Preliminary Environmental Screening of the Remediation of the former CAM-E DEW Line Site, Keith Bay, Nunavut
FINAL

Prepared for:
Public Works and Government Services Canada
10025 Jasper Avenue
Edmonton, AB T5J 1S6

Prepared by:
Stantec Consulting Ltd.
5021 – 49 Street
Yellowknife, NT X1A 2N4

Project No.: 1225-10734

March 31, 2014

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Executive Summary

Aboriginal Affairs and Northern Development Canada (AANDC), with assistance from Public Works and Government Services Canada (PWGSC), is currently pursuing remediation of the former CAM-E Distant Early Warning (DEW) Line site, near Keith Bay, Nunavut (the Project). The CAM-E site was part of the DEW Line System established across the 66th parallel in Alaska, northern Canada and Greenland in the late 1950s. The CAM-E site was an intermediate site within the system and primarily housed transmitters for the radar system; the CAM-E site was operated until 1963. Facilities constructed at the CAM-E site included a module train, warehouse, garage, petroleum, oil and lubricant tanks, Quonset huts, storage pads, a radar tower, and two airstrips. Through Environment Canada and the Department of National Defence, an initial clean-up of the CAM-E site occurred in the mid-1980s; however, several environmental risks still remain. As such, the CAM-E site is currently scheduled for remediation in the summer of 2016, following mobilization of necessary equipment. Remediation will be conducted as per the *Abandoned Military Site Remediation Protocol* (INAC 2009a) and will generally include:

- Construction and operation of a temporary winter access trail to/from the CAM-E site
- Excavation of identified borrow sources
- Construction of two engineered landfill facilities
- Excavation and disposal of contaminated soil
- Treatment of Type B contaminated soil in a Treatment Cell via ex-situ Biopiles
- Excavation and appropriate disposal of hazardous and non-hazardous wastes.

Stantec Consulting Ltd. was retained by PWGSC to prepare this Environmental Screening document for the remediation project. This Environmental Screening document contains information regarding the planned remediation activities at the CAM-E site, existing environmental conditions, and an assessment of the potential effects of the Project on valued components of the physical, biological and socioeconomic environment. This Environmental Screening document has been developed to fulfill the Part 2 Project-Specific Information Requirements of the Nunavut Impact Review Board, and provide information on the remediation project to other regulatory agencies.

A number of mitigation measures have been identified for various Project-related activities, and with the implementation of these mitigations, adverse effects of the Project on valued components are expected to be negligible or low in magnitude. Positive residual effects were identified for several valued components due to the removal, treatment and/or proper disposal of contaminated soil, hazardous and non-hazardous wastes, and other identified environmental risks.

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Abbreviations

µg/L	micrograms per litre
km	Kilometres
km^2	square kilometres
L	Litres
m^2	square metres
m^3/s	cubic metres per second
mg/kg	milligram per kilogram
AANDC	Aboriginal Affairs and Northern Development Canada
ACMs	Asbestos containing materials
AIA	Archaeological impact assessment
AMSRP	Abandoned Military Sites Remediation Protocol
ATV	All-terrain vehicle
CCME	Canadian Council of Ministers of the Environment
COSEWIC	Committee on the Statues of Endangered Wildlife in Canada
DEW	Distant Early Warning
DCC	DEW Line Clean-up Criteria
DFO	Department of Fisheries and Oceans Canada
EC	Environment Canada
ESA	Environmental Site Assessment
ESC	Erosion and sediment control
IOL	Inuit-owned lands
NIRB	Nunavut Impact Review Board
NU	Nunavut
NWB	Nunavut Water Board
NWHS	Nunavut Wildlife Harvest Study
PCB	polychlorinated biphenyls
PHC	petroleum hydrocarbons
POL	Petroleum, oil and lubricants
PPE	personal protective equipment
Project	Remediation of the former CAM-E DEW Line site, Keith Bay, NU
PSIR	Project-Specific Information Requirements
PWGSC	Public Works and Government Services
RAP	Remedial Action Plan
SARA	*Species at Risk Act*

Stantec	Stantec Consulting Ltd.
Site	Former CAM-E DEW Line site, Keith Bay, NU
VCs	Valued Components

1.0 Introduction

Aboriginal Affairs and Northern Development Canada (AANDC) is currently pursuing the remediation of the former CAM-E Distant Early Warning (DEW) Line site, near Keith Bay, Nunavut (the Project). AANDC retained Public Works and Government Services Canada (PWGSC) to assist with coordination of the remediation program. To carry out the Project, a number of permits and approvals will be required. One of these includes screening by the Nunavut Impact Review Board (NIRB) to assess potential effects of the Project on the physical, biological and socioeconomic environment. To complete this, PWGSC retained Stantec Consulting Ltd. (Stantec) to prepare an environmental screening document for the Project.

This Environmental Screening document contains information regarding the planned remediation activities at the CAM-E site, existing environmental conditions, and an assessment of the potential effects of the Project on valued components of the physical, biological and socioeconomic environment. This Environmental Screening document has been developed to fulfill the Part 2 Project Specific Information Requirements (PSIR) of the NIRB, and provides required Project information to other regulatory agencies with responsibility for issuing necessary permits and approvals.

As the design phase for the Project is not yet complete, several details of Project components and/or activities are unconfirmed at the date of this report; these are noted throughout the document. Upon completion of the design phase (expected in mid-2014), this Environmental Screening document will be updated to reflect the new design information and finalized details regarding Project components and activities.

1.1 BACKGROUND

Through the federal Contaminated Sites Program, AANDC has responsibility for various sites across Canada that are no longer maintained by their original operator. The CAM-E site is one such site. The CAM-E site was part of the DEW Line System established across the 66th parallel in Alaska, northern Canada and Greenland in the late 1950s. The DEW Line System provided a total of 63 radar stations (ESG 1995) to provide early warning of an air attack during the Cold War period; 42 of the stations were situated within Canada. Construction of the North American stations was completed in 1957, in less than three years from conception. The CAM-E site was an intermediate site within the system, which means it primarily housed transmitters for the radar system (versus radar equipment and/or receivers that were typically housed at main and auxiliary sites), and was operated until 1963.

Facilities constructed at the former CAM-E site (the Site) included a module train; warehouse; garage; petroleum, oil and lubricant (POL) tanks; Quonset huts; storage pads; a radar tower; and, two airstrips (WESA 2012). Through Environment Canada (EC) and the Department of National Defence, an initial clean-up of the Site was conducted during the summer of 1985 to

remove hazardous materials and surface contaminants, such as polychlorinated biphenyls (PCBs) and POL tanks, and to identify areas of buried material that could pose environmental risks in the future (WESA 2012). However, subsequent studies (i.e., ESG 1995, WESA 2012, Stantec 2013) have identified a number of environmental risks and contamination remaining on the Site. Based on the information collected during these studies, the following waste streams are identified:

- Non-hazardous waste
- Hazardous waste
- Metal and/or PCB-contaminated soil (DEW Line Cleanup Criteria [DCC] Tier I and Tier II)
- Petroleum hydrocarbon (PHC)-contaminated soil (Type A [heavy] and Type B [light])
- Metal-contaminated surface water.

In July 2013, Stantec completed a Phase III Environmental Site Assessment (ESA) at the Site to further characterize and quantify the wastes present at the Site (Stantec 2013). During the assessment program, geotechnical and archeological assessments were also completed at the Site. The purpose of the geotechnical investigation was to:

- Confirm the suitability of airstrips
- Identify potential barge landing areas
- Determine suitable locations for a landfill
- Identify sources of borrow material.

The archaeological investigation was conducted to identify any artifacts or heritage resources that may be impacted by the Project, and if present, provide recommendations for mitigation. A review of the information collected during the geotechnical and archaeological investigations are provided in Sections 4.1.1 and 4.3.2, respectively.

Following the Phase III ESA, Stantec prepared a draft Remedial Action Plan (RAP) to outline the proposed methods for remediation of the Site (Stantec 2014). The proposed methods were presented to residents of Kugaaruk during a community meeting in January 2014 (see Section 2.11 for more information). Upon approval of the draft RAP by AANDC and PWGSC, the document was finalized and incorporated feedback received during the review and consultation process. The design phase of the Project is expected to occur in mid-2014.

1.2 SUMMARY OF PROJECT ACTIVITES

AANDC is now pursuing the remediation of the Site; a summary of activities to be completed during the Project includes:

- Construction of a temporary winter access trail for mobilization and demobilization (via cat train) to/from the Site.
- Construction and operation of a maximum of eight borrow sources at the Site.

- Construction of an on-site Non-Hazardous Waste Tier I Landfill (Tier I Landfill) at the Site, as per the *Abandoned Military Site Remediation Protocol* (AMSRP) (INAC 2009a).
- Construction of an on-site DCC Tier II Contaminated Soil Landfill (Tier II Landfill) with associated groundwater monitoring wells and thermistors, as per INAC (2009a).
- Construction of a temporary Staging/Abatement Area at the Site for the purpose of handing wastes requiring off-site disposal.
- Construction of a Treatment Cell for the ex-situ treatment of contaminated soil (via Biopiles)
- Set-up of a temporary camp; the camp will have a basic water treatment system, a storage area for domestic refuse, disposal systems for sewage and greywater, potable water supply, and fuel supply.
- Completion of remedial activities, as summarized in Table 1-1.
- Site maintenance activities including backfilling of excavations, grading of existing on-site roads and the airstrip, and installation and removal of a culvert under the access road between the two areas of the Site.
- Closure of the Treatment Cell, Tier I and Tier II Landfills.
- Post-closure monitoring of the landfills at the Site.

Table 1-1: Summary of Environmental Issues, Waste Types, and Remedial Methods for the Former CAM-E DEW Line Site

Environmental Issue	Category	Estimated Quantity of Waste	Remedial Option Selected
Contaminated soil	DCC Tier I	83 cubic metres (m^3)	• Tier I contaminated soil will be excavated and placed in the Tier I Landfill
	DCC Tier II	3,200 m^3	• Tier II contaminated soil will be excavated and placed in the Tier II Landfill
	Type A	1,050 m^3	• Type A contaminated soil will be excavated and placed in the Tier I Landfill
	Type B	1,900 m^3	• Type B contaminated soil will be treated ex-situ using Biopiles
Non-hazardous waste	Drums	1,600 m^3 (after crushing)	• Drums will be emptied, cleaned, crushed and disposed of in the Tier I Landfill • Drum contents will be will be collected and, depending on characteristics, will be incinerated, disposed of in the Tier II Landfill, or transported for off-site disposal at an approved facility • Water generated during drum cleaning will be treated on-site and discharged, or collected and disposed of at an approved off-site facility
	Existing buildings and infrastructure		• To be demolished, shredded/incinerated, compacted and disposed of in the Tier I Landfill • Existing concrete slab foundations will be covered with granular material and graded to match the surrounding topography
	Other non-hazardous waste		• Collected, shredded, compacted and disposed of at the Tier I Landfill
	Compressed gas cylinders	6 units	• Compressed gas cylinders will be vented and disposed of in the Tier I Landfill
Hazardous Waste	Asbestos	25 m^3	• Asbestos-containing materials (ACMs) will be collected, double-bagged, and disposed of at the Tier I Landfill
	Batteries	16 units	• Batteries will be packaged, containerized and disposed of off-site at an approved facility
	PCB and/or lead	1,050 m^3	• On-site partial abatement of poorly adhered paint; collection and

Table 1-1: Summary of Environmental Issues, Waste Types, and Remedial Methods for the Former CAM-E DEW Line Site

Environmental Issue	Category	Estimated Quantity of Waste	Remedial Option Selected
	amended paint		transportation of removed paint at an approved off-site facility • On-site disposal of materials with well-adhered paint in the Tier II Landfill
Buried debris areas (BDAs)[1]	Class A/B	1,200 m^2	• The Class A/B BDA will be excavated • Depending on characteristics, excavated debris will be disposed of the in Tier I or Tier II landfill
	Class B and C	1,171 m^2	• Exposed debris at Class B or C BDAs will be removed; BDAs will be covered and re-contoured to match existing grade

NOTE:
1. Quantity of waste in BDAs has not been confirmed; the areal extent of the BDAs is provided.

2.0 General Project Information

2.1 PROJECT LOCATION

The Project will be undertaken at the former CAM-E DEW Line Site, located near the shores of Keith Bay at Cape Barclay, on the southwestern edge of the Simpson Peninsula (68° 15' 45" N, 88° 8' 38" W) in Nunavut (Drawing R1 in Appendix A). The Site is approximately 75 km southeast of the community of Kugaaruk, Nunavut, and is located on Crown land within Nunavut's Kitikmeot region.

The Project footprint incorporates two main areas of the Site: Area 1 and Area 2. Area 1 is situated in the northern portion of the Site and includes a small airstrip, former infrastructure (i.e., module train debris, warehouse, garage, Inuit house, POL tanks, Quonset huts, storage pads, and a dismantled radar tower), drum storage areas, and five areas of buried material, including the main station landfill (Drawing R2 in Appendix A). Area 2 is situated in the southern portion of the Site, on a beach plateau approximately 5.6 km from Area 1. This area includes a larger airstrip, a helipad, some former infrastructure (i.e., two Quonset huts, a bunker), various scattered debris (including wreckage of a plane), two dump areas, one drum cache, and three areas of buried material (Drawing R3 in Appendix A).

2.2 GENERAL INFORMATION

2.2.1 Need for the Project

The purpose of the Project is to remediate the Site to a condition consistent with the objectives of the AMSRP. As such, the following clean-up objectives will be implemented during the remedial program:

- To restore sites to meet the environmental objectives established for northern sites.
- To prevent migration of contaminants into the Arctic ecosystem.
- To remove physical hazards for the protection of human health and safety.
- To implement a cost-effective remedial solution.

2.2.2 Project Alternatives

Alternatives to the Project, including both viable technical and economic alternatives for carrying out the Project, have been considered. The alternative to the Project is to not complete the remediation. This is not considered feasible due to the following:

- Adverse impact to the Arctic environment.
- Health and safety risks to persons who may access the Site.
- Potential migration of contaminants off-site.

- Potential future legal liabilities for the federal government.
- Additional remedial costs to be incurred if the Project is delayed.

Alternative means of carrying out the Project focused on alternative access, alternative location of the landfills, and alternative technical methods for completing the remedial activities. Alternative means to those proposed herein have been considered not feasible for the following reasons:

- An alternative access method was not considered feasible as a result of the limitations of getting a barge on-site due to large amounts of ice in Keith bay during the summer months. In addition, suitable barge landing locations were not identified at the Site.
- An alternative location for the proposed landfills off-site was not considered feasible as it is preferable to have the landfills within close proximity of waste areas.
- All viable technical methods for completing remedial activities were evaluated during the development of the RAP, including off-site disposal of wastes. As a result, it is believed that the best possible options have been proposed for the various waste streams at the Site.

2.2.3 Project Schedule

The tentative schedule for Project activities is outlined in Table 2-1.

Table 2-1: Tentative Schedule for Project Activities

Task	Completion Date
Design remediation and prepare tender	April 1, 2014 to November 30, 2014
Contract tendering	September 30 to November 30, 2014
Contract award	November 30, 2014
Receipt of required permits and approvals	April 1, 2015
Mobilization: • Equipment/camp to community[1] via barge • Equipment/camp to Site via temporary winter access trail and cat train	 July to September 2015 February to March 2016 (six weeks)
Year 1 Site Remediation – construction of Project facilities and remedial operations	June to September 2016
Year 2 Site Remediation – remedial operations	June to September 2017
Year 3 Site Remediation – remedial operations (tentative)	June to September 2018 (tentative)
Demobilization: • Equipment/camp from Site via temporary winter access trail and cat train • Equipment/camp from community[1] via barge	 February to March 2019 (six weeks) July to September 2019
Post-closure Phase I monitoring, as per INAC (2009) (short-term monitoring; years 1, 3 and 5, post-remediation)	August 2019, 2021, and 2023

Table 2-1: Tentative Schedule for Project Activities

Task	Completion Date
Post-closure Phase II monitoring, as per INAC (2009) (long-term monitoring term; years 7, 10, 15 and 25) (if deemed necessary following Phase I monitoring)	August 2025, 2028, 2033 and 2043
NOTE: 1. The departure community for the winter access trail will be determined following selection of the routing by the chosen Contractor (anticipated in November 2014).	

2.2.4 Regulatory Framework

Several federal and territorial acts, regulations and guidelines apply to the Project. Throughout all Project phases, Project personnel will work in cooperation with regulatory authorities to ensure compliance with applicable acts/regulations/guidelines outlined below.

Federal

- Abandoned Military Site Remediation Protocol (AMSRP)
- *Arctic Waters Pollution Prevention Act* and Regulations
- *Canadian Environmental Protection Act*
  - Chlorobiphenyls Regulations
- Canada Labor Code – Part II
- Canadian Occupational Safety and Health Regulations, Part X – Hazardous Substances
- Contaminated Sites Management Policy (INAC 2002)
- Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (1999, 2005 amendment)
- Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations (1999, 2002 amendment)
- *Fisheries Act*
- *Migratory Birds Convention Act*
- Nunavut Land Claims Agreement
- *Nunavut Waters and Surface Rights Tribunal Act*
- *Species at Risk Act*
- Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations (CEPA SOR/2008-197)
- *Territorial Lands Act* and Regulations (Land Use and Quarrying)
- *Transportation of Dangerous Goods Act* and Regulations
- Guidelines for Spill Contingency Planning (INAC 2007)
- Northern Land Use Guidelines
  - Pits and Quarries (INAC 2009b)
  - Access: Roads and Trails (INAC 2010)
  - Camps and Support Facilities (INAC 2011).

Territorial

- *Commissioners Lands Act*
- Nunavut Archaeological and Paleontological Site Regulations
- *Nunavut Environmental Protection Act*
- Nunavut Environmental Protection Guidelines:
  - Guidelines for Dust Suppression (GN 2002)
  - Guidelines for Used Oil and Waste Fuel (GN 2012a)
  - Guidelines for the Management of Waste Asbestos (GN 2011a)
  - Guidelines for the Management of Waste Lead and Lead Paint (GN 2011b)
  - Guidelines for the Management of Waste Batteries (GN 2011c)
  - Guidelines for the General Management of Hazardous Wastes (GN 2010)
  - Guidelines for the Burning and Incineration of Solid Waste (GN 2012b)
  - Guidelines for Ambient Air Quality (GN 2011d)
- *Public Health Act* and Regulations
- Spill Planning and Reporting Regulations.

2.2.5 Required Permits and Approvals

The Site is situated on Crown land within Nunavut's Kitikmeot region, outside of a planning region with an approved land use plan. The majority of Project activities will occur on Crown land; however, the winter access trail may cross Commissioner's Land and/or Inuit-Owned Land (IOL). Therefore, to proceed with the Project and Project-related activities, AANDC/PWGSC will be required to obtain the following permits and approvals (Table 2-2).

Table 2-2: Required Permits and Approvals for the Project

Permit/Approval	Issuing Agency	Trigger
Type B Water License	Nunavut Water Board (NWB)	Under the Northwest Territories Water Regulations: • Disposal of waste • Use of more than 100 m^3 of water, but less than 300 m^3 of water, per day
Class A Land Use Permit	AANDC Land Administration	Under the Territorial Land Use Regulations: • Establishment of a campsite to be used for over 400 man days • Operation of any vehicle that exceeds 10 tonnes
Land Use Permit[1]	Planning and Land Division Department of Community and Government Services Government of Nunavut	Access to Commissioner's Lands (if required) for the temporary winter access trail (mobilization and demobilization)

Table 2-2: Required Permits and Approvals for the Project

Permit/Approval	Issuing Agency	Trigger
Access to IOL[1]	Kitikmeot Inuit Association and/or other designated Inuit organization[2]	Access to IOL (if required) for the temporary winter access trail (mobilization and demobilization)
Quarry Permit	AANDC Land Administration	Development of borrow sources on Crown land
Screening Decision	Nunavut Impact Review Board	Application for a Class A Land Use Permit are automatically referred to the NIRB for screening

NOTES:

1. The requirement for this permit is contingent upon selection of the winter access trail route and access to Commissioner's Land and/or IOLs.
2. The need for involvement of multiple designated Inuit organizations will depend upon the final route of the winter access trail.

