REMEDIAL ACTION PLAN

Old Town Site, Clyde River, Nunavut

Prepared for:

Community and Government Services
Government of Nunavut
Pond Inlet, Nunavut

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Project No.:

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EXECUTIVE SUMMARY

Nunami Stantec Limited has been retained by the Department of Community and Government Services (CGS) of the Government of Nunavut (GN) to complete the planning, design, construction supervision and monitoring for the remediation of the Old Town Site in Clyde River, Nunavut. This Remedial Action Plan (RAP) is intended to provide the basis for the preparation of design drawings and specifications for the project.

The purpose of this RAP is to identify and evaluate potential remedial options, recommend the best option, identify regulatory approvals required, and provide a preliminary schedule for remediation. Remedial options were developed for each waste stream and the potential risks, advantages and disadvantages of each option were examined.

Originally prepared in 2009, this RAP has been updated to incorporate the findings of the Supplemental Phase III Environmental Site Assessment (ESA) and Human Health and Ecological Risk Assessment (HHERA) completed in 2010. In addition, this document incorporates comments provided by Clyde River community members regarding the preliminary remedial options presented in the 2009 RAP.

Based on the information collected to date, several waste streams are present on-site; including:

- Non hazardous Waste– including construction materials (e.g. wood, concrete, piping, roofing products, machine and equipment parts), miscellaneous metal debris and residential wastes (e.g. cans, wiring, appliances).
- Hazardous Waste - Including several drums of waste oil potentially containing ethylene glycol and several potentially polychlorinated biphenyl (PCB) containing capacitors and transformers.
- Aluminum Waste – including the white powdery substance west of the spillway on-site. This substance consists of a hydrogen generation by-product characterized by high concentrations of aluminum (max = 340,000 mg/kg) and is alkaline.
- Waste Petroleum Product – including drums of petroleum product waste and four 6,000 L aboveground storage tanks (ASTs).
- Special Wastes – including asbestos containing materials [ACMs, including tiles, shingles and insulation], lead contaminated waste (lead based paint constituents) some types of electrical equipment (e.g. batteries, wiring) and sanitary wastes.
- PHC and metal impacted soil
- PHC and metal impacted water

In preparation of this RAP, Nunami Stantec identified several disposal options for each waste stream. Once identified, each option was evaluated against a set of evaluation criteria, including regulatory compliance, long term effectiveness, execution, stakeholder acceptance and cost. The following table presents the remedial options selected for each waste stream:

Environmental Issue	Quantity of Waste[1]	Remedial Option Selected
Non-Hazardous Wastes	1,254 m^3	All non-hazardous waste should be collected and disposed off-site at the existing Clyde River Landfill. Combustible non-hazardous waste could be incinerated to reduce volumes.
Hazardous Waste[2]	17 m^3	All hazardous waste should be containerized in accordance with the applicable regulations and disposed off-site at a licensed hazardous waste disposal facility in southern Canada.
Aluminum Waste	1,000 m^3	The top 0.3 m of the aluminum waste footprint should be excavated and disposed of in a containment cell, to be constructed at the Clyde River Landfill as part of the remedial program.
Waste Petroleum Product	1,854 L	Waste petroleum products should be collected and incinerated in a waste fuel incinerator on-site. Drums and ASTs present on the Site will be rinsed on-site and any residual fluids will be collected and treated. Once rinsed, the drums and ASTs will be disposed as non-hazardous waste at the existing Clyde River Landfill.
Special Wastes		
Asbestos Containing Materials	187 m^3	Asbestos containing waste should be collected, placed in plastic sealed bags, and disposed of at the existing Clyde River Landfill according to applicable guidelines
Polychlorinated Biphenyls		Capacitors and transformers found intact would be treated as hazardous waste, containerized, and shipped off-site to a licensed disposal facility in southern Canada.
Electrical Wastes		Broken and intact batteries should be collected and transported to a registered recycling facility in southern Canada. Capacitors / transformers that are broken and contain no liquids should be placed in the existing Clyde River Landfill.
Lead Impacted Wastes		These wastes will be disposed of in the containment cell constructed at the Clyde River Landfill.
Sanitary Wastes		Any identified sanitary wastes should be collected and, depending on the nature of the waste, be transported to the septic disposal area at the existing Clyde River Landfill or placed in an on-site landfarm.
Petroleum Hydrocarbon Impacted Soil	4,900 m^3	Petroleum hydrocarbon impacted soil should be excavated and bioremediated using the biopile or landfarming treatment technique. This would entail the construction of a lined land treatment facility where soil can be placed in a thin layer and mechanically aerated and chemically amended for a period of several years while biodegradation of the hydrocarbon compounds is achieved through microbial metabolism and volatilization through aeration.
Metal Impacted Soil	575 m^3	Metal impacted soil should be excavated and disposed of in a containment cell to be constructed at the Clyde River Landfill as part of the remedial program.
Petroleum Hydrocarbon and Metal Impacted Water	1,000,000 L (estimate)	Any PHC and/or metal impacted water encountered during the remediation project (including excavation water and water collected from the landfarm) should be transferred to an on-site waste water treatment

Environmental Issue	Quantity of Waste[1]	Remedial Option Selected
		system. Upon completion of treatment, water samples should be collected and analysed to confirm the treated water meets the applicable discharge criteria.

NOTE:

1. The estimated volume of impacted soil in the table below have been developed considering the Site Specific Threshold Levels (SSTLs) generated by the HHERA.
2. Hazardous waste on-site includes drums of waste oil containing ethylene glycol and PCB bearing capacitors.
3. Lead impacted wastes present on-site contain high concentrations of lead; however, further analysis is required to determine the leachability of the waste. This information will dictate the handling and disposal requirements for this waste stream. This analysis can be conducted as part of the geotechnical program to be conducted in July 2011.

   Once the leachbility is confirmed, the waste may either be a) disposed of in the existing Clyde River Landfill or b) disposed of at the containment cell to be constructed at the Clyde River Landfill in 2012 (as part of the remedial activities).

In order to facilitate the remedial activities the following site facilities are required:

Site Facility	Details
Access Road from Quarry Road to Site	Current access from Clyde River to the Site is inadequate to support remediation activities.
Site Roads	Roads will be required to facilitate transportation between the main access road, the waste handling facility and the land treatment facility.
Borrow Sources	Borrow material is required for construction of access roads, waste handling facility, land treatment facility and backfill material.
Waste Handling Facility	Contained waste handling facility required for the handling of wastes requiring off-site disposal.
Clyde River Landfill	Due to type and amount of wastes to be disposed of at the Clyde River landfill, construction of an additional landfill containment cell is required.
On-site Land Treatment Facility	On-site land treatment facility is required for the on-site bioremediation of hydrocarbon impacted soils.
Waste Water Treatment System	Hydrocarbon and metal impacted water treatment on-site is required throughout the remedial program.

The statements made in this Executive Summary are subject to the same limitations included in the Statement of Limitations in Section 12, and are to be read in conjunction with the remainder of this report.

TABLE OF CONTENTS

List of Tables

List of Appendices

List of Drawings

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1 INTRODUCTION

Nunami Stantec Limited has been retained by the Department of Community and Government Services (CGS) of the Government of Nunavut (GN) to complete the planning, design, construction supervision and monitoring for the remediation of the Old Town Site in Clyde River, Nunavut. This Remedial Action Plan (RAP) is intended to provide the basis for the preparation of design drawings and specifications for the project. The purpose of this RAP is to identify and evaluate potential remedial options, recommend the best option, identify regulatory approvals required, and provide a preliminary schedule for remediation. Remedial options were developed for each waste stream and the potential risks, advantages and disadvantages of each option were examined.

This report is organized in fourteen sections. Section 1 presents an introduction and outlines the remedial objectives for the Site. Section 2 provides descriptions of the Site and the biophysical environment. Section 3 describes the current site conditions, and Section 4 outlines the reviews of the findings of the community consultation conducted in 2009. Section 5 explains the applicable regulatory framework governing the remediation of the Site. Sections 6 and 7 outlines and evaluates the various remedial options for the different waste streams. Section 8 presents a consideration of Site and logistical factors affecting remediation of the Site. Section 9 identifies the regulatory approvals necessary to implement the recommended remedial approach and Section 10 outlines the proposed remedial work schedule. Section 11 presents considerations for verification sampling and post closure monitoring. Section 12 is a closure statement and Section 13 presents references. Preliminary drawings and supporting information is presented in the appendices.

1.1 Remediation Objectives

Consistent with the objectives documented in the 2009 RAP developed for the Site by Nunami and presented at the public meeting in Clyde River in 2009, the remediation objectives for the Site are summarized as follows:

1. To provide for long-term, cost-effective, technically defensible and environmentally acceptable remediation of the Site;
2. To remove all hazardous and non-hazardous waste from Site and restore the natural topography of the area;
3. To provide a remediation plan that will be acceptable to the community, regulators and project sponsors; and,
4. To restore the Site to a condition where community members may use the site for recreational / traditional purposes.

2 BACKGROUND

2.1 Site Location

The community of Clyde River was originally established on the east side of Patricia Bay, approximately 5 km east of the present day community as illustrated in Figure 1 in **Appendix A**. Known locally as "Old Town", the original settlement was occupied from 1923 until 1970 when the new community was established. The Site formerly included a weather station, school, electrical generating plants and residences. Residents of Clyde River currently camp in the Old Town area during the summer and collect drinking water from the streams running through the area.

Representatives of the Hamlet of Clyde River have indicated that the Site is an important fishing and camping area for community residents, including elders. During the summer period, residents of Clyde River visit the Site and are exposed to physical hazards and wastes that remain on-site.

2.2 Biophysical Environment

The Site is located within the Baffin Island Coastal Lowland Ecozone (Ecological Stratification Working Group, 1996). Characterized by long winters and short summers, the mean temperature in this area ranges from -22.5°C in winter to 1°C in the summer. The annual precipitation in this zone ranges from approximately 200 mm to 300 mm.

2.2.1 Geology

Bedrock geology in the northern Baffin Island area consists of Archean aged Mary River Group rock underlain by Archean aged orthogneiss units of the Rae Craton (Scott, D.J., St-Onge, M.R., Corrigan, D., 2003). Dominant soils encountered in this region consist of turbic cryosols on sandy colluvial, morainal and marine deposits featuring continuous permafrost (Ecological Stratification Working Group, 1996).

2.2.2 Flora

Vegetation in the region typically consists of mosses, willows, grasses, sedges and flowering herbs (Ecological Stratification Working Group, 1996). Prevalent species in the area include purple saxifrage (*Saxifruga oppositifolia), Dryas spp.,* arctic willow *(Salix arctica*), *Kobresia spp.*, *Canex spp*. and arctic poppy *(Papaver radicadum).* In wet areas, several different species of wood rush (*Luzula spp.*), wire rush (*Juncus spp.*) and saxifrage (*Saxifraga spp.)* may also be present.

2.2.3 Fauna

Terrestrial fauna common in this ecozone include arctic hare (*Lepus arcticus)*, arctic fox (*Alopex lagopus)*, erimine (*Mustela erminea*), collared lemming (*Dicrostonyx torquatus*) and polar bear *(Ursus maritimus)* (Ecological Stratification Working Group, 1996). Avian species present in this ecozone include king eider (*Somateria spectabilis*), rock ptarmigan (*Lagopus muta*), northern fulmar

(*Fulmarus glacialis*), little ringed plover (*Charadrius dubius*), hoary redpoll (*Carduelis hornemanni*) and snow bunting (*Plectrophenax nivalis*).

3 CURRENT SITE CONDITIONS

Located within the municipality of Clyde River, the Old Town Site consists of several building foundations and footprints, four bulk fuel aboveground storage tanks (ASTs) and several dumping sites for hazardous and non-hazardous waste. The area surrounding the Old Town Site is undeveloped.

The Site is divided into several areas including the Hudson Bay Company (HBC) Area, the Department of Transportation (DOT) Area, the Site Dump, the Fuel Dump, and other areas [including the Southern Powerhouse and Garage, Residential Plateau, the Extreme South Beach Dump, the Beach Dump (north of the Main Site) and the structure southeast of the Beach Dump]. Two graves are also located on-site. The Site features are presented on Drawings 123600017-RAP-1 and 123600017-RAP-2 in **Appendix A**.

Upon completion of the 2010 Supplementary Phase III Environmental Site Assessment (ESA) and Human Health and Ecological Risk Assessment (HHERA), the following environmental concerns were identified on-site:

- 1,254 m^3 of non hazardous wastes
- 17 m^3 of hazardous wastes
- 1,000 m^3 of aluminum waste
- 1,854 L of waste petroleum product
- 187 m^3 of special wastes (including asbestos containing materials, lead impacted waste, aluminum waste, some types of electrical equipment and sanitary wastes).
- 575 m^3 of metal impacted soil exceeding the site specific threshold levels (SSTLs) developed during the HHERA.
- 4,900 m^3 of petroleum hydrocarbon (PHC) impacted soil exceeding the SSTLs developed during the HHERA.

In addition to the environmental concerns identified during the 2010 assessments, the following area of concern was identified in previous environmental investigations on-site:

- Petroleum hydrocarbon and metal impacted groundwater / meltwater exceeding the applicable guidelines was identified on-site.

