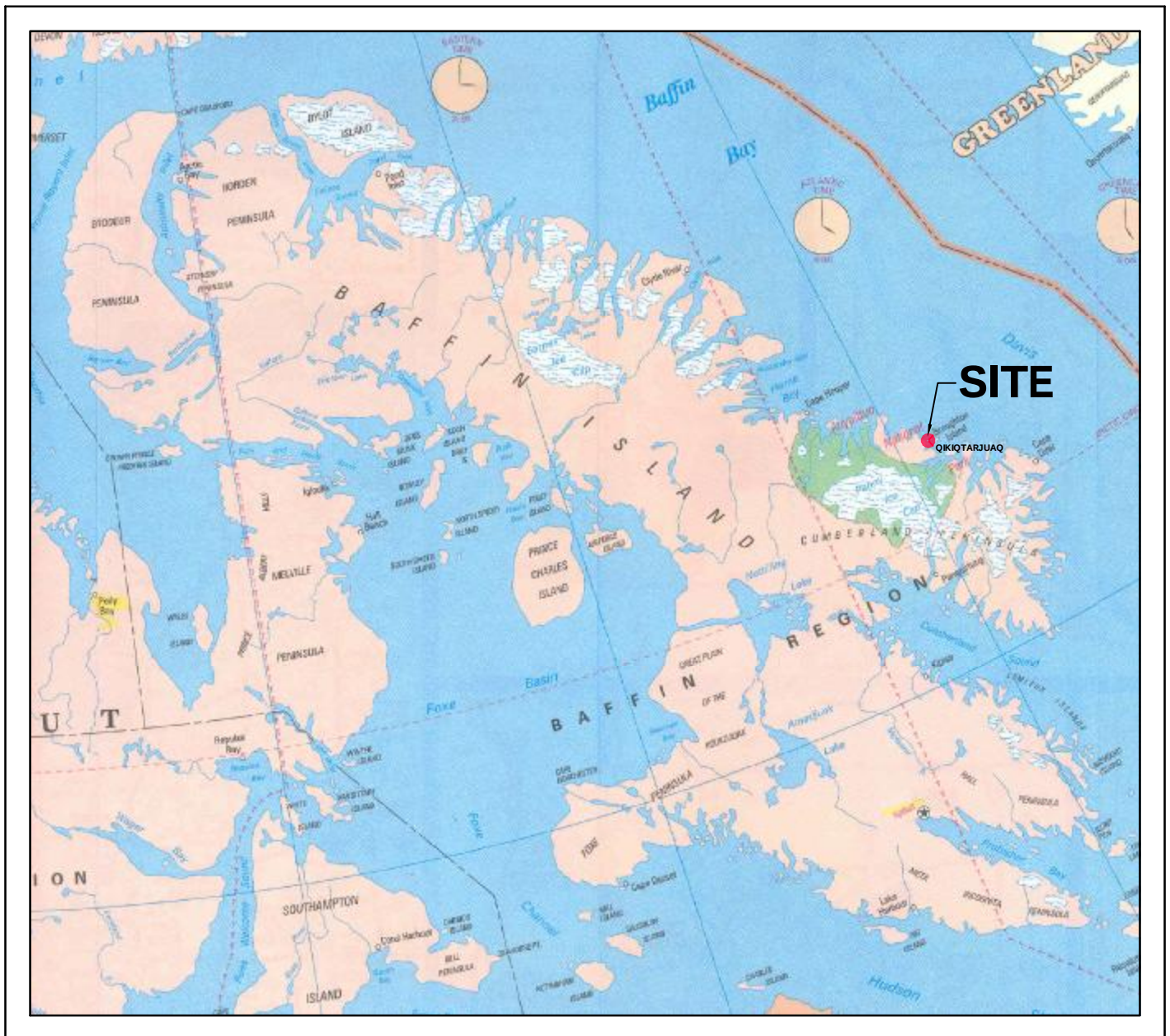
The Hamlet of Qikiqtarjuaq (meaning “big island”), is a Community of approximately 599 people located on the eastern coast of Baffin Island and on an island known as Broughton Island in the territory of Nunavut. As illustrated in Figure 1, the Hamlet is located approximately 470 kilometers northeast of the Capital City of Iqaluit, a distance that is covered by plane in about one hour. The geographic coordinates for the Hamlet of Qikiqtarjuaq are 67°33’ north latitude and 64°02’ west longitude. As indicated on Figure 2, the community is situated on the northwest portion of Broughton Island.

2.2 Sewage Collection, Water Supply, Treatment and Distribution, and Storage

The Hamlet provides trucked water service for the community. Historically, water is drawn from the Tulugak River during the summer, and from the lined earthen reservoir (Figure 3) for the remainder of the year. The water is chlorinated as it is pumped into the tanker delivery trucks through the truck fill station. The truck fill station operates by diesel generator and has an above ground storage (AST) tank on-site.

Sewage is collected in the Hamlet of Qikiqtarjuaq by vacuum truck, and transported to the Sewage Treatment Facility (Figure 4) operated by the Hamlet of Qikiqtarjuaq located approximately 2.3 km from the Hamlet. Wastewater is collected from customer holding tanks and discharged to the wastewater lagoon located to the east of the community north of the DEW Line Access Road.

The Hamlet of Qikiqtarjuaq provides regular solid waste pickup for the Community’s residents, businesses, and institutions. Collection occurs on a daily basis throughout the Hamlet, to minimize the potential for attraction of foxes and polar bears. Solid waste is trucked to the Hamlet’s Solid Waste Disposal facility (Figure 5), which is currently permitted by the Nunavut Water Board (NWB). The current Facility is located adjacent to the sewage lagoon.



Map Reference:
Map of Canada
Published by the CAA

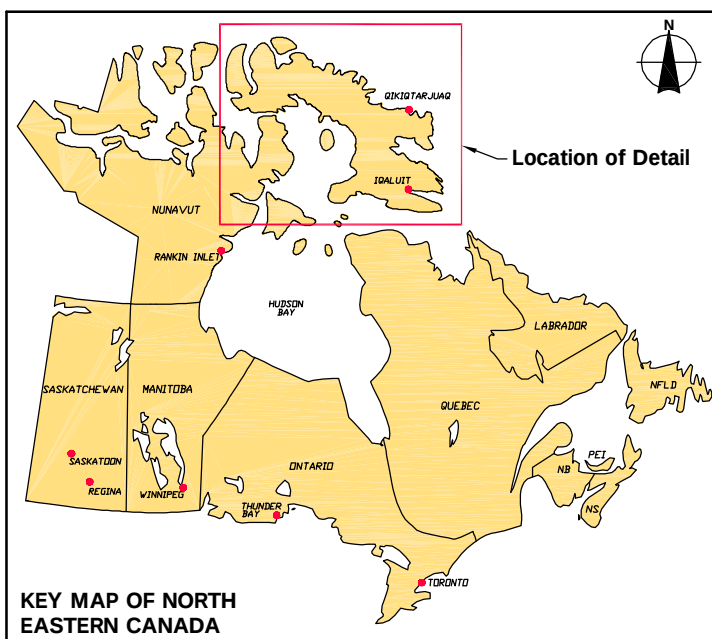


FIGURE 1 - SITE LOCATION MAP

THE HAMLET OF QIKIQTARJUAQ, NUNAVUT

ENVIRONMENTAL EMERGENCY CONTINGENCY PLAN

January 2006
Project Number: N-O 09439.0

Prepared by: K. Pridham

Verified by: M. Paznar

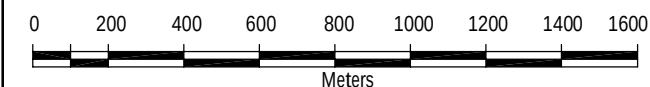
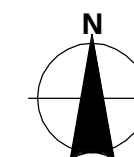
Burnside



FIGURE 2
THE HAMLET OF QIKIQTARJUAQ
ENVIRONMENTAL EMERGENCY
CONTINGENCY PLAN

SATELLITE IMAGERY OF
ENTIRE COMMUNITY
AND INFRASTRUCTURE

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



1:20,000
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

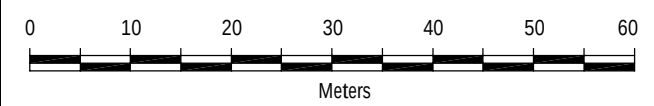
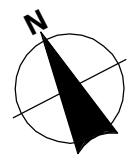
Verified by: M. Paznar



FIGURE 3
THE HAMLET OF QIKIQTARJUAQ
ENVIRONMENTAL EMERGENCY
CONTINGENCY PLAN

WATER RESERVOIR SITE

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



1:750
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: M. Paznar



DAVIS STRAIT

PROPOSED SOLID WASTE
DISPOSAL FACILITY
(LANDFILL)
EXPANSION

PROPOSED WETLAND
TREATMENT AREA
(22 Ha)

EXISTING FINAL
DISCHARGE POINT

EXISTING SOLID WASTE
DISPOSAL FACILITY
(LANDFILL)

EXISTING SEWAGE LAGOON

PROPOSED SEWAGE
LAGOON EXPANSION

LANDFILL ACCESS ROAD

DEW LINE ACCESS ROAD

FIGURE 4

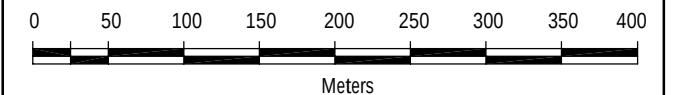
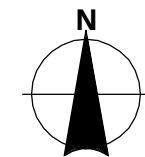
THE HAMLET OF QIKIQTARJUAQ ENVIRONMENTAL EMERGENCY CONTINGENCY PLAN

REGIONAL VIEW OF SEWAGE LAGOON & SOLID WASTE DISPOSAL FACILITY (LANDFILL)

Legend

→ → → → INTERPRETED EXISTING SURFACE WATER
FLOW DIRECTION

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



1:5,000
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: M. Paznar

 **BURNSIDE**

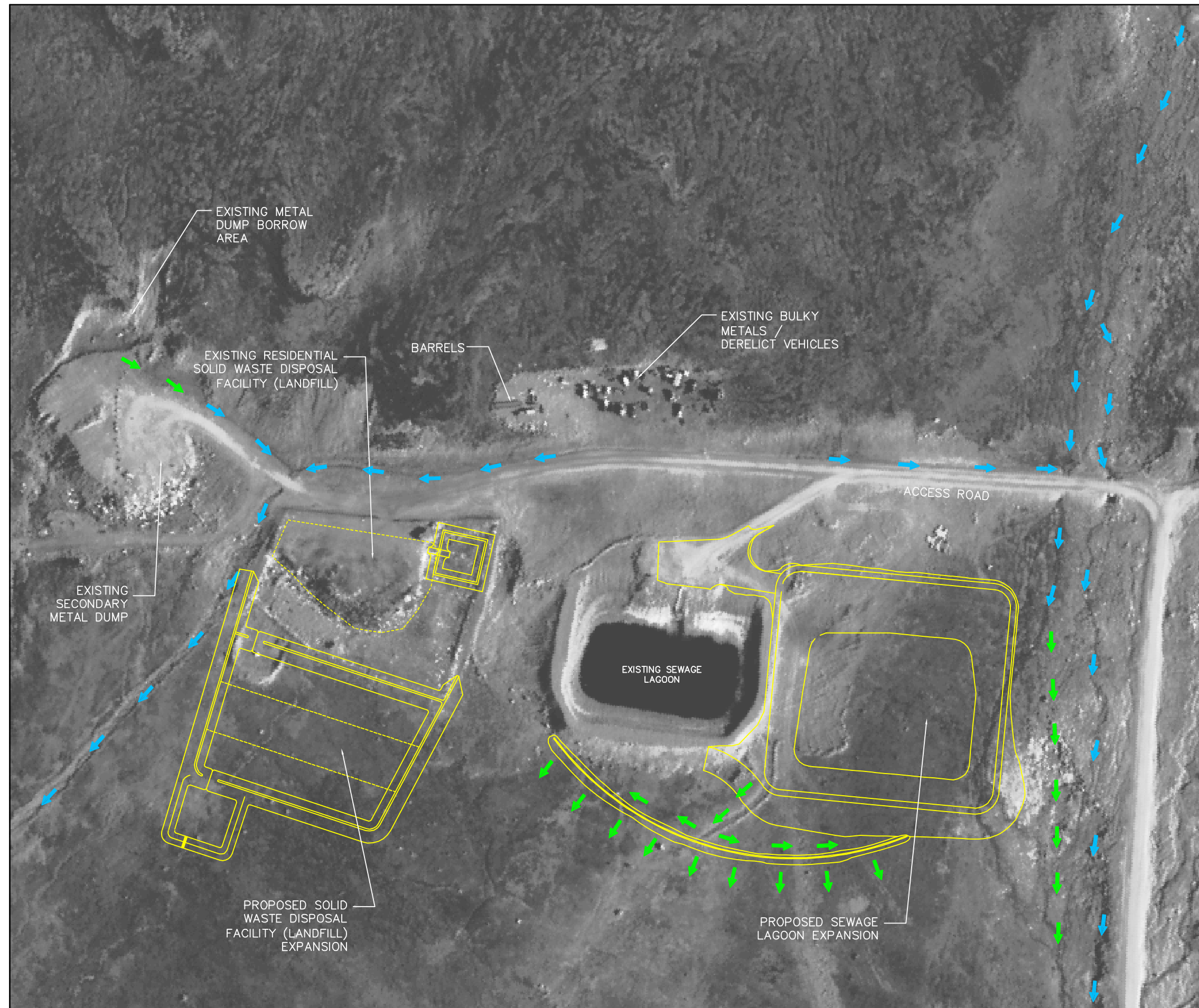


FIGURE 5

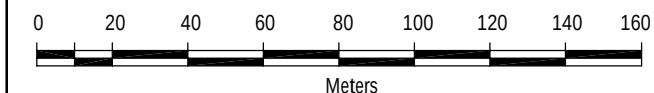
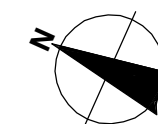
THE HAMLET OF QIKIQTARJUAQ
ENVIRONMENTAL EMERGENCY
CONTINGENCY PLAN

SOLID WASTE DISPOSAL
FACILITY (LANDFILL)

Legend

- → EXISTING SURFACE WATER FLOW DIRECTION
- → PROPOSED SURFACE WATER FLOW DIRECTION

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



1:2,000
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

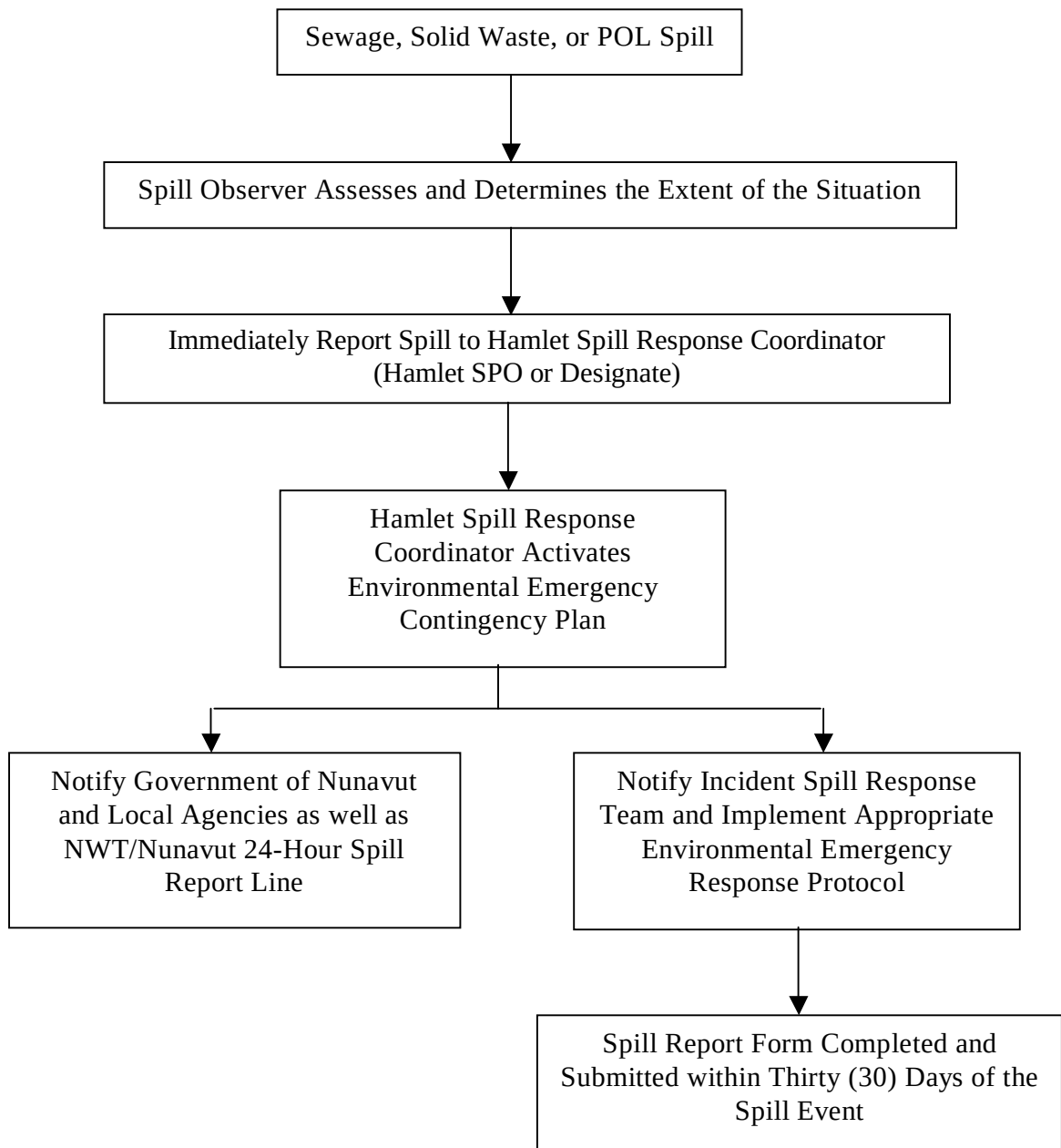
Prepared by: C. Sheppard

Verified by: M. Paznar

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3.0 Spill Response Organization

The following is a flow chart to illustrate the sequence of events that must be followed in the event of a sewage, solid waste, or POL spill occurring during supply, distribution, collection, transportation, storage, and treatment operations:



Emergency Response Flow Chart

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3.1 Incident Spill Response Team

The Hamlet Senior Administrative Officer (SAO) or his/her Designate will serve as the Spill Response Coordinator for the Hamlet in the event of a sewage or POL spill during collection and transport operations. The SAO of the Hamlet of Qikiqtarjuaq will appoint and train appropriate personnel to make up the Incident Spill Response Team, which normally consist of the following personnel:

- Spill Response Coordinator Hamlet SAO (or Designate)
- Hamlet Works Personnel Will generally vary from 3-7 people throughout the year

The responsibilities of the Spill Response Coordinator are as follows:

1. Assume complete authority over the spill scene and coordinate all personnel involved
2. Evaluate the spill situation and develop overall plan of action
3. Activate the *Environmental Emergency Contingency Plan* for the Hamlet of Qikiqtarjuaq
4. Immediately report the spill to the NWT/Nunavut 24-Hour Spill Report Line at (867) 920-8130, and other applicable regulatory or assistance agencies
5. Provide regulatory agencies with information regarding the status of the clean-up activities
6. Act as a spokesperson on behalf of the Hamlet of Qikiqtarjuaq with regulatory agencies, the public, and the media
7. Prepare and submit a report on the spill incident to regulatory agencies within 30 days of the event.

3.2 Contact Information

A complete listing of contact information, including telephone numbers of standard regulatory agencies, Hamlet personnel, and assistance agencies who may be contacted to supply resources, expertise, and advise needed to deal with a spill emergency is included in Appendix A.

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4.0 Spill Reporting Procedure

The Spill Response Coordinator must be notified immediately by any individual who is aware of any spill either by phone, radio, or in person.

The following is the incident reporting procedures once the Spill Response Coordinator activates this Environmental Emergency Spill Contingency Plan:

1. Report spill immediately to the 24-Hour NWT/Nunavut Spill Report Line Phone (867) 920-8130 (Section 4.1)
2. Report immediately to the INAC Manager, Water Resources in Iqaluit at (867) 975-4550
3. Notify Hamlet of Qikiqtarjuaq Fire Department
4. Fill out the NWT/Nunavut Spill Report Form (Appendix B) within thirty (30) days of the spill event occurring.

4.1 NWT/Nunavut Spill Report Line

All spills as defined in this document must be reported immediately to the 24-hour NWT/Nunavut Spill Report Line. Gather the following information prior to making the call:

- Date and time of spill (if known)
- Location and map coordinates (if known) and direction of flow of spill materials if moving
- Party responsible for spill
- Product/material spilled and estimate of the quantity
- Cause of spill
- If the spill has been stopped or if it is continuing
- Extent of contaminated area
- Factors affecting spill or recovery, such as weather conditions or terrain
- If containment of spill is available
- Action taken or proposed
- If assistance is required
- Possible hazards to person, property or environment (e.g. fire, drinking water, fish, wildlife, etc.).

The information collected should be brief, and quick estimates made so the Spill Report Line and the Spill Response Coordinator can assess the situation. The information is similar to that required in boxes B, D, E, F, G, H, I, J, K, L, M, N, O, and P on the spill report form that must be completely fill out in thirty days, and available in Appendix B.

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5.0 Action Plans

5.1 Initial Action

The instructions to be followed by the first person on the spill scene are as follows:

1. Always be alert and consider your safety first
2. If possible, estimate the volume of material that has been spilled
3. Assess the hazard of people in the vicinity of the spill
4. If possible, and safety permits, attempt to stop the release of product to minimize potential for environmental impacts
5. Immediately report the spill to the Spill Response Coordinator
6. Resume any effective action to contain, mitigate, or terminate the flow of the spilled material.

5.2 Environmental Health Protection and Mitigation Measures

The environmental protection and mitigation measures outlined in the following sections are to be taken by all personnel responding to a spill event and to reduce the chance of environmental impairment and health hazards due to spill, release, or other incident.

5.2.1 General Procedures

The following general clean-up procedures shall apply for all spill areas within the Hamlet:

- Always wear personnel protective equipment (PPE)
- Smoking is prohibited during all spill response activities
- Eliminate all ignition sources
- Contain spills on soil or rock by construction of earthen dykes using available material. If soil is not available, place sorbent materials or a boom in the path of the spill. As the sorbent barrier becomes saturated, continually replace it. Fuel or other liquids lying in pools, or trenches are to be removed with pumps, buckets, or skimmers
- If the ground is snow covered, create snow dykes, and line with a chemically-compatible liner for containment and recover of liquid
- For fuels on water, deploy containment booms, and recovery as much fuel as possible with a work boat and skimmer if the area has less than 1/10th ice cover. If the area is ice infested, burn any fuel spills using igniters
- Apply sorbets, if necessary
- Assess potential for disturbance of wildlife, fish, and archaeological sites by spill or clean-up operations

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- Notify environmental authorities to discuss available and feasible disposal and clean-up options
- Conduct required clean-up operations
- Assess and appropriately treat any areas disturbed by clean-up activities with laboratory testing
- Ensure the site has been completely restored and cease operations, only when all work is finalized and laboratory testing confirmed.

Specific procedures relating to mitigating measures for specific contaminants following below:

5.3 Mitigative Measures: Sewage, Gasoline, Diesel Fuel, Hydraulic Fluid, Lubricating Oil and Aviation Fuel

If possible, and safety permits, stop the flow of product, which is occurring, and eliminate all ignition sources. ***Smoking is prohibited during all spill response activities.***

5.3.1 POL Spill on Soil, Gravel, Rock, or Vegetation

- Build a containment berm using soil material or snow and place a plastic tarp at the foot of the berm for easy capture of the spill after all vapors have dissipated
- Remove the spill by using absorbent pads or excavating the soil, gravel or snow
- Remove spill splashed on vegetation using particulate absorbent material
- If soil, gravel, or vegetation are to be removed from the site, the Hamlet shall contact regulatory agencies for approval before commencing with the removal.

5.3.2 POL Spill On Water

- Use containment boom to capture spill for recovery after vapors have dissipated
- Use absorbent pads to capture small spills
- Use a petroleum skimmer for larger spills.

5.3.3 POL Spill on Ice and Snow

- Build a containment berm around spill using snow
- Remove spill using absorbent pads or particulate sorbent material
- The contaminated ice and snow must be scraped and shoveled into plastic buckets with lids, 205 litre drums, and/or polypropylene bags.

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5.3.4 POL-Contaminated Material Storage and Transfer

All contaminated water, ice, snow, soil, and clean up supplies will be stored in closed, labeled containers. All containers will be stored in a well ventilated area away from incompatible materials.

5.3.5 Disposal

Contact Federal and Territorial regulatory agencies to identify appropriate disposal methods before disposing of contaminated material. ***No contaminated material is to be disposed of in any Facility operated by the Hamlet of Qikiqtarjuaq without the express written consent of the Nunavut Water Board.***

5.4 Mitigative Measures: Ethylene Glycol Antifreeze

If possible, and safety permits, stop the flow of product, which is occurring.

5.4.1 Ethylene Glycol Spill on Soil, Gravel, Rock, or Vegetation

- Build a containment berm using soil material or snow and place a plastic tarp at the foot of the berm for easy capture of the spill
- Remove the spill by using absorbent pads or excavating the soil, gravel, or snow
- Remove spill splashed on vegetation using particulate absorbent material
- If soil, gravel, and/or vegetation must be removed from the spill site, the Hamlet shall contact the appropriate regulatory agencies for approval before commencing with the removal.

5.4.2 Ethylene Glycol Spill On Water

Use containment boom to capture spill, and pump contaminated water into 205 L drums.

5.4.3 Ethylene Glycol Spill On Ice and Snow

- Build a containment berm around spill using snow
- Remove spill using particulate sorbent material
- The contaminated sorbent material, ice and snow must be scraped and shoveled into plastic buckets with lids, 205 litre drums, and/or polypropylene bags.

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5.4.4 Ethylene Glycol Storage and Transfer

All contaminated water, ice, snow, soil, and clean up supplies will be stored in closed, labeled containers. All containers will be stored in a well ventilated area away from incompatible materials.

5.4.5 Disposal

Contact Federal and Territorial regulatory agencies to identify appropriate disposal methods before disposing of contaminated material. ***No contaminated material is to be disposed of in any Facility operated by the Hamlet of Qikiqtarjuaq without the express written consent of the Nunavut Water Board.***

5.5 Mitigative Measures: Sewage

If possible, and safety permits, stop the flow of product, which is occurring.

5.5.1 Sewage Spill on Soil, Gravel, Rock, or Vegetation

- Build a containment berm using soil material or snow and place a plastic tarp at the foot of the berm for easy capture of the spill, and to prevent sewage from entering any water body
- Remove the spill by using vacuum trucks or excavating the soil, gravel, or snow
- If soil, gravel, and/or vegetation must be removed from the spill site, the Hamlet shall contact the appropriate regulatory agencies for approval before commencing with the removal.

5.5.2 Sewage Spill into Water

- Use containment boom to capture spill, and pump contaminated water into vacuum trucks
- Deposit contaminated water to the Hamlet sewage lagoon
- Monitor the affected water body sampling at a minimum for Biological Oxygen Demand (BOD), Total Suspended Solids (TSS), ammonia (NH₃), and faecal coliforms (FC).

5.5.3 Sewage Spill on Ice and Snow

- Build a containment berm around spill using snow
- Remove spilled sewage and contaminated snow and ice to the Hamlet sewage lagoon.

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5.5.4 Sewage Storage and Transfer

All contaminated water, ice, snow, soil, and clean-up supplies will be deposited to the Hamlet sewage lagoon or landfill facility, as appropriate.

5.6 Mitigative Measures: Solid Waste

5.6.1 Solid Waste Spill on Soil, Gravel, Rock, or Vegetation

- Physically remove the spilled solid waste from the waste, and deposit to the approved Hamlet Solid Waste Disposal Facility
- If soil, gravel, or vegetation are to be removed from the site, the Hamlet shall contact regulatory agencies for approval before commencing with the removal.

5.6.2 Solid Waste Spill into Water

- Use containment boom to capture soil for recovery
- Physically remove the spilled solid waste from the water, and deposit to the approved Hamlet Solid Waste Disposal Facility
- Capture any sheen from the water using absorbent pads or skimmer, and deposit any used absorbent pads to the approved Hamlet Solid waste Disposal facility.

5.6.3 Solid Waste Spill on Ice and Snow

- Build a containment berm around spill using snow
- Physically remove the spilled solid waste and deposit to the approved Hamlet Solid Waste Disposal Facility
- If soil, gravel, or vegetation are to be removed from the site, the Hamlet shall contact regulatory agencies for approval before commencing with the removal.

5.6.4 Disposal

Any solid waste shall be removed to the approved Hamlet Solid Waste Disposal Facility.

5.7 Spill Recovery Assessment

In order to determine whether a spill has been successfully remediated, samples of the soil and/or water within the spill containment area and surrounding the area, are to be collected and sent to an accredited Canadian Association of Environmental Analytic Laboratories (CAEAL) laboratory to be analyzed for the chemical parameters contained in the spill material. If concentrations of the spill chemicals are not detected, or are at

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concentrations below the applicable Territorial, Federal, or CCME regulations/criteria, the spill clean-up will be determined a success. Clean-up operations may then cease.

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6.0 Spill Response Resource Inventory

6.1 Additional Personnel Available

In addition to Hamlet staff, approximately 10 people are available from the Qikiqtarjuaq Fire Department, to assist in spill response and clean-up activities. Personnel from the local RCMP Detachment will be available for securing the site from unauthorized individuals, closing roads, etc. The Community Health Centre have personnel to assist in the treatment of anyone injured during the emergency.

6.2 Spill Response Equipment Inventory

Equipment available within the community to assist in responding to a hazardous materials spill includes heavy equipment (i.e. vacuum trucks, dozer, front end loader, and grader), as well as various hand held tools including shovels. In addition, three spill kits should be available on site during spill incident response operations. Each spill kit should contain the following supplies.

Composition of Spill Kit

	Quantity
• 360 litre polyethylene over pack drum	1
• oil sorbent booms (5" X 10')	6
• oil sorbent sheets (16.5" X 20" X 3/8")	100
• drain cover (36" X 36" X 1/16")	1
• Caution tape (3" X 500')	1
• 1 lb plugging compound	1
• Nitrile gloves (pair)	4
• Safety goggles (pair)	4
• Tyvek coveralls (pair)	4
• instruction booklet	1
• printed disposable bags (24" X 48")	10

Sorbent capacity of each spill kit is 240 litres.

All equipment is generally stored at the Hamlet Operations Yard/Garage. Some equipment may be stored in other areas throughout the community while being used to complete tasks.

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7.0 Training

All employees working for the Hamlet of Qikiqtarjuaq should be trained in the safe operation of all machinery and tools to help prevent sewage and hazardous material spills. All employees on site should also be trained for initial spill incident response. Annual refresher exercises should be conducted to review the procedures of this *Environmental Emergency Contingency Plan*, with all individuals involved in the Incident Spill Response Team, including members of the local volunteer fire department, RCMP Detachment, and Community Health Centre.

Incident Spill Response Team training should include the following aspects:

- Spill awareness and prevention
- Methods of detection
- Types of spills and seasonal considerations
- Reporting procedures and initial responses
- Spill response kit familiarization
- Clean-up and site remediation methods
- Occupational health and safety including proper selection and use of PPE's.

Environmental Emergency Contingency Plan for
Water, Sewage, and Solid Waste Operations in the
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8.0 Annual Review of this Environmental Emergency Contingency Plan

As part of the preparation of the Annual Report to the Nunavut Water Board for the Water License, the Hamlet should review and update the information contained within this plan. The purpose of the update is to ensure all changes to regulations are incorporated into this plan, along with the use of any new technology or method advances, to prevent or stop a spill and to mitigate and/or remediate a spill. This ensures that the plan adapts as the Hamlet grows, to ensure the community is properly prepared in the event of an incident.

Finally, it is recommended that annual refresher training of personnel be completed after any revisions to this document have been approved. This will familiarize personnel with the updated plan, and to provide a rapid and coordinated response.

Environmental Emergency Contingency Plan for
Water, Sewage, and Solid Waste Operations in the
Hamlet of Qikiqtarjuaq, Nunavut

February 2006

9.0 References

Nunavut Water Board, September 2000. *Hamlet of Qikiqtarjuaq Water License NWB3Q1K0106*. Goja Haven, Nunavut.

Nunavut Water Board, November 2004. *Guidelines for Spill Contingency Planning*. Goja Haven, Nunavut.

Northwest Territories, Date Unknown. *Contingency Planning and Spill Reporting in the NWT: A Guide to the New Regulations*, Yellowknife, Northwest Territories.

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Appendix A
Contact Information

**Appendix A
Contact Information**

Contact	Location	Telephone	Fax
Hamlet of Qikiqtarjuaq Senior Administrative Officer or Designate	Qikiqtarjuaq	(867) 927-8832	(867) 927-8120
Northwest Territories/Nunavut 24 Hour Spill Report Line	Iqaluit	(867) 920-8130	(867) 873-6924
Indian and Northern Affairs Canada Water Resources Manger Nunavut Regional Office	Iqaluit	(867) 975-4550	(867) 975-4585
Nunavut Water Board	Gjoa Haven	(867) 360-6338	(867) 360-6369
Environment Canada Environment Protection Branch Inspector	Iqaluit	(867) 975-4644	(867) 975-4594
Manager Pollution Control and Air Quality Environmental Protection Government of Nunavut	Iqaluit	(867) 975-5907	(867) 975-5981
Indian and Northern Affairs Canada Land Administration Minister Nunavut Regional Office	Iqaluit	(867) 975-4280	(867) 975-4286
Department of Fisheries and Oceans Canada Nunavut Regional Office	Iqaluit	(867) 979-8000	(867) 979-8039
Fire Department	Qikiqtarjuaq	(867) 927-4422	N/A
Royal Canadian Mounted Police (RCMP) Detachment	Qikiqtarjuaq	(867) 927-0123	N/A
Community Health Centre	Qikiqtarjuaq	(867) 927-8916	N/A

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Appendix B
NWT Spill Report



NWT SPILL REPORT

(Oil, Gas, Hazardous Chemicals or other Materials)

24 – Hour Report Line
Phone: (867) 920-8130
Fax: (867) 873-6924

A Report Date and Time		B Date and Time of spill (if known)		C ☐ Original Report ☐ Update no. _____		Spill Number	
D Location and map coordinates (if known) and direction (if moving)							
E Partly responsible for spill							
F Product(s) spilled and estimated quantities (provide metric volumes/weights if possible)							
G Cause of spill							
H Is spill terminated? ☐ yes ☐ no		I If spill is continuing, give estimated rate		J Is further spillage possible? ☐ yes ☐ no		K Extent of contaminated area (in square meters if possible)	
L Factors effecting spill or recovery (weather conditions, terrain, snow cover, etc.)				M Containment (natural depression, dikes, etc.)			
N Action, if any, taken or proposed to contain, recover, clean up or dispose of product(s) and contaminated materials							
O Do you require assistance? ☐ no ☐ yes, describe:				P Possible hazards to person, property, or environment; eg: fire, drink water, fish or wildlife			
Q Comments or recommendations						FOR SPILL LINE USE ONLY	
						Lead agency	
						Spill significance	
						Lead Agency contact and time	
						Is this file now closed? ☐ yes ☐ no	
Reported by		Position. Employer, Location				Telephone	
Reported to		Position. Employer, Location				Telephone	



Appendix F
Monitoring Program Quality
Assurance/Quality Control Plan



**Quality Assurance/Quality Control Plan for
Hamlet Water Reservoir, Sewage Lagoon, and
Solid Waste Disposal Facility Monitoring Program
Hamlet of Qikiqtarjuaq, Nunavut**

Prepared for

The Hamlet of Qikiqtarjuaq
P.O. Box 4, Qikiqtarjuaq NU X0A 0B0 Canada

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

Revised Date

February 2006

File No: N-O 09439.0

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1.0 Introduction

The Hamlet of Qikiqtarjuaq (meaning “big island”), is a Community of approximately 599 people located on the eastern coast of Baffin Island and on an island known as Broughton Island in the territory of Nunavut. As illustrated in Figure 1, the Hamlet is located approximately 470 kilometers northeast of the Capital City of Iqaluit, a distance that is covered by plane in about one hour. The geographic coordinates for the Hamlet of Qikiqtarjuaq are 67°33’ north latitude and 64°02’ west longitude. As indicated on Figure 2, the community is situated on the northwest portion of Broughton Island.

The Hamlet provides trucked water and sewage services, along with regular solid waste collection for the residents, businesses and institutions. Historically, water is drawn from the Tulugak River during the summer, and from the lined earthen reservoir for the remainder of the year. Sewage is collected by truck from individual holding tanks at each building and discharged to the unlined sewage lagoon located to the east of the community north of the DEW Line Access Road. Sewage treatment is provided by a retention lagoon, with the treated effluent charge flowing north towards the ocean through a naturally occurring wetland treatment area. Solid waste is disposed of at a facility located adjacent to the sewage lagoon. The solid waste disposal facility includes areas for bulky metals/derelect vehicles, barrels, metal dump borrow, secondary metal, and residential solid waste.

1.1 Purpose

The Quality Assurance/Quality Control Plan has been prepared to meet the requirements of the Monitoring Program developed for the Hamlet of Qikiqtarjuaq to comply with licensing requirements. A copy of the current license is included in Appendix A.

Quality Assurance (QA) and Quality Control (QC) are vitally important components of environmental management for the Hamlet of Qikiqtarjuaq. Contact information for the Hamlet is provided in Appendix B.

1.2 Objectives

The Plan has been developed to achieve the following objectives:

- To ensure that all samples taken in the field will follow procedures and controls in order to maintain a high quality, so that the results obtained represent both the physical and chemical nature of the samples being taken
- To ensure best management practices (BMP) are used throughout the sampling program

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- To ensure all samples are delivered promptly to an accredited laboratory for analysis.

This document describes the procedures and controls to be used by Hamlet operations staff when conducting environmental sampling to meet the requirements of the license.

Although the QA/QC Plan is submitted to the NWB as a condition of the water license, it is primarily intended to be read, understood, and implemented by Hamlet operations personnel responsible for environmental quality monitoring. The procedures should be applied to **all** water quality samples taken by the Hamlet.

1.3 Quality Assurance and Quality Control

Quality Assurance is a set of operating principles that, if strictly followed during sample collection and analysis, will produce data of known and defensible quality (Wilson, 1995). As such the accuracy of the analytical results can be stated with a high level of confidence. A high level of quality assurance can be achieved by applying the following principles:

- Personnel involved in water sampling and analysis are well trained
- Facilities and equipment required for sampling are suitable, well maintained, and always kept clean
- Standard procedures are developed and implemented for the collection, transportation and analysis of samples, based on recognized BMP
- Laboratory and field instruments are calibrated according to manufacturers recommendations or recognized as good operating practice
- Supplies used in sampling and analysis are of consistent high quality and are not expired
- Quality Control (QC) procedures are development and implemented based on good operating practices to assess quality of analytical data and provide warning of unacceptable errors
- Implement prompt remedial action when deficiencies are identified
- Results of the monitoring program are reported in the Annual report as required in the water license. Annual report is required to be submitted by March 31 for the pervious calendar year to the NWB sample form can be found in Appendix C.

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Quality Control (QC) is a set of specific procedures used to measure the quality of the data produced and correct deficiencies in the sampling or analyses, as they occur. Quality control is used by the analyst and sampler to achieve standards of measurement for the three principles components of quality: precision, accuracy and reliability.

1.4 Lab Accreditation

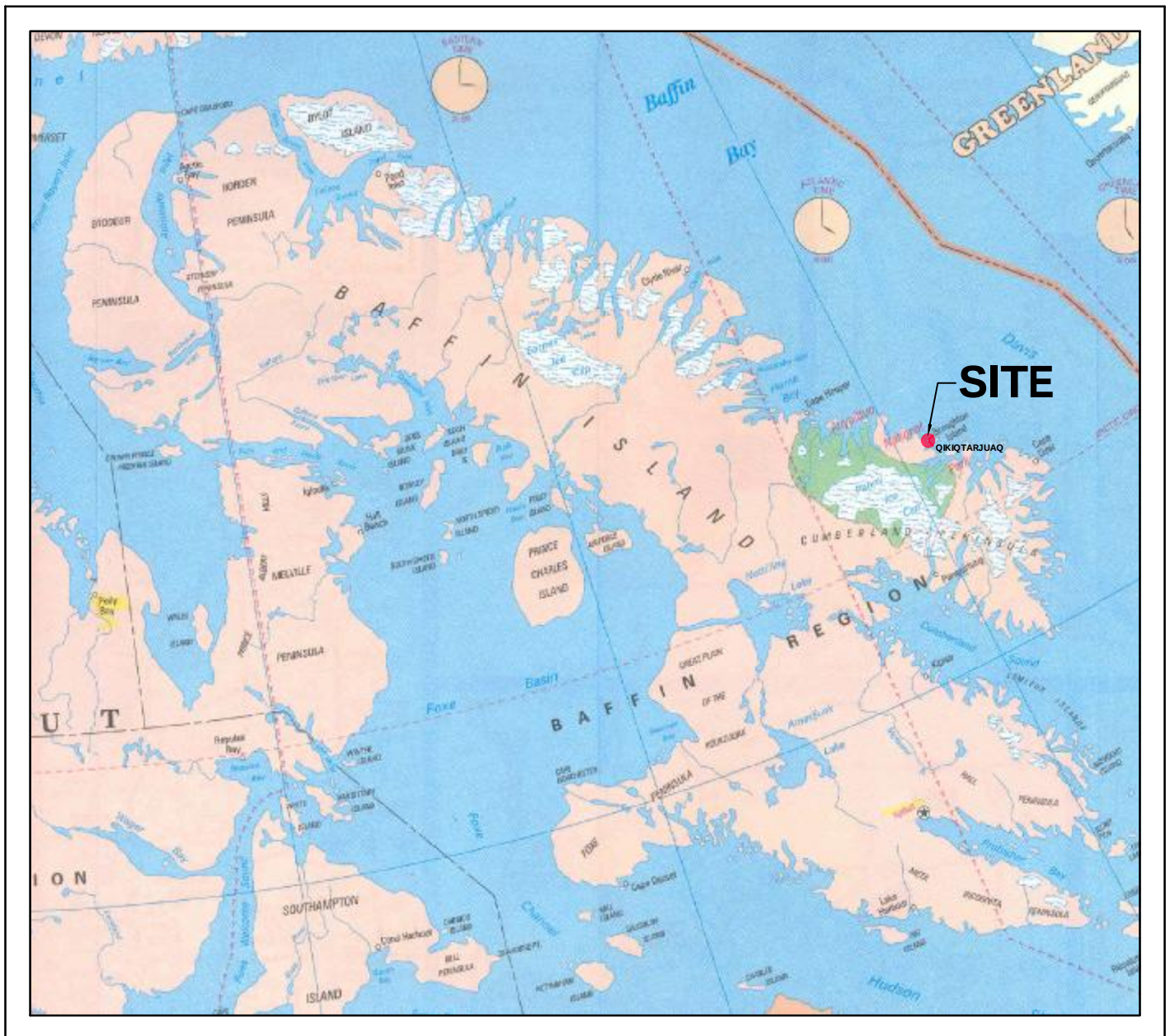
All analyses shall be conducted in laboratories, which are accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL), unless otherwise approved by an Analyst. The Contact information for the DIAND Analyst for Nunavut is provided in Appendix A.

The following is the contact information for the Laboratory retained by the Hamlet of Qikiqtarjuaq to complete analysis:

Name of Laboratory	_____
Address	_____

Phone No.	_____
Fax No.	_____

Prior to sampling being undertaken by representatives of the Hamlet, the Hamlet shall notify the NWB of the Laboratory to be used to perform the analysis. This is required as per the Water License.



Map Reference:
Map of Canada
Published by the CAA

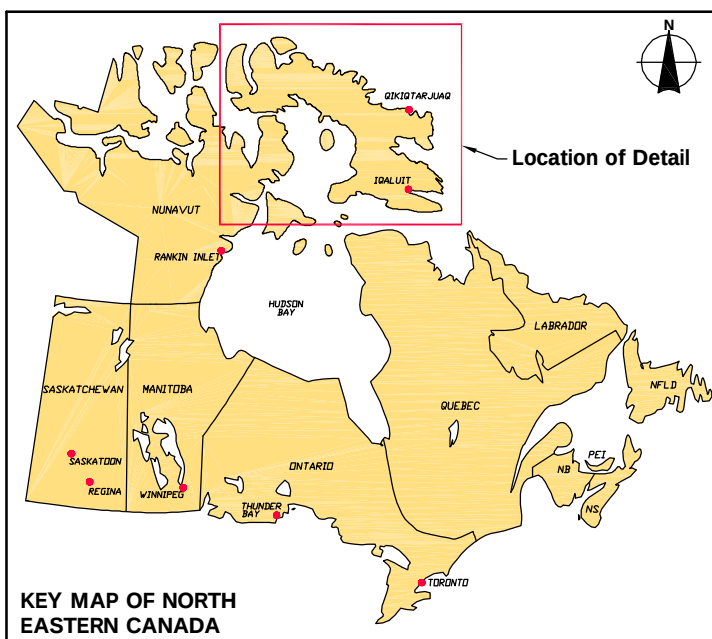


FIGURE 1 - SITE LOCATION MAP

THE HAMLET OF
QIKIQTARJUAQ, NUNAVUT

QUALITY ASSURANCE/QUALITY CONTROL PLAN

January 2006
Project Number: N-O 09439.0

Prepared by: K. Pridham

Verified by: M. Paznar

Burnside



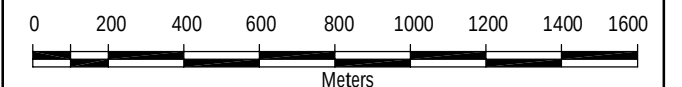
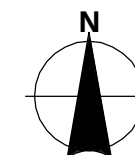
FIGURE 2
THE HAMLET OF QIKIQTARJUAQ
QUALITY ASSURANCE/QUALITY CONTROL
PLAN

SATELLITE IMAGERY OF
ENTIRE COMMUNITY
AND INFRASTRUCTURE

Legend

X QIK - 1 **SAMPLING STATION LOCATION**

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



1:20,000
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: M. Paznar



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2.0 Field Sampling

2.1 Sample Collection

Effluent and surface water sampling by the Hamlet of Qikiqtarjuaq is conducted to provide information for the Hamlet for effective environmental management and to monitor regulatory compliance.

2.1.1 Sampling Location and Frequency

The Monitoring Program of the water license prescribes the specific effluent and surface water monitoring program for the Hamlet. It includes detailed information such as where to take samples, how often to take samples and what parameters will be analyzed on the collected samples. The proposed Monitoring Program is summarized in Table 1.

Table 1: Surveillance Network Program for Water License NWB3Q1K0106

Station	Description	Frequency	Analysis Requirements
QIK -1	Raw water supply intake at the Tulugak River	Monthly from May to August prior to refilling reservoir	Measure volume of water drawn from river • Total Ammonia-N • Total Organic Carbon (TOC) • Total Suspended Solids • Chloride (Cl) • Nitrate (N) • Total Arsenic (As) • Total Chromium (Cr) • Total Copper (Cu) • Total Lead (Pb) • Total Mercury (Hg) • Total Sodium (Na) - Microbiological • Heterotrophic plate count (HPC) • Coliform • Colour • pH • Turbidity • Nitrite (N) • Sulphate (SO₄) • Total Cadmium (Cd) • Total Cobalt (Co) • Total Iron (Fe) • Total Manganese (Mn) • Total Nickel (Ni) • Total Zinc (Zn) • Background • Escherichia coli (E.coli)

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Station	Description	Frequency	Analysis Requirements
QIK - 2	Raw water supply intake at the reservoir truck fill station	Monthly from May to August	Measure volume of water drawn from reservoir
QIK - 3	Raw sewage from pump out truck	Monthly from May to August	Amount deposited to lagoon
QIK - 4	Discharge from the FINAL DISCHARGE POINT OF SEWAGE DISPOSAL FACILITIES	Monthly during periods of flow	• 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
QIK - 5	Runoff from the Solid Waste Disposal Facility	Monthly during periods of flow	Same as STN QIK - 4

The sampling stations will be clearly identified in the field by posted signs. All signs shall be in the Official Languages of Nunavut, and shall be located and maintained to the satisfaction of an Inspector. Each sampling location must have their Global Positioning System (GPS) coordinates determined. Table 2 provides an estimate of the GPS coordinates based on the satellite imagery shown in Figure 2. These locations must be confirmed by the Inspection, and the coordinates updated if necessary.

Table 2: GPS Locations of SNP Sampling Stations

Station	GPS Coordinates (Easting, Northing)
QIK - 1	458912, 7493383
QIK - 2	458740, 7493463
QIK - 3	458962, 7495017
QIK - 4	458091, 7495340
QIK - 5	458754, 7495176

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Samples shall be taken at the same location on each sampling occasion, unless the Inspector has approved a new location.

Additional sampling and analysis may be requested by an Inspector.

Note: The License also describes the sampling station QIK-1 as the raw water supply prior to treatment. The Hamlet is not required to take samples at this site to comply with the water license. Samples for QIK-1 shall be taken by the Indian and Northern Affairs Canada (INAC) and/or GN Environmental Health Office (EHO).

2.1.2 Sample Planning

To understand what sample containers, sampling techniques, and preservation methods are required, Hamlet personnel first need to understand what parameters will be analyzed in the laboratory. Table 3 is a summary of parameters required in the License, which are grouped according to their different sampling requirements:

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Table 3: Parameters Examined in NWB Water Licenses

Group	Description	Parameter
I	Microbiological	Biological Oxygen Demand (BOD) Fecal Coliform (FC)
II	General Water Chemistry	pH Conductivity Total Alkalinity Total Suspended Solids (TSS) Ammonia Nitrogen (NH ₃ -N) Nitrate-Nitrite (NO ₃ -NO ₂) Oil and Grease (OGG) (Visual) Sulphate (SO ₄) Sodium (Na) Total Organic Carbon (TOC) Potassium (K) Magnesium (Mg) Calcium (Ca) Total Hardness Chloride (Cl)
	Total Metals (except Mercury):	Total Nickel (Ni) Total Aluminum (Al) Total Arsenic (As) Total Cadmium (Cd) Total Copper (Cu) Total Cobalt (Co) Total Chromium (Cr) Total Iron (Fe) Total Lead (Pb) Total Manganese (Mn) Total Zinc (Zn)
III		Total Mercury (Hg)
IV		Total Phenols (Total-P)

It is strongly recommended that the Hamlet seek advice for the sizes and types of buffers required for analysis of the parameters required. Furthermore, it is recommended that the laboratory pre-fill the sample collection bottles with the proper preservative to minimize error in the field.

All of the samples taken will be grab samples. Samples will normally be taken from natural lakes, streams, treatment ponds, or process streams. Where possible, samples

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shall be taken from just below the surface to avoid floating debris, which may contaminate the sample.

Freshwater Streams, Surface Drainage, and Wetlands

The samples shall be collected as close to the middle of the stream where water flows freely and is free of debris. After getting into position, the sampler shall wait to allow any stirred sediment that occurred from entering the stream to settle or wash away. The sample bottle shall be partially filled with the water to be sampled and rinsed with the lid in place at least three times. Rinse water shall be emptied downstream of the sampling point, so that stream sediments remain undisturbed. **Prior to sampling for oil/grease, bacteria, and for any bottles containing preservative, the bottles shall not be rinsed.**

If possible, bottles shall be plunged into the stream to a depth of approximately half the total stream depth, and allow it to fill with the mouth of the bottle facing upstream. Where stream is too shallow to allow for sample bottle to be filled completely, without disturbing bottom sediment of the streambed. The sampler may use a smaller container that has been properly rinsed to transfer sample to the larger bottle. Do not use a smaller sample bottle containing preservatives.

When taking the sample, sufficient room shall be left to allow for the addition of preservatives, if required.

Lakes or Ponds

Surface sampling shall be collected using the same procedures as streams. Sample bottles shall be plunged to approximately 150 mm (6 inches) below the water surface.

Although not currently required under the Monitoring Program, information on water quality at various depths in lakes or ponds may be required. If an Inspector requests that this sampling be carried out, specific procedures shall be implemented in accordance with accepted sampling and good engineering practice.