The federal Department of Fisheries and Oceans (DFO) have identified mitigation measures to avoid causing serious harm to fish, which replace the former Operational Statements. Currently, DFO's mitigation measures do not specifically address all of the Project activities, specifically including the construction of the winter access trail. Therefore, the Project will follow mitigation measures contained within the former Operational Statement for *Ice Bridges and Snow Fills* (DFO 2007) (see Appendix G).

2.3 TRANSPORTATION

2.3.1 Winter Access Trail

Equipment and supplies required for the Project will be brought to Site via a winter access trail and cat train. Mobilization of necessary equipment and supplies will take place the winter before remediation commences (i.e., Winter 2015-2016 for Site remediation during Summer 2016 to 2018) while demobilization will occur the winter following remedial activities (i.e., Winter 2018-2019).

Although the alignment of the winter access trail is currently undetermined, three potential departure communities have been identified based on the ability to get all needed supplies into the community via barge; these communities include:

- Repulse Bay, NU (located approximately 209 km from the Site)
- Taloyoak, NU (located approximately 263 km from the Site)
- Hall Beach, NU (located approximately 280 km from the Site).

The selection of the departure community and final trail routing will be completed by the chosen contractor, following contract tendering and award. Depending on the final route, the winter

access trail is expected to have several water crossings. It is expected these will crossings will primarily be constructed snow fills and ice bridges; the final number and location of water crossings will be confirmed upon the selection of the final trail routing.

2.3.2 Existing Site Access Roads

There are presently a number of existing gravel roads currently connecting the different areas of the Site; including the main access road located between Area 1 and Area 2. Prior to use, a culvert will be installed on the main access road approximately 0.8 km north of Area 2.

Maintenance activities will include the re-grading of access roads at the Site. Upon completion of the Project, the roadways will remain intact with the exception of any structures (i.e., culverts) that were installed during the Project. The final design of any modifications to the existing site access road(s), if necessary, will be confirmed during the design phase.

2.3.2.1 Culvert Installation

One culvert installation will be required to facilitate Project activities. An ephemeral drainage channel has washed out a portion of the road between Areas 1 and 2 (situated approximately 0. 8 km north of Area 2) and a culvert will be required to repair this section of the road. The size of the culvert to be installed will be selected during the design phase; standard practices will be employed to ensure adequate flow is provided given the temporary nature of its placement and the expected ephemeral nature of the drainage channel.

Stream flow is expected to be none to negligible at this drainage channel during culvert installation; during the July 2013 field survey, the drainage channel was completely dry (see Photo 1 to Photo 3 in Appendix B). However, if water is present at the time of installation, temporary cofferdams will be installed up and downstream of the crossing site to enable culvert installation in-the-dry. A water pump around system may be installed to transfer the natural drainage flow directly downstream of the work site. The rate of pumping will correspond to the flow volume. Though fish are not expected in this drainage channel, an appropriately sized fish screen will be placed on the pump intake to prevent any potential fish entrapment. The downstream pump outlet will also be stabilized, if necessary, to prevent unnecessary scouring and erosion.

2.3.3 Runway

Upon construction of the winter access trail, the North Airstrip in Area 1 (Drawing R2 in Appendix A) will be plowed to facilitate the arrival of personnel and other supplies (e.g., groceries, consumable supplies, environmental samples, etc.) required for winter access trail operations.

During the summer, personnel and other supplies will be mobilized to/from the Site via aircraft landing at the North Airstrip in Area 1. The Site will primarily be accessed via Twin Otter aircraft

throughout all Project phases however larger aircraft (e.g., Hercules) will also potentially be used. Approximately 200 mm of gravel will be scarified into the runway to provide a smooth landing surface.

While operating within the Project area, all aircraft will maintain a minimum altitude of 650 m. Maintenance activities will include the re-plowing (winter) and re-grading (summer) of the runway surface throughout the Project.

2.4 CAMP SITE

A total of three temporary camps are expected over the duration of the Project. The final camp configuration will be determined by the chosen Contractor, but is anticipated to consist of the following:

- Sleeping quarters
- Kitchen/dining area
- Washroom/shower and laundry facilities
- Office area
- First aid facilities.

Additional auxiliary units required to support the camp include the following:

- Mechanics and equipment areas for equipment maintenance/repair
- Power unit housing generators
- Fuel storage
- Camp incinerator (for domestic waste)
- Potable water tank(s)
- Greywater disposal system (e.g., sump) or treatment unit
- Sewage disposal system (e.g., incinerating toilets, pit privy) or treatment unit
- Emergency shelter.

At the on-site camps, the water supply will be withdrawn from the Freshwater Lake at a rate not exceeding 5 m^3 per day. The water will be treated using a combination filtration/disinfection unit selected by the Contractor. Each of the established camps will be located at a minimum of 100 m from the high water mark of any waterbody.

2.4.1 Winter Camp Site

Two temporary camps will be set-up to facilitate the mobilization and demobilization of the equipment required for the remedial program. One camp will be located at the Site and the other will be located at an intermediate location along the winter access trail; the location of this camp will be determined upon selection of the final winter access trail route. Each of the

camps will be designed for approximately 13 personnel; and will be in use for a maximum of six weeks between February/March 2015 and February/March 2019.

2.4.2 Summer Camp Site

A temporary camp will be set-up at the Site for the duration of the remediation program, during June to September 2016 to 2018. The camp will be designed for approximately 30 personnel. A potentially suitable location for the camp area has been identified in Area 1, located near the North Airstrip and the Freshwater Lake (Drawing R2 in Appendix A). Following Year 1 and Year 2 of remedial work, the camp will be shut down and winterized. The camp will be dismantled and prepared for demobilization following remedial work in Year 3.

The facilities will be brought to Site during mobilization, and will be removed as part of the demobilization. The camp will operate for a maximum of 16 weeks over each summer in 2016, 2017 and 2018.

2.5 EQUIPMENT

The equipment used during the Project activities will be determined by the chosen contractor, however a tentative list of required equipment is provided below:

- Excavators, dozers, graders, and loaders – for excavating, transporting, placing, and compacting of granular material and/or wastes
- Water truck – for transporting water and dust suppression
- Haul/dump trucks – for transporting loads of granular material for construction activities, as well as transportation of contaminated soil and/or wastes
- Rock crusher – for crushing gravel to required size for construction of Project facilities
- Pick-up trucks and all-terrain vehicles (ATVs) – for crew transportation
- Incinerator – for burning combustible waste, including domestic waste
- Generators – for camp operation
- Fuel truck – for fuelling equipment and camp facilities
- Drinking water treatment system, including pumps – for treatment of drinking water
- Wastewater treatment system, including pumps – for treatment of contaminated water generated during the equipment/drum rinsing and excavation activities
- Water storage tanks – for storing contaminated and treated water
- Corrugated steel pipe – for culvert material
- Geotextile material – for construction of the Tier II Landfill
- Tracked all-terrain vehicles (i.e., Hagglunds) – for opening the winter access trail and transporting crew during the winter operations
- Winter trail grooming equipment (i.e., snowmobiles and snow groomer) – for trail maintenance and trail breaking
- Tracked heavy equipment (i.e., Challenger tractor) – for winter transportation of sleds loaded with equipment to Site

- Sleds – for winter transportation of equipment to the Site.

Digital photos of the equipment to be used during the Project are not presently available.

2.6 WATER

To service the Project, freshwater will be obtained from the Freshwater Lake in Area 1 (see Drawing R2 in Appendix A) for all on-site activities. Water may also be withdrawn along the selected winter access trail route to build up and construct the trail, and for potable water at the intermediate camp. The volume of water required for winter access trail construction is unknown at this time, however will be determined upon selection of the final route. The uses of water on-site will include:

- Potable water
- Dust suppression
- Equipment/drum cleaning.

On the Site, water will be obtained from the Freshwater Lake using an intake hose connected to a water truck. The water truck will transport water to storage tanks for use on-site, as well as be used for dust suppression activities. The final intake location, screen size, and intake flow rate will be determined by the Contractor however the water withdrawal rates will not exceed 10% of the total volume of the Freshwater Lake, as per INAC (2009a).

All water withdrawal for the Project will be undertaken in accordance with the recommendations in the following DFO documents:

- Fish Screen Design Criteria for Flood and Water Truck Pumps (DFO 2011)
- Freshwater Intake End-of-Pipe Fish Screen Guideline (DFO 1995).

The following sections provide additional detail on water use associated with the Project. The management of water encountered within excavations is also discussed.

2.6.1 Potable Water

For the camps, potable water will be obtained from the Freshwater Lake (for on-site camps) and an identified waterbody along the winter access trail route (for the intermediate winter camp; see Section 2.4.1). This waterbody will be chosen during selection of the winter access trail alignment and will likely be adjacent to the intermediate winter camp location. All potable water withdrawn will be treated to disinfect and meet Health Canada's Guideline for Canadian Drinking Water Quality (GCDWQ) (0 coliforms per 100 mL; Health Canada 2012). In addition, coliform testing will be completed on a weekly basis throughout the Project. If results from the analysis exceed the GCDWQ and/or there is insufficient water supply, drinking water will be transported to Site. It is anticipated that water will be withdrawn daily.

An estimated volume of 120 L per person per day will be required for potable water. This equates to approximately 1,560 L per day (1.6 m^3) for each of the two temporary winter camps (13 people per camp) and 3,600 L per day (3.6 m^3) for the summer camps (30 people). The total volume of potable water over the Project (maximum of 420 days, excluding post-closure monitoring) is estimated at 1,472 m^3, inclusive of 1,341 m^3 from the on-site Freshwater Lake and 131 m^3 along the winter access trail route.

2.6.2 Dust Suppression

Water used for dust suppression will also be obtained from the Freshwater Lake. Water will be obtained in the same way as the potable water, but will be sprayed across on-site roads, the airstrip, and other facilities using the water truck equipped with a spray bar. An estimated total of 604,800 L (605 m^3) of water will be withdrawn from the Freshwater Lake for the purposes of dust suppression over the Project. This equates to approximately 1,800 L (1.8 m^3) of water per day during remedial work on-site (336 days). Water will likely be withdrawn weekly for dust suppression, depending on weather and dust conditions.

2.6.3 Equipment/Drum Cleaning

Water will also be used for cleaning/rinsing of on-site equipment and drums. Water from the Freshwater Lake will be obtained in the same way as the potable water, being pumped and transferred into clean water tanks. An estimated 118,000 L (approximately 20 L per drum, by 5,900 drums; or 118 m^3) of water will be required over the Project for the equipment/drum cleaning activities.

The location of the equipment/drum cleaning area, and subsequent location of clean, dirty and treated water storage tanks, will be confirmed upon completion of the Project's design phase; however, the location will be a minimum of 100 m from the high water mark of any waterbody.

2.7 WASTEWATER AND SOLID WASTE

Wastes generated during the Project may include, but not be limited to:

- Wastewater (includes sewage, greywater, and contaminated water)
- Domestic waste
- Used oil and waste fuel
- Contaminated soil
- Overburden material from culvert installation.

These are described in further detail in the following sections.

2.7.1 Wastewater

Wastewater generated during the remediation program will consist of sewage and greywater from the camps, as well as contaminated water generated during equipment/drum washing activities and contact water encountered during excavation activities.

An estimated volume of 40 L per person of sewage and 80 L per person of greywater will be produced each day during the remedial work and winter access trail mobilization/demobilization. This equates to approximately 520 L (0.5 m^3) of sewage and 1,040 L (1.0 m^3) of greywater per day for each the two temporary winter camps, and 1,200 L (1.2 m^3) of sewage and 2,400 L (2.4 m^3) of greywater per day for the summer camp. The total volume of sewage and greywater generated over the Project (maximum of 420 days) is estimated at 1,472 m^3.

Sewage and greywater will be disposed of in a separate on-site treatment or disposal system; the final configuration of the disposal system will be determined by the Contractor. The location of the sewage and greywater disposal system will comply with the requirements of the Water License and Land Use Permit.

Contaminated water generated during the Project may contain several potential contaminants of concern. Contaminated water will be stored in separate storage tanks and will be recycled, wherever possible, to minimize volumes required. An estimated 118,000 L (equivalent to 20 L per drum) of contaminated water will be produced during the equipment/drum washing program. As the amount of water intrusion will vary based on the excavation location, an estimated of the volume of contaminated water produced during the excavation activities cannot be calculated.

Wastewater generated during remedial activities will be treated in the on-site wastewater treatment system. Following treatment, wastewater will be contained in suitable storage containers until such time that the analytical results confirm concentrations of contaminants are below applicable discharge limits, as identified in the Project's Water License. The Contractor will be required to provide a water treatment system which meets the discharge limits and the specific treatment system will confirmed at a later date.

In the absence of discharge limits established by the NWB, the GN's *Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities* (GN 2011e) are suggested for use as treated wastewater discharge limits for the Project. These criteria are presented in Table 2-3; the parameters selected are based on the types of contaminants found at the Site during the previous investigations.

Table 2-3: Suggested Treated Wastewater Discharge Limits for the Project (from GN 2011e)

Parameter	Discharge Limit
pH	6 to 10.5 pH units
Aluminum	1 mg/L
Arsenic	1 mg/L
Cadmium	0.1 mg/L
Chromium	0.1 mg/L
Copper	1 mg/L
Iron	1 mg/L
Lead	0.05 mg/L
Mercury	0.0006 mg/L
Nickel	1 mg/L
Phenolic Compounds	0.02 mg/L
Zinc	0.5 mg/L
Total Suspended Solids	15 mg/L
Oil and Grease	15 mg/L and no visible sheen or odors

The treated wastewater will be tested each time prior to discharge. Once it is confirmed that the treated wastewater meets the discharge limits, the water will be released onto the ground at the Site; the discharge location will be a minimum of 31 m from the high water mark of any waterbody, and be released in a manner such that direct flow into a waterbody is not possible. The discharge location will be confirmed upon completion of the design phase of the Project.

2.7.2 Domestic Waste

Domestic wastes generated during the Project would include wastes generated by camp activities. All Project personnel will be familiar with the Site-specific waste management plan and be aware of the required waste management procedures. Food will not be allowed outside of the camp area and the Site will be periodically inspected (e.g., weekly) for proper procedures. If issues are identified, these will be discussed with all Site personnel during the daily tailgate meeting.

Prior to disposal, all domestic wastes will be segregated into combustible and non-combustible wastes. Kitchen wastes, including grease, shall be stored in wildlife-proof containers to prevent scavenging and to reduce scattering of debris prior to daily incineration. The incinerator will adhere to Environment Canada`s *Technical Document for Batch Waste Incineration* (EC 2010). Combustible wastes will be incinerated in an on-site camp incinerator and any remaining

incinerator waste (i.e., ash) will be disposed in the Tier I Landfill. All non-combustible wastes (including plastics, etc.) will also be disposed of in the Tier I Landfill.

2.7.3 Used Oil and Waste Fuel

Used oil and waste fuel generated during the Project, including any used spill clean-up materials, will either be incinerated on-site or be shipped to an approved disposal facility, depending on type of material. Prior to incineration, samples will be collected of the used oil and/or waste fuel to confirm concentrations of contaminants are below applicable criteria for incineration, as per the Barrel Incineration Protocol in the AMSRP (INAC 2009a).

2.7.4 Contaminated Soil

Contaminated soil generated during the Project will be disposed of at either the Tier I Landfill or the Tier II Landfill, depending on the type of contaminants present. See Section 3.1.2 for additional information.

2.7.5 Overburden Material

Overburden excavated during culvert installation will be stockpiled. The piles will be situated a minimum of 30 m from the high water mark of any waterbody to prevent material from entering the waterbody. The piles will also be sloped a minimum 2:1 horizontal to vertical ratio to prevent wind and water erosion.

Due to the prevalence of gravel at the Site in all identified borrow sources, excess overburden from borrow source excavation is not anticipated. However, if overburden is excavated, recommended procedures in the *Northern Land Use Guidelines: Pits and Quarries* (INAC 2009b) for managing overburden will be implemented.

2.8 FUEL

It is anticipated that fuel used on-site will consist of diesel and gasoline. Fuel will be transported to the Site via the cat train on the winter access trail. The designated fuel storage and re-fueling location at the Site will be determined during the design phase of the Project, but will be a minimum of 100 m from the high water mark of any waterbody. Fuelling at the Site will only be allowed in this designated area and will be performed via hand pump or electrical pump over spill pads or drip pans.

The exact quantity and types of fuel, details of the secondary containment, and methods of storage, will be provided by the chosen Contractor, once the contract has been awarded. However, fuel storage containers will adhere to the *Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations* (CEPA SOR/2008-197), and the Contractor will be expected to implement all mitigation measures identified in this document for fuel storage and

handling. A Draft Spill Contingency Plan has also been developed for the Project and is included in Appendix C.

2.9 CHEMICALS AND HAZARDOUS MATERIALS

Chemicals and hazardous materials used during the Project will primarily include oils and lubricants for equipment; it is estimated approximately 1,000 L will be required over the life of the Project. All oils and lubricants for the Project will be stored at the designated fuel storage location on the Site; this location will be determined during the design phase.

Oils and lubricants will be transferred via hand into the equipment during regular equipment maintenance. This will occur over spill pads or drip trays within the lined and bermed Abatement Facility (herein referred to as the Staging Area). The Staging Area will be a minimum of 100 m from the high water mark of any waterbody.

2.10 WORKFORCE AND HUMAN RESOURCES

A qualified remedial Contractor with expertise in completing northern remediation projects will be contracted to execute the Project. Necessary infrastructure will primarily be constructed using local labour and equipment mobilized to Site via the winter access trail. Local employment will include residents of Kugaaruk with knowledge in the use of required heavy equipment, as well as wildlife monitors and general labourers. Where possible, training of local Inuit beneficiaries will occur, including the training of all site personnel in site-specific health and safety requirements, and proper handling of contaminated soil and waste. Designated site personnel will also be trained in operational procedures for the landfills, the Treatment Cell, Biopiles, water treatment systems, monitoring programs, and sampling.

The construction, operation and closure phases of the Project are expected to be completed over three summer periods (June to September 2016, 2017 and 2018). Project work will operate 12 hours per day, seven days a week. Personnel will be transported to the Site via aircraft and likely work a two-week rotational shift.

2.11 PUBLIC INVOLVEMENT/TRADITIONAL KNOWLEDGE

To date, parties consulted for this Project include the hamlet of Kugaaruk and the Kurtairujuark Hunters and Trappers Organization. The following is a summary of the formal and informal consultation that has occurred in relation to the Project.

2.11.1 Site Assessment – July 2013

Local knowledge was informally collected by Stantec during their July 2013 field program for the Phase III ESA. During the site visit, Stantec was accompanied by four residents of Kugaaruk who acted as wildlife monitors and general labourers. During this time, local knowledge of the Site

and Project area was obtained. One team member (Ms. Julie Ross, Archaeologist with Golder Associates) also interviewed a local Elder, Mr. Ovide Alakannuark, to obtain information on Site history, and past and present use of the Site by residents of Kugaaruk.

Informally-obtained Information regarding wildlife and plant species, fish presence, and heritage sites were incorporated into this overall assessment and provided background about the Project area.

2.11.2 Community Meeting – January 2014

On January 8, 2014, a community meeting was held in Kugaaruk, NU. The purpose of this meeting was to present the RAP and to allow an opportunity for the community to provide input on the Project. A total of 63 members from the community attended the meeting. The meeting was chaired by Mr. Dele Morakinyo of AANDC, Mr. Jessie Hoyt of PWGSC, and Mr. Michael Doucet of Stantec.

The community meeting included a presentation outlining the Project components and activities, and was presented by Mr. Morakinyo. Upon completion of the presentation, community members were provided an opportunity to ask questions and comment on the Project. The community members provided several comments; these are outlined below with the response from AANDC:

- Clarification regarding the proposed schedule for the Project. Concern was expressed regarding the completion of a similar type of project at CAM-4 which was scheduled for two years and ended up taking approximately ten years.
  - Mr. Morakinyo confirmed that the level of assessment completed at the CAM-4 site was less than what has been completed at the Site. The additional information that has been collected at this Site allows for more certainty with the schedule.
- Clarification regarding the material remaining at the Site. Community members inquired if materials could be salvaged.
  - Mr. Morakinyo confirmed that AANDC has a release process whereby a community member may take material(s) from the Site if they sign for the liability associated with the item(s).
- Community members identified the presence of a grave site that may not have been observed during the Archaeological Impact Assessment (AIA) completed in 2013.
  - The location of the grave site was indicated roughly on a map. Prior to remediation commencing, this location will be identified to the Site archaeologist so that it can be marked and avoided during remediation.