An overview of the impacted areas present on-site is illustrated in **Figure 123600017-RAP-1** in **Appendix A**.

4 COMMUNITY CONSULTATION

A public meeting was conducted on June 23, 2009 in the community of Clyde River. Approximately 40 community members, including two Hamlet Council members and the local MLA, were present. The comments received during this meeting have been incorporated into this RAP. Based on feedback received, the community members are generally in support of the proposed remedial program. A copy of the meeting minutes are provided in **Appendix C**.

5 REGULATORY FRAMEWORK

The regulatory framework outlined during the remedial activities should be consistent with the guidelines/ standards/ criteria employed during the 2010 Supplementary Phase III ESA including:

- Government of Nunavut Environmental Guideline for Site Remediation;
- Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Criteria;
- CCME Canada Wide Standards for Petroleum Hydrocarbons in Soil;
- Health Canada Guidelines for Canadian Drinking Water Quality;
- Alberta Environment Tier 2 Guidelines;
- Canadian Sediment Quality Guidelines for the Protection of Aquatic Life;
- Used Oil and Waste Fuel Management Guidelines; and the,
- Federal Hazardous Products Act.

Table 5.1 below provides a summary of the guidelines / standards / criteria used during the Supplemental Phase III ESA program. The following sections provide details on the guidelines which have been used to screen each of the environmental media at the Site.

Table 5.1: Regulatory Framework Matrix

Sample Type	Parameter	Regulatory Criteria										
		GN Guidelines	CCME CSQGs	CCME CWS	CCME CWQG (FAL & MAL)	CCME CSQG (PELs) (FAL and MAL)	GCDWQs	AENV Tier 2 Guidelines	Oakridge Guidelines	GNWT Used Oil and Waste Fuel Guidelines	Federal Hazardous Products Act	US EPA
Soil	Benzene, Toluene, Ethylbenzene and Xylenes	✓	✓[1]									
	Petroleum Hydrocarbons F1 to F4	✓		✓								
	Metals, Polycyclic Aromatic Hydrocarbons (PAHs), and pH	✓	✓[2]									
	Polychlorinated Biphenyl's (PCBs)	✓	✓					✓[3]				
Groundwater / Meltwater/ Surface Water	Benzene, Toluene, Ethyl benzene				✓		✓[4]					
	Xylenes						✓[4]	✓[5]				
	Petroleum Hydrocarbon (Fractions F1 – F2)							✓[5]				
	Total and Dissolved Metals				✓		✓[4]					
	General Chemistry and PAHs				✓		✓[4]					
	PCBs											
Sediment	Benzene, Toluene, Ethylbenzene and Xylenes		✓						✓[6]			
	Petroleum Hydrocarbon (F1 to F4)			✓								
	Metals and PAHs		✓[7]			✓						
Fuel / Waste Oil	Cd, Cr, Pb, Total Organic Halogens, PCBs, Flashpoint									✓		

NOTE:

GN Guidelines = Environmental Guideline for Contaminated Site Remediation (March 2009).
CCME CSQGs = Canadian Council of the Ministers of the Environment Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health (1999, last update 2007).
CCME CWS = Canadian Council of the Ministers of the Environment Canada Wide Standards for Petroleum Hydrocarbons in Soil (2008), Tier 2 Pathway Specific Guidelines.
CCME CWQG FAL = Canadian Council of the Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (1999, last update 2007).
CCME CWQG MAL = Canadian Council of the Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Marine Aquatic Life (1999, last update 2007).
CCME CSQG (PELs) = Canadian Council of Ministers of the Environment Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (1999; last update 2002); Probable Effect Levels (PELs)
GCDWQs = Health Canada Guidelines for Canadian Drinking Water Quality, May 2008
AENV Tier 2 Guidelines – Alberta Environment Tier 2 Guidelines (2009).
Oakridge Guidelines = Sediment Quality Guidelines, 1997

1. Pathway specific (soil ingestion and eco soil contact) CCME CSQGs were used for comparison of BTEX concentrations in soil.
2. Guidelines for PAHs (soil ingestion and eco soil contact pathways) were obtained from the CCME CSQGs Factsheet for Polycyclic Aromatic Hydrocarbons, 2010.
3. Alberta Tier 2 Guidelines for Ecological Health were presented for Total PCBs in the absence of CCME guidelines for Ecological Health.
4. Health Canada GCDWQ were used where no CCME Human Health guidelines were available.
5. AENV Tier 2 Guidelines used in the absence of CCME CWQGs and/or GCDWQGs
6. Oakridge Guidelines were used in the absence of CCME Ecological guidelines
7. CCME Soil Guidelines used for Human Health and Sediment Guidelines used for Ecological Health

5.1 Human Health and Ecological Risk Assessment

In order to determine whether or not on-site concentrations of contaminants posed unacceptable risk to human or ecological receptors currently or in the future, Nunami Stantec conducted an HHERA in 2010 as part of the Supplemental Phase III ESA.

The HHERA generated Site Specific Threshold Levels (SSTLs) for aluminum, lead and petroleum hydrocarbon fractions F1, F2 and F3 (provided below). These levels are to be used as remedial criteria in conjunction with the generic screening criteria presented in Section 5.0 during the remediation phase of the project.

Table 5.2: Site Specific Threshold Levels

Parameter	SSTL (mg/kg)
Aluminum	180,000 mg/kg
Lead	474 mg/kg
PHC Fraction F1	240 mg/kg
PHC Fraction F2	3,700 mg/kg
PHC Fraction F3	1,800 mg/kg

5.2 Other Applicable Criteria

Remedial activities on-site should also be conducted in accordance with the following guidelines:

- Government of Nunavut Guideline for Dust Suppression (2002)
- Government of Nunavut Guideline for the General Management of Hazardous Waste (2010)
- Government of Nunavut Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities (2011)
- Government of Nunavut Guideline for the Management of Waste Lead and Lead Paint (2001)
- Government of Nunavut Environmental Guidelines for Waste Asbestos (2011)
- Government of Nunavut Environmental Guideline for Waste Batteries (2011)
- Government of Nunavut Environmental Guideline for the Burning and Incineration of Solid Waste (2011).

6 REMEDIAL OPTIONS ANALYSES

6.1 Disposal Options

6.1.1 Non-Hazardous Waste

Approximately 1,254 m^3 of non-hazardous waste remains on-site. The wastes observed included construction materials (e.g. wood, concrete, piping, roofing products, machine and equipment parts), miscellaneous metal debris and residential wastes (e.g. cans, wiring, appliances).

Prior to disposal, all debris present on-site (including the buried materials identified during the 2010 Geophysical Investigation) should be collected and sorted into non-hazardous and hazardous waste streams. Non-hazardous waste should be crushed, shredded and/or incinerated to reduce the volumes. Nunami Stantec has identified four disposal options for the non-hazardous waste including:

Option 1: Bury in Place On-site

All non-hazardous waste could be crushed using heavy equipment and covered with engineered compacted fill. The cover or cap material used should be of low hydraulic conductivity and be placed in such a manner as to promote positive drainage and graded to match the surrounding terrain.

This option is expected to present the most cost effective option for disposal of non-hazardous waste. However, this option does not satisfy all of the remedial objectives outlined in Section 1.1; specifically, it does not remove the waste from the Site.

Option 2: Place in On-site Landfill

All non-hazardous waste could be collected and disposed of at a non-hazardous landfill constructed on-site. Where practical, existing foundations will be removed to below ground surface and the remaining foundations (if present and not able to be removed) will be covered with engineered compacted fill. Foundations removed from the Site would be taken to the landfill and disposed of as non-hazardous wastes.

Similar to option 1, this option provides a cost effective approach to disposing of wastes. However, this approach does not remove the materials from the Site and establishes a landfill which should receive long term monitoring.

Option 3: Dispose Off-site at the Clyde River Landfill

All non-hazardous waste could be collected and transported to the existing Clyde River Landfill. Where practical, existing foundations will be removed to below ground surface and the remaining foundations (if present) will be covered with engineered compacted fill. Foundations removed from the Site could be taken to the landfill and disposed of as non-hazardous wastes.

The advantage of this option is that it removes the wastes from the Site and does not create another permanent landfill with potential liability over the long term. In comparison to the other off-site

disposal options presented, this approach presents a cost effective and practical approach for the disposal of these wastes. Due to the large amount of non-hazardous waste present, the existing Clyde River Landfill may become overburdened; with negative impact to community use of the facility in the future.

Option 4: Dispose Off-site at a Disposal Facility in Southern Canada

All non-hazardous waste could be collected and transported via ship to southern Canada for disposal. Prior to transport, non-hazardous waste will be containerized and transported to Clyde River and then shipped to a disposal facility in southern Canada.

Similar to option 3 this option would remove the waste from the Site entirely but may prove to be cost prohibitive due to the transportation costs. This option could consider the potential for recycling of metal wastes at a southern facility.

6.1.2 Hazardous Waste

Due to the regulatory requirements of this waste stream, limited remedial options are available for this type of waste. Transformers / capacitors found intact would be treated as hazardous waste, containerized and shipped off-site to a licensed disposal facility.

6.1.3 Aluminum Waste

Based on the information collected during previous assessments, a white powdery substance was identified on-site in the area west of the spillway. This substance consists of a hydrogen generation by-product characterized by high concentrations of aluminum (max = 340,000 mg/kg) and is alkaline.

Three options for disposal of the aluminum waste are presented below.

Option 1 – Cap in Place

Areas containing aluminum waste could be capped with 1.0 m of low permeability compacted engineered fill. The fill will be graded to promote positive drainage and could mitigate the exposure to people living on the Site. It would; however, not remove the liability from the site and depending upon the concentration could continue to impact the meltwater and near shore marine environment.

This approach is anticipated to have a low cost. However, it does not satisfy the remedial objectives presented in Section 1.1 as the impacts remain on-site.

Option 2 – Dispose off-site at the Clyde River Landfill

Areas containing aluminum waste would be excavated to a depth of approximately 0.3 m. The excavated material would be transported to the Clyde River Landfill where it would be disposed in a new lined, engineered containment cell constructed as part of the remedial program. Appropriate methods to prevent loss during transportation would be required. Following excavation, the excavated material should be covered to mitigate leaching and/or airborne dispersion until placed in the containment cell.

Although this option satisfies the requirements of the Remedial Objectives in Section 1.1, the long term storage of metal impacted soils at the Clyde River Landfill may not receive support from the community or regulators. Excavation and transportation of the wastes will be costlier than on-site disposal.

Option 3 – Dispose off-site in Southern Canada

Areas containing aluminum waste would be excavated to a depth of approximately 0.3 m. The excavated material would be containerized and then transported to a licensed disposal facility in Southern Canada.

This option satisfies the requirements of the Remedial Objectives in Section 1.1; however, the cost for this option would be high.

6.1.4 Waste Petroleum Products

Approximately 1,854 L of waste petroleum product and four 6,000 L ASTs were identified on the Site. Currently, the ASTs are vented to the atmosphere and are presumed to contain residual product (approximately 100 L). Waste product will be incinerated; drums and ASTs rinsed and then disposed of as non-hazardous waste at the existing Clyde River Landfill. The options for this waste stream address where the waste incineration activity would occur.

Option 1 – Incinerate and Dispose Off-site at the Existing Clyde River Landfill

Waste petroleum products will be transferred to the Clyde River Landfill where they will be incinerated. The drums and ASTs would then be rinsed and crushed for disposal in the landfill. Contaminated rinse water would be treated before release. All wastes will be transported via truck in accordance with Transportation of Dangerous Goods Act requirements.

This approach allows for the petroleum wastes to be removed from the Site; however it requires additional handling and the presence of a water treatment system at the landfill.

Option 2 – incinerate On-Site

Waste petroleum products will be incinerated on-site. Drums and the ASTs will be rinsed with rinse water subject to treatment using the water treatment system established for contaminated melt water and water from the land treatment facility. Cleaned drums and ASTs will be transported to the Clyde River Landfill for disposal as non – hazardous waste.

This option requires limited transport of waste petroleum product, thereby limiting the potential for additional contamination. It also utilizes a water treatment system that would already be on-site. This option does meet all of the remedial objectives identified in Section 1.1.

6.1.5 Special Wastes

Special wastes observed on-site include asbestos containing materials [(ACMs) including tiles, shingles and insulation], electrical equipment (e.g. batteries, wiring), lead impacted waste and sanitary wastes.

Due to the regulatory requirements of this waste stream, limited remedial options are available for these wastes. The remedial methods for each of these wastes include:

- Asbestos - Asbestos waste would be collected, placed in plastic sealed bags, and disposed of at the non-hazardous landfill located at the existing Clyde River Landfill.
- Electrical Wastes - Broken and intact batteries would be collected and transported to a registered recycling facility in southern Canada. Capacitors that are broken and contain no liquids would also be placed in the existing Clyde River Landfill. Capacitors found intact would be treated as hazardous waste and transported to a licensed hazardous waste disposal facility in southern Canada.
- Lead Impacted Waste – Pending design review and approval by the GN Department of the Environment, this waste could be deposited in the landfill containment cell also used for the metal impacted soils.
- Sanitary Wastes - Any identified sanitary wastes should be collected and depending on the status of these wastes, they would either be transported to the septic disposal area at the existing Clyde River Landfill or placed in an on-site landfarm.