Process Streams

When sampling a process stream (i.e. valve or pipe discharge) the sampler shall collect a grab sample or a set of composite samples collected over an extended period of time. In the case of sampling from a valve, valves shall be open and running for a least one-minute before taking the sample to ensure that a representative sample of the process stream is taken.

2.1.3 Sample Container Selection

Sample containers vary in size and material of construction depending on the specific type of analysis to be conducted. Sample containers for each analysis are shown in Table

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2. Sample containers to be used shall be obtained directly from the laboratory, which shall provide new containers to the Hamlet specific for the sampling program requested by the Hamlet. The laboratory will provide the correct sizes and types of bottles based on the parameters required. The Hamlet shall **contact the laboratory at least one month prior to sampling event** in order to ensure that containers are available for sampling. Refer to Section 1.3 for laboratory contact information.

2.1.4 Field Sampling Log

The individual collecting the water sample shall record the following at the time of sampling:

- Date of sampling
- Time of sampling
- Weather conditions
- Monitoring Station Number (i.e. QIK-2, QIK-3, QIK-4, etc.)
- Results of any Field measurements
- Sampler shall also indicate if sample used preservatives
- Any unusual conditions
- Any deviation from standard procedures.

2.1.5 Field Measurements

No field measurements are required as part of the Hamlet sampling program, however, it is strongly recommended that the following parameters be sampled immediately on site using appropriate portable field equipment:

- pH
- Temperature
- Dissolved oxygen
- Total alkalinity
- Turbidity
- Chlorine residuals.

It is important that separate equipment be used to sample between potable water and non-potable water (i.e. surface water). Furthermore, all instruments, glassware, etc. should be cleaned between each sample following manufacturer's recommended guidelines and/or BMPs.

2.1.6 Sampling Procedures

The sampling procedures described in Table 4 shall be used to collect water samples appropriate to the sampling location.

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Table 4: General Procedures for Sample Collection

	BIOLOGICAL	PHYSICAL	INORGANIC	ORGANIC
Phase 1: Sample Program Design	Step 1: Choose sample locations, sample frequency, and analytes to be measured Step 2: Contact laboratory used for analysis and get advice and information for sampling program Step 3: Contact manager of sample location facility; determine all safety requirements Step 4: Create sample identification system			
Phase 2: Sample Program Preparation	Step 1: Obtain sample containers, storage containers, distilled water, Personal Protective Equipment (PPE), and other required equipment Step 2: Create sample labels and apply to sample containers Step 3: Plan first sampling event - arrange all transportation and notify laboratory			
	• 1000 mL plastic or glass container for BOD • 300 mL plastic or glass container for fecal coliform	• Have equipment needed for any flow or temperature measurements • 200 mL plastic or glass container for suspended solids	• Electrode meter for dissolved oxygen and pH • 1000 mL nitric acid rinsed container, nitric acid for preservation, and filter for metals • Specific containers and preservatives for nutrients or other analytes	• 1000 mL plastic or glass container, hydrochloric or sulfuric acid, for oil and grease
Phase 3: Sample Collection	Step 1: Keep sample containers closed until used Step 2: Record the date, time, location, geographic position, weather conditions, and other details in a field notebook at each sample location Step 3: Fill out the sample label, including: sample ID, location, date, time, and name of sample collector Step 4: Collect sample using appropriate container, by filling without rinsing, immediately close and keep cool Step 5: Pack all samples and provide a sample information sheet listing all contents in the storage container Step 6: Label the storage container with the recipient, WATER SAMPLES, FRAGILE, THIS END UP, and any TDG or WHMIS labels required			
	• BOD - fill container completely and refrigerate, Fecal coliform - leave space at top of container, refrigerate • Maximum storage time: BOD - 24 hrs, Fecal Coliforms - 30 hrs,	• TSS - Refrigerate • Maximum storage time: TSS - 7 days, temperature - 0.25 hrs	• Fill container and leave a small (1% of volume) air space at the top, refrigerate • Maximum storage time: ammonia - 7 days, nitrate and phosphate - 48 hrs, metals - indefinite, DO and pH - 0.25 hrs	• Fill container to top and refrigerate • Maximum storage time: oil and grease - 28 days
Phase 4: Sample Transportation	Step 1: Fill out the "sampler" portion of the Chain of Custody form Step 2: Ensure that all personnel handling the samples fill out a subsequent section of the Chain of Custody form Step 3: Transport the samples to lab for analysis as quickly as possible Step 4: Verify that the lab has received the samples and analysis is underway			

Note: Sizes and types of sample collection containers (bottles) are a suggestion only. The laboratory may suggest and use other sizes and types. Follow the suggestions of a CAEAL accredited laboratory.

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2.1.7 Sample Identification

All samples collected are to be labeled according to standard identification procedures (Name of sampler, time and date of sampling, sample identifier, sampling method and type of sample). **Sample labels shall be water-resistant, and prepared prior to going into the field.** An example of a typical Label is provided in Figure 3.

Figure 3: Example of Water Sample Label

Name of Sampler:	Gill Evans	Sample #:	1 of 15
Date of Collection:	1 May 2006 (0900 hrs)		
Type of Sample:	Grab Water Sample for Microbiological Analysis		
Parameter to be analyzed:	BOD		
Preservation method used:	no preservatives		
Temperature:	11°C	pH:	7.04
Sample Location:	QIK-4		
	Hamlet of Qikiqtarjuaq		
	Qikiqtarjuaq, NU		
	Phone: (867) 927-8943		

2.1.8 Sample Preservation

To obtain good results from a sampling program, time is critical. All samples are to be shipped to the Laboratory that has been contracted to carry out the analysis the same day as they are collected. Samples must be protected from breakage, and shall be shipped in an insulated cooler that can be provided by the Laboratory. **If samples cannot be shipped until the next day, due to unavoidable events such as weather or mechanical problems with transport aircraft, all samples must be stored in a refrigerator at 4°C.** Samples must not be frozen.

In all cases where samples cannot be delivered to the lab on the same day, specific preservatives must be added to the samples to prevent chemical changes that may alter the concentration of the parameters of interest. The samples must be preserved within two hours of sampling. Usually, samples can be preserved away from the field at the end of the site visit. In most cases, the laboratory can fill the bottles with preservative, and then ship them to the Hamlet to be filled and sent back for analysis.

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For the Hamlet of Qikiqtarjuaq, Table 5 provides the appropriate preservation methods for the parameters to be assessed.

Table 5: Sample Preservation

Type of Sample	Preservation Required
Group I Microbiological	Store in refrigerator at 4°C. Ship to Lab the same day as collected
Group II General Water Chemistry	Store in refrigerator at 4°C. Ship to Lab the same day as collected
Group II Total Metals (except mercury)	Acidify with 5 mL of <20 percent nitric acid. Store in refrigerator at 4°C. Ship to Lab the same day as collected
Group III Total Mercury	Acidify with 2 mL of 1:1 sulfuric acid and 5 percent potassium dichromate Store in refrigerator at 4°C. Ship to Lab the same day as collected
Group IV Total Phenols	Acidify with 4 mL of 1:1 sulfuric acid. Store in refrigerator at 4°C. Ship to Lab the same day as collected

Note: 1000 mL = 1 Liter

2.1.9 Sample Transportation

The main objective of the sampler is to minimize any chemical changes to the sample between the time it is collected and delivery to the laboratory. Heat, light and agitation can all impact the water chemistry and the samples shall be protected from these effects.

Effluent and surface water samples shall be stored and transported at a temperature of 4°C. Coolers and ice packs need to be available and are usually provided by the laboratory. Upon arrival at the laboratory, samples shall be refrigerated as soon as possible.

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3.0 Quality Control

Most commercial laboratories undertake QA/QC procedures with the volume of sample sent for analysis. Reports are usually provided with the Certificates of Analysis. It is recommended that the suggested QA/QC protocols by the laboratory be followed.

To ensure that the monitoring program maintains accepted quality control, field blanks and duplicate samples may be suggested by the laboratory. These samples are collected and analyzed for the sample parameters as the monitoring program in the license as part of a quality control check on monitoring activities.

The Field Blanks shall accompany the sampler into the field, labeled as field blanks, preserved in the field and submitted to the laboratory with the field samples.

3.1 Replicate or Duplicate Samples

Replicate or duplicate samples is the collection of more than one sample for a given sampling station subject to specific analysis. Standard procedures used for the routine sampling shall be applied. The replicate or duplicate samples are useful in identifying problems with accuracy and sampling methods.

Once per operating season for each active monitoring station a set of duplicate samples will be taken, representing as many of the routine analysis as possible. Where possible this shall be carried out in conjunction with the sampling undertaken by an INAC Inspector.

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4.0 Laboratory Analysis/Reporting

The laboratory will perform the analysis of all samples as outlined in the License. The results shall be received by the Hamlet within the time frame agreed to with the laboratory. The results shall be submitted the NWB for review with the Annual report. The results shall contain the limits of Detection used for analysis of each parameter as supplied by the laboratory.

The Hamlet may request clarification of the Analysis be contacting the NWB Technical Advisor and a review of the analysis will be provided upon request.

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5.0 Glossary

Quality Assurance (QA): is the definitive program for laboratory operation that specifies the measures required to produce defensible data of known precision and accuracy. QA includes quality control and quality assessment activities.

Quality Control (QC): is a set of measures within a sample analysis methodology to assure that the process is in control.

Quality Assessment: is a process to determine the quality of the laboratory measurements through internal and external QC evaluations. It includes performance evaluation samples, laboratory inter-comparisons samples and performance audits.

Quality Assurance/Quality Control Plan for Hamlet Water Reservoir, Sewage Lagoon, and Solid Waste Disposal Facility Monitoring Program, Hamlet of Qikiqtarjuaq, Nunavut

February 2006

6.0 References

Nunavut Water Board. *Water License NWB3QIK0106*. Gjoa have, Nunavut.

Wilson, Neal. 1995. *Soil Water and Ground Water Sampling*. CRC Press: New York, USA.

J:\2006\F\NUNA\08983\Reports\Quality Assurance Quality Control\Report.doc



Appendix A

Contact Information

APPENDIX A

Contact Information

Nunavut Water Board Contact:

Technical Advisor
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU X0B 1J0
Telephone: (867) 360-6338
Fax: (867) 360-6369
Email: srtech@nwb.nunavut.ca

Inspector Contact:

Water Resources Manager
Nunavut District, Nunavut Region
Department of Indian and Northern Affairs Canada
P.O. Box 100
Iqaluit, NU X0A 0H0
Telephone: (867) 975-4550
Fax: (867) 979-6445

Analyst Contact:

Laboratory Manager
Taiga Laboratories
Department of Indian and Northern Affairs Canada
4601 - 52 Avenue, P.O. Box 1500
Yellowknife, NT X1A 2R3
Telephone: (867) 669-2780
Fax: (867) 669-2718



Appendix B
Notification of Laboratory Form

APPENDIX B
Notification of Laboratory Form

Attention: Technical Advisor
Nunavut Water Board

Re: Notification of Laboratory
Water License NWB3QIK0106

Dear Sir/Madame,

The following CAEAL-certified laboratory has been retained by the Hamlet of Qikiqtarjuaq to complete the sample analysis required by Water License NWB3QIK0106:

Name of Laboratory : _____

Address : _____

: _____

: _____

Phone # : _____

Fax # : _____

Regards,

Name (print) : _____

Signature : _____ Date : _____

Please send this form, once completed, to the Nunavut Water Board at the following address:

Nunavut Water Board
c/o Technical Advisor
PO Box 119
Gjoa Haven, NU X0B 1J0
Telephone: (867) 360-6338
Fax: (867) 360-6369
Email: srtech@nwb.nunavut.ca

Appendix C
Annual Report for the
Hamlet of Qikiqtarjuaq

APPENDIX C
Annual Report for the Hamlet of Qikiqtarjuaq

Year Being Reported: _____

The following information is compiled pursuant to the requirements of Part B, Item 1 of Water License NWB3QIK0106 issued to the Hamlet of Qikiqtarjuaq.

Tabular summaries of all data generated under the Monitoring Program, monthly and annual quantities in cubic meters of freshwater obtained from all sources, monthly and annual quantities in cubic meters of each and all wastes discharged.

Attached to this document are results for Monitoring Station QIK-1, QIK-2, QIK-3, QIK-4, and QIK-5 as well as detailed chemical, physical, and biological analysis required at QIK-2 and QIK-5 (for the months of May to August, inclusive).

Month Reported	Quantity of Water Obtained From all Sources (m³)	Quantity of Sewage Waste Discharged (m³)
January		
February		
March		
April		
May		
June		
July		
August		
September		
October		
November		
December		
Annual Total		

Please indicate volumes in cubic meters – 1 cubic meter equals 1,000 liters.

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

A list of unauthorized discharges and summary of follow up action taken.

A summary of any abandonment and restoration work completed during the year, and an outline of any work anticipated for the next year.

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.

Any other details on water use or waste disposal required by the Board by November 1st of the year being reported.

Updates or revisions to the approved Operation and Maintenance Plans.

Additional information that the licensee deems useful.

Follow up regarding inspection/compliance concerns.

Appendix H2
Sewage Lagoon



**Sewage Treatment Facility
Operation and Maintenance (O&M) Plan
Hamlet of Qikiqtarjuaq, Nunavut**

Prepared for

The Hamlet of Qikiqtarjuaq
P.O. Box 4, Qikiqtarjuaq NU X0A 0B0 Canada

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

Revision Date

February 2006

File No: N-O 09439.0

The material in this report reflects best judgement in light of the information available at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Nuna Burnside accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Sewage Treatment Facility
Operation and Maintenance (O&M) Plan
Hamlet of Qikiqtarjuaq, Nunavut

February 2006

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- 3 Regional View of Sewage Lagoon and Solid Waste Disposal Facility (Landfill)

Appendices

- A Climate Normal Data
- B Projected Water Requirements and Sewage Generation Rates
- C Nunavut Water Board License
- D Example Operation Log
- E Environmental Emergency Contingency Plan
- F Monitoring Program Quality Assurance/Quality Control Plan

Sewage Treatment Facility
Operation and Maintenance (O&M) Plan
Hamlet of Qikiqtarjuaq, Nunavut

February 2006

1.0 Introduction

The Hamlet of Qikiqtarjuaq (meaning “big island”), is a Community of approximately 599 people located on the eastern coast of Baffin Island and on an island known as Broughton Island in the territory of Nunavut. As illustrated in Figure 1, the Hamlet is located approximately 470 kilometers northeast of the Capital City of Iqaluit, a distance that is covered by plane in about one hour. The geographic coordinates for the Hamlet of Qikiqtarjuaq are 67°33’ north latitude and 64°02’ west longitude. As indicated on Figure 2, the community is situated on the northwest portion of Broughton Island.

Qikiqtarjuaq is located within the continuous permafrost zone. Maximal local depth of annual thaw of the active layer ranges from 0.6 to 1.6 meters, depending on the thickness and nature of the surface cover. Materials located beneath the thin active layer are perennially frozen to a substantial depth. Qikiqtarjuaq sits on glacial drift primarily composed of silty sand and gravels mixed with boulders.

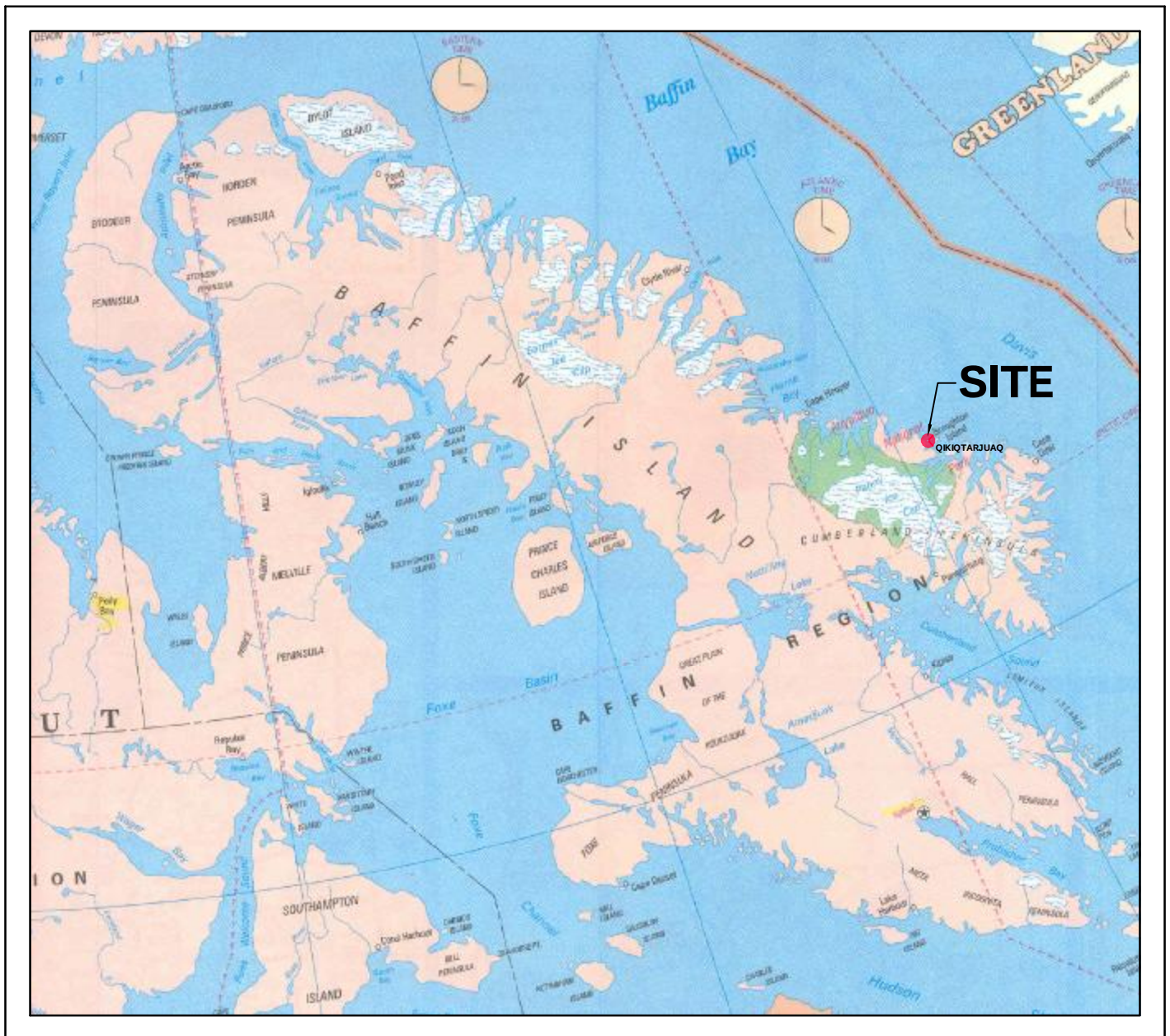
The vegetation present in Qikiqtarjuaq is typical of that evidenced on the Arctic tundra. Hardy grasses, mosses, and lichens sit in a thin organic layer on the surface, which is generally 0.2 m or less in thickness.

Qikiqtarjuaq receives an average of 39 mm of rainfall and 223 mm of snowfall per annum. July mean high and low temperatures are 7°C and 1°C, respectively. January mean high and low temperatures measure -21°C and -28°C, respectively. July and August are the only two months of the year that historically have had average daily temperatures above the freezing mark. Prevailing winds are generally north-northeast with an annual average velocity of 8.3 km/h. Climate normal information was obtained from Environment Canada’s website, and is available in Appendix A.

The Detailed Design Report (Nuna Burnside, 2006) for the Improvements to the Water, Wastewater, and Solid Waste Facilities determined the projected population, and associated water requirements and sewage generation rates using information from the Nunavut Bureau of Statistics. The tables with the detailed calculations are available for inspection in Appendix B.

1.1 Purpose

The Hamlet of Qikiqtarjuaq operates their municipal water, sewage, and solid waste facilities under the Nunavut Water Board (NWB) License NWB3Q1K0106, dated November 28, 2000 (Appendix C). Part G, Section 1 requires that an Operation and Maintenance (O&M) Plan be submitted for the facilities in accordance with all applicable regulations and following applicable guidelines. This document is created based on the



Map Reference:
Map of Canada
Published by the CAA

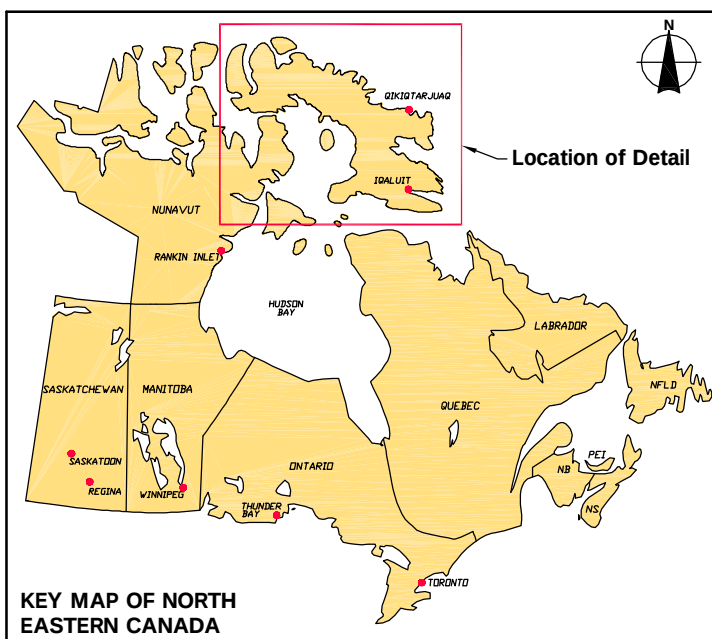


FIGURE 1 - SITE LOCATION MAP

THE HAMLET OF QIKIQTARJUAQ, NUNAVUT

SEWAGE TREATMENT FACILITY O&M PLAN

January 2006
Project Number: N-O 09439.0

Prepared by: K. Pridham

Verified by: M. Paznar

Burnside

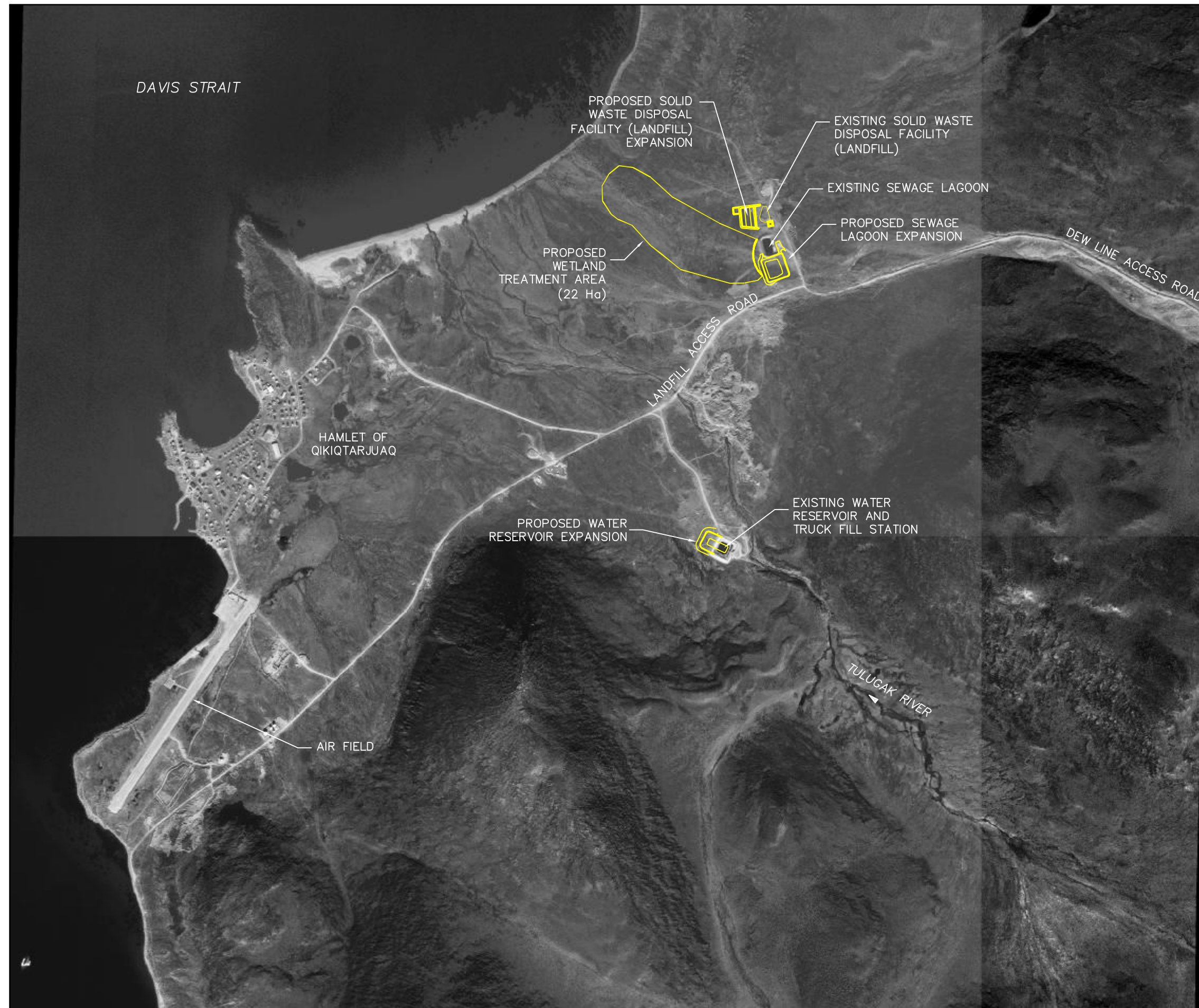
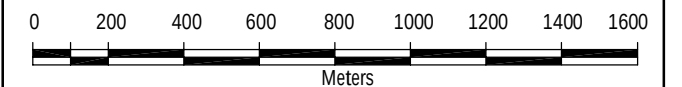
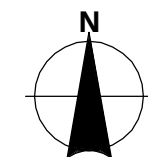


FIGURE 2
THE HAMLET OF QIKIQTARJUAQ
SEWAGE TREATMENT FACILITY
O&M PLAN

SATELLITE IMAGERY OF ENTIRE COMMUNITY AND INFRASTRUCTURE

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



1:20,000
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: M. Paznar

Sewage Treatment Facility
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improvements proposed for the sewage treatment system, which an amendment and renewal to the NWB license is being requested.

The O&M Plan of the sewage disposal facility will be used in conjunction with the normal operating procedures. This document provides a list of tasks and procedures that will assist the Hamlet's operations staff in the O&M of the facility.

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2.0 Background Information on Hamlet Operations

The Hamlet of Qikiqtarjuaq provides trucked water and sewage services, as well as regular solid waste pickup for the Community's residents, businesses, and institutions.

The Sewage Treatment Facility operated by the Hamlet of Qikiqtarjuaq is located approximately 2.3 km from the Hamlet. Sewage is collected by truck from customer holding tanks and discharged to the sewage lagoon located to the east of the community north of the DEW Line Access Road. The Hamlet currently utilizes an engineered facultative lagoon originally designed to hold sewage for 365 days, with an annual discharge in mid-August. The existing unlined earthen lagoon was constructed in 1992 (Figure 3). The design intent was for a 20-year lagoon to be constructed as two independent cells, but only one cell was built. The current single-cell lagoon is approximately 96 m x 70m x 4 m, with a total volume of 17,127 m³, and a working capacity of 10,558 m³. The contemplated double-celled lagoon will have an approximate useable storage capacity of 38,850 m³. Sewage effluent from the lagoon will be discharged overland, annually, through a large wetland treatment area, to the Final Discharge Point, which is located approximately 1 km from the Initial Discharge Point of the Sewage Treatment Facility.

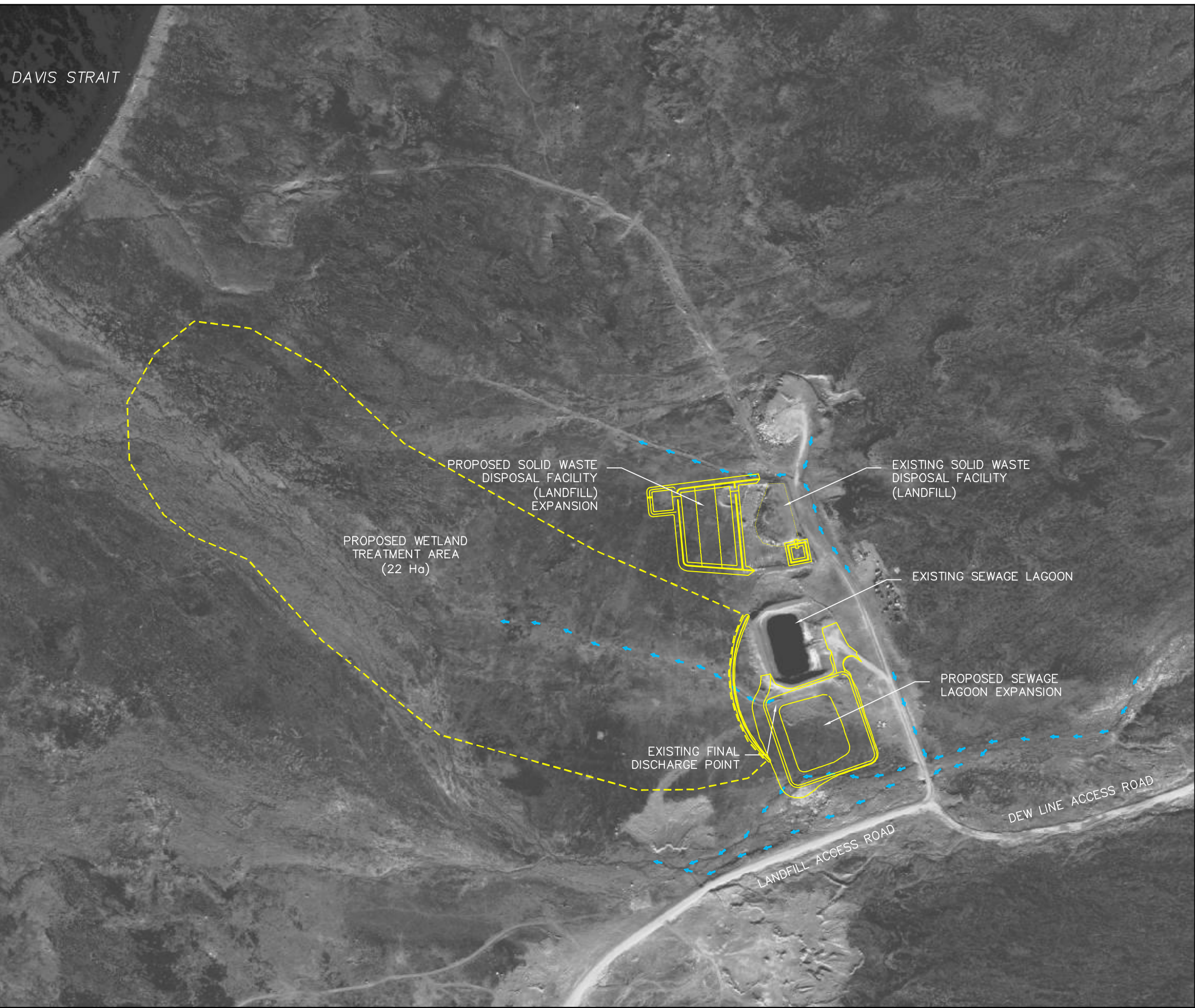


FIGURE 3

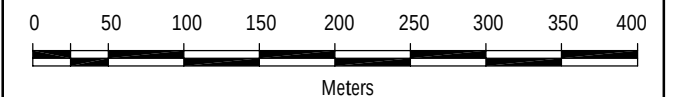
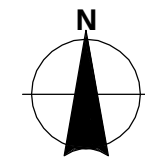
THE HAMLET OF QIKIQTARJUAQ
SEWAGE TREATMENT FACILITY
O&M PLAN

REGIONAL VIEW OF
SEWAGE LAGOON & SOLID
WASTE DISPOSAL FACILITY
(LANDFILL)

Legend

→ → → → INTERPRETED EXISTING SURFACE WATER
FLOW DIRECTION

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



1:5,000
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: M. Paznar



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3.0 Operation and Maintenance of the Sewage Treatment Facility

Satellite imagery of the Sewage Treatment Facility operated by the Hamlet of Qikiqtarjuaq, which is described above, is provided in Figure 2. This Figure illustrates both the drainage pathway of the treatment wetland and the proximity to adjacent water bodies (in this case, the Davis Strait). The boundaries of the treatment wetland area are also illustrated in this figure.

In the event of emergency, guidance regarding containment and site emergency response can be obtained from the following sources (Table 1):

Table 1 – Emergency Contacts

Contact	Location	Telephone Number	Fax Number
INAC – Manager, Water Resources	Iqaluit	(867) 975-4550	(867) 979-6445
Hamlet of Qikiqtarjuaq – SAO	Qikiqtarjuaq	(867) 927-8832	(867) 927-8120
Government of Nunavut (Regional Engineer)	Pond Inlet	(867) 975-7314	
Environment Canada – Inspector	Iqaluit	(867) 975-4644	(867) 975-4594
Fire Department	Qikiqtarjuaq	(867) 927-4422	
RCMP Detachment	Qikiqtarjuaq	(867) 927-0123	
Community Health Center	Qikiqtarjuaq	(867) 927-8916	

3.1 Sewage Collection Procedures

The following sewage collection operational procedures shall be carried out by the Hamlet of Qikiqtarjuaq on a daily basis dependent upon weather conditions:

- Household and commercial sewage holding tanks will be pumped out using a vacuum truck and hauled to the Sewage Lagoon Storage Facility
- Sewage from the vacuum truck will be discharged to the Sewage Lagoon Storage Facility, via a flume designed to prevent erosion of the lagoon wall
- Daily waste volumes deposited to the Sewage Lagoon Storage Facility (and trip counts) shall be recorded on the recording form attached in Appendix D

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- In the event of an accident, a spill of sewage or petroleum products or a fire during sewage collection operations, the *Hamlet of Qikiqtarjuaq Environmental Emergency Response Plan* (Appendix E) shall be implemented.

3.2 Lagoon Operation Procedures

The following operational procedures shall be carried out by the Hamlet of Qikiqtarjuaq, during lagoon decant and wetland treatment operations:

- Household and commercial sewage deposited to the Sewage Lagoon Storage Facility shall be decanted to the Wetland Treatment Facility via the outlet discharge piping over a 60 day period (approximately 650 m³/day)
- Decant operations shall occur between June 15th and October 1st, dependant on weather conditions
- The Hamlet of Qikiqtarjuaq shall advise an Inspector and the Nunavut Water Board at least 10 days prior to starting decant operations of the wastewater lagoon
- During decant operations, the sewage lagoon decant control structures and treatment wetland drainage features shall be inspected daily for defects or blockages, and repaired immediately as necessary
- During decant operations, effluent quality monitoring shall be undertaken in accordance with the terms and conditions outlined in the NWB water license, or at the direction of an Inspector as defined in the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*
- Upon completion of decanting operations, the decant structure valves shall be closed, the lagoon berms inspected, and any required maintenance (as described below) performed

3.3 Periodic and Seasonal Maintenance Procedures

The following procedures shall be undertaken by the Hamlet of Qikiqtarjuaq during periodic and seasonal maintenance operations at the Sewage Treatment Facility:

- The roadway and truck pad shall be maintained by snow clearing in the winter and grading in the summer in addition to be repaired as necessary
- Ditches and drainage channels shall being inspected for erosion (once per month) during the summer, and repaired as necessary

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- Site warning signage, which identifies the boundaries of the Sewage Treatment Facility (which includes the Sewage Lagoon Storage Facility and the Wetland Treatment Areas) shall be inspected weekly, and repaired or replaced as necessary
- The discharge flume to the Sewage Lagoon Storage Facility shall be inspected for damage or displacement monthly, and repaired as necessary
- Any airborne litter shall be removed from the Sewage Treatment Facility to the Hamlet landfill in the Spring and Autumn, or as required
- The Sewage Lagoon Storage Facility shall be inspected for erosion and settlement monthly, and repaired as necessary
- The Sewage Lagoon Storage Facility shall be inspected following decant operations, to determine the thickness of sludge which has accumulated in the lagoon since the previous inspection
- Desludging of the lagoons shall occur every 5 to 10 years or as required based on the determination of the sludge thickness.

The activities described above shall be completed by Hamlet staff and the details of any repairs shall be reported in the Annual Report submitted to the Nunavut Water Board, in compliance with the Hamlet's Water License.

3.4 Facility Monitoring Procedures

As outlined in the NWB water license, regular monitoring of the effluent from the Sewage Treatment Facility is required. The Monitoring Program is to include effluent samples collected at the Final Discharge Point of the Wetland Treatment Facility, during the months of June to October, inclusive. Effluent samples collected shall be analyzed for the following parameters:

• Biological Oxygen Demand (BOD)	• Faecal Coliforms (FC)
• Total Suspended Solids (TSS)	• pH
• Conductivity	• Nitrate-Nitrite (NO ₃ -NO ₂)
• Oil and Grease (OGG) (Visual)	• Total Phenols (Total-P)
• Magnesium (Mg)	• Calcium (Ca)
• Sodium (Na)	• Potassium (K)
• Chloride (Cl)	• Sulphate (SO ₄)
• Total Hardness	• Total Alkalinity
• Ammonia Nitrogen (NH ₃ -N)	• Total Zinc (Zn)
• Total Cadmium (Cd)	• Total Iron (Fe)

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- Total Cobalt (Co)
- Total Chromium (Cr)
- Total Copper (Cu)
- Total Aluminum (Al)
- Total Mercury (Hg)
- Total Manganese (Mn)
- Total Nickel (Ni)
- Total Lead (Pb)
- Total Arsenic (As)
- Total Organic Carbon (TOC)

Additional analytical parameters, which are identified in the NWB water license, or by an Inspector as defined in the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* shall also have samples collected and analyzed.

Sampling completed by the Hamlet of Qikiqtarjuaq shall be in accordance with the Hamlet of Qikiqtarjuaq Monitoring Program Quality Assurance/Quality Control (QA/QC) Plan, which is appended to this Plan (Appendix F).

A monitoring station will be established at the point where raw wastewater is off-loaded by the vacuum trucks. Monthly and annual quantities of raw wastewater offloaded will be measured and recorded in the official operations logbook on a form similar to that presented in Appendix D.

3.5 Annual Reporting Procedures

Results of analytical testing and monitoring are to be recorded on a regular basis by the Hamlet's operation staff. Copies of the analytical certificates and Chain of Custody forms are to be kept for future reference to determine the effectiveness of the treatment facility.

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Operation and Maintenance (O&M) Plan
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4.0 References

Department of Municipal and Community Affairs, Government of Northwest Territories, October 1996. *Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories*. Queen's Printer: Yellowknife, Northwest Territories.

National Research Council. August 2004. *National Guide to Sustainable Municipal Infrastructure: Optimization of Lagoon Operations*. Ottawa, Ontario.

Nuna Burnside Engineering and Environmental Ltd. January 2005. *Detailed Design of the Improvements to the Water Reservoir, Wastewater Lagoon and Solid Waste facility in the Hamlet of Qikiqtarjuaq*. Rankin Inlet, Nunavut.

Nunavut Water Board. September 2000. *Hamlet of Qikiqtarjuaq Water License NWB3QIK0106*. Gjoa Haven, Nunavut.

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Appendix A
Climate Normal Data

Appendix A: Climate Normals for Qikiqtarjuaq, Nunavut

<u>Temperature:</u>	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		
<u>Precipitation: Precipitation:</u>														
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+		

<u>Temperature:</u>	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+		
<u>Days with Maximum Temperature:</u> <u>Days with Maximum Temperature:</u>														
<= 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
<u>Days with Minimum Temperature:</u> <u>Days with Minimum Temperature:</u>														
> 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

<u>Temperature:</u>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
<u>Days with Snow Depth:</u> <u>Days with Snow Depth:</u>														
>= 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
<u>Wind:</u> <u>Wind:</u>														
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	
<u>Degree Days:</u> <u>Degree Days:</u>														
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

<u>Temperature:</u>	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
<u>Humidex:</u> <u>Humidex:</u>														
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		
<u>Wind Chill:</u> <u>Wind Chill:</u>														
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		
<u>Humidity:</u> <u>Humidity:</u>														
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 A: 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											
M o n t h	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
<u>Jan</u>	-24.3	-28.7	-33.1	-15.5	-43.2	0.0	4.0	4.0	35		
<u>Feb</u>	-20.2	-24.9E	-29.4	-10.0	-40.2	0.0	5.0	5.0	41		
<u>Mar</u>	-24.3	-29.8	-35.2	-13.4	-45.5	0.0	6.2	6.2	47		
<u>Apr</u>	-11.4	-17.2	-22.9	-4.5	-31.5	0.0	34.0	34.0	61		
<u>May</u>	-1.2	-3.8	-6.4	6.5	-16.5	0.0	3.0	3.0	25		
<u>Jun</u>	4.7	1.8	-1.1	9.9	-7.2	Trace	Trace	Trace	0		
<u>Jul</u>	7.8	4.6	1.4	17.2	-1.7	1.0	6.0	7.0	0		
<u>Aug</u>	8.3	5.6	2.9	17.1	0.0	13.0	0.0	13.0	0		
<u>Sep</u>	4.4	2.0	-0.5	11.0	-11.0	6.0	13.0	19.0	4		
<u>Oct</u>	1.9	-1.0	-3.9	9.0S	-8.0	0.4	7.4	7.8	4		
<u>Nov</u>	-6.6	-10.6	-14.6	3.0	-24.5	0.0	91.0	91.0	54		
<u>Dec</u>	-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 B
Projected Water Requirements and
Sewage Generation Rates

Table 1 - Projected Water Consumption

Planning Year	Calendar Year	Projected Population	Projected Water Consumption	Projected Total Consumption Volume				10 Month Storage Requirement	Additional Capacity Required
			[Lpcd]	[Litres/day]	[Litres/year]	[m ³ /day]	[m ³ /year]	[m ³ /year]	[m ³]
Schematic	2005	599	102.4	61337	22388071	61	22388	18657	657
Detailed	2006	611	102.6	62718	22891977	63	22892	19077	1077
0	2007	624	102.9	64220	23440330	64	23440	19534	1534
	2008	637	103.2	65729	23991238	66	23991	19993	1993
	2009	650	103.5	67246	24544699	67	24545	20454	2454
	2010	663	103.7	68769	25100714	69	25101	20917	2917
	2011	677	104.0	70417	25702355	70	25702	21419	3419
5	2012	691	104.3	72074	26306958	72	26307	21922	3922
	2013	705	104.6	73738	26914522	74	26915	22429	4429
	2014	720	104.9	75531	27568771	76	27569	22974	4974
	2015	735	105.2	77333	28226420	77	28226	23522	5522
	2016	750	105.5	79144	28887469	79	28887	24073	6073
10	2017	765	105.8	80964	29551917	81	29552	24627	6627
	2018	781	106.2	82916	30264410	83	30264	25220	7220
	2019	797	106.5	84879	30980772	85	30981	25817	7817
	2020	813	106.8	86852	31701001	87	31701	26418	8418
	2021	830	107.2	88960	32470484	89	32470	27059	9059
15	2022	847	107.5	91080	33244334	91	33244	27704	9704
	2023	864	107.9	93212	34022551	93	34023	28352	10352
	2024	882	108.3	95483	34851305	95	34851	29043	11043
	2025	900	108.6	97767	35684955	98	35685	29737	11737
	2026	918	109.0	100064	36523501	100	36524	30436	12436
20	2027	937	109.4	102504	37413945	103	37414	31178	13178

Table 2 - Projected Sewage and Sludge Generation Rates

Planning Year	Calendar Year	Projected Population	Projected Sewage Generation	Projected Volume		Projected Sludge Volume	Cumulative Sludge Volume	BOD	TSS	T-PO ₄	TKN	Faecal Coliforms
			[Lpcd]	[Litres/day]	[Litres/year]	[m ³ /year]	[m ³]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[CFU/100 mL]
Schematic Design	2005	599	102.4	61,337	22,388,071	10.9	10.9	439.5	468.8	22.5	117.2	9.28E+07
0	2006	611	102.6	62,718	22,891,977	11.2	22.1	438.4	467.6	22.4	116.9	9.25E+07
	2007	624	102.9	64,220	23,440,330	11.4	33.5	437.2	466.4	22.3	116.6	9.23E+07
	2008	637	103.2	65,729	23,991,238	11.6	45.1	436.1	465.2	22.3	116.3	9.21E+07
	2009	650	103.5	67,246	24,544,699	11.9	57.0	435.0	464.0	22.2	116.0	9.18E+07
	2010	663	103.7	68,769	25,100,714	12.1	69.1	433.8	462.8	22.2	115.7	9.16E+07
5	2011	677	104.0	70,417	25,702,355	12.4	81.4	432.6	461.5	22.1	115.4	9.13E+07
	2012	691	104.3	72,074	26,306,958	12.6	94.0	431.4	460.2	22.1	115.0	9.11E+07
	2013	705	104.6	73,738	26,914,522	12.9	106.9	430.2	458.9	22.0	114.7	9.08E+07
	2014	720	104.9	75,531	27,568,771	13.1	120.0	429.0	457.6	21.9	114.4	9.06E+07
	2015	735	105.2	77,333	28,226,420	13.4	133.4	427.7	456.2	21.9	114.1	9.03E+07
10	2016	750	105.5	79,144	28,887,469	13.7	147.1	426.4	454.9	21.8	113.7	9.00E+07
	2017	765	105.8	80,964	29,551,917	14.0	161.1	425.2	453.5	21.7	113.4	8.98E+07
	2018	781	106.2	82,916	30,264,410	14.3	175.3	423.9	452.1	21.7	113.0	8.95E+07
	2019	797	106.5	84,879	30,980,772	14.5	189.9	422.5	450.7	21.6	112.7	8.92E+07
	2020	813	106.8	86,852	31,701,001	14.8	204.7	421.2	449.3	21.5	112.3	8.89E+07
15	2021	830	107.2	88,960	32,470,484	15.1	219.9	419.9	447.8	21.5	112.0	8.86E+07
	2022	847	107.5	91,080	33,244,334	15.5	235.3	418.5	446.4	21.4	111.6	8.83E+07
	2023	864	107.9	93,212	34,022,551	15.8	251.1	417.1	444.9	21.3	111.2	8.81E+07
	2024	882	108.3	95,483	34,851,305	16.1	267.2	415.7	443.4	21.2	110.8	8.78E+07
	2025	900	108.6	97,767	35,684,955	16.4	283.6	414.3	441.9	21.2	110.5	8.75E+07
20	2026	918	109.0	100,064	36,523,501	16.8	300.4	412.8	440.4	21.1	110.1	8.72E+07
	2027	937	109.4	102,504	37,413,945	17.1	317.5	411.3	438.8	21.0	109.7	8.68E+07

Appendix C

Nunavut Water Board License



P.O. Box 119
GJOA HAVEN, NT X0E 1J0

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TEL: (867) 360-6338
FAX: (867) 360-6369

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,

A handwritten signature in black ink, appearing to read 'P. di Pizzo', written over the printed name.

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.

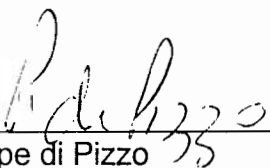
With respect to this application, the NWB gave notice to the public that the Municipality had filed an application for renewal of water licence N4L3-0640 issued by the Northwest Territories Water Board.

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

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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.

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

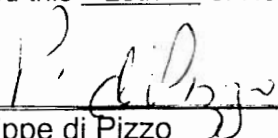
Date of Licence

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 statutes 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	1×10^4 CFU/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 Inuktitut.
- 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

Example Operation Log

Hamlet of Qikiqtarjuaq
Sewage Disposal Operations Log Sheet

Month: _____

Truck #: _____

Date	Number of Trips to the Sewage Lagoon	Quantity of Sewage Discharged (Liters)	Driver Signature
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
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Appendix E
Environmental Emergency
Contingency Plan



Environmental Emergency Contingency Plan for Water, Sewage, and Solid Waste Operations in the Hamlet of Qikiqtarjuaq, Nunavut

Prepared for

The Hamlet of Qikiqtarjuaq
P.O. Box 4, Qikiqtarjuaq NU X0A 0B0 Canada

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

Revision Date

February 2006

File No: N-O 09439.0

The material in this report reflects best judgement in light of the information available at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Nuna Burnside accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

February 2006

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Water, Sewage, and Solid Waste Operations in the
Hamlet of Qikiqtarjuaq, Nunavut

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Environmental Emergency Contingency Plan for
Water, Sewage, and Solid Waste Operations in the
Hamlet of Qikiqtarjuaq, Nunavut

February 2006

Preamble

This Environmental Emergency Contingency Plan relating to the collection, transportation, storage, and treatment operations of sewage for the Hamlet of Qikiqtarjuaq, Nunavut, is effective from *BEGINNING DATE OF WATER LICENSE until EXPIRY DATE OF NEW WATER LICENSE*. This plan applies to all operations and spill events relating to sewage and petroleum, oil, and lubricating (POL) products in the Hamlet of Qikiqtarjuaq, Nunavut (formerly known as Broughton Island).

The following formal distribution will be made after this document receives approval:

- Hamlet of Qikiqtarjuaq:
 - Mayor and Council
 - Senior Administrative Officer (SAO)
 - Hamlet Operations Staff
 - Fire Department
 - Community Health Centre
 - RCMP Detachment.
- Nunavut Water Board.

Additional copies and updates of this plan may be obtained by writing to:

Hamlet of Qikiqtarjuaq
Senior Administrative Officer (SAO)
P.O. Box 4
Qikiqtarjuaq, NU X0A 0B0

Environmental Emergency Contingency Plan for
Water, Sewage, and Solid Waste Operations in the
Hamlet of Qikiqtarjuaq, Nunavut

February 2006

1.0 Introduction

1.1 Purpose of Plan

The impacts of spills can be catastrophic and may threaten or damage the environment, especially water resources. As such, the Government of Nunavut (GN) requires contingency plans to be written and fully implemented. The purpose of this *Environmental Emergency Contingency Plan* is to provide a plan of action for all spills of sewage, solid waste, and petroleum products that may occur as a result of water supply and distribution, sewage collection and treatment, and solid waste collection and disposal operations undertaken within the Hamlet of Qikiqtarjuaq, Nunavut.

This *Environmental Emergency Contingency Plan* will assist in implementing corrective options quickly to minimize environmental damage. Furthermore, it defines the responsibilities of key personnel and outlines procedures to effectively and efficiently contain and recover spills of sewage, solid waste, and petroleum products arising from water, sewage, and solid waste; collection, transportation, storage, and treatment operations. It will assist the Hamlet in meeting the regulatory requirements related to reporting events to the appropriate authorities within the prescribed time period.

Sewage, solid waste, and petroleum, oil and lubricating (POL) products that currently, or potentially, fall within the Scope of this *Environmental Emergency Contingency Plan* are as follows:

- Sewage (as defined in the Nunavut Water Board (NWB) water license)
- Solid waste (as defined in the Nunavut Water Board (NWB) water license)
- Gasoline
- Diesel fuel
- Hydraulic fluid
- Lubricating oil.

1.2 Objectives

The objectives of this Emergency Spill Contingency Plan are to:

- Provide a plan including procedures so that the Hamlet and their Incident Spill Response Team can rapidly respond to a spill situation and minimize injury to individuals and environmental damage
- Comply with all existing regulations
- Cooperate with other groups and agencies

Environmental Emergency Contingency Plan for
Water, Sewage, and Solid Waste Operations in the
Hamlet of Qikiqtarjuaq, Nunavut

February 2006

- Be prepared and able to provide an integrated team approach with all involved departments and agencies
- Keep staff, government officials, and Hamlet residents informed.

1.3 Hamlet of Qikiqtarjuaq Environmental Policy

It is the policy of the Hamlet of Qikiqtarjuaq to fully comply with all applicable legislation to ensure the protection of the environment of the territory of Nunavut. The legislation includes, but is not limited to, the:

- Environmental Protection Act, Section 34 – Spill Contingency Planning and Reporting Regulations
- Nunavut Waters and Nunavut Surface Rights Tribunal Act.

The Hamlet will cooperate with other groups committed to protecting the environment and shall ensure that Hamlet employees, regulatory authorities, and the public are informed on the policies and procedures developed to help protect the environment and the citizens of the Hamlet of Qikiqtarjuaq.

February 2006

2.0 Site Description

2.1 General Site Description

This *Environmental Emergency Contingency Plan* is to be implemented within the Municipal boundaries of the Hamlet of Qikiqtarjuaq, Nunavut.