2.11.3 Traditional Knowledge

As noted in Section 2.11.1, a local Elder was interviewed during the July 2013 field program. No other sources of traditional knowledge were utilized in Project planning.

2.11.4 Ongoing Community Consultation

Prior to the commencement of the Project, an additional community meeting will be held with interested parties in Kugaaruk to update them on the planned work activities. Once the departure community for the winter access trail is selected, additional consultation activities with parties in that community will take place. The consultation will provide information on the Project and winter access trail, and obtain advice on its preferred routing. Upon completion of these additional consultation activities, this document will be updated.

3.0 Project Specific Information

3.1 REMEDIAL METHODS

Wastes and contaminated materials are distributed throughout the Site. Some materials are wholly or partially buried within BDAs (e.g., on-site dumps and landfills) while other wastes are scattered across the Site. This includes a large number of drums, as well as hazardous wastes (e.g., ACMs, lead paint), non-hazardous wastes (e.g., wood), and contaminated soil. The following sections outline the remedial methods for each type of waste, or waste-containing area, at the Site.

3.1.1 Surficial and Buried Waste

3.1.1.1 Existing Landfills

There are five existing landfills at the Site including the Station Dump, Main Station Landfill, Beach Airstrip Dump, Bunker and Beach Landfill, and the Station Airstrip Dump (see Drawings R2, R3, R17 and R18 in Appendix A, and Photo 4 to Photo 7 in Appendix B). These landfills feature surficial and buried debris.

In addition, two other BDAs (BDA1 and BDA2) are located in an area north of the Main Station (Drawing R17 in Appendix A) and one (BDA8) in an area east of the Bunker and Beach Landfill (see Drawing R18 in Appendix A). None of the landfills and/or BDAs are engineered facilities.

At the Site, there are three types of waste disposal areas, as defined by the AMSRP (INAC 2009). These include:

- Class A: waste disposal areas that are located in an unstable, high erosion location. In this case, wastes present will be relocated to an engineered landfill.
- Class B: waste disposal areas that are located in suitable stable locations; however, there is evidence of contaminant migration. In this case, wastes should be excavated and disposed of in an engineered landfill.
- Class C: Features of these waste disposal areas include a suitable, stable location with no evidence of contaminant migration. Due to this, wastes may be left in place with additional granular fill materials placed overtop (if necessary).

In addition to the surficial and buried waste present at the existing landfills, contaminated soil was also identified in these areas. Remedial methods for contaminated soil are further discussed in Section 3.1.2 but details of each on-site landfill and BDA are provided in Table 3-1.

Table 3-1: Existing Landfill Sites and BDAs at CAM-E, Keith Bay, NU (from Stantec 2013)

Landfill Name	Area of Inferred Waste (m^2)	Approx. Depth Range (m)	Types of Surficial Waste Present	Types of Buried Waste Present	Landfill Class	Contaminated Soil Present in Landfill? Type?
Station Dump	25	0.2 – 0.3	• burn pile • oil filters • metal, including automobile parts and large aircraft parts • stained surficial materials	None	N/A (only surficial waste)	Yes DCC Tier I
BDA1 and BDA2 (north of Main Station)	147	< 1.5	None	Metal debris	C	No
Main Station Landfill (inclusive of BDA3, BDA4, BDA5)	10,375	0.2 – 2.0	• batteries • drums • other metal debris	Metal debris	A (9,031 m^2) B (144 m^2) C (1,200 m^2)	Yes Tier I/II and Type A/B (co-mingled)
Station Airstrip Dump	30	0.2	• drums • canisters of grease • burn piles • stained surface	None	N/A (only surficial waste)	Yes Type A
Beach Airstrip Dump	90	< 1.0	• empty drums • empty and burned cans • glass • misc. metal debris.	None	N/A (only surficial waste)	Yes Tier II
Bunker and Beach Landfill (inclusive of BDA6 and BDA7)	540	0.3	• gravel • debris	Metal debris	C	Yes Type B
BDA8 (South of Bunker and Beach Landfill)	105	> 1.5	None	Unknown	B	No

All debris from the landfills and BDAs will be directed to a Staging Area, where the debris/waste will be segregated based on waste type (e.g., hazardous, non-hazardous), and processed as described in sections below. See Section 3.2.2 for more information on the Staging Area. However, specifically, the following remedial activities will take place at the existing landfills and BDAs, depending on the class of landfill and type of waste:

- Buried Debris Areas:
  - Class A and B landfill sites will be excavated to the limits of visible debris. Debris present will be separated from the soil, will be transported to the Staging Area and segregated based on waste type, and treated as described in Sections 3.1.1.2 and 3.1.1.3. Excavated soil from these areas will be disposed of in accordance to the requirements outlined in Section 3.1.2.
  - Class C landfill sites will be left in place. Exposed surficial debris will be removed and disposed of as outlined in Sections 3.1.1.2 and 3.1.1.3. Additional granular fill material will be placed atop of the remaining buried waste. The cover material will consist of a well-graded, erosion resistant material. In addition, the material will be compacted to limit the infiltration of water. The cover will be graded to conform to the surrounding topography and promote drainage.
- Surficial Debris:
  - Surficial debris will be transported to the Staging Area, segregated based on waste type, and processed according to the requirements of the waste streams outlined in Sections 3.1.1.2 and 3.1.1.3.
- Contaminated Soil:
  - Contaminated soil identified within the existing landfills and BDAs will be excavated and treated as per Section 3.1.2.

3.1.1.2 Non-Hazardous Wastes

Several non-hazardous materials were identified on-site including wood, metal, glass, electrical equipment, vehicle debris, etc. The volume of the non-hazardous materials will be minimized through crushing, shredding, or incineration. An approximate volume of 1,600 m^3 on non-hazardous waste will remain after crushing, shredding and incinerating. All non-hazardous materials will be placed in the on-site Tier I Landfill, including metal, glass, electrical equipment, vehicle debris, etc.; Table 3-2 summarizes the non-hazardous waste disposal methods and provides additional handling requirements.

Table 3-2 Non-hazardous Waste Disposal Methods (from Stantec 2014)

Waste Material	Minimized Volume (m^3)	Disposal Methods
Compressed Gas Cylinders	1,600 m^3 after crushing	To be vented prior to disposal at the Tier I Landfill
Building Infrastructure		To be demolished, shredded and/or incinerated and disposed at the Tier I Landfill
Other Non-Hazardous Waste		To be collected, shredded, compacted and disposed of at the Tier I Landfill

3.1.1.3 Hazardous Waste

Hazardous wastes present at the Site include ACMs, batteries, and PCB, lead and/or mercury-amended paint. Approximately 1,075 m^3 of hazardous waste was identified in various areas throughout the Site. Table 3-3 presents the maximum concentration for each contaminant found on the Site (Stantec 2013).

Table 3-3 Maximum Concentrations of Hazardous Materials at CAM-E, Keith Bay, NU (from Stantec 2013)

Contaminant	Maximum Concentration
ACM	73.8% Chrysotile
Lead-amended paint	45,000 ppm
Mercury-amended paint	130 ppm
PCB-amended paint	2,300 ppm

Hazardous wastes will be collected, placed in appropriate containers, and transported to the Staging Area. The wastes will then be further inspected, tested, classified, and packaged or disposed of, as necessary. Disposal methods for each of the identified hazardous wastes are summarized in Table 3-4.

Table 3-4: Summary of Disposal Methods for Hazardous Wastes On-site

Waste	Total Approximate Volume (m^3)	Disposal Methods
ACMs	25	ACMs will be double-bagged and disposed of in the Tier I Landfill. Bagged asbestos-containing materials will be consolidated into one location in the landfill and covered with enough soil so that none of the bags are exposed.

Table 3-4: Summary of Disposal Methods for Hazardous Wastes On-site

Waste	Total Approximate Volume (m^3)	Disposal Methods
Batteries	16 batteries	Batteries will be collected and transported to a registered recycling facility in southern Canada.
Lead-, mercury-, and PCB-amended paint (co-mingled)	1,050	Poorly adhered paint will undergo a partial abatement program on-site. The removed paint will be disposed of in the Tier II Landfill. If lead has leached into substrate at concentrations above the applicable guideline, this material will be collected and disposed off-site.

Any hazardous waste requiring transport to a disposal facility in southern Canada will be stored in a secure temporary storage area on-site until to shipment off-site via the winter access trail; the location of this temporary storage area will be determined during the design phase of the Project.

3.1.1.4 Drums

Approximately 5,900 drums were observed scattered and piled across the Site. Approximately 30 drums were identified as containing liquid however these drums were easily accessible and not all drums were tested. Labels which were legible indicated that the majority of the drums formerly contained fuel oil; however, other labels indicated that toluene, antifreeze, or waste oil was stored at one time.

During the remedial activities, all drums will be sampled to determine drum contents. Drums will either be sampled in place or collected and brought to the Staging Area for sampling. Once drum contents are confirmed, drums will be dealt with using one of the following disposal methods:

- Drums containing only rust shall be treated as empty.
- Drums containing water (with less than 2% glycols or alcohols) will be collected and transported to the Staging Area. The contents of each drum will be transferred to a receptacle. The water will be tested prior to discharge in accordance with the wastewater discharge criteria. Where the water meets the discharge criteria, the water will be discharged as described in Section 2.7.1.
- Drums containing glycols, alcohols or organic phases, and meet the applicable criteria in the AMSPR (INAC 2009b) will be incinerated on-site. Any solid residual material remaining after incineration will be subject to a leachate extraction test. Material found not to be leachable will be disposed at the Tier II Landfill. Liquids and/or residual solids exceeding the applicable criteria will be disposed at a licensed facility off-site.

- Empty drums will be rinsed. The rinsate will be collected, treated (if necessary) and discharged, as per Section 2.7.1; rinsate will also be recycled as much as possible to reduce required water volumes.
- Rinsed and empty drums will be crushed and disposed of in the Tier I Landfill.

As many drums are located in undisturbed areas, specifically within the Freshwater Lake and along the beach area near Area 2, drums in these areas will be collected manually using ATVs and a trailer to avoid sensitive land features. In the Freshwater Lake, drums will be collected by hand and brought to shore for loading onto the ATV trailer.

3.1.1.5 Salvageable Equipment

Based on the condition of the wastes present at the Site, there is no salvageable equipment, infrastructure or supplies present.

3.1.2 Contaminated Soil

It is estimated that approximately 6,233 m^3 of contaminated soil are present at the Site. The locations of the contaminated soils are identified in Drawings R4 to R16 in Appendix A. The maximum concentrations of contaminants in soil Table 3-5

Table 3-5 Maximum Concentrations of Contaminants in Soil at CAM-E, Keith Bay, NU (from Stantec 2013)

Contaminant	Maximum soil concentration (mg/kg)
Copper	1,900
Lead	5,000
Zinc	3,300
Naphthalene	0.046
PCBs	1.6
PHC F2 (> C10-C16)	680
PHC F3 (> C16-C34)	30,000

Contaminated soils will be mechanically excavated with heavy equipment (e.g., excavators and backhoes). Depending on type, contaminated soils will be placed in either the on-site Tier I Landfill, the Tier II Landfill, or the Treatment Cell. The remedial criteria for each type of contaminated soil, as well as the estimated soil volume and remedial method are presented in Table 3-6.

Table 3-6 Summary of the Contaminated Soil Types, Classification Criteria, Estimated Soil Volumes, and Remedial Methods for CAM-E, Keith Bay, NU (adapted from Stantec 2014)

Contaminated Soil Type	Classification Criteria	Estimated Volume (m^3)	Remedial Method
DCC Tier I Contaminated Soil	Soils containing concentrations of any or all of the contaminants listed as follows: • Lead – 200 mg/kg • PCBs – 1.0 mg/kg	83	Excavated and placed in the Tier I Landfill
DCC Tier II Contaminated Soil	Soils containing concentrations of any or all of the contaminants listed as follows: • Arsenic – 30 mg/kg • Cadmium – 5.0 mg/kg • Chromium – 250 mg/kg • Cobalt – 50 mg/kg • Copper – 100 mg/kg • Lead – 500 mg/kg • Mercury – 2.0 mg/kg • Nickel – 100 mg/kg • Zinc – 500 mg/kg • PCBs – 5.0 mg/kg	3,200	Excavated and placed in the Tier II Landfill
Type A Contaminated Soil	Soils containing concentrations of any or all of the contaminants listed as follows: • PHC fraction F3 – 20,000 mg/kg • Type A Hydrocarbon Contamination – 20,000 mg/kg	1,050	Excavated and placed in the Tier I Landfill
Type B Contaminated Soil	Soils containing concentrations of any or all of the contaminants listed as follows: If within 30 m of a waterbody: • PHC faction F1 – 1,290 mg/kg • PHC fraction F2 – 330 mg/kg For soils between depth of 0.0 to 0.5 mbg: • Type B Hydrocarbon Contamination – 2,500 mg/kg For soils below 0.5 mbg depth: • Type B Hydrocarbon Contamination – 5,000 mg/kg	1,900	Excavated and placed in the Treatment Cell for ex-situ remediation using Biopiles

3.1.3 Water

3.1.3.1 Surface Water

Metal contaminated surface water, or water with contaminants above Canadian Council of Ministers of the Environment (CCME) Freshwater Aquatic Life guidelines, was only identified from the small pond within the Main Station Landfill in Area 1; this area already requires excavation of metal and petroleum hydrocarbon impacted soil, as well as buried debris. Elevated aluminum concentrations were detected in surface waters in Area 1 and Area 2; however, these concentrations were attributed to natural variability. Table 3-7 summarizes the contaminants of concern in water at the Main Station Landfill and presents the maximum concentration for each contaminant (Stantec 2013).

Table 3-7 Maximum Concentrations of Contaminants in Surface Water at the Main Station Landfill in Area 1, CAM-E, Keith Bay, NU (from Stantec 2013).

Contaminant	Maximum Concentration (µg/L)
Aluminum (total)	13
Cadmium (total)	0.31
Copper (total)	7.7
Iron (total)	920
Lead (total)	12
Zinc (total)	75

3.1.3.2 Groundwater

Groundwater quality investigations completed during previous investigations did not identify concentrations of contaminants above the applicable regulatory criteria (i.e., CCME). Upon completion of the remedial activities, groundwater quality in the vicinity of the Tier II Landfill will be assessed to confirm concentrations are below the applicable regulatory criteria. Groundwater quality will also be monitored following remediation activities, as part of the post-closure monitoring program.

3.1.3.3 Contact Water (Surface Water and Groundwater)

It has been assumed that additional surface water and/or groundwater may require treatment during the Project, arising from contact water collected during excavation dewatering activities, and that which collects within the landfill cells and biopile berms. The total volume of water to be treated cannot be determined at this time.

Contact water will be analyzed following collection to determine if it meets the applicable discharge criteria. If contact water meets the discharge criteria, it will be discharged without treatment. However, if it does not meet the discharge criteria, contact water will collected and treated through the on-site contaminated water treatment system, as described in Section 2.7.1.

3.1.4 Sediments

Sediment sampling completed during previous investigations did not identify concentrations of contaminants above the applicable regulatory criteria (i.e., CCME). No remedial work will be undertaken on sediments.

3.1.5 Explosives

No explosives were identified at the Site and none will be used during the Project.

3.2 PROJECT INFRASTRUCTURE REQUIREMENTS

To facilitate the completion of the Project, several facilities are required to be constructed on-site. These include:

1. Landfill containment cells
2. Staging Area
3. Contaminated water treatment system
4. Incinerators
5. Winter access trail and site access roads
6. Borrow sources.

3.2.1 Landfill Containment Cells

For wastes which do not require off-site disposal, two new engineered landfills will be constructed on-site to contain these wastes. These include the Tier I Landfill and the Tier II Landfill. Each of the facilities will be designed and constructed in accordance with the AMSRP (INAC 2009b), and are described below.

3.2.1.1 Non-hazardous Waste Landfill

A Tier I Landfill will be constructed to dispose of contaminated soil (DCC Tier I and Type A soils), ACMs, and non-hazardous waste. The Tier I Landfill will be located at Potential Landfill/Landfarm Site 5 (see Drawing R19 in Appendix A) (Stantec 2014). This location features bedrock and is located adjacent to the existing roadway that connects Areas 1 and 2. The area is free of ponded water and is greater than 100 m from any waterbody.

As per the AMSRP (INAC 2009a), construction of the landfill will include ground preparation, such as the removal of boulders, all vegetation, loose soil, and ice and snow (if present). Once

complete, a perimeter berm consisting of a minimum width of 3.0 m granular material will be constructed directly on the ground surface (INAC 2009a). The berm will have an exterior slope of 3:1 and an interior slope of 2:1. The perimeter berm and landfill cover will consist of well-graded sand and gravel with a minimum of 8 % fines (INAC 2009a). The material will be compacted to a minimum of 95% maximum dry density. Four groundwater monitoring wells will be installed around the perimeter of the facility to allow for monitoring during and after completion of the remediation activities.

During the operation of the facility, waste will be deposited into the cell in 0.5 m lifts with a minimum of 0.15 m of granular fill placed over each lift to fill in any voids (INAC 2009a). Bagged ACMs will be consolidated into one location and covered with granular fill.

The landfill will have a maximum debris thickness of 3.0 m and minimum cover thickness of 1.0 m (INAC 2009a). The landfill cover will consist of a well-graded cap of granular material that is erosion resistant and has moderate water infiltration. The sections of the Tier I Landfill used during each year of remedial work will be closed to reduce wildlife attractants, potential off-site migration of contaminants, and wind-blown debris. In Year 3 of remedial work, prior to final closure of the Tier I Landfill, the landfill will be graded to promote positive drainage (2 to 5%) to prevent any ponding of water (INAC 2009a).

The final specifications (including landfill size, granular fill requirements, side slopes, cover thickness, etc.) will be provided upon completion of the design phase of the Project.

3.2.1.2 Tier II Landfill

A Tier II Landfill will be constructed to dispose of contaminated soil (DCC Tier II, as well as co-mingled DCC Tier II – Type A/B soils). The Tier II Landfill will be located at Potential Landfill/Landfarm Site 1, as identified on Drawing R19 in Appendix A (Stantec 2013). This location features permafrost near ground surface, and is located adjacent to an existing access road. The area is free of any ponded water and is greater than 100 m from any waterbody.

As per the AMSRP (INAC 2009a), the facility will have perimeter berms that are keyed into the underlying permafrost. The base will be lined (e.g., geomembrane liner located between two layers of non-woven geotextile) with the liner extending to the top of the perimeter berms (INAC 2009a). A layer of sand will be placed atop of the liner.

Contaminated soil will be placed in the facility. The section(s) of the Tier II Landfill used during each year of remedial work will be closed to reduce wildlife attractants, potential off-site migration of contaminants, and wind-blown debris. In Year 3 of remedial work, once remediation is complete, the facility will be capped with a layer of granular fill and sand. A geomembrane liner will be placed on top of the sand layer followed by additional layers of sand and granular fill material (INAC 2009a). Prior to final closure, the landfill will be graded to promote positive drainage (2 to 5%) to prevent any ponding of water. Installation of monitoring

wells and thermistors will also be completed to monitor groundwater quality and ground temperature (INAC 2009a).

The final specifications (including landfill size, granular fill requirements, side slopes, cover thickness, etc.,) will be provided upon completion of the design phase of the Project. During the design process, geothermal analyses will also be carried out to substantiate the use of permafrost as a means of containment (INAC 2009a).

3.2.2 Biopiles

Biopiles are a remedial technique whereby the soil is aerated to enhance microbial activity so that contaminants are naturally degraded. Aeration can occur mechanically (via an excavator), actively (via blowers), or passively (via perforated pipes and a fan system). Bacteria and/or fertilizers can also be added to the Biopiles to increase microbial activity and enhance hydrocarbon removal. Biopiles were selected to remediate Type B hydrocarbon-contaminated soils and were chosen as they require less disturbed area than an equivalent landfarm, and have been shown to be more effective and efficient (i.e., require less time) at remediating soil than a landfarm.

The Biopiles will be located in the Treatment Cell constructed at either Potential Landill/Landfarm Site 3 or 5 (see Drawing R19 in Appendix A) as both locations are near the existing roadway and near borrow sources. The Treatment Cell will be constructed of a geosynthetic liner with containment berms to capture surface runoff. Biopiles in the Treatment Cell will be constructed in a windrow to approximately 3 m in height using an excavator. The final Treatment Cell design and construction method will be confirmed during the Project's design phase.