6.1.6 Petroleum Hydrocarbon Impacted Soil

Nunami Stantec has developed estimates of the PHC impacted soil present at the Site. These volumes are provided in Table 6.1 below:

Table 6.1: Summary of Petroleum Hydrocarbon Soil Volumes at the Old Town Site

Area	Location	Approximate Area (m^2)	Approximate Depth (m)	Approximate Volume (m^3)
Petroleum hydrocarbon impacted soil	Southern Powerhouse, Main Site DOT Area, Spillway, Fuel Tanks and Main Site Dump	4,900	0.5 to 1.25	4,900

6.1.6.1 Options for PHC Impacted Soil

Option 1 - Cap in Place

Areas containing PHC impacted soil could be capped with 1.0 m of low permeability compacted engineered fill. The fill will be graded to promote drainage and could mitigate the exposure to people visiting/living on the Site. It would however not reduce the liability of the existence of the impact and depending upon the concentration, could continue to impact the meltwater and near shore marine environment.

This approach would allow the remedial work for the PHC impacted soil to be completed in one season. Additionally, this remedial option is anticipated to have a low cost. However, the engineered fill may be visible by community members camping in the area.

Option 2 – Dispose Off-site at the Clyde River Landfill

All PHC impacted soil exceeding SSTLs could be excavated and disposed at an engineered containment cell at the Clyde River Landfill. The containment cell should be constructed to the applicable Nunavut regulations.

Depending upon the concentration of COCs in the soil, the soil may be suitable as cover material for the existing Clyde River landfill. This method would provide for some form of land farming and bioremediation for the soil and also provides cover fill for waste present at the landfill.

This approach removes the contamination from the Site. However; this approach is labour intensive as a large amount of soil would need to be transported. Community members may express concern regarding the long term storage of impacted soil within the landfill site.

Option 3 – On site Bioremediation

Hydrocarbon impacted soil exceeding the SSTLs would be excavated from the impacted areas identified during the 2010 Supplemental Phase III ESA (Drawing 123600017 – RAP-1 in **Appendix A)**. Once excavated, the impacted soil would be transported to an engineered and lined Land Treatment Facility (LTF) constructed on-site. Prior to placement of impacted soil inside of the LTF, the soil would be aerated using an alluing bucket (or other similar technology) and treated with chemical amendments (fertilizer) to promote the biodegradation and volatilization of the PHCs. The soil would then be remediated using traditional landfarming / biopiling techniques.

Despite the technique selected, annual monitoring / treatment would be required. This monitoring / treatment would include:

1. Soil sampling to monitor the progress of the soil remediation;
2. Groundwater sampling of the monitoring wells surrounding LTF;
3. Addition of chemical amendments (fertilizer) and soil rotation; and,
4. Water encountered inside of the LTF during its operation would need to be collected and monitored to confirm COCs are below the applicable screening criteria; if concentrations are above, the water would require treatment in the proposed on-site water treatment system.

Once soil samples confirm that the PHC impacts present are below the SSTLs criteria, soil will be transferred from the LTF and placed on-site. Upon completion of the soil remediation, the LTF would be decommissioned, the liner removed and the soil contoured to the surrounding topography.

a) Treat On-site using Biopiling Technique

The PHC impacted soils would be collected into piles and wrapped in a synthetic liner to promote anaerobic degradation of the hydrocarbons. The purpose of the liner is to promote bioactivity by retaining heat, which is otherwise difficult using other remediation techniques (landfarming).

In this option, hydrocarbon impacted soil would remain on the Site; however, the presence of contaminants will eventually decrease with time. This option would require both capital and

operational expenditures; however, in its comparison to the landfarming option presented below, the remediation of the soil may occur in a shorter timeframe.

b) Treat On-site using Landfarming Technique

The PHC impacted soil would be deposited into the LTF to a total height of approximately 1 m. The landfarm should be engineered and constructed to the applicable regulations. Several years may be required to reduce concentrations to within acceptable levels.

In this option, the PHC contamination in the soil would eventually be eliminated from the Site, with no transportation of the soil off-site. As this approach would require landfarming this option would require both capital and operational expenditures.

6.1.7 Metal Impacted Soil

Unlike PHC impacted soil, metal impacted soil cannot be easily remediated and therefore remedial options for metal impacted soil typically focus on excavation and containment of the soil.

Table 6.2: Summary of Metal Impacted Soil Volumes at the Old Town Site

Area	Location	Approximate Area (m^2)	Approximate Depth (m)	Approximate Volume (m^3)
Metal Impacted Soil	Residential Area and Main Site DOT Area	655	0.6 to 1.2	575

Option 1 - Cap in Place

Areas containing metal impacted soil could be capped with 1.0 m of low permeability compacted engineered fill. The fill will be graded to promote drainage and could mitigate the exposure to people visiting/living on the Site. It would however not reduce the liability of the existence of the impact and depending upon the concentration, could continue to impact the meltwater and near shore marine environment.

This approach would allow the remedial work for the metal impacted soil to be completed in one season. Additionally, this remedial option is anticipated to have a low cost.

Option 2 - Dispose Off- site at the Clyde River Landfill

All metal impacted soil could be excavated and transported to the Clyde River Landfill where it would be disposed of in a lined, engineered containment cell, to be constructed at the Clyde River Landfill. Appropriate care will need to be taken when transporting this material to prevent spillage. Following excavation, the excavated material should be covered with plastic sheeting to mitigate leaching and/or airborne dispersion of dust.

Although this option satisfies the requirements of the Remedial Objectives in Section 1.1, the long term storage of metal impacted soils at the Clyde River Landfill may not receive support from the community or regulators. Excavation and transportation of the wastes will be cost and labour intensive.

6.1.8 Petroleum Hydrocarbon and Metal Impacted Groundwater / Meltwater

Petroleum hydrocarbon and metal impacts exceeding the screening criteria were encountered in the groundwater in several on-site areas during investigations completed in 2008 and 2010.

Groundwater remediation will be required during the remedial activities (i.e. during excavation of impacted soil). Upon completion of the remedial activities, groundwater quality should be re-assessed to establish post remediation contaminant concentrations. During the operation of the on-site land treatment facility, groundwater quality would continue to be monitored until the facility is decommissioned.

Option 1 – Natural Attenuation

It is expected that, potentially impacted groundwater / meltwater would be encountered during the remedial excavation process. Remediation of the impacted soils would remove the source of the impacts and natural processes would eventually reduce the concentrations of contaminants in the water below the applicable criteria. The water could also be pumped out of the excavations, transferred into a storage tank and left to settle. Samples would be collected from the tank and the effluent can be discharged back into the environment once analytical results show that the water meets the applicable criteria.

This option is expected to present the most cost effective option for disposal of contaminated water. However, this option does not satisfy all of the remedial objectives outlined in Section 1.1; regulators and community members may express concern regarding the long term storage of contaminated water at the Site.

Option 2 – Pump and Treat

All groundwater / meltwater encountered during the remediation process would be transferred to an on-site waste water treatment system.

The groundwater / meltwater will be transferred to settling tank, where the suspended solids will settle out before being decanted into a filtration system. Effluent would then be pumped through a set of sand, clay/ activated carbon and activated carbon filters to remove the majority of COCs.

Built-up sludge from the settling tank would be regularly sampled to ensure that it meets the disposal criteria at the existing Clyde River landfill. Sludge not meeting the applicable criteria would be incorporated into the contaminated material at the on-site landfarm for remediation.

Upon completion of treatment, water samples should be collected and analysed to confirm the treated water meets the applicable discharge criteria.

This approach is labour intensive and requires long term monitoring. Other effluent treatment methods are available; however, these systems would require more specialized equipment, trained operators and on-going maintenance. Regulators and community members may express concern regarding the long term storage of contaminated water at the Site.

6.1.9 Hydrocarbon and Metal Impacted Surface Water

In addition to the impacts identified in groundwater, several COCs exceeding the screening criteria were also identified in surface water samples collected on-site. In order to determine future remedial requirements for surface water, a post-remediation assessment (after source removal) will be required.

7 EVALUATION OF REMEDIAL OPTIONS

Each potential remedial option presented in Section 6 is compared against five assessment criteria. These criteria are established to assess option viability with respect to statutory requirements, as well as proven effectiveness, public acceptance and cost. Criteria applied to assess identified remedial options are summarized in Table 7.1 and includes:

- Regulatory Compliance
- Long Term Effectiveness
- Execution
- Stakeholder Acceptance
- Cost

Table 7.1: Remediation Evaluation Criteria

Criteria	Definition
Compliance	In order to be the selected approach, the option must comply with applicable legislation, regulations and guidelines.
Long Term Effectiveness	Effectiveness of the option to minimize risk associated with the Site in the long term.
Execution	Execution addresses the technical and practical feasibility of executing the potential option. It considers if the option can be implemented with current technology, local equipment, resources and skills, etc.
Stakeholder Acceptance	This criterion is a measure of the community, regulator and project sponsor (GN) acceptance of the potential remedial option. During the community meeting, residents expressed the desire to have all contaminants and wastes removed from the Old Town site.
Cost	A qualitative opinion on cost (i.e., low, moderated, high) is included for potential remedial options for this screening level evaluation. Factors considered include types of equipment required, disposal costs, available local skills, person days of work, etc.

7.1 Evaluation of Remedial Options

Potential remedial options were evaluated on a qualitative basis by assigning a relative measure of adequacy. All criteria are qualitatively assessed with each option's expected performance compared to other considered options.

Options were assigned a pass, fail, poor, medium, or good rating as follows:

- Pass – Option complies with applicable legislation
- Fail – Option fails to comply with applicable legislation
- Poor - Option unlikely to satisfy evaluation criteria
- Medium – Option generally satisfies evaluation criteria

- Good - Option strongly satisfies evaluation criteria

The cost for each option has been assessed as low, medium and high rating.

Table 7.2: Evaluation of Remedial Options

Potential Remedial Option	Disposal Location	Compliance	Effectiveness	Execution	Stakeholder Acceptance	Cost
Non-Hazardous Waste						
On-Site (Buried in Place)	Site	Pass	Poor	Good	Poor	Low
On-Site Landfill	Site	Pass	Poor	Medium	Poor	Medium
Off-site Disposal	Clyde River Landfill[1]	Pass	Good	Good	Medium	Low
	Southern Canada	Pass	Good	Good	Good	High
Aluminum Waste						
On-site (Cap in Place)	Site	Fail	Medium	Good	Poor	Low
Off- Site Disposal	Clyde River Landfill[2]	Pass	Good	Good	Medium	Medium to High
Off-Site Disposal	Southern Canada	Pass	Good	Good	Good	High
Waste Petroleum Product						
Off-Site Disposal	Clyde River Landfill	Pass	Good	Good	Good	Medium
On-Site Disposal	Site	Pass	Good	Good	Low	Low
Petroleum Hydrocarbon Impacted Soil						
On-Site Cap in Place	Site	Fail	Medium	Good	Poor	Low
Off-Site Disposal	Clyde River Landfill	Fail	Good	Good	Medium	Medium to High
On-site Disposal using Bio Piles	Site	Pass	Medium	Good	Medium	Medium
On-Site Disposal in Land Farm	Site	Pass	Medium	Good	Poor to Medium	High
Metal Impacted Soil						
On-Site Cap in Place	Site	Fail	Medium	Good	Poor	Low
Off- Site Disposal	Clyde River	Pass	Good	Good	Medium	High

Potential Remedial Option	Disposal Location	Compliance	Effectiveness	Execution	Stakeholder Acceptance	Cost
	Landfill[2]					
Petroleum Hydrocarbon and Metal Impacted Groundwater / Meltwater						
On-site Natural Attenuation	Site	Pass	Poor to medium	Good	Poor	Low
On-site Pump and Treat	Site	Pass	Good	Medium	Medium	Medium

NOTE:

1. Non-Hazardous Waste from Site will be deposited into the current Clyde River Landfill.
2. The metal impacted soil and aluminum powder will be deposited into a newly constructed cell at the Clyde River Landfill.

7.2 Recommended Remedial Approach

Based on the evaluation of remedial options, Nunami Stantec recommends the following remedial methods be employed during the remediation of the Site.

Non-Hazardous Waste – All non-hazardous waste should be collected and disposed off-site at the existing Clyde River Landfill. Combustible non-hazardous waste could be burned on-site to reduce volumes.

Hazardous Waste – All hazardous waste should be containerized in accordance with the applicable regulations and disposed off-site at a licensed hazardous waste disposal facility in southern Canada.

Aluminum Waste - The top 0.3 m of the aluminum waste footprint should be excavated and disposed of in a containment cell to be constructed at the Clyde River Landfill.

Waste Petroleum Products – All waste petroleum products should be collected and incinerated on-site in a waste fuel incinerator. Drums and ASTs present on the Site will be rinsed on-site and any residual fluids will be collected and stored in drums. Once rinsed, the drums and ASTs will be disposed as non-hazardous waste at the existing Clyde River Landfill.