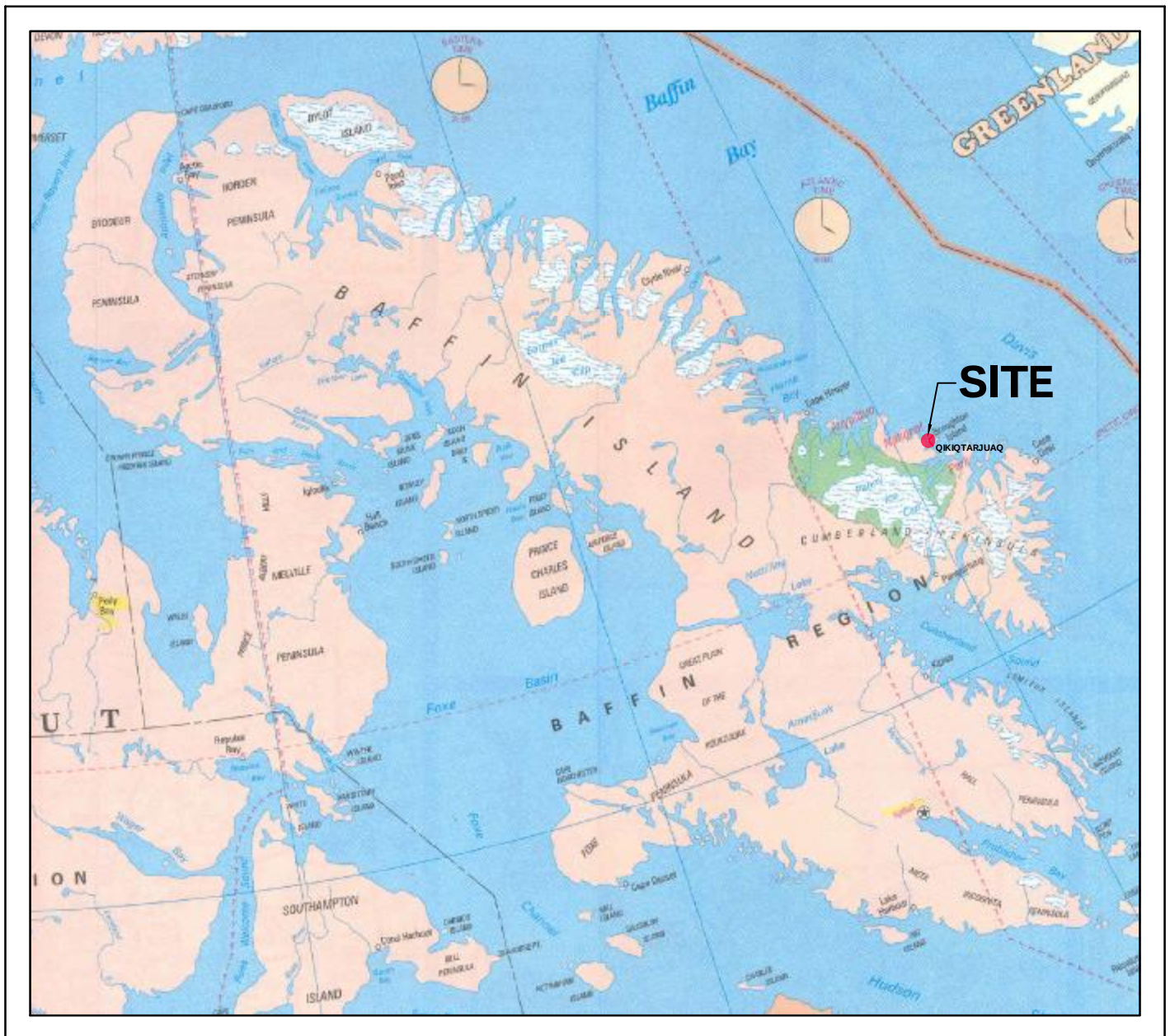
The Hamlet of Qikiqtarjuaq (meaning “big island”), is a Community of approximately 599 people located on the eastern coast of Baffin Island and on an island known as Broughton Island in the territory of Nunavut. As illustrated in Figure 1, the Hamlet is located approximately 470 kilometers northeast of the Capital City of Iqaluit, a distance that is covered by plane in about one hour. The geographic coordinates for the Hamlet of Qikiqtarjuaq are 67°33’ north latitude and 64°02’ west longitude. As indicated on Figure 2, the community is situated on the northwest portion of Broughton Island.

2.2 Sewage Collection, Water Supply, Treatment and Distribution, and Storage

The Hamlet provides trucked water service for the community. Historically, water is drawn from the Tulugak River during the summer, and from the lined earthen reservoir (Figure 3) for the remainder of the year. The water is chlorinated as it is pumped into the tanker delivery trucks through the truck fill station. The truck fill station operates by diesel generator and has an above ground storage (AST) tank on-site.

Sewage is collected in the Hamlet of Qikiqtarjuaq by vacuum truck, and transported to the Sewage Treatment Facility (Figure 4) operated by the Hamlet of Qikiqtarjuaq located approximately 2.3 km from the Hamlet. Wastewater is collected from customer holding tanks and discharged to the wastewater lagoon located to the east of the community north of the DEW Line Access Road.

The Hamlet of Qikiqtarjuaq provides regular solid waste pickup for the Community’s residents, businesses, and institutions. Collection occurs on a daily basis throughout the Hamlet, to minimize the potential for attraction of foxes and polar bears. Solid waste is trucked to the Hamlet’s Solid Waste Disposal facility (Figure 5), which is currently permitted by the Nunavut Water Board (NWB). The current Facility is located adjacent to the sewage lagoon.



Map Reference:
Map of Canada
Published by the CAA

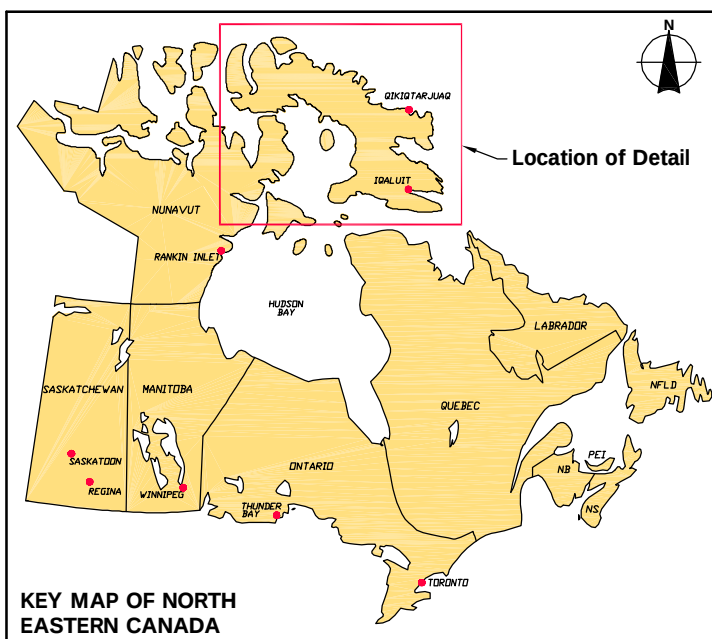


FIGURE 1 - SITE LOCATION MAP

THE HAMLET OF QIKIQTARJUAQ, NUNAVUT

ENVIRONMENTAL EMERGENCY CONTINGENCY PLAN

January 2006
Project Number: N-O 09439.0

Prepared by: K. Pridham

Verified by: M. Paznar

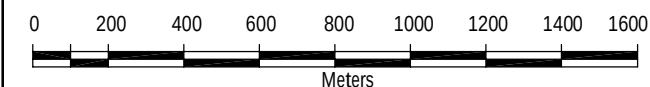
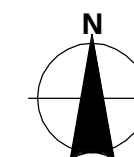
Burnside



FIGURE 2
THE HAMLET OF QIKIQTARJUAQ
ENVIRONMENTAL EMERGENCY
CONTINGENCY PLAN

SATELLITE IMAGERY OF
ENTIRE COMMUNITY
AND INFRASTRUCTURE

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



1:20,000
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

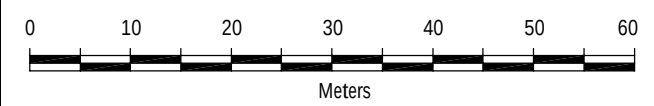
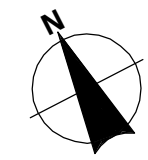
Verified by: M. Paznar



FIGURE 3
THE HAMLET OF QIKIQTARJUAQ
ENVIRONMENTAL EMERGENCY
CONTINGENCY PLAN

WATER RESERVOIR SITE

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



1:750
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: M. Paznar



DAVIS STRAIT

PROPOSED SOLID WASTE
DISPOSAL FACILITY
(LANDFILL)
EXPANSION

PROPOSED WETLAND
TREATMENT AREA
(22 Ha)

EXISTING FINAL
DISCHARGE POINT

EXISTING SOLID WASTE
DISPOSAL FACILITY
(LANDFILL)

EXISTING SEWAGE LAGOON

PROPOSED SEWAGE
LAGOON EXPANSION

LANDFILL ACCESS ROAD

DEW LINE ACCESS ROAD

FIGURE 4

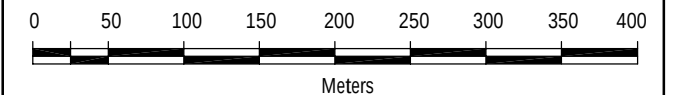
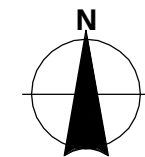
THE HAMLET OF QIKIQTARJUAQ ENVIRONMENTAL EMERGENCY CONTINGENCY PLAN

REGIONAL VIEW OF SEWAGE LAGOON & SOLID WASTE DISPOSAL FACILITY (LANDFILL)

Legend

→ → → → INTERPRETED EXISTING SURFACE WATER
FLOW DIRECTION

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



1:5,000
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: M. Paznar

BURNSIDE

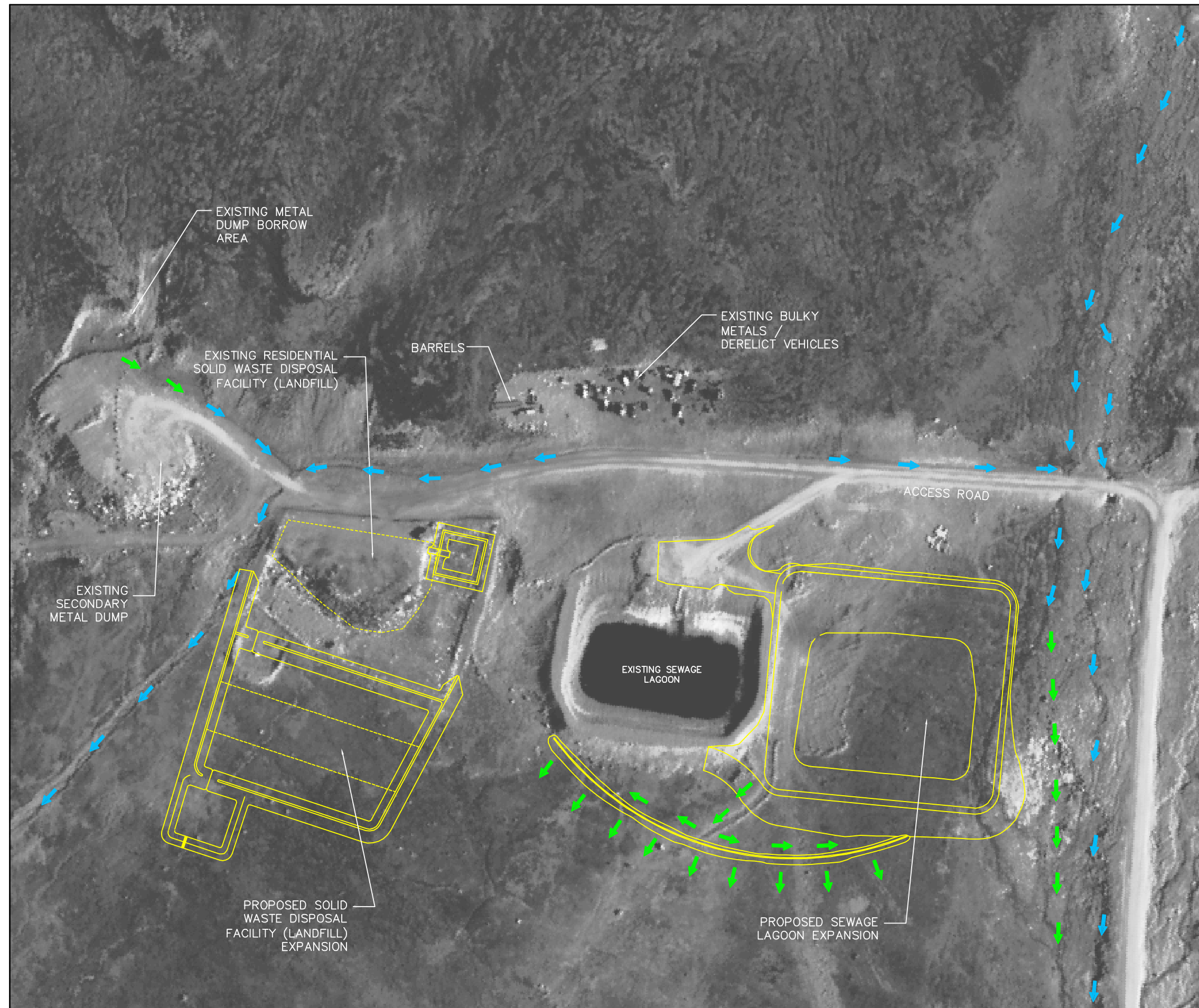


FIGURE 5

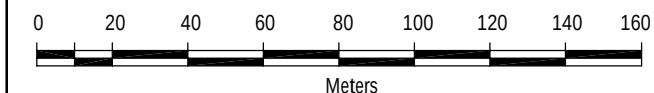
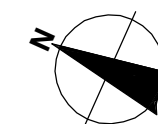
THE HAMLET OF QIKIQTARJUAQ
ENVIRONMENTAL EMERGENCY
CONTINGENCY PLAN

SOLID WASTE DISPOSAL
FACILITY (LANDFILL)

Legend

- → EXISTING SURFACE WATER FLOW DIRECTION
- → PROPOSED SURFACE WATER FLOW DIRECTION

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



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January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

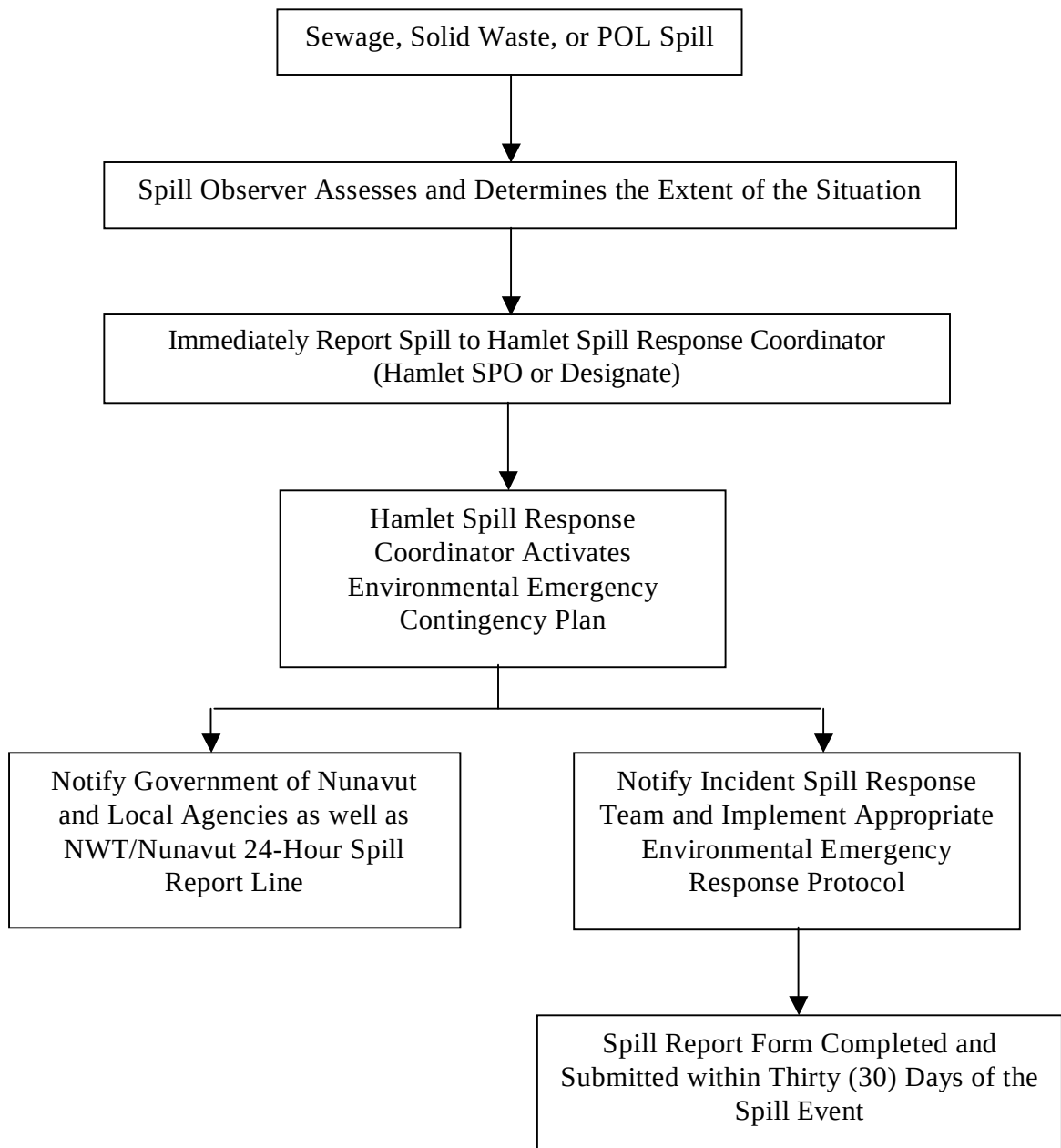
Prepared by: C. Sheppard

Verified by: M. Paznar

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3.0 Spill Response Organization

The following is a flow chart to illustrate the sequence of events that must be followed in the event of a sewage, solid waste, or POL spill occurring during supply, distribution, collection, transportation, storage, and treatment operations:



Emergency Response Flow Chart

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3.1 Incident Spill Response Team

The Hamlet Senior Administrative Officer (SAO) or his/her Designate will serve as the Spill Response Coordinator for the Hamlet in the event of a sewage or POL spill during collection and transport operations. The SAO of the Hamlet of Qikiqtarjuaq will appoint and train appropriate personnel to make up the Incident Spill Response Team, which normally consist of the following personnel:

- Spill Response Coordinator Hamlet SAO (or Designate)
- Hamlet Works Personnel Will generally vary from 3-7 people throughout the year

The responsibilities of the Spill Response Coordinator are as follows:

1. Assume complete authority over the spill scene and coordinate all personnel involved
2. Evaluate the spill situation and develop overall plan of action
3. Activate the *Environmental Emergency Contingency Plan* for the Hamlet of Qikiqtarjuaq
4. Immediately report the spill to the NWT/Nunavut 24-Hour Spill Report Line at (867) 920-8130, and other applicable regulatory or assistance agencies
5. Provide regulatory agencies with information regarding the status of the clean-up activities
6. Act as a spokesperson on behalf of the Hamlet of Qikiqtarjuaq with regulatory agencies, the public, and the media
7. Prepare and submit a report on the spill incident to regulatory agencies within 30 days of the event.

3.2 Contact Information

A complete listing of contact information, including telephone numbers of standard regulatory agencies, Hamlet personnel, and assistance agencies who may be contacted to supply resources, expertise, and advise needed to deal with a spill emergency is included in Appendix A.

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4.0 Spill Reporting Procedure

The Spill Response Coordinator must be notified immediately by any individual who is aware of any spill either by phone, radio, or in person.

The following is the incident reporting procedures once the Spill Response Coordinator activates this Environmental Emergency Spill Contingency Plan:

1. Report spill immediately to the 24-Hour NWT/Nunavut Spill Report Line Phone (867) 920-8130 (Section 4.1)
2. Report immediately to the INAC Manager, Water Resources in Iqaluit at (867) 975-4550
3. Notify Hamlet of Qikiqtarjuaq Fire Department
4. Fill out the NWT/Nunavut Spill Report Form (Appendix B) within thirty (30) days of the spill event occurring.

4.1 NWT/Nunavut Spill Report Line

All spills as defined in this document must be reported immediately to the 24-hour NWT/Nunavut Spill Report Line. Gather the following information prior to making the call:

- Date and time of spill (if known)
- Location and map coordinates (if known) and direction of flow of spill materials if moving
- Party responsible for spill
- Product/material spilled and estimate of the quantity
- Cause of spill
- If the spill has been stopped or if it is continuing
- Extent of contaminated area
- Factors affecting spill or recovery, such as weather conditions or terrain
- If containment of spill is available
- Action taken or proposed
- If assistance is required
- Possible hazards to person, property or environment (e.g. fire, drinking water, fish, wildlife, etc.).

The information collected should be brief, and quick estimates made so the Spill Report Line and the Spill Response Coordinator can assess the situation. The information is similar to that required in boxes B, D, E, F, G, H, I, J, K, L, M, N, O, and P on the spill report form that must be completely fill out in thirty days, and available in Appendix B.

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5.0 Action Plans

5.1 Initial Action

The instructions to be followed by the first person on the spill scene are as follows:

1. Always be alert and consider your safety first
2. If possible, estimate the volume of material that has been spilled
3. Assess the hazard of people in the vicinity of the spill
4. If possible, and safety permits, attempt to stop the release of product to minimize potential for environmental impacts
5. Immediately report the spill to the Spill Response Coordinator
6. Resume any effective action to contain, mitigate, or terminate the flow of the spilled material.

5.2 Environmental Health Protection and Mitigation Measures

The environmental protection and mitigation measures outlined in the following sections are to be taken by all personnel responding to a spill event and to reduce the chance of environmental impairment and health hazards due to spill, release, or other incident.

5.2.1 General Procedures

The following general clean-up procedures shall apply for all spill areas within the Hamlet:

- Always wear personnel protective equipment (PPE)
- Smoking is prohibited during all spill response activities
- Eliminate all ignition sources
- Contain spills on soil or rock by construction of earthen dykes using available material. If soil is not available, place sorbent materials or a boom in the path of the spill. As the sorbent barrier becomes saturated, continually replace it. Fuel or other liquids lying in pools, or trenches are to be removed with pumps, buckets, or skimmers
- If the ground is snow covered, create snow dykes, and line with a chemically-compatible liner for containment and recover of liquid
- For fuels on water, deploy containment booms, and recovery as much fuel as possible with a work boat and skimmer if the area has less than 1/10th ice cover. If the area is ice infested, burn any fuel spills using igniters
- Apply sorbets, if necessary
- Assess potential for disturbance of wildlife, fish, and archaeological sites by spill or clean-up operations

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- Notify environmental authorities to discuss available and feasible disposal and clean-up options
- Conduct required clean-up operations
- Assess and appropriately treat any areas disturbed by clean-up activities with laboratory testing
- Ensure the site has been completely restored and cease operations, only when all work is finalized and laboratory testing confirmed.

Specific procedures relating to mitigating measures for specific contaminants following below:

5.3 Mitigative Measures: Sewage, Gasoline, Diesel Fuel, Hydraulic Fluid, Lubricating Oil and Aviation Fuel

If possible, and safety permits, stop the flow of product, which is occurring, and eliminate all ignition sources. ***Smoking is prohibited during all spill response activities.***

5.3.1 POL Spill on Soil, Gravel, Rock, or Vegetation

- Build a containment berm using soil material or snow and place a plastic tarp at the foot of the berm for easy capture of the spill after all vapors have dissipated
- Remove the spill by using absorbent pads or excavating the soil, gravel or snow
- Remove spill splashed on vegetation using particulate absorbent material
- If soil, gravel, or vegetation are to be removed from the site, the Hamlet shall contact regulatory agencies for approval before commencing with the removal.

5.3.2 POL Spill On Water

- Use containment boom to capture spill for recovery after vapors have dissipated
- Use absorbent pads to capture small spills
- Use a petroleum skimmer for larger spills.

5.3.3 POL Spill on Ice and Snow

- Build a containment berm around spill using snow
- Remove spill using absorbent pads or particulate sorbent material
- The contaminated ice and snow must be scraped and shoveled into plastic buckets with lids, 205 litre drums, and/or polypropylene bags.

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5.3.4 POL-Contaminated Material Storage and Transfer

All contaminated water, ice, snow, soil, and clean up supplies will be stored in closed, labeled containers. All containers will be stored in a well ventilated area away from incompatible materials.

5.3.5 Disposal

Contact Federal and Territorial regulatory agencies to identify appropriate disposal methods before disposing of contaminated material. ***No contaminated material is to be disposed of in any Facility operated by the Hamlet of Qikiqtarjuaq without the express written consent of the Nunavut Water Board.***

5.4 Mitigative Measures: Ethylene Glycol Antifreeze

If possible, and safety permits, stop the flow of product, which is occurring.

5.4.1 Ethylene Glycol Spill on Soil, Gravel, Rock, or Vegetation

- Build a containment berm using soil material or snow and place a plastic tarp at the foot of the berm for easy capture of the spill
- Remove the spill by using absorbent pads or excavating the soil, gravel, or snow
- Remove spill splashed on vegetation using particulate absorbent material
- If soil, gravel, and/or vegetation must be removed from the spill site, the Hamlet shall contact the appropriate regulatory agencies for approval before commencing with the removal.

5.4.2 Ethylene Glycol Spill On Water

Use containment boom to capture spill, and pump contaminated water into 205 L drums.

5.4.3 Ethylene Glycol Spill On Ice and Snow

- Build a containment berm around spill using snow
- Remove spill using particulate sorbent material
- The contaminated sorbent material, ice and snow must be scraped and shoveled into plastic buckets with lids, 205 litre drums, and/or polypropylene bags.

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5.4.4 Ethylene Glycol Storage and Transfer

All contaminated water, ice, snow, soil, and clean up supplies will be stored in closed, labeled containers. All containers will be stored in a well ventilated area away from incompatible materials.

5.4.5 Disposal

Contact Federal and Territorial regulatory agencies to identify appropriate disposal methods before disposing of contaminated material. ***No contaminated material is to be disposed of in any Facility operated by the Hamlet of Qikiqtarjuaq without the express written consent of the Nunavut Water Board.***

5.5 Mitigative Measures: Sewage

If possible, and safety permits, stop the flow of product, which is occurring.

5.5.1 Sewage Spill on Soil, Gravel, Rock, or Vegetation

- Build a containment berm using soil material or snow and place a plastic tarp at the foot of the berm for easy capture of the spill, and to prevent sewage from entering any water body
- Remove the spill by using vacuum trucks or excavating the soil, gravel, or snow
- If soil, gravel, and/or vegetation must be removed from the spill site, the Hamlet shall contact the appropriate regulatory agencies for approval before commencing with the removal.

5.5.2 Sewage Spill into Water

- Use containment boom to capture spill, and pump contaminated water into vacuum trucks
- Deposit contaminated water to the Hamlet sewage lagoon
- Monitor the affected water body sampling at a minimum for Biological Oxygen Demand (BOD), Total Suspended Solids (TSS), ammonia (NH₃), and faecal coliforms (FC).

5.5.3 Sewage Spill on Ice and Snow

- Build a containment berm around spill using snow
- Remove spilled sewage and contaminated snow and ice to the Hamlet sewage lagoon.

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5.5.4 Sewage Storage and Transfer

All contaminated water, ice, snow, soil, and clean-up supplies will be deposited to the Hamlet sewage lagoon or landfill facility, as appropriate.

5.6 Mitigative Measures: Solid Waste

5.6.1 Solid Waste Spill on Soil, Gravel, Rock, or Vegetation

- Physically remove the spilled solid waste from the waste, and deposit to the approved Hamlet Solid Waste Disposal Facility
- If soil, gravel, or vegetation are to be removed from the site, the Hamlet shall contact regulatory agencies for approval before commencing with the removal.

5.6.2 Solid Waste Spill into Water

- Use containment boom to capture soil for recovery
- Physically remove the spilled solid waste from the water, and deposit to the approved Hamlet Solid Waste Disposal Facility
- Capture any sheen from the water using absorbent pads or skimmer, and deposit any used absorbent pads to the approved Hamlet Solid waste Disposal facility.

5.6.3 Solid Waste Spill on Ice and Snow

- Build a containment berm around spill using snow
- Physically remove the spilled solid waste and deposit to the approved Hamlet Solid Waste Disposal Facility
- If soil, gravel, or vegetation are to be removed from the site, the Hamlet shall contact regulatory agencies for approval before commencing with the removal.

5.6.4 Disposal

Any solid waste shall be removed to the approved Hamlet Solid Waste Disposal Facility.

5.7 Spill Recovery Assessment

In order to determine whether a spill has been successfully remediated, samples of the soil and/or water within the spill containment area and surrounding the area, are to be collected and sent to an accredited Canadian Association of Environmental Analytic Laboratories (CAEAL) laboratory to be analyzed for the chemical parameters contained in the spill material. If concentrations of the spill chemicals are not detected, or are at

Environmental Emergency Contingency Plan for
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concentrations below the applicable Territorial, Federal, or CCME regulations/criteria, the spill clean-up will be determined a success. Clean-up operations may then cease.

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6.0 Spill Response Resource Inventory

6.1 Additional Personnel Available

In addition to Hamlet staff, approximately 10 people are available from the Qikiqtarjuaq Fire Department, to assist in spill response and clean-up activities. Personnel from the local RCMP Detachment will be available for securing the site from unauthorized individuals, closing roads, etc. The Community Health Centre have personnel to assist in the treatment of anyone injured during the emergency.

6.2 Spill Response Equipment Inventory

Equipment available within the community to assist in responding to a hazardous materials spill includes heavy equipment (i.e. vacuum trucks, dozer, front end loader, and grader), as well as various hand held tools including shovels. In addition, three spill kits should be available on site during spill incident response operations. Each spill kit should contain the following supplies.

Composition of Spill Kit

	Quantity
• 360 litre polyethylene over pack drum	1
• oil sorbent booms (5" X 10')	6
• oil sorbent sheets (16.5" X 20" X 3/8")	100
• drain cover (36" X 36" X 1/16")	1
• Caution tape (3" X 500')	1
• 1 lb plugging compound	1
• Nitrile gloves (pair)	4
• Safety goggles (pair)	4
• Tyvek coveralls (pair)	4
• instruction booklet	1
• printed disposable bags (24" X 48")	10

Sorbent capacity of each spill kit is 240 litres.

All equipment is generally stored at the Hamlet Operations Yard/Garage. Some equipment may be stored in other areas throughout the community while being used to complete tasks.

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7.0 Training

All employees working for the Hamlet of Qikiqtarjuaq should be trained in the safe operation of all machinery and tools to help prevent sewage and hazardous material spills. All employees on site should also be trained for initial spill incident response. Annual refresher exercises should be conducted to review the procedures of this *Environmental Emergency Contingency Plan*, with all individuals involved in the Incident Spill Response Team, including members of the local volunteer fire department, RCMP Detachment, and Community Health Centre.

Incident Spill Response Team training should include the following aspects:

- Spill awareness and prevention
- Methods of detection
- Types of spills and seasonal considerations
- Reporting procedures and initial responses
- Spill response kit familiarization
- Clean-up and site remediation methods
- Occupational health and safety including proper selection and use of PPE's.

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8.0 Annual Review of this Environmental Emergency Contingency Plan

As part of the preparation of the Annual Report to the Nunavut Water Board for the Water License, the Hamlet should review and update the information contained within this plan. The purpose of the update is to ensure all changes to regulations are incorporated into this plan, along with the use of any new technology or method advances, to prevent or stop a spill and to mitigate and/or remediate a spill. This ensures that the plan adapts as the Hamlet grows, to ensure the community is properly prepared in the event of an incident.

Finally, it is recommended that annual refresher training of personnel be completed after any revisions to this document have been approved. This will familiarize personnel with the updated plan, and to provide a rapid and coordinated response.

Environmental Emergency Contingency Plan for
Water, Sewage, and Solid Waste Operations in the
Hamlet of Qikiqtarjuaq, Nunavut

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9.0 References

Nunavut Water Board, September 2000. *Hamlet of Qikiqtarjuaq Water License NWB3Q1K0106*. Goja Haven, Nunavut.

Nunavut Water Board, November 2004. *Guidelines for Spill Contingency Planning*. Goja Haven, Nunavut.

Northwest Territories, Date Unknown. *Contingency Planning and Spill Reporting in the NWT: A Guide to the New Regulations*, Yellowknife, Northwest Territories.

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Appendix A

Contact Information

**Appendix A
Contact Information**

Contact	Location	Telephone	Fax
Hamlet of Qikiqtarjuaq Senior Administrative Officer or Designate	Qikiqtarjuaq	(867) 927-8832	(867) 927-8120
Northwest Territories/Nunavut 24 Hour Spill Report Line	Iqaluit	(867) 920-8130	(867) 873-6924
Indian and Northern Affairs Canada Water Resources Manger Nunavut Regional Office	Iqaluit	(867) 975-4550	(867) 975-4585
Nunavut Water Board	Gjoa Haven	(867) 360-6338	(867) 360-6369
Environment Canada Environment Protection Branch Inspector	Iqaluit	(867) 975-4644	(867) 975-4594
Manager Pollution Control and Air Quality Environmental Protection Government of Nunavut	Iqaluit	(867) 975-5907	(867) 975-5981
Indian and Northern Affairs Canada Land Administration Minister Nunavut Regional Office	Iqaluit	(867) 975-4280	(867) 975-4286
Department of Fisheries and Oceans Canada Nunavut Regional Office	Iqaluit	(867) 979-8000	(867) 979-8039
Fire Department	Qikiqtarjuaq	(867) 927-4422	N/A
Royal Canadian Mounted Police (RCMP) Detachment	Qikiqtarjuaq	(867) 927-0123	N/A
Community Health Centre	Qikiqtarjuaq	(867) 927-8916	N/A

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Appendix B
NWT Spill Report



NWT SPILL REPORT

(Oil, Gas, Hazardous Chemicals or other Materials)

24 – Hour Report Line
Phone: (867) 920-8130
Fax: (867) 873-6924

A Report Date and Time		B Date and Time of spill (if known)		C ☐ Original Report ☐ Update no. _____		Spill Number	
D Location and map coordinates (if known) and direction (if moving)							
E Partly responsible for spill							
F Product(s) spilled and estimated quantities (provide metric volumes/weights if possible)							
G Cause of spill							
H Is spill terminated? ☐ yes ☐ no		I If spill is continuing, give estimated rate		J Is further spillage possible? ☐ yes ☐ no		K Extent of contaminated area (in square meters if possible)	
L Factors effecting spill or recovery (weather conditions, terrain, snow cover, etc.)				M Containment (natural depression, dikes, etc.)			
N Action, if any, taken or proposed to contain, recover, clean up or dispose of product(s) and contaminated materials							
O Do you require assistance? ☐ no ☐ yes, describe:				P Possible hazards to person, property, or environment; eg: fire, drink water, fish or wildlife			
Q Comments or recommendations						FOR SPILL LINE USE ONLY	
						Lead agency	
						Spill significance	
						Lead Agency contact and time	
						Is this file now closed? ☐ yes ☐ no	
Reported by		Position. Employer, Location				Telephone	
Reported to		Position. Employer, Location				Telephone	



Appendix F
Monitoring Program Quality
Assurance/Quality Control Plan



**Quality Assurance/Quality Control Plan for
Hamlet Water Reservoir, Sewage Lagoon, and
Solid Waste Disposal Facility Monitoring Program
Hamlet of Qikiqtarjuaq, Nunavut**

Prepared for

The Hamlet of Qikiqtarjuaq
P.O. Box 4, Qikiqtarjuaq NU X0A 0B0 Canada

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

Revised Date

February 2006

File No: N-O 09439.0

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- C Annual Report for the Hamlet of Qikiqtarjuaq

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1.0 Introduction

The Hamlet of Qikiqtarjuaq (meaning “big island”), is a Community of approximately 599 people located on the eastern coast of Baffin Island and on an island known as Broughton Island in the territory of Nunavut. As illustrated in Figure 1, the Hamlet is located approximately 470 kilometers northeast of the Capital City of Iqaluit, a distance that is covered by plane in about one hour. The geographic coordinates for the Hamlet of Qikiqtarjuaq are 67°33’ north latitude and 64°02’ west longitude. As indicated on Figure 2, the community is situated on the northwest portion of Broughton Island.

The Hamlet provides trucked water and sewage services, along with regular solid waste collection for the residents, businesses and institutions. Historically, water is drawn from the Tulugak River during the summer, and from the lined earthen reservoir for the remainder of the year. Sewage is collected by truck from individual holding tanks at each building and discharged to the unlined sewage lagoon located to the east of the community north of the DEW Line Access Road. Sewage treatment is provided by a retention lagoon, with the treated effluent charge flowing north towards the ocean through a naturally occurring wetland treatment area. Solid waste is disposed of at a facility located adjacent to the sewage lagoon. The solid waste disposal facility includes areas for bulky metals/derelect vehicles, barrels, metal dump borrow, secondary metal, and residential solid waste.

1.1 Purpose

The Quality Assurance/Quality Control Plan has been prepared to meet the requirements of the Monitoring Program developed for the Hamlet of Qikiqtarjuaq to comply with licensing requirements. A copy of the current license is included in Appendix A.

Quality Assurance (QA) and Quality Control (QC) are vitally important components of environmental management for the Hamlet of Qikiqtarjuaq. Contact information for the Hamlet is provided in Appendix B.

1.2 Objectives

The Plan has been developed to achieve the following objectives:

- To ensure that all samples taken in the field will follow procedures and controls in order to maintain a high quality, so that the results obtained represent both the physical and chemical nature of the samples being taken
- To ensure best management practices (BMP) are used throughout the sampling program

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- To ensure all samples are delivered promptly to an accredited laboratory for analysis.

This document describes the procedures and controls to be used by Hamlet operations staff when conducting environmental sampling to meet the requirements of the license.

Although the QA/QC Plan is submitted to the NWB as a condition of the water license, it is primarily intended to be read, understood, and implemented by Hamlet operations personnel responsible for environmental quality monitoring. The procedures should be applied to **all** water quality samples taken by the Hamlet.

1.3 Quality Assurance and Quality Control

Quality Assurance is a set of operating principles that, if strictly followed during sample collection and analysis, will produce data of known and defensible quality (Wilson, 1995). As such the accuracy of the analytical results can be stated with a high level of confidence. A high level of quality assurance can be achieved by applying the following principles:

- Personnel involved in water sampling and analysis are well trained
- Facilities and equipment required for sampling are suitable, well maintained, and always kept clean
- Standard procedures are developed and implemented for the collection, transportation and analysis of samples, based on recognized BMP
- Laboratory and field instruments are calibrated according to manufacturers recommendations or recognized as good operating practice
- Supplies used in sampling and analysis are of consistent high quality and are not expired
- Quality Control (QC) procedures are development and implemented based on good operating practices to assess quality of analytical data and provide warning of unacceptable errors
- Implement prompt remedial action when deficiencies are identified
- Results of the monitoring program are reported in the Annual report as required in the water license. Annual report is required to be submitted by March 31 for the pervious calendar year to the NWB sample form can be found in Appendix C.

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Quality Control (QC) is a set of specific procedures used to measure the quality of the data produced and correct deficiencies in the sampling or analyses, as they occur. Quality control is used by the analyst and sampler to achieve standards of measurement for the three principles components of quality: precision, accuracy and reliability.

1.4 Lab Accreditation

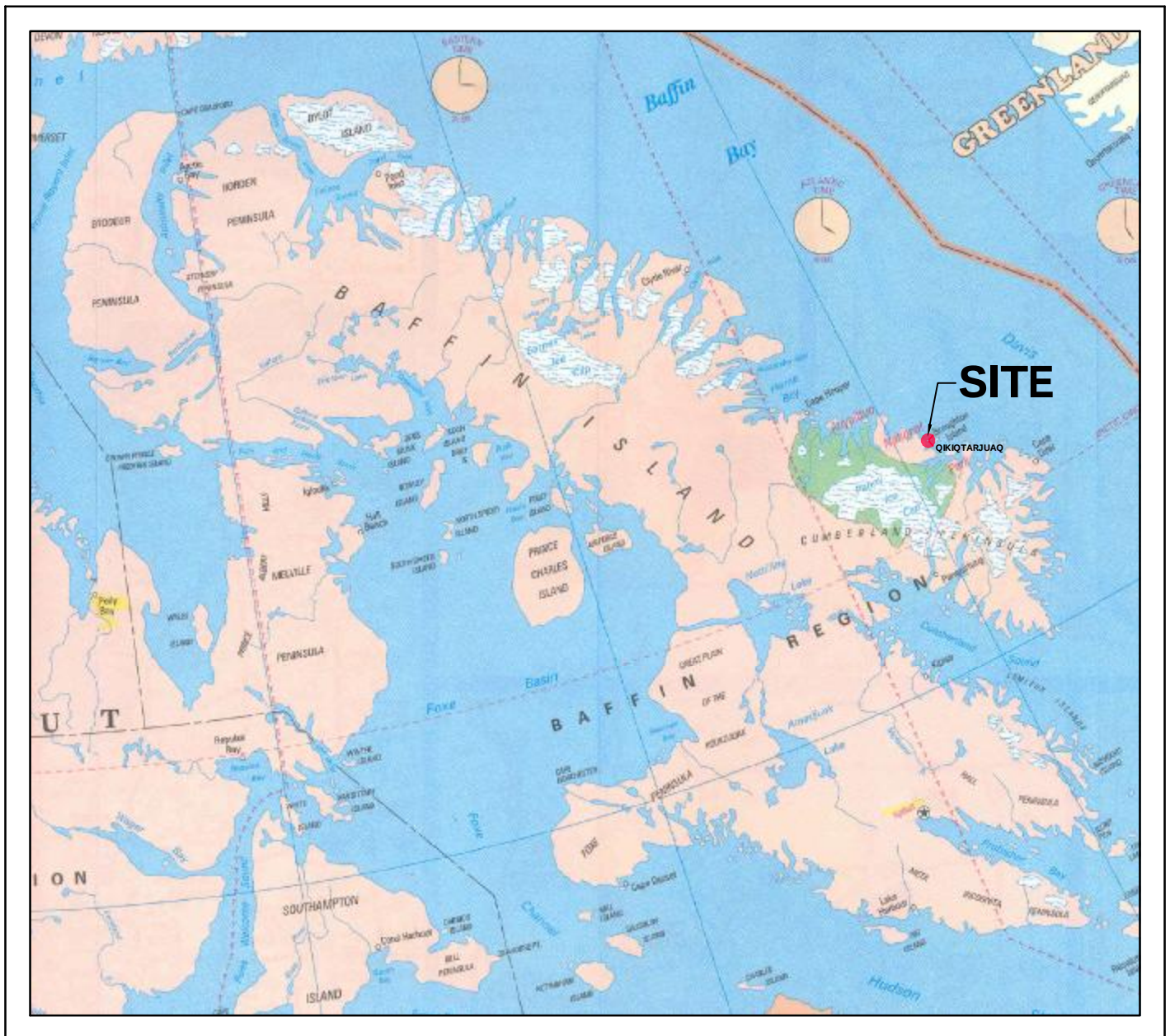
All analyses shall be conducted in laboratories, which are accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL), unless otherwise approved by an Analyst. The Contact information for the DIAND Analyst for Nunavut is provided in Appendix A.

The following is the contact information for the Laboratory retained by the Hamlet of Qikiqtarjuaq to complete analysis:

Name of Laboratory	_____
Address	_____

Phone No.	_____
Fax No.	_____

Prior to sampling being undertaken by representatives of the Hamlet, the Hamlet shall notify the NWB of the Laboratory to be used to perform the analysis. This is required as per the Water License.



Map Reference:
Map of Canada
Published by the CAA

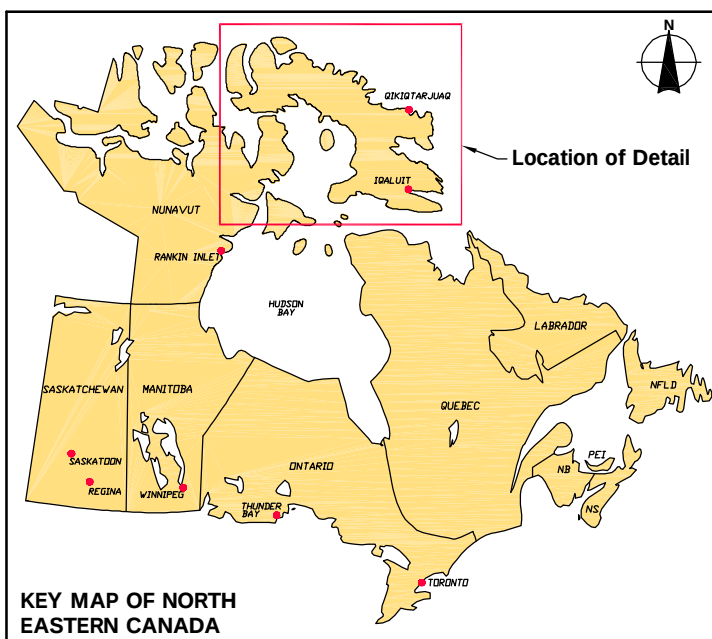


FIGURE 1 - SITE LOCATION MAP

THE HAMLET OF QIKIQTARJUAQ, NUNAVUT

QUALITY ASSURANCE/QUALITY CONTROL PLAN

January 2006
Project Number: N-O 09439.0

Prepared by: K. Pridham

Verified by: M. Paznar

Burnside



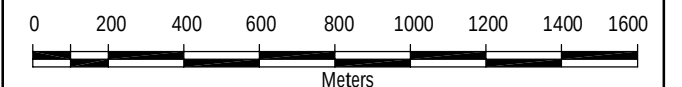
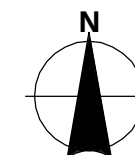
FIGURE 2
THE HAMLET OF QIKIQTARJUAQ
QUALITY ASSURANCE/QUALITY CONTROL
PLAN

SATELLITE IMAGERY OF
ENTIRE COMMUNITY
AND INFRASTRUCTURE

Legend

X QIK - 1 **SAMPLING STATION LOCATION**

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



1:20,000
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: M. Paznar



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2.0 Field Sampling

2.1 Sample Collection

Effluent and surface water sampling by the Hamlet of Qikiqtarjuaq is conducted to provide information for the Hamlet for effective environmental management and to monitor regulatory compliance.

2.1.1 Sampling Location and Frequency

The Monitoring Program of the water license prescribes the specific effluent and surface water monitoring program for the Hamlet. It includes detailed information such as where to take samples, how often to take samples and what parameters will be analyzed on the collected samples. The proposed Monitoring Program is summarized in Table 1.

Table 1: Surveillance Network Program for Water License NWB3Q1K0106

Station	Description	Frequency	Analysis Requirements
QIK -1	Raw water supply intake at the Tulugak River	Monthly from May to August prior to refilling reservoir	Measure volume of water drawn from river • Total Ammonia-N • Total Organic Carbon (TOC) • Total Suspended Solids • Chloride (Cl) • Nitrate (N) • Total Arsenic (As) • Total Chromium (Cr) • Total Copper (Cu) • Total Lead (Pb) • Total Mercury (Hg) • Total Sodium (Na) - Microbiological • Heterotrophic plate count (HPC) • Coliform • Colour • pH • Turbidity • Nitrite (N) • Sulphate (SO₄) • Total Cadmium (Cd) • Total Cobalt (Co) • Total Iron (Fe) • Total Manganese (Mn) • Total Nickel (Ni) • Total Zinc (Zn) • Background • Escherichia coli (E.coli)

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Station	Description	Frequency	Analysis Requirements
QIK - 2	Raw water supply intake at the reservoir truck fill station	Monthly from May to August	Measure volume of water drawn from reservoir
QIK - 3	Raw sewage from pump out truck	Monthly from May to August	Amount deposited to lagoon
QIK - 4	Discharge from the FINAL DISCHARGE POINT OF SEWAGE DISPOSAL FACILITIES	Monthly during periods of flow	• 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
QIK - 5	Runoff from the Solid Waste Disposal Facility	Monthly during periods of flow	Same as STN QIK - 4

The sampling stations will be clearly identified in the field by posted signs. All signs shall be in the Official Languages of Nunavut, and shall be located and maintained to the satisfaction of an Inspector. Each sampling location must have their Global Positioning System (GPS) coordinates determined. Table 2 provides an estimate of the GPS coordinates based on the satellite imagery shown in Figure 2. These locations must be confirmed by the Inspection, and the coordinates updated if necessary.

Table 2: GPS Locations of SNP Sampling Stations

Station	GPS Coordinates (Easting, Northing)
QIK - 1	458912, 7493383
QIK - 2	458740, 7493463
QIK - 3	458962, 7495017
QIK - 4	458091, 7495340
QIK - 5	458754, 7495176

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Samples shall be taken at the same location on each sampling occasion, unless the Inspector has approved a new location.

Additional sampling and analysis may be requested by an Inspector.

Note: The License also describes the sampling station QIK-1 as the raw water supply prior to treatment. The Hamlet is not required to take samples at this site to comply with the water license. Samples for QIK-1 shall be taken by the Indian and Northern Affairs Canada (INAC) and/or GN Environmental Health Office (EHO).

2.1.2 Sample Planning

To understand what sample containers, sampling techniques, and preservation methods are required, Hamlet personnel first need to understand what parameters will be analyzed in the laboratory. Table 3 is a summary of parameters required in the License, which are grouped according to their different sampling requirements:

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Table 3: Parameters Examined in NWB Water Licenses

Group	Description	Parameter
I	Microbiological	Biological Oxygen Demand (BOD) Fecal Coliform (FC)
II	General Water Chemistry	pH Conductivity Total Alkalinity Total Suspended Solids (TSS) Ammonia Nitrogen (NH ₃ -N) Nitrate-Nitrite (NO ₃ -NO ₂) Oil and Grease (OGG) (Visual) Sulphate (SO ₄) Sodium (Na) Total Organic Carbon (TOC) Potassium (K) Magnesium (Mg) Calcium (Ca) Total Hardness Chloride (Cl)
	Total Metals (except Mercury):	Total Nickel (Ni) Total Aluminum (Al) Total Arsenic (As) Total Cadmium (Cd) Total Copper (Cu) Total Cobalt (Co) Total Chromium (Cr) Total Iron (Fe) Total Lead (Pb) Total Manganese (Mn) Total Zinc (Zn)
III		Total Mercury (Hg)
IV		Total Phenols (Total-P)

It is strongly recommended that the Hamlet seek advice for the sizes and types of buffers required for analysis of the parameters required. Furthermore, it is recommended that the laboratory pre-fill the sample collection bottles with the proper preservative to minimize error in the field.

All of the samples taken will be grab samples. Samples will normally be taken from natural lakes, streams, treatment ponds, or process streams. Where possible, samples

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shall be taken from just below the surface to avoid floating debris, which may contaminate the sample.

Freshwater Streams, Surface Drainage, and Wetlands

The samples shall be collected as close to the middle of the stream where water flows freely and is free of debris. After getting into position, the sampler shall wait to allow any stirred sediment that occurred from entering the stream to settle or wash away. The sample bottle shall be partially filled with the water to be sampled and rinsed with the lid in place at least three times. Rinse water shall be emptied downstream of the sampling point, so that stream sediments remain undisturbed. **Prior to sampling for oil/grease, bacteria, and for any bottles containing preservative, the bottles shall not be rinsed.**

If possible, bottles shall be plunged into the stream to a depth of approximately half the total stream depth, and allow it to fill with the mouth of the bottle facing upstream. Where stream is too shallow to allow for sample bottle to be filled completely, without disturbing bottom sediment of the streambed. The sampler may use a smaller container that has been properly rinsed to transfer sample to the larger bottle. Do not use a smaller sample bottle containing preservatives.

When taking the sample, sufficient room shall be left to allow for the addition of preservatives, if required.

Lakes or Ponds

Surface sampling shall be collected using the same procedures as streams. Sample bottles shall be plunged to approximately 150 mm (6 inches) below the water surface.

Although not currently required under the Monitoring Program, information on water quality at various depths in lakes or ponds may be required. If an Inspector requests that this sampling be carried out, specific procedures shall be implemented in accordance with accepted sampling and good engineering practice.