It is anticipated that the Treatment Cell will be operated for two years during the remediation activities (2017 and 2018). The Biopiles will require aeration annually, as well as sampling of the soil to track how remediation is progressing, and to determine when the soil meets applicable soil quality criteria (i.e., AMSRP; INAC 2009a). Presently, it is anticipated that annual aeration will be performed with the use of an excavator present on-site. Accumulated water inside of the Treatment Cell will be treated in the on-site water treatment system. However, if additional time is required to achieve the remediation objectives, a small excavator and water treatment system will be mobilized via aircraft to Site annually. The final aeration design, and subsequent logistics, will be determined in the design phase of the Project.

Once it is determined that soil meets the applicable criteria, the Biopiles will be re-graded to match existing contours. The geosynthetic liner will be taken off-site for disposal at an appropriate facility. Prior to final closure of the Treatment Cell, the cell will be graded to promote positive drainage (2 to 5%) to prevent any ponding of water.

The final specifications for the Treatment Cell (including size, granular fill requirements, side slopes, etc.,) will be determined during the design phase of the Project.

3.2.3 Staging Area

A Staging Area will be constructed to facilitate the processing of waste and debris at the Site, being used to sort, package, sample and process hazardous and non-hazardous wastes. Hazardous wastes will be processed in a designated Hazardous Material Processing Area within the Staging Area. The location of the Staging Area will be determined during the design phase of the Project, but will be constructed greater than 100 m from the high water mark of any waterbody, and in an area free of ponded water.

At the end of the remedial works (i.e., September 2018), the Staging Area will be re-graded to match existing contours.

3.2.4 Contaminated Water Treatment System

Contaminated water will be treated in an on-site water treatment system as discussed in Section 2.7.1. The type of water treatment system will be determined by the Contractor to meet the discharge criteria set in the Project's Water License. The system (including the discharge point) will be constructed a minimum of 100 m from the high water mark of any waterbody.

3.2.5 Incinerators

Select non-hazardous wastes and waste petroleum product will be incinerated, as well as domestic waste from the camp. Two separate incinerators will be used for these different waste streams (i.e., a domestic waste incinerator and a non-hazardous, combustible waste incinerator). The type of the incinerators will be determined by the Contractor, however the units will adhere to the AMSRP (Annex B; INAC 2009a) and Environment Canada's *Technical Document for Batch Waste Incineration* (EC 2010), as well as Nunavut and Canadian emissions guidelines.

3.2.6 Winter Access Trail

A temporary winter access trail will be required to mobilize equipment to the Site. Heavy equipment will be mobilized using a cat train. At the date of this document, the alignment of the temporary winter access trail has not been finalized, nor has the departure community been selected (options include Repulse Bay, Taloyoak, and Hall Beach; see Section 2.3.1). This document will be updated, as necessary, upon selection of the winter access trail route.

Construction of the temporary winter access trail will occur once the ground has frozen and there is sufficient snow cover to protect the ground from tracks of vehicles (INAC 2010). If snow clearing or packing is required, bulldozer blades will be raised off the ground and smear blades will be used to avoid cutting the tops of high areas, which can lead to ground subsidence during the spring. A minimum 10 cm of compacted snow will be in place before heavier wheeled vehicles are permitted to operate on the winter access trail. The compacted snow will be allowed to settle for a few days after compaction to allow it to gain strength. Snow windrows,

if constructed, will have breaks at regular intervals to allow wildlife passage and drainage of meltwater in the spring.

It is likely that the temporary winter access trail will cross watercourses. In this case, snow fills or ice bridges (depending on the waterbody) will be constructed to allow the equipment and camp units to cross. Snowfills will only be used in streams that freeze to the bottom and will be removed or notched during closure of the winter access trail, so that spring drainage is not impeded (INAC 2010). These crossings will likely be constructed by Snow Cats pushing clean snow (i.e., free of vegetation and debris) into the crossing and compacting it to provide for safe passage over the watercourse. For streams that develop solid ice cover, but do not freeze to bottom, an ice bridge can be constructed. Snow can be removed from the ice so that water can be used to increase the ice thickness in successive layers (INAC 2010). Snow can then be packed over the approaches to avoid river bank disturbances. Snow fills and ice bridges will be constructed in accordance with mitigation measures outlined in DFO's former Nunavut Operational Statement for Ice Bridges and Snow Fills (DFO 2007).

The winter road will connect with the existing access road on the Site that connects Area 1 and Area 2. For summer operations, one culvert will be required to maintain drainage for a washed out section of this access road, situated approximately 0.8 km north of Area 2. Re-grading of this existing access road will also be required to permit access by all required vehicle and equipment types. Re-grading maintenance will also occur throughout the Project.

To protect exposed and/or disturbed areas from runoff and erosion, erosion and sediment control (ESC) measures will be implemented, including but not limited to, silt fences, and sand bags. These ESC measures will provide slope stabilization and prevent sediment from entering into any nearby watercourses. Runoff and erosion are not expected during construction and operation of the winter access trail, however may be encountered during summer operations; in this case, ESC measure will be installed, where necessary. Any ESC measures will be left in place until the area has stabilized, likely over the following open water period, as per ESC Best Management Practices (Alberta Transportation 2011).

3.2.7 Pits and Quarries

Eight potential borrow sources were identified during the July 2013 geotechnical field program by test pitting and laboratory testing. The potential borrow sources are shown on Drawing R19 in Appendix A. At the date of this document, it is unknown which borrow sources will be developed as it will depend on the material required for the Project. This will be confirmed in the design phase of the Project however at this point, it is assumed all borrow sources will be utilized.

Material from the borrow sources will be used to supply granular material for the re-grading of the existing access road and North Airstrip, construction of the new on-site engineered landfills, construction of a Staging Area, backfilling and capping. Some crushing of granular materials is expected, though the location of crushing activities and quantity of material are unknown at this

time. Each of the borrow sources will be accessed using the existing access road. Details of each identified borrow source are provided in Table 3-8.

Table 3-8 Summary of Potential Borrow Sources on-Site (Stantec 2013)

Potential Borrow Source No.	Estimated Borrow Material Volume (m^3)					Overburden Thickness (m)	Depth to Permafrost (Range [m])	Moisture Content (Range [%])
	Sands and Gravels			Granular Soil	TOTAL			
	< 5% fines	< 10% fines	< 20% fines	≥ 20% fines				
1	10,420	-	13,900	-	24,320	> 0.6	0.5 – 0. 6	2 – 8
2	25,720	-	15,010	-	40,730	> 0.9	0.4 – 0.9	0 – 2
3	3,980	5,310	11,950	-	21,240	> 0.8	0.8	6 – 8
4	-	3,930	7,860	4,360	16,150	> 1.0	Not encountered, or 0.7 –1.0	6 – 7
5	1,200	4,210	-	2,410	7,820	> 0.7	0.6 – 0.7	5 – 6
6	-	7,700	4,150	-	11,850	> 0.7	0.6 – 0.7	6 – 8
7	-	3,810	3,810	-	7,620	0.5	Not encountered	5 – 6
8	4,820	-	11,260	540	16,620	> 0.9	0.7 – 0.9	6 – 8

All potential borrow source areas were situated on well-drained terrain with sparse vegetative ground cover. All borrow source areas were either flat or gently undulating with no existing slumping; see Photo 8 to Photo 13 in Appendix B.

As presented in Table 3-8, the depth to permafrost in the borrow areas ranges from 0.4 to 1.0 m, depending on the terrain and landform (Stantec 2013). Therefore, it is likely that permafrost will be encountered during excavation particularly at the deeper borrow sources. Based on the specifics of this Project, some melt back of the upper permafrost is likely to occur following excavation. In addition, excavation of material at the identified borrow sources will expose underlying permafrost to warming and may cause permafrost thaw and slumping. Mitigation measures will be implemented to protect the underlying permafrost of borrow sources and prevent excessive thaw and subsequent slumping, as well as reduce the potential for flooding or ponding of water, and erosion; mitigation measures are presented in Section 5.5.

Carving stone deposits were not identified during the Phase III Site visit. The acid rock drainage potential or metal leaching characteristics are also not known for the borrow sources at the Site. Borrow sources will be excavated with the use of heavy equipment (e.g., excavator) and blasting will not be required to access the granular materials.

4.0 Existing Environment

4.1 PHYSICAL ENVIRONMENT

4.1.1 Terrain

The Site is located on the eastern shore of the Simpson Peninsula at Cape Barclay, in the Gulf of Boothia, near the shores of Keith Bay (Drawing R1 in Appendix A). The Site is situated within the Gulf of Boothia Plain ecoregion of the Northern Arctic ecozone (ESWG 1995). The Gulf of Boothia Plain ecoregion is characterized by a gently south-sloping landscape and ranges in elevation from sea level to 300 m above sea level (masl) (ESWG 1995). Bedrock geology at the Site primarily consists of dolomitic limestone, sandstone and shale from the Paleozoic Ordovician and Silurian periods (Paul et al. 2002). Surficial geology at the Site consists of marine sediments, primarily gravel and sand, with 1 to 5 m thick ridge and swale formations (GSC 1985). From the geotechnical assessment, the granular materials at the potential borrow sources are generally well-drained and include: well-graded sands and gravel with < 5% fines; well-graded sands and gravel with < 10% fines; sands and gravel with < 20% fines; and granular soil with ≥ 20% fines (Stantec 2013). Glacial till blanket and till veneer can be found west of the Site, on the shoreline of Keith Bay while consolidated sedimentary rocks can be found northeast of Area 1 (GSC 1985).

The Gulf of Boothia Plain ecoregion is dominated by mineral static cryosol soils that have developed on morainal and marine sediments; static cryosol soils typically have permafrost within 1 m of the surface (Centre for Land and Biological Resources Research 1996). Permafrost is continuous across the ecoregion, with abundant ice wedges (ESWG 1995). From the geotechnical assessment, permafrost at the Site was typically encountered between 0.4 to 1.0 m below the surface, depending on the terrain and landform (Stantec 2013). Permafrost was not encountered in several test pits, primarily in Borrow Sources No. 4 and 7 (see Section 3.2.7 and Stantec 2013).

4.1.2 Climate

Overall, the Gulf of Boothia Plain ecoregion is classified as having a mid-arctic ecoclimate, with mean annual temperature of approximately -15°C and mean annual precipitation ranging from 100 to 200 mm (ESWG 1995). The weather station nearest the Site is located at the Kugaaruk airport, 75 km northwest of the Site. Therefore, climate normals at Kugaaruk, over the period 1981 – 2010 (EC 2013), are provided in Table 4-1.

Table 4-1: Climate Normal over the Period 1981 to 2010 at Kugaaruk, NU (EC 2013)

Month	Mean Daily Temperature (°C)	Minimum Daily Temperature (°C)	Maximum Daily Temperature (°C)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snowfall (mm)
January	-33.5	-37.1	-29.9	9.0	0.0	9.0
February	-33.5	-37.3	-29.5	8.1	0.0	8.1
March	-28.5	-33.0	-24.0	14.1	0.0	14.1
April	-19.4	-24.5	-14.3	20	0.0	20.1
May	-7.9	-11.7	-4.0	18.6	1.1	17.7
June	2.9	-0.4	6.1	22.1	18.1	4.1
July	9.2	4.6	13.9	36.5	36.5	0.0
August	6.5	2.9	10.1	44.8	43.1	1.6
September	0.4	-2.0	2.7	28.7	15.2	13.6
October	-9.1	-12.1	-6.0	28.3	2.6	26.0
November	-21.1	-24.9	-17.4	17.7	0	18.4
December	-29.3	-32.0	-24.5	13.5	0	13.5
Annual	**-13.5**	**-17.3**	**-9.7**	**261.2**	**116.6**	**146.2**

4.1.3 Hydrology

The Site is situated on the Simpson Peninsula which is located within the Arctic Ocean watershed, Gulf of Boothia sub-basin and Committee Bay sub-sub-basin. No instrumented hydrologic stations (i.e., Water Survey of Canada) are present in the area of the Site, Kugaaruk or Simpson Peninsula. At the Site however, surface waters include small freshwater ponds, ephemeral and non-ephemeral streams, and the marine waters of Keith Bay. The marine waters of Keith Bay will not be affected by Project activities; works will be limited to Area 1 and Area 2 only, as well as the existing road between the two areas (see in Drawing R2 and R3 in Appendix A). Several small freshwater waterbodies are located near areas were remediation activities will occur; these are described below:

- Area 1:
  - Freshwater Lake – located on the eastern edge of Area 1 (see Photo 14 to Photo 18 in Appendix D); the end of an access road current extends out into the Freshwater Lake. It will also be utilized as a potable water source for the camp during the Project, as well as a source of water for remediation activities.
  - Pond within the Main Station Landfill – a small pond is situated in the middle of the Main Station Landfill (see Drawing R10 in Appendix A and Photo 19 to Photo 20 in Appendix B).

This pond has been affected by surface debris in the landfill and will be drained for excavations during remediation activities.

  - Wetland South of the Main Station Landfill – located in the northern portion of Area 1 (see Photo 21 to Photo 22 in Appendix B); this wetland is located in a depression of land and receives drainage from the surrounding upland areas. The southern portion of this area will be slightly disturbed by remediation activities in Northwest Drum Cache (see Drawing R7 in Appendix A).
  - Pond within the Former Sewage Lagoon Area – located in the southwestern edge of Area 1 (see Photos 23 to Photo 24 in Appendix B), this was the former sewage lagoon for the Site. A small area near the end of the sewer pipe will be excavated during remediation; the pond will not be affected (see Drawing R4 in Appendix A).
  - Pond within the Tier I Landfill area (Potential Landfill/Landfarm Site 5) – one small pond is present within the area identified as Potential Landfill/Landfarm Site 5 (see Drawing R19 in Appendix A and Photo 25 in Appendix B). This pond was less than 0.5 m deep during the July 2013 field survey and was sparsely vegetated. The pond will likely be filled in with construction of the Tier I Landfill.
- Area 2:
  - Pond near Beach Airstrip Dump (see Drawing R12 in Appendix A) – situated approximately 50 m north of the Beach Airstrip Dump (see Photo 26 in Appendix B); however, this pond will not be affected by remedial activities.
  - Pond near the Tier II Landfill (Potential Landfill/Landfarm Site 1) (see Drawing R19 in Appendix A) – this small pond is situated approximately 50 m from the southern edge of Potential Landfill/Landfarm Site 1 (see Photo 27in Appendix B) and will not be affected during remedial activities.
- Area between Area 1 and Area 2:
  - Unnamed Drainage Channel – a drainage channel has presently washed out a section of the existing roadway between Area 1 and Area 2 (see Photo 1 to Photo 3 in Appendix B). This will be repaired during the Project and a culvert installed. The drainage channel was dry at the time of the July 2013 field survey.
  - Several small ponds near potential borrow source areas (see Drawing R19 in Appendix A) – several small ponds are situated near the edges of the identified borrow sources throughout the Site; all of these ponds were less than 0.5 m deep during the July 2013 field survey. Some of these ponds may be affected by borrow source development.
- Winter Access Trail:
  - The route for the winter access trail has not yet been selected. Any water crossings will be identified during the preliminary reconnaissance for the route.

During the July 2013 field survey, all ponds listed above had water present. Most surface water ponds on the Site are located in depressional areas and are a drainage point for the surrounding upland area. In July 2013, all surface waterbodies, including the Freshwater Lake, were less than 1 m deep, with most waterbodies being less than 0.5 m deep. Given the historic climate in Kugaaruk (see Section 4.1.2), the timing of the snow melt is likely to occur in June and

July (EC 2013). Therefore water levels in many surface waterbodies at Site would be expected to decline through the summer period, and potentially dry up completely.

4.2 BIOLOGICAL ENVIRONMENT

4.2.1 Vegetation

In general, the Gulf of Boothia ecoregion is characterized by discontinuous upland tundra vegetation, dominated by purple saxifrage (*Saxifraga oppositifolia*), avens (*Dryas* spp.), Arctic willow (*Salix arctica*), alpine foxtail (*Alopecurus alpinus*), as well as wood rush (*Luzula* spp.) and other saxifrage species; lowland or wet areas tend to have a continuous cover of sedge (*Carex* spp.), cottongrass (*Eriophorum* spp.), saxifrage and moss (ESWG 1995).

At the Site, vegetation was sparse and intermittent in upland areas, primarily occurring in tufts or as individual plants on the rocky talus (see general photos in Appendix B). Upland vegetation was primarily comprised of purple saxifrage, mountain avens (*Dryas integrifolia*), willows (*Salix* spp.), Arctic poppy (*Papaver radicatum*), cushioned whit-low grass (*Draba corymbosa*) and lichens. Within wetlands, or around areas with ponded water, vegetation was more abundant and typically included buttercup species (*Ranunculus* spp.), Arctic cottongrass (*Eriophorum vaginatum*), purple bladder-campion (*Melandrium apetalum*), willows, rushes (*Juncus* spp.), sedge, grass, and moss (see general photos in Appendix B). A list of all vegetation species identified during the July 2013 field program, and their territorial status ranking is provided in Table C-1 in Appendix C. No identified species are given status under the Federal *Species at Risk Act* (SARA), or listed as Sensitive, May Be At Risk or At Risk.

4.2.2 Wildlife

The following sections identify wildlife species (terrestrial and marine mammals) that are known or expected to occur in or near the Project area (see Table C-2 in Appendix C for a complete list).

4.2.2.1 Terrestrial Mammals

There are an estimated 36 terrestrial mammalian species known or expected to occur in Nunavut (CESCC 2011) and 18 species are known or expected to occur near or within the Site (Table C-2 in Appendix C). For the purposes of this environmental screening, grizzly bear (*Ursus arctos*), wolverine (*Gulo gulo*), and barren-ground caribou (*Rangifer tarandus groenlandicus*) are discussed in further detail below.

4.2.2.1.1 Barren-ground Caribou

Barren-ground caribou are found throughout mainland Nunavut and are currently ranked as Secure in the territory (CESCC 2011). The Project area is situated within the northern range of the Wager and Lorillard herds (GN 2007) (part of the Northeast Mainland caribou). Overall, population estimates of the Northeast Mainland caribou have dropped from 1983 (119,800 ± 13,900) to 1995

(73,994 ± 11,670) (Campbell 2005). However, surveys have shown little change in Lorillard population estimates between 2000 and 2003; and, Wager Bay caribou appear to have increased between 2000 and 2004 (Gunn et al. 2011). In 2003, the Lorillard herd was estimated at approximately 12,150 on their primary calving grounds, while the Wager Bay herd was estimated at 28,120 on their primary calving ground in 2004 (Campbell 2005). Further research and collaring are underway to refine population estimates and ranges for Northeast Mainland caribou (Gunn et al. 2011).

The range of the Lorillard and Wager Bay herds overlap; however, they are separated into distinct herds based on their primary calving areas. Individuals of the Lorillard herd typically winter in the area north of Chesterfield Inlet and west to Baker Lake and the Back River (GN 2007). They begin their spring migration in April and travel north, primarily spending the summer (including calving and post-calving) between Chesterfield Inlet and Wager Bay, around the Lorillard River; however, cows have been collared and tracked to the Kugaaruk and Repulse Bay areas throughout the summer (GN 2007). The Wager Bay herd has a slightly larger wintering area than the Lorillard herd, generally stretching from the Chesterfield Inlet area, north to Repulse Bay, and west to the Back River (GN 2007). Spring migration also begins in April and the caribou typically calve and spend the summer north of Wager Bay and further north into the Repulse Bay-Melville Peninsula area; however, some cows have been tracked to the west side of Committee Bay on the Simpson Peninsula, as well as further north onto the Boothia Peninsula near Taloyoak (GN 2007). Both herds begin to move south in September to their wintering grounds (GN 2007).

Residents of Kugaaruk harvest barren-ground caribou and the Nunavut Wildlife Harvest Study (NWHS) reported an average harvest of 430 animals per year, ranging from 274 in 1996/1997 to 589 in 1997/1998 (Priest and Usher 2004). However, it was noted that this was comprised of both barren-ground and island caribou and that the harvest estimates were believed to be low (Priest and Usher 2004). Caribou were observed on the Site during the July 2013 field survey; they were typically found throughout Area 1 and Area 2, as well as the stretch of land between the two portions of the Site (see Drawing R19 in Appendix A for an overview of the Site).