Special Wastes

- ***Asbestos*** - Asbestos containing waste should be collected, placed in plastic sealed bags, and disposed of at the existing Clyde River Landfill.
- ***PCB Wastes*** - Capacitors and transformers found intact would be treated as hazardous waste, containerized, and shipped off-site to a licensed disposal facility in southern Canada.
- ***Electrical Wastes*** - Broken and intact batteries should be collected and transported to a registered recycling facility in southern Canada. Capacitors / transformers that are broken and contain no liquids should be placed in the existing Clyde River Landfill.
- ***Lead Impacted Wastes*** – This material can be disposed of in the containment cell with the aluminum waste and metal impacted soil, pending design approval by GN DOE.

- ***Sanitary Wastes*** - Any identified sanitary wastes should be collected and, depending on the nature of the waste, be transported to the septic disposal area at the existing Clyde River Landfill or deposited in the on-site landfarm.

PHC Impacted Soil – Petroleum hydrocarbon impacted soil should be excavated and treated through on-site bioremediation using either the biopiling or landfarming technique. This would entail the construction of a Land Treatment Facility where soil can be placed in a thin layer and mechanically aerated and chemically amended for a period of several years while biodegradation of the hydrocarbon compounds is achieved through microbial metabolism and volatilization through aeration.

Metal Impacted Soil – Metal impacted soil should be excavated and disposed of in a containment cell to be constructed at the Clyde River Landfill.

PHC and Metal Impacted Water – All groundwater / meltwater encountered during the remediation process would be transferred to the proposed on-site waste water treatment system.

The groundwater / meltwater will be transferred to settling tank, where the suspended solids will settle out of the effluent before being decanted into a filtration system. Effluent is then pumped through a set of sand, clay/ activated carbon and activated carbon filters to remove the majority of COCs.

Built-up sludge from the settling tank would be regularly sampled to ensure that it meets the disposal criteria at the existing Clyde River landfill. Sludge not meeting the applicable criteria would be incorporated into the contaminated material at the on-site landfarm for remediation.

Upon completion of treatment, water samples should be collected and analysed to confirm the treated water meets the applicable discharge criteria.

8 SITE ACCESS AND LOGISTICS

8.1 Access

The Site is accessible by all terrain vehicle (ATV) or boat. The existing ATV trails that lead from the community to the Site are in poor condition, and are not suitable for heavy equipment use. The existing roads at the Site will require upgrading prior to the remedial activities.

8.2 Hamlet of Clyde River Facilities

The local landfill facilities within the Hamlet of Clyde River are limited. The Clyde River landfill, located approximately 1 km northwest of the community, features areas of PHC storage, a domestic waste area and a metal disposal area. The metal disposal area and the PHC storage area did not appear to be engineered (e.g. no liner or containment berm was observed).

Nunami Stantec does not anticipate that a camp will need to be mobilized to Clyde River to facilitate the remedial work. Local accommodation (including the Inns North Hotel) can be used to accommodate out of town workers.

8.2.1 Clyde River Site Facility Requirements

In order to complete the remedial activities, the following facilities should be constructed:

Site Access - To facilitate the remedial activities on-site, several temporary roads are required to be constructed. These include a route extending from the quarry access road (located approximately 3 km north of the Site) and several on-site access roads. The roads must be adequate for heavy equipment use and provide easy access to the inaccessible areas of the Site, the waste handling facility and the landfarm. Upon decommissioning of the Site, the temporary roads should be removed.

During the 2010 Supplemental Phase III ESA field program, Nunami Stantec evaluated the potential routes between the quarry access road and the Site. Based on the topography, drainage, and proximity to areas currently in use, Nunami Stantec has selected one route that meets the requirements for remediation of the Site. This route has been provided in Drawing **110200017-RAP-3** in **Appendix A**.

Prior to the final selection of the routing, a geotechnical assessment will be completed in July 2011 to provide a description of soil conditions in the vicinity of this route. Upon completion, Nunami Stantec will provide general design parameters for the road.

Borrow Sources - Borrow materials are required for the construction of the waste handling facility, land farm and access roads. It would appear from our site inspection work that a borrow source for gravel exists near the airport (source for the airport granular fill). Additionally, a quarry is located approximately 3 km from the Site. Existing granular resources should be exhausted, where possible, before utilizing new resources.

In preparation of the RAP, Nunami Stantec contacted the Hamlet of Clyde River Assistant Senior Administrative Officer (ASAO), Mr. Stephen Aipellee, to discuss the current availability and cost of granular materials present within the community. Mr. Aipellee confirmed that approximately 5,000 m^3 of crushed granular material and 5,000 m^3 of sand are available for the remediation project. Based on the preliminary estimate of borrow materials required, this quantity may be sufficient. However, upon finalization of the engineering design for the access roads, waste handling facility and land treatment facility additional quantities may be required.

A geotechnical assessment will be completed in July 2011 to confirm the quantity of material available at the current quarry; and, if necessary, determine locations of other potential granular resources.

Clyde River Landfill Containment Cell – To dispose of the aluminum waste, metal impacted soil and lead impacted waste from the Site, Nunami Stantec recommends that a containment cell be constructed adjacent to the existing Clyde River Landfill. The cell should be constructed to current regulations and standards and should be a lined facility with a cover in place once filled. It will be designed with a single membrane liner and upon the placement of wastes the cell will be covered with a second membrane liner. Long term monitoring should be incorporated and design review by GN DOE is required.

Waste Handling Area - A contained waste handling area is required to collect, sort, and containerize wastes. The waste handling area shall be lined with an engineered clay/synthetic liner to prevent the migration of contaminants released during processing. The fluids handling area is to be bermed and the engineered liner should have some fill cover to protect the liner integrity. The waste handling facility shall have applicable safety items and personal protective equipment (PPE) which include but are not limited to: extinguisher, first aid kit, eye wash station, emergency spill kit etc. Materials to be received and sorted at the waste handling area include but are not limited to:

- Drums
- Batteries
- Capacitors and transformers
- Compressed Gas Cylinders
- Items painted with Lead Paint
- Aluminum waste and metal impacted soil for off-site removal

The waste handling area should be surrounded by temporary road to provide access to vehicles and equipment required in the delivery sorting and transport of the site waste.

In addition, the area should be large enough to decontaminate the heavy equipment prior to leaving the facility thereby mitigating the distribution of impacts from the Site along the transportation route(s).

Upon decommissioning of the waste handling area the area beneath the facility shall be sampled for confirmatory purposes. The liner will be disposed off-site as non-hazardous waste at the Clyde River Landfill and the underlying soil sampled for COCs.

Land Treatment Facility - An on-site LTF is recommended for the treatment of PHC impacted soil on-site. The lined LTF should have groundwater monitoring wells placed around the perimeter of the containment cell for groundwater / meltwater monitoring purposes. The LTF should be graded to promote positive drainage within the cell and the cell should have a water collection sump at its low point to collect any water that has come in contact with the soil. The collected water will run through a water treatment process and will then be discharged in accordance with applicable regulations.

Once the PHC impacted material have been remediated to the SSTLs, the remediated soil will be removed from the landfarm, and used to slope and re-contour the Site. The landfarm will then be decommissioned.

Waste Water Treatment System - Any PHC and/or metal impacted water encountered during the remediation project (including excavation water and water collected from the landfarm) should be transferred to the proposed on-site waste water treatment system.

The waste water will be transferred to settling tank, where the suspended solids will settle out of the effluent before being decanted into a filtration system. Effluent is then pumped through a set of sand, clay / activated carbon and activated carbon filters to remove the majority of COCs.

Built-up sludge from the settling tank would be regularly sampled to ensure that it meets the disposal criteria at the existing Clyde River landfill. Sludge not meeting the applicable criteria would be incorporated into the contaminated material at the on-site landfarm for remediation.

Upon completion of treatment, water samples should be collected and analysed to confirm the treated water meets the applicable discharge criteria.

8.3 Additional Items Required to Support Remediation

8.3.1 Health and Safety and Environmental Response Plans

As part of the site remediation program, site specific Health and Safety and Environmental Response Plans should be prepared. The Health and Safety Plans (HASP) will govern how all site remediation work is conducted and will identify hazards associated with the remediation work; PPE requirements for on-site workers; safe work procedures and actions to be taken in the event of an emergency; and will identify monitoring procedures to protect both site workers and Clyde River summer residents. The HASP will identify the duties and responsibilities of all remediation personnel relative to site safety. Procedures for obtaining help in the event of an accident will be detailed. It will include procedures for regular site meetings to discuss safety issues, and documentation of such meetings and any safety incidents that occur. All site personnel are expected to become familiar with the HASP and to follow their procedures.

An Environmental Response Plan (ERP) should be prepared to address accidental spills and/or releases of contaminants during site remediation activities. Spill response actions would be detailed

in the plan, as well as responsibilities of on-site remediation personnel. Reporting requirements and contacts for spills and releases would be identified.

8.3.2 Training

Appropriate training will be needed for Clyde River residents who are involved in the site remediation work. This training should include a variety of elements, including:

- Basic site safety
- Health and safety training, as it relates to impacted site remediation work
- Use of PPE
- Spill response measures
- Asbestos cleanup procedures

All remediation personnel will receive training in the first three items, while only those personnel directly involved with either spill response and/or asbestos cleanup will need that training. Depending upon the skills available locally other training may be required (e.g., heavy equipment operation, welding).

8.3.3 Logistics

Logistical assistance would be required to support the site remediation work. This should include specification of equipment to be used and logistics associated with acquiring and delivering this equipment to Site. Specialty contractors for some remediation work components (e.g., containment cell construction, tank decommissioning) maybe required depending upon local resources, scheduling, and how the GN and the community wish to proceed with this project.

8.3.4 Remediation Plan Supervision

Implementation of the Site remediation plan would require appropriate supervision. Further discussions and decisions are needed to determine how the RAP would be executed and supervision required. Roles and responsibilities must be clearly defined, discussed, and agreed upon well in advance of the remediation.

8.3.5 Site Closure Plan

A Site Closure Plan should be developed as part of the remediation project, to minimize any residual impacts and provide details as to the final decommissioning of the Site. This Site Closure Plan must include closure of the Land Treatment Facility and, if appropriate, decommissioning of the temporary road.

9 PERMITTING

9.1.1 Regulatory Approvals

The remediation project will likely require authorizations from several regulatory bodies including the Nunavut Water Board, CGS, Nunavut Planning Commission (NPC) and possibly the Department of Fisheries and Oceans (DFO), Indian and Northern Affairs Canada (INAC) and the Nunavut Impact Review Board (NIRB). In order to ensure that all regulatory requirements are met, a minimum of three months should be allowed for the acquisition of required authorizations prior to the commencement of work on-site.

The regulatory requirements for each authority are reviewed in the following subsections.

9.2 Nunavut Water Board

The Department of Community and Government Services (CGS) is currently undertaking the renewal of the communities' water license No. 3BM-CLY090, which expired in 2009. The facilities currently governed by the water license include:

- Water Supply
- Solid Waste Management Landfill
- Waste Water Treatment (Sewage Lagoon)

In addition to the existing licenses required for the community, the Old Town Clyde River project will require a license or amendment for:

1. Disposal of Waste Water (generated from the on-site water treatment process); and,
2. Construction and operation of an on-site landfarm.

9.3 GN Community and Government Services

As the Site is located within the municipal boundary of Clyde River, CGS has the jurisdiction over quarry permits and land use authorizations.

9.3.1 Quarry Permit

Based on information provided by CGS Regional Lands Administrator, Mr. Ken Wasylyshen, quarry permits are required for each new proposed quarry location to be utilized during the remediation project.

9.3.2 Land Use Authorization

As the Site is within the Municipality of Clyde River, a land use authorization is required by CGS.

9.4 Nunavut Planning Commission

As Clyde River falls within the North Baffin Regional Land Use Plan, regulatory applications will be forwarded to the Nunavut Planning Commission (NPC) for review by the authorizing agencies. NPC will review the project proposal to ensure that it conforms to the North Baffin Regional Land Use Plan. NPC will forward its conformity decision to the authorizing agencies, who will then commence the review and approval process.

9.5 Department of Fisheries and Oceans

The project has the potential to affect fish habitat as a result of excavations near shore, construction of the road near and possibly over fish habitat. As there are no Operational Statements within Nunavut pertaining to the proposed remedial activities (other than culvert installation), the project proposal will need to be reviewed by DFO to determine if the project will affect fish and/or fish habitat. This review would likely occur during the water license application review; however, DFO may require additional information or mitigations not normally included in the water licensing process.

9.6 Indian and Northern Affairs Canada (INAC)

The Site is under the authority of CGS; however, INAC has stated that it may have “interests” in the area. Nunami Stantec has not yet received confirmation of any INAC interests that would require their approval; therefore, it is assumed that INAC will not have a regulatory approval role; however, it will be a party consulted during the licencing process.

9.7 Nunavut Impact Review Board Screening

Nunami Stantec has reviewed the NIRB screening process and criteria for triggering a screening and confirms that a screening will be triggered by the Commissioner’s Land authorization, and, if included, the quarry application. Each of these triggering activities has been reviewed below.