Process Streams

When sampling a process stream (i.e. valve or pipe discharge) the sampler shall collect a grab sample or a set of composite samples collected over an extended period of time. In the case of sampling from a valve, valves shall be open and running for a least one-minute before taking the sample to ensure that a representative sample of the process stream is taken.

2.1.3 Sample Container Selection

Sample containers vary in size and material of construction depending on the specific type of analysis to be conducted. Sample containers for each analysis are shown in Table

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2. Sample containers to be used shall be obtained directly from the laboratory, which shall provide new containers to the Hamlet specific for the sampling program requested by the Hamlet. The laboratory will provide the correct sizes and types of bottles based on the parameters required. The Hamlet shall **contact the laboratory at least one month prior to sampling event** in order to ensure that containers are available for sampling. Refer to Section 1.3 for laboratory contact information.

2.1.4 Field Sampling Log

The individual collecting the water sample shall record the following at the time of sampling:

- Date of sampling
- Time of sampling
- Weather conditions
- Monitoring Station Number (i.e. QIK-2, QIK-3, QIK-4, etc.)
- Results of any Field measurements
- Sampler shall also indicate if sample used preservatives
- Any unusual conditions
- Any deviation from standard procedures.

2.1.5 Field Measurements

No field measurements are required as part of the Hamlet sampling program, however, it is strongly recommended that the following parameters be sampled immediately on site using appropriate portable field equipment:

- pH
- Temperature
- Dissolved oxygen
- Total alkalinity
- Turbidity
- Chlorine residuals.

It is important that separate equipment be used to sample between potable water and non-potable water (i.e. surface water). Furthermore, all instruments, glassware, etc. should be cleaned between each sample following manufacturer's recommended guidelines and/or BMPs.

2.1.6 Sampling Procedures

The sampling procedures described in Table 4 shall be used to collect water samples appropriate to the sampling location.

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Table 4: General Procedures for Sample Collection

	BIOLOGICAL	PHYSICAL	INORGANIC	ORGANIC
Phase 1: Sample Program Design	Step 1: Choose sample locations, sample frequency, and analytes to be measured Step 2: Contact laboratory used for analysis and get advice and information for sampling program Step 3: Contact manager of sample location facility; determine all safety requirements Step 4: Create sample identification system			
Phase 2: Sample Program Preparation	Step 1: Obtain sample containers, storage containers, distilled water, Personal Protective Equipment (PPE), and other required equipment Step 2: Create sample labels and apply to sample containers Step 3: Plan first sampling event - arrange all transportation and notify laboratory			
	• 1000 mL plastic or glass container for BOD • 300 mL plastic or glass container for fecal coliform	• Have equipment needed for any flow or temperature measurements • 200 mL plastic or glass container for suspended solids	• Electrode meter for dissolved oxygen and pH • 1000 mL nitric acid rinsed container, nitric acid for preservation, and filter for metals • Specific containers and preservatives for nutrients or other analytes	• 1000 mL plastic or glass container, hydrochloric or sulfuric acid, for oil and grease
Phase 3: Sample Collection	Step 1: Keep sample containers closed until used Step 2: Record the date, time, location, geographic position, weather conditions, and other details in a field notebook at each sample location Step 3: Fill out the sample label, including: sample ID, location, date, time, and name of sample collector Step 4: Collect sample using appropriate container, by filling without rinsing, immediately close and keep cool Step 5: Pack all samples and provide a sample information sheet listing all contents in the storage container Step 6: Label the storage container with the recipient, WATER SAMPLES, FRAGILE, THIS END UP, and any TDG or WHMIS labels required			
	• BOD - fill container completely and refrigerate, Fecal coliform - leave space at top of container, refrigerate • Maximum storage time: BOD - 24 hrs, Fecal Coliforms - 30 hrs,	• TSS - Refrigerate • Maximum storage time: TSS - 7 days, temperature - 0.25 hrs	• Fill container and leave a small (1% of volume) air space at the top, refrigerate • Maximum storage time: ammonia - 7 days, nitrate and phosphate - 48 hrs, metals - indefinite, DO and pH - 0.25 hrs	• Fill container to top and refrigerate • Maximum storage time: oil and grease - 28 days
Phase 4: Sample Transportation	Step 1: Fill out the "sampler" portion of the Chain of Custody form Step 2: Ensure that all personnel handling the samples fill out a subsequent section of the Chain of Custody form Step 3: Transport the samples to lab for analysis as quickly as possible Step 4: Verify that the lab has received the samples and analysis is underway			

Note: Sizes and types of sample collection containers (bottles) are a suggestion only. The laboratory may suggest and use other sizes and types. Follow the suggestions of a CAEAL accredited laboratory.

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2.1.7 Sample Identification

All samples collected are to be labeled according to standard identification procedures (Name of sampler, time and date of sampling, sample identifier, sampling method and type of sample). **Sample labels shall be water-resistant, and prepared prior to going into the field.** An example of a typical Label is provided in Figure 3.

Figure 3: Example of Water Sample Label

Name of Sampler:	Gill Evans	Sample #:	1 of 15
Date of Collection:	1 May 2006 (0900 hrs)		
Type of Sample:	Grab Water Sample for Microbiological Analysis		
Parameter to be analyzed:	BOD		
Preservation method used:	no preservatives		
Temperature:	11°C	pH:	7.04
Sample Location:	QIK-4		
	Hamlet of Qikiqtarjuaq		
	Qikiqtarjuaq, NU		
	Phone: (867) 927-8943		

2.1.8 Sample Preservation

To obtain good results from a sampling program, time is critical. All samples are to be shipped to the Laboratory that has been contracted to carry out the analysis the same day as they are collected. Samples must be protected from breakage, and shall be shipped in an insulated cooler that can be provided by the Laboratory. **If samples cannot be shipped until the next day, due to unavoidable events such as weather or mechanical problems with transport aircraft, all samples must be stored in a refrigerator at 4°C.** Samples must not be frozen.

In all cases where samples cannot be delivered to the lab on the same day, specific preservatives must be added to the samples to prevent chemical changes that may alter the concentration of the parameters of interest. The samples must be preserved within two hours of sampling. Usually, samples can be preserved away from the field at the end of the site visit. In most cases, the laboratory can fill the bottles with preservative, and then ship them to the Hamlet to be filled and sent back for analysis.

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For the Hamlet of Qikiqtarjuaq, Table 5 provides the appropriate preservation methods for the parameters to be assessed.

Table 5: Sample Preservation

Type of Sample	Preservation Required
Group I Microbiological	Store in refrigerator at 4°C. Ship to Lab the same day as collected
Group II General Water Chemistry	Store in refrigerator at 4°C. Ship to Lab the same day as collected
Group II Total Metals (except mercury)	Acidify with 5 mL of <20 percent nitric acid. Store in refrigerator at 4°C. Ship to Lab the same day as collected
Group III Total Mercury	Acidify with 2 mL of 1:1 sulfuric acid and 5 percent potassium dichromate Store in refrigerator at 4°C. Ship to Lab the same day as collected
Group IV Total Phenols	Acidify with 4 mL of 1:1 sulfuric acid. Store in refrigerator at 4°C. Ship to Lab the same day as collected

Note: 1000 mL = 1 Liter

2.1.9 Sample Transportation

The main objective of the sampler is to minimize any chemical changes to the sample between the time it is collected and delivery to the laboratory. Heat, light and agitation can all impact the water chemistry and the samples shall be protected from these effects.

Effluent and surface water samples shall be stored and transported at a temperature of 4°C. Coolers and ice packs need to be available and are usually provided by the laboratory. Upon arrival at the laboratory, samples shall be refrigerated as soon as possible.

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3.0 Quality Control

Most commercial laboratories undertake QA/QC procedures with the volume of sample sent for analysis. Reports are usually provided with the Certificates of Analysis. It is recommended that the suggested QA/QC protocols by the laboratory be followed.

To ensure that the monitoring program maintains accepted quality control, field blanks and duplicate samples may be suggested by the laboratory. These samples are collected and analyzed for the sample parameters as the monitoring program in the license as part of a quality control check on monitoring activities.

The Field Blanks shall accompany the sampler into the field, labeled as field blanks, preserved in the field and submitted to the laboratory with the field samples.

3.1 Replicate or Duplicate Samples

Replicate or duplicate samples is the collection of more than one sample for a given sampling station subject to specific analysis. Standard procedures used for the routine sampling shall be applied. The replicate or duplicate samples are useful in identifying problems with accuracy and sampling methods.

Once per operating season for each active monitoring station a set of duplicate samples will be taken, representing as many of the routine analysis as possible. Where possible this shall be carried out in conjunction with the sampling undertaken by an INAC Inspector.

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4.0 Laboratory Analysis/Reporting

The laboratory will perform the analysis of all samples as outlined in the License. The results shall be received by the Hamlet within the time frame agreed to with the laboratory. The results shall be submitted the NWB for review with the Annual report. The results shall contain the limits of Detection used for analysis of each parameter as supplied by the laboratory.

The Hamlet may request clarification of the Analysis be contacting the NWB Technical Advisor and a review of the analysis will be provided upon request.

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5.0 Glossary

Quality Assurance (QA): is the definitive program for laboratory operation that specifies the measures required to produce defensible data of known precision and accuracy. QA includes quality control and quality assessment activities.

Quality Control (QC): is a set of measures within a sample analysis methodology to assure that the process is in control.

Quality Assessment: is a process to determine the quality of the laboratory measurements through internal and external QC evaluations. It includes performance evaluation samples, laboratory inter-comparisons samples and performance audits.

Quality Assurance/Quality Control Plan for Hamlet Water Reservoir, Sewage Lagoon, and Solid Waste Disposal Facility Monitoring Program, Hamlet of Qikiqtarjuaq, Nunavut

February 2006

6.0 References

Nunavut Water Board. *Water License NWB3QIK0106*. Gjoa have, Nunavut.

Wilson, Neal. 1995. *Soil Water and Ground Water Sampling*. CRC Press: New York, USA.

J:\2006\F\NUNA\08983\Reports\Quality Assurance Quality Control\Report.doc



Appendix A

Contact Information

APPENDIX A

Contact Information

Nunavut Water Board Contact:

Technical Advisor
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU X0B 1J0
Telephone: (867) 360-6338
Fax: (867) 360-6369
Email: srtech@nwb.nunavut.ca

Inspector Contact:

Water Resources Manager
Nunavut District, Nunavut Region
Department of Indian and Northern Affairs Canada
P.O. Box 100
Iqaluit, NU X0A 0H0
Telephone: (867) 975-4550
Fax: (867) 979-6445

Analyst Contact:

Laboratory Manager
Taiga Laboratories
Department of Indian and Northern Affairs Canada
4601 - 52 Avenue, P.O. Box 1500
Yellowknife, NT X1A 2R3
Telephone: (867) 669-2780
Fax: (867) 669-2718



Appendix B
Notification of Laboratory Form

APPENDIX B
Notification of Laboratory Form

Attention: Technical Advisor
Nunavut Water Board

Re: Notification of Laboratory
Water License NWB3QIK0106

Dear Sir/Madame,

The following CAEAL-certified laboratory has been retained by the Hamlet of Qikiqtarjuaq to complete the sample analysis required by Water License NWB3QIK0106:

Name of Laboratory : _____

Address : _____

: _____

: _____

Phone # : _____

Fax # : _____

Regards,

Name (print) : _____

Signature : _____ Date : _____

Please send this form, once completed, to the Nunavut Water Board at the following address:

Nunavut Water Board
c/o Technical Advisor
PO Box 119
Gjoa Haven, NU X0B 1J0
Telephone: (867) 360-6338
Fax: (867) 360-6369
Email: srtech@nwb.nunavut.ca

Appendix C
Annual Report for the
Hamlet of Qikiqtarjuaq

APPENDIX C
Annual Report for the Hamlet of Qikiqtarjuaq

Year Being Reported: _____

The following information is compiled pursuant to the requirements of Part B, Item 1 of Water License NWB3QIK0106 issued to the Hamlet of Qikiqtarjuaq.

Tabular summaries of all data generated under the Monitoring Program, monthly and annual quantities in cubic meters of freshwater obtained from all sources, monthly and annual quantities in cubic meters of each and all wastes discharged.

Attached to this document are results for Monitoring Station QIK-1, QIK-2, QIK-3, QIK-4, and QIK-5 as well as detailed chemical, physical, and biological analysis required at QIK-2 and QIK-5 (for the months of May to August, inclusive).

Month Reported	Quantity of Water Obtained From all Sources (m³)	Quantity of Sewage Waste Discharged (m³)
January		
February		
March		
April		
May		
June		
July		
August		
September		
October		
November		
December		
Annual Total		

Please indicate volumes in cubic meters – 1 cubic meter equals 1,000 liters.

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

A list of unauthorized discharges and summary of follow up action taken.

A summary of any abandonment and restoration work completed during the year, and an outline of any work anticipated for the next year.

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.

Any other details on water use or waste disposal required by the Board by November 1st of the year being reported.

Updates or revisions to the approved Operation and Maintenance Plans.

Additional information that the licensee deems useful.

Follow up regarding inspection/compliance concerns.

Appendix H3
Solid Waste Management Facility



**Solid Waste Facility
Operation and Maintenance (O&M) Plan
Hamlet of Qikiqtarjuaq, Nunavut**

Prepared for

The Hamlet of Qikiqtarjuaq
P.O. Box 4, Qikiqtarjuaq NU X0A 0B0 Canada

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

Revision Date

February 2006

File No: N-O 09439.0

The material in this report reflects best judgement in light of the information available at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Nuna Burnside accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

February 2006

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A	Climate Normal Data
B	Projected Waste Quantity Calculations
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D	Waste Disposal Site Forms
E	Environmental Emergency Contingency Plan
F	Monitoring Program Quality Assurance/Quality Control Plan

Solid Waste Facility
Operation and Maintenance (O&M) Plan
Hamlet of Qikiqtarjuaq, Nunavut

February 2006

1.0 Introduction

The operation and maintenance of the Solid Waste Disposal Facility will occur as a component of normal Hamlet of Qikiqtarjuaq operating procedures.

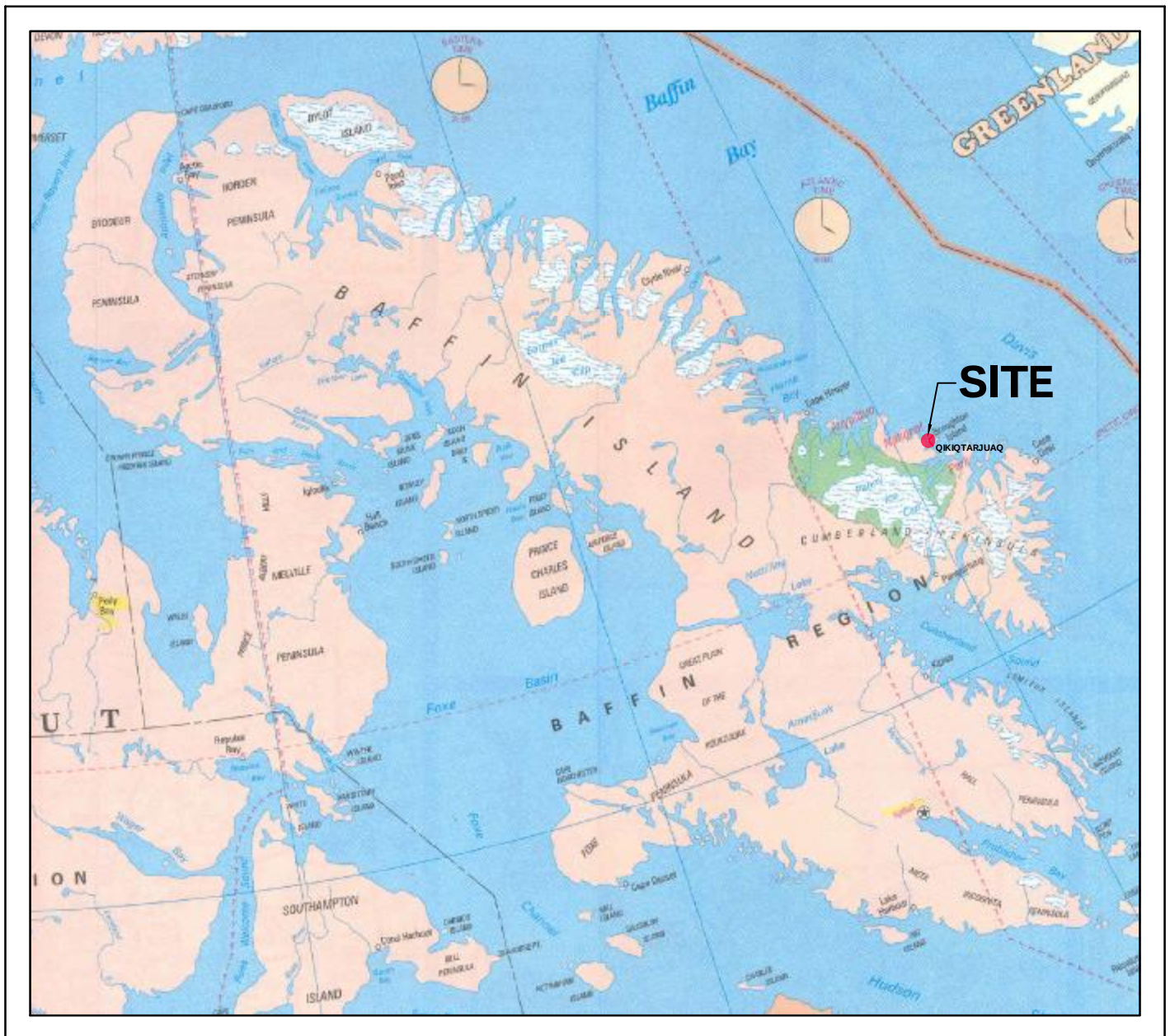
The Hamlet of Qikiqtarjuaq (meaning “big island”), is a Community of approximately 599 people located on the eastern coast of Baffin Island on Broughton Island, Nunavut (Figure 1). The Hamlet is located approximately 470 kilometers northeast of the City of Iqaluit, at 67°33’ N and 64°02’ W. The layout of the community is displayed in Figure 2.

Qikiqtarjuaq is located within the continuous permafrost zone. Maximal local depth of annual thaw of the active layer ranges from 0.6 to 1.6 meters, depending on the thickness and nature of the surface cover. Materials located beneath the thin active layer are perennially frozen to a substantial depth. Qikiqtarjuaq sits on glacial drift primarily composed of silty sand and gravels mixed with boulders.

The vegetation present in Qikiqtarjuaq is typical of that evidenced on the Arctic tundra. Hardy grasses, mosses, and lichens sit in a thin organic layer on the surface, which is generally 0.2 m or less in thickness.

Qikiqtarjuaq receives an average of 39 mm of rainfall and 223 mm of snowfall *per annum*. July mean high and low temperatures are 7°C and 1°C, respectively. January mean high and low temperatures measure -21°C and -28°C, respectively. Prevailing winds are generally north-northeast with an annual average velocity of 8.3 km/h. Climate normal information has been obtained from Environment Canada, and is presented in Appendix A.

Projected population and solid waste generation rates are provided in Appendix B.



Map Reference:
Map of Canada
Published by the CAA

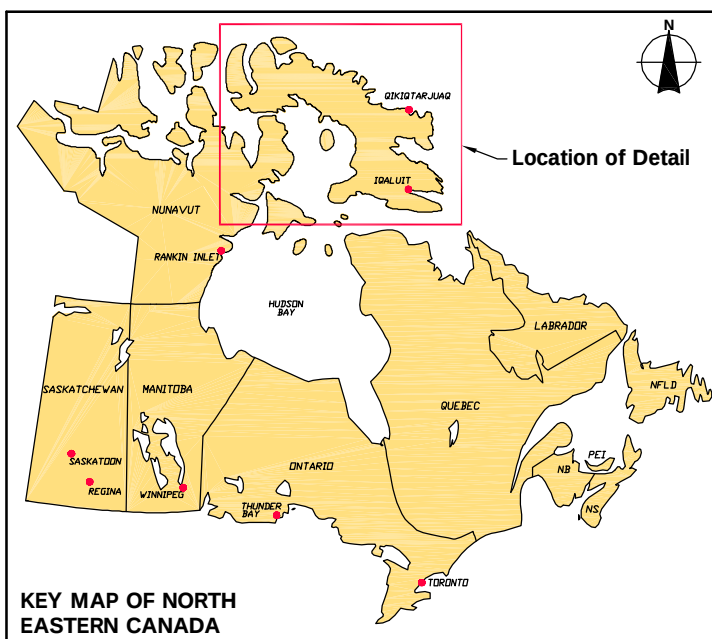


FIGURE 1 - SITE LOCATION MAP

THE HAMLET OF QIKIQTARJUAQ, NUNAVUT SOLID WASTE DISPOSAL FACILITY O&M PLAN

January 2006
Project Number: N-O 09439.0
Prepared by: K. Pridham

Verified by: M. Paznar

Burnside

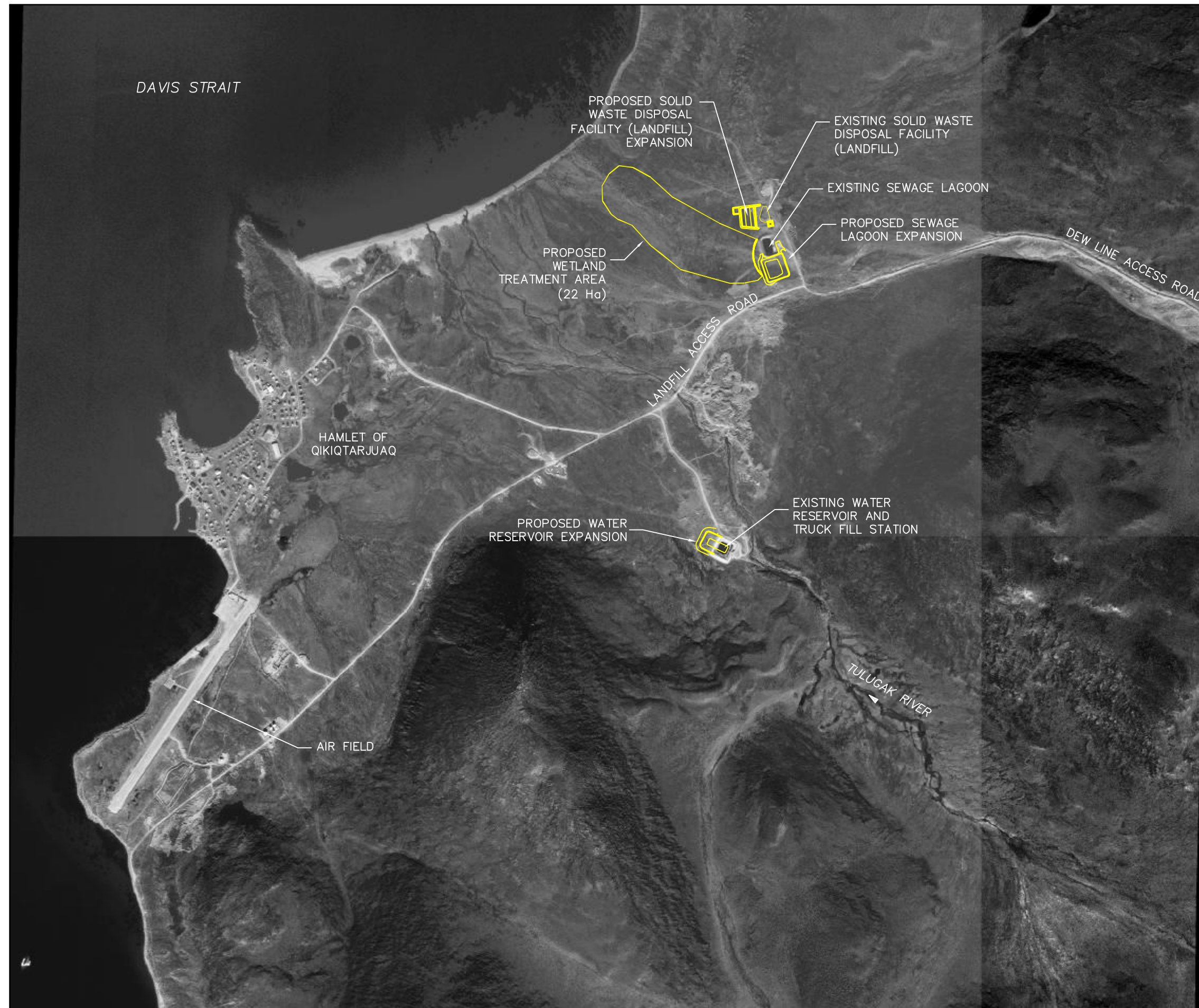
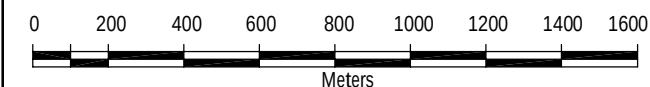
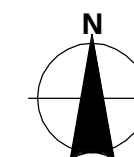


FIGURE 2
THE HAMLET OF QIKIQTARJUAQ
SOLID WASTE
DISPOSAL FACILITY
O&M PLAN

SATELLITE IMAGERY OF
ENTIRE COMMUNITY AND
INFRASTRUCTURE

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



1:20,000
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: M. Paznar



Solid Waste Facility
Operation and Maintenance (O&M) Plan
Hamlet of Qikiqtarjuaq, Nunavut

February 2006

2.0 Background Information on Hamlet Operations

The Hamlet of Qikiqtarjuaq provides regular solid waste pickup for the Community's residents, businesses, and institutions. Collection occurs on a daily basis throughout the Hamlet, to minimize the potential for attraction of foxes and polar bears. Solid waste is deposited in the Hamlet's Solid Waste Disposal Facility, which is currently permitted by the Nunavut Water Board (NWB License No. NWB3QIK0106, dated November 28, 2000 (Appendix C)). The Facility is located approximately 2.3 km east of the community north of the DEW Line Access Road. Waste is collected by the Hamlet-owned garbage truck and transported to the waste disposal facility. Access to the Solid Waste Disposal Facility is unmanned and public sorting/ scavenging of the waste is allowed. Specific areas for the segregation of hazardous and bulky waste (the Hazardous Waste Segregation Facility and the Bulky Waste Disposal Area, respectively) are provided. The Hazardous Waste Segregation Facility is located within the fenced area at the landfill, while the Bulky Waste Disposal Area is located in an adjacent, but unfenced, area.

Solid Waste Facility
Operation and Maintenance (O&M) Plan
Hamlet of Qikiqtarjuaq, Nunavut

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3.0 Operation and Maintenance of the Solid Waste Disposal Facility

Satellite imagery of the Solid Waste Disposal Facility operated by the Hamlet of Qikiqtarjuaq, which is described above, is provided in Figure 3. This Figure illustrates both the drainage pathway of the area adjacent to the Solid Waste Disposal Facility and the proximity to adjacent water bodies (the Davis Strait).

In the event of emergency, guidance regarding containment and site emergency response can be obtained from the following sources (see Table 1):

Table 1 – Emergency Contacts

Contact	Location	Telephone Number	Fax Number
INAC – Manager, Water Resources	Iqaluit	(867) 975-4550	(867) 979-6445
Hamlet of Qikiqtarjuaq – SAO	Qikiqtarjuaq	(867) 927-8832	(867) 927-8120
Government of Nunavut (Regional Engineer)	Pond Inlet	(867) 975-7314	
Environment Canada – Inspector	Iqaluit	(867) 975-4644	(867) 975-4594
Fire Department	Qikiqtarjuaq	(867) 927-4422	
RCMP Detachment	Qikiqtarjuaq	(867) 927-0123	
Community Health Center	Qikiqtarjuaq	(867) 927-8916	

3.1 Solid Waste Collection Procedures

The following solid waste collection operational procedures shall be carried out by the Hamlet of Qikiqtarjuaq on a daily basis (weather dependant):

- Household and commercial solid waste will be collected daily by Hamlet staff using a Ford F-450 equipped with a Haul-All compactor, and hauled to the Solid Waste Disposal Facility
- Solid waste shall be discharged to the approved Solid Waste Disposal Facility
- Hazardous waste observed by the collection staff shall be segregated in the Hazardous Waste Segregation Facility for later disposal in an approved facility
- Daily waste volumes deposited to the Solid Waste Disposal Facility (and trip counts) shall be recorded on the Waste Placement Form provided in Appendix D
- In the event of an accident, a spill of solid waste or petroleum products or a fire during solid waste collection operations, the *Hamlet of Qikiqtarjuaq Environmental Emergency Response Plan* (Appendix E) shall be implemented.

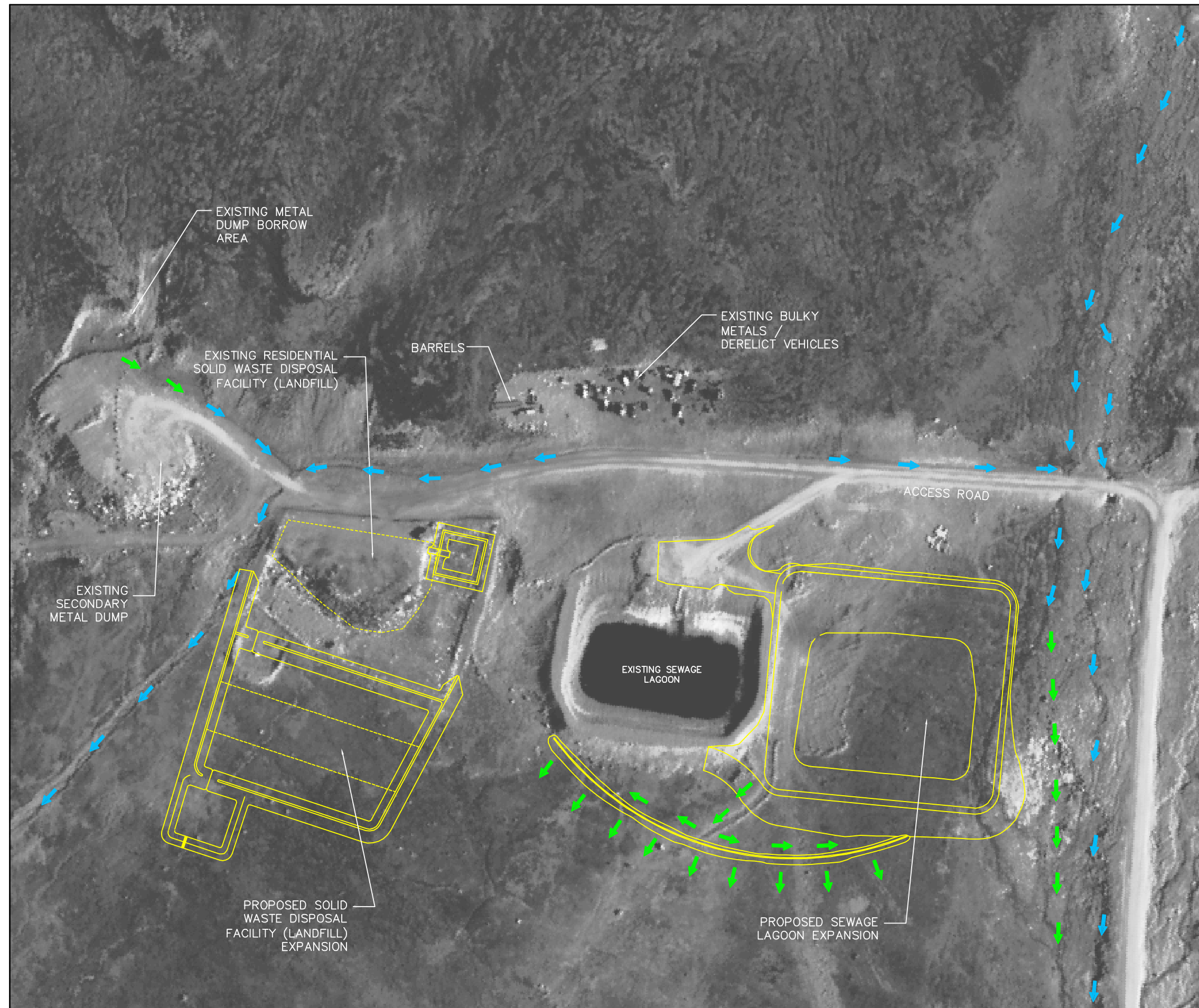


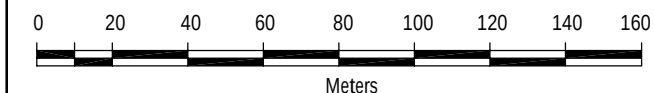
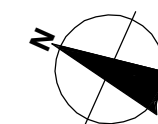
FIGURE 3
THE HAMLET OF QIKIQTARJUAQ
SOLID WASTE
DISPOSAL FACILITY
O&M PLAN

SOLID WASTE DISPOSAL
FACILITY (LANDFILL)

Legend

→ → **INTERPRETED SURFACE WATER FLOW DIRECTION**

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



1:2,000
 January 2006
 Project Number: N-O 09439.0

Projection: UTM Zone 20
 Datum: NAD83

Prepared by: C. Sheppard

Verified by: M. Paznar



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3.2 Landfill Operation

Waste Receiving

The collection vehicles will progress to the tipping area. If possible, wastes should not to be tipped directly onto burning or smoldering waste. Wastes may be tipped or unloaded into the day's burn area as determined by staff (if unlit) or adjacent to the burn area, if lit, smoldering or hot. The staff will perform a cursory inspection of the waste to ensure that it does not contain visible hazardous or bulky waste. If such waste is noted, it will be segregated in the appropriate locations of the approved Hazardous Waste Segregation Facility or the Bulky Waste Disposal Area.

The staff will record the number of trips to the Solid Waste Disposal Facility per day and estimate the approximate quantity in cubic metres on the Waste Placement Forms included as Appendix D. If waste is present on site that has been tipped by others, an estimate of the quantity shall be made and recorded. Records are to be delivered to the Hamlet office once per week, where they will be retained on file for inclusion in the Annual Report.

Burning

It has been indicated that the burning of waste is a necessity to prevent odour (since the ability to cover waste is limited due to the short operational season), eliminate flies, and to reduce potential problems with scavengers, such as bears and foxes. In order to minimize the potential for impacts from fires the following rules are to be followed:

- Establish the burn area before each burn and demarcate it with box horses or safety cones. Acceptable burn areas shall be located:
 - At least 15 m away from the hazardous waste segregation area
 - At least 10 m from the fence line, roads and areas that may be visited by the members of the community
 - Not on previously filled areas unless it can be determined that a suitable thickness of cover material is present
- Ensure that the weather is acceptable for burning. The following guidelines are recommended:
 - Wind levels should be checked. If loose paper or debris can be lifted and carried off site (moderate breezes or greater), burning shall be avoided
 - The wind direction should be checked, to ensure that smoke does not drift towards the Hamlet, or workers in the vicinity (i.e., the Sewage Treatment Lagoon)
 - If heavy rain is present, burning should be avoided (as it may result in poor combustion and greater potential to generate by-products).

The site operators shall stay upwind of the fire at all times.

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3.3 Landfill Construction and Development

3.3.1 Regular Operation

Prior to waste handling, the equipment operator will confirm that the waste is no longer hot or burning. As required, using a dozer or a loader, the general municipal wastes will be pushed down the landfill slope towards the working face of the landfill, observing the following operating principles:

- All waste shall be removed from the tipping and burn areas
- The waste shall be pushed as close to the intermediate berm or working face as possible, preferably against the intermediate berm or working face. Once the waste is pushed up the intermediate berm, the waste shall become the new working face until a new lift is advanced vertically.

Figures 4 to 10 illustrates the progress for landfill development.

3.3.2 Annual Shaping

Fine shaping of the landfill area will occur once per year, as early in the summer as feasible. During the annual shaping, the surface of the landfill slope will be graded using a dozer and loader so that it has an even grade and the waste will be pushed towards the berm or working face so that the footprint is minimized. The following operating principles should be observed during the annual shaping:

- The waste shall be pushed and packed against the berm and working face
- The waste shall not be pushed any higher than the height of the berm
- The dozer or loader shall make repeated passes down the slope until the landfill slope (i.e., the east slope) is 3:1 or shallower, but not shallower than 10:1 (5%)
- The surface drainage shall remain generally towards the northeast.

Once the final grades of the waste are established, interim cover will be placed over the waste. This will entail importing sand, gravel and cobbles from any convenient borrow location and placing over the waste to a thickness of 0.2 m. A grader may be used to attain a smoother interim surface.

An invert (opening) is present to ensure that water does not accumulate within the landfill base. As necessary due to filling, this invert may need to be re-cut.

If the operator is having trouble with development the landfill slopes at a 3:1, they may elect to develop an interim berm on top of the lift to assist in vertical development (refer to Figures 4 through 11). In areas where the intermediate berm is located on top of an existing lift of waste, the new berm shall be offset from the outside edge of the lower lift

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by at least 1 m. However, it would be preferable if vertical lifts were avoided, in that they will consume landfill space.

When the waste is at the top of the berm and the landfill slope is 3:1 or shallower, then a new intermediate berm will be constructed approximately 30 m from the toe of the previous intermediate berm. This new berm will form the working face for the next phase of waste placement. As before, the intermediate berm will be constructed using sand, gravel and cobble material from any convenient borrow source. The top of the intermediate berm will be 1 m wide, and the inside slope (landfill side) will be at 2:1, while the outside slope is at a 3:1.

The final configuration of the landfill is shown on Figure 11.

If during the operation, there is a complaint (i.e., odours, smoke in the community), actions will be taken to assess and mitigate the problem. As every situation may be unique, it is important to consider the complaint and address it to the extent possible. Some examples include:

- In the case of odours, cover may need to be applied
- If smoke is drifting towards the community or people in the area, the fire should be extinguished (if possible) and relit when the wind conditions are more favourable
- If leachate is running off the site, it must be contained within the Water Retention Area.

All complaints should be logged and included in the annual report.

3.4 Bulky Metals Disposal Area Construction and Development

Periodically usually metals shall be relocated from the 'scrap yard' and tipped into the Bulky Metals Disposal Area. All bulky metals should be inspected to ensure that they contain no liquids (i.e., gasoline, radiator fluid) or hazardous substances (i.e., batteries). These shall be removed and relocated to the hazardous waste storage area. It is generally recommended that the materials be placed at the bottom of the cell using the access road, instead of tipped over the edge to minimize the potential for damage. As the material accumulates, tipping may be necessary. In this case staff must ensure that all personnel are out of the way, access to any roads along the bottom of the cells should be blocked and the materials shall be carefully pushed over the tip. Wastes should never be tipped directly over the edge, as serious injury may result if vehicles slip over the edge of the slope.

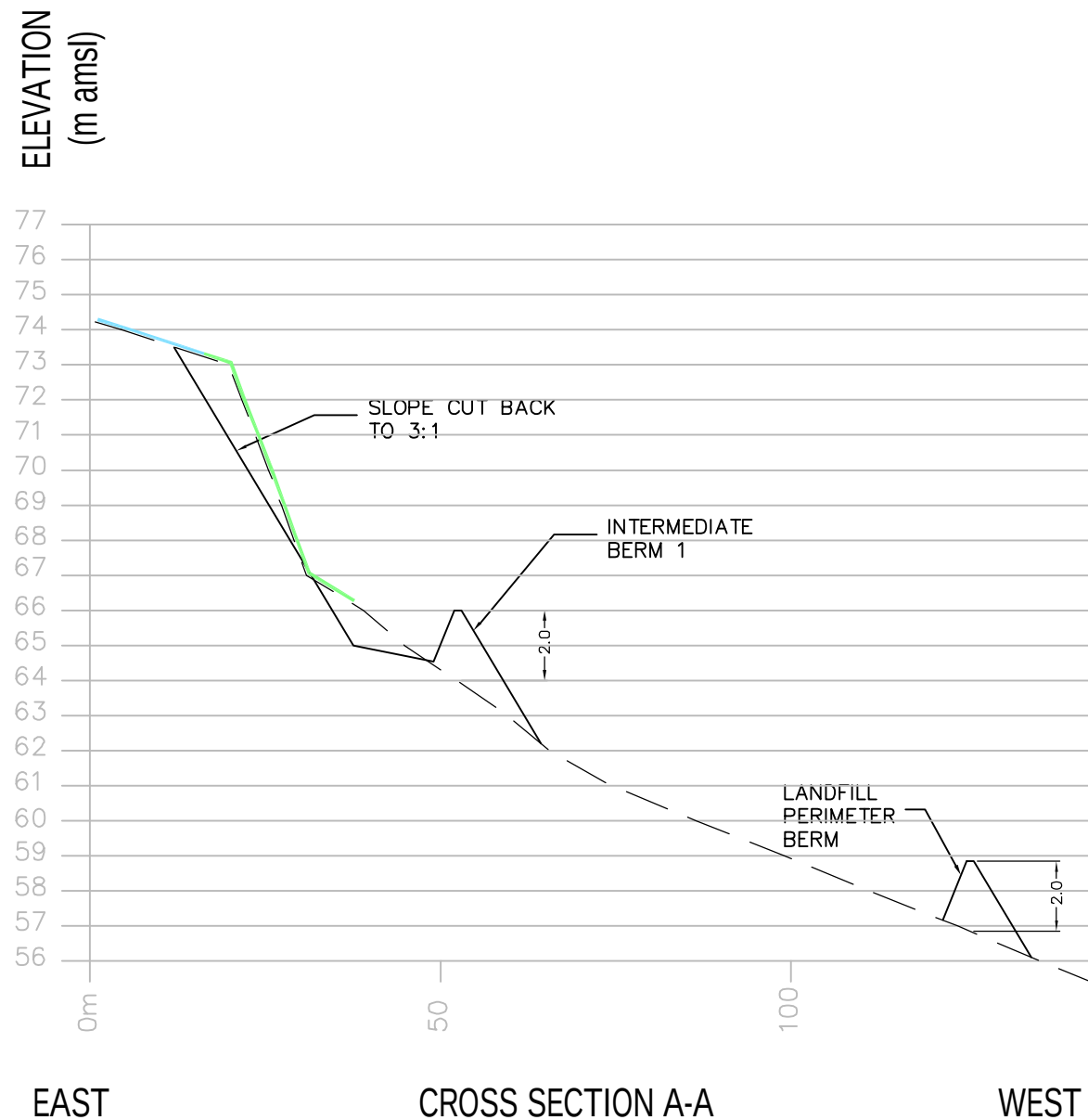
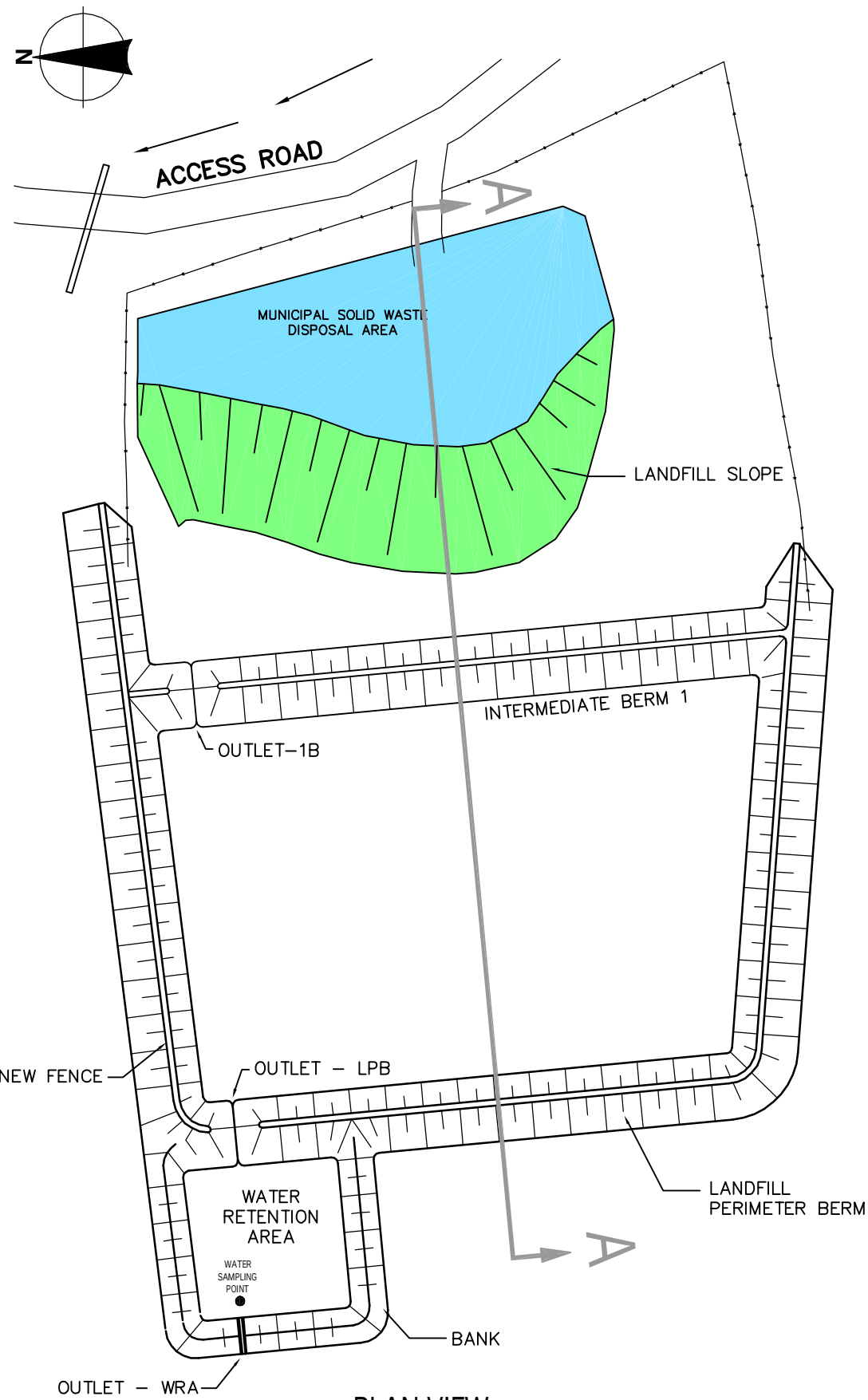
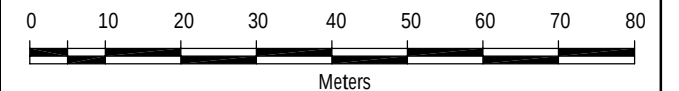


FIGURE 4
 THE HAMLET OF QIKIQTARJUAQ
 SOLID WASTE
 DISPOSAL FACILITY
 O&M PLAN
 LANDFILL DEVELOPMENT 1
 INITIAL SITE REDEVELOPMENT

Legend

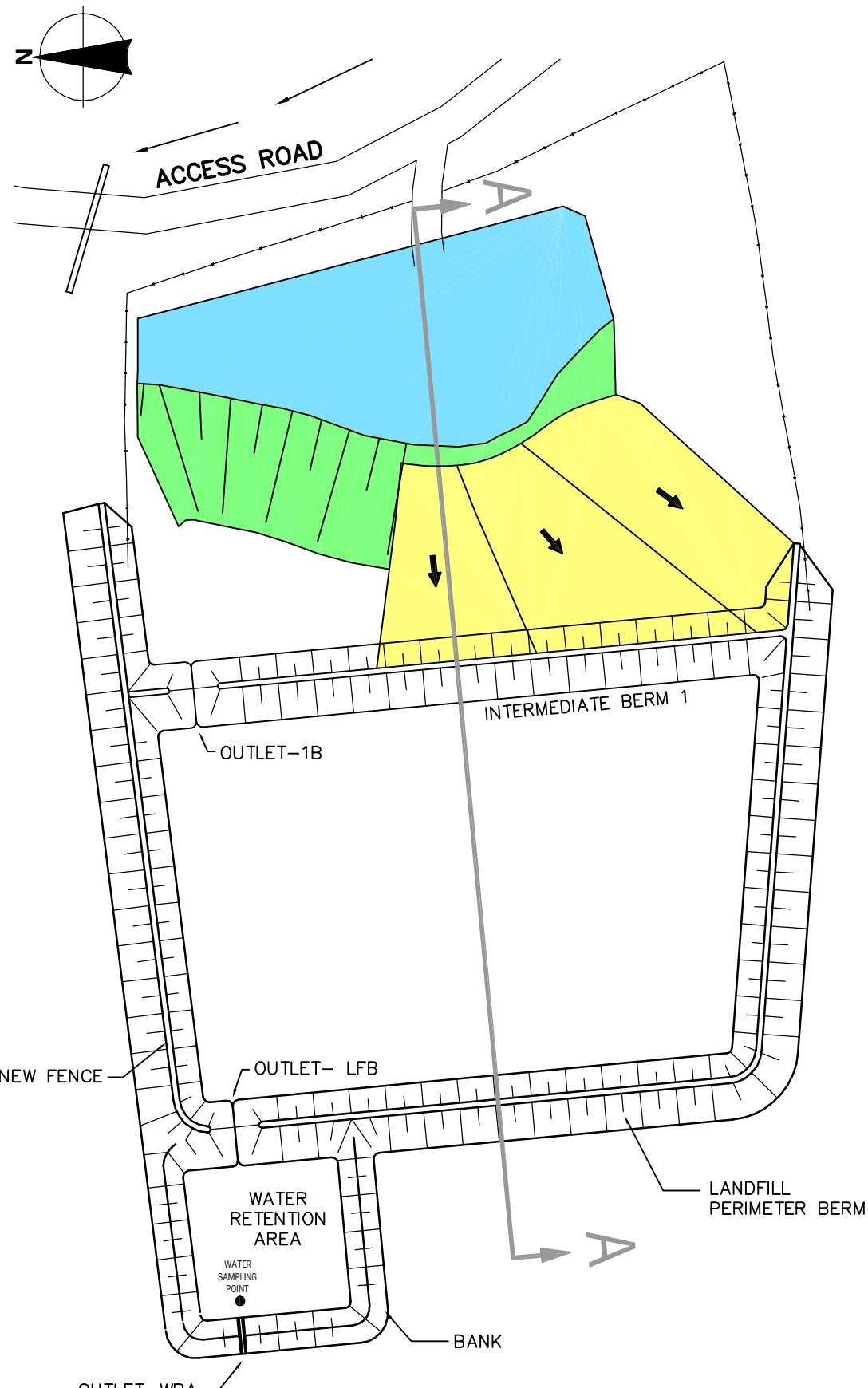
- LANDFILL TIPPING AREA
- LANDFILL SIDE SLOPE



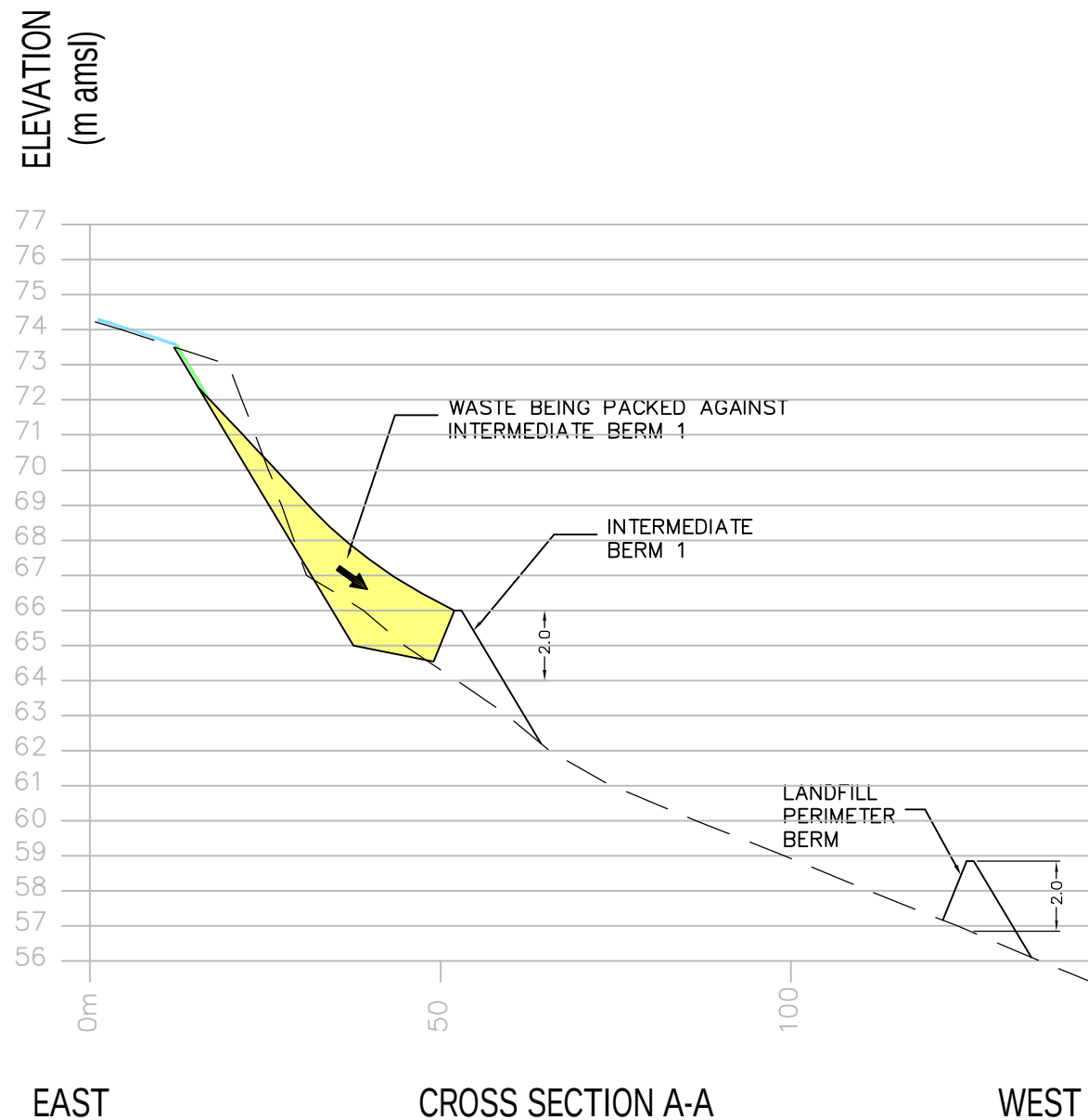
February 2006
 Project Number: F0E 08 983