4.2.2.1.2 Grizzly Bear

Grizzly bear of the Western population are expected to be found throughout much of mainland Nunavut (COSEWIC 2012). The grizzly bear is currently ranked as Secure in the territory (CESCC 2011); however, the Western population of grizzly bear is listed as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), but is not listed under the SARA (SARPR 2013). Population densities in the Kitikmeot and Kivalliq region are low (COSEWIC 2012), though the grizzly bear population in Nunavut was noted as increasing in 1999 at an annual rate of 3% (McLoughlin et al. 2003). The range of grizzly bear in Nunavut also appears to have expanded, though without further research, it is unknown if this expansion is due to an increase in abundance or due to changes in movements or distribution (COSEWIC 2012). Regardless, grizzly bear have been recently documented in areas of the Arctic where

they had not previously been observed; several instances are reported in COSEWIC (2012), including sightings on Melville Island in the Northwest Territories, and King William Island in Nunavut. Only one harvested grizzly bear was reported for Kugaaruk from 1996 to 2001 in the NWHS; however, it was noted that the community typically does harvest one grizzly bear per year (Priest and Usher 2004).

Grizzly bears are habitat generalists and occupy a diverse range of habitats throughout Canada. In Nunavut, grizzly bear would be found throughout the low Arctic tundra area (COSEWIC 2012), utilizing bedrock habitats, wetland areas with good cover, eskers, and mesic and mat tundra sites (Gau 1998). Habitat associations are strongly seasonal and generally reflect changes in the grizzly bear's environment and food source (i.e., regional plant phenology, and timing of spring ungulate calving) (Schwartz et al. 2003).

In Nunavut, grizzly bear typically den from October/November to April/May (COSEWIC 2012). Grizzly bear have been shown to prefer esker habitat in the Slave Geologic Province of the Northwest Territories and Nunavut, with dens typically occurring on well-drained slopes under cover of tall shrubs (greater than 0.5 m) (McLoughlin et al. 1999). However, the same study also showed the use of typical heath tundra habitat for denning, as well as birch seeps, tall shrub riparian areas, and spruce forest (McLoughlin et al. 1999).

4.2.2.1.3 Wolverine

The wolverine is territorially ranked as Secure (CESCC 2011) but the Western population of wolverine is listed as Special Concern by COSEWIC; it is not listed under the SARA (SARPR 2013). Densities in Nunavut range from 'moderate' in the western portion of the territory to 'low' throughout the rest of the territory, including the Site (COSEWIC 2003). The wolverine population in Nunavut is expected to be stable, though it is likely sensitive to harvest pressures; population estimates for the territory are not provided in COSEWIC (2003). Wolverine fur is valued in the North and residents of Kugaaruk do harvest wolverine in small numbers annually; average of two animals per year, ranging from two to five animals per year throughout 1998 to 2001 (Priest and Usher 2004). The majority of harvested Wolverine appears to be kept for domestic purposes rather than sent to auction however as fur trade statistics appear to largely underestimate the total harvest in Nunavut (COSEWIC 2003).

Wolverines utilize a variety of habitats although have specific denning habitats, which include boulders, under deadfall, rock outcrops, and wind-hardened snowdrifts (Magoun and Copeland 1998). Wolverine dens are generally built under 1 to 5 m of snow and consist of complex snow tunnels that lead to boulder fields, rock overhangs, or large cracks in rocks; these provide additional protection from predators and allow the kits to move around (Magoun and Copeland 1998). Denning females typically enter dens for the birthing season, which occurs in late winter (February to mid-March) and emerge in early spring (May) (Magoun and Copeland 1998). Females may re-occupy den sites or denning habitats for several consecutive years (Magoun 1985, Lee and Niptantiak 1996). Denning females are particularly sensitive to

disturbance (Magoun and Copeland 1998) and any impacts can lead to den relocation or litter abandonment (COSEWIC 2003).

4.2.2.2 Marine Mammals

There are an estimated 13 marine mammalian species that are known or expected to occur within the marine waters of Nunavut (CESCC 2011). However, only polar bear (*Ursus maritimus*) are expected to occur within or near the Site due to its utilization of both marine and terrestrial habitats.

4.2.2.2.1 Polar Bear

Polar bear is currently ranked as Sensitive in Nunavut (CESCC 2011), is listed as Special Concern by COSEWIC, and is listed as Special Concern under the SARA on Schedule 1 (SARPR 2013). Polar bears occur throughout coastal Nunavut, including all marine areas and Arctic islands. The Project area is situated within the range of the Gulf of Boothia sub-population and polar bears have been known to frequent the vicinity of the Site. In 2000, this sub-population was estimated at 1,528 bears (Taylor et al. 2009), and is considered to be increasing due to relatively high recruitment and survival rates (COSEWIC 2008). The NWHS reported an average of 13 bears harvested per year by Kugaaruk residents, ranging from eight bears to 15 bears over the study period (1996 to 2001) (Priest and Usher 2004).

In the Arctic, polar bear habitat is closely linked with that of the ringed seal (*Pusa hispida*), their main prey species. Typical habitat includes consolidated pack ice, areas adjacent to pressure ridges, areas between first-year and multi-year ice floes, and at the floe edge between marginal and land-fast sea ice (Stirling et al. 1982, Kingsley et al. 1985, Stirling and Derocher 1993, Stirling et al. 1993, Ferguson et al. 2000). The distribution of bears in most areas changes with the seasonal cover of sea-ice; throughout the summer, polar bears tend to concentrate long the edge of persistent pack ice, unless they are pushed onto land due to lack of sea ice (COSEWIC 2008). If forced onto land, their habitat utilization is often dependent upon age group and sex; for example, males tend to displace females and cubs further inland, away from the coast (Stirling et al. 2004). While on land, some bears may rely entirely on their fat reserves and not consume any food over the summer period (Derocher and Stirling 1990). However, some may eat and bears have been observed to feed on berries, depredate waterfowl nests, and even take down caribou; whale carcasses can also attract large numbers of bears (COSEWIC 2008). In autumn, as the sea ice begins to form again, bears that were forced on land re-distribute themselves throughout their sub-population range (COSEWIC 2008). One major concern for polar bear management and human safety is the attraction of bears to garbage while they are on land (Lunn and Stirling 1985); therefore, acceptable waste management practices need to be implemented.

4.2.3 Avifauna

Of the over 250 avian species which are known or expected to occur in Nunavut, an estimated 50 species are known or expected to occur within or near the Site (see Table C-3 in Appendix C). Six of the 50 species are identified as resident, spending the entire year in the North; these include hoary redpoll (*Acanthis hornemanni*), snowy owl (*Bubo scandiacus*), common raven (*Corvus corax*), gyrfalcon (*Falco rusticolus*), willow ptarmigan (*Lagopus lagopus*) and rock ptarmigan (*Lagopus muta*). The remaining 44 species are migratory and may breed in or near the Site, depending on habitat requirements.

Of the 50 avian species which may be found within or near the Site, 20 are listed as Sensitive in Nunavut while one is listed as At Risk (red knot [*Calidris canutus rufa*]) (CESCC 2011) (see Table C-3 in Appendix C). Red knot *rufa* subspecies is designated as Endangered by COSEWIC, and is listed under the Federal SARA on Schedule 1, and is protected by the Federal *Migratory Birds Convention Act* (SARPR 2013). Peregrine falcon *anatum/tundrius* (*Falco peregrinus anatum/tundrius*) is listed as Special Concern by COSEWIC and is also on Schedule 1 of the SARA (SARPR 2013), though it is considered Secure in the territory (CESCC 2011). These two species are discussed in further detail below.

During the July 2013 field survey, a nesting raven with one fledgling was observed within the garage structure in Area 1 of the Site. Other species observed included lapland longspur (*Calcarius lapponicus*) and glaucous gull (*Larus hyperboreus*), while goose scat and tracks were also noted throughout areas associated with water (i.e., marshy areas near shore of Keith Bay, along the shore of the Freshwater Lake, within the wetland south of the Main Station Landfill in Area 1).

4.2.3.1 Red Knot

Red knot *rufa* subspecies was designated as Endangered by COSEWIC in 2007 following a new status assessment (COSEWIC 2007a). Six subspecies are currently recognized worldwide, all of which form distinct biogeographical populations based on their distribution and the timing of their annual cycle (COSEWIC 2007a). The current population size of the red knot *rufa* is estimated at 13,500 to 15,000 based on counts from their wintering grounds in 2005; however, these surveys have indicated that the population has decreased by approximately 70% from estimates in the early 1980s (COSEWIC 2007a). The main threat to the *rufa* population is a declining supply of Atlantic horseshoe crab (*Limulus polyphemus*) eggs in Delaware Bay during their northward migration; the *rufa* subspecies are particularly at risk as they have the longest migration of the six subspecies. In the red knot's Arctic breeding grounds, climate change was cited as the main threat, including changes in habitat, particularly long-term reductions in High Arctic habitat, and uncoupling of phenology of food resources and breeding events (Meltofte et al. 2007).

The *rufa* subspecies nest throughout the central Canadian Arctic and migrate to the southern tip of South America for the winter (Morrison 1984). The northward migration to the Arctic usually

begins in late April or early May with individuals arriving at their nesting sites by early June. Delaware Bay, situated between Delaware and New Jersey in the United States, is a major stopover location for the *rufa* subspecies during their northward migration. The southward migration begins in late July and the birds typically arrive on their wintering grounds in October. Niles et al. (2005) identified several areas along the east coast of the Simpson Peninusla as potential red knot nesting habitat, which may include the Site; the nearest known nesting location of red knot *rufa* is situated on the north shore of the Simpson Peninsula, approximately 100 km northwest of the Site.

In its central Arctic nesting grounds, red knot typically utilizes barren habitats, often with less than 5% vegetation. Nests are usually found in dry, south-facing locations, including windswept ridges, slopes or plateaus; after hatching, red knots may be found near wetlands or lake edges (COSEWIC 2007a). An examination of potential breeding habitat characteristics of the *rufa* subspecies on Southampton Island indicated that they were typically found at elevations less than 150 masl, less than 50 m from the coast, and in areas with less than 5% vegetation (COSEWIC 2007a).

4.2.3.2 Peregrine Falcon

Originally listed as two separate subspecies, *anatum* and *tundrius,* peregrine falcon are now considered a single species (*anatum/tundrius*) based on recent genetic evidence (ENR 2012). Peregrine falcon had undergone a dramatic decline in population between the 1950s and 1970s, primarily resulting from increased egg mortality due to the eggshell-thinning effect of pesticides (e.g., DDT). Since the mid-1970s however, the number of nesting pairs has increased and COSEWIC down-listed peregrine falcon from Threatened to Special Concern in early 2007 (COSEWIC 2007b).

COSEWIC (2007b) identifies the potential breeding range of peregrine falcon throughout Nunavut, with over 400 nest sites reported in the territory as a whole. Based on available range maps, breeding does occur on the Simpson Peninsula (White et al. 2002) however little information could be found regarding nest sites or breeding pairs on the on the peninsula, nor on specific habitat use and requirements on the peninsula. Peregrine falcon are known to occur near the Igulik area (GN 2008), approximately 280 km northeast of the Site, and near Rankin Inlet, approximately 630 km south of the Site. In the Rankin Inlet area, peregrine falcon been reported to nest in south- or southwest-facing vertical coastal cliffs (Court et al. 1988a), or in rocky bluffs in inland tundra areas (Court et al. 1988b). In 2000, a total of 22 pairs were reported from the Rankin Inlet area and 18 from Tuktut Nogait National Park in the northeastern corner of the Northwest Territories (Rowell et al. 2003). Small mammals, including lemmings and juvenile Arctic ground squirrels (*Urocitellus parryii*), make up an important portion of a peregrine falcon's diet though they have also been shown to consume ptarmigans, shorebirds and small songbirds in tundra areas (COSEWIC 2007b).

4.2.4 Fisheries

Keith Bay lies within the Lancaster Sound Region marine ecozone, of which 47 species of marine species have been reported (Coad and Reist 2004). Diversity of freshwater species in the region are limited to a handful, mainly comprised of Lake Trout (*Salvelinus namaycush*), Arctic Char (*S. alpinus*), Whitefish species (*Coregonus* spp.), and Ninespine Stickleback (*Pungitius pungitius*) (Scott and Crossman 1998). Access to overwintering habitat is critical for Arctic species and, in northern freshwater environments, this can typically be limited in capacity as streams and shallow ponds may freeze to bottom every winter (Craig 1989). As Project activities are not occurring within or immediately adjacent to the marine environment, only freshwater fish are considered further.

Limited fisheries inventory information is available for the Project area. Anadromous Arctic Char, Lake Trout and marine sculpin species were reported as harvested by residents of Kugaaruk in the NWHS (Priest and Usher 2004); however, the area of capture for these species is unknown. Residents of Kugaaruk have reported using the Site in the past; however, it is not known what species may have been harvested near or within the Project area. There have been several test fisheries over the last couple of decades of anadromous Arctic Char in the Keith Bay area; quotas were approximately 4,500 kg per year (Kristofferson et al. 1982, Carder 1993).

As the winter access trail route has not been selected, fish utilization in this area cannot be assessed. Fish capture efforts were not completed during the July 2013 field survey due to a delay in receiving the capture permit, but based on observations of waterbodies within the Project footprint, fish utilization of freshwater habitat at the Site is expected to be low. All on-site waterbodies were observed to be less than 1 m deep in July 2013; this includes the Freshwater Lake, the largest waterbody on the Site. Many of the surface water ponds were small (e.g., less than 50 m^2) and appeared to be fed by intermittent overland or subsurface drainage with no defined inlets or outlets. These ponds are expected to further dry up throughout the summer period, some likely completely dry, and are not expected to support populations of freshwater fish.

Freshwater fairy shrimp (*Anostraca*) were observed in several surface ponds across the Site and in the Freshwater Lake. Members of this phyllopod order are typically restricted to temporary freshwater habitats, including vernal ponds that dry up in the summer (Clifford 1991). The reason for this habitat restriction is likely two-fold. First, eggs of phyllopods appear to require a period of desiccation or other environmental shock to stimulate their development (Clifford 1991). Second, phyllopods are large, slow-moving crustaceans and would be subject to predation by fish; therefore, if phyllodpods are found in a freshwater environment, it is likely that there is not a permanent fish population (Clifford 1991).

4.3 SOCIOECONOMIC ENVIRONMENT

4.3.1 Local Economy and Traditional Land Use

The departure community for the winter access trail has not yet been selected and cannot be included in this review. However, Kugaaruk, NU, is the closest community to the Site. From the 2011 Census, the population in Kugaark was 771, which increased from 688 in 2006, a 12% increase (StatsCan 2012). Just over half of the population of the community is over 15 years of age (58.6%) and the median age in the community is 18.4 years (StatsCan 2012). Inuktitut is the primary language spoken in Kugaaruk, followed by English, though most residents do speak both languages. The employment rate in 2011 was estimated at 35.6% and occupations within the sales and service sector, and the trades, transport and equipment operator sector appear to be dominant (StatsCan 2013). The primary industry in the community was reported as public administration, followed by retail trade, construction, and educational services (StatsCan 2013).

The economy of Kugaaruk is largely traditional and many residents engage in traditional hunting and fishing. The community is known as a place for bowhead whales (*Balaena mysticetus*) and tourism opportunities include whale watching as well as sea kayaking, camping, hiking, fishing, wildlife viewing, dog sledding, snowmobiling, and riding ATVs (Nunavut Tourism 2013). There are no national or territorial parks near Kugaaruk or the Site.

According to the NWHS, species typically harvested by residents of Kugaaruk include caribou, seals, Arctic fox, wolves, polar bears, musk-ox, Arctic char, lake trout and sculpin; harvesting of birds (e.g., goose, ducks, loons, ptmarigans) is also reported, though to a lesser extent (Priest and Usher 2004). Eggs are also fairly important though the values reported in the NWHS are thought to be lower than the actual harvest as hunters did not know they were to report on eggs. Eggs are harvested every year and are typically seagull eggs, but some goose and eider duck eggs are also harvested (Priest and User 2004). The NWHS reports an average of 19 goose eggs harvested annually with a range from 0 to 49 eggs over the NWHS period; only five seagull eggs were reported during the harvest study (Priest and Usher 2004).

Residents of Kugaaruk have reported using the Site in the past, however due to distance from the community (75 km), it is used infrequently. Signs of recent land use (i.e., past 50 years) were identified at the Site during the archaeological survey; this included one site on a beach ridge on the southwest shore of Cape Barclay, near the marine waters of Committee Bay. Land use features included wood debris, two tent rings, and a hearth, as well as a small burnt area, a child's rubber boot, and a wooden box (Golder 2013). These land use features represent evidence of recent human use, but are not exclusively Inuit; as a result, the sites are not assigned Borden numbers and they are not protected under law (Golder 2013).

4.3.2 Archaeological and Heritage Resources

An archaeological impact assessment (AIA) was conducted during the July 2013 Phase III ESA field program at the Site. All areas of potential disturbance were surveyed for heritage resources. No heritage sites were identified within these areas and no previously recorded archaeological sites were identified in the vicinity of the Site (Golder 2013). The CAM-E site is located in two distinct areas: a lower area (Area 2) and a higher area (Area 1) that are connected by a road. The Project area has little vegetation and terrain predominately consisted of gravel, raised beaches, and large, gently sloping to flat gravel raised inter tidal areas (Golder 2013). As expected, a considerable amount of the area has been previously disturbed by activities at the former DEW Line site.

Eight previously unrecorded Neoeskimo archaeological sites were identified during the AIA however, outside of identified Project work areas. These sites were situated along the upper beach area, near the west shore of Cape Barclay and the marine waters of Keith Bay (Golder 2013). These sites were typically comprised of several features each, including caches, stone markers, tent rings, meat processing areas, and graves (possible and confirmed) (Golder 2013). Proposed Project activities will likely not impact these sites, however if work areas extend near these sites, a buffer of 30 m will be established for heavy equipment. If clean-up work is necessary within the 30 m buffer (i.e., removal of barrels and other debris), this will be conducted by hand with light equipment (i.e., ATVs and trailers) and avoidance of the features, as recommended by Golder (2013).

5.0 Identification of Impacts and Proposed Mitigation

5.1 OVERVIEW

This section describes the potential effects of Project activities on Valued Components (VCs), identifies mitigation measures to reduce, control or eliminate the effects, and presents the residual effects, or those remaining following application of mitigation measures. The assessment of potential impacts has been completed using the standard methodological framework developed by Stantec to meet the requirements of the *Nunavut Land Claims Act* and other environmental legislation, as well as the NIRB's *Proponent's Guide* (Draft 2; NIRB 2013a).

Potential environmental effects were identified through community consultation, a review of previous studies conducted at the Site, and a review of literature. The Project activities will be confined to the Site, and the temporary winter access trail alignment. The remediation activities are localized and will be completed during the summer in previously disturbed areas, or areas adjacent to these. Hauling of materials into and out of the Site will take place during the winter via the preferred winter access trail alignment. It is anticipated that these factors, along with the implementation of proposed mitigation measures, will reduce residual effects on the VCs and that Project activities will not contribute measurably to cumulative effects in the area.

5.2 BOUNDARIES

Spatial boundaries consider the geographic extent over which the Project activities and their effects are likely to occur. The spatial scope of the Project was evaluated at three scales: the Project Footprint, the Project Area, and the Regional Area. The Project Footprint includes the areas of physical disturbance associated with Project activities at the Site, as well as the alignment of the temporary winter access trail. The Project Area includes a 1 km buffer around the Project Footprint while the Regional Area includes a 5 km buffer around the Project Footprint. As the preferred winter trail alignment has not yet been selected, an assessment of potential effects in the spatial boundary of this component cannot be completed. An assessment of general winter access trail activities has been completed; however, this document will be updated to reflect new information following selection of the preferred alignment during the detailed design phase.

The temporal boundaries are defined based on the timing and duration of the Project environmental effects in relation to each VC. The temporal boundaries of the Project include the mobilization and construction activities, remediation/operations, demobilization, closure, and post-closure activities, including decommissioning and abandonment. Mobilization is tentatively planned to occur during Winter 2015/2016, while remediation at the Site will occur over three summer periods (June to September 2016, 2017 and 2018). Demobilization will occur during Winter 2018/2019, with AMSRP Phase I (short-term) monitoring until Summer 2023. As it will not be known whether AMSRP Phase II (long-term) monitoring is required until the end of the Phase I

monitoring in 2023, and additional permitting activities may be required at that time, Phase II monitoring has not been assessed in the present document.