Landfarm / Access Road

Under the NIRB’s “Guide 4 – Project Proposal’s Exempt from Screening” , the construction of the landfarm and access roads are considered “industrial activities” which trigger the need for a screening ; therefore, a NIRB screening will likely be required for these activities.

Quarry Development and Use

Expansion of the existing quarry or development of a new quarry will trigger a screening.

Screening Requirements and Process

A Project Proposal which addresses NIRBs information requirements, including the Project Specific Information Requirement form is required to be submitted to the NIRB to assist with screening. Upon receipt of the Project Proposal, indication from an authorizing agency of a project requiring screening and a positive conformity decision from the NPC, the NIRB will commence the screening process. The typical timeframe for a screening decision by NIRB is approximately 45 days after receipt of the

necessary information. Following the screening decision, the authorizing agencies complete their review process (which in the case of a water licence involves review by stakeholders) and if positive, issue the authorizations. A minimum of 90 days should be allowed between submission of applications and receipt of project approvals.

10 SCHEDULE

A tentative project schedule has been proposed below. The schedule is based on discussion between Nunami Stantec and CGS during May and June 2011. The intent is to tender the project well in advance of the 2012 construction season.

Submission of Draft RAP for Review	May 3, 2011
Review and Approval of Draft RAP[1]	May 13, 2011
Final RAP	June 10, 2011
Topo Survey/Geotech Investigation	July 2011
75% Drawings and Specifications	Sept 30, 2011
100% Drawings and Specifications	Oct 21, 2011
Permit applications submitted	Oct 31, 2011
Tender Ready	November 9, 2011
Tender Close	December 20, 2011
Construction Contract Award	January 18, 2012
Permits Received	January 31, 2012
Contractor Mobilization to Site	July/Aug 2012
Construction	2012-2013
Soils Treatment	2012-2015
Decommissioning	2015
Long term monitoring	2013- 2015

11 VERIFICATION SAMPLING AND MONITORING

In addition to construction supervision which will monitor contractor performance in relation to the contract, verification sampling and environmental monitoring will be required to confirm contract specifications and remedial objectives have been met. Each of the required activities is outlined below.

11.1 Verification Monitoring

Verification monitoring will occur during the construction and the active remediation portion (construction, processing and removal of waste, facility decommissioning) of the contract. The purpose of verification monitoring is to confirm compliance of the remedial activities with the specified contract specifications and requirements in regulatory authorizations. This will involve collection and analysis of confirmatory samples at all soil excavation locations, collection and analysis of samples of treated water prior to discharge and collection of soil and groundwater samples in areas potentially impacted by remedial activities (under the waste handling facility and landfarm). It will also involve monitoring of structures to ensure they remain competent and are able to continue to perform their intended purpose. Results will be utilized to direct/confirm contractor adherence to contract requirements and to report to regulatory authorities on compliance with authorizations.

11.2 Post Construction Monitoring Program

Following the construction period, post construction monitoring would occur to collect information to determine the success in meeting remedial objectives. This will involve visual monitoring of all structures and collection of surface and groundwater samples.

Visual monitoring of the structures will be required at the site and at the landfill cell in the community. Surface and groundwater samples will be collected within and downgradient of the site and analyzed for metals and PHC. Results will be compared with assessment and remediation criteria, and requirements specified in regulatory approvals. Results and the need for mitigative action will be reported to CGS on a regular basis. It is suggested that post construction monitoring commence the year after the construction period, occur annually for two years and then if results meet objectives, be terminated.

12 CLOSURE

This report has been prepared for the sole benefit of the Department of Community and Government Services (CGS), Government of Nunavut. No other person or entity may use this report without the express written consent of Nunami Stantec Limited or the Department of Community and Government Services, Government of Nunavut. .

Any uses which a third party makes of this report, or any reliance on decisions made based on it, are the responsibility of such third parties. Nunami Stantec Limited accepts no responsibility for any damages suffered by any third party as a result of decisions made or actions based on this report.

The information and conclusions presented in this report are based upon work undertaken by trained professional and technical staff in accordance with generally accepted professional practices current at the time the work was performed. Conclusions presented in this report should not be construed as legal or medical advice.

Should additional information become available, Nunami Stantec Limited requests that this information be brought to our attention so that the conclusions presented may be re-assessed as necessary.

This report was prepared by Patricia Coyne, B.Sc., and reviewed by Rob McCullough, BES, CET, CESA, and Nick Lawson, B.Sc.

Respectfully submitted,

Nunami Stantec Limited

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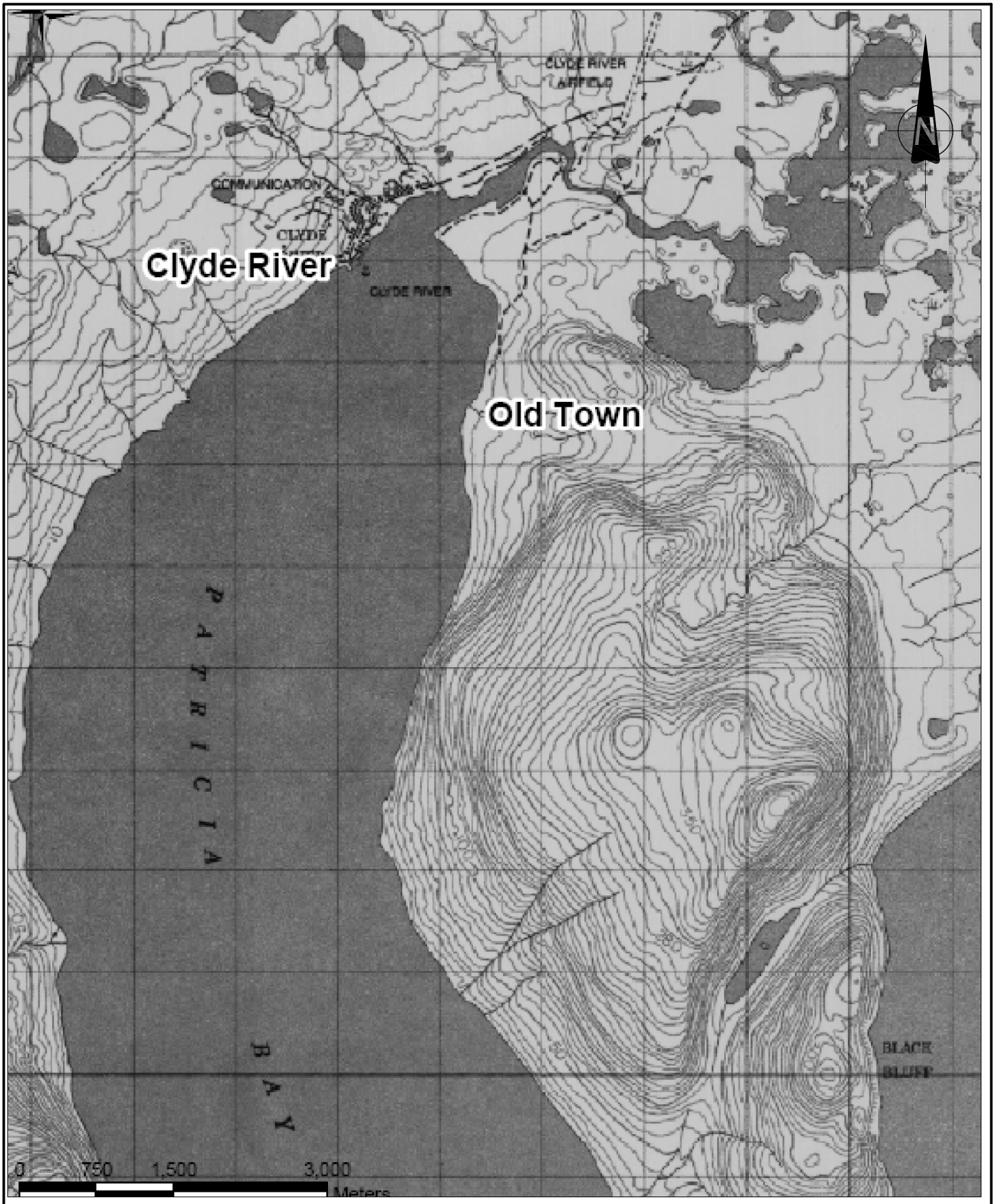
APPENDIX A