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Verified by: K. Hunter



PLAN VIEW
SCALE 1:1000



CROSS SECTION A-A
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:200

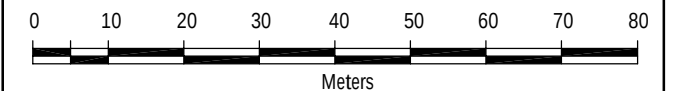
FIGURE 5

THE HAMLET OF QIKIQTARJUAQ
SOLID WASTE
DISPOSAL FACILITY
O&M PLAN

LANDFILL DEVELOPMENT 2
FILL TO INTERMEDIATE BERM 1

Legend

- LANDFILL TIPPING AREA
- LANDFILL SIDE SLOPE
- WASTE CELLS No. 1

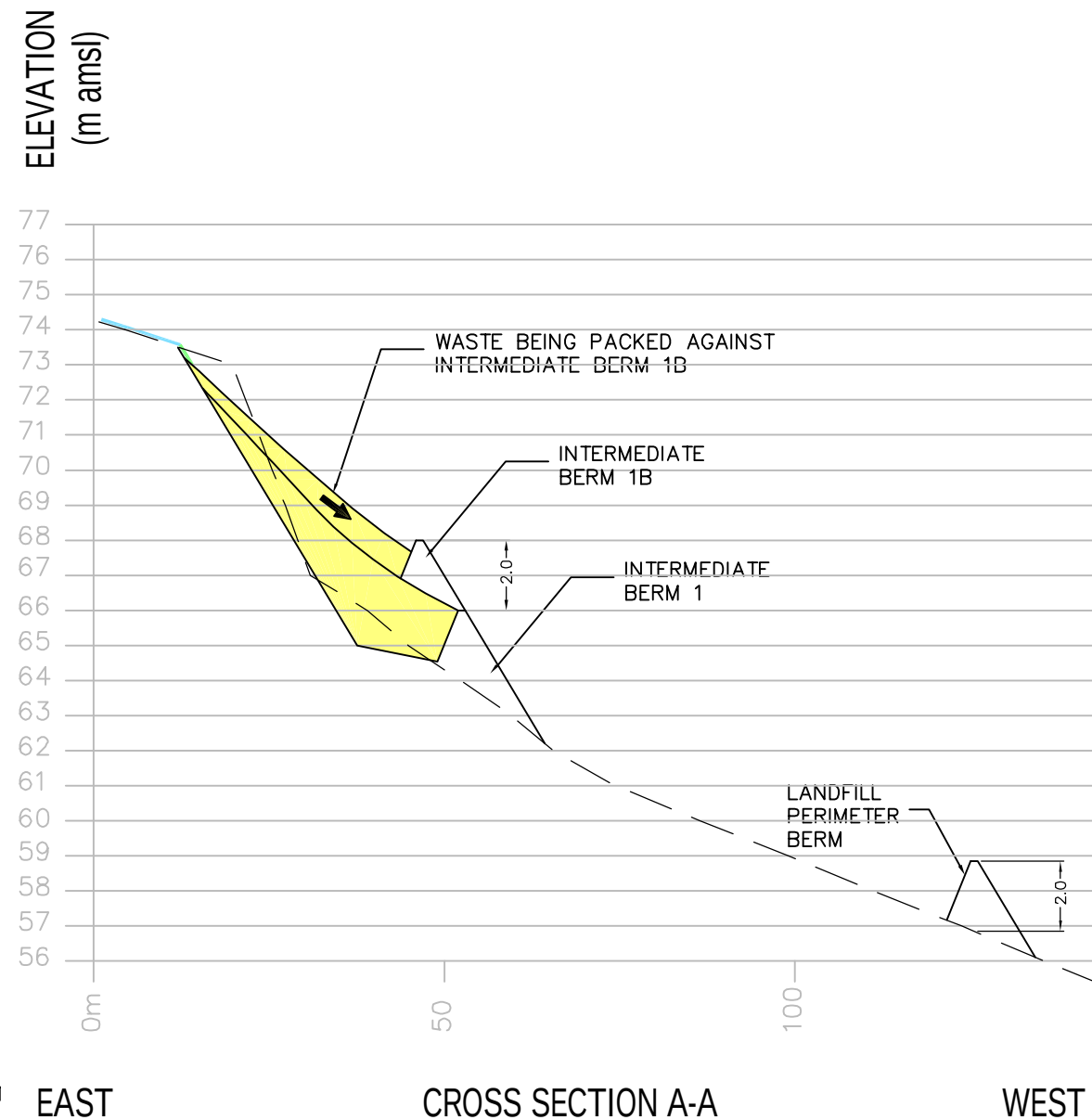
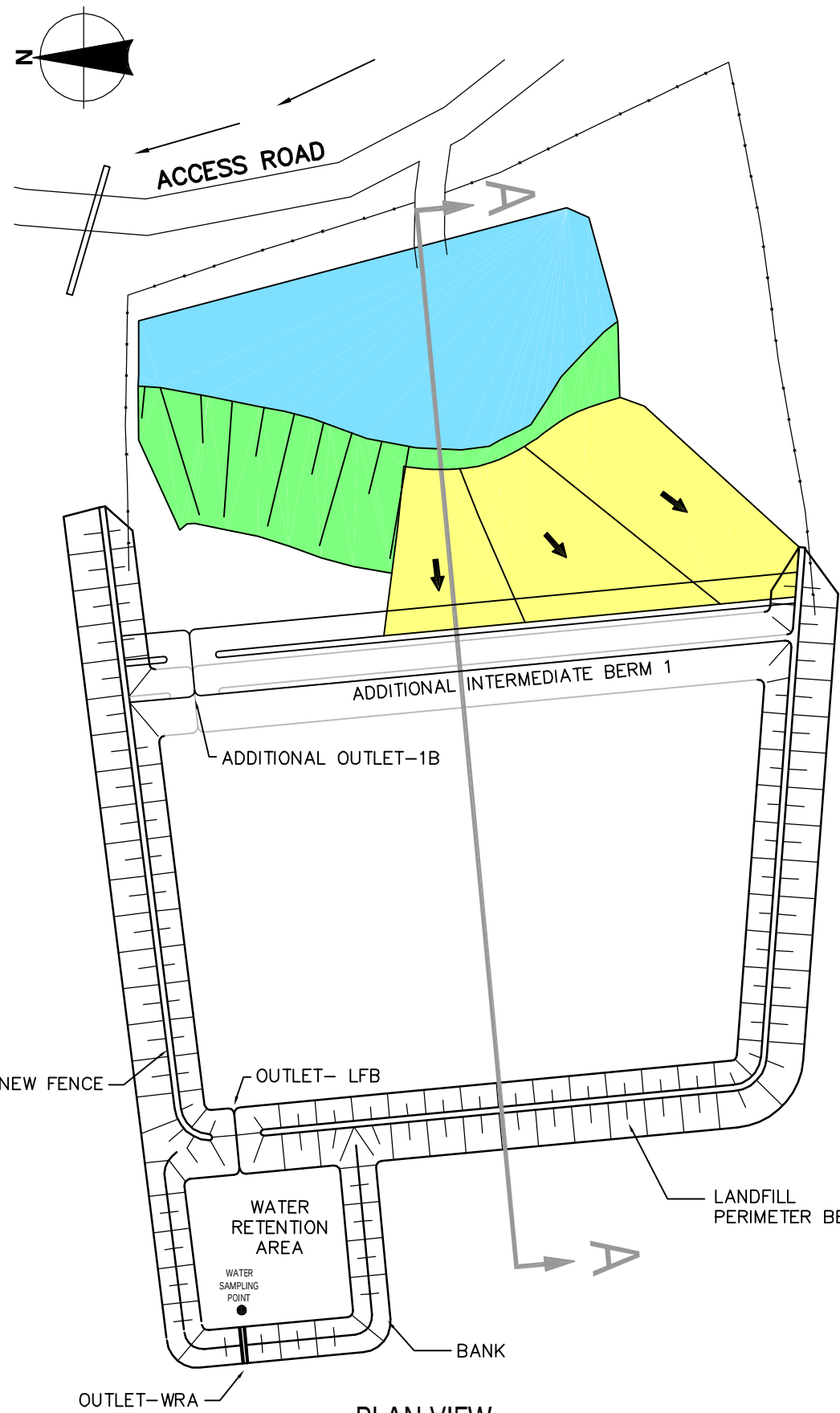


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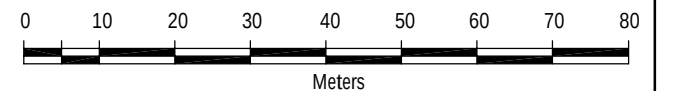


NOTE
SITE OPERATORS MAY ELECT TO INSTALL AN ADDITIONAL VERTICAL BERM
IF CONSTRUCTION WASTES WITH 3:1 SLOPE IS PROBLEMATIC

FIGURE 6
THE HAMLET OF QIKIQTARJUAQ
SOLID WASTE
DISPOSAL FACILITY
O&M PLAN
LANDFILL DEVELOPMENT 2B
OPTIONAL CONSTRUCTION OF
ADDITIONAL BERM

Legend

- LANDFILL TIPPING AREA**
- LANDFILL SIDE SLOPE**
- WASTE CELLS No. 1**



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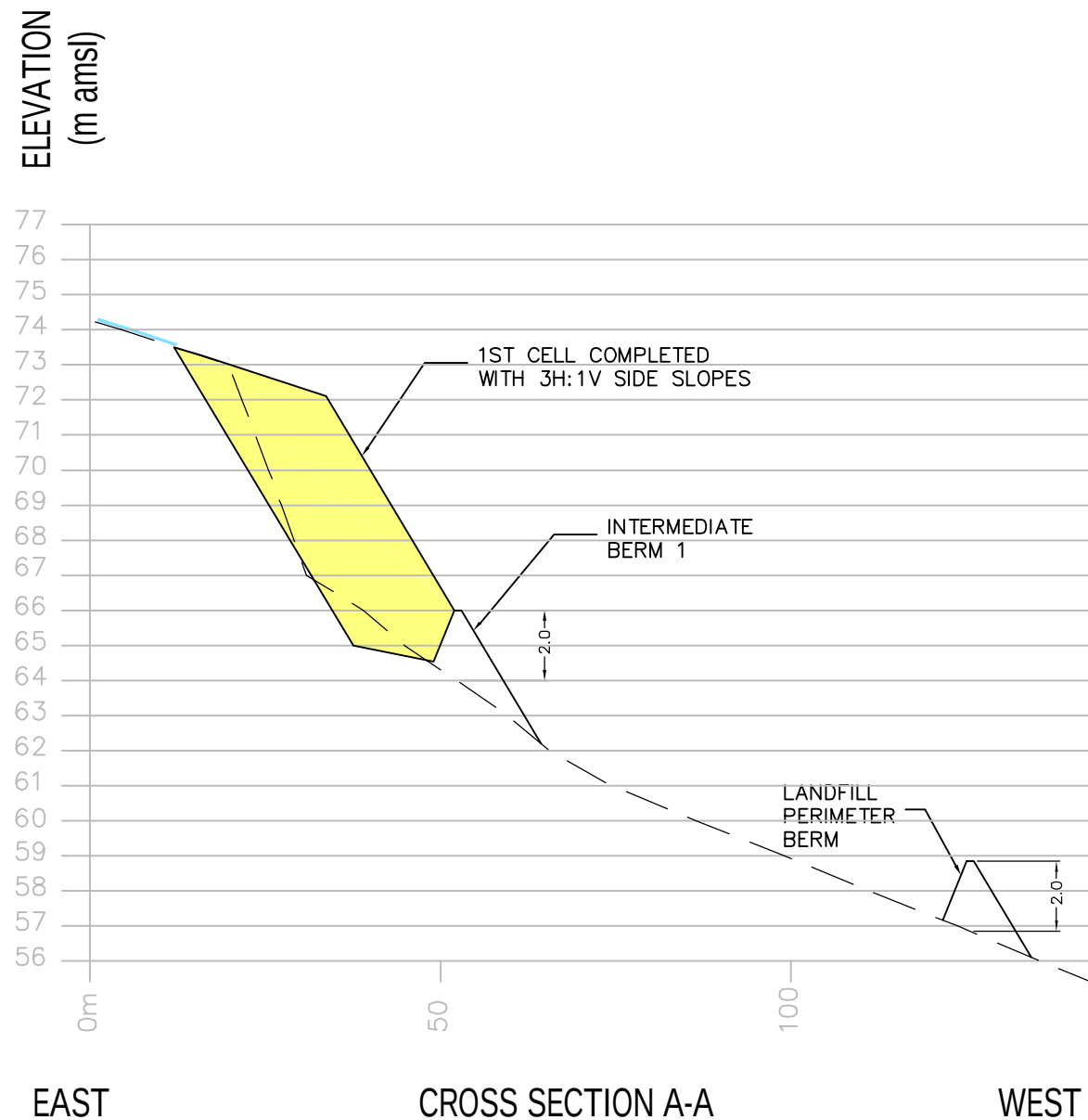
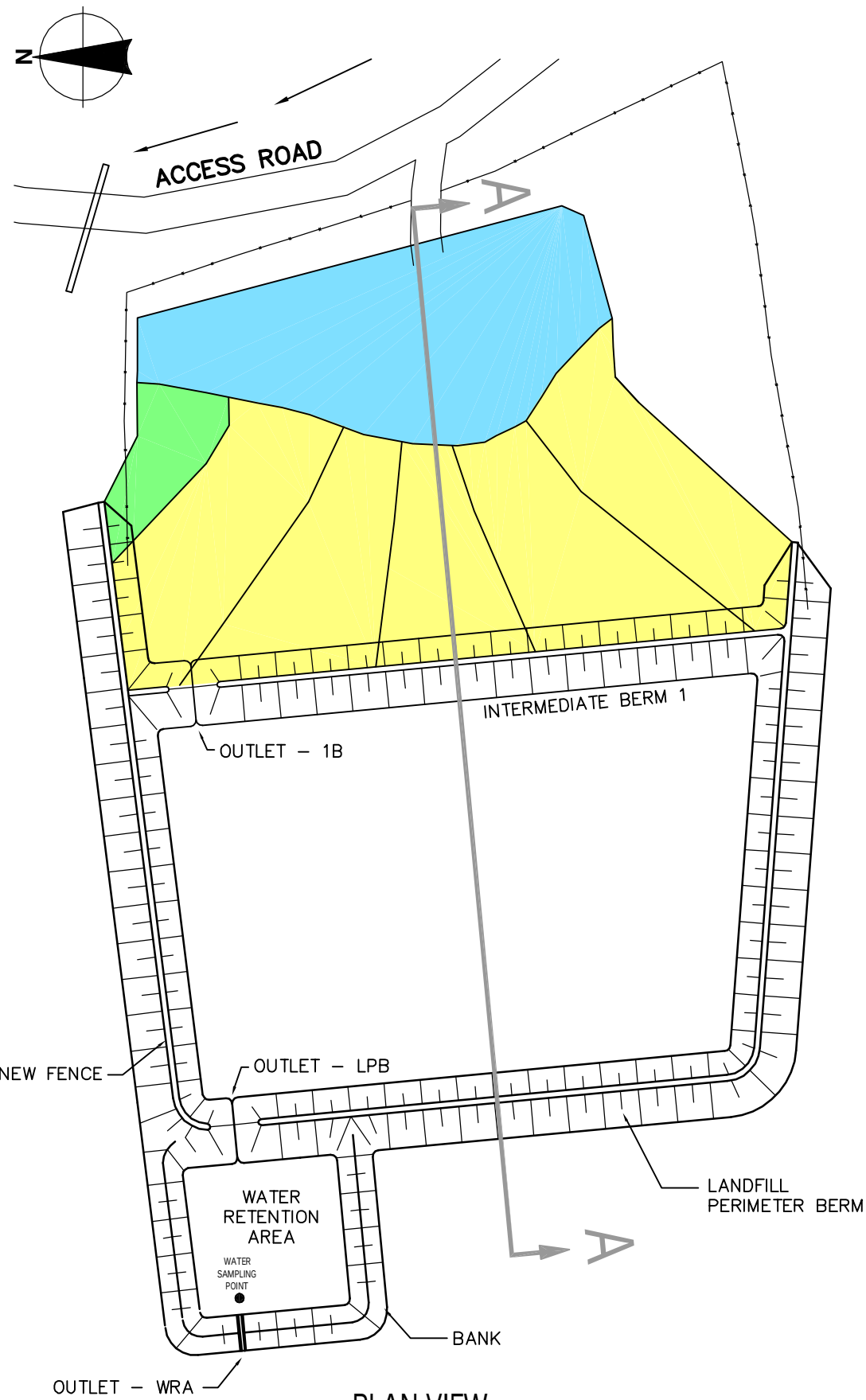
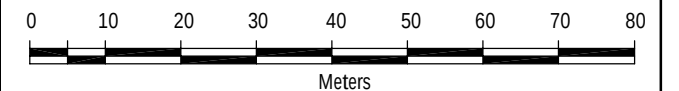


FIGURE 7
THE HAMLET OF QIKIQTARJUAQ
SOLID WASTE
DISPOSAL FACILITY
O&M PLAN

LANDFILL DEVELOPMENT 3
1ST WASTE CELL COMPLETED

Legend

- LANDFILL TIPPING AREA**
- LANDFILL SIDE SLOPE**
- WASTE CELLS No. 1**



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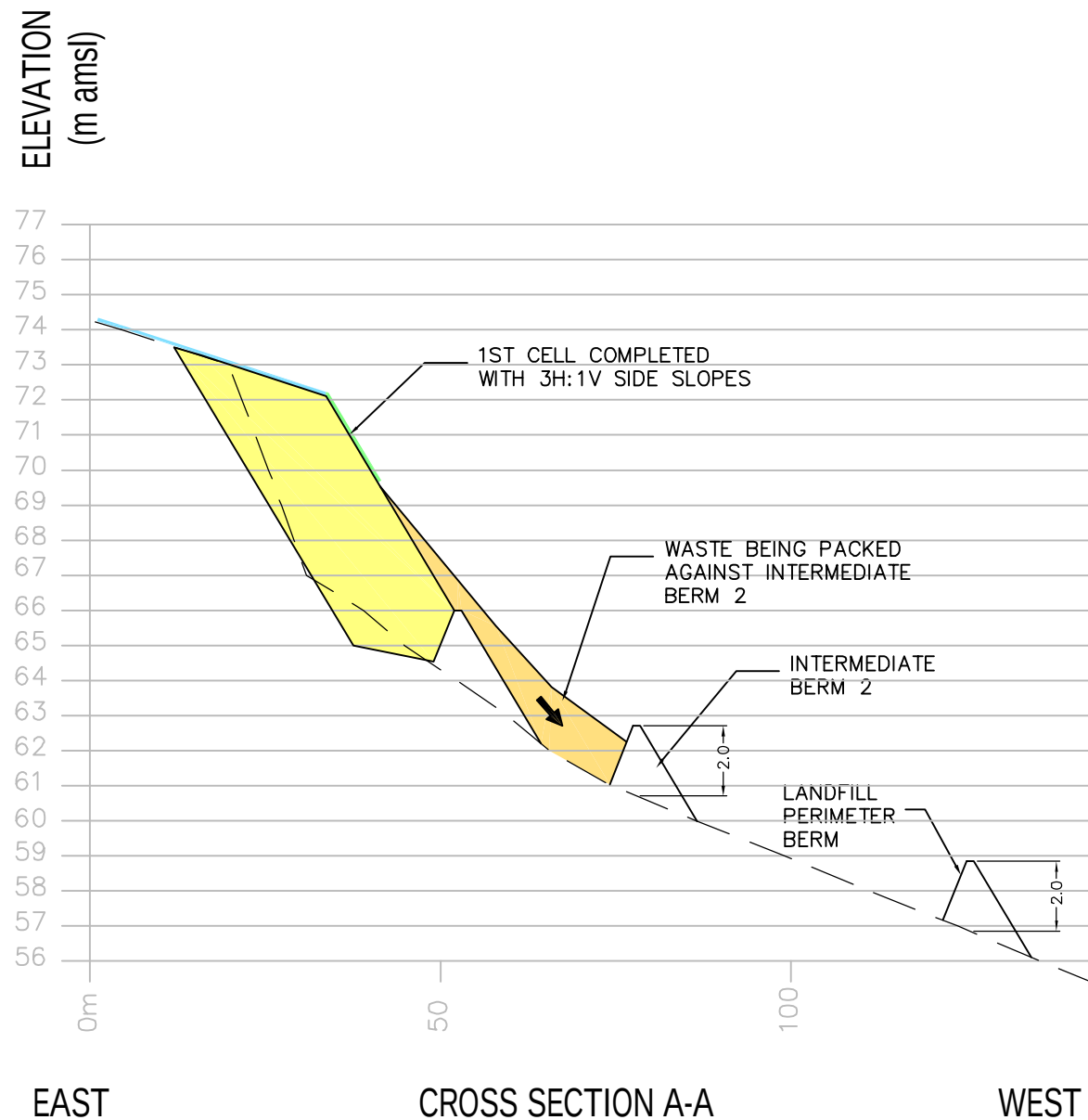
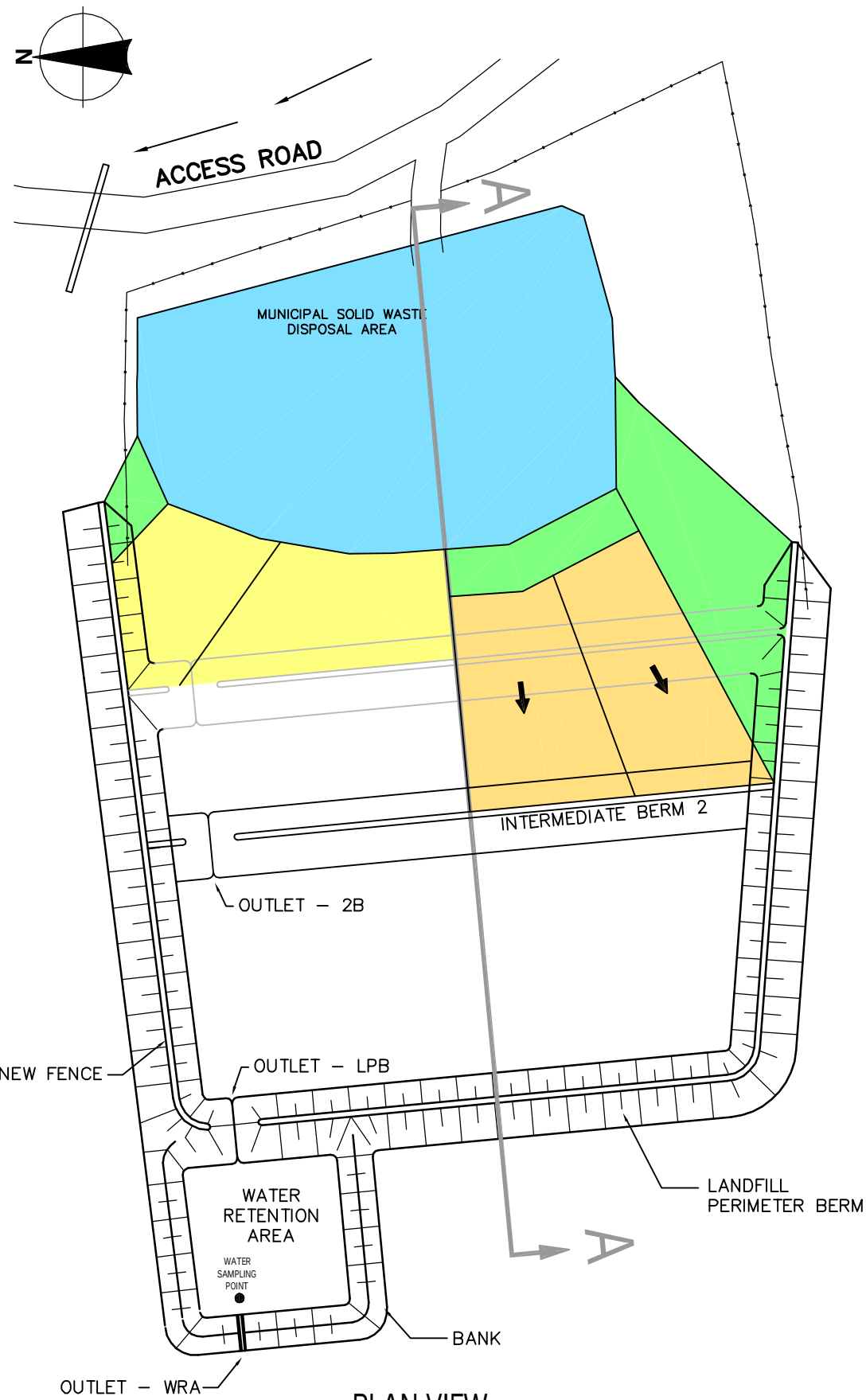
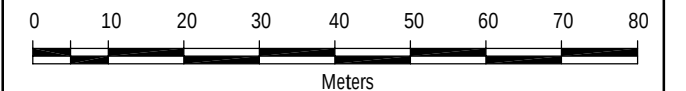


FIGURE 8
THE HAMLET OF QIKIQTARJUAQ
SOLID WASTE
DISPOSAL FACILITY
O&M PLAN

**LANDFILL DEVELOPMENT 4
BEGIN FILLING TO
INTERMEDIATE BERM 2**

Legend

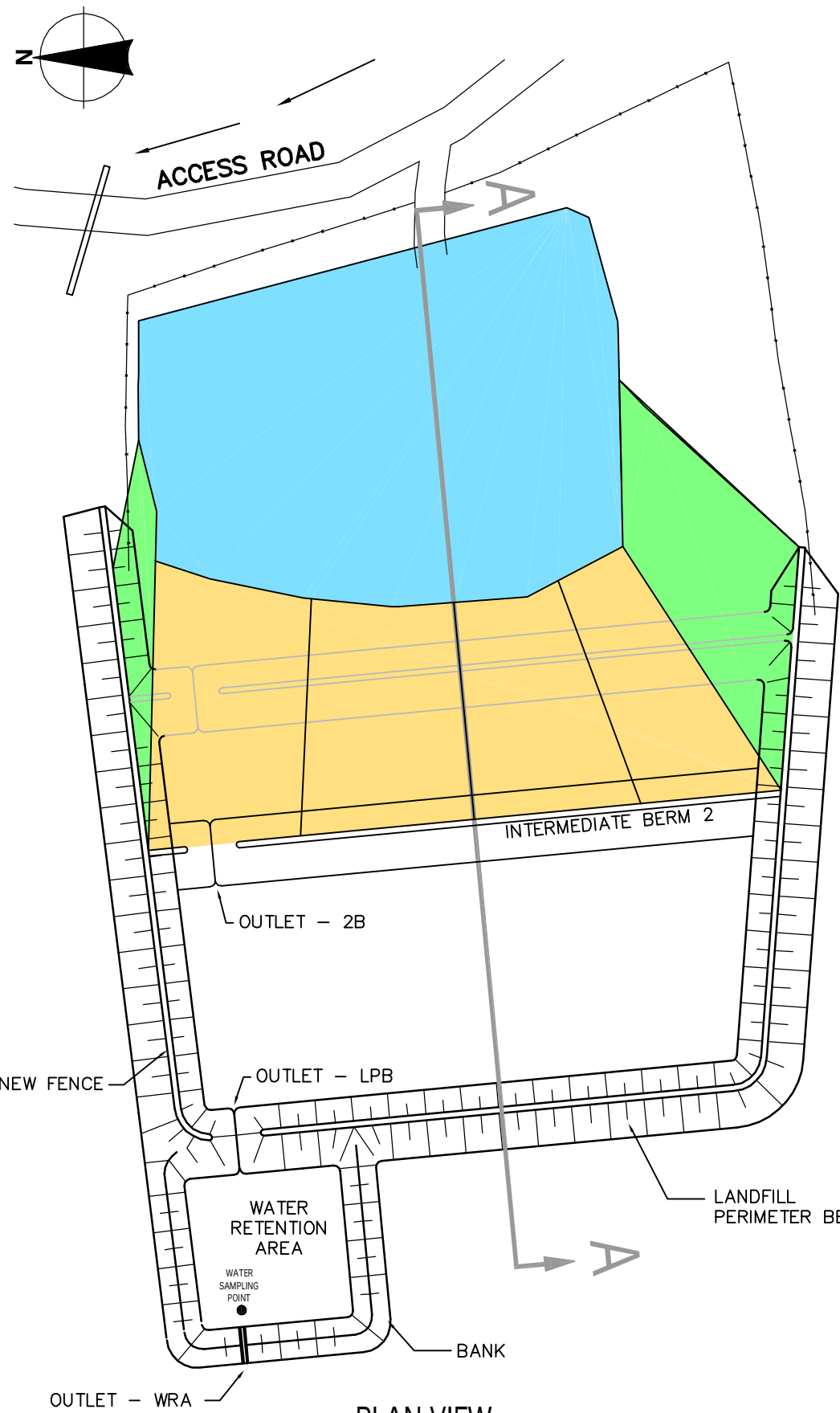
- LANDFILL TIPPING AREA**
- LANDFILL SIDE SLOPE**
- WASTE CELLS No. 1**
- WASTE CELLS No. 2**



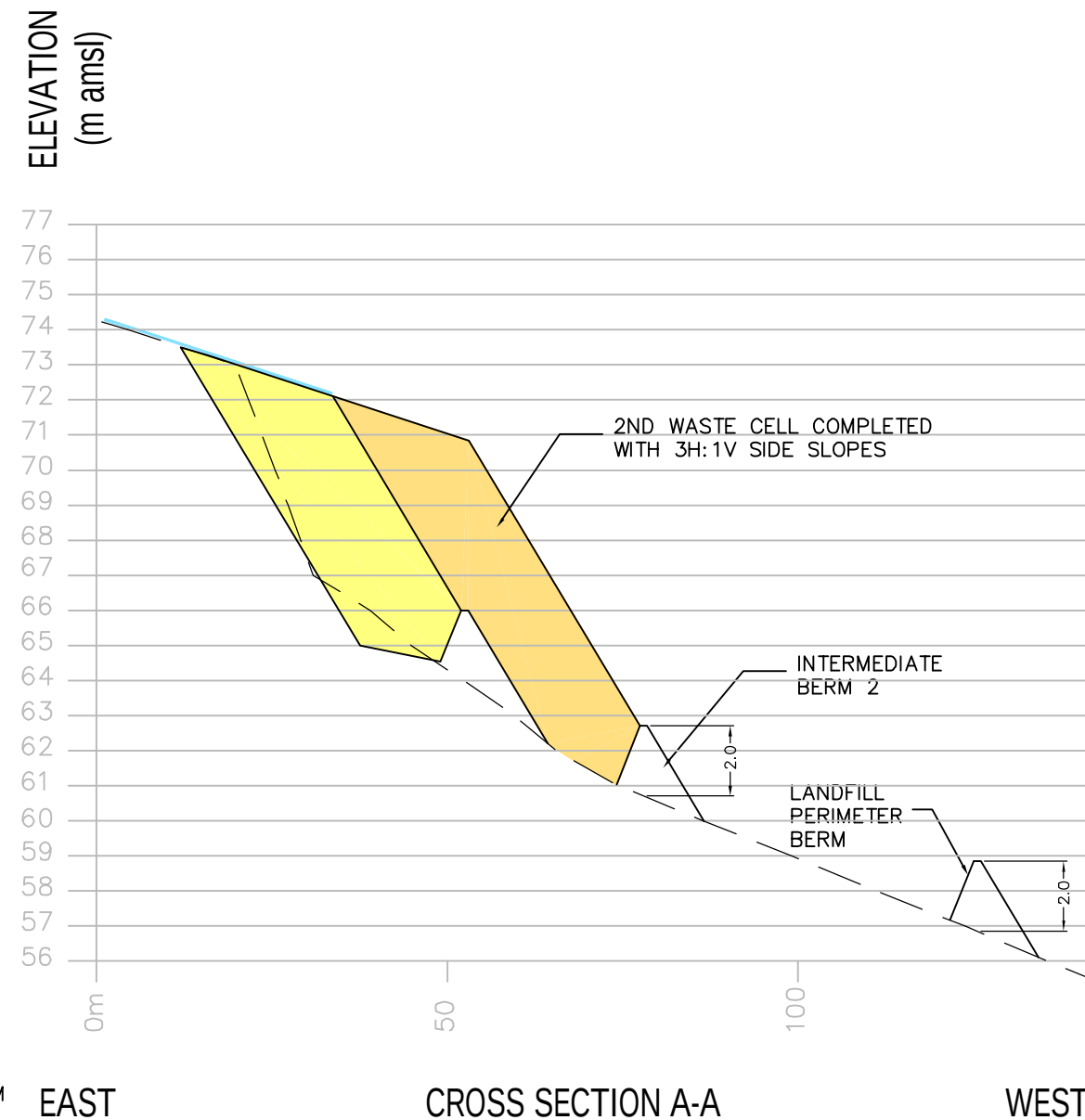
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Verified by: K. Hunter



PLAN VIEW
SCALE 1:1000



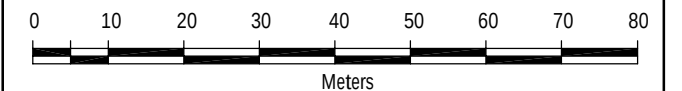
CROSS SECTION A-A
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:200

FIGURE 9
THE HAMLET OF QIKIQTARJUAQ
SOLID WASTE
DISPOSAL FACILITY
O&M PLAN

LANDFILL DEVELOPMENT 5
2ND WASTE CELL COMPLETED

Legend

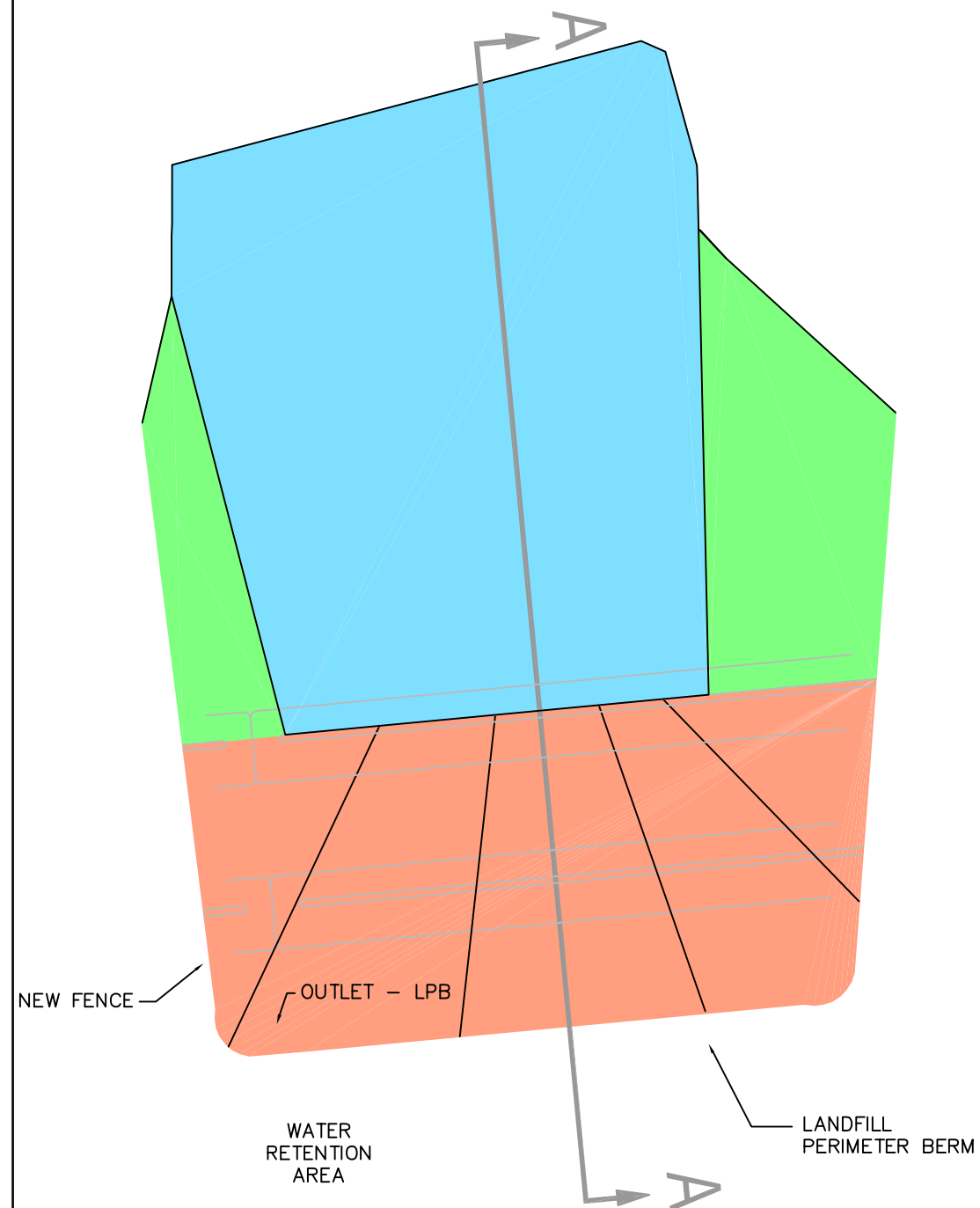
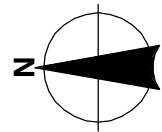
- LANDFILL TIPPING AREA
- LANDFILL SIDE SLOPE
- WASTE CELLS No. 1
- WASTE CELLS No. 2



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ELEVATION
(m amsl)

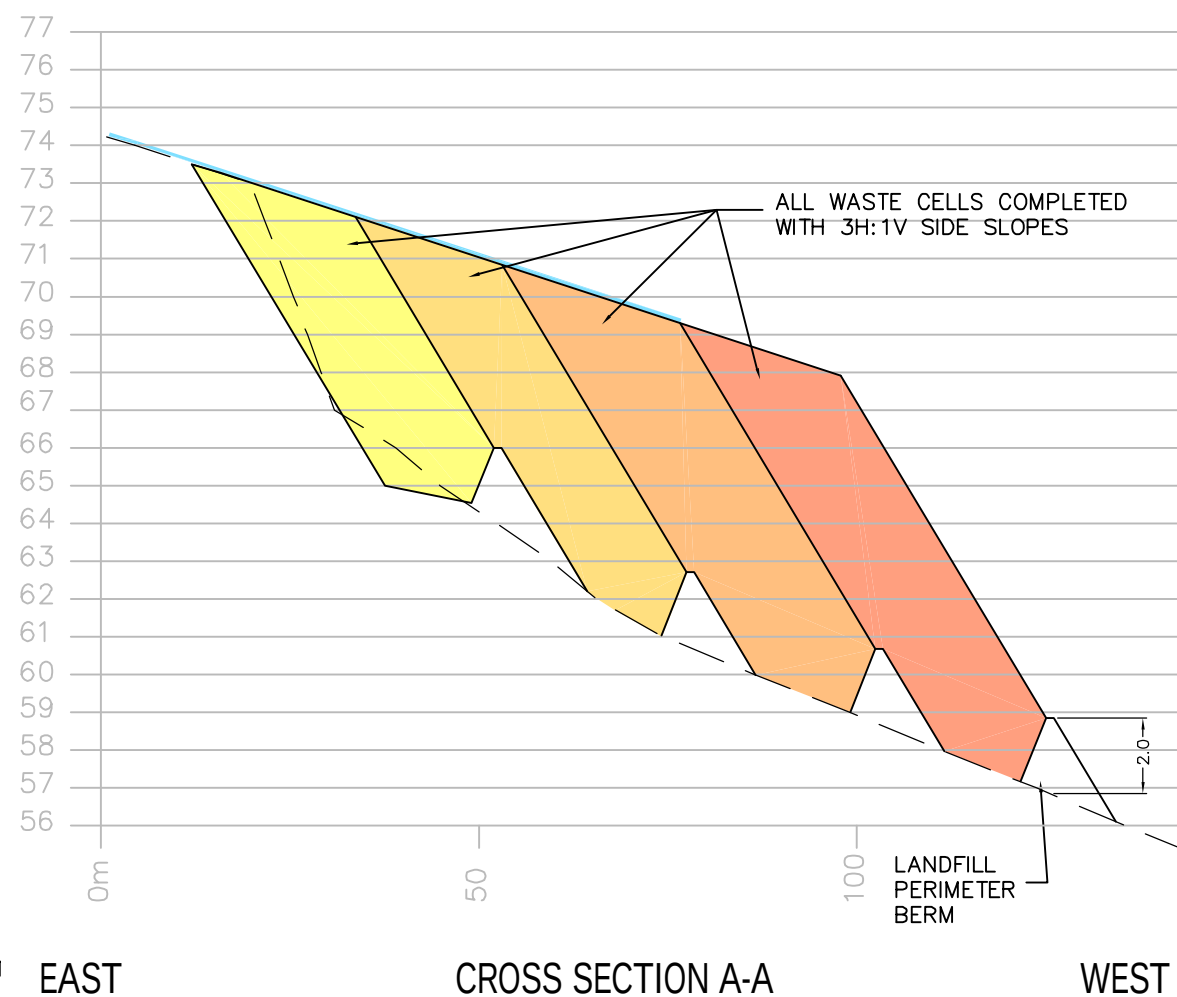


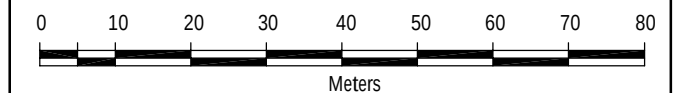
FIGURE 10

THE HAMLET OF QIKIQTARJUAQ
SOLID WASTE
DISPOSAL FACILITY
O&M PLAN

LANDFILL DEVELOPMENT 6
ALL WASTE CELLS COMPLETED

Legend

- LANDFILL TIPPING AREA
- LANDFILL SIDE SLOPE
- WASTE CELLS No. 1
- WASTE CELLS No. 2
- WASTE CELLS No. 3
- WASTE CELLS No. 4

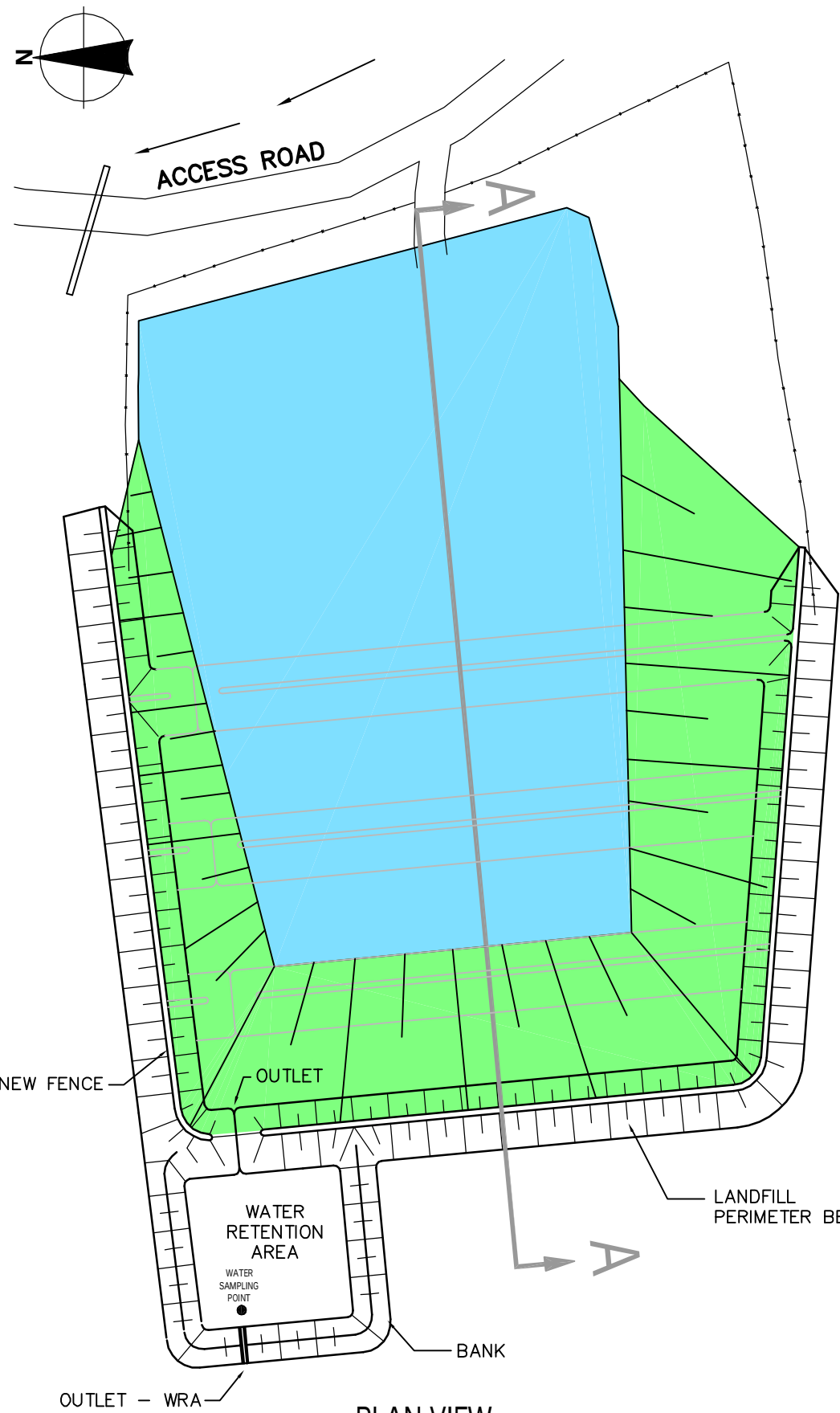


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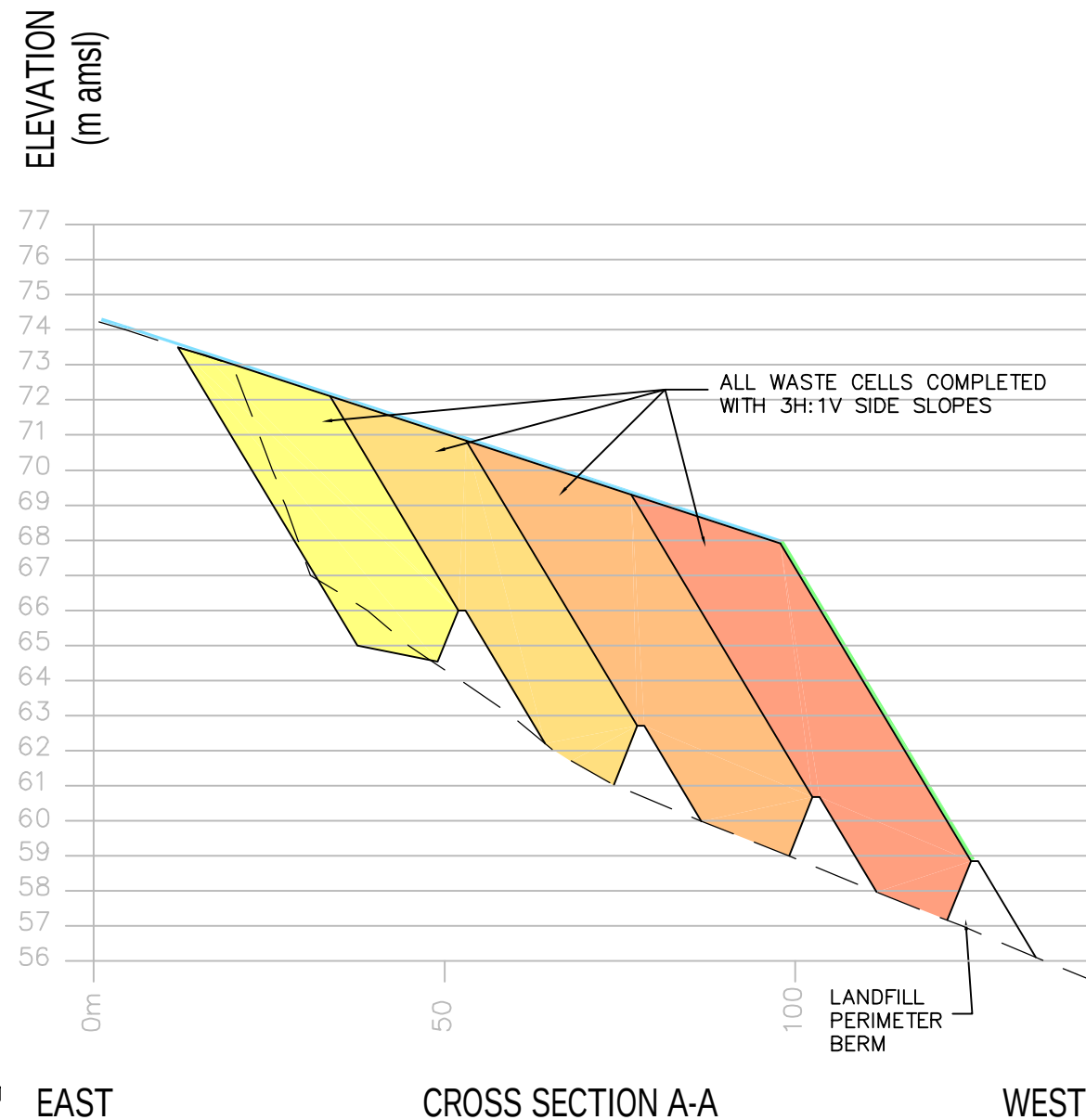
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PLAN VIEW
SCALE 1:1000



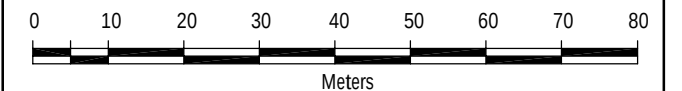
CROSS SECTION A-A
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:200

FIGURE 11
THE HAMLET OF QIKIQTARJUAQ
SOLID WASTE
DISPOSAL FACILITY
O&M PLAN

LANDFILL DEVELOPMENT 7
FINAL SITE CONFIGURATION

Legend

- LANDFILL TIPPING AREA
- LANDFILL SIDE SLOPE
- WASTE CELLS No. 1
- WASTE CELLS No. 2
- WASTE CELLS No. 3
- WASTE CELLS No. 4



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When warranted, cover shall be placed over the bulky metals. Cover material, comprising sand, gravel, cobbles and any locally available material shall be end dumped near the tip and then pushed over the accumulated wastes. Vehicles should refrain from driving on the surface until the slopes are less than 3:1, at which time the surface can be graded until stable.