5.3 VALUED COMPONENTS

A VC is defined as an environmental, social, economic or cultural component that is considered important by the proponent, local communities, technical specialists and/or government. The assessment of Project effects on VCs provides an indication of Project effects on broader environmental and social conditions. Similarly, mitigation measures for Project effects on VCs provide protection for the broader environmental and social systems that they represent. The VCs in relation to the Project were selected based on:

- Sensitivity to Project effects
- Importance to local communities and resource users
- Territorial, national or international importance (include status under the SARA)
- Value as an indicator of effects on related resources and broader systems.

Candidate VCs were identified for the Project based on the environmental overview and community consultation, with the final VCs selected based on their potential to be affected by Project activities. In this study, candidate VCs were excluded if they did not overlap temporally or spatially with the Project, or if there was no, or negligible, potential for the Project to affect them.

Selected VCs and the rationale for selection are provided in Table 5-1, while their potential Project interactions are described in Table 5-2. Potential effects and selected mitigation measures for each VC are discussed in Section 5.5 via Table 5-3.

Table 5-1: Valued Components in the Project Area and Rationale for Selection

Valued Component	Rationale for Selection
Physical	
Terrain Stability and Permafrost	• Has value for and affects other ecosystem elements (e.g., soil quality, groundwater, surface water, vegetation, and infrastructure) • May be affected by Project activities
Soil Quality	• Soils are components of vegetation and animal habitat • May be affected by Project activities
Air Quality	• Project activities will result in emissions that could affect ambient air quality in the surrounding area
Water Quantity	• Project activities will require water withdrawal and usage
Water Quality	• Project activities may produce water of degraded quality • Project activities may cause erosion and sedimentation, and/or introduction of a deleterious substance

Table 5-1: Valued Components in the Project Area and Rationale for Selection

Valued Component	Rationale for Selection
Biological	
Vegetation Communities	• Project activities may result in localized disturbance and loss of vegetation
Mammals, including: • Barren-ground caribou • Grizzly bear • Wolverine • Polar bear	• Potential sensory disturbance during all Project phases • Potential for mortality risk for wildlife species interacting with camp operations • Potential mortality risk from interactions with vehicles and equipment, as well as collisions
Avifauna, including: • Red Knot • Peregrine Falcon	• Potential habitat loss from construction of Project facilities and excavations • Potential sensory disturbance of nesting or hunting areas during remediation activities • Potential mortality risk from vehicle and equipment collisions
Fish and Fish Habitat	• Potential for increased erosion, sedimentation, and the introduction of a deleterious or toxic substance resulting in reduced fish habitat quality or fish health • Potential for loss of habitat from water withdrawal and improper installation of ice bridges and/or snow fills • Potential for reduced dissolved oxygen levels in waterbodies where water withdrawal occurs resulting in reduced fish habitat quality or fish health
Socioeconomic	
Local Economy	• Potential employment during all Project phases • Potential business opportunities during construction and operation
Traditional Land Use	• Project will overlap with traditional land use areas • Noise and vehicle movements from Project activities may temporarily change distribution of harvested species through avoidance and may affect personal enjoyment of the land
Human Health	• Potential impact to workers' health during remediation activities • Positive impact to existing human health conditions in the Project Area
Archaeological and Heritage Resources	• Potential impact to known and unknown heritage resources of cultural, archaeological, and/or historical significance

5.4 PROJECT INTERACTIONS WITH VALUED COMPONENTS

A summary of potential Project interactions with VCs is presented in Table 5-2. This table identifies which Project component may affect the VC, and sets the context for further discussion regarding the potential impacts and mitigation measures used to minimize these effects (Section 5.5).

Table 5-2: Project Activity – Valued Component Potential Interaction Matrix

Project Activity	VC												
	Terrain Stability and Permafrost	Soil Quality	Air Quality	Water Quantity	Water Quality	Vegetation	Mammals	Avifauna	Fish and Fish Habitat	Local Economy	Traditional Land Use	Human Health	Archaeological and Heritage Resources
Mobilization													
Construction of the temporary winter access trail	M		M	M		M	M	M	M	P	M		M
Mobilization of equipment via the winter access trail	M		M	M		M	M	M	M	P	M		M
Mobilization of personnel and equipment via aircraft (summer)							M	M		P	M		
Fuel transfer and storage		M			M	M	M		M			M	
Construction													
Upgrading of existing on-site roads and airstrip			M		M		M			P			
Culvert installation	M			M					M	P			
Construction of the Staging Area	M		M			M	M	M		P			M
Construction of the Tier I and Tier II Landfills	M		M			M	M	M		P			M
Fuel transfer and storage		M			M	M	M		M			M	

Table 5-2: Project Activity – Valued Component Potential Interaction Matrix

Project Activity	VC												
	Terrain Stability and Permafrost	Soil Quality	Air Quality	Water Quantity	Water Quality	Vegetation	Mammals	Avifauna	Fish and Fish Habitat	Local Economy	Traditional Land Use	Human Health	Archaeological and Heritage Resources
Remediation/Operations													
Mobilization of personnel and equipment via aircraft							M	M		P	M		
Camp operation	M		M			M	M	M		P	M		M
Sewage and greywater treatment					M				M			M	
Water withdrawal				M					M				
Development of borrow sources	M	M	M		M	M	M	M	M	P	M		M
Remedial excavations	M	P	M		M	M	M	M		P	M	M/P	
Operation and closure of the Tier I and Tier II Landfills		P/M			M		M	M	M	P	M		
Construction and operation of the Treatment Cell		P/M			M	M	M	M	M	P	M	M/P	M
Waste incineration			M				M			P	M	M	
Drum collection, washing and crushing		M			M		M		M	P	M		M
Collection and packaging of hazardous waste		P								P		M/P	

Table 5-2: Project Activity – Valued Component Potential Interaction Matrix

Project Activity	VC												
	Terrain Stability and Permafrost	Soil Quality	Air Quality	Water Quantity	Water Quality	Vegetation	Mammals	Avifauna	Fish and Fish Habitat	Local Economy	Traditional Land Use	Human Health	Archaeological and Heritage Resources
Contaminated water treatment and discharge		M			M				M	P		M/P	
Fuel transfer and storage		M			M	M	M		M			M	
Closure													
Culvert removal	M			M	M				M				
Contouring of disturbed areas to match natural grades	M					M				P			M
Demobilization of personnel and equipment via aircraft							M	M			M		
Construction of the temporary winter access trail	M	M	M	M		M	M	M	M	P	M		M
Demobilization of equipment and hazardous waste from the Site via the winter access trail	M	M	M	M		M	M	M	M	P	M		M
Fuel transfer and storage		M			M	M	M		M			M	

Table 5-2: Project Activity – Valued Component Potential Interaction Matrix

Project Activity	VC												
	Terrain Stability and Permafrost	Soil Quality	Air Quality	Water Quantity	Water Quality	Vegetation	Mammals	Avifauna	Fish and Fish Habitat	Local Economy	Traditional Land Use	Human Health	Archaeological and Heritage Resources
Post-Closure													
Mobilization/demobilization of personnel and equipment via aircraft							M	M			M		
Phase I (short-term) monitoring													
Aeration of the Biopiles			M									M/P	
Contaminated water treatment and discharge		M			M				M	P		M	
Closure of the Treatment Cell and grading of Biopiles (once remediated) to match natural contours	M					M				P			M

NOTES:

1. As per the NIRB's PSIR tables, the above lettering denotes the following:
   - P = positive effect
   - N = negative and non-mitigable
   - M = negative and mitigable
   - U = unknown
   - If cell is left blank, no impact is expected

5.5 IMPACT ASSESSMENT AND MITIGATION

The following section describes the potential effects on VCs and the proposed mitigation measures to reduce, control, or eliminate the effects. The mitigation measures provided in Table 5-3 will be implemented for the protection of the VCs identified in Table 5-1.

Table 5-3: Potential Effects and Mitigations for Valued Components

Potential Effects on Valued Components	Mitigation
Terrain Stability and Permafrost	
Disturbance of natural surficial materials, increasing active layer depth and causing melting of ground ice within the near surface materials, further resulting in ponding of water, erosion, thaw settlement	• Steep slopes will be avoided, where possible. Areas of sensitive terrain (e.g., polygons, ice-rich ground, wetlands) will be avoided, where practical. • Frozen granular materials will not be used to reduce the potential for excessive settlement, slope failures and surface water ponding. • Construction and operation of the winter access trail will only occur when the ground is frozen (e.g., December to April). • Build-up and pre-packing of snow on winter access trail to a minimum of 0.10 m thickness to protect the underlying ground and vegetation. • Restriction of all Project activities to designated, previously-disturbed work areas and existing roads, or areas that have been built-up with gravel pad(s), where practical. • Where off-road travel is required for remedial work, activities will be completed with low ground pressure vehicles (e.g., rubber-tired ATVs, Argos) and sensitive land areas and features will be avoided. • End-dump method of construction for Project infrastructure to reduce the need for heavy equipment to travel directly on the terrain. • Minimum of 0.6 m of compacted fill on constructed road beds and gravel pads before allowing equipment to travel on them. • Sloping of borrow source floors to create positive drainage away from the face and floor. • Installation of drainage ditches or channels, if necessary, to promote positive drainage in borrow source excavations. • Progressive reclamation of depleted borrow sources, including applicable recommendations in AANDC's *Northern Land Use Guidelines: Pits and Quarries* (INAC 2009b).
Admixing and compaction of surface soil, and overburden may result in reduced quality soils, and hence issues with natural site re-vegetation	• Excavations will be backfilled with clean granular materials. Where surface soil is present and is not impacted by a contaminant, surface soils will be salvaged and returned to the surface of the affected area.

Table 5-3: Potential Effects and Mitigations for Valued Components

Potential Effects on Valued Components	Mitigation
Soil voids formation after backfilling of the excavations resulting in water and ice becoming trapped into the soils, affecting the local thermal regime and resulting in subsidence	• Additional fill will be used where excavations are required in ice- or water-rich materials.
Soil Quality	
Off-site migration of contaminants from the Tier I and Tier II Landfills, or Treatment Cell, causing further degradation of soil quality in the vicinity of these structures	• Engineered facilities will be designed according to best practices, including standards outlined in the AMSRP, to reduce potential for off-site migration of contaminants. • A qualified contractor will be hired to oversee that construction quality is maintained through the construction of the engineered facilities. • Construction monitoring and inspections will be completed by an on-site Project Engineer to oversee adherence to design specifications, and monitor structure integrity through all Project phases. • Phase I Monitoring (short-term; five years, post-remediation) will occur to examine soil quality, groundwater quality, thermal regime, and integrity of the engineered structures.
Release of fuel or other hazardous materials during remedial work resulting in degraded soil quality	• The Contractor will comply with fuel storage and handling guidelines and best practices, including personnel training, storage setbacks, secondary containment, and regular storage inspection. • Restriction of all fueling, servicing and staging of machines to designated areas. • Regular inspections of all machinery to reduce the risk of a spill by identifying and correcting potential equipment failures. • Emergency spill kits will be kept with all working machinery during all Project phases. • Development and implementation of Project-specific Spill Contingency Plan (SCP) (see Appendix D for draft SCP).
Air Quality	
Release of air contaminants during waste incineration	• Select equipment that complies with Nunavut (i.e., GN 2011d) and Canadian emissions regulations. • Follow best practices to reduce vehicle/equipment exhaust emissions, including ensuring equipment is maintained regularly, properly muffled, and turned off when not in use unless required for effective operation. • Follow best practices to reduce incinerator emissions, including Environment Canada's *Technical Guidance on Batch Waste Incineration* (EC 2010) and the GN's *Environmental Guideline for Burning and Incineration of Solid Waste* (GN 2012b).

Table 5-3: Potential Effects and Mitigations for Valued Components

Potential Effects on Valued Components	Mitigation
Release of fugitive dust during borrow source development, and use of access roads and airstrip	• Follow best practices for development and operation of borrow sources to reduce releases of fugitive dust, including INAC (2009c). • Implement dust suppression techniques in the borrow sources and along roadways, including following best practices for dust suppression such as the GN's *Environmental Guideline for Dust Suppression* (GN 2002). • Development and implementation of dust management procedures, as part of a Project-specific Environmental Protection Plan (EPP) (see Appendix F for draft EPP).
Water Quantity	
Reduction of surface water quantities	• Comply with DFO Protocol for Winter Water Withdrawal from Ice-covered Waterbodies (DFO 2010) for build-up of the temporary winter access trail. • Comply with AMSRP protocol for withdrawal of water for camp and remedial activities (i.e., not to exceed 10% of lake volume). • Comply with Water License conditions.
Flooding of watercourses along winter access trail during spring break-up and/or delayed snowmelt due to increased ice thickness and snow compaction	• Comply with mitigation measures in the former DFO Operational Statement for Ice Bridges and Snow Fills (see Appendix G).
Alteration of stream flow resulting from culvert installations or a change in natural surface drainage patterns	• Design of culverts using standard practices will provide adequate flow given the temporary nature of their placement, and the expected ephemeral nature of the drainage channels. • Minimize Project footprint and number of water crossings. • Ensure natural drainage is not obstructed, or that flooding or channel diversion does not occur. • Establishment of a minimum of 30 m buffer between any Project work site and the high water mark of a waterbody, except where in-water work (i.e., removal of drums from the Freshwater Lake) is required.
Water Quality	
Off-site migration of contaminants from the Tier I and Tier II Landfills, or Treatment Cell, causing degradation of water quality in the vicinity of these structures	• Engineered facilities will be designed and closed according to best practices, including standards outlined in the AMSRP, to reduce potential for off-site migration of contaminants. • A qualified contractor will be hired to oversee that construction quality is maintained through the construction of the engineered facilities. • Construction monitoring and inspections will be completed by an on-site Project Engineer to oversee adherence to design specifications, and monitor structure integrity through all Project phases. • Annual closure of the utilized section(s) of the Tier I and Tier II Landfills to reduce wildlife attractants, off-site migration of contaminants, and wind-blown debris.

Table 5-3: Potential Effects and Mitigations for Valued Components

Potential Effects on Valued Components	Mitigation
	• Phase I Monitoring (short-term; five years, post-remediation) will occur to examine soil quality, groundwater quality, thermal regime, and integrity of the engineered structures.
Release of fuel or other deleterious substances (e.g., sediments) during all Project phases, resulting in degraded water quality	• Implement sediment and erosion prevention and control measures, where necessary. • Follow best practices for development and operation of borrow sources to reduce potential for erosion, including INAC (2009b). • Implement spill prevention and response protocols. • Minimize disturbance near waterbodies and riparian areas. • Complete any required in-water work by hand, and with clean equipment. • Maintain clean camp and work sites. • Conduct routine equipment and infrastructure inspections. • Comply with appropriate regulations, guidelines and Project approvals, including treatment of contaminated water to approved discharge limits. • Discharge of treated water at a location a minimum of 31 m from the high water mark of any waterbody, and where direct flow into a waterbody is not possible. • Use of water for dust suppression, as opposed to dust suppression products. • Comply with appropriate guidelines for greywater and sewage disposal, including AANDC's *Northern Land Use Guidelines: Camps and Support* Facilities (INAC 2011). • Comply with fuel storage and handling guidelines and best practices, including personnel training, storage setbacks, secondary containment, and regular storage inspection. • Restriction of all fueling, servicing and staging of machines to designated areas. • Regular inspections of all machinery to reduce the risk of a spill by identifying and correcting potential equipment failures. • Emergency spill kits will be kept with all working machinery during all Project phases. • Development and implementation of dust management procedures, as part of a Project-specific EPP (see Appendix F for draft EPP).
Alteration of existing water chemistry parameters	• Comply with Project approvals and discharge release limits.

Table 5-3: Potential Effects and Mitigations for Valued Components

Potential Effects on Valued Components	Mitigation
Vegetation	
Loss of vegetation as a result of construction of Project facilities, development of borrow sources and remedial excavations Damage to vegetation from ground disturbance, from accidental spills or excessive dust	• Minimize Project footprint in undisturbed, natural areas. • Restrict equipment operation to previously disturbed and built-up areas. • Where off-road travel is required for remedial work, activities will be completed with low ground pressure vehicles (e.g., rubber-tired ATVs, Argos) and sensitive land areas and features will be avoided. • Where vegetation exists and surface layer disturbance is necessary (e.g., borrow source development, remedial excavations, spill clean-up), the area will be backfilled with clean granular material to prevent possible melting of permafrost. Where surface soils are present and are not impacted by a contaminant, surface soils will be salvaged and returned to the surface of the affected area to and facilitate natural re-vegetation. • Construction and operation of the winter access trail will only occur when the ground is frozen (e.g., December to April). • Build-up and pre-packing of snow on winter access trail to a minimum of 0.10 m thickness to protect the underlying ground and vegetation. • Equipment used for snow clearing will be equipped with mushroom shoes to prevent contact with root mat. • Use of water for dust suppression and implementation of a Dust Management Plan (Appendix X).
Mammals	
Sensory disturbance and mortality risk (general measures)	• Wildlife monitors will be present throughout all Project phases. • Development of a site-specific Environmental Protection Plan (EPP) to outline all required mitigation measures and procedures. • All on-site personnel will receive an orientation, which will include Project-specific wildlife protocols. • Workers will not feed, harass or approach wildlife. • Hunting or fishing by Project personnel will not be allowed; only wildlife monitors will be allowed to carry firearms. • All sightings of caribou, wolverine, grizzly bear or polar bear will be reported to the wildlife monitors and their location recorded; the information will be submitted to the GN Department of Environment (GN-DOE) upon completion of the project. • Minimize Project footprint. • All domestic wastes, food, and petroleum-based chemicals will be kept in secure locations, in appropriate wildlife-proof containers. • In the Project Area, Project equipment and vehicles will not travel at speeds greater than 30 km/h.

Table 5-3: Potential Effects and Mitigations for Valued Components

Potential Effects on Valued Components	Mitigation
Sensory disturbance from general Project activities – barren-ground caribou	• Project activities will be suspended when caribou are within 500 m of operations. • Maintenance of minimum flight altitudes (650 m) throughout all Project phases (AANDC 2011).
Sensory disturbance from general Project activities – grizzly bear, wolverine, polar bear	• Conduct den surveys prior to winter access trail construction and operation. • If active bear or wolverine dens are encountered within the Project footprint during the winter access trail construction and operation, the GN-DOE will be contacted immediately to determine appropriate mitigation. Activities may be temporarily suspended pending consultation with GN-DOE. • During September 30 to March 30, maintenance of a minimum 800 m setback for general industrial activities from any known active bear or wolverine dens (AANDC 2011). • Workers will not work off-site, unless there is a specific requirement (i.e., waste recovery); workers required to work off-site will be accompanied by a wildlife monitor. • Maintenance of minimum flight altitudes (650 m) throughout all Project phases (AANDC 2011).
Increased mortality risk – barren-ground caribou	• All human/caribou conflicts and incidents will be reported to the Wildlife Monitor and the GN-DOE Biologist will be contacted immediately.
Increased mortality risk – grizzly bear, wolverine, polar bear	• All site personnel will receive appropriate bear awareness training. • Camps and associated infrastructure will be designed to incorporate wildlife safety, including installing lighting, implementing strict waste management procedures, cleaning and maintaining the kitchen and dining area. • Waste management practices that reduce attractants to wildlife, including the following measures: – Reduce and properly dispose of attractants to wildlife, such as garbage, food wastes and other edible and aromatic substances in appropriate wildlife-proof containers, until such as that it is incinerated. – Store all food and garbage in either airtight, sealed containers, wildlife-proof containers, or in an enclosed wildlife-proof area. – Store all on-site grease, oils and fuels in wildlife-proof containers, or in an enclosed wildlife-proof area. • Work crews will inspect areas surrounding each camp to collect and properly dispose of any waste material that has blown off site. • The wildlife monitor and designated, trained staff will have access to bear deterrent materials including bear spray, cracker shells, and firearms with plastic slugs and bullets. The use of any wildlife deterrent will be reported to the GN-DOE.