Preliminary Drawings



APP'D

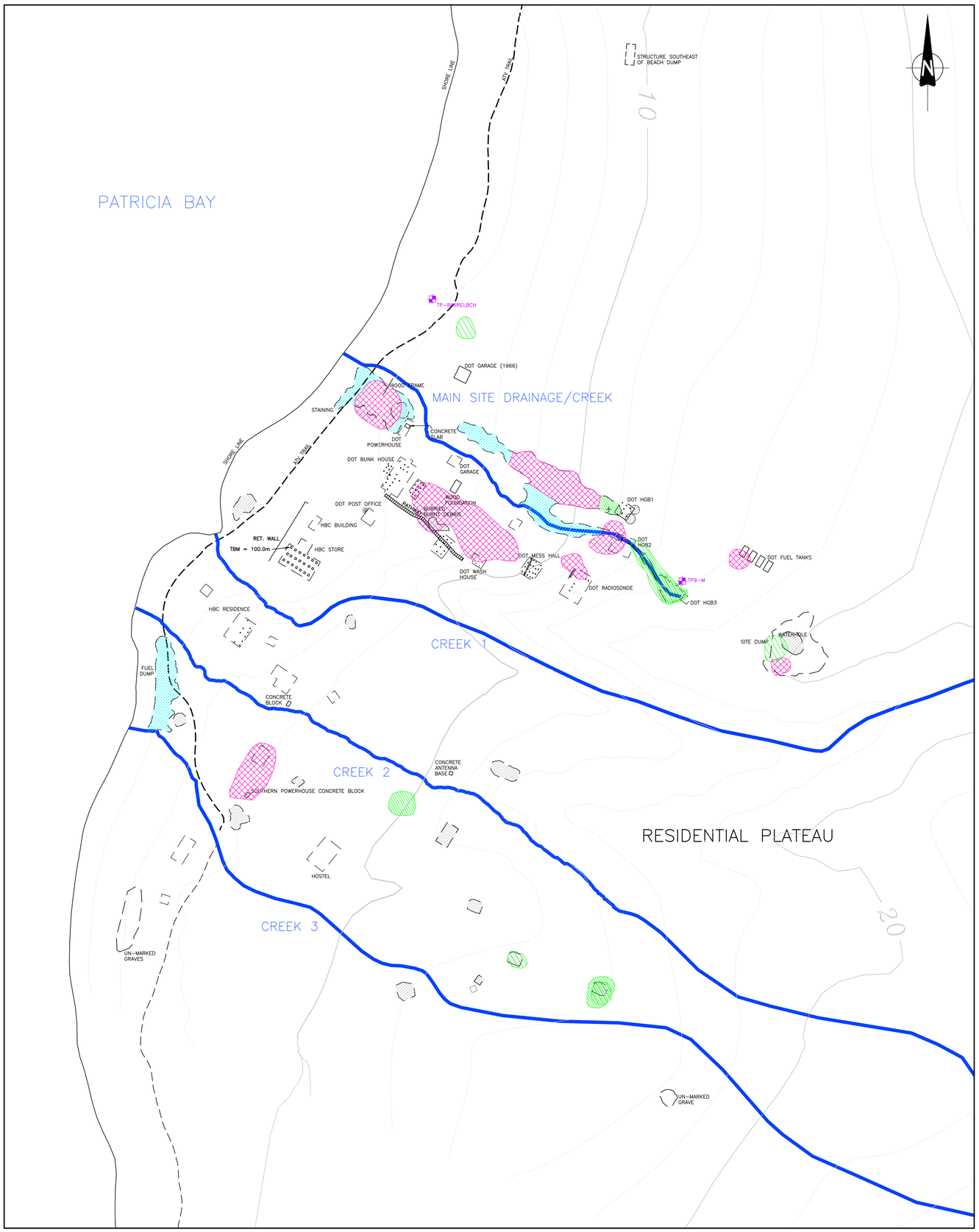
GENERAL SITE LOCATION AND TOPOGRAPHY

SCALE 1: 50,000

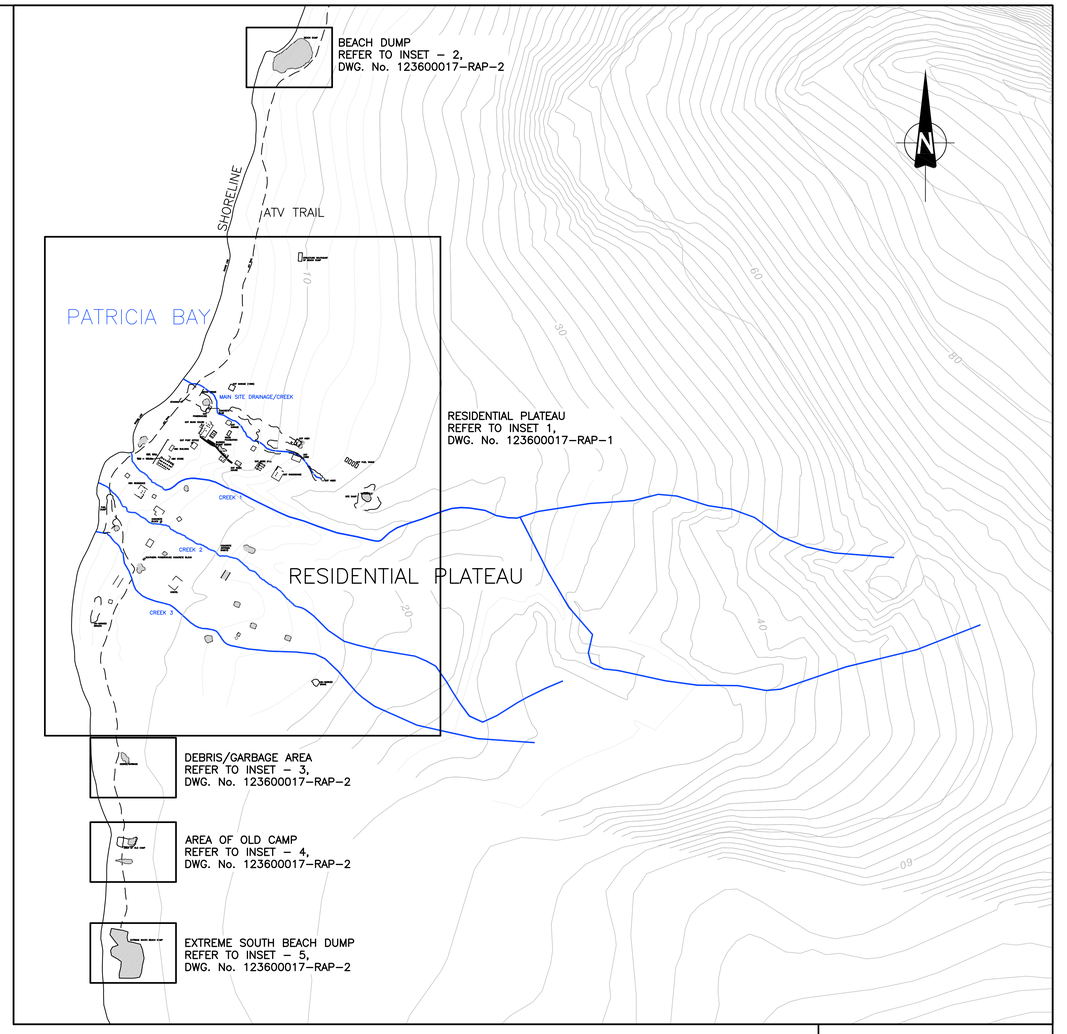
Stantec

123600017

FIGURE 1



INSET #1
MAIN AREA OF OLD TOWN
SCALE: 1:1000



KEY PLAN
SCALE: 1:1000

THIS DRAWING FORMS PART OF STANTEC CONSULTING LTD. SUPPLEMENTARY PHASE III ENVIRONMENTAL SITE ASSESSMENT REPORT, 2010 AND SHOULD BE READ IN CONJUNCTION WITH THE REPORT.

LEGEND:

- ESTIMATED EXTENT OF FORMER BUILDING FOOTPRINT
- LOCATION OF FOOTING POST
- APPROXIMATE AREA OF SURFACE DEBRIS
- SURFACE STAINING (HYDROCARBON OR ALUMINUM) OUTSIDE OF AREA OF SSTL EXCEEDANCE, THAT SHOULD BE REMOVED
- SOIL CONTAINING CONCENTRATIONS OF PETROLEUM HYDROCARBONS GREATER THAN SSTLS.
- SOIL CONTAINING METALS CONCENTRATIONS GREATER THAN SSTLS.

APP'D	NO.	DETAILS	DATE
REVISIONS			
215–2300		GOVERNMENT OF NUNAVUT COMMUNITY DEVELOPEMENT COMMUNITY & GOV. SERVICES, KUGLUKTUK	07/15/2010

REFERENCE

DEPARTMENT OF COMMUNITY AND GOVERNMENT SERVICES – GOVERNMENT OF NUNAVUT

REMEDIAL ACTION PLAN

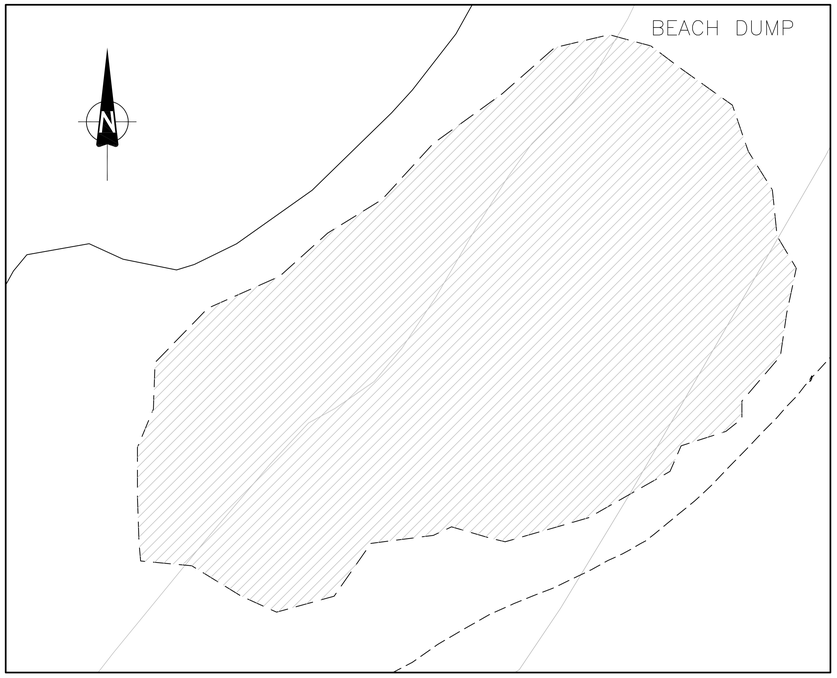
OLD TOWN CLYDE RIVER, NU

AREAS OF IMPACTS EXCEEDING RISK ASSESSMENT SSTL's

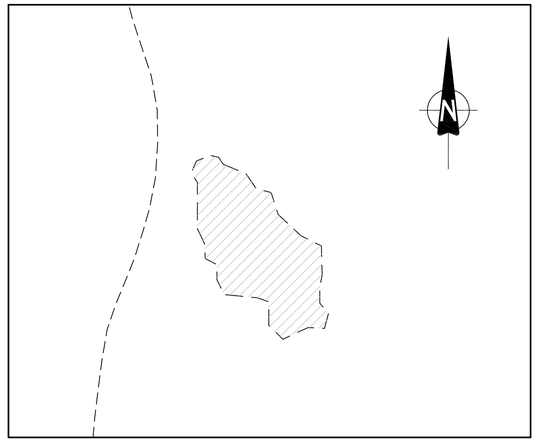
Stantec

DATE	SCALE
2011/04/21	1:1000
DRAWN BY: TDB/SJT	APPROVED BY:

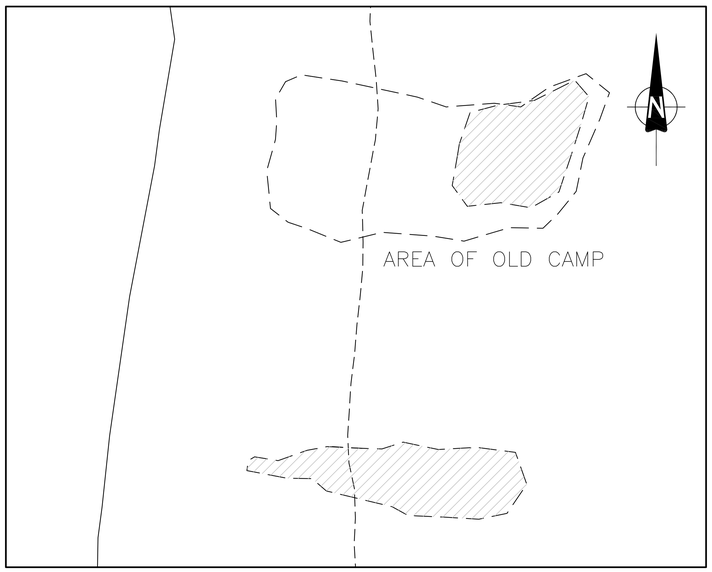
DRAWING NO: 123600017–RAP–1



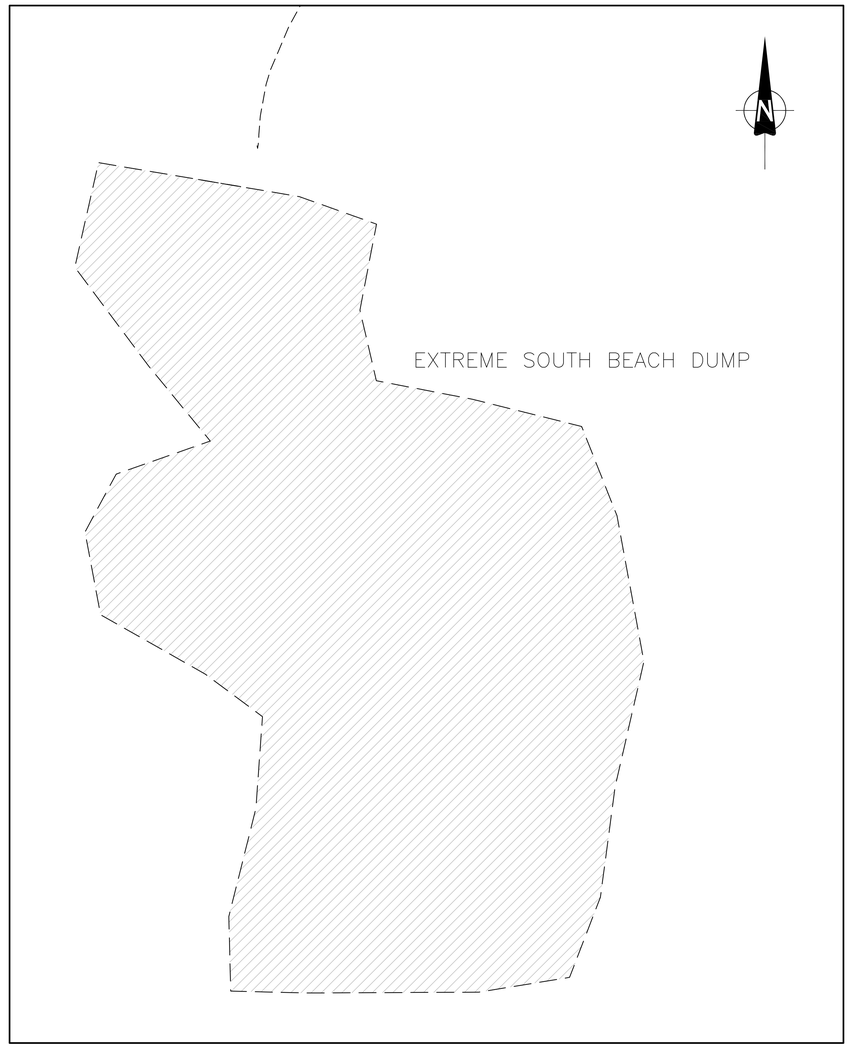
INSET #2
NORTH BEACH DUMP
SCALE: 1:200



INSET #3
DEBRIS/GARBAGE AREA
SCALE: 1:200



INSET #4
AREA OF OLD CAMP
SCALE: 1:200



INSET #5
EXTREME SOUTH BEACH DUMP
SCALE: 1:200

THIS DRAWING FORMS PART OF STANTEC CONSULTING LTD. SUPPLEMENTARY PHASE III ENVIRONMENTAL SITE ASSESSMENT REPORT, 2010 AND SHOULD BE READ IN CONJUNCTION WITH THE REPORT.