3.5 Periodic and Seasonal Maintenance Procedures

The staff shall undertake weekly inspections and repair any items that are noted. A weekly inspection form is included in Appendix D. This will include the following activities:

- The roadway and truck pad shall be maintained by snow clearing in the winter and grading in the summer, and repaired as necessary
- Ditches and drainage channels shall be inspected for erosion, and repaired as necessary
- Site warning signage, which identifies the boundaries of the Solid Waste Disposal Facility (which includes the Municipal Solid Waste Disposal Area, Hazardous Waste Segregation Area and the Bulky Metals Disposal Area) shall be inspected, and repaired or replaced as necessary
- Any airborne litter outside of the litter-control fences (which are located on top of the berms at the Facility) shall be removed, and deposited to the Municipal Solid Waste Disposal Area, or as required
- Litter that has accumulated against the fences shall be removed and placed into the Municipal Solid Waste Disposal Area
- After rain events and following the spring thaw, inspect that site for leachate breakout. Cover the face if possible and ensure that leachate is being contained within the water retention area
- The berms and final cover at the Solid Waste Disposal Facility shall be inspected for erosion and settlement
- The fences at the Solid Waste Disposal Facility shall be inspected for damage, and repaired as necessary.

All details of any repairs shall be reported in the Annual Report.

3.6 Facility Monitoring Procedures

As outlined in the NWB water license, regular monitoring of runoff from the Solid Waste Disposal Facility is required. The Monitoring Program is to include effluent samples collected from the water collection pond during the months on June to September, inclusive. It is recognized that historically the water collection pond has not retained

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water for long periods. Typically the pond is dry after spring run-off. Effluent samples collected shall be analyzed for the following parameters:

BOD	Faecal Coliforms
pH	Conductivity
Total Suspended Solids	Ammonia Nitrogen
Nitrate-Nitrite	Oil and Grease
Total Phenols	Total Alkalinity
Total Hardness	Calcium
Magnesium	Potassium
Sodium	Sulphate
Total Arsenic	Total Cadmium
Total Copper	Total Chromium
Total Iron	Total Lead
Total Mercury	Total Nickel

In addition, any additional analytical parameters which are identified in the NWB water license, or by an Inspector (as defined in the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*) shall be included.

It is recognized that it may take some time for results to be received from the appropriate laboratory. In the event that the water retention area fills to the invert with water, it should be inspected for odours, stain, or signs of visible impact (sheens, floating garbage). The invert may be blocked to facilitate additional water accumulation in this case, until the results are received.

Water sampling completed by the Hamlet of Qikiqtarjuaq shall be in accordance with the *Hamlet of Qikiqtarjuaq Monitoring Program Quality Assurance/Quality Control (QA/QC) Plan* which is attached to this Plan (Appendix F).

Results of analytical testing and monitoring are to be recorded on a regular basis by the staff. Copies of the analytical certificates and Chain of Custody forms are to be kept for future reference to determine the effectiveness of the treatment facility.

Monthly and annual quantities of solid waste offloaded will be estimated and recorded on the Waste Placement Form (Appendix D)

3.7 Emergency Procedures

The *Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories* requires that the

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Operation and Maintenance Report include procedures to respond to emergencies. The following emergency procedures are considered:

Worker injury

In the event of a worker injury:

- Apply first aid
- Seek medical assistance, if necessary
- Report the injury to the employer
- Fill out all necessary forms regarding the necessary.

Spills

In the event of a liquid spill, prevent the flow of wastes to water courses with earthen dykes or other methods. If the spill can be collected (i.e., if pooled) scoop up and store in drums in the hazardous waste disposal area. If the spill has soaked into the ground, attempt to remove stained or impacted soil and store in drums.

Fires

In the event that grass or tundra does catch on fire, assess the situation. Do not attempt to fight a fire if it cannot be done safely. Standard fire fighting equipment available in the Hazardous Waste Depot can manage most small fires. Alternatively, sand and gravel can be thrown onto the fire either by hand, or by using available equipment (i.e., loader). Obtain help as necessary.

Refer to the Environmental Emergency Contingency Plan in Appendix E from details.

3.8 Annual Reporting Procedures

An annual report shall be prepared for the site submitted to the Nunavut Water Board, in compliance with the Hamlet's Water License. The report shall include:

- An overall description of the activities that occurred at the facility throughout the year, including both regular waste acceptance and annual shaping
- An estimate of the quantity of material received at the site
- A description of any maintenance or improvements that were completed at the site throughout the year
- A list of any complaints and actions taken to address them
- Analytical test results.

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4.0 References

Department of Municipal and Community Affairs, Government of Northwest Territories. October 1996. *Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories*. Queen's Printer: Yellowknife, Northwest Territories.

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Nuna Burnside Engineering and Environmental Ltd. January 2005. *Detailed Design of the Improvements to the Water Reservoir, Wastewater Lagoon and Solid Waste facility in the Hamlet of Qikiqtarjuaq*. Rankin Inlet, Nunavut.

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Appendix A
Climate Normal Data

Appendix A: Climate Normals for Qikiqtarjuaq, Nunavut

<u>Temperature:</u>	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		
<u>Precipitation: Precipitation:</u>														
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+		

<u>Temperature:</u>	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+		
<u>Days with Maximum Temperature:</u> <u>Days with Maximum Temperature:</u>														
<= 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
<u>Days with Minimum Temperature:</u> <u>Days with Minimum Temperature:</u>														
> 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

<u>Temperature:</u>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
<u>Days with Snow Depth:</u> <u>Days with Snow Depth:</u>														
>= 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
<u>Wind:</u> <u>Wind:</u>														
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	
<u>Degree Days:</u> <u>Degree Days:</u>														
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

<u>Temperature:</u>	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
<u>Humidex:</u> <u>Humidex:</u>														
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		
<u>Wind Chill:</u> <u>Wind Chill:</u>														
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		
<u>Humidity:</u> <u>Humidity:</u>														
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 A: 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											
M o n t h	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
<u>Jan</u>	-24.3	-28.7	-33.1	-15.5	-43.2	0.0	4.0	4.0	35		
<u>Feb</u>	-20.2	-24.9E	-29.4	-10.0	-40.2	0.0	5.0	5.0	41		
<u>Mar</u>	-24.3	-29.8	-35.2	-13.4	-45.5	0.0	6.2	6.2	47		
<u>Apr</u>	-11.4	-17.2	-22.9	-4.5	-31.5	0.0	34.0	34.0	61		
<u>May</u>	-1.2	-3.8	-6.4	6.5	-16.5	0.0	3.0	3.0	25		
<u>Jun</u>	4.7	1.8	-1.1	9.9	-7.2	Trace	Trace	Trace	0		
<u>Jul</u>	7.8	4.6	1.4	17.2	-1.7	1.0	6.0	7.0	0		
<u>Aug</u>	8.3	5.6	2.9	17.1	0.0	13.0	0.0	13.0	0		
<u>Sep</u>	4.4	2.0	-0.5	11.0	-11.0	6.0	13.0	19.0	4		
<u>Oct</u>	1.9	-1.0	-3.9	9.0S	-8.0	0.4	7.4	7.8	4		
<u>Nov</u>	-6.6	-10.6	-14.6	3.0	-24.5	0.0	91.0	91.0	54		
<u>Dec</u>	-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 B
Projected Waste Quantity Calculations

Appendix B

Waste Quantity Calculations

Planning Year	Calendar Year	Projected Population [people]	Annual Volume of Solid Waste [m ³]	Cumulative Volume of Solid Waste [m ³]	Annual Volume of Combustible Solid Waste [m ³]	Annual Volume of Combustible Solid Waste After Burning [m ³]	Annual Volume of Uncombustible Solid Waste [m ³]	Total Annual Volume of Uncombustible and Combusted (Burned) Solid Waste [m ³]	Annual Volume of Compacted Waste [m ³]	Annual Volume of Cover Material [m ³]	Total Annual Volume of Compacted Waste and Cover Material [m ³]	Cumulative Landfill Volume {m3}
0	2006	599	3060.9	3060.9	2571.1	1542.7	489.7	2032.4	1524.3	304.9	1829.2	1,829.19
	2007	611	3122.2	6183.1	2622.7	1573.6	499.6	2073.1	1554.9	311.0	1865.8	3,695.02
	2008	624	3188.6	9371.7	2678.5	1607.1	510.2	2117.3	1587.9	317.6	1905.5	5,600.55
	2009	637	3255.1	12626.8	2734.3	1640.6	520.8	2161.4	1621.0	324.2	1945.2	7,545.78
	2010	650	3321.5	15948.3	2790.1	1674.0	531.4	2205.5	1654.1	330.8	1984.9	9,530.71
5	2011	663	3387.9	19336.2	2845.9	1707.5	542.1	2249.6	1687.2	337.4	2024.6	11,555.34
	2012	677	3459.5	22795.7	2906.0	1743.6	553.5	2297.1	1722.8	344.6	2067.4	13,622.72
	2013	691	3531.0	26326.7	2966.0	1779.6	565.0	2344.6	1758.4	351.7	2110.1	15,732.85
	2014	705	3602.6	29929.3	3026.1	1815.7	576.4	2392.1	1794.1	358.8	2152.9	17,885.73
	2015	720	3679.2	33608.5	3090.5	1854.3	588.7	2443.0	1832.2	366.4	2198.7	20,084.42
10	2016	735	3755.9	37364.3	3154.9	1892.9	600.9	2493.9	1870.4	374.1	2244.5	22,328.92
	2017	750	3832.5	41196.8	3219.3	1931.6	613.2	2544.8	1908.6	381.7	2290.3	24,619.22
	2018	765	3909.2	45106.0	3283.7	1970.2	625.5	2595.7	1946.8	389.4	2336.1	26,955.33
	2019	781	3990.9	49096.9	3352.4	2011.4	638.5	2650.0	1987.5	397.5	2385.0	29,340.30
	2020	797	4072.7	53169.6	3421.0	2052.6	651.6	2704.3	2028.2	405.6	2433.8	31,774.12
15	2021	813	4154.4	57324.0	3489.7	2093.8	664.7	2758.5	2068.9	413.8	2482.7	34,256.81
	2022	830	4241.3	61565.3	3562.7	2137.6	678.6	2816.2	2112.2	422.4	2534.6	36,791.41
	2023	847	4328.2	65893.5	3635.7	2181.4	692.5	2873.9	2155.4	431.1	2586.5	39,377.93
	2024	864	4415.0	70308.5	3708.6	2225.2	706.4	2931.6	2198.7	439.7	2638.4	42,016.35
	2025	882	4507.0	74815.5	3785.9	2271.5	721.1	2992.7	2244.5	448.9	2693.4	44,709.75
20	2026	900	4599.0	79414.5	3863.2	2317.9	735.8	3053.7	2290.3	458.1	2748.4	47,458.11
	2027	918	4691.0	84105.5	3940.4	2364.3	750.6	3114.8	2336.1	467.2	2803.3	50,261.44
	2028	937	4788.1	88893.6	4022.0	2413.2	766.1	3179.3	2384.5	476.9	2861.4	53,122.79
	2029	956	4885.2	93778.7	4103.5	2462.1	781.6	3243.7	2432.8	486.6	2919.4	56,042.16
	Design criteria	2030	976	4987.4	98766.1	4189.4	2513.6	3311.6	2483.7	496.7	2980.4	59,022.61

percentage remaining after burning 0.6

Appendix C

Nunavut Water Board License



P.O. Box 119
GJOA HAVEN, NT X0E 1J0

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TEL: (867) 360-6338
FAX: (867) 360-6369

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,

A handwritten signature in black ink, appearing to read 'P. di Pizzo', written over the printed name.

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.

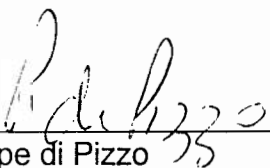
With respect to this application, the NWB gave notice to the public that the Municipality had filed an application for renewal of water licence N4L3-0640 issued by the Northwest Territories Water Board.

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

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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.

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

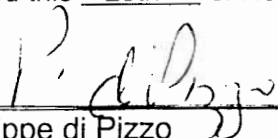
Date of Licence

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 statutes 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	1×10^4 CFU/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 Inuktitut.
- 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
Waste Disposal Site Forms

Hamlet of Qikiqtarjuaq Waste Placement Form

[illegible]

Hamlet of Qikiqtarjuaq
-Weekly Solid Waste Disposal Facility Inspection Form-

Inspected by: _____ Date: _____

Wind direction: _____ Temperature: _____

Precipitation: _____ Ground cover: _____

	YES	NO
1. Is roadway and truck pad clear of snow?	_____	_____
2. Does roadway require grading?	_____	_____
3. Is there visible erosion on the berms?	_____	_____
4. Is all signage visible and in tact?	_____	_____
5. Is there litter on the fences?	_____	_____
6. Is there evidence of leachate break-out from the face of the landfill?	_____	_____
7. Are fences in good condition?	_____	_____
8. Has there been any evidence of scavenging?	_____	_____
9. Is there water accumulating in the Water Retention Area	_____	_____
10. Has any hazardous material been incorporated into the waste pile?	_____	_____
11. Does the waste require placement into the landfill?	_____	_____
12. Are there any problems on the site?	_____	_____



Appendix E
Environmental Emergency
Contingency Plan



Environmental Emergency Contingency Plan for Water, Sewage, and Solid Waste Operations in the Hamlet of Qikiqtarjuaq, Nunavut

Prepared for

The Hamlet of Qikiqtarjuaq
P.O. Box 4, Qikiqtarjuaq NU X0A 0B0 Canada

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

Revision Date

February 2006

File No: N-O 09439.0

The material in this report reflects best judgement in light of the information available at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Nuna Burnside accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

February 2006

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Water, Sewage, and Solid Waste Operations in the
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Environmental Emergency Contingency Plan for
Water, Sewage, and Solid Waste Operations in the
Hamlet of Qikiqtarjuaq, Nunavut

February 2006

Preamble

This Environmental Emergency Contingency Plan relating to the collection, transportation, storage, and treatment operations of sewage for the Hamlet of Qikiqtarjuaq, Nunavut, is effective from *BEGINNING DATE OF WATER LICENSE until EXPIRY DATE OF NEW WATER LICENSE*. This plan applies to all operations and spill events relating to sewage and petroleum, oil, and lubricating (POL) products in the Hamlet of Qikiqtarjuaq, Nunavut (formerly known as Broughton Island).

The following formal distribution will be made after this document receives approval:

- Hamlet of Qikiqtarjuaq:
 - Mayor and Council
 - Senior Administrative Officer (SAO)
 - Hamlet Operations Staff
 - Fire Department
 - Community Health Centre
 - RCMP Detachment.
- Nunavut Water Board.

Additional copies and updates of this plan may be obtained by writing to:

Hamlet of Qikiqtarjuaq
Senior Administrative Officer (SAO)
P.O. Box 4
Qikiqtarjuaq, NU X0A 0B0

February 2006

1.0 Introduction

1.1 Purpose of Plan

The impacts of spills can be catastrophic and may threaten or damage the environment, especially water resources. As such, the Government of Nunavut (GN) requires contingency plans to be written and fully implemented. The purpose of this *Environmental Emergency Contingency Plan* is to provide a plan of action for all spills of sewage, solid waste, and petroleum products that may occur as a result of water supply and distribution, sewage collection and treatment, and solid waste collection and disposal operations undertaken within the Hamlet of Qikiqtarjuaq, Nunavut.

This *Environmental Emergency Contingency Plan* will assist in implementing corrective options quickly to minimize environmental damage. Furthermore, it defines the responsibilities of key personnel and outlines procedures to effectively and efficiently contain and recover spills of sewage, solid waste, and petroleum products arising from water, sewage, and solid waste; collection, transportation, storage, and treatment operations. It will assist the Hamlet in meeting the regulatory requirements related to reporting events to the appropriate authorities within the prescribed time period.

Sewage, solid waste, and petroleum, oil and lubricating (POL) products that currently, or potentially, fall within the Scope of this *Environmental Emergency Contingency Plan* are as follows:

- Sewage (as defined in the Nunavut Water Board (NWB) water license)
- Solid waste (as defined in the Nunavut Water Board (NWB) water license)
- Gasoline
- Diesel fuel
- Hydraulic fluid
- Lubricating oil.

1.2 Objectives

The objectives of this Emergency Spill Contingency Plan are to:

- Provide a plan including procedures so that the Hamlet and their Incident Spill Response Team can rapidly respond to a spill situation and minimize injury to individuals and environmental damage
- Comply with all existing regulations
- Cooperate with other groups and agencies

Environmental Emergency Contingency Plan for
Water, Sewage, and Solid Waste Operations in the
Hamlet of Qikiqtarjuaq, Nunavut

February 2006

- Be prepared and able to provide an integrated team approach with all involved departments and agencies
- Keep staff, government officials, and Hamlet residents informed.

1.3 Hamlet of Qikiqtarjuaq Environmental Policy

It is the policy of the Hamlet of Qikiqtarjuaq to fully comply with all applicable legislation to ensure the protection of the environment of the territory of Nunavut. The legislation includes, but is not limited to, the:

- Environmental Protection Act, Section 34 – Spill Contingency Planning and Reporting Regulations
- Nunavut Waters and Nunavut Surface Rights Tribunal Act.

The Hamlet will cooperate with other groups committed to protecting the environment and shall ensure that Hamlet employees, regulatory authorities, and the public are informed on the policies and procedures developed to help protect the environment and the citizens of the Hamlet of Qikiqtarjuaq.

February 2006

2.0 Site Description

2.1 General Site Description

This *Environmental Emergency Contingency Plan* is to be implemented within the Municipal boundaries of the Hamlet of Qikiqtarjuaq, Nunavut.

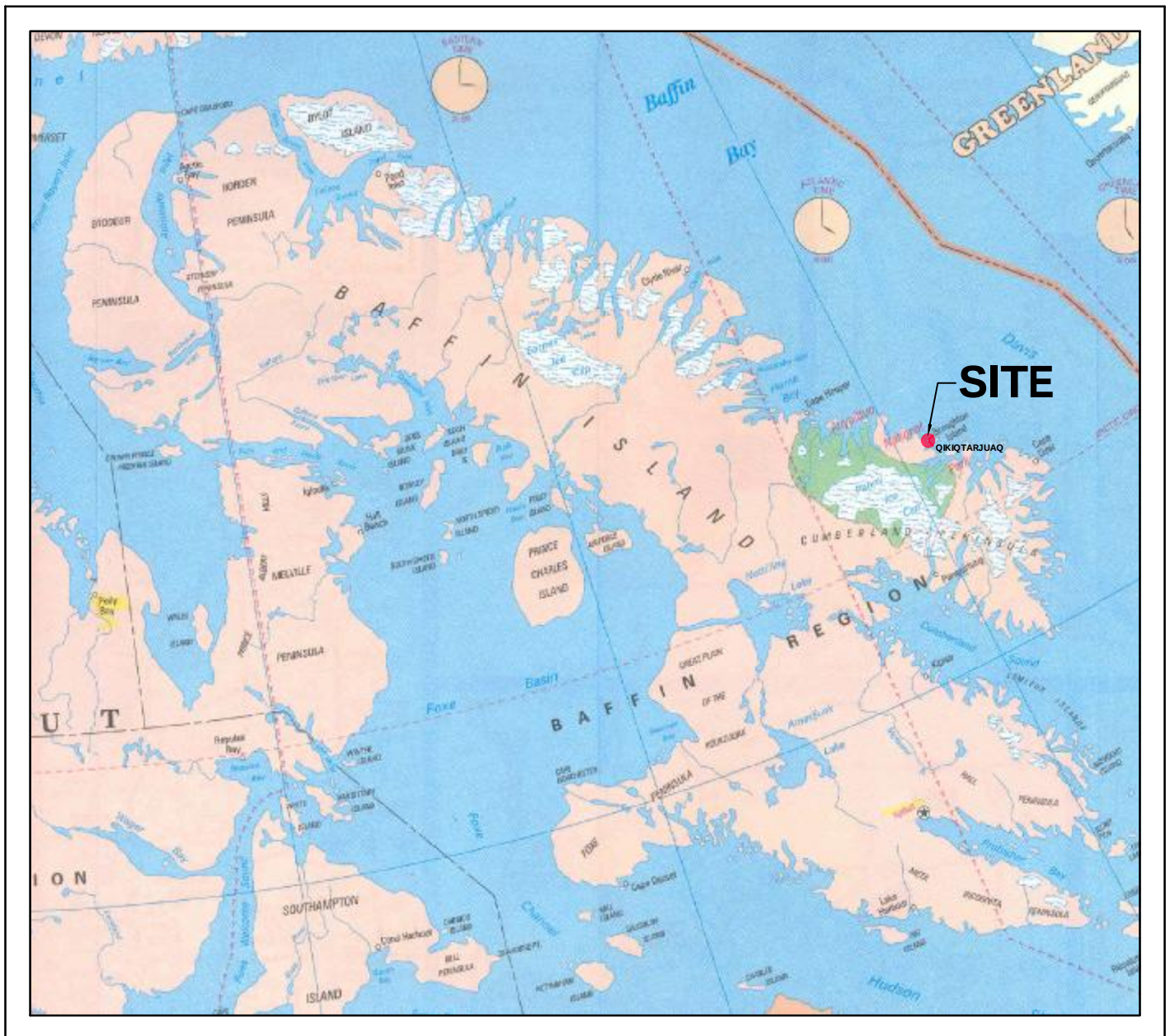
The Hamlet of Qikiqtarjuaq (meaning “big island”), is a Community of approximately 599 people located on the eastern coast of Baffin Island and on an island known as Broughton Island in the territory of Nunavut. As illustrated in Figure 1, the Hamlet is located approximately 470 kilometers northeast of the Capital City of Iqaluit, a distance that is covered by plane in about one hour. The geographic coordinates for the Hamlet of Qikiqtarjuaq are 67°33’ north latitude and 64°02’ west longitude. As indicated on Figure 2, the community is situated on the northwest portion of Broughton Island.

2.2 Sewage Collection, Water Supply, Treatment and Distribution, and Storage

The Hamlet provides trucked water service for the community. Historically, water is drawn from the Tulugak River during the summer, and from the lined earthen reservoir (Figure 3) for the remainder of the year. The water is chlorinated as it is pumped into the tanker delivery trucks through the truck fill station. The truck fill station operates by diesel generator and has an above ground storage (AST) tank on-site.

Sewage is collected in the Hamlet of Qikiqtarjuaq by vacuum truck, and transported to the Sewage Treatment Facility (Figure 4) operated by the Hamlet of Qikiqtarjuaq located approximately 2.3 km from the Hamlet. Wastewater is collected from customer holding tanks and discharged to the wastewater lagoon located to the east of the community north of the DEW Line Access Road.

The Hamlet of Qikiqtarjuaq provides regular solid waste pickup for the Community’s residents, businesses, and institutions. Collection occurs on a daily basis throughout the Hamlet, to minimize the potential for attraction of foxes and polar bears. Solid waste is trucked to the Hamlet’s Solid Waste Disposal facility (Figure 5), which is currently permitted by the Nunavut Water Board (NWB). The current Facility is located adjacent to the sewage lagoon.



Map Reference:
Map of Canada
Published by the CAA

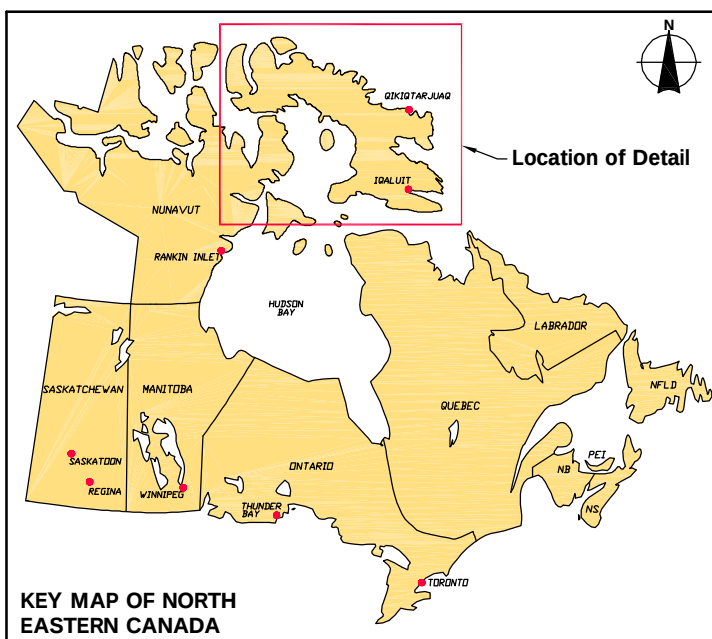


FIGURE 1 - SITE LOCATION MAP

THE HAMLET OF QIKIQTARJUAQ, NUNAVUT

ENVIRONMENTAL EMERGENCY CONTINGENCY PLAN

January 2006
Project Number: N-O 09439.0

Prepared by: K. Pridham

Verified by: M. Paznar

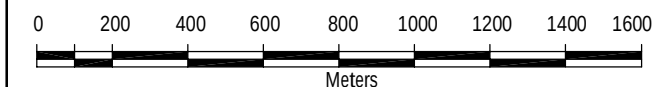
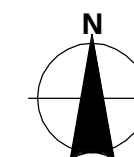
Burnside



FIGURE 2
THE HAMLET OF QIKIQTARJUAQ
ENVIRONMENTAL EMERGENCY
CONTINGENCY PLAN

SATELLITE IMAGERY OF ENTIRE COMMUNITY AND INFRASTRUCTURE

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



1:20,000
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

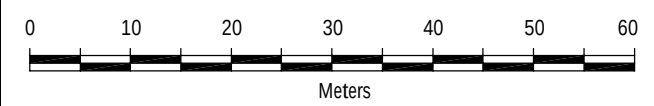
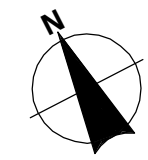
Verified by: M. Paznar



FIGURE 3
THE HAMLET OF QIKIQTARJUAQ
ENVIRONMENTAL EMERGENCY
CONTINGENCY PLAN

WATER RESERVOIR SITE

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



1:750
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: M. Paznar



DAVIS STRAIT

PROPOSED SOLID WASTE
DISPOSAL FACILITY
(LANDFILL)
EXPANSION

PROPOSED WETLAND
TREATMENT AREA
(22 Ha)

EXISTING FINAL
DISCHARGE POINT

EXISTING SOLID WASTE
DISPOSAL FACILITY
(LANDFILL)

EXISTING SEWAGE LAGOON

PROPOSED SEWAGE
LAGOON EXPANSION

LANDFILL ACCESS ROAD

DEW LINE ACCESS ROAD

FIGURE 4

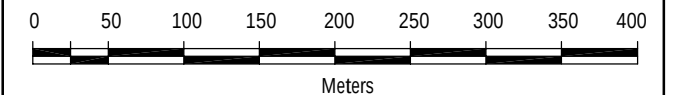
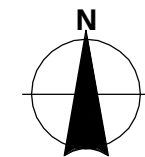
THE HAMLET OF QIKIQTARJUAQ ENVIRONMENTAL EMERGENCY CONTINGENCY PLAN

REGIONAL VIEW OF SEWAGE LAGOON & SOLID WASTE DISPOSAL FACILITY (LANDFILL)

Legend

→ → → → INTERPRETED EXISTING SURFACE WATER
FLOW DIRECTION

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



1:5,000
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: M. Paznar

 **BURNSIDE**

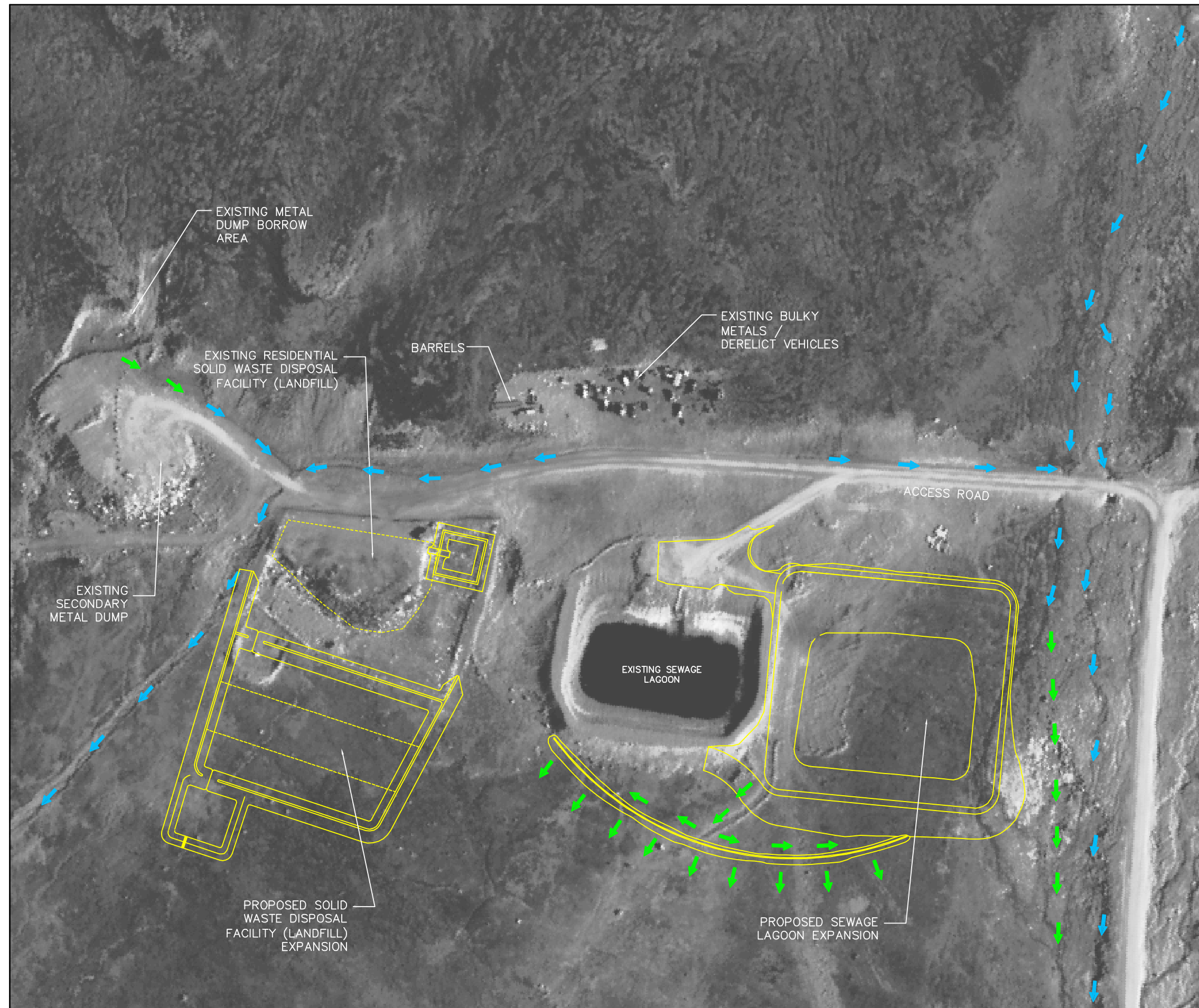


FIGURE 5

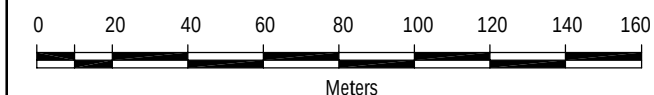
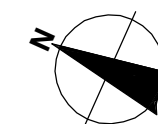
THE HAMLET OF QIKIQTARJUAQ
ENVIRONMENTAL EMERGENCY
CONTINGENCY PLAN

SOLID WASTE DISPOSAL
FACILITY (LANDFILL)

Legend

- → EXISTING SURFACE WATER FLOW DIRECTION
- → PROPOSED SURFACE WATER FLOW DIRECTION

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



1:2,000
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

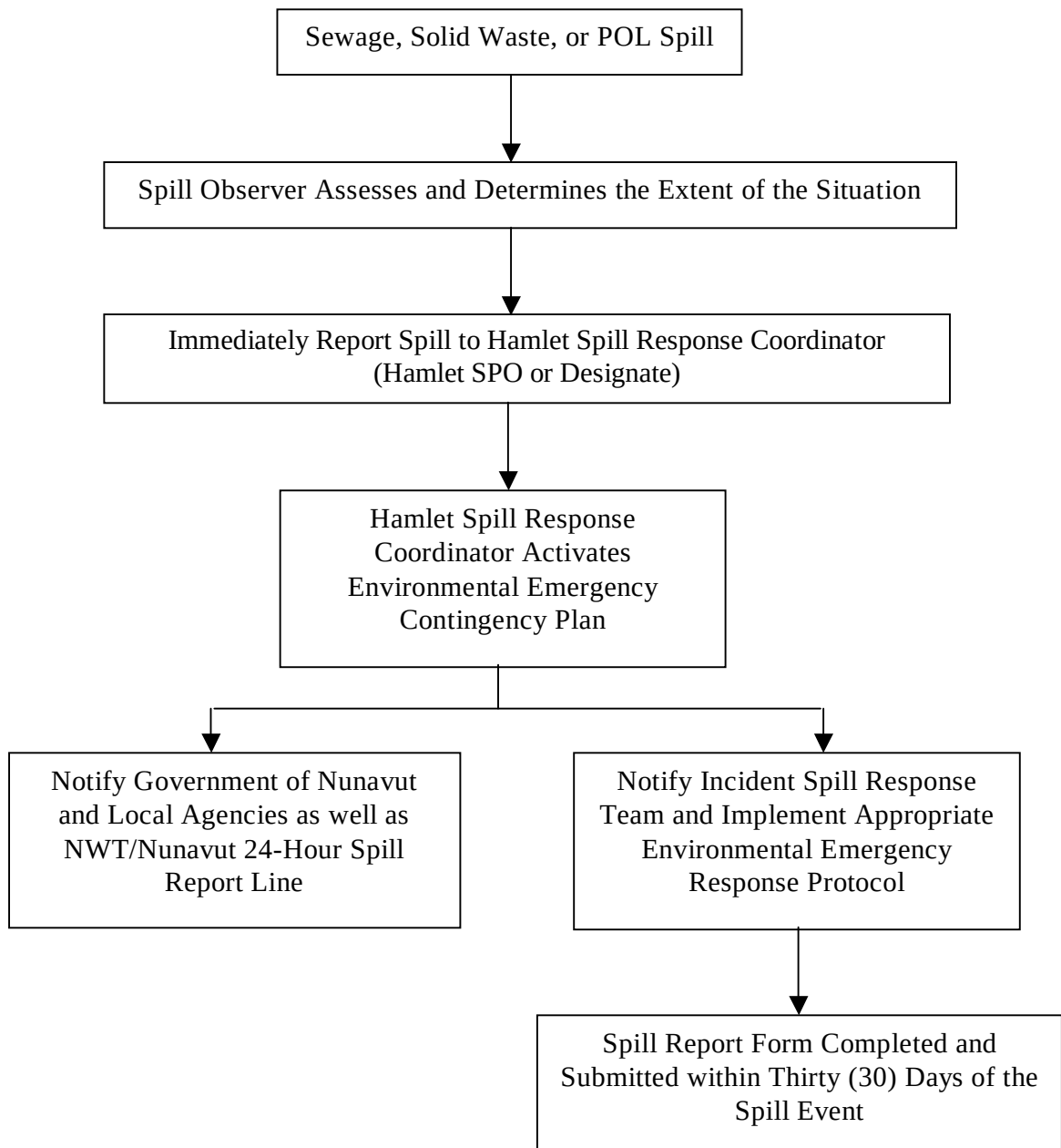
Prepared by: C. Sheppard

Verified by: M. Paznar

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3.0 Spill Response Organization

The following is a flow chart to illustrate the sequence of events that must be followed in the event of a sewage, solid waste, or POL spill occurring during supply, distribution, collection, transportation, storage, and treatment operations:



Emergency Response Flow Chart

February 2006

3.1 Incident Spill Response Team

The Hamlet Senior Administrative Officer (SAO) or his/her Designate will serve as the Spill Response Coordinator for the Hamlet in the event of a sewage or POL spill during collection and transport operations. The SAO of the Hamlet of Qikiqtarjuaq will appoint and train appropriate personnel to make up the Incident Spill Response Team, which normally consist of the following personnel:

- Spill Response Coordinator Hamlet SAO (or Designate)
- Hamlet Works Personnel Will generally vary from 3-7 people throughout the year

The responsibilities of the Spill Response Coordinator are as follows:

1. Assume complete authority over the spill scene and coordinate all personnel involved
2. Evaluate the spill situation and develop overall plan of action
3. Activate the *Environmental Emergency Contingency Plan* for the Hamlet of Qikiqtarjuaq
4. Immediately report the spill to the NWT/Nunavut 24-Hour Spill Report Line at (867) 920-8130, and other applicable regulatory or assistance agencies
5. Provide regulatory agencies with information regarding the status of the clean-up activities
6. Act as a spokesperson on behalf of the Hamlet of Qikiqtarjuaq with regulatory agencies, the public, and the media
7. Prepare and submit a report on the spill incident to regulatory agencies within 30 days of the event.

3.2 Contact Information

A complete listing of contact information, including telephone numbers of standard regulatory agencies, Hamlet personnel, and assistance agencies who may be contacted to supply resources, expertise, and advise needed to deal with a spill emergency is included in Appendix A.

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4.0 Spill Reporting Procedure

The Spill Response Coordinator must be notified immediately by any individual who is aware of any spill either by phone, radio, or in person.

The following is the incident reporting procedures once the Spill Response Coordinator activates this Environmental Emergency Spill Contingency Plan:

1. Report spill immediately to the 24-Hour NWT/Nunavut Spill Report Line Phone (867) 920-8130 (Section 4.1)
2. Report immediately to the INAC Manager, Water Resources in Iqaluit at (867) 975-4550
3. Notify Hamlet of Qikiqtarjuaq Fire Department
4. Fill out the NWT/Nunavut Spill Report Form (Appendix B) within thirty (30) days of the spill event occurring.

4.1 NWT/Nunavut Spill Report Line

All spills as defined in this document must be reported immediately to the 24-hour NWT/Nunavut Spill Report Line. Gather the following information prior to making the call:

- Date and time of spill (if known)
- Location and map coordinates (if known) and direction of flow of spill materials if moving
- Party responsible for spill
- Product/material spilled and estimate of the quantity
- Cause of spill
- If the spill has been stopped or if it is continuing
- Extent of contaminated area
- Factors affecting spill or recovery, such as weather conditions or terrain
- If containment of spill is available
- Action taken or proposed
- If assistance is required
- Possible hazards to person, property or environment (e.g. fire, drinking water, fish, wildlife, etc.).

The information collected should be brief, and quick estimates made so the Spill Report Line and the Spill Response Coordinator can assess the situation. The information is similar to that required in boxes B, D, E, F, G, H, I, J, K, L, M, N, O, and P on the spill report form that must be completely fill out in thirty days, and available in Appendix B.

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5.0 Action Plans

5.1 Initial Action

The instructions to be followed by the first person on the spill scene are as follows:

1. Always be alert and consider your safety first
2. If possible, estimate the volume of material that has been spilled
3. Assess the hazard of people in the vicinity of the spill
4. If possible, and safety permits, attempt to stop the release of product to minimize potential for environmental impacts
5. Immediately report the spill to the Spill Response Coordinator
6. Resume any effective action to contain, mitigate, or terminate the flow of the spilled material.

5.2 Environmental Health Protection and Mitigation Measures

The environmental protection and mitigation measures outlined in the following sections are to be taken by all personnel responding to a spill event and to reduce the chance of environmental impairment and health hazards due to spill, release, or other incident.

5.2.1 General Procedures

The following general clean-up procedures shall apply for all spill areas within the Hamlet:

- Always wear personnel protective equipment (PPE)
- Smoking is prohibited during all spill response activities
- Eliminate all ignition sources
- Contain spills on soil or rock by construction of earthen dykes using available material. If soil is not available, place sorbent materials or a boom in the path of the spill. As the sorbent barrier becomes saturated, continually replace it. Fuel or other liquids lying in pools, or trenches are to be removed with pumps, buckets, or skimmers
- If the ground is snow covered, create snow dykes, and line with a chemically-compatible liner for containment and recover of liquid
- For fuels on water, deploy containment booms, and recovery as much fuel as possible with a work boat and skimmer if the area has less than 1/10th ice cover. If the area is ice infested, burn any fuel spills using igniters
- Apply sorbets, if necessary
- Assess potential for disturbance of wildlife, fish, and archaeological sites by spill or clean-up operations

February 2006

- Notify environmental authorities to discuss available and feasible disposal and clean-up options
- Conduct required clean-up operations
- Assess and appropriately treat any areas disturbed by clean-up activities with laboratory testing
- Ensure the site has been completely restored and cease operations, only when all work is finalized and laboratory testing confirmed.

Specific procedures relating to mitigating measures for specific contaminants following below:

5.3 Mitigative Measures: Sewage, Gasoline, Diesel Fuel, Hydraulic Fluid, Lubricating Oil and Aviation Fuel

If possible, and safety permits, stop the flow of product, which is occurring, and eliminate all ignition sources. ***Smoking is prohibited during all spill response activities.***

5.3.1 POL Spill on Soil, Gravel, Rock, or Vegetation

- Build a containment berm using soil material or snow and place a plastic tarp at the foot of the berm for easy capture of the spill after all vapors have dissipated
- Remove the spill by using absorbent pads or excavating the soil, gravel or snow
- Remove spill splashed on vegetation using particulate absorbent material
- If soil, gravel, or vegetation are to be removed from the site, the Hamlet shall contact regulatory agencies for approval before commencing with the removal.

5.3.2 POL Spill On Water

- Use containment boom to capture spill for recovery after vapors have dissipated
- Use absorbent pads to capture small spills
- Use a petroleum skimmer for larger spills.

5.3.3 POL Spill on Ice and Snow

- Build a containment berm around spill using snow
- Remove spill using absorbent pads or particulate sorbent material
- The contaminated ice and snow must be scraped and shoveled into plastic buckets with lids, 205 litre drums, and/or polypropylene bags.

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5.3.4 POL-Contaminated Material Storage and Transfer

All contaminated water, ice, snow, soil, and clean up supplies will be stored in closed, labeled containers. All containers will be stored in a well ventilated area away from incompatible materials.

5.3.5 Disposal

Contact Federal and Territorial regulatory agencies to identify appropriate disposal methods before disposing of contaminated material. ***No contaminated material is to be disposed of in any Facility operated by the Hamlet of Qikiqtarjuaq without the express written consent of the Nunavut Water Board.***

5.4 Mitigative Measures: Ethylene Glycol Antifreeze

If possible, and safety permits, stop the flow of product, which is occurring.

5.4.1 Ethylene Glycol Spill on Soil, Gravel, Rock, or Vegetation

- Build a containment berm using soil material or snow and place a plastic tarp at the foot of the berm for easy capture of the spill
- Remove the spill by using absorbent pads or excavating the soil, gravel, or snow
- Remove spill splashed on vegetation using particulate absorbent material
- If soil, gravel, and/or vegetation must be removed from the spill site, the Hamlet shall contact the appropriate regulatory agencies for approval before commencing with the removal.

5.4.2 Ethylene Glycol Spill On Water

Use containment boom to capture spill, and pump contaminated water into 205 L drums.

5.4.3 Ethylene Glycol Spill On Ice and Snow

- Build a containment berm around spill using snow
- Remove spill using particulate sorbent material
- The contaminated sorbent material, ice and snow must be scraped and shoveled into plastic buckets with lids, 205 litre drums, and/or polypropylene bags.

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5.4.4 Ethylene Glycol Storage and Transfer

All contaminated water, ice, snow, soil, and clean up supplies will be stored in closed, labeled containers. All containers will be stored in a well ventilated area away from incompatible materials.

5.4.5 Disposal

Contact Federal and Territorial regulatory agencies to identify appropriate disposal methods before disposing of contaminated material. ***No contaminated material is to be disposed of in any Facility operated by the Hamlet of Qikiqtarjuaq without the express written consent of the Nunavut Water Board.***

5.5 Mitigative Measures: Sewage

If possible, and safety permits, stop the flow of product, which is occurring.

5.5.1 Sewage Spill on Soil, Gravel, Rock, or Vegetation

- Build a containment berm using soil material or snow and place a plastic tarp at the foot of the berm for easy capture of the spill, and to prevent sewage from entering any water body
- Remove the spill by using vacuum trucks or excavating the soil, gravel, or snow
- If soil, gravel, and/or vegetation must be removed from the spill site, the Hamlet shall contact the appropriate regulatory agencies for approval before commencing with the removal.

5.5.2 Sewage Spill into Water

- Use containment boom to capture spill, and pump contaminated water into vacuum trucks
- Deposit contaminated water to the Hamlet sewage lagoon
- Monitor the affected water body sampling at a minimum for Biological Oxygen Demand (BOD), Total Suspended Solids (TSS), ammonia (NH₃), and faecal coliforms (FC).

5.5.3 Sewage Spill on Ice and Snow

- Build a containment berm around spill using snow
- Remove spilled sewage and contaminated snow and ice to the Hamlet sewage lagoon.

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5.5.4 Sewage Storage and Transfer

All contaminated water, ice, snow, soil, and clean-up supplies will be deposited to the Hamlet sewage lagoon or landfill facility, as appropriate.

5.6 Mitigative Measures: Solid Waste

5.6.1 Solid Waste Spill on Soil, Gravel, Rock, or Vegetation

- Physically remove the spilled solid waste from the waste, and deposit to the approved Hamlet Solid Waste Disposal Facility
- If soil, gravel, or vegetation are to be removed from the site, the Hamlet shall contact regulatory agencies for approval before commencing with the removal.

5.6.2 Solid Waste Spill into Water

- Use containment boom to capture soil for recovery
- Physically remove the spilled solid waste from the water, and deposit to the approved Hamlet Solid Waste Disposal Facility
- Capture any sheen from the water using absorbent pads or skimmer, and deposit any used absorbent pads to the approved Hamlet Solid waste Disposal facility.

5.6.3 Solid Waste Spill on Ice and Snow

- Build a containment berm around spill using snow
- Physically remove the spilled solid waste and deposit to the approved Hamlet Solid Waste Disposal Facility
- If soil, gravel, or vegetation are to be removed from the site, the Hamlet shall contact regulatory agencies for approval before commencing with the removal.

5.6.4 Disposal

Any solid waste shall be removed to the approved Hamlet Solid Waste Disposal Facility.

5.7 Spill Recovery Assessment

In order to determine whether a spill has been successfully remediated, samples of the soil and/or water within the spill containment area and surrounding the area, are to be collected and sent to an accredited Canadian Association of Environmental Analytic Laboratories (CAEAL) laboratory to be analyzed for the chemical parameters contained in the spill material. If concentrations of the spill chemicals are not detected, or are at

Environmental Emergency Contingency Plan for
Water, Sewage, and Solid Waste Operations in the
Hamlet of Qikiqtarjuaq, Nunavut

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concentrations below the applicable Territorial, Federal, or CCME regulations/criteria, the spill clean-up will be determined a success. Clean-up operations may then cease.

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6.0 Spill Response Resource Inventory

6.1 Additional Personnel Available

In addition to Hamlet staff, approximately 10 people are available from the Qikiqtarjuaq Fire Department, to assist in spill response and clean-up activities. Personnel from the local RCMP Detachment will be available for securing the site from unauthorized individuals, closing roads, etc. The Community Health Centre have personnel to assist in the treatment of anyone injured during the emergency.

6.2 Spill Response Equipment Inventory

Equipment available within the community to assist in responding to a hazardous materials spill includes heavy equipment (i.e. vacuum trucks, dozer, front end loader, and grader), as well as various hand held tools including shovels. In addition, three spill kits should be available on site during spill incident response operations. Each spill kit should contain the following supplies.

Composition of Spill Kit

	Quantity
• 360 litre polyethylene over pack drum	1
• oil sorbent booms (5" X 10')	6
• oil sorbent sheets (16.5" X 20" X 3/8")	100
• drain cover (36" X 36" X 1/16")	1
• Caution tape (3" X 500')	1
• 1 lb plugging compound	1
• Nitrile gloves (pair)	4
• Safety goggles (pair)	4
• Tyvek coveralls (pair)	4
• instruction booklet	1
• printed disposable bags (24" X 48")	10

Sorbent capacity of each spill kit is 240 litres.

All equipment is generally stored at the Hamlet Operations Yard/Garage. Some equipment may be stored in other areas throughout the community while being used to complete tasks.

Environmental Emergency Contingency Plan for
Water, Sewage, and Solid Waste Operations in the
Hamlet of Qikiqtarjuaq, Nunavut

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7.0 Training

All employees working for the Hamlet of Qikiqtarjuaq should be trained in the safe operation of all machinery and tools to help prevent sewage and hazardous material spills. All employees on site should also be trained for initial spill incident response. Annual refresher exercises should be conducted to review the procedures of this *Environmental Emergency Contingency Plan*, with all individuals involved in the Incident Spill Response Team, including members of the local volunteer fire department, RCMP Detachment, and Community Health Centre.

Incident Spill Response Team training should include the following aspects:

- Spill awareness and prevention
- Methods of detection
- Types of spills and seasonal considerations
- Reporting procedures and initial responses
- Spill response kit familiarization
- Clean-up and site remediation methods
- Occupational health and safety including proper selection and use of PPE's.

Environmental Emergency Contingency Plan for
Water, Sewage, and Solid Waste Operations in the
Hamlet of Qikiqtarjuaq, Nunavut

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8.0 Annual Review of this Environmental Emergency Contingency Plan

As part of the preparation of the Annual Report to the Nunavut Water Board for the Water License, the Hamlet should review and update the information contained within this plan. The purpose of the update is to ensure all changes to regulations are incorporated into this plan, along with the use of any new technology or method advances, to prevent or stop a spill and to mitigate and/or remediate a spill. This ensures that the plan adapts as the Hamlet grows, to ensure the community is properly prepared in the event of an incident.

Finally, it is recommended that annual refresher training of personnel be completed after any revisions to this document have been approved. This will familiarize personnel with the updated plan, and to provide a rapid and coordinated response.

Environmental Emergency Contingency Plan for
Water, Sewage, and Solid Waste Operations in the
Hamlet of Qikiqtarjuaq, Nunavut

February 2006

9.0 References

Nunavut Water Board, September 2000. *Hamlet of Qikiqtarjuaq Water License NWB3Q1K0106*. Goja Haven, Nunavut.

Nunavut Water Board, November 2004. *Guidelines for Spill Contingency Planning*. Goja Haven, Nunavut.

Northwest Territories, Date Unknown. *Contingency Planning and Spill Reporting in the NWT: A Guide to the New Regulations*, Yellowknife, Northwest Territories.

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Appendix A
Contact Information

Appendix A
Contact Information

Contact	Location	Telephone	Fax
Hamlet of Qikiqtarjuaq Senior Administrative Officer or Designate	Qikiqtarjuaq	(867) 927-8832	(867) 927-8120
Northwest Territories/Nunavut 24 Hour Spill Report Line	Iqaluit	(867) 920-8130	(867) 873-6924
Indian and Northern Affairs Canada Water Resources Manger Nunavut Regional Office	Iqaluit	(867) 975-4550	(867) 975-4585
Nunavut Water Board	Gjoa Haven	(867) 360-6338	(867) 360-6369
Environment Canada Environment Protection Branch Inspector	Iqaluit	(867) 975-4644	(867) 975-4594
Manager Pollution Control and Air Quality Environmental Protection Government of Nunavut	Iqaluit	(867) 975-5907	(867) 975-5981
Indian and Northern Affairs Canada Land Administration Minister Nunavut Regional Office	Iqaluit	(867) 975-4280	(867) 975-4286
Department of Fisheries and Oceans Canada Nunavut Regional Office	Iqaluit	(867) 979-8000	(867) 979-8039
Fire Department	Qikiqtarjuaq	(867) 927-4422	N/A
Royal Canadian Mounted Police (RCMP) Detachment	Qikiqtarjuaq	(867) 927-0123	N/A
Community Health Centre	Qikiqtarjuaq	(867) 927-8916	N/A

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Appendix B
NWT Spill Report



NWT SPILL REPORT

(Oil, Gas, Hazardous Chemicals or other Materials)

24 – Hour Report Line
Phone: (867) 920-8130
Fax: (867) 873-6924

A Report Date and Time		B Date and Time of spill (if known)		C ☐ Original Report ☐ Update no. _____		Spill Number	
D Location and map coordinates (if known) and direction (if moving)							
E Partly responsible for spill							
F Product(s) spilled and estimated quantities (provide metric volumes/weights if possible)							
G Cause of spill							
H Is spill terminated? ☐ yes ☐ no		I If spill is continuing, give estimated rate		J Is further spillage possible? ☐ yes ☐ no		K Extent of contaminated area (in square meters if possible)	
L Factors effecting spill or recovery (weather conditions, terrain, snow cover, etc.)				M Containment (natural depression, dikes, etc.)			
N Action, if any, taken or proposed to contain, recover, clean up or dispose of product(s) and contaminated materials							
O Do you require assistance? ☐ no ☐ yes, describe:				P Possible hazards to person, property, or environment; eg: fire, drink water, fish or wildlife			
Q Comments or recommendations						FOR SPILL LINE USE ONLY	
						Lead agency	
						Spill significance	
						Lead Agency contact and time	
						Is this file now closed? ☐ yes ☐ no	
Reported by		Position. Employer, Location				Telephone	
Reported to		Position. Employer, Location				Telephone	



Appendix F
Monitoring Program Quality
Assurance/Quality Control Plan



**Quality Assurance/Quality Control Plan for
Hamlet Water Reservoir, Sewage Lagoon, and
Solid Waste Disposal Facility Monitoring Program
Hamlet of Qikiqtarjuaq, Nunavut**

Prepared for

The Hamlet of Qikiqtarjuaq
P.O. Box 4, Qikiqtarjuaq NU X0A 0B0 Canada

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

Revised Date

February 2006

File No: N-O 09439.0

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- 2 Satellite Imagery of Entire Community and Infrastructure

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- A Contact Information
- B Notification of Laboratory Form
- C Annual Report for the Hamlet of Qikiqtarjuaq

February 2006

1.0 Introduction

The Hamlet of Qikiqtarjuaq (meaning “big island”), is a Community of approximately 599 people located on the eastern coast of Baffin Island and on an island known as Broughton Island in the territory of Nunavut. As illustrated in Figure 1, the Hamlet is located approximately 470 kilometers northeast of the Capital City of Iqaluit, a distance that is covered by plane in about one hour. The geographic coordinates for the Hamlet of Qikiqtarjuaq are 67°33’ north latitude and 64°02’ west longitude. As indicated on Figure 2, the community is situated on the northwest portion of Broughton Island.