Table 5-3: Potential Effects and Mitigations for Valued Components

Potential Effects on Valued Components	Mitigation
Avifauna	
Sensory disturbance – Avifauna (general)	• Complete pre-construction nest surveys in areas of disturbance during the breeding season. • Maintenance of minimum setback of 250 m from any active nest sites during nesting (approximately mid-May to end of July), as well as from staging areas or avifauna concentrations. • If identified, nests or eggs of migratory birds will not be disturbed or destroyed. • Hunting or egg collection by Project personnel will not be allowed; only wildlife monitors will be allowed to carry firearms.
Sensory disturbance – Peregrine Falcon	• Avoid Project activities within 1.5 km of active raptor nests during the breeding season (March 1 to September 1) (AANDC 2011). • Avoid Project activities within 500 m of active raptor nests outside of the breeding season (September 2 to February 28) (AANDC 2011). • Minimum flight altitudes (650 m) will be maintained throughout the Project.
Sensory disturbance – Red Knot	• Avoid Project activities within 250 m of active shorebird nests during the nesting season (approximately mid-May to end of July). • Minimum flight altitudes (650 m) will be maintained throughout the Project.
Direct habitat loss – Avifauna (general)	• Where possible, avoid Project activities along the edges of wetlands or in riparian areas. • Minimize Project footprint in undisturbed, natural areas. • Restrict equipment operation to previously disturbed and built-up areas. • Where off-road travel is required for remedial work, activities will be completed with low ground pressure vehicles (e.g., rubber-tired ATVs, Argos) and sensitive land areas and features will be avoided.

Table 5-3: Potential Effects and Mitigations for Valued Components

Potential Effects on Valued Components	Mitigation
Increased risk of indirect mortality – Avifauna (general)	• Camps and associated infrastructure will be designed to incorporate avifauna safety, including installing lighting, implementing strict waste management procedures, cleaning and maintaining the kitchen and dining area. • Waste management practices that reduce attractants to wildlife, including the following measures: – Reduce and properly dispose of attractants to wildlife, such as garbage, food wastes and other edible and aromatic substances in appropriate wildlife-proof containers, until such as that it is incinerated. – Store all food and garbage in either airtight, sealed containers, wildlife-proof containers, or in an enclosed wildlife-proof area. – Store all on-site grease, oils and fuels in wildlife-proof containers, or in an enclosed wildlife-proof area. • Work crews will inspect areas surrounding each camp to collect and properly dispose of any waste material that has blown off site.
Increased risk of direct mortality – Avifauna (general)	• Survey of Project work areas to check for presence of nests prior to disturbance. If nests are encountered, these areas will be avoided until nesting is complete (end of July). • Where it is not possible to delay Project activities in areas where nests are found, the local Wildlife Officer and/or Environment Canada (if species are migratory) will be contacted to provide advice. • Throughout the Project Area, Project equipment and vehicles will not travel at speeds greater than 30 km/h. • Restriction of all Project activities to designated, previously-disturbed work areas and existing roads, or areas that have been built-up with gravel pad(s), where practical. • Where off-road travel is required for remedial work, activities will be completed with low ground pressure vehicles (e.g., rubber-tired ATVs, Argos) and sensitive land areas and features will be avoided.

Table 5-3: Potential Effects and Mitigations for Valued Components

Potential Effects on Valued Components	Mitigation
Fish and Fish Habitat	
Introduction of a deleterious substance (e.g., sediments, contaminated water, hydrocarbons from spills, etc.)	• Implement sediment and erosion prevention and control measures, where necessary. • Follow best practices for development and operation of borrow sources to reduce potential for erosion, including INAC (2009b). • Drainage from borrow sources to be diverted away from waterbodies. • Implement spill prevention and response protocols. • Minimize disturbance near waterbodies and riparian areas. • Restriction of all Project activities to designated, previously-disturbed work areas and existing roads, or areas that have been built-up with gravel pad(s), where practical. • Complete any required in-water work by hand, and with clean equipment. • Maintain clean camp and work sites. • Conduct routine equipment and infrastructure inspections. • Comply with appropriate regulations, guidelines and Project approvals, including treatment of contaminated water to approved discharge limits. • Discharge of treated water at a location a minimum of 30 m from the high water mark of any waterbody, and where direct flow into a waterbody is not possible. • Use of water for dust suppression, as opposed to dust suppression products. • Comply with appropriate guidelines for greywater and sewage disposal, including AANDC's *Northern Land Use Guidelines: Camps and Support* Facilities (INAC 2011). • Comply with fuel storage and handling guidelines and best practices, including personnel training, storage setbacks, secondary containment, and regular storage inspection. • Restriction of all fueling, servicing and staging of machines to designated areas. • Regular inspections of all machinery to minimize the risk of a spill by identifying and correcting potential equipment failures. • Emergency spill kits will be kept with all working machinery during all Project phases. • Development and implementation of Project-specific SCP (see Appendix D for draft SCP).
Increased risk of direct mortality during required in-water remedial work	• Comply with DFO mitigation measures for timing windows, to avoid causing serious harm to fish. • In-water remedial work will only be conducted between July 15 and August 15.

Table 5-3: Potential Effects and Mitigations for Valued Components

Potential Effects on Valued Components	Mitigation
Blockage or restriction of stream flow through the construction of ice bridges, or delays in spring fish migration due to blockage or spring melt from snow fills	• Comply with DFO mitigation measures to avoid causing serious harm to fish. • Comply with mitigation measures in the former DFO Nunavut Operational Statement for Ice Bridges and Snow Fills (see Appendix G). • No cutting of banks. • Use of erosion control measures if ground is exposed. • Use of clean snow, free of vegetation and debris. • Notch or remove the crossing after use.
Loss of fish habitat from reduced water levels and potential decrease in oxygen levels	• Comply with the Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut (DFO 2010). • Comply with Water License conditions.
Entrainment or impingement of fish during water withdrawal	• Screens used for water withdrawal will be designed and operated according to the DFO *Freshwater Intake End-of-pipe Fish Screen Guidelines* (DFO 1995) and DFO *Fish Screen Design Criteria for Flood and Water Truck Pumps* (DFO 2011).
Local Economy	
Employment opportunities Business opportunities	• AANDC and its Contractor will provide information to residents and businesses of Kugaaruk, and the selected winter access trail departure community, about potential employment and business opportunities, and potential skills required by employers.
Traditional Land Use	
Change in access to harvesting areas	• Temporary winter access trail route to be selected following consultation with the chosen departure community to avoid heavily used traditional areas, where practical.
Change in distribution of harvested species	• Wildlife monitors will record all wildlife sightings in daily reports.
Human Health	
Project personnel health and safety	• Development of Project-specific health and safety plan. • All Project personnel will receive appropriate health and safety training, applicable to the tasks they will be performing. • All Project personnel will attend an orientation, which will discuss site-specific health and safety protocols. • All Project personnel will be provided personnel protective equipment (PPE) necessary for the tasks they will be performing.

Table 5-3: Potential Effects and Mitigations for Valued Components

Potential Effects on Valued Components	Mitigation
Archaeological and Heritage Resources	
Loss of site contents and contexts if potential effects not mitigated	• Avoidance of any Project activities within 30 of an identified archaeological site. • Restriction of all Project activities to designated, previously-disturbed work areas and existing roads, or areas that have been built-up with gravel pad(s), where practical. • Where off-road travel is required for remedial work, activities will be completed with low ground pressure vehicles (e.g., rubber-tired ATVs, Argos) and sensitive land areas and features will be avoided.

5.6 RESIDUAL EFFECTS OF THE PROJECT

The NIRB is required to consider whether the Project might have a significant adverse effect on the physical, biological or socioeconomic environment, or might cause public concern. The significance of potential residual effects (if any) of Project activities on selected VCs are presented and discussed in the following section. The determination whether the Project residual effects are significant has been based on applicable guidelines or thresholds, professional judgment and knowledge of the Project area. Generally, potentially significant effects would be those that threaten the long-term sustainability of the VC, so those that are long-term, moderate to high in magnitude and may occur in the Regional Area.

5.6.1 Assessment of Residual Environmental Effects

Residual environmental effects are those effects to VCs that remain after the application of the mitigation measures identified in Table 5-3. The assessment criteria of residual effects are presented in Table 5-4.

Table 5-4 Assessment Criteria for Potential Residual Environmental Effects

Criteria	Potential Outcomes			
Duration	Short-Term: Effect lasts for duration of Project	Medium-Term: Effect lasts for up to 5 years after activity ceases	Long-Term: Effect lasts greater than 5 years after activity ceases	
Frequency	Once: Effect occurs once	Intermittent: Effect occurs intermittently	Continuous: Effect occurs continuously	
Seasonal Timing	Season-Specific: Effect is restricted to a particular season or seasons	Non Season-Specific: Effect could occur year round		
Geographic Extent	Project Footprint: Winter access trail route, Site area, existing Site roads, camps (Site and access trail), laydown areas	Project Area: Project Footprint, plus a 1 km buffer	Regional Area: Project Footprint plus a 5 km buffer, and/or seasonal range of VC	
Reversibility[1]	Reversible or Irreversible			
Magnitude of effect	None/Negligible	Low: Class 3 Effect[2]	Moderate: Class 2 Effect[3]	High: Class 1 Effect[4]

NOTES:

1. Reversibility—The likelihood that the VC will recover from an environmental effect.
2. Class 3 Effect—The predicted trend in the measurable parameter under projected levels of development may result in a decline in the VC in the Project Area during the life of the Project, but VC levels should recover to baseline after Project closure.
3. Class 2 Effect—The predicted trend in the measurable parameter under projected levels of development will likely result in a decline in the VC to lower than baseline, but stable levels in the Project Area after closure and into the foreseeable future.
4. Class 1 Effect—The predicted trend in the measurable parameter under projected levels of development could threaten the sustainability of the VC in the Project Area, after Project closure, and into the foreseeable future.

5.6.2 Physical VCs

5.6.2.1 Terrain Stability and Permafrost

Mitigation measures for potential Project effects to terrain stability and permafrost are presented in Table 5-3. The application of the mitigation measures, including the restriction of Project equipment and vehicles to previously disturbed and built-up portions of the Site, will limit the effects of the Project on terrain stability and permafrost in the Project Area. Areas where terrain and permafrost are susceptible to erosion will be avoided, where practical.

The remedial excavations and excavation of borrow sources may cause some warming and melt back of the permafrost due to the removal of the active layer/overburden. Where excavations within sensitive land areas cannot be avoided (i.e., potentially required in the wetland area of the Northwest Drum Cache), excavations will be backfilled as soon as possible once it is confirmed the extent of contamination has been removed. Water will also be managed within the excavations, as required, to prevent ponding and further permafrost degradation. Given the short-term nature of the Project and use of progressive reclamation for excavations, any increased warming or melt back of the permafrost in these areas is expected to recover following Project completion.

Through the application of the mitigation measures outlined in Table 5-3, the potential residual effects to the terrain stability and permafrost VC are predicted to be short to medium-term, will occur once, be season-specific and confined to the Project Footprint. The potential residual effects are predicted to be negligible in magnitude, reversible, and not significant.

5.6.2.2 Soil Quality

Overall, the potential residual effects to soil quality from Project activities are expected to be positive. The execution of the Project will remove the contaminated soil and waste debris from contact with the surrounding environment and improve overall soil quality on the Site.

However, improper construction of the Tier I and Tier II Landfills, or improper fuel handling and storage through all Project phases, could cause an adverse effect on soil quality in the Project Footprint. Mitigation measures for potential adverse Project effects to soil quality are presented in Table 5-3. The application of these mitigation measures, including the use of applicable design criteria, construction monitoring, and appropriate fuel handling and storage techniques, will limit adverse effects of Project activities on the soil quality in the Project Footprint. The potential adverse residual effects to the soil quality VC are therefore predicted to be short-term, occur once, be season-specific, confined within the Project Footprint, be negligible in magnitude, reversible, and are not significant.

5.6.2.3 Air Quality

Mitigation measures for potential Project effects to air quality are presented in Table 5-3. The application of these mitigation measures, including use of equipment which meets emissions standards, regular equipment maintenance, and implementation of a dust management plan, will limit the effects of the Project on air quality. With these mitigation measures, residual effects on air quality are expected to be short-term, season-specific and occur intermittently as all Project work will likely be restricted to a maximum of 12 hours per day. The effects are also predicted to be largely restricted to the Project Footprint, be reversible, negligible in magnitude, and not significant.

5.6.2.4 Water Quantity

Mitigation measures for potential Project effects to water quantity are presented in Table 5-3. With the application of the identified mitigation measures, particularly water withdrawal protocols, measures to properly construct and decommission ice bridges and snow fills, and correct installation of culverts, residual effects of Project activities on water quantity will be reduced.

Project effects that alter measurable water quantity parameters, such as, but not limited to, mean, minimum, or maximum discharges, and/or event frequencies are not anticipated, as the Project watercourse crossings will not impound or alter the course of flowing water. The use of ice bridges and snow fills along the winter access trail may result in a delayed melt due to increased accumulation and density, but the snow water equivalent (the amount of water on the ground once the snow has melted) would be inconsequential at the basin scale. However, snow fills used to span streams or creeks should be "notched" or removed when no longer needed to prevent atypical flooding in the spring, as per DFO's former guidelines.

The total volume of water required for the Project at the Site (from the Freshwater Lake) is estimated to be a maximum of 2,270 m^3 over the duration of the Project. This is inclusive of 1,341 m^3 for camp usage (potable water; see Section 2.6.1), 605 m^3 for dust suppression (see Section 2.6.2), and 118 m^3 for drum cleaning (see Section 2.6.3), plus a 10% contingency. The volume of water in the Freshwater Lake has been conservatively estimated at 48,000 m^3 using a surface area of 192,000 m^2 and an estimated average depth of 0.25 m. The volume of water required for the Project is less than 10% of the estimated lake volume and should not affect the hydrologic function of the Freshwater Lake. However, the lake volume will be confirmed prior to remedial work; an alternate freshwater source will be sought should the lake volume be significantly less than the above estimate.

Water will be required for the temporary camp along the winter access trail route (estimated 131 m^3) and may also be used to build the winter access trail however this volume is unknown at this time. Though the Contractor for this Project has yet to be selected, the chosen Contractor will comply with all mitigation measures identified within this document for construction and operation of the winter access trail, including water withdrawal protocols (not more than 10% of the lake volume or flow volume), and measures to properly construct and decommission ice bridges and snow fills (DFO 2007; see Appendix G).

The residual effects on water quantity are considered to be of short-term duration, intermittent in frequency (throughout mobilization, construction, remediation/construction, and demobilization phases), and contained within the Project Area. Any residual effects are considered reversible, provided all mitigations are in place, and suitable water withdrawal locations are selected for the winter access trail. The magnitude of potential residual impacts is classified as negligible or none, and the effect is not significant.

5.6.2.5 Water Quality

Mitigation measures for potential Project effects to water quality are presented in Table 5-3. When complete, the Project is expected to have a negligible effect on existing water quality, provided the proper measures and protocols are followed during all phases of the Project.

The Project will largely occur outside of permanent waterbodies, and new disturbances will be limited. Where culvert installation is required, proper sizing of the culvert and the expected ephemeral nature of the crossing will reduce potential impact to water quantity, water quality, and subsequently any downstream fish and fish habitat. Use of riparian setbacks will maintain the riparian zone's function of protecting water chemistry, erosion prevention or reduction, and the provision of aquatic habitat for aquatic organisms. Refueling away from sensitive aquatic areas in conjunction with spill prevention and response plans will reduce the risk of hydrocarbons and other deleterious substances entering the watercourses. Treatment of contaminated water to discharge limits, and proper siting of release locations (i.e., at least 31 m away from the high water mark of any waterbody, and where direct flow into a waterbody is not possible) will prevent degradation of existing water quality. Monitoring during construction of engineered structures will inspect for compliance with all applicable design criteria and protective measures. Where in-water remedial work is required (i.e., within the Freshwater Lake to remove barrels), work will be completed by hand. Therefore, residual effects on water quality are predicted to be short-term, intermittent, season-specific, confined to the Project Footprint reversible, negligible or none in magnitude, and not significant.

5.6.3 Biological VCs

5.6.3.1 Vegetation

Mitigation measures for potential Project effects to vegetation are presented in Table 5-3. Upon completion, the Project is expected to have little effect on the existing vegetation communities at the Site. Most Project work will be restricted to previously disturbed areas, or areas with minimal vegetation cover; these areas are expected to eventually recover following Project completion. Along the winter access trail, the vegetation cover will be protected with the build-up of snow along the route (minimum of 0.1 m) and snow-clearing equipment will be fitted with mushroom shoes to prevent contact with the root mat. Effective dust management procedures will also reduce potential adverse effects from fugitive dust.

With the application of the mitigation measures, residual effects of the Project on vegetation are expected to be short-term, occur intermittently (through three summer remediation/operation periods), be season-specific, confined to the Project Area, reversible, negligible in magnitude, and not significant.

5.6.3.2 Mammals

Potential residual effects of the Project on wildlife include wildlife habitat avoidance or displacement due to sensory disturbance and mortality risk (i.e., due to interactions with vehicles and/or equipment, and attraction to the Site). Project effects were assessed on selected VCs with the potential to interact with Project activities, including barren-ground caribou, grizzly bear, wolverine and polar bear, and are discussed below.

Mitigation measures to reduce potential Project effects on wildlife are presented in Table 5-3. The mitigation measures identified will reduce potential Project effects by reducing the Project footprint, maintaining setbacks from active den sites, implementing site-specific waste and wildlife management procedures, and restriction of Project activities to disturbed areas.

5.6.3.2.1 Barren-ground Caribou

Potential effects to barren-ground caribou during mobilization and construction, remediation/operations, and closure, include sensory disturbance and increased mortality risk (i.e., due to collisions with Project vehicles or equipment). The mitigation measures identified in Table 5-3 will reduce potential effects; however, some potential residual effects as a result of sensory disturbance will persist.

Noise from Project equipment and camp operations may cause caribou to alter their behavior and/or avoid habitat within the Project Area during all Project phases. Though a different sub-species, island caribou have been shown to behave in the following ways in response to nearby land-based seismic operations (F.F. Slaney and Co. 1975a, b):

- Caribou remained for a day or more within 4 km of sight or sound of a seismic operation.
- Caribou continued to forage following the detonation of seismic shots 3.5 km away, and remained in the area for at least several hours.
- Caribou by-passed a seismic camp within 800 m without altering their direction of movement.
- Caribou ceased foraging when approached by seismic vehicles that were closer than 800 m away.

F.F. Slaney and Co. (1975 a, b) noted that there was some displacement from foraging areas and some increased energy expenditure as a result of the nearby land-based seismic operations, these were within ranges of normal activities (e.g., predator avoidance). Explosive shots are typically used for land-based seismic activities, and given that explosives will not be used for the Project, Project activities are not expected to be as loud as land-based seismic operations.

The bulk of Project activities (excluding post-closure monitoring) will occur over a three-year period (February 2016 to March 2019) with most activity concentrated to the summer months using 12-hour work shifts. As a result, sensory disturbance to barren-ground caribou is expected to be intermittent, short-term, reversible, and will be limited to the Project Area. Based on the

mitigation measures in Table 5-3, sensory disturbance is expected to be minimal and residual effects are expected to be low in magnitude and not significant.

5.6.3.2.2 Grizzly Bear

Potential effects to grizzly bear during mobilization and construction, remediation/operations, and closure, include sensory disturbance and increased mortality risk. The mitigation measures identified in Table 5-3 will reduce potential effects; however, some potential residual effects may persist. These are related to potential disruption of denning during winter access trail construction and operation, sensory disturbance during remedial operations (summer), and increased mortality risk from attraction of grizzly bear to the Project area.

Project activities occurring in the winter include construction and operation of the winter access trail, including camp activities along the selected route. These have the potential to disrupt denning bears during their winter dormancy period. While the consequence of inadvertently disturbing an active bear den, especially one containing cubs, is potentially high with a long-term effect (due to potential cub mortality), the probability of this occurring is expected to be low. The risk of disturbance to grizzly bear dens is limited to the Project Area and to a maximum of six weeks per winter mobilization/demobilization period. Potential residual effects to grizzly bear from den disturbance are therefore low in magnitude, reversible, and not significant.

During remedial operations in the summer, grizzly bear may avoid the Project Area due to sensory disturbance (increased noise) from Project activities, potentially resulting in a decline in local abundance during the duration of the Project (three years). However, grizzly bear may also be attracted to the Project area as a result of domestic food wastes and other aromatic wastes (e.g., oils, gas). This attraction increases the potential for human/bear interactions and potential subsequent grizzly bear mortality if they become a nuisance. With the implementation of mitigation measures in Table 5-3, including fuel and waste management procedures with training, site inspections, and complete incineration of domestic and other combustible wastes, potential residual effects to grizzly bear from summer remedial work will be minimized. If a grizzly bear does become a nuisance, the GN-DOE will be contacted for advice on dealing with the bear. Potential residual effects from sensory disturbance and attraction may occur continuously over the duration of the Project as on-site wastes are expected throughout, but will be short-term in duration, season-specific, be restricted to the Project Area, reversible, low in magnitude and not significant.

5.6.3.2.3 Wolverine

Potential effects to wolverine during mobilization and construction, remediation/operations, and closure, include sensory disturbance and increased mortality risk. The mitigation measures identified in Table 5-3 will reduce potential effects; however, some potential residual effects may persist; these are related to potential disruption of denning during winter access trail construction and operation, sensory disturbance during remedial operations (summer), and increased mortality risk from attraction of wolverine to the Project area.

Wolverines have been reported to be sensitive to human activity, particularly in the winter, and disturbance at den sites may cause den relocation, den abandonment, or litter abandonment (COSEWIC 2003). As with grizzly bear, while the consequence of disturbing a wolverine den is high with a potential long-term effect due to potential litter/kit mortality, the probability is expected to be low. The risk of disturbance to dens is limited to the Project Area and to a maximum of six weeks per winter mobilization/demobilization period. Potential residual effects to wolverine from den disturbance are therefore low in magnitude, reversible, and not significant.

Similar to grizzly bear, wolverine may avoid the Project Area as a result of increased noise from Project activities and cause a decline in local abundance over the one year duration of the Project. Due to wolverine's keen sense of smell, they may also be attracted to the Project Area due to the presence of domestic food wastes and other aromatic wastes (e.g., oils, gas); this attraction could occur through both summer and winter operations as wolverine are active throughout the year. This increases the potential for human/wolverine interactions and, if they become a problem, potential subsequent wolverine mortality. For example, several wolverine mortalities, re-locations and other incidents have occurred at two of the operating diamond mines in the Northwest Territories (OWRT 2013). If a wolverine does become a nuisance, the GN-DOE will be contacted for advice on dealing with the animal. With the implementation of mitigation measures in Table 5-3, including fuel and waste management procedures, potential residual effects will be minimized, but may occur continuously over the duration of the Project as on-site wastes are always expected, and occur in both winter and summer phases. Potential residual effects are expected to be short-term in duration, restricted to the Project Area, reversible, low in magnitude and not significant.

5.6.3.2.4 Polar Bear

Potential effects to polar bear may occur during the construction, remediation/operations, and closure phases, and include sensory disturbance and increased mortality risk. During winter, Project effects are expected to be negligible as polar bears will be out on the sea ice away from the Project Area. Polar bear – Project interactions only have the potential to occur during the summer portion of the Project, if the bears are pushed on land due to lack of sea ice. The mitigation measures identified in Table 5-3, including implementation of waste management procedures, will reduce potential effects of the Project on Polar Bear. However, a potential residual effect may persist due to increased mortality risk as a result of the potential attraction of land-based polar bears to the Project Area.

Again, similar to grizzly bear and wolverine, polar bear may be attracted to domestic wastes while they are on land (Lunn and Stirling 1985). Given the potential requirement to destroy a bear should an interaction occur, and that polar bear are a SARA-listed species, the consequence of human/bear interactions is potentially high with a long-term effect. However, the probability of this occurring is expected to be low. With the implementation of the mitigation measures in Table 5-3, including fuel and waste management procedures, potential residual effects of the Project on polar bear are predicted to be short-term in duration (over three years)

and limited to the summer season within the Project Area. Potential residual effects to polar bear are therefore expected to be reversible, low in magnitude, and not significant.

5.6.3.3 Avifauna

Potential residual effects of the Project on avifauna include habitat loss and habitat avoidance or displacement due to sensory disturbance. Project effects were assessed on avifauna with the potential to interact with Project activities; the assessment focused on general avifauna species, as well as two species at risk, red knot and peregrine falcon.

Mitigation measures to reduce potential Project effects on avifauna are presented in Table 5-3. The mitigation measures identified will reduce potential Project effects by reducing the Project footprint; completing pre-disturbance nest surveys; maintaining setbacks from active nest sites, staging areas or avifauna concentrations; implementing waste management procedures; and, restriction of Project activities to previously disturbed areas. Therefore potential residual effects on avifauna, including red knot and peregrine falcon, are predicted to be short- to medium-term, occur intermittently, season-specific, restricted to the Project Area, reversible, low in magnitude and not significant.

5.6.3.3.1 Red Knot

Potential effects to Red Knot may occur during construction and remediation/operations phases and include direct habitat loss, sensory disturbance and increased direct and indirect mortality risk. The mitigation measures identified in Table 5-3 will reduce potential effects however some potential residual effects may remain.

Though it is unknown if Red Knot utilize the Site, Red Knot typically nest in barren habitats with less than 5% vegetation cover; much of the Site can be characterized as this, and as a result, there may be some residual effects of habitat loss due to construction of Project structures and excavations in this habitat type. Furthermore, if Red Knot are present, residual effects on sensory disturbance may occur during the summer operation period. However, red knots typically nest north of the Site within the Arctic Islands, and the nearest known nesting site is 100 km north of the Site. Red knots are not expected at the Site, but this cannot be confirmed. Therefore, as the Project will occur over three summer seasons, potential residual effects are expected to be season-specific, reversible, and occur intermittently within the Project Area. The overall residual effects are predicted to be of a medium-term due to potential habitat loss; however, the magnitude is expected to be low due to the availability of similar habitat in the area, and potential residual effects not significant.

5.6.3.3.2 Peregrine Falcon

Potential effects to Peregrine Falcon may occur during construction, remediation/operations, and closure phases and include direct habitat loss, sensory disturbance and increased direct and indirect mortality risk. Similar to Red Knot, the mitigation measures identified in Table 5-3 will reduce potential effects however some potential residual effects on sensory disturbance may

persist if peregrine falcons are in the area. Little information could be found on nest sites on the Simpson Peninsula though peregrine falcon are known near the Igulik area (GN 2008), approximately 280 km northeast of the Site. However, if peregrine falcons are present, the Project is expected to last for a maximum of three years and potential residual effects are expected to be short-term, season-specific, reversible, and occur intermittently within the Project Area. Any habitat avoidance due to sensory disturbance is expected to be negligible in magnitude and not significant, as the Project footprint is relatively small compared to Peregrine Falcon hunting territory.

5.6.3.4 Fish and Fish Habitat

Mitigation measures for potential Project effects to fish and fish habitat are presented in Table 5-3. When complete, the Project is expected to have little to no residual effect on fish or fish habitat. Though fish presence was not confirmed within the waterbodies on Site, all waterbodies were less than 1 m deep, had large invertebrates (i.e., *Anostraca*), no defined inlets or outlets, and fish of a commercial, recreational or Aboriginal fishery are not expected. Therefore, with the application of the identified mitigation measures, any residual effects of Project activities on potential fish and fish habitat at the Site are expected to be short-term, intermittent, season-specific (summer), be confined to the Project Footprint, reversible, of a negligible magnitude, and not significant.

Though the route for the winter access trail has not yet been selected, adherence to DFO's mitigation measures, and those identified in Table 5-3, should result in little to no measureable residual effects on fish and fish habitat along the selected route. The potential effects are short-term, intermittent, season-specific (winter), reversible, confined to the Project Footprint, negligible in magnitude, and not significant.

5.6.4 Socioeconomic VCs

5.6.4.1 Local Economy

Mitigation measures for potential Project effects to local economy are presented in Table 5-3. Completion of the Project is expected to generate some direct employment and business opportunities both for Kugaaruk and the selected departure community for the winter access trail. During the mobilization and construction, remediation/operations, and closure phases, the Project is expected to create short-term employment and business opportunities over the anticipated three year schedule. The effect of the Project on local economy is expected to be positive, short term, season-specific, regional, and low in magnitude.

5.6.4.2 Traditional Land Use

Mitigation measures for potential Project effects to traditional land use are presented in Table 5-3. Project activities will occur over a three year period at the Site and along the winter access

trail route, which has yet to be selected. Though residents of Kugaaruk have reported using the Site in the past, it is used infrequently due to the distance from the community (75 km). As a result, the activities at the Site are unlikely to interfere with subsistence harvesting activities and long-term use of traditional/local trails, and residual effects to traditional land use of the Site are not expected.

The winter access trail routing will be selected to avoid heavily used traditional areas, where practical, following consultation with the chosen departure community. With the application of this mitigation measure, any potential residual effects on traditional land use (including subsistence harvesting) resulting from the winter access trail are expected to be short-term, season-specific, reversible, intermittent, confined to the Project Area, negligible in magnitude, and not significant.

5.6.4.3 Human Health

Mitigation measures for potential Project effects to human health are presented in Table 5-3. With the application of identified mitigation measures, including provision of appropriate health and safety training and PPE, Project effects on human health will be reduced and little to no adverse residual effects are expected. Should a residual effect occur, it would be considered short-term, intermittent, season-specific, reversible, restricted to the Project Footprint, negligible in magnitude, and not significant. With the completion of the Project and remediation of the Site, the overall residual effect on human health is expected to be positive due to the removal and clean-up of potentially harmful contaminants and waste debris.

5.6.4.4 Archaeological and Heritage Resources

Mitigation measures for potential Project effects to archaeological and heritage resources are presented in Table 5-3. An AIA was completed during the July 2013 field survey and a number of features were identified along the beach area. However, the majority of Project work will occur outside of the beach area and effects are not expected. Where remedial work is required within the beach area (i.e., collected of barrels), the establishment of a 30 m buffer around identified features, as well as the completion of work manually, and with low ground pressure vehicles, will protect the identified features and residual effects are not expected.

6.0 Cumulative Effects

From the NIRB's Technical Guide Series *Terminology and Definitions* (Draft 2) (NIRB 2013b), a cumulative effect is described as "*... an impact on the biophysical and socio-economic environment that results from the incremental effects of a development when added to other past, present and reasonably foreseeable future developments, regardless of what agency or person undertakes such other developments. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time*." From this definition, the assessment of cumulative effects predicts the significance of potential residual Project effects in combination with past, present and reasonably foreseeable activities that have the potential to interact with Project effects. The assessment of the significance of cumulative effects is based on technical information and professional judgment, and considers the following:

- Are there adverse residual effects from Project activities?
- Do identified residual effects overlap with (i.e., act in combination with) those of other existing projects and activities?
- What is the contribution of the Project to those overlapping cumulative effects of present projects, if any?
- Do the combined Project and environmental effects of present projects or activities overlap with those of any approved or proposed projects that will be carried out?

These questions were considered for each VC to the extent that they are applicable within the impact assessment conducted in Section 5.0. Those VCs with low magnitude residual effects have been carried forward in the cumulative effects assessment and are considered below.

6.1 PHYSICAL VCs

Once mitigation measures are applied, residual effects of the Project on the selected Physical VCs (terrain stability and permafrost, soil quality, air quality, water quantity, and water quality) were predicted to be none or negligible in magnitude. A positive residual effect of low magnitude is identified for soil quality. Cumulative effects were not considered further for the Physical VCs.

6.2 BIOLOGICAL VCs

Once mitigation measures are applied, residual effects of the Project on the selected Biological VCs (vegetation, wildlife, avifauna, and fish and fish habitat) were predicted to be negligible or low in magnitude. The VCs with residual effects predicted to be low in magnitude include:

- Barren-ground Caribou – sensory disturbance

- Grizzly Bear – den disturbance
- Wolverine – den disturbance
- Polar Bear – increased mortality risk
- Red Knot – habitat loss.

There are no known previous developments within or near the Project Area which might affect the above identified wildlife and avifauna VCs of the Project Area. The nearest current and reasonably foreseeable development is the Diamonds North Resources Ltd. Amaruk property, located near Kugaaruk but approximately 55 km west of the Site. This property is in the exploration phase and has included airborne geophysical surveys, drilling and camp operations. It is unknown if exploration will take place during the Project's timeline, however given the distance of the property from the Site and the short-term nature of the Project, cumulative effects from interactions with the Diamonds North development are not expected. There are no other known current or reasonably foreseeable developments within or near the Project Area which might interact cumulatively with selected Biological VCs of the Project area.

6.3 SOCIOECONOMIC VCs

Once mitigation measures are applied, residual effects of the Project on the selected Socioeconomic VCs (local economy, traditional land use, human health, and archaeological and heritage resources) were predicted to be none or negligible in magnitude. A positive residual effect of low magnitude is identified for local economy and human health. Cumulative effects were not considered further for the Socioeconomic VCs.

7.0 Supporting Documentation

Project-specific mitigation plans will be prepared by the Contractor selected to implement the Project. However, conceptual plans have been submitted with this Environmental Screening document as an indication of a proposed approach, and are included in appendices. The mitigation plans describe the techniques that will be employed and the practices that will be adhered to in order to meet the commitments stated in this document and to meet the conditions of approvals and permits. The draft mitigation plans include:

- Spill Contingency Plan:
  - The Spill Contingency Plan describes the steps that will be taken in the event of a fuel, oil, or chemicals spill. This includes a description of clean up materials and tools, waste handling, and large spills. In addition, this document describes how to report a spill and includes Project-specific contact names and phone numbers.
  - A draft SCP is provided in Appendix D of this document.
- Waste Management Plan:
  - The Waste Management Plan outlines the procedures used to manage waste at the Site, including wastes being dealt with as part of the remediation work, and those generated by the camps.
  - A draft WMP is provided in Appendix E of this document.
- Environmental Protection Plan:
  - An Environmental Protection Plan outlines the environmental compliance measures, and the mobilization/demobilization, construction, remediation/operations, closure, and post-closure measures that will be implemented to protect the environment.
  - Includes dust management procedures to outlines the steps that will be taken to minimize the release of fugitive dust through Project activities.
  - A draft EPP is provided in Appendix F of this document.

In addition, the following documents are included to support Project permitting, and provide further background information on the Site and Project:

- Phase III Environmental Site Assessment for CAM-E (Keith Bay), Nunavut (Stantec 2013)
- Remedial Action Plan for CAM-E (Keith Bay), Nunavut (Stantec 2014)
- Limited Environmental Investigation, Keith Bay, CAM-E (WESA 2012)
- Environmental Study of Abandoned DEW Line Sites – CAM-E (ESG 1995).

These supporting documents are included in Appendix H.

8.0 Closure

Stantec Consulting Ltd. has prepared this preliminary report for the sole benefit of Public Works and Government Services Canada (PWGSC) for the purpose of describing and evaluating potential environmental impacts associated with remediation of the former CAM-E DEW Line Site at Keith Bay, Nunavut, and is intended to assist with obtaining regulatory approvals. The report may not be relied upon by any other person or entity, other than for its intended purposes, without the express written consent of Stantec Consulting Ltd. and PWGSC. Any use of this report by a third party, or any reliance on decisions made based upon it, are the responsibility of such third parties.

The information provided in this report was compiled from existing documents and data provided by PWGSC, and by field data compiled by Stantec Consulting Ltd. This preliminary report represents the best professional judgment of our personnel available at the time of its preparation. Stantec Consulting Ltd. reserves the right to modify the contents of this report, in whole or in part, to reflect any new information that becomes available. If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

Respectfully submitted,

Stantec Consulting Ltd.

Patricia Coyne, B.Sc., EPt
Environmental Scientist
Phone: (867) 920-2882
Fax: (867) 920-2278
patricia.coyne@stantec.com

Carey Sibbald, B.Sc., EPt
Environmental Biologist
Phone: (604) 235-1874
Fax: (604) 436-3752
carey.sibbald@stantec.com

Reviewed by:

Clare Edwards, M.Sc.
Principal, Senior Reviewer
Phone: (403) 538-3494
Fax: (403) 269-5245
clare.edwards@stantec.com

CS/CE/dsc

Stantec

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Appendix A Drawings

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LEGEND:

SITE

NOTE:
- CO-ORD SYSTEM: CANADA LAMBERT CONFORMAL CONIC
- BASE FEATURES PRODUCED BY ESRI

GENERAL SITE LOCATION
REMEDIAL ACTION PLAN
CAM-E (KEITH BAY), NUNAVUT

Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Job No.:	122510734
Scale:	BAR SCALE
Date:	2013/12/12
Dwn. By:	P.J.SOO
App'd By:	

Dwg. No.: R1

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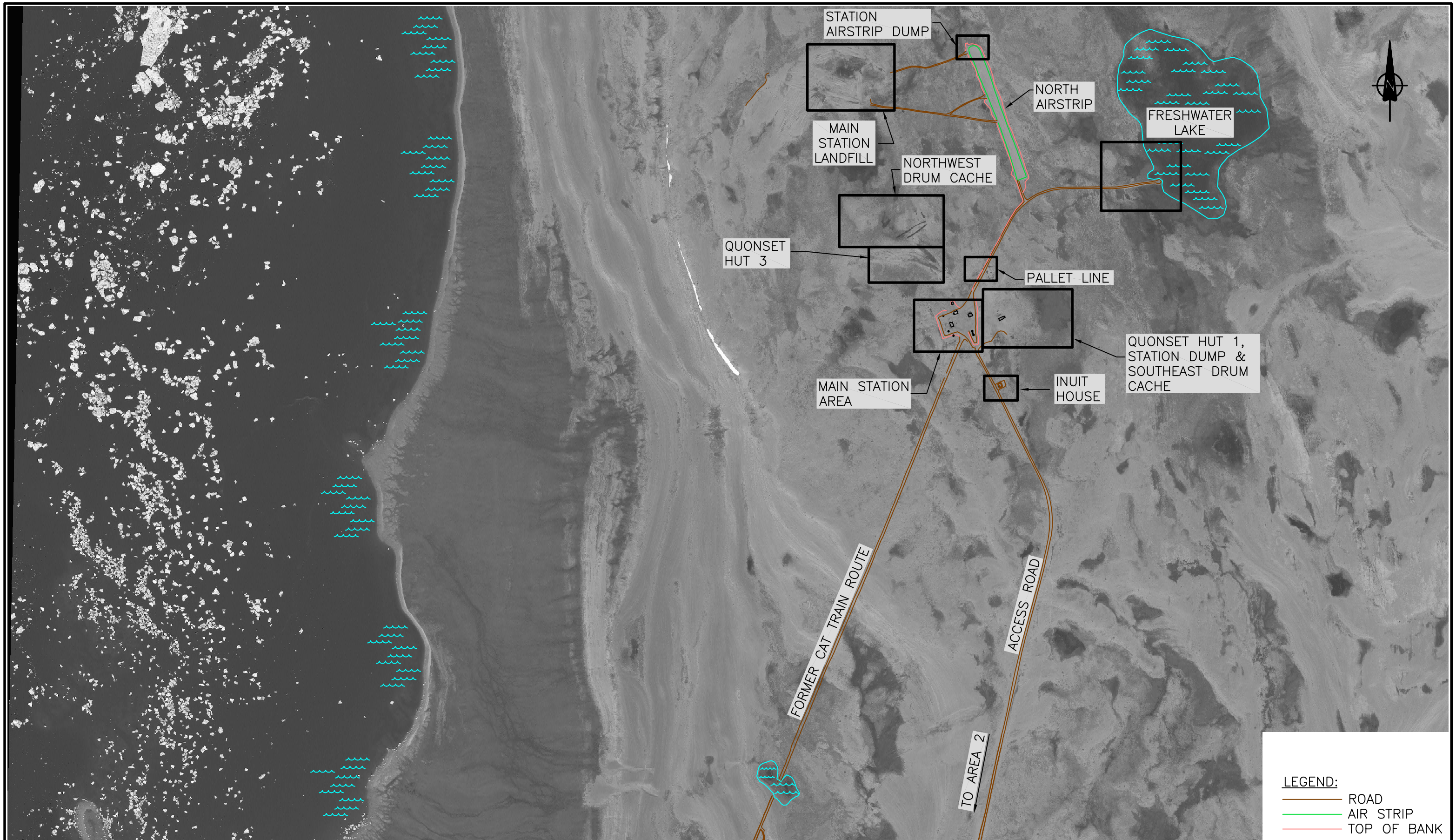

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