LEGEND:

- MONITOR WELL LOCATION
- SEDIMENT SAMPLE LOCATION
- SURFACE WATER SAMPLE LOCATION
- TEST PIT LOCATION (2010)
- TRAP LOCATION
- SURFACE SOIL SAMPLE LOCATION
- LOCATION OF 2008 TEST PITS WHERE SAMPLES WERE SUBMITTED FOR LAB ANALYSIS
- ESTIMATED EXTENT OF FORMER BUILDING FOOTPRINT
- LOCATION OF FOOTING POST
- APPROXIMATE AREA OF SURFACE DEBRIS

APP'D	NO.	DETAILS	DATE
REVISIONS			
215-2300		GOVERNMENT OF NUNAVUT COMMUNITY DEVELOPEMENT COMMUNITY & GOV. SERVICES, KUGLUKTUK	07/15/2010

REFERENCE

DEPARTMENT OF COMMUNITY AND GOVERNMENT SERVICES – GOVERNMENT OF NUNAVUT

REMEDIAL ACTION PLAN

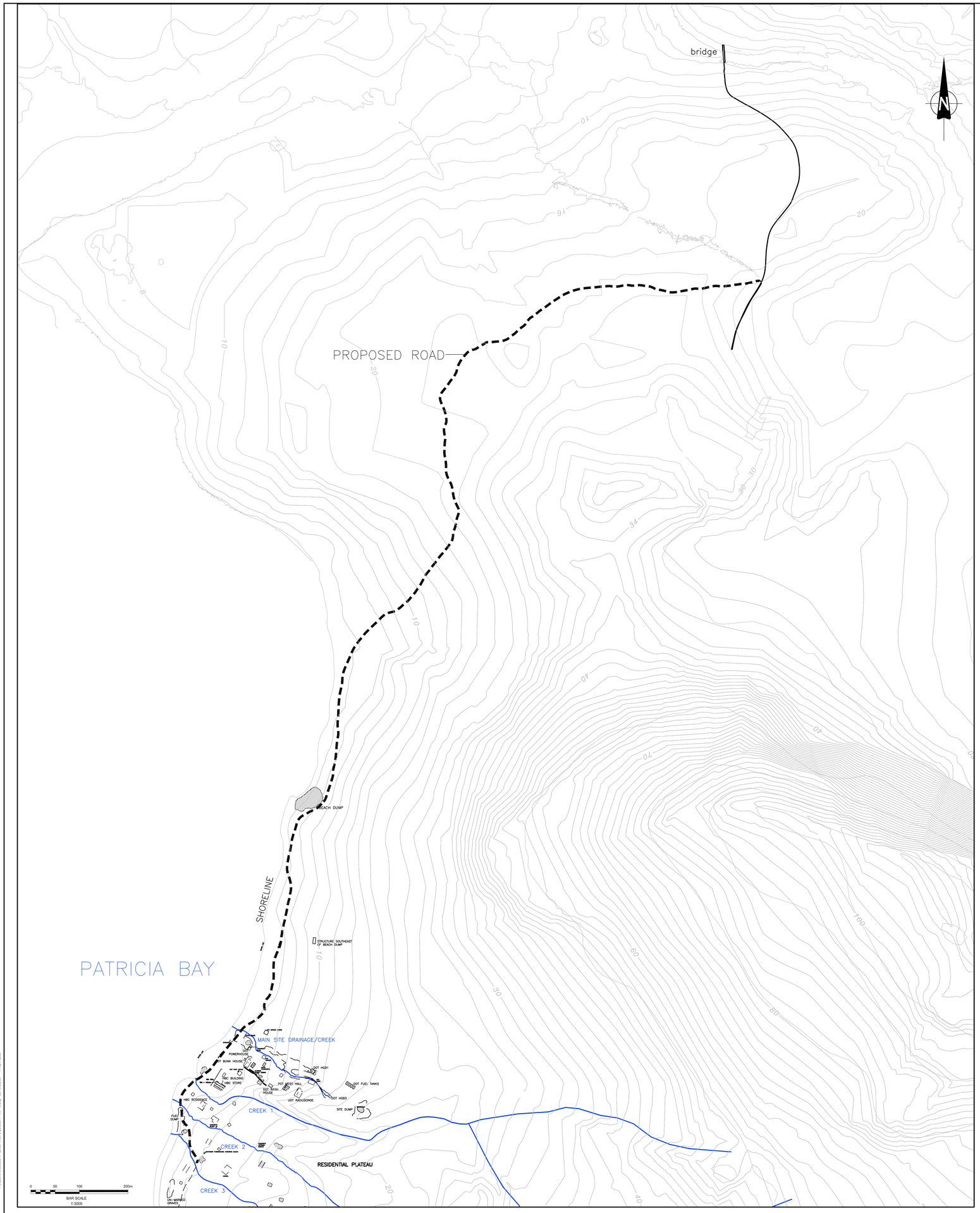
OLD TOWN CLYDE RIVER, NU

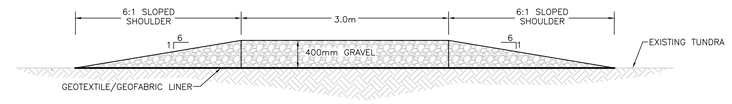
AREAS OF CONCENTRATED SURFICIAL DEBRIS AND METAL DEBRIS OUTSIDE OF CAMP AREA

Stantec

DATE	SCALE
2010/10/19	AS NOTED
DRAWN BY: TDB/SJT	APPROVED BY:

DRAWING NO.
123600017-RAP-2





PROPOSED ROAD SECTION

N.T.S

APP'D	NO.	DETAILS	DATE
REVISIONS			
215-2300		GOVERNMENT OF NUNAVUT COMMUNITY DEVELOPEMENT COMMUNITY & GOV. SERVICES, KUGLUKTUK	07/15/2010
REFERENCE			

DEPARTMENT OF COMMUNITY AND GOVERNMENT SERVICES – GOVERNMENT OF NUNAVUT

REMEDIAL ACTION PLAN

OLD TOWN CLYDE RIVER, NU

PROPOSED ROAD TO SITE

Stantec

DATE	SCALE
2011/04/21	AS NOTED
DRAWN BY: TDB/SJT	APPROVED BY:

DRAWING NO.
123600017-RAP-3

APPENDIX B

Waste Inventory

Table F-1 **Surface Waste Observed at the Hudson Bay Company Area**
Old Town Clyde River
Clyde River, Nunavut
NSL Project No.: 123600063

Buildings	Non Hazardous Waste	PHC Product Waste	Special Wastes	Hazardous Waste	Volume of Non Hazardous Waste (m^3)	Volume of Petroleum Products (L)	Volume of Special Wastes (m^3)	Volume of Hazardous Waste (m^3)	Comments
HBC Residence	- Concrete Pilings - Wooden Debris - One rusted pole - One bag of domestic garbage on beach adjacent to the residence. - One bicycle - Small amount of plastic waste - Small amount of metal debris (including dryer vents, wheel, etc.)	- Several canisters of camping fuel	- Paint on concrete pilings (Red and Orange)	None Noted	10	0	1	0	Tent rings are present for summer camping.
HBC Store	- Wood debris [wooden building frame, flooring, 3 pallets (2 m x 1.5 m), utility poles, pallets, boards, charred wooden floor braces,] - Burnt debris pile [4m x 5m; wiring, metal, burned wood, plastic) - Metal debris (sinks, fuel cans, engine parts, pipes, cabling, wiring) - Pieces of concrete - Burned carpet - Buried barrel with wooden post north of footings - Scrap metal (5 rusted out drums, cable wheel, empty fuel cans, engine parts, two sinks, pipes, nails, utility box, braces)	- Barrel Dump including 7 intact 205L drums containing oily water and sludge	- Green painted chipboard (1m x 1m)	None Noted	15	0	0.5	0	A lot of the debris has been burned on the Site.
HBC Warehouse	- Wooden Debris [Pallets (3) Plywood boards (6)] - Scrap metal (including outboard motors, metal braces, empty drums, empty tank, empty fuel cans, metal anchor, rusted pole, etc) - Three metal pipes (in water along beach) - Insulation (Fiberglass) - Tent rings - Domestic waste piles - Burned domestic waste in half barrel on the beach	None Noted	- Painted wooden platform (3 m x 1.5 m) - Painted chipboard (1.5 m x 1 m) - Asphalt staining (1 m x 1 m) - Waste pile containing shingles, wood, tiles, glass, small motor, electrical wire, metal debris (4.5m x 5m x 0.5m)	None Noted	10	0	15	0	-Stressed vegetation in this area. - Tent rings are present for summer camping

Table F-1 **Surface Waste Observed at the Hudson Bay Company Area**
Old Town Clyde River
Clyde River, Nunavut
NSL Project No.: 123600063

Buildings	Non Hazardous Waste	PHC Product Waste	Special Wastes	Hazardous Waste	Volume of Non Hazardous Waste (m^3)	Volume of Petroleum Products (L)	Volume of Special Wastes (m^3)	Volume of Hazardous Waste (m^3)	Comments
HBC Outbuildings	- Wood debris	None	None	None	5	0	0	0	- Very little left of any of the buildings - 3.5 m x 8 m stained area
TOTAL VOLUME OF WASTES (m^3)					**40**	**0**	**17**	**0**	

Table F-2 **Surface Waste Observed at the Department of Transportation Area**
Old Town Clyde River
Clyde River, Nunavut
NSL Project No.: 123600063

Areas	Non Hazardous Waste	PHC Product Waste	Special Wastes	Hazardous Waste	Volume of Non Hazardous Waste (m^3)	Volume of Petroluem Products (L)	Volume of Special Wastes (m^3)	Volume of Hazardous Waste (m^3)	Comments
DOT Bunkhouse	- Domestic waste - Cable - Crushed glass - Scrap metal (metal sinks, radiator covers, rusted muffler, empty fuel cans, valves) - Scrap wood (floor beams, wooden pilings, wall panels, plywood) - Rusted electrical box	- One canister of camping fuel	- White insulation in tarp, and in pipe - Asphalt shingles - Floor tiles - Tiles/shingles - Painted rocks - Painted wood - Rusted electrical box	- Two radio power transformers	15	0	28	0.5	
DOT Hot Water House east of Bunkhouse	- Rusted metal radiator cover - One red pressurized tank - Three hot water tanks - Two radiators - Copper piping and valves - Scrap metal and wooden debris - Cable - Rusted metal machinery	None	- Painted wood (2 m x 2 m) - Insulation (inside of Hot Water Heater) - One paint can - Crushed tile, shingles	- Rusted ignition transformer	10	0	5	0.5	
DOT Post Office	- Scrap metal (rusted antennae, radiators, rebar) - Concrete foundations (building, antennae) - Cables, wiring - Wooden debris (plywood, wooden paneling)	None	- Painted concrete stairs and rocks - Floor tiles inside building footprint - Painted wood inside of building footprint - Particle board located on the east side of the building - Two fluorescent light fixtures with ballasts - Painted lamp posts	None	5	0	20	0	

Table F-2 **Surface Waste Observed at the Department of Transportation Area**
Old Town Clyde River
Clyde River, Nunavut
NSL Project No.: 123600063

Areas	Non Hazardous Waste	PHC Product Waste	Special Wastes	Hazardous Waste	Volume of Non Hazardous Waste (m^3)	Volume of Petroluem Products (L)	Volume of Special Wastes (m^3)	Volume of Hazardous Waste (m^3)	Comments
DOT Powerhouse	- Wiring and cable - Scrap metal (radiators, electrical switch boxes, heating vents, three empty drums, metal box, pipes, snowmobile parts, valves, empty cans of camping fuel, muffler, heating vents, copper pipes, radiator covers, sink, hot water tank) - Concrete (some charred) - Wooden debris	None	- Tiles (12" x 12") - Asphalt Shingles - Painted concrete - Painted wooden debris - Asbestos heat exchanger	None	60	0	20	0	- 18 m x 15 m surface staining under piles of waste west of Power House - 1 m x 1 m surface stained area east of Power House
West of Powerhouse on Beach	- Shower stall - Fluorescent light boxes (no ballasts present) - Nine radiator covers - Two empty cans of camping fuel - Half drum (empty) - Washing machine parts - Domestic waste pile - Two Narwhale carcasses	None	- Painted particle board	None	100	0	0	0	- 30 m x 10 m surface stain
DOT Garage	- Two utility poles - Scrap metal (piping, electrical box, Colman stove, muffler) - Wood and concrete debris - Charred wooden foundation - Domestic waste - Cement - Cable - Fiberglass insulation	None	- Asphalt shingles - Painted concrete slab - Particle board	None	5	0	2	0	- 4 m x 3 m stained area in footprint of building - Buried material north of garage in creek - Buried wood south east side of garage.
DOT Garage (1966)	- Three generators - Steel radio cabinet - One spool of copper ground wire - Bombardier tracks - 2 water holding tanks - Concrete foundation (8 m x 8m) - Furnace - Electrical boxes and cables - Scrap wood - Cable	- One open 205 L drum	- Asbestos shingles - Eleven wet cell batteries (some cracked open) - Paint cans - Crushed tiles and particle board - Cable with insulation	None	15	0	5	0	- 0.5 m x 0.5 m surface stain - 6 m x 3 m surface stain under generator - 1m x 1m surface stain northwest of foundation - Buried materials including shingles, scrap wood, and tiles located east of the foundation

Table F-2 **Surface Waste Observed at the Department of Transportation Area**
Old Town Clyde River
Clyde River, Nunavut
NSL Project No.: 123600063

Areas	Non Hazardous Waste	PHC Product Waste	Special Wastes	Hazardous Waste	Volume of Non Hazardous Waste (m^3)	Volume of Petroluem Products (L)	Volume of Special Wastes (m^3)	Volume of Hazardous Waste (m^3)	Comments
DOT Mess Hall	- Concrete slab - Pipe - Scrap wood (pilings) - Concrete filled drum - Cables - Small piece of fiberglass insulation		- Painted wood located in concrete filled drum	None	1	0	0.5	0	
DOT Wash House	- Scrap metal (electrical box, valves, wheels, washing machines, water tanks, pipes, heating ducts, dryer parts, shop lights, motors, radiator fins, radiators, hot water heater, sink, large metal box, large cylinder, radiator panels, oil burner) - Cable - Wooden debris	None	- Three waste piles of shingles, drywall, and tile. - Insulation inside of hot water heaters and metal boxes - Paint cans - Painted wood	- Ignition transformer - Two transformers located in radio box on south side of area.	40	0	20	0.5	- 8 m x 7 m surface stain inside footprint of building - 4 m x 4 m pile of insulation east of the building - 4 m x 2 m surface stain north of the building.
DOT Radiosonde	- Furnace - Rusted freezer with ignition transformer inside - Metal debris (cans, pipe joints) - Engine parts - Wires and cables (some partially buried) - Small pail full of debris - Scrap wood (utility pole, wooden boxes, wooden planks) - Drum of concrete - Cable	None	- Painted wood (Orange)	- Ignition transformer	15	0	2	0.5	- Based on observations, drums may have been previously located on the north and west sides of the former building. - Piles of soil with stressed or no vegetation throughout this area.

Table F-2 **Surface Waste Observed at the Department of Transportation Area**
Old Town Clyde River
Clyde River, Nunavut
NSL Project No.: 123600063

Areas	Non Hazardous Waste	PHC Product Waste	Special Wastes	Hazardous Waste	Volume of Non Hazardous Waste (m^3)	Volume of Petroluem Products (L)	Volume of Special Wastes (m^3)	Volume of Hazardous Waste (m^3)	Comments
DOT Building between Radiosonde and Wash House	- Scrap metal (equipment parts, tin cans, metal stripping, heating vents, empty paint cans, generator) - Scrap wood (two utility poles, planks) - Buried cable - Metal cable (on surface) - Half drum with utility pole (anchor) - Small domestic dump (2m x 1m)	None	- Painted wood - Rusted paint cans with paint - One waste pile located southwest of the building includes drywall, crushed tile, scrap wood, painted particle board, insulation (1m x 1m x 1m) - Asphalt shingles	None	5	0	5	0	- Spill area (0.5m x 0.5m) west of hydro pole - Two white stained areas located to the west
DOT Hydrogen Generating Building 1	- Scrap metal (generators, pipes, mufflers, hydrogen reactor, empty drum, empty metal canisters, generator box) - Wooden debris - Cable	None	- Piles of tiles, shingles, insulation and drywall - Tarpaper - One drum of asbestos tiles - Insulation (inside of building footprint)	None	20	0	30	0	- Stained area located northeast of the building (2 m x 2m) - Stained area surrounding the Hydrogen Generator (5 m x 2 m) - White stain adjacent to hydrogen generation building.
DOT Hydrogen Generating Building 2	- Scrap metal (piping) - Wood Debris [plywood (3 m x 1 m) - Broken up concrete foundation - Utility pole - Partially buried cable - Generator - Cable	None	- Tiles	None	15	0	5	0	- Stained area northwest of the foundation (1.3 m x 0.6 m)
DOT Hydrogen Generating Building 3	- Concrete slab - Wooden debris - Scrap metal (cans, machinery, furnace)	None	- Paint cans - White stain on west side of the building	None	5	0	2	0	- 4 m x 3 m stained area northwest side of building.
Building South of DOT Garage	- Scrap metal - Scrap wood (charred wooden foundation, plywood, - Domestic waste - Rebar - Melted unknown material	- 20 L rusted metal pail with oily sludge (Half full)	None	None	5	0	0	0	- 3 m x 2 m stained area northwest side of the Building south of DOT Garage
DOT Fuel Tanks	- Scrap metal from four 6000 L ASTs with flex connectors	- Four 6000 L Painted ASTs with unknown contents (estimated to be less than 100 L)	- Paint on ASTs	None	50	0	1	0	- ASTs are aligned side by side on wooden platforms - 5 m x 10 m stained area on the west side of the ASTs
TOTAL VOLUME OF WASTES (m^3)					**366**	**0**	**146**	**2**	

Table F-3 **Surface Waste Observed at the Department of Northern Affairs and National Resources Area**
Old Town Clyde River
Clyde River, Nunavut
NSL Project No.: 123600063

Areas	Non Hazardous Waste	PHC Product Waste	Special Wastes	Hazardous Waste	Volume of Non Hazardous Waste (m^3)	Volume of Petroleum Products (L)	Volume of Special Wastes (m^3)	Volume of Hazardous Waste (m^3)	Comments
DNANR Teacher's Residence	- Wood debris (burnt) - Washing machine	None	None	None	1	0	0	0	- Tent ring present for summer camping
DNANR School	- Gas cylinders - Metal debris (pipe, ducting)	None	None	None	2	0	0	0	
DNANR Powerhouse and Garage	- Snow machines (2) - Scrap metal (bath tubs, mattress coils, furnace, generator parts, hoists, power poles, radiator, copper piping, duct pieces, snow plow, metal snow blade) - Wooden debris (wooden foundation, wooden boards, sled, utility pole) - Concrete (3 m x 1.5 m)	None	- Painted snow blade (3 x 1 m) - Propane tank - Paint cans - Painted wood	None	15	0	5	0	
DNANR Hostel	- Scrap metal (heating ducts, laundry tub, disintegrated drums, piping, bed frame, metal poles, heating pipe) - Washing machine - Wood debris - Charred wooden posts - Cable	- Paint cans with black sludge (oil)	None	None	5	0	0	0	- Gravel pad with tent ring present for summer camping
Fuel Dump	- Copper wire and tubing - Scrap metal (including one bicycle, empty fuel cans, radiator, bicycle parts, furnace, wiring, car parts, mattress coils, metal pipes, ducting, and cables) - Propane cylinders - Empty fuel tank and drums - Charred garbage dump on beach (3 m x 4 m)	- Potential waste remaining in open drums, fuel cans and fuel tank	None	None	20	0	0	10	- Two 3 m x 2 m stained areas, one 4 m x 2 m stained area, one 5 m x 6 m stained area, and one 12 m x 3m stained area.

Table F-3 **Surface Waste Observed at the Department of Northern Affairs and National Resources Area**
Old Town Clyde River
Clyde River, Nunavut
NSL Project No.: 123600063

Areas	Non Hazardous Waste	PHC Product Waste	Special Wastes	Hazardous Waste	Volume of Non Hazardous Waste (m^3)	Volume of Petroleum Products (L)	Volume of Special Wastes (m^3)	Volume of Hazardous Waste (m^3)	Comments
Medical Building	- Stove - Cable - Metal antennae - Scrap metal (wiring and sheet metal) - Domestic waste inside of building footprint	None	None	None	15	0	5	0	- Stressed vegetation was observed in this area
Mission	- Incinerator (filled with various debris including tin cans and batteries) - Concrete foundation - Domestic waste (some charred) - Concrete supports for antennae - Scrap Metal (base of metal antennae)	None	- Painted wood	None	5	0	0.5	0	
TOTAL VOLUME OF WASTES (m^3)					**63**	**0**	**11**	**10**	

Table F-4 **Surface Wastes Observed at the Dump Areas**
Old Town Clyde River
Clyde River, Nunavut
NSL Project No.: 123600063

Areas	Non Hazardous Waste	PHC Product Waste	Special Wastes	Hazardous Waste	Volume of Non Hazardous Waste (m^3)	Volume of Petroleum Products (L)	Volume of Special Wastes (m^3)	Volume of Hazardous Waste (m^3)	Comments
Site Dump	- Scrap metal (reactor vessel, metal cans, furnace pieces, snowmobile parts, engine parts, mattress coils, radiators, reactor parts, washer parts, buckets, stoves, electrical boxes, sink, generator, water holding tank, hot water heater) - Wooden debris (pallets, boards) - Charred wooden debris - Charred domestic waste - Cable - Concrete filled cylinder	- 205 L drums (6 partially full)	- Batteries - Paint cans - Asbestos tiles and asphalt shingles - Painted wood	- Small transformer and several capacitors	600	1230	10	5	
Beach Dump	- Wood pallets - Plywood sheets - Wooden crates - Snow machine parts - Square steel cauldron - Furniture - Domestic debris - Crushed rusted 205 L drum	None	None	None	100	0	0	0	- Wood and drums have been used by campers to support tents - Drums are rusted - Two drums are full of debris - Cauldron full of burnt debris, mostly household wastes and electronics
Extreme S Beach Dump	- Snowmobile parts (track) - Metal Debris (including motor parts, cans, ducting, empty drum lids, sink, empty drums, engine parts, shop light boxes, cylinder with metal piping) - Wooden Debris (including power pole, walkway, pallets, - Drums with domestic waste - Propane cylinder - Tires - Water Tank - Wire box - Burned garbage piles - Cables - Pile of 20 L buckets	None	- Car batteries (7) - Paint Cans - Electrical Box (with insulation) - Stove with insulation - Tiles	None	50	0	2	0	- Tent rings present for summer camping - Potentially buried debris - Asphalt staining
TOTAL VOLUME OF WASTES (m^3)					**750**	**1,230**	**12**	**5**	

Table F-5 **Surface Waste Observed at Other Areas On-site**
Old Town Clyde River
Clyde River, Nunavut
NSL Project No.: 123600063

Areas	Non Hazardous Waste	PHC Product Waste	Special Wastes	Hazardous Waste	Volume of Non Hazardous Waste (m^3)	Volume of Petroleum Products (L)	Volume of Special Wastes (m^3)	Volume of Hazardous Waste (m^3)	Comments
Upper Plateau Residential Area	- Wooden debris (pallets, walkways, two power poles) - Scrap metal (bath tubs, washing machine parts, tin cans, snowmobile parts, copper pipes, mattress coils, laundry tub, stove) - Burnt buckets - One intact drum (empty)	None	- Painted wood	None	10	0	1	0	- Tent rings for summer camping
Structure SE of Beach Dump	- Utility poles - Metal siding - Asphalt shingles - Electrical gear - Furnace	None	- Tiles	None	5	0	1	0	- Hydro poles form a rectangle
Area 50 m north of HBC Outbuildings along beach	- Pile of metal and wooden debris (8m x 5m x 0.5m) - Boulder piles - Domestic debris (garbage) and copper piping, 4 m x 3m. - Scrap metal (reactor vessel, generator, empty tank) - Concrete stairs - Trailer - Wooden Pallets - Buried drainage pipe - Pile of antennas - Box with beam supports	- Ten visible buried 205 L barrels (Unknown Contents) were observed in 2008. During the 2010 Phase III ESA field program, the drums were removed; liquid was noted in three of the drums.	None	None	20	615	0	0	- Stained surface soil (approximately 25 m x 15 m, unknown depth) located west of buried barrels.
TOTAL VOLUME OF WASTES (m^3)					**35**	**615**	**2**	**0**	

Table F-6 **Total Amount of Surface Waste Present On-site**
Old Town Clyde River
Clyde River, Nunavut
NSL Project No.: 123600063

Volume of Non Hazardous Waste (m^3)	Volume of Petroluem Products (L)	Volume of Special Wastes (m^3)	Volume of Hazardous Waste (m^3)
1,254	1,845	187	17

APPENDIX C

Community Meeting Minutes

Old Town Clyde River Community Consultation – June 23, 2009

Nick Lawson of NJWL presented a preliminary Remedial Action Plan for the "Old Town" site to the public, mayor and council site at the Community Hall. He was accompanied by Moonie Kolola and Malli Auluk of GN CGS Iqaluit. Approximately 40 community members attended this meeting. There were only two council members present at this meeting, since they were busy with search and rescue operation. The local MLA was also present at this meeting.

Most of the audience members were pleased of the fact that they were being consulted and asked for their input in the planning stage. They further expressed their pleasure of the fact that eventually something is going to happen after a long time, and clean up will be undertaken. Concern was also expressed about remediation of the site (Cape Christian) that was occupied by Americans.

Elders present at the meeting asked if the community members have to provide directions on the clean up.

Nick responded that we wish to hear from community members on their thoughts about the preliminary plan and receive some general direction on the clean-up of the Old Town site. This way we will also be able to seek a resolution from the Hamlet Council before proceeding with the final design. This process will also help us to secure funding and expedite the overall work of cleaning up.

Elders suggested that metal and non hazardous materials can be shipped to local dump, and hazardous material should be shipped to the south. Do not want to see contamination contained on site it should be removed. There were different opinions as to whether the contaminated soil could be contained in Clyde River landfill or should be sent south for treatment. One person asked if contaminated soil could go to Cape Christian where Indian and Northern Affairs is doing a clean-up. The capacity might be another issue i.e. how much soil can be accepted by them.

The audience members expressed concerns about the availability of heavy equipment onsite to look after cleanup. Nick indicated that heavy equipment will be available in the community for the next 2 years, since there are 2 contractors in the community at the present time working on other projects. If the project is not started within 2 years contractors would have to demobilize their equipment once these projects are finished.

The preferred option by elders is to remove contaminated soil from the site and not have it buried onsite.

Audience members expressed their preferred option and it will be that contaminated soil be removed and not just be covered over with clean fill. They stressed this area is being used as a campground. This way the children can play in the area without any risk to their health that may be posed by the presence of contaminants. They further mentioned that people used to dump garbage into the ocean.

The elder thanked and were happy of the fact that the task of planning stage is underway and cleanup may go ahead.

The audience members asked about the schedule of cleanup. Malli Auluk stressed that we were not able to make any commitment on schedule, since we still have to secure the funds to undertake this work.

The audience members asked if it would be cost effective to ship metal to the south for recycling. The audience members asked if it would be possible to ask the contractors currently working in the community to leave the heavy duty equipment in town for use of this project if gets delayed.