The Hamlet provides trucked water and sewage services, along with regular solid waste collection for the residents, businesses and institutions. Historically, water is drawn from the Tulugak River during the summer, and from the lined earthen reservoir for the remainder of the year. Sewage is collected by truck from individual holding tanks at each building and discharged to the unlined sewage lagoon located to the east of the community north of the DEW Line Access Road. Sewage treatment is provided by a retention lagoon, with the treated effluent charge flowing north towards the ocean through a naturally occurring wetland treatment area. Solid waste is disposed of at a facility located adjacent to the sewage lagoon. The solid waste disposal facility includes areas for bulky metals/derelect vehicles, barrels, metal dump borrow, secondary metal, and residential solid waste.

1.1 Purpose

The Quality Assurance/Quality Control Plan has been prepared to meet the requirements of the Monitoring Program developed for the Hamlet of Qikiqtarjuaq to comply with licensing requirements. A copy of the current license is included in Appendix A.

Quality Assurance (QA) and Quality Control (QC) are vitally important components of environmental management for the Hamlet of Qikiqtarjuaq. Contact information for the Hamlet is provided in Appendix B.

1.2 Objectives

The Plan has been developed to achieve the following objectives:

- To ensure that all samples taken in the field will follow procedures and controls in order to maintain a high quality, so that the results obtained represent both the physical and chemical nature of the samples being taken
- To ensure best management practices (BMP) are used throughout the sampling program

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- To ensure all samples are delivered promptly to an accredited laboratory for analysis.

This document describes the procedures and controls to be used by Hamlet operations staff when conducting environmental sampling to meet the requirements of the license.

Although the QA/QC Plan is submitted to the NWB as a condition of the water license, it is primarily intended to be read, understood, and implemented by Hamlet operations personnel responsible for environmental quality monitoring. The procedures should be applied to **all** water quality samples taken by the Hamlet.

1.3 Quality Assurance and Quality Control

Quality Assurance is a set of operating principles that, if strictly followed during sample collection and analysis, will produce data of known and defensible quality (Wilson, 1995). As such the accuracy of the analytical results can be stated with a high level of confidence. A high level of quality assurance can be achieved by applying the following principles:

- Personnel involved in water sampling and analysis are well trained
- Facilities and equipment required for sampling are suitable, well maintained, and always kept clean
- Standard procedures are developed and implemented for the collection, transportation and analysis of samples, based on recognized BMP
- Laboratory and field instruments are calibrated according to manufacturers recommendations or recognized as good operating practice
- Supplies used in sampling and analysis are of consistent high quality and are not expired
- Quality Control (QC) procedures are development and implemented based on good operating practices to assess quality of analytical data and provide warning of unacceptable errors
- Implement prompt remedial action when deficiencies are identified
- Results of the monitoring program are reported in the Annual report as required in the water license. Annual report is required to be submitted by March 31 for the pervious calendar year to the NWB sample form can be found in Appendix C.

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Quality Control (QC) is a set of specific procedures used to measure the quality of the data produced and correct deficiencies in the sampling or analyses, as they occur. Quality control is used by the analyst and sampler to achieve standards of measurement for the three principles components of quality: precision, accuracy and reliability.

1.4 Lab Accreditation

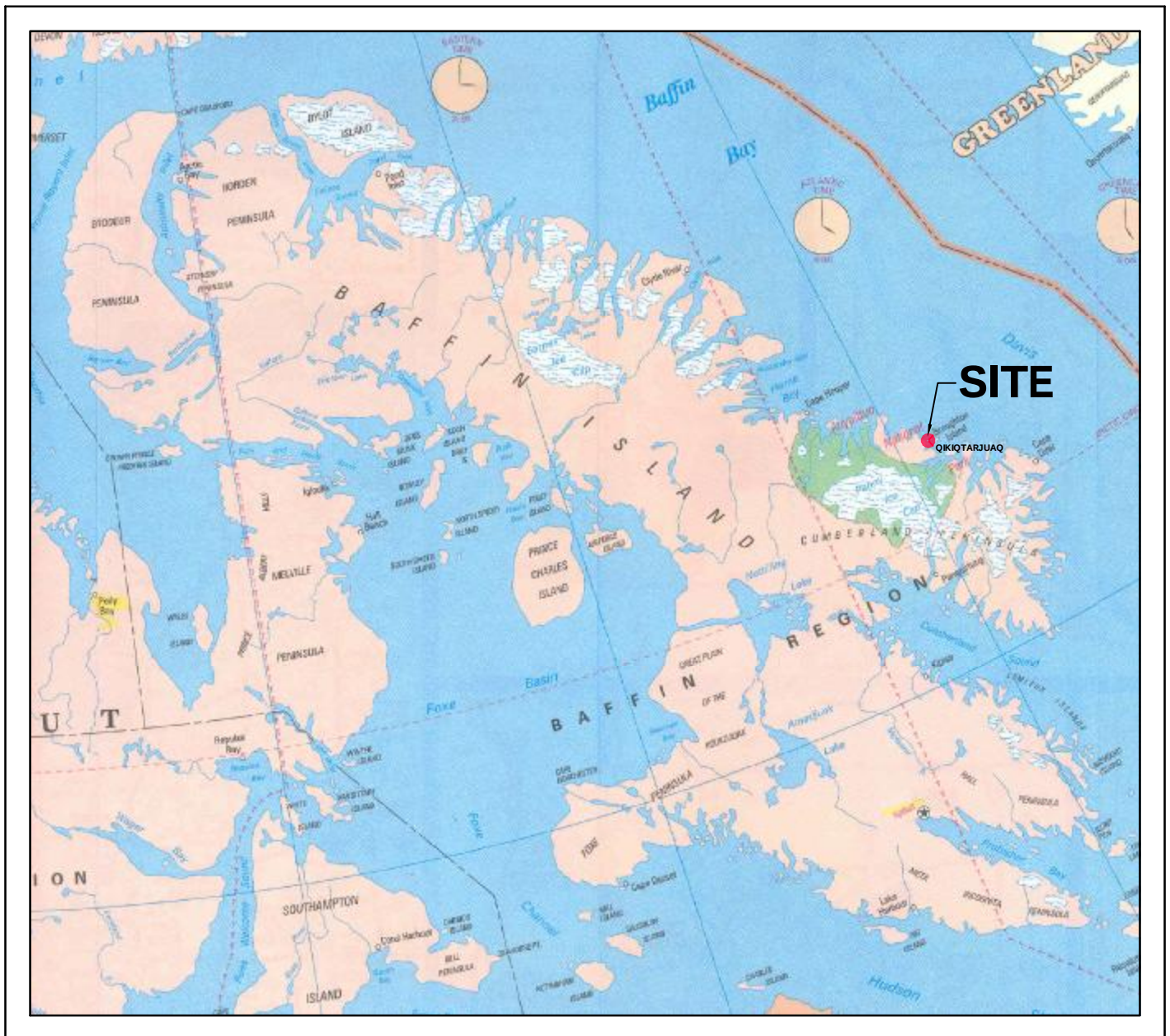
All analyses shall be conducted in laboratories, which are accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL), unless otherwise approved by an Analyst. The Contact information for the DIAND Analyst for Nunavut is provided in Appendix A.

The following is the contact information for the Laboratory retained by the Hamlet of Qikiqtarjuaq to complete analysis:

Name of Laboratory	_____
Address	_____

Phone No.	_____
Fax No.	_____

Prior to sampling being undertaken by representatives of the Hamlet, the Hamlet shall notify the NWB of the Laboratory to be used to perform the analysis. This is required as per the Water License.



Map Reference:
Map of Canada
Published by the CAA

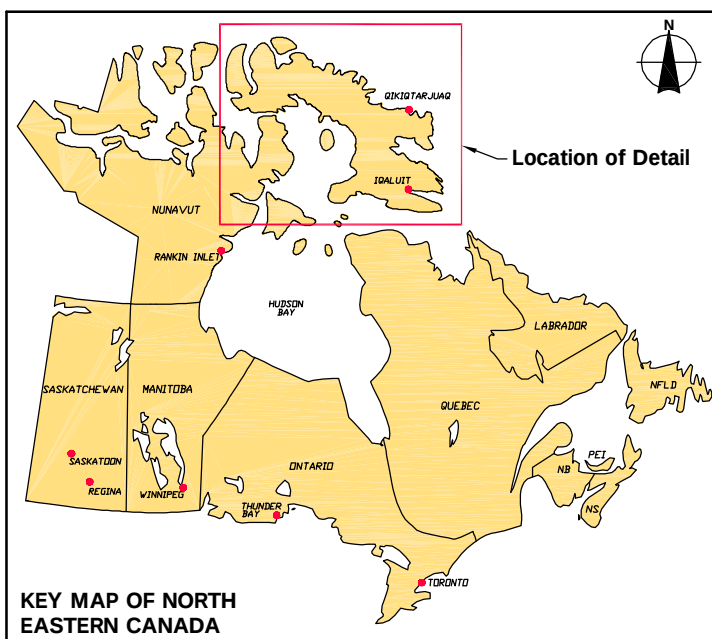


FIGURE 1 - SITE LOCATION MAP

THE HAMLET OF
QIKIQTARJUAQ, NUNAVUT

QUALITY ASSURANCE/QUALITY CONTROL PLAN

January 2006
Project Number: N-O 09439.0

Prepared by: K. Pridham

Verified by: M. Paznar



BURNSIDE



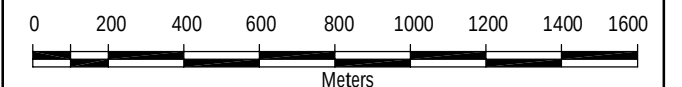
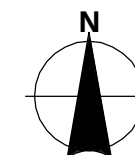
FIGURE 2
THE HAMLET OF QIKIQTARJUAQ
QUALITY ASSURANCE/QUALITY CONTROL
PLAN

SATELLITE IMAGERY OF
ENTIRE COMMUNITY
AND INFRASTRUCTURE

Legend

X QIK - 1 **SAMPLING STATION LOCATION**

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



1:20,000
January 2006
Project Number: N-O 09439.0

Projection: UTM Zone 20
Datum: NAD83

Prepared by: C. Sheppard

Verified by: M. Paznar



February 2006

2.0 Field Sampling

2.1 Sample Collection

Effluent and surface water sampling by the Hamlet of Qikiqtarjuaq is conducted to provide information for the Hamlet for effective environmental management and to monitor regulatory compliance.

2.1.1 Sampling Location and Frequency

The Monitoring Program of the water license prescribes the specific effluent and surface water monitoring program for the Hamlet. It includes detailed information such as where to take samples, how often to take samples and what parameters will be analyzed on the collected samples. The proposed Monitoring Program is summarized in Table 1.

Table 1: Surveillance Network Program for Water License NWB3Q1K0106

Station	Description	Frequency	Analysis Requirements
QIK -1	Raw water supply intake at the Tulugak River	Monthly from May to August prior to refilling reservoir	Measure volume of water drawn from river • Total Ammonia-N • Total Organic Carbon (TOC) • Total Suspended Solids • Chloride (Cl) • Nitrate (N) • Total Arsenic (As) • Total Chromium (Cr) • Total Copper (Cu) • Total Lead (Pb) • Total Mercury (Hg) • Total Sodium (Na) - Microbiological • Heterotrophic plate count (HPC) • Coliform • Colour • pH • Turbidity • Nitrite (N) • Sulphate (SO₄) • Total Cadmium (Cd) • Total Cobalt (Co) • Total Iron (Fe) • Total Manganese (Mn) • Total Nickel (Ni) • Total Zinc (Zn) • Background • Escherichia coli (E.coli)

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Station	Description	Frequency	Analysis Requirements
QIK - 2	Raw water supply intake at the reservoir truck fill station	Monthly from May to August	Measure volume of water drawn from reservoir
QIK - 3	Raw sewage from pump out truck	Monthly from May to August	Amount deposited to lagoon
QIK - 4	Discharge from the FINAL DISCHARGE POINT OF SEWAGE DISPOSAL FACILITIES	Monthly during periods of flow	• 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
QIK - 5	Runoff from the Solid Waste Disposal Facility	Monthly during periods of flow	Same as STN QIK - 4

The sampling stations will be clearly identified in the field by posted signs. All signs shall be in the Official Languages of Nunavut, and shall be located and maintained to the satisfaction of an Inspector. Each sampling location must have their Global Positioning System (GPS) coordinates determined. Table 2 provides an estimate of the GPS coordinates based on the satellite imagery shown in Figure 2. These locations must be confirmed by the Inspection, and the coordinates updated if necessary.

Table 2: GPS Locations of SNP Sampling Stations

Station	GPS Coordinates (Easting, Northing)
QIK - 1	458912, 7493383
QIK - 2	458740, 7493463
QIK - 3	458962, 7495017
QIK - 4	458091, 7495340
QIK - 5	458754, 7495176

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Samples shall be taken at the same location on each sampling occasion, unless the Inspector has approved a new location.

Additional sampling and analysis may be requested by an Inspector.

Note: The License also describes the sampling station QIK-1 as the raw water supply prior to treatment. The Hamlet is not required to take samples at this site to comply with the water license. Samples for QIK-1 shall be taken by the Indian and Northern Affairs Canada (INAC) and/or GN Environmental Health Office (EHO).

2.1.2 Sample Planning

To understand what sample containers, sampling techniques, and preservation methods are required, Hamlet personnel first need to understand what parameters will be analyzed in the laboratory. Table 3 is a summary of parameters required in the License, which are grouped according to their different sampling requirements:

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Table 3: Parameters Examined in NWB Water Licenses

Group	Description	Parameter
I	Microbiological	Biological Oxygen Demand (BOD) Fecal Coliform (FC)
II	General Water Chemistry	pH Conductivity Total Alkalinity Total Suspended Solids (TSS) Ammonia Nitrogen (NH ₃ -N) Nitrate-Nitrite (NO ₃ -NO ₂) Oil and Grease (OGG) (Visual) Sulphate (SO ₄) Sodium (Na) Total Organic Carbon (TOC) Potassium (K) Magnesium (Mg) Calcium (Ca) Total Hardness Chloride (Cl)
	Total Metals (except Mercury):	Total Nickel (Ni) Total Aluminum (Al) Total Arsenic (As) Total Cadmium (Cd) Total Copper (Cu) Total Cobalt (Co) Total Chromium (Cr) Total Iron (Fe) Total Lead (Pb) Total Manganese (Mn) Total Zinc (Zn)
III		Total Mercury (Hg)
IV		Total Phenols (Total-P)

It is strongly recommended that the Hamlet seek advice for the sizes and types of buffers required for analysis of the parameters required. Furthermore, it is recommended that the laboratory pre-fill the sample collection bottles with the proper preservative to minimize error in the field.

All of the samples taken will be grab samples. Samples will normally be taken from natural lakes, streams, treatment ponds, or process streams. Where possible, samples

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shall be taken from just below the surface to avoid floating debris, which may contaminate the sample.

Freshwater Streams, Surface Drainage, and Wetlands

The samples shall be collected as close to the middle of the stream where water flows freely and is free of debris. After getting into position, the sampler shall wait to allow any stirred sediment that occurred from entering the stream to settle or wash away. The sample bottle shall be partially filled with the water to be sampled and rinsed with the lid in place at least three times. Rinse water shall be emptied downstream of the sampling point, so that stream sediments remain undisturbed. **Prior to sampling for oil/grease, bacteria, and for any bottles containing preservative, the bottles shall not be rinsed.**

If possible, bottles shall be plunged into the stream to a depth of approximately half the total stream depth, and allow it to fill with the mouth of the bottle facing upstream. Where stream is too shallow to allow for sample bottle to be filled completely, without disturbing bottom sediment of the streambed. The sampler may use a smaller container that has been properly rinsed to transfer sample to the larger bottle. Do not use a smaller sample bottle containing preservatives.

When taking the sample, sufficient room shall be left to allow for the addition of preservatives, if required.

Lakes or Ponds

Surface sampling shall be collected using the same procedures as streams. Sample bottles shall be plunged to approximately 150 mm (6 inches) below the water surface.

Although not currently required under the Monitoring Program, information on water quality at various depths in lakes or ponds may be required. If an Inspector requests that this sampling be carried out, specific procedures shall be implemented in accordance with accepted sampling and good engineering practice.

Process Streams

When sampling a process stream (i.e. valve or pipe discharge) the sampler shall collect a grab sample or a set of composite samples collected over an extended period of time. In the case of sampling from a valve, valves shall be open and running for a least one-minute before taking the sample to ensure that a representative sample of the process stream is taken.

2.1.3 Sample Container Selection

Sample containers vary in size and material of construction depending on the specific type of analysis to be conducted. Sample containers for each analysis are shown in Table

February 2006

2. Sample containers to be used shall be obtained directly from the laboratory, which shall provide new containers to the Hamlet specific for the sampling program requested by the Hamlet. The laboratory will provide the correct sizes and types of bottles based on the parameters required. The Hamlet shall **contact the laboratory at least one month prior to sampling event** in order to ensure that containers are available for sampling. Refer to Section 1.3 for laboratory contact information.

2.1.4 Field Sampling Log

The individual collecting the water sample shall record the following at the time of sampling:

- Date of sampling
- Time of sampling
- Weather conditions
- Monitoring Station Number (i.e. QIK-2, QIK-3, QIK-4, etc.)
- Results of any Field measurements
- Sampler shall also indicate if sample used preservatives
- Any unusual conditions
- Any deviation from standard procedures.

2.1.5 Field Measurements

No field measurements are required as part of the Hamlet sampling program, however, it is strongly recommended that the following parameters be sampled immediately on site using appropriate portable field equipment:

- pH
- Temperature
- Dissolved oxygen
- Total alkalinity
- Turbidity
- Chlorine residuals.

It is important that separate equipment be used to sample between potable water and non-potable water (i.e. surface water). Furthermore, all instruments, glassware, etc. should be cleaned between each sample following manufacturer's recommended guidelines and/or BMPs.

2.1.6 Sampling Procedures

The sampling procedures described in Table 4 shall be used to collect water samples appropriate to the sampling location.

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Table 4: General Procedures for Sample Collection

	BIOLOGICAL	PHYSICAL	INORGANIC	ORGANIC
Phase 1: Sample Program Design	Step 1: Choose sample locations, sample frequency, and analytes to be measured Step 2: Contact laboratory used for analysis and get advice and information for sampling program Step 3: Contact manager of sample location facility; determine all safety requirements Step 4: Create sample identification system			
Phase 2: Sample Program Preparation	Step 1: Obtain sample containers, storage containers, distilled water, Personal Protective Equipment (PPE), and other required equipment Step 2: Create sample labels and apply to sample containers Step 3: Plan first sampling event - arrange all transportation and notify laboratory			
	• 1000 mL plastic or glass container for BOD • 300 mL plastic or glass container for fecal coliform	• Have equipment needed for any flow or temperature measurements • 200 mL plastic or glass container for suspended solids	• Electrode meter for dissolved oxygen and pH • 1000 mL nitric acid rinsed container, nitric acid for preservation, and filter for metals • Specific containers and preservatives for nutrients or other analytes	• 1000 mL plastic or glass container, hydrochloric or sulfuric acid, for oil and grease
Phase 3: Sample Collection	Step 1: Keep sample containers closed until used Step 2: Record the date, time, location, geographic position, weather conditions, and other details in a field notebook at each sample location Step 3: Fill out the sample label, including: sample ID, location, date, time, and name of sample collector Step 4: Collect sample using appropriate container, by filling without rinsing, immediately close and keep cool Step 5: Pack all samples and provide a sample information sheet listing all contents in the storage container Step 6: Label the storage container with the recipient, WATER SAMPLES, FRAGILE, THIS END UP, and any TDG or WHMIS labels required			
	• BOD - fill container completely and refrigerate, Fecal coliform - leave space at top of container, refrigerate • Maximum storage time: BOD - 24 hrs, Fecal Coliforms - 30 hrs,	• TSS - Refrigerate • Maximum storage time: TSS - 7 days, temperature - 0.25 hrs	• Fill container and leave a small (1% of volume) air space at the top, refrigerate • Maximum storage time: ammonia - 7 days, nitrate and phosphate - 48 hrs, metals - indefinite, DO and pH - 0.25 hrs	• Fill container to top and refrigerate • Maximum storage time: oil and grease - 28 days
Phase 4: Sample Transportation	Step 1: Fill out the "sampler" portion of the Chain of Custody form Step 2: Ensure that all personnel handling the samples fill out a subsequent section of the Chain of Custody form Step 3: Transport the samples to lab for analysis as quickly as possible Step 4: Verify that the lab has received the samples and analysis is underway			

Note: Sizes and types of sample collection containers (bottles) are a suggestion only. The laboratory may suggest and use other sizes and types. Follow the suggestions of a CAEAL accredited laboratory.

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2.1.7 Sample Identification

All samples collected are to be labeled according to standard identification procedures (Name of sampler, time and date of sampling, sample identifier, sampling method and type of sample). **Sample labels shall be water-resistant, and prepared prior to going into the field.** An example of a typical Label is provided in Figure 3.

Figure 3: Example of Water Sample Label

Name of Sampler:	Gill Evans	Sample #:	1 of 15
Date of Collection:	1 May 2006 (0900 hrs)		
Type of Sample:	Grab Water Sample for Microbiological Analysis		
Parameter to be analyzed:	BOD		
Preservation method used:	no preservatives		
Temperature:	11°C	pH:	7.04
Sample Location:	QIK-4		
	Hamlet of Qikiqtarjuaq		
	Qikiqtarjuaq, NU		
	Phone: (867) 927-8943		

2.1.8 Sample Preservation

To obtain good results from a sampling program, time is critical. All samples are to be shipped to the Laboratory that has been contracted to carry out the analysis the same day as they are collected. Samples must be protected from breakage, and shall be shipped in an insulated cooler that can be provided by the Laboratory. **If samples cannot be shipped until the next day, due to unavoidable events such as weather or mechanical problems with transport aircraft, all samples must be stored in a refrigerator at 4°C.** Samples must not be frozen.

In all cases where samples cannot be delivered to the lab on the same day, specific preservatives must be added to the samples to prevent chemical changes that may alter the concentration of the parameters of interest. The samples must be preserved within two hours of sampling. Usually, samples can be preserved away from the field at the end of the site visit. In most cases, the laboratory can fill the bottles with preservative, and then ship them to the Hamlet to be filled and sent back for analysis.

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For the Hamlet of Qikiqtarjuaq, Table 5 provides the appropriate preservation methods for the parameters to be assessed.

Table 5: Sample Preservation

Type of Sample	Preservation Required
Group I Microbiological	Store in refrigerator at 4°C. Ship to Lab the same day as collected
Group II General Water Chemistry	Store in refrigerator at 4°C. Ship to Lab the same day as collected
Group II Total Metals (except mercury)	Acidify with 5 mL of <20 percent nitric acid. Store in refrigerator at 4°C. Ship to Lab the same day as collected
Group III Total Mercury	Acidify with 2 mL of 1:1 sulfuric acid and 5 percent potassium dichromate Store in refrigerator at 4°C. Ship to Lab the same day as collected
Group IV Total Phenols	Acidify with 4 mL of 1:1 sulfuric acid. Store in refrigerator at 4°C. Ship to Lab the same day as collected

Note: 1000 mL = 1 Liter

2.1.9 Sample Transportation

The main objective of the sampler is to minimize any chemical changes to the sample between the time it is collected and delivery to the laboratory. Heat, light and agitation can all impact the water chemistry and the samples shall be protected from these effects.

Effluent and surface water samples shall be stored and transported at a temperature of 4°C. Coolers and ice packs need to be available and are usually provided by the laboratory. Upon arrival at the laboratory, samples shall be refrigerated as soon as possible.

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3.0 Quality Control

Most commercial laboratories undertake QA/QC procedures with the volume of sample sent for analysis. Reports are usually provided with the Certificates of Analysis. It is recommended that the suggested QA/QC protocols by the laboratory be followed.

To ensure that the monitoring program maintains accepted quality control, field blanks and duplicate samples may be suggested by the laboratory. These samples are collected and analyzed for the sample parameters as the monitoring program in the license as part of a quality control check on monitoring activities.

The Field Blanks shall accompany the sampler into the field, labeled as field blanks, preserved in the field and submitted to the laboratory with the field samples.

3.1 Replicate or Duplicate Samples

Replicate or duplicate samples is the collection of more than one sample for a given sampling station subject to specific analysis. Standard procedures used for the routine sampling shall be applied. The replicate or duplicate samples are useful in identifying problems with accuracy and sampling methods.

Once per operating season for each active monitoring station a set of duplicate samples will be taken, representing as many of the routine analysis as possible. Where possible this shall be carried out in conjunction with the sampling undertaken by an INAC Inspector.

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4.0 Laboratory Analysis/Reporting

The laboratory will perform the analysis of all samples as outlined in the License. The results shall be received by the Hamlet within the time frame agreed to with the laboratory. The results shall be submitted the NWB for review with the Annual report. The results shall contain the limits of Detection used for analysis of each parameter as supplied by the laboratory.

The Hamlet may request clarification of the Analysis be contacting the NWB Technical Advisor and a review of the analysis will be provided upon request.

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5.0 Glossary

Quality Assurance (QA): is the definitive program for laboratory operation that specifies the measures required to produce defensible data of known precision and accuracy. QA includes quality control and quality assessment activities.

Quality Control (QC): is a set of measures within a sample analysis methodology to assure that the process is in control.

Quality Assessment: is a process to determine the quality of the laboratory measurements through internal and external QC evaluations. It includes performance evaluation samples, laboratory inter-comparisons samples and performance audits.

Quality Assurance/Quality Control Plan for Hamlet Water Reservoir, Sewage Lagoon, and Solid Waste Disposal Facility Monitoring Program, Hamlet of Qikiqtarjuaq, Nunavut

February 2006

6.0 References

Nunavut Water Board. *Water License NWB3QIK0106*. Gjoa have, Nunavut.

Wilson, Neal. 1995. *Soil Water and Ground Water Sampling*. CRC Press: New York, USA.

J:\2006\F\NUNA\08983\Reports\Quality Assurance Quality Control\Report.doc



Appendix A

Contact Information

APPENDIX A

Contact Information

Nunavut Water Board Contact:

Technical Advisor
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU X0B 1J0
Telephone: (867) 360-6338
Fax: (867) 360-6369
Email: srtech@nwb.nunavut.ca

Inspector Contact:

Water Resources Manager
Nunavut District, Nunavut Region
Department of Indian and Northern Affairs Canada
P.O. Box 100
Iqaluit, NU X0A 0H0
Telephone: (867) 975-4550
Fax: (867) 979-6445

Analyst Contact:

Laboratory Manager
Taiga Laboratories
Department of Indian and Northern Affairs Canada
4601 - 52 Avenue, P.O. Box 1500
Yellowknife, NT X1A 2R3
Telephone: (867) 669-2780
Fax: (867) 669-2718



Appendix B
Notification of Laboratory Form

APPENDIX B
Notification of Laboratory Form

Attention: Technical Advisor
Nunavut Water Board

Re: Notification of Laboratory
Water License NWB3QIK0106

Dear Sir/Madame,

The following CAEAL-certified laboratory has been retained by the Hamlet of Qikiqtarjuaq to complete the sample analysis required by Water License NWB3QIK0106:

Name of Laboratory : _____

Address : _____

: _____

: _____

Phone # : _____

Fax # : _____

Regards,

Name (print) : _____

Signature : _____ Date : _____

Please send this form, once completed, to the Nunavut Water Board at the following address:

Nunavut Water Board
c/o Technical Advisor
PO Box 119
Gjoa Haven, NU X0B 1J0
Telephone: (867) 360-6338
Fax: (867) 360-6369
Email: srtech@nwb.nunavut.ca

Appendix C
Annual Report for the
Hamlet of Qikiqtarjuaq

APPENDIX C
Annual Report for the Hamlet of Qikiqtarjuaq

Year Being Reported: _____

The following information is compiled pursuant to the requirements of Part B, Item 1 of Water License NWB3QIK0106 issued to the Hamlet of Qikiqtarjuaq.

Tabular summaries of all data generated under the Monitoring Program, monthly and annual quantities in cubic meters of freshwater obtained from all sources, monthly and annual quantities in cubic meters of each and all wastes discharged.

Attached to this document are results for Monitoring Station QIK-1, QIK-2, QIK-3, QIK-4, and QIK-5 as well as detailed chemical, physical, and biological analysis required at QIK-2 and QIK-5 (for the months of May to August, inclusive).

Month Reported	Quantity of Water Obtained From all Sources (m³)	Quantity of Sewage Waste Discharged (m³)
January		
February		
March		
April		
May		
June		
July		
August		
September		
October		
November		
December		
Annual Total		

Please indicate volumes in cubic meters – 1 cubic meter equals 1,000 liters.

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

A list of unauthorized discharges and summary of follow up action taken.

A summary of any abandonment and restoration work completed during the year, and an outline of any work anticipated for the next year.

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.

Any other details on water use or waste disposal required by the Board by November 1st of the year being reported.

Updates or revisions to the approved Operation and Maintenance Plans.

Additional information that the licensee deems useful.

Follow up regarding inspection/compliance concerns.

Appendix I
Cost Estimate Tables

SCHEDULE OF UNIT PRICES

Nuna Burnside Engineering and Environmental Ltd.

Project No. N-O 09439.0

Page No. 1

Contractor:

Address:

Hamlet of Qikiqtarjuaq

Contract Title:

Improvements to the Water Reservoir, Sewage Lagoon & Solid Waste

SCHEDULE A - MISCELLANEOUS ITEMS

ITEM NO.	DESCRIPTION	CONTRACT QUANTITY	UNIT	UNIT PRICE	CLASS B COST TOTAL
1	Mobilization/Demobilization (assume equipment is available within the Hamlet)	1	LS	\$50,000.00	\$50,000.00
2	Bonding & Insurance	1	LS	\$30,000.00	\$30,000.00
3	Construction Camp	1	LS	\$200,000.00	\$200,000.00
				SUBTOTAL:	\$280,000.00

SCHEDULE OF UNIT PRICES

Nuna Burnside Engineering and Environmental Ltd.

Project No. N-O 09439.0

Page No. 2

Contractor:

Address:

Hamlet of Qikiqtarjuaq

Contract Title:

Improvements to the Water Reservoir, Sewage Lagoon & Solid Waste

Schedule B - Water Reservoir

ITEM NO.	DESCRIPTION	CONTRACT QUANTITY	UNIT	UNIT PRICE	CLASS B COST TOTAL
	<u>PHASE 1</u>				
1	Electrical upgrades	1	LS	\$17,000.00	\$17,000.00
2	Replace reservoir intake pipe	1	LS	\$50,000.00	\$50,000.00
3	Replace river intake pipe	300	m(l)	\$200.00	\$60,000.00
4	Supply & place liners	20,000	m ²	\$40.00	\$800,000.00
5	Supply & place screened gravel	4,500	m ³	\$90.00	\$405,000.00
6	Replace gate, misc. fence repairs to existing	1	LS	\$2,500.00	\$2,500.00
7	Supply & place extended fencing	210	m(l)	\$50.00	\$10,500.00
7	Replace truck fill pumps	2	Ea	\$10,000.00	\$20,000.00
8	Signage	1	LS	\$3,000.00	\$3,000.00
9	Construct Berm (assumed borrow area within 50 m)	30,000	m ³	\$20.00	\$600,000.00
	<u>PHASE 2</u>				
10	Excavate & dispose of internal berm	15,000	m ³	\$20.00	\$300,000.00
				SUBTOTAL:	\$2,268,000.00

SCHEDULE OF UNIT PRICES

Nuna Burnside Engineering and Environmental Ltd.

Project No. N-O 09439.0

Page No. 3

Contractor:

Address:

Hamlet of Qikiqtarjuaq

Contract Title:

Improvements to the Water Reservoir, Sewage Lagoon & Solid Waste

SCHEDULE C - SEWAGE LAGOONS

ITEM NO.	DESCRIPTION	CONTRACT QUANTITY	UNIT	UNIT PRICE	CLASS B COST TOTAL
1	Granular 'A' for truck pad	40	m ³	\$100.00	\$4,000.00
2	Supply & place discharge flume	1	LS	\$10,000.00	\$10,000.00
3	Supply & place effluent discharge piping				
	i). Valves with sealed tube (200 mm) operators	1	LS	\$10,000.00	\$10,000.00
	ii). Piping (200 mm)	230	m(l)	\$150.00	\$34,500.00
4	Supply & place signage	1	LS	\$5,000.00	\$5,000.00
5	Exfiltration berm	180	m(l)	\$20.00	\$3,600.00
6	Berm construction (balance cut/fill)	25,000	m ³	\$20.00	\$500,000.00
				SUBTOTAL:	\$567,100.00

SCHEDULE OF UNIT PRICES

Nuna Burnside Engineering and Environmental Ltd.

Project No. N-O 09439.0

Page No. 4

Contractor:

Address: Hamlet of Qikiqtarjuaq

Contract Title: Improvements to the Water Reservoir, Sewage Lagoon & Solid Waste

SCHEDULE D - SOLID WASTE

ITEM NO.	DESCRIPTION	CONTRACT QUANTITY	UNIT	UNIT PRICE	CLASS B COST TOTAL
	<u>PART 1: HOUSEHOLD HAZARDOUS WASTE DEPOT</u>				
1	40 mil HDPE Arctic Liner installed	350	m ²	\$40.00	\$14,000.00
2	Signage	2	Ea	\$2,000.00	\$4,000.00
3	Berm construction (1m high with 3:1 slopes) and surface preparation	225	m(l)	\$30.00	\$6,750.00
4	Fencing (1.8 m frost fence with poles) on berm	68	m(l)	\$50.00	\$3,400.00
5	Swing gates (1.8 m high fence to provide 3 m wide opening)	1	LS	\$1,000.00	\$1,000.00
6	Rehabilitate 10 m shipping container with liner and spill barrier (2 m x 10 m) installed	20	m ²	\$40.00	\$800.00
7	Shelving and vents for shipping container	1	Ea	\$1,000.00	\$1,000.00
8	Spill kit, fire extinguisher, emergency kit and tools	1	Ea	\$1,000.00	\$1,000.00
	<u>PART 2: BULKY METALS DISPOSAL AREA</u>				
9	Signage	1	Ea	\$1,000.00	\$1,000.00
10	Compact and cover exposed metals, contour area to promote drainage (final cover to 600 mm, interim cover to 200 mm)	2,000	m ²	\$30.00	\$60,000.00
	<u>Assumptions:</u> up slope ditching is part of landfill costing Cover material extracted from borrow area upslope of the disposal area				
				SUBTOTAL:	\$92,950.00

SCHEDULE OF UNIT PRICES

Nuna Burnside Engineering and Environmental Ltd.

Project No. N-O 09439.0

Page No. 5

Contractor:

Address:

Hamlet of Qikiqtarjuaq

Contract Title:

Improvements to the Water Reservoir, Sewage Lagoon & Solid Waste

SCHEDULE D - SOLID WASTE (CONTINUED)

ITEM NO.	DESCRIPTION	CONTRACT QUANTITY	UNIT	UNIT PRICE	CLASS B COST TOTAL
<u>PART 3: MUNICIPAL SOLID WASTE DISPOSAL SITE</u>					
11	Fencing (1.8 m post and wire) installed on berms (install 330 m and repair 110 m)	300	m(l)	\$50.00	\$15,000.00
12	Fencing (3 m post and wire) installed on down wind berm	100	m(l)	\$75.00	\$7,500.00
13	Sliding gate (1.8 m high fencing)	1	Ea	\$3,000.00	\$3,000.00
14	Signage	3	Ea	\$1,000.00	\$3,000.00
15	Ditching and swale to control run off up gradient of landfill and bulky metals disposal area (1.5 m deep with 3:1 slopes)	800	m(l)	\$40.00	\$32,000.00
16	Supply and install 1200 mm culvert under access road with appropriate bedding and cover	1	LS	\$20,000.00	\$20,000.00
17	Deepen existing swale on east side of access road	1	LS	\$2,000.00	\$2,000.00
18	Deepen existing swale on south side of landfill	1	LS	\$2,000.00	\$2,000.00
19	Cut and fill tipping face of landfill to grades shown on plan such that slopes do not exceed 3:1	1	LS	\$2,000.00	\$2,000.00
20	Create landfill perimeter berm using native soils around outside of landfill	330	m(l)	\$20.00	\$6,600.00
21	Create intermediate berm using native soils within the landfill cell	110	m(l)	\$20.00	\$2,200.00
22	Construct 625 m ² by 1.5 m deep bermed water retention area	1	LS	\$10,000.00	\$10,000.00
	<u>Assumptions:</u> Spill kit and emergency kit costed as part of household hazardous waste depot				
<u>PART 4: DERELICT VEHICLE/RECYCLING AREA</u>					
23	Signage	1	Ea	\$1,000.00	\$1,000.00
				SUBTOTAL:	\$106,300.00



Appendix J
CEAA Environmental Screening Report



Appendix J1

Water Reservoir

Indian and Northern Affairs Canada

Environmental Screening Report

CANADIAN ENVIRONMENTAL ASSESSMENT ACT

This form, when completed in full, constitutes an environmental screening report intended to meet the requirements of s. 16 of the *Canadian Environmental Assessment Act* (CEAA). It contains the following sections:

- 1) PROJECT IDENTIFICATION
- 2) LOCATION OF PROJECT
- 3) PROJECT JUSTIFICATION
- 4) PROJECT DESCRIPTION
- 5) CONSULTATION
- 6) EXISTING ENVIRONMENT
- 7) ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES
- 8) CUMULATIVE EFFECTS ASSESSMENT
- 9) SUMMARY OR ENVIRONMENTAL EFFECTS
- 10) CEAA SCREENING DECISION
- 11) KEY REFERENCES & SOURCES
- 12) LIST OF ATTACHMENTS

The table on Page 2 will be completed by INAC staff. The proponent should complete the sections that follow, starting with "1. PROJECT IDENTIFICATION" on page 3.

Project Reference	
Section 5 Triggers	Please identify the reason(s) for INAC involvement: • <i>CEAA</i> s. 5.1(a) proponent • <i>CEAA</i> s. 5.1(b) funding • <i>CEAA</i> s. 5.1(c) granting an interest in land • <i>CEAA</i> s. 5.1(d)** regulatory function ----- **If a 5.1 (d) trigger, please specify the trigger, as per <i>Law List Regulations</i>: • <i>Indian Act</i> subsection 18(2) • <i>Indian Act</i> subsection 28(2) • <i>Indian Act</i> paragraph 58(4)(b) • <i>Indian Act</i> subsection 35(1) • <i>Indian Act</i> subsection 39(1) • <i>Indian Mining Regulations</i> subsection 5(2) • <i>Indian Mining Regulations</i> subsection 6(1) • <i>Indian Reserve Waste Disposal Regulations</i> section 5 • <i>Indian Timber Regulations</i> subsection 5(1) • <i>Indian Timber Regulations</i> section 9 • <i>Indian Timber Regulations</i> subsection 22(1)
FEAC ¹ ("LEAD RA")	
Other RAs	
Expert FAs	
Project also subject to a provincial EA: YES/NO - (if YES, provide details)	
CEAR ² Reference #	
Env. Officer	
Reviewing Officer	
RCM & Directorate	

¹ FEAC - Federal Environmental Assessment Coordinator

² CEAR - Canadian Environmental Assessment Registry

1) PROJECT IDENTIFICATION

Location:	Hamlet of Qikiqtarjuaq, Nunavut
Project Title:	Improvements to Water Reservoir.
Project proponent(s):	Government of Nunavut, Community and Government Services

2) LOCATION

Detailed Location: <i>If project is not on reserve, specify latitude and longitude coordinates, and nearest town, highway, lake, etc.</i>	Broughton Island, Nunavut located on the eastern coast of Baffin Island, 470 kilometres northeast of Iqaluit. Approximately 566 residents. 67°33' north latitude and 64°02' west longitude. Project is on Hamlet land.

☐ YES ☐ All or part of the project is OFF Reserve Land (YES/NO)

Definition of Project Area <i>The geographical extent of the project, and those areas affected during construction and operation. For example:</i> - key transportation routes for equipment and materials - staging & refueling areas - main activity/construction site, traffic routes, etc.	The community now draws its water from the Tulugak River, which flows in the northwest direction towards Davis Strait. The water is transported to the reservoir using a gravity fill pipe. The water is stored in a storage reservoir located to the east of the main community and south of the access road. The preferred water supply and storage reservoir option for this community involves deepening and expanding the existing reservoir away from the truck filling station (to the northwest). Therefore most of the work will take place in the immediate vicinity of the existing reservoir. The access route will remain the same as it is currently (water reservoir access roadway). (There is a roadway that is used to truck water from the existing reservoir to the community). It is assumed that refueling will take place at the existing fuel depot, in the main community.

Adjacent Land: <i>Land use and description to the North, East, South, and West of project</i>	N: There is a soil/borrow pit approximately 500 m to the north. The solid waste disposal area is approximately 1500 to the north. Remaining areas are vacant, undisturbed tundra.
	E: The Tulugak River flows northwesterly approximately 100 m south of the existing reservoir and proposed expansion. Remaining areas are vacant, undisturbed tundra.
	S: Vacant, undisturbed tundra.
	W: Vacant undisturbed tundra. The main community of Qikiqtarjuaq is more than 2 kilometres west of the site.

3) PROJECT JUSTIFICATION

Need for the Project:

Rationale: e.g. what problem is the project going to solve or what opportunity is the project going to provide?

There are deficiencies in the existing water supply system that services the Hamlet of Qikiqtarjuaq. The existing reservoir is too small to meet demands for the next 20 years.

Purpose of the Project:

What is going to be achieved by carrying out the project?

Ample safe drinking water will be made available to the community for a 20-year planning period.

Alternatives Considered:

Different ways to meet the project need and achieve the project purpose

Several options were considered:

- null option, not a viable solution due to existing system deficiencies
- deepen and expand existing reservoir on all four sides (more expensive than expansion on one side)
- deepen and expand the existing reservoir on one side (least expensive option that can meet future demands)
- construct a second reservoir at this location or another location (most costly alternative).

4) PROJECT DESCRIPTION

Proposed Start Date:

(year-month-day, if known)

July 2006

Estimated Completion Date:

October 2007

Estimated Total Cost:

Approximately \$1,500,000

Description of Project:
(attach/reference supporting material as required)

The preferred alternative has been selected. This option consists of pushing the berm out on one side of the reservoir and deepening it in order to increase its capacity to ensure that the water supply for this community accommodates future growth. The tasks required to undertake this project include:

- deepen the reservoir approximately 1 m
- push out 1 berm approximately 12 m
- extend the slope stabilization system
- replace of existing fuel tank
- electrical upgrades
- install, replace intake pipe
- fencing
- inspect/repair generators
- 2 metre wide berms surrounding the reservoir
- grade reservoir walls
- place 2 geotextile liners separated by crushed stone
- geomembrane liner
- install new double intake pipe.

**Project Management Team
Members & Affiliation**

Mr. Brian Duguay, Project Officer, Community and Government Services, Baffin Region
Nuna Burnside Engineering and Environmental Ltd., Mike O'Hara, P.Eng.
Lootie Toomasie, Mayor of Qikiqtarjuaq

5) CONSULTATION

(a) Government Departments, Agencies, Non-Governmental Organizations, Community Councils, etc.

Department, Agency, or Organization:	Contact Person & Telephone Number:	Nature of Consultation & Response Received:
Community and Government Services, Baffin Region	Brian Duguay, Project Officer	Was provided a copy of the Schematic Design Report identifying options available to meet the community's needs. Discussed and identified preferred alternative.
Community council and public works	Lootie Toomasie, Mayor	Held two meetings: July 8, 2005 and September 14, 2005 meeting minutes recorded. Approved the Schematic Design.

(b) Public Consultation, including Community Members

Public Consulted:	Method Used:	Date:	Details/Issues Raised:
Residents	Meetings with Hamlet and Hamlet public works staff	July 8 Sept 14, 2005.	The Hamlet residents concerns and comments were expressed through council. Concerns regarding water supply quantity and inability of existing system to meet demands.

6) EXISTING ENVIRONMENT

COMPONENT	DESCRIPTION <i>(describe features; indicate sensitivity to disturbance)</i>
6.1 PHYSICAL FEATURES - VALUED ECOSYSTEM COMPONENTS	
Topography/Terrain: <i>(hilly, flat)</i>	The area is generally flat in the vicinity of the reservoir as well as toward the community and Davis Strait. Further inland the terrain becomes more hilly.
Soil and Geology: <i>(soil type, quality and use; bedrock geology)</i>	Test pitting on site found the overburden to consist of coarse sand and gravel, with cobbles and small boulders. The underlying bedrock is described as felsic and rare mafic plutonic rock. The bedrock was not encountered during the field investigations. Permafrost was typically encountered at a depth of 2 m.
Surface Water: <i>(presence & quality)</i>	The Tulugak River flows northwesterly towards Davis Strait. It is approximately 100 south of the reservoir. The reservoir draws water from this river. The water quality is good. The river freezes completely during the winter.
Distance to Water:	<i>(from project area/activity, in metres):</i> approximately 100 m to the Tulugak River. In the winter the nearest water is the Ocean.
Aquatic Sediment/Substrate: <i>(type & quality)</i>	Not known
Groundwater: <i>(local use & quality)</i>	Groundwater not used. The entire area is permafrost below 2.0 m..
Air Quality: <i>(local air quality)</i>	Good.

COMPONENT	DESCRIPTION <i>(describe features; indicate sensitivity to disturbance)</i>
6.2 BIOLOGICAL FEATURES - VALUED ECOSYSTEM COMPONENTS	
Vegetation: <i>(e.g. forest, ground cover, aquatic plants)</i>	The existing facilities are located within areas of disturbed tundra that are covered in cobble, sand and gravel. Very limited amounts and diversity of vegetation are present on these sites. Small areas of undisturbed tundra will be disturbed to accommodate the proposed facilities. These areas are also sparsely vegetated.
Wetlands: <i>(e.g. fens, swamp)</i>	The preliminary review did not identify any existing wetlands in the Study Area, although the estuary of the Tulugak River to the west of the Study Area may contain some wetland characteristics.
Fish & Fish Habitat: <i>(types of habitat and common species found)</i>	The Tulugak River freezes solid in the winter months therefore it is not a fish habitat most of the year. Davis strait however is a significant habitat for many species. It is more than two kilometers from the site and will not be affected by this development. Fishing for char (<i>Salvelinus alpinus</i>) is an important part of daily life. Char is likely the primary fish species being harvested in the area. It is not expected that fish are present in the Tulugak River in the summer months.
Migratory Birds: <i>(e.g. waterfowl, songbirds)</i>	Several species of shorebirds and waterfowl are likely to be found in the general area, although it is unlikely that birds use the Study Area for nesting or staging given the limited amount of suitable habitat on the site. Greater concentrations of birds, both in terms of diversity and densities, are found in the two Important Bird Areas to the east of Qikiqtarjuaq (see Special Habitat Areas below).
Other Fauna: <i>(mammals/amphibians reptiles/insects; game & protected species)</i>	Qikiqtarjuaq is located in Davis Strait off the east coast of Baffin Island. This rocky area is rich in marine mammal wildlife. Right Whale, Ring and Harp Seals, Beluga Whales, Narwhal, Walrus and Killer Whales all inhabit the waters off Qikiqtarjuaq, away from the study area. Hunting and fishing are still important parts of daily life in this area. Locals hunt Seals, Narwhal and Walrus, although this takes place some distance from the community of Qikiqtarjuaq, and away from the Study Area. Local people have been reported to consume a variety of terrestrial species including polar bear (<i>Ursus maritimus</i>) and, more rarely, carnivores such as arctic wolves (<i>Canis lupus arctos</i>) and arctic fox (<i>Alopex lagopus</i>). Musk ox (<i>Ovibos moschatus</i>) and Barren Ground Caribou (<i>Rangifer tarandus groenlandicus</i>) also have historic ranges that include the area, and are likely hunted by local people. Local people indicate these species do not frequent the Study Area. None of these species have status under the Species At Risk Act (SARA).

COMPONENT	DESCRIPTION (<i>describe features; indicate sensitivity to disturbance</i>)
6.2 BIOLOGICAL FEATURES - VALUED ECOSYSTEM COMPONENTS	
Special Habitat Areas (<i>specially designated or protected habitats</i>)	No special habitat areas were identified in the Study Area during the preliminary review. Two Important Bird Areas (IBAs) were identified to the east of Qikiqtarjuaq. The first of these, Cape Searle, is located approximately 80 km east of Qikiqtarjuaq. The second, Reid Bay, is located approximately 125 km east of Qikiqtarjuaq. Species of interest that have been recorded from these IBAs include: Northern Fulmar (<i>Fulmarus glacialis</i>), Glaucous Gull (<i>Larus hyperboreus</i>) and Black Guillemots (<i>Cepphus grille</i>) from Cape Searle; and, Black-legged Kittiwake (<i>Rissa tridactyla</i>), Iceland Gull (<i>Larus glaucoides</i>), Thick-billed Murre (<i>Uria lomvia</i>), Glaucous Gull, Northern Fulmar and Black Guillemots from Reid Bay. The Canadian Wildlife Service (CWS) has been trying to establish protection for the seabird colonies at Cape Searle and Reid Bay since the mid 1980s. In May 2000, the community of Qikiqtarjuaq and the CWS agreed to proceed on work to create these new NWAs. Information on the two IBAs is available at: http://www.bsc-eoc.org/iba/regional.jsp?region=NWT
Species at Risk	No Species at Risk have been identified in close proximity to the Study Area. No threats to Species at Risk have been identified. See sections above.

COMPONENT	DESCRIPTION <i>(describe features; indicate sensitivity to disturbance)</i>
6.3 SOCIO-CULTURAL FEATURES – VALUED ECOSYSTEM COMPONENTS	
Sensitive Areas: <i>(e.g. residential zones, parkland, hospitals, schools)</i>	The reservoir is more than 2 kilometres from the main community. There are no known sensitive areas near the site.
Human Health and Safety: <i>(any persons whose health and safety may be affected by the construction and operation of the project)</i>	The reservoir is more than 2 kilometres from the main community therefore it is not likely to affect human health and safety. Improving the water supply system for the community will result in improved human health.
Traditional Land Use Activities: <i>(e.g. trapping, fishing, medicinal plant collection, ceremonial grounds)</i>	The area is already occupied by the existing reservoir therefore its expansion is not expected to cause an effect on traditional land use activities. Hamlet staff indicate the study area has no traditional land uses.
Aesthetics: <i>(general character of the surrounding area; and if the project is compatible)</i>	There is already a reservoir in this area and the project is removed from the main community therefore aesthetics are not an issue. The area has been designated by the Hamlet for use as a water reservoir.
Archaeological Resources: <i>(recorded, or potential)</i>	The area is removed from the main community and the site has already been developed Hamlet staff indicate there are no known archaeological resources in the study area.
Special Designations: <i>(parks, protected areas)</i>	There are no known areas with special designations in the vicinity of the or proposed reservoir expansion.

7) ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES – SUMMARY

The next table summarizes the following:

(A)	List of Project Activities
	Key project activities associated with construction, operation, maintenance and decommissioning , if applicable. Includes locations, scheduling details, and estimates of magnitude and scale.
(B)	Potential Environmental Effect(s) associated with each project activity.
	<i>An Environmental Effect is defined as:</i>
	i) any <u>change that the project may cause in the environment</u> , Including any effect of any such change on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes, or on any structure, site, or thing that is of historical, archaeological, paleontological or architectural significance; and ii) any <u>change to the project that may be caused by the environment</u> . (Example: ice break-up damaging a bridge or dock; freezing and bursting of unprotected water lines.)
(C)	Mitigation Measures
	<i>A Mitigation Measure is:</i>
	i) an action or provision made that will <u>eliminate, reduce or control the adverse environmental effects of the project</u> , and may include restoration, compensation or replacement of any damages or impacts.
(D)	Determination of Significance
	A determination of the significance of the environmental effects, taking into account appropriate mitigation measures if applicable. Mitigation measures are intended to prevent or reduce any potentially negative effects. The abbreviations used are:
	N/S - effect not significant, or rendered insignificant with mitigation SP - significant positive effect SN - significant negative effect U - outcome unknown or cannot be predicted, even with mitigation.

ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES - SUMMARY				
(A) Key Project Activities		(B) Potential Environmental Effect(s)	(C) Mitigation Measures	(D)
1	Clearing and grubbing of expansion area and areas to be disturbed	a) Minor loss of vegetation b) Minor potential for soil erosion	a) Area cleared is small. b) Can prevent by limiting maximum area to be exposed, limiting delays, providing temporary drainage and buffers between project area and water bodies	N/S
2	Permanent replacement of reservoir fill pipe	a) Negligible loss of vegetation b) Minor potential for soil erosion c) Noise	a) Area cleared is very small. b) Can prevent by limiting maximum area to be exposed, limiting delays, providing temporary drainage and buffers between project area and water bodies c) Activities to be scheduled to avoid sensitive times for people and animals.	N/S
3	Installation of new intake pipe	a) Negligible loss of vegetation b) Minor potential for soil erosion c) Noise	a) Area cleared is very small. b) Can prevent by limiting maximum area to be exposed, limiting delays, providing temporary drainage and buffers between project area and water bodies c) Activities to be scheduled to avoid sensitive times for people and animals.	N/S
4	Deepening and expanding existing reservoir	a) Very minor loss of vegetation b) Minor potential for soil erosion	a) Area cleared is small. b) Can prevent by limiting maximum area to be exposed, limiting delays, providing temporary drainage and buffers between project area and water bodies	N/S
5	Replace existing fuel tank with a double walled tank and installation of a secondary containment liner.	a) Possible leaks or spills during replacement.	c) Follow regulations and guidelines. Ensure tanks are empty.	NP

ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES - SUMMARY				
(A) Key Project Activities		(B) Potential Environmental Effect(s)	(C) Mitigation Measures	(D)
6.	Upgrade site fencing	a) Very minor loss of vegetation	a) a) Small area to be cleared.	NP

8) CUMULATIVE EFFECTS ASSESSMENT

The natural environment is interconnected, and does not recognize project boundaries or lines on maps. The impacts caused by one project, which may be considered minor and insignificant on their own, combined with other environmental impacts from other projects or developments planned or already underway in the area. Together, these impacts may combine to become significant, and adverse. The consideration and assessment of these “cumulative” effects is therefore an important part of the environmental assessment process.

The following table should be completed to help identify the potential for cumulative effects, and to assess their significance (e.g. N/S - not significant; SP - significant positive effect; SN - significant negative effect; U - unknown, unable to assess).

(A) <u>Other projects or developments planned, or underway in the area</u>	(B) <u>Potential Cumulative Effects:</u> <i>The potentially adverse impacts of this Project; which could combine with those from the other projects identified in (A)</i>	(C) <u>Mitigation Measures</u> <i>needed to effectively manage or prevent any cumulative, adverse effects; and</i> <u>Significance of residual impacts after mitigation (N/S, SP, SN, U)</u>
No known development sites within 1 kilometre of the site.		
Future development beyond 1 kilometre includes: - Expansion and upgrades to existing landfill site - Upgrade the existing waste water treatment lagoon	Both of these development sites are removed from the water reservoir.	Cumulative impacts are not anticipated therefore mitigation measures are not required. All of these projects will improve environmental conditions therefore a positive impact is anticipated. SP.

9) SUMMARY OF ENVIRONMENTAL EFFECTS

Assuming that all mitigation measures are implemented as proposed in Sections 7 and 8, the following effects are predicted for the Valued Ecosystem Components identified in Section 6:

(N/S not significant; SP significant positive effect; SN significant negative effect; U unknown; N/A not applicable)

VALUED ECOSYSTEM COMPONENT	Summary of Effects (check box)					comments
	N/S	SP	SN	U	N/A	
Topography/terrain	√					
Soil/geology	√					
Aquatic sediment/substrate	√					
Surface water	√					
Groundwater					√	
Air quality	√					
Vegetation	√					
Wetlands					√	
Fish & fish habitat					√	
Migratory birds	√					
Other fauna	√					
Special habitat					√	
Sensitive areas					√	
Human health and safety	√					
Traditional land use activities					√	
Aesthetics	√					
Archaeological resources					√	
Specially-designated areas					√	

Screening Report Completed by:

Jim Walls

Name and signature

January 31, 2006

Date

10) CEAA SCREENING DECISION

- ☐ [00] DECISION PENDING. Assessment not final.
- ☒ [01] PROJECT MAY PROCEED. All potentially adverse effects are mitigable with known technology, and therefore will be rendered insignificant (CEAA s. 20(1)(a)).
- ☐ [02] PROJECT MAY NOT PROCEED. The project is likely to cause significant adverse environmental effects that cannot be justified in the circumstances (CEAA s.20(1)(b)).
- ☐ [03] ENVIRONMENTAL ASSESSMENT IS TO BE REFERRED TO THE MINISTER FOR MEDIATION OR A REVIEW PANEL, since it is uncertain whether the project is likely to cause significant adverse environmental effects (CEAA s. 20(1)(c)(i)); significant public concern has been raised, warranting a referral to a mediator or a review panel (CEAA s. 20(1)(c)(ii)); and/or public concerns warrant a reference to a mediator or a review panel (CEAA s. 20(1)(c)(iii)).

Reviewed and Recommended by:		
Representative of Council, or designate (<i>name & signature</i>)		Date
INAC Environmental Officer (<i>name & signature</i>)		Date
Other Federal RA(s) (<i>specify details</i>)		Date

INAC USE ONLY

SCREENING DECISION by LEAD RESPONSIBLE AUTHORITY (enter code):		
Approved by:		
INAC Responsibility Centre Manager (<i>name + signature</i>)		Date

11) KEY REFERENCES & SOURCES

Nuna Burnside Engineering and Environmental Ltd., “*Schematic Design for the Improvements of the Water Reservoir, Wastewater Lagoon and Solid Waste Disposal Facility, The Hamlet of Qikiqtarjuaq, Nunavut*”, September 2005. (file: N-O 09439).

Nuna Burnside Engineering and Environmental Ltd., “*Geotechnical Evaluation of Options for the Improvements of the Water Reservoir, Wastewater Lagoon and Solid Waste Disposal Facility, Supplement to the Schematic Design Report (September 2005), The Hamlet of Qikiqtarjuaq, Nunavut*”, November 2005. (file: N-O 09439).

Nuna Burnside Engineering and Environmental Ltd., “*Detailed Design Report for the Improvements to the Water Reservoir, Sewage Lagoon, and Solid Waste Disposal Facility, The Hamlet of Qikiqtarjuaq, Nunavut*”, February 2006. (file N-O 09439).

12) LIST OF ATTACHMENTS

Detailed Design Report listed above.

J:\2006\FINUNA\08983\Reports\Detailed Design\Appendices\Appendix J1_CEEA Reservoir.doc



Appendix J2
Sewage Lagoon

Indian and Northern Affairs Canada

Environmental Screening Report

CANADIAN ENVIRONMENTAL ASSESSMENT ACT

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The table on Page 2 will be completed by INAC staff. The proponent should complete the sections that follow, starting with "1. PROJECT IDENTIFICATION" on page 3.

Project Reference	
Section 5 Triggers	Please identify the reason(s) for INAC involvement: • CEAA s. 5.1(a) proponent • CEAA s. 5.1(b) funding • CEAA s. 5.1(c) granting an interest in land • CEAA s. 5.1(d)** regulatory function ----- **If a 5.1 (d) trigger, please specify the trigger, as per <i>Law List Regulations</i>: • <i>Indian Act</i> subsection 18(2) • <i>Indian Act</i> subsection 28(2) • <i>Indian Act</i> paragraph 58(4)(b) • <i>Indian Act</i> subsection 35(1) • <i>Indian Act</i> subsection 39(1) • <i>Indian Mining Regulations</i> subsection 5(2) • <i>Indian Mining Regulations</i> subsection 6(1) • <i>Indian Reserve Waste Disposal Regulations</i> section 5 • <i>Indian Timber Regulations</i> subsection 5(1) • <i>Indian Timber Regulations</i> section 9 • <i>Indian Timber Regulations</i> subsection 22(1)
FEAC ¹ ("LEAD RA")	
Other RAs	
Expert FAs	
Project also subject to a provincial EA: YES/NO - (if YES, provide details)	
CEAR ² Reference #	
Env. Officer	
Reviewing Officer	
RCM & Directorate	

¹ FEAC - Federal Environmental Assessment Coordinator

² CEAR - Canadian Environmental Assessment Registry

1) PROJECT IDENTIFICATION

Location:	Hamlet of Qikiqtarjuaq, Nunavut
Project Title:	Improvements to Wastewater Lagoon
Project proponent(s):	Government of Nunavut, Community and Government Services

2) LOCATION

Detailed Location: <i>If project is not on reserve, specify latitude and longitude coordinates, and nearest town, highway, lake, etc.</i>	Broughton Island, Nunavut located on the eastern coast of Baffin Island, 470 kilometres northeast of Iqaluit. Approximately 566 residents. 67°33' north latitude and 64°02' west longitude. Project is on Hamlet land.

YES

All or part of the project is OFF Reserve Land (YES/NO)

Definition of Project Area <i>The geographical extent of the project, and those areas affected during construction and operation. For example:</i> - key transportation routes for equipment and materials - staging & refueling areas - main activity/construction site, traffic routes, etc.	Most of the work will take place in the immediate vicinity of the existing wastewater treatment facility. The current wastewater treatment facility will be upgraded with updated operational and maintenance procedures. The access route will remain the same as it is currently. It is assumed that refueling will take place at the existing fuel depot, in the main community.

Adjacent Land: <i>Land use and description to the North, East, South, and West of project</i>	N: The existing landfill site, metal dump/borrow area as well as a secondary metal dump are located to the north. Vacant undisturbed tundra is located further north.
	E: There is an access road followed by a bulky metals/derelict vehicle storage area. Vacant undisturbed tundra is located further east.
	S: Landfill access road to the south, a borrow pit further south followed by vacant, undisturbed tundra.
	W: Vacant undisturbed tundra. The main community of Qikiqtarjuaq is more than 2 kilometres west of the site.

3) PROJECT JUSTIFICATION

Need for the Project:
Rationale: e.g. what problem is the project going to solve or what opportunity is the project going to provide?

The community now operates a single wastewater lagoon with effluent discharge to a naturally occurring wetland that eventually discharges into Davis Strait. The drainpipe freezes and has to be thawed out every year to drain the lagoon. Effluent is discharged directly onto the ground at the base of the lagoon berm. This is the current point of discharge in accordance with the operating license. The lagoon is the only treatment available before the effluent is discharged into the natural environment. There are deficiencies in the existing wastewater treatment system that services the Hamlet of Qikiqtarjuaq.

- There is insufficient storage in the lagoon,
- There are operational issues associated with discharging into the natural wetland area that is in violation of Section 36(6) of the Fisheries Act.

There are maintenance issues associated with surface water flow and erosion that could result in berm failure.

Purpose of the Project:
What is going to be achieved by carrying out the project?

To provide a wastewater system for the community that can meet the regulatory requirements as well as the needs of the community over the next 20 years.

Alternatives Considered:
Different ways to meet the project need and achieve the project purpose

Several options were considered:

- Null option, not a viable solution due to existing system deficiencies (insufficient capacity and environmental concerns)
- Upgrade the current wastewater treatment facility with updated operational and maintenance procedures.
- Wastewater treatment facility relocation.

4) PROJECT DESCRIPTION

Proposed Start Date: <i>(year-month-day, if known)</i>	July 2006	Estimated Completion Date: October 2007
Estimated Total Cost:	Approximately \$700,000	
Description of Project: <i>(attach/reference supporting material as required)</i>	The existing lagoon will be rehabilitated and a new lagoon constructed. A new wetland treatment area will also be constructed. The project will involve the following: - The new lagoon will have a depth similar to the existing lagoon. - The size will be approximately 90 m long and 67 metres wide such that there is a common berm between the existing and proposed lagoon. - Construction of improved ditching around the site. - Creation of a wetland treatment area - Installation of the necessary drainage structures for decanting. - Supply and place appropriate signage.	
Project Management Team Members & Affiliation	Mr. Brian Duguay, Project Officer, Community and Government Services, Baffin Region Nuna Burnside Engineering and Environmental Ltd., Mike O'Hara, P.Eng. Lootie Toomasie, Mayor of Qikiqtarjuaq	

5) CONSULTATION

(a) Government Departments, Agencies, Non-Governmental Organizations, Community Councils, etc.

Department, Agency, or Organization:	Contact Person & Telephone Number:	Nature of Consultation & Response Received:
Community and Government Services, Baffin Region	Brian Duguay, Project Officer	Was provided a copy of the Schematic Design Report identifying options available to meet the community's needs. Discussed and identified preferred alternative.
Community council and public works	Lootie Toomasie, Mayor	Held two meetings: July 8, 2005 and September 14, 2005. Meeting minutes recorded. Approved of the Schematic Design.

(b) Public Consultation, including Community Members

Public Consulted:	Method Used:	Date:	Details/Issues Raised:
Residents	Meetings with Hamlet council and Hamlet public works staff	July 8 Sept 14, 2005.	The Hamlet residents concerns and comments were expressed through council. Concerns regarding the lagoon and meeting future demands.

6) EXISTING ENVIRONMENT

COMPONENT	DESCRIPTION <i>(describe features; indicate sensitivity to disturbance)</i>
6.1 PHYSICAL FEATURES - VALUED ECOSYSTEM COMPONENTS	
Topography/Terrain: <i>(hilly, flat)</i>	The area is generally flat in the vicinity of the lagoon as well as toward the community and Davis Strait. Further inland the terrain becomes more hilly.
Soil and Geology: <i>(soil type, quality and use; bedrock geology)</i>	The underlying bedrock is described as felsic and rare mafic plutonic rock. The bedrock was not encountered during the field investigations. Permafrost was typically encountered at a depth of 2 m. Test pitting on site found the over burden to approximately 2.0 m to consist of coarse sand and gravel with cobbles and small boulders.
Surface Water: <i>(presence & quality)</i>	The Tulugak River as well as intermittent tributaries flows northwesterly towards Davis Strait. The Tulugak River is more than a kilometre south of the lagoon. Davis Strait is more than a kilometer west of the site. The surface water quality in the Tulugak River is good. The Tulugak River freezes completely during the winter.
Distance to Water:	<i>(from project area/activity, in metres):</i> There is low-lying, poorly drained area immediately west of the lagoon into which the lagoon is drained. This is only seasonally thawed and will be used for the engineered wetland treatment area.
Aquatic Sediment/Substrate: <i>(type & quality)</i>	Not known
Groundwater: <i>(local use & quality)</i>	Groundwater not used. The entire area is permafrost below approximately 2.0 m.
Air Quality: <i>(local air quality)</i>	Good

COMPONENT	DESCRIPTION (<i>describe features; indicate sensitivity to disturbance</i>)
6.2 BIOLOGICAL FEATURES - VALUED ECOSYSTEM COMPONENTS	
Vegetation: (<i>e.g. forest, ground cover, aquatic plants</i>)	The existing facilities are located within areas of disturbed tundra that are covered in cobble, sand and gravel. Very limited amounts and diversity of vegetation are present on these sites. Small areas of undisturbed tundra will be disturbed to accommodate some of the proposed facilities. These areas are also sparsely vegetated.
Wetlands: (<i>e.g. fens, swamp</i>)	The preliminary review did not identify any existing wetlands in the Study Area, although the estuary of the Tulugak River to the west of the Study Area may contain some wetland characteristics. The proposed project will establish a 10-hectare wetland treatment area, which will provide seasonal habitat for species of birds and other wildlife in the area.
Fish & Fish Habitat: (<i>types of habitat and common species found</i>)	The Tulugak River and tributaries freeze solid in the winter months therefore they are not fish habitat most of the year. Davis Strait however is a significant habitat for many species. It is more than one kilometer west of the site. Improvements to the existing system will significantly reduce the potential of impacting the fish habitat. Fishing for char (<i>Salvelinus alpinus</i>) is an important part of daily life. Char is likely the primary fish species being harvested in the area. It is not expected that fish are present in the Tulugak River in the summer months.
Migratory Birds: (<i>e.g. waterfowl, songbirds</i>)	Several species of shorebirds and waterfowl are likely to be found in the general area, although it is unlikely that birds use the Study Area for nesting or staging given the limited amount of suitable habitat on the site. Greater concentrations of birds, both in terms of diversity and densities, are found in the two Important Bird Areas to the east of Qikiqtarjuaq (see Special Habitat Areas below).
Other Fauna: (<i>mammals/amphibians reptiles/insects; game & protected species</i>)	Qikiqtarjuaq is located in Davis Strait off the east coast of Baffin Island. This rocky area is rich in marine mammal wildlife. Right Whale, Ring and Harp Seals, Beluga Whales, Narwhal, Walrus and Killer Whales all inhabit the waters off Qikiqtarjuaq, away from the Study Area. Hunting and fishing are still important parts of daily life in this area. Locals hunt Seals, Narwhal and Walrus, although this takes place some distance from the community of Qikiqtarjuaq, and away from the Study Area. Local people have been reported to consume a variety of terrestrial species including Polar Bear (<i>Ursus maritimus</i>) and, more rarely, carnivores such as Arctic Wolves (<i>Canis lupus arctos</i>) and Arctic Fox (<i>Alopex lagopus</i>). Musk Ox (<i>Ovibos moschatus</i>) and Barren Ground Caribou (<i>Rangifer tarandus groenlandicus</i>) also have historic ranges that include the area, and are likely hunted by local people. Local people indicate these species do not frequent the Study Area. None of these species have status under the Species At Risk Act (SARA).

COMPONENT	DESCRIPTION <i>(describe features; indicate sensitivity to disturbance)</i>
6.2 BIOLOGICAL FEATURES - VALUED ECOSYSTEM COMPONENTS	
Special Habitat Areas <i>(specially designated or protected habitats)</i>	No special habitat areas were identified in the Study Area during the preliminary review. Two Important Bird Areas (IBAs) were identified to the east of Qikiqtarjuaq. The first of these, Cape Searle, is located approximately 80 km east of Qikiqtarjuaq. The second, Reid Bay, is located approximately 125 km east of Qikiqtarjuaq. Species of interest that have been recorded from these IBAs include: Northern Fulmar (<i>Fulmarus glacialis</i>), Glaucous Gull (<i>Larus hyperboreus</i>) and Black Guillemots (<i>Cepphus grille</i>) from Cape Searle; and, Black-legged Kittiwake (<i>Rissa tridactyla</i>), Iceland Gull (<i>Larus glaucoides</i>), Thick-billed Murre (<i>Uria lomvia</i>), Glaucous Gull, Northern Fulmar and Black Guillemots from Reid Bay. The Canadian Wildlife Service (CWS) has been trying to establish protection for the seabird colonies at Cape Searle and Reid Bay since the mid 1980s. In May 2000, the community of Qikiqtarjuaq and the CWS agreed to proceed on work to create these new NWAs. Information on the two IBAs is available at: http://www.bsc-eoc.org/iba/regional.jsp?region=NWT
Species at Risk	No Species at Risk have been identified in close proximity to the sludge area. No threats to Species at Risk have been identified. Refer to sections above for details.

COMPONENT	DESCRIPTION <i>(describe features; indicate sensitivity to disturbance)</i>
6.3 SOCIO-CULTURAL FEATURES – VALUED ECOSYSTEM COMPONENTS	
Sensitive Areas: <i>(e.g. residential zones, parkland, hospitals, schools)</i>	The wastewater treatment facility is more than 2 kilometres from the main community. There are no known sensitive areas near the site.
Human Health and Safety: <i>(any persons whose health and safety may be affected by the construction and operation of the project)</i>	The wastewater treatment facility is more than 2 kilometres from the main community therefore it is not likely to affect human health and safety. Improving the wastewater treatment system for the community will result in improved human health reduced impact to the natural environment.
Traditional Land Use Activities: <i>(e.g. trapping, fishing, medicinal plant collection, ceremonial grounds)</i>	The area is already occupied by the existing lagoon although there is a proposed wetland area in a previously undisturbed area. Expansion is not expected to cause an impact to traditional land use activities. Hamlet staff indicate the area has no traditional land uses.
Aesthetics: <i>(general character of the surrounding area; and if the project is compatible)</i>	There is already a lagoon in this area and the project is removed from the main community therefore aesthetics are not an issue. The area has been designated by the community for information including the landfill, bulky metals disposal, and wastewater lagoon.
Archaeological Resources: <i>(recorded, or potential)</i>	The area is removed from the main community and the site has already been developed. Hamlet staff indicate there are no known archaeological resources in this area.
Special Designations: <i>(parks, protected areas)</i>	There are no known areas with special designations in the vicinity of the proposed wastewater treatment facility expansion.

7) ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES – SUMMARY

The next table summarizes the following:

(A)	List of Project Activities
	Key project activities associated with construction, operation, maintenance and decommissioning , if applicable. Includes locations, scheduling details, and estimates of magnitude and scale.
(B)	Potential Environmental Effect(s) associated with each project activity.
	<i>An Environmental Effect is defined as:</i>
	i) any <u>change that the project may cause in the environment</u> , Including any effect of any such change on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes, or on any structure, site, or thing that is of historical, archaeological, paleontological or architectural significance; and ii) any <u>change to the project that may be caused by the environment</u> . (Example: ice break-up damaging a bridge or dock; freezing and bursting of unprotected water lines.)
(C)	Mitigation Measures
	<i>A Mitigation Measure is:</i>
	i) an action or provision made that will <u>eliminate, reduce or control the adverse environmental effects of the project</u> , and may include restoration, compensation or replacement of any damages or impacts.
(D)	Determination of Significance
	A determination of the significance of the environmental effects, taking into account appropriate mitigation measures if applicable. Mitigation measures are intended to prevent or reduce any potentially negative effects. The abbreviations used are:
	N/S - effect not significant, or rendered insignificant with mitigation SP - significant positive effect SN - significant negative effect U - outcome unknown or cannot be predicted, even with mitigation.

ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES - SUMMARY				
(A) Key Project Activities		(B) Potential Environmental Effect(s)	(C) Mitigation Measures	(D)
1	Clearing and grubbing of new lagoon area and areas to be disturbed	a) Very minor loss of vegetation b) Potential for soil erosion c) Dust	a) Smallest possible area will be cleared b) Can prevent by limiting maximum area to be exposed, limiting delays, providing temporary drainage and buffers between project area and water bodies. Limiting work during spring thaw period c) Limit exposed area. Use water to control dust	N/S
2	Construction of a new lagoon adjacent to the existing one and improve ditching.	a) Potential for soil erosion b) Noise c) Minimal odours d) Dust	a) Can prevent by limiting maximum area to be exposed, limiting delays, providing temporary drainage and buffers between project area and water bodies. Limit work during spring thaw period b) Activities to be scheduled to avoid sensitive times for people and animals c) Activities to be scheduled to avoid sensitive times for people and animals d) Limit exposed area and use water to control dust	N/P
3	Creation of a new wetland treatment area	a) None anticipated	a) None anticipated	N/P

ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES - SUMMARY				
(A) Key Project Activities		(B) Potential Environmental Effect(s)	(C) Mitigation Measures	(D)
4	Installation of necessary drainage structures (for decanting)	a) Very minor loss of vegetation b) Minor potential for soil erosion	a) Area cleared is small. b) Can prevent by limiting maximum area to be exposed, limiting delays, providing temporary drainage and buffers between project area and water bodies	N/P
5.	Construction of an Exfiltration Berm	a) Potential for soil erosion b) Noise	a) Can prevent by limiting maximum area to be exposed, limiting delays, providing temporary drainage and buffers between project area and water bodies. Limit work during spring thaw period b) Activities to be scheduled to avoid sensitive times for people and animals.	N/P

8) CUMULATIVE EFFECTS ASSESSMENT

The natural environment is interconnected, and does not recognize project boundaries or lines on maps. The impacts caused by one project, which may be considered minor and insignificant on their own, combined with other environmental impacts from other projects or developments planned or already underway in the area. Together, these impacts may combine to become significant, and adverse. The consideration and assessment of these “cumulative” effects is therefore an important part of the environmental assessment process.

The following table should be completed to help identify the potential for cumulative effects, and to assess their significance (e.g. N/S - not significant; SP - significant positive effect; SN - significant negative effect; U - unknown, unable to assess).

(A) <u>Other projects or developments planned, or underway in the area</u>	(B) <u>Potential Cumulative Effects:</u> <i>The potentially adverse impacts of this Project; which could combine with those from the other projects identified in (A)</i>	(C) <u>Mitigation Measures</u> <i>needed to effectively manage or prevent any cumulative, adverse effects; and</i> <u>Significance of residual impacts after mitigation (N/S, SP, SN, U)</u>
Landfill site expansion is proposed approximately 100 m north of the site.	Both the wastewater treatment lagoon and the landfill site already exist at these locations. Upgrades to the existing landfill will involve similar activities of earth moving and construction. Cumulative impacts are expected to be minimal	This project will improve existing conditions as well as existing cumulative impacts. No mitigation required. NP.
Future development beyond 1 kilometre includes: - Upgrade the existing water reservoir	This development site is removed from the water reservoir	No mitigation required. Cumulative impacts are not anticipated. N/S

9) SUMMARY OF ENVIRONMENTAL EFFECTS

Assuming that all mitigation measures are implemented as proposed in Sections 7 and 8, the following effects are predicted for the Valued Ecosystem Components identified in Section 6:

(N/S not significant; SP significant positive effect; SN significant negative effect; U unknown; N/A not applicable)

VALUED ECOSYSTEM COMPONENT	Summary of Effects (check box)					comments
	N/S	SP	SN	U	N/A	
Topography/terrain	√					
Soil/geology	√					
Aquatic sediment/substrate		√				
Surface water		√				
Groundwater					√	
Air quality	√					
Vegetation	√					
Wetlands		√				
Fish & fish habitat	√					
Migratory birds	√					
Other fauna	√					
Special habitat					√	
Sensitive areas					√	
Human health and safety		√				
Traditional land use activities					√	
Aesthetics	√					
Archaeological resources					√	
Specially-designated areas					√	

Screening Report Completed by:

Jim Walls

Name and signature

January 31, 2006

Date

10) CEAA SCREENING DECISION

- ☐ [00] DECISION PENDING. Assessment not final.
- ☒ [01] PROJECT MAY PROCEED. All potentially adverse effects are mitigable with known technology, and therefore will be rendered insignificant (CEAA s. 20(1)(a)).
- ☐ [02] PROJECT MAY NOT PROCEED. The project is likely to cause significant adverse environmental effects that cannot be justified in the circumstances (CEAA s.20(1)(b)).
- ☐ [03] ENVIRONMENTAL ASSESSMENT IS TO BE REFERRED TO THE MINISTER FOR MEDIATION OR A REVIEW PANEL, since it is uncertain whether the project is likely to cause significant adverse environmental effects (CEAA s. 20(1)(c)(i)); significant public concern has been raised, warranting a referral to a mediator or a review panel (CEAA s. 20(1)(c)(ii)); and/or public concerns warrant a reference to a mediator or a review panel (CEAA s. 20(1)(c)(iii)).

Reviewed and Recommended by:		
Representative of Council, or designate (<i>name & signature</i>)		Date
INAC Environmental Officer (<i>name & signature</i>)		Date
Other Federal RA(s) (<i>specify details</i>)		Date

INAC USE ONLY

SCREENING DECISION by LEAD RESPONSIBLE AUTHORITY (enter code):		
Approved by:		
INAC Responsibility Centre Manager (<i>name + signature</i>)		Date

11) KEY REFERENCES & SOURCES

Nuna Burnside Engineering and Environmental Ltd., “*Schematic Design for the Improvements of the Water Reservoir, Wastewater Lagoon and Solid Waste Disposal Facility, The Hamlet of Qikiqtarjuaq, Nunavut*”, September 2005. (file: N-O 09439)

Nuna Burnside Engineering and Environmental Ltd., “*Geotechnical Evaluation of Options for the Improvements of the Water Reservoir, Wastewater Lagoon and Solid Waste Disposal Facility, Supplement to the Schematic Design Report (September 2005), The Hamlet of Qikiqtarjuaq, Nunavut*”, November 2005. (file: N-O 09439)

Nuna Burnside Engineering and Environmental Ltd., “*Detailed Design Report for the Improvements to the Water Reservoir, Sewage Lagoon, and Solid Waste Disposal Facility, The Hamlet of Qikiqtarjuaq, Nunavut*”, February 2006. (file N-O 09439).

12) LIST OF ATTACHMENTS

Detailed Design Report listed above.

J:\2006\F\NUNA\08983\Reports\Detailed Design\Appendices\Appendix J2_CEEA Lagoon.doc



Appendix J3
Solid Waste Management Facility

Indian and Northern Affairs Canada

Environmental Screening Report

CANADIAN ENVIRONMENTAL ASSESSMENT ACT

This form, when completed in full, constitutes an environmental screening report intended to meet the requirements of s. 16 of the *Canadian Environmental Assessment Act* (CEAA). It contains the following sections:

- 1) PROJECT IDENTIFICATION
- 2) LOCATION OF PROJECT
- 3) PROJECT JUSTIFICATION
- 4) PROJECT DESCRIPTION
- 5) CONSULTATION
- 6) EXISTING ENVIRONMENT
- 7) ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES
- 8) CUMULATIVE EFFECTS ASSESSMENT
- 9) SUMMARY OR ENVIRONMENTAL EFFECTS
- 10) CEAA SCREENING DECISION
- 11) KEY REFERENCES & SOURCES
- 12) LIST OF ATTACHMENTS

The table on Page 2 will be completed by INAC staff. The proponent should complete the sections that follow, starting with "1. PROJECT IDENTIFICATION" on page 3.

Project Reference	
Section 5 Triggers	Please identify the reason(s) for INAC involvement: • <i>CEAA</i> s. 5.1(a) proponent • <i>CEAA</i> s. 5.1(b) funding • <i>CEAA</i> s. 5.1(c) granting an interest in land • <i>CEAA</i> s. 5.1(d)** regulatory function ----- **If a 5.1 (d) trigger, please specify the trigger, as per <i>Law List Regulations</i>: • <i>Indian Act</i> subsection 18(2) • <i>Indian Act</i> subsection 28(2) • <i>Indian Act</i> paragraph 58(4)(b) • <i>Indian Act</i> subsection 35(1) • <i>Indian Act</i> subsection 39(1) • <i>Indian Mining Regulations</i> subsection 5(2) • <i>Indian Mining Regulations</i> subsection 6(1) • <i>Indian Reserve Waste Disposal Regulations</i> section 5 • <i>Indian Timber Regulations</i> subsection 5(1) • <i>Indian Timber Regulations</i> section 9 • <i>Indian Timber Regulations</i> subsection 22(1)
FEAC ¹ ("LEAD RA")	
Other RAs	
Expert FAs	
Project also subject to a provincial EA: YES/NO - (if YES, provide details)	
CEAR ² Reference #	
Env. Officer	
Reviewing Officer	
RCM & Directorate	

¹ FEAC - Federal Environmental Assessment Coordinator

² CEAR - Canadian Environmental Assessment Registry

1) PROJECT IDENTIFICATION

Location:	Hamlet of Qikiqtarjuaq, Nunavut
Project Title:	Improvements to Solid Waste Disposal Facility
Project proponent(s):	Government of Nunavut, Community and Government Services

2) LOCATION

Detailed Location: <i>If project is not on reserve, specify latitude and longitude coordinates, and nearest town, highway, lake, etc.</i>	Broughton Island, Nunavut located on the eastern coast of Baffin Island, 470 kilometres northeast of Iqaluit. Approximately 566 residents. 67°33' north latitude and 64°02' west longitude. Project is on Hamlet land.

NO

All or part of the project is OFF Reserve Land (YES/NO)

Definition of Project Area <i>The geographical extent of the project, and those areas affected during construction and operation. For example:</i> - key transportation routes for equipment and materials - staging & refueling areas - main activity/construction site, traffic routes, etc.	Most of the work will take place in the immediate vicinity of the existing solid waste disposal site (landfill) and bulky metals disposal area. The current landfill site will be improved. The access route will remain the same as it is currently. It is assumed that refueling of any equipment will take place at the existing fuel depot (in the main community).

Adjacent Land:	N: There is vacant undisturbed tundra.
Land use and description to the North, East, South, and West of project	E: There is an access road followed by a bulky metals/derelict vehicle storage area. Undisturbed, vacant. Tundra is further east.
	S: The existing wastewater lagoon and the landfill access road. Further to the south, a borrow pit followed by vacant, undisturbed tundra.
	W: Vacant undisturbed tundra. The main community of Qikiqtarjuaq is more than 2 kilometres west of the site.

3) PROJECT JUSTIFICATION

Need for the Project:

Rationale: e.g. what problem is the project going to solve or what opportunity is the project going to provide?

The community now operates a landfill site at this site. The site operates with a steep tipping face and needs expansion and rehabilitation to meet the needs of the Hamlet for the next 20 years.

Purpose of the Project:

What is going to be achieved by carrying out the project?

To provide a waste disposal system for the Hamlet that can meet the regulatory requirements as well as the needs of the remote community over the next 20 years.

Alternatives Considered:

Different ways to meet the project need and achieve the project purpose

Several options were considered:

- null option, not a viable solution. There are significant environmental and public health and safety issues that need to be addressed (steep tipping face, blown litter, lack of capacity)
- Remediation of the current site with updated operational maintenance procedures. (surface water management, operational issues and cover requirements can be addressed)
- Solid waste disposal facility relocation. This option is expensive but will create environmental issues in a new area and an access road will have to be built. Surface water, operational issues, litter and cover material issues will be addressed with this option.
-

4) PROJECT DESCRIPTION

Proposed Start Date: <i>(year-month-day, if known)</i>	July 2006	Estimated Completion Date: October 2007
Estimated Total Cost:	Approximately \$350,000	
Description of Project: <i>(attach/reference supporting material as required)</i>	The existing landfill will be rehabilitated to better accommodate the needs of the community over the next 20 years. The project will involve the following: - Improving surface water diversion ditching around the site. - Contouring the existing waste and covering exposed waste except for a small active disposal area - Application of additional cover (to be imported) - Establishment of new berms below the tipping face to contain the waste and cover - Construct a sedimentation pond for run-off collection and containment - Move and add fencing around the site.	
Project Management Team Members & Affiliation	Mr. Brian Duguay, Project Officer, Community and Government Services, Baffin Region Nuna Burnside Engineering and Environmental Ltd., Jim Walls, P.Geo. Lootie Toomasie, Mayor of Qikiqtarjuaq	

5) CONSULTATION

(a) Government Departments, Agencies, Non-Governmental Organizations, Community Councils, etc.

Department, Agency, or Organization:	Contact Person & Telephone Number:	Nature of Consultation & Response Received:
Community and Government Services, Baffin Region	Brian Duguay, Project Officer	Was provided a copy of the Schematic Design Report identifying options available to meet the community's needs. Discussed and identified preferred alternative.
Community council and public works	Lootie Toomasie, Mayor	Held two meetings: July 8, 2005 and September 14, 2005 meeting minutes recorded. Issues identified included: blown litter from the site was found in the water reservoir, potential impacts on the "wetland" (poorly drained area used for wastewater treatment). Approved Schematic Design.

(b) Public Consultation, including Community Members

Public Consulted:	Method Used:	Date:	Details/Issues Raised:
Residents (via council)	Meetings with Hamlet council and Hamlet public works staff	July 8 Sept 14, 2005.	The Hamlet residents concerns and comments were expressed through council. Concerns regarding blown litter and the site's inability to meet future demands. The community also had concerns regarding the potential for impacting the poorly drained area (wetland) that is used for wastewater treatment.

6) EXISTING ENVIRONMENT

COMPONENT	DESCRIPTION <i>(describe features; indicate sensitivity to disturbance)</i>
6.1 PHYSICAL FEATURES - VALUED ECOSYSTEM COMPONENTS	
Topography/Terrain: <i>(hilly, flat)</i>	The area is generally flat in the vicinity of the landfill and toward the community and Davis Strait. Further inland the terrain becomes more hilly.
Soil and Geology: <i>(soil type, quality and use; bedrock geology)</i>	Test pitting on site identified approximately 2.0 m of coarse sand and gravel with cobbles and boulders. The underlying bedrock is described as felsic and rare mafic plutonic rock. The bedrock was not encountered during the field investigations. Permafrost was typically encountered at a depth of 2 m.
Surface Water: <i>(presence & quality)</i>	The Tulugak River as well as intermittent tributaries flow northwesterly towards Davis Strait. The Tulugak River is more than a kilometre south of the landfill. Davis Strait is more than a kilometer west of the site. The surface water quality in the Tulugak River is good. The Tulugak River freezes completely during the winter.
Distance to Water:	<i>(from project area/activity, in metres):</i> There is wetland area immediately west of the landfill. The landfill area drains towards this area. This is only seasonally thawed and will be utilized by the wastewater treatment system as an engineered wetland treatment area.
Aquatic Sediment/Substrate: <i>(type & quality)</i>	Not known
Groundwater: <i>(local use & quality)</i>	Groundwater not used. The entire area is permafrost below approximately 2.0 m.
Air Quality: <i>(local air quality)</i>	Good

COMPONENT	DESCRIPTION (<i>describe features; indicate sensitivity to disturbance</i>)
6.2 BIOLOGICAL FEATURES - VALUED ECOSYSTEM COMPONENTS	
Vegetation: (<i>e.g. forest, ground cover, aquatic plants</i>)	The existing facilities are located within areas of disturbed tundra that are covered in cobble, sand and gravel. Very limited amounts and diversity of vegetation are present on these sites. Small areas of undisturbed tundra will be disturbed to accommodate some of the proposed facilities. These areas are also sparsely vegetated.
Wetlands: (<i>e.g. fens, swamp</i>)	The preliminary review did not identify any existing wetlands in the Study Area, although the estuary of the Tulugak River to the west of the Study Area may contain some wetland characteristics. The adjacent wastewater treatment facility proposed for the community will establish a 10-hectare wetland treatment area, which will provide seasonal habitat for species of birds and other wildlife in the area.
Fish & Fish Habitat: (<i>types of habitat and common species found</i>)	The Tulugak River and tributaries freeze solid in the winter months therefore they are not a fish habitat most of the year. Davis Strait however is a significant habitat for many species. It is more than one kilometer west of the site. Improvements to the existing system will significantly reduce the potential of impacting the fish habitat. Fishing for char (<i>Salvelinus alpinus</i>) is an important part of daily life. Char is likely the primary fish species being harvested in the area. It is not expected that fish are present in the Tulugak River.
Migratory Birds: (<i>e.g. waterfowl, songbirds</i>)	Several species of shorebirds and waterfowl are likely to be found in the general area, although it is unlikely that birds use the Study Area for nesting or staging given the limited amount of suitable habitat on the site. Greater concentrations of birds, both in terms of diversity and densities, are found in the two Important Bird Areas to the east of Qikiqtarjuaq (see Special Habitat Areas below).
Other Fauna: (<i>mammals/amphibians reptiles/insects; game & protected species</i>)	Qikiqtarjuaq is located in Davis Strait off the east coast of Baffin Island. This rocky area is rich in marine mammal wildlife. Right Whale, Ring and Harp Seals, Beluga Whales, Narwhal, Walrus and Killer Whales all inhabit the waters off Qikiqtarjuaq, away from the Study Area. Hunting and fishing are still important parts of daily life in this area. Locals hunt Seals, Narwhal and Walrus, although this takes place some distance from the community of Qikiqtarjuaq, and away from the Study Area. Local people have been reported to consume a variety of terrestrial species including Polar Bear (<i>Ursus maritimus</i>) and, more rarely, carnivores such as Arctic Wolves (<i>Canis lupus arctos</i>) and Arctic Fox (<i>Alopex lagopus</i>). Musk Ox (<i>Ovibos moschatus</i>) and Barren Ground Caribou (<i>Rangifer tarandus groenlandicus</i>) also have historic ranges that include the area, and are likely hunted by local people. Local people indicate species do frequent some of the Study Area. Scavengers are occasionally attracted to the site when waste is not burned and buried regularly. None of these species have status under the Species At Risk Act (SARA).

COMPONENT	DESCRIPTION (<i>describe features; indicate sensitivity to disturbance</i>)
6.2 BIOLOGICAL FEATURES - VALUED ECOSYSTEM COMPONENTS	
Special Habitat Areas (<i>specially designated or protected habitats</i>)	No special habitat areas were identified in the Study Area during the preliminary review. Two Important Bird Areas (IBAs) were identified to the east of Qikiqtarjuaq. The first of these, Cape Searle, is located approximately 80 km east of Qikiqtarjuaq. The second, Reid Bay, is located approximately 125 km east of Qikiqtarjuaq. Species of interest that have been recorded from these IBAs include: Northern Fulmar (<i>Fulmarus glacialis</i>), Glaucous Gull (<i>Larus hyperboreus</i>) and Black Guillemots (<i>Cepphus grille</i>) from Cape Searle; and, Black-legged Kittiwake (<i>Rissa tridactyla</i>), Iceland Gull (<i>Larus glaucoides</i>), Thick-billed Murre (<i>Uria lomvia</i>), Glaucous Gull, Northern Fulmar and Black Guillemots from Reid Bay. The Canadian Wildlife Service (CWS) has been trying to establish protection for the seabird colonies at Cape Searle and Reid Bay since the mid 1980s. In May 2000, the community of Qikiqtarjuaq and the CWS agreed to proceed on work to create these new NWAs. Information on the two IBAs is available at: http://www.bsc-eoc.org/iba/regional.jsp?region=NWT
Species at Risk	No Species at Risk have been identified in close proximity to the study area. No threats to Species at Risk have been identified. Refer to above sections for details.

COMPONENT	DESCRIPTION <i>(describe features; indicate sensitivity to disturbance)</i>
6.3 SOCIO-CULTURAL FEATURES – VALUED ECOSYSTEM COMPONENTS	
Sensitive Areas: <i>(e.g. residential zones, parkland, hospitals, schools)</i>	The landfill is more than 2 kilometres from the main community. There are no known sensitive areas near the site although there is a poorly drained area to the west.
Human Health and Safety: <i>(any persons whose health and safety may be affected by the construction and operation of the project)</i>	The landfill is more than 2 kilometres from the main community therefore it is not likely to affect human health and safety. Improving the solid waste disposal system for the community will result in improved human health and reduced impact to the natural environment.
Traditional Land Use Activities: <i>(e.g. trapping, fishing, medicinal plant collection, ceremonial grounds)</i>	The area is already occupied by the existing landfill. Rehabilitation and expansion are not expected to cause an impact to traditional land use activities. Hamlet staff indicate the area has no traditional land uses.
Aesthetics: <i>(general character of the surrounding area; and if the project is compatible)</i>	There is already a landfill in this area and the project is removed from the main community therefore aesthetics are not an issue. The area has been designated by the community for infrastructure purposes including the landfill, bulky metals disposal, and wastewater lagoon.
Archaeological Resources: <i>(recorded, or potential)</i>	The area is removed from the main community and the site has already been developed. Hamlet staff indicate there are no known archaeological resources in this area.
Special Designations: <i>(parks, protected areas)</i>	There are no known areas with special designations in the vicinity of the existing or proposed landfill area.

7) ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES – SUMMARY

The next table summarizes the following:

(A)	List of Project Activities
	Key project activities associated with construction, operation, maintenance and decommissioning , if applicable. Includes locations, scheduling details, and estimates of magnitude and scale.
(B)	Potential Environmental Effect(s) associated with each project activity.
	<i>An Environmental Effect</i> is defined as:
	i) any <u>change that the project may cause in the environment</u> , Including any effect of any such change on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes, or on any structure, site, or thing that is of historical, archaeological, paleontological or architectural significance; and ii) any <u>change to the project that may be caused by the environment</u> . (Example: ice break-up damaging a bridge or dock; freezing and bursting of unprotected water lines.)
(C)	Mitigation Measures
	<i>A Mitigation Measure</i> is:
	i) an action or provision made that will <u>eliminate, reduce or control the adverse environmental effects of the project</u> , and may include restoration, compensation or replacement of any damages or impacts.
(D)	Determination of Significance
	A determination of the significance of the environmental effects, taking into account appropriate mitigation measures if applicable. Mitigation measures are intended to prevent or reduce any potentially negative effects. The abbreviations used are:
	N/S - effect not significant, or rendered insignificant with mitigation SP - significant positive effect SN - significant negative effect U - outcome unknown or cannot be predicted, even with mitigation.

ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES - SUMMARY				
(A) Key Project Activities		(B) Potential Environmental Effect(s)	(C) Mitigation Measures	(D)
1	Ditching to divert run off around fill area	a) Minor loss of vegetation b) Potential for soil erosion c) Noise from operating equipment d) Dust.	a) Smallest possible area will be cleared. b) Can prevent by limiting maximum area to be exposed, limiting delays, providing temporary drainage and buffers between project area and water bodies. Limiting work during spring thaw period. c) Limit activities to specified hours to reduce potential impacts on animals and humans d) Limit exposed area. Could also use water to control dust.	N/P
2	Construction of a 2 m high berm around fill area.	a) Minor loss of vegetation b) Potential for soil erosion and dust c) Noise from equipment d) Dust.	a) Smallest possible area will be cleared. b) Can prevent by limiting maximum area to be exposed, limiting delays, providing temporary drainage and buffers between project area and water bodies. Limiting work during spring thaw period c) Limit activities to specified hours to reduce potential impacts on animals and humans d) Limit exposed area. Could also use water to control dust.	N/P

ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES - SUMMARY				
(A) Key Project Activities		(B) Potential Environmental Effect(s)	(C) Mitigation Measures	(D)
3	Construction of a sedimentation pond to control impacted water on site.	a) Minor loss of vegetation b) Potential for soil erosion c) Noise from equipment d) Dust.	a) Smallest possible area will be cleared. b) Can prevent by limiting maximum area to be exposed, limiting delays, providing temporary drainage and buffers between project area and water bodies. Limiting work during spring thaw period c) Limit activities to specified hours to reduce potential impacts on animals and humans. d) Limit exposed area. Could also use water to control dust.	N/P
4	Reconfiguring the waste area and applying cover	a) Potential for soil erosion b) Noise from equipment c) Dust.	a) Can prevent by limiting maximum area to be exposed, limiting delays, providing temporary drainage and buffers between project area and water bodies. Limiting work during spring thaw period b) Limit activities to specified hours to reduce potential impacts on animals and humans. c) Limit exposed area. Could also use water to control dust.	N/S

8) CUMULATIVE EFFECTS ASSESSMENT

The natural environment is interconnected, and does not recognize project boundaries or lines on maps. The impacts caused by one project, which may be considered minor and insignificant on their own, combined with other environmental impacts from other projects or developments planned or already underway in the area. Together, these impacts may combine to become significant, and adverse. The consideration and assessment of these “cumulative” effects is therefore an important part of the environmental assessment process.

The following table should be completed to help identify the potential for cumulative effects, and to assess their significance (e.g. N/S - not significant; SP - significant positive effect; SN - significant negative effect; U - unknown, unable to assess).

(A) <u>Other projects or developments planned, or underway in the area</u>	(B) <u>Potential Cumulative Effects:</u> <i>The potentially adverse impacts of this Project; which could combine with those from the other projects identified in (A)</i>	(C) <u>Mitigation Measures</u> <i>needed to effectively manage or prevent any cumulative, adverse effects; and</i> <u>Significance of residual impacts after mitigation (N/S, SP, SN, U)</u>
Wastewater treatment plant expansion is proposed approximately 100 m south of the site.	Both the wastewater treatment lagoon and the landfill site already exist at this location. Upgrades to the wastewater lagoon will involve similar construction activities. Cumulative construction and operation impacts are expected to be minimal.	This project will improve the overall impacts from the existing landfill site. No mitigation required. SP.
Future development beyond 1 kilometre includes: - Upgrade/expand the existing water reservoir.	This development site is removed from the landfill site therefore cumulative impacts are not anticipated	No mitigation required. N/S.

9) SUMMARY OF ENVIRONMENTAL EFFECTS

Assuming that all mitigation measures are implemented as proposed in Sections 7 and 8, the following effects are predicted for the Valued Ecosystem Components identified in Section 6:

(N/S not significant; SP significant positive effect; SN significant negative effect; U unknown; N/A not applicable)

VALUED ECOSYSTEM COMPONENT	Summary of Effects (check box)					comments
	N/S	SP	SN	U	N/A	
Topography/terrain	√					
Soil/geology	√					
Aquatic sediment/substrate	√					
Surface water		√				
Groundwater					√	
Air quality	√					
Vegetation	√					
Wetlands		√				
Fish & fish habitat	√					
Migratory birds	√					
Other fauna	√					
Special habitat					√	
Sensitive areas					√	
Human health and safety		√				
Traditional land use activities					√	
Aesthetics	√					
Archaeological resources					√	
Specially-designated areas					√	

Screening Report Completed by:

Jim Walls

Name and signature

January 31, 2006

Date

10) CEAA SCREENING DECISION

- ☐ [00] DECISION PENDING. Assessment not final.
- ☒ [01] PROJECT MAY PROCEED. All potentially adverse effects are mitigable with known technology, and therefore will be rendered insignificant (CEAA s. 20(1)(a)).
- ☐ [02] PROJECT MAY NOT PROCEED. The project is likely to cause significant adverse environmental effects that cannot be justified in the circumstances (CEAA s.20(1)(b)).
- ☐ [03] ENVIRONMENTAL ASSESSMENT IS TO BE REFERRED TO THE MINISTER FOR MEDIATION OR A REVIEW PANEL, since it is uncertain whether the project is likely to cause significant adverse environmental effects (CEAA s. 20(1)(c)(i)); significant public concern has been raised, warranting a referral to a mediator or a review panel (CEAA s. 20(1)(c)(ii)); and/or public concerns warrant a reference to a mediator or a review panel (CEAA s. 20(1)(c)(iii)).

Reviewed and Recommended by:		
Representative of Council, or designate (<i>name & signature</i>)		Date
INAC Environmental Officer (<i>name & signature</i>)		Date
Other Federal RA(s) (<i>specify details</i>)		Date

INAC USE ONLY

SCREENING DECISION by LEAD RESPONSIBLE AUTHORITY (enter code):		
Approved by:		
INAC Responsibility Centre Manager (<i>name + signature</i>)		Date

11) KEY REFERENCES & SOURCES

Nuna Burnside Engineering and Environmental Ltd., “*Schematic Design for the Improvements of the Water Reservoir, Wastewater Lagoon and Solid Waste Disposal Facility, The Hamlet of Qikiqtarjuaq, Nunavut*”, September 2005. (file: N-O 09439)

Nuna Burnside Engineering and Environmental Ltd., “*Geotechnical Evaluation of Options for the Improvements of the Water Reservoir, Wastewater Lagoon and Solid Waste Disposal Facility, Supplement to the Schematic Design Report (September 2005), The Hamlet of Qikiqtarjuaq, Nunavut*”, November 2005. (file: N-O 09439)

Nuna Burnside Engineering and Environmental Ltd., “*Detailed Design Report for the Improvements to the Water Reservoir, Sewage Lagoon, and Solid Waste Disposal Facility, The Hamlet of Qikiqtarjuaq, Nunavut*”, February 2006. (file N-O 09439).

12) LIST OF ATTACHMENTS

Detailed Design Report listed above.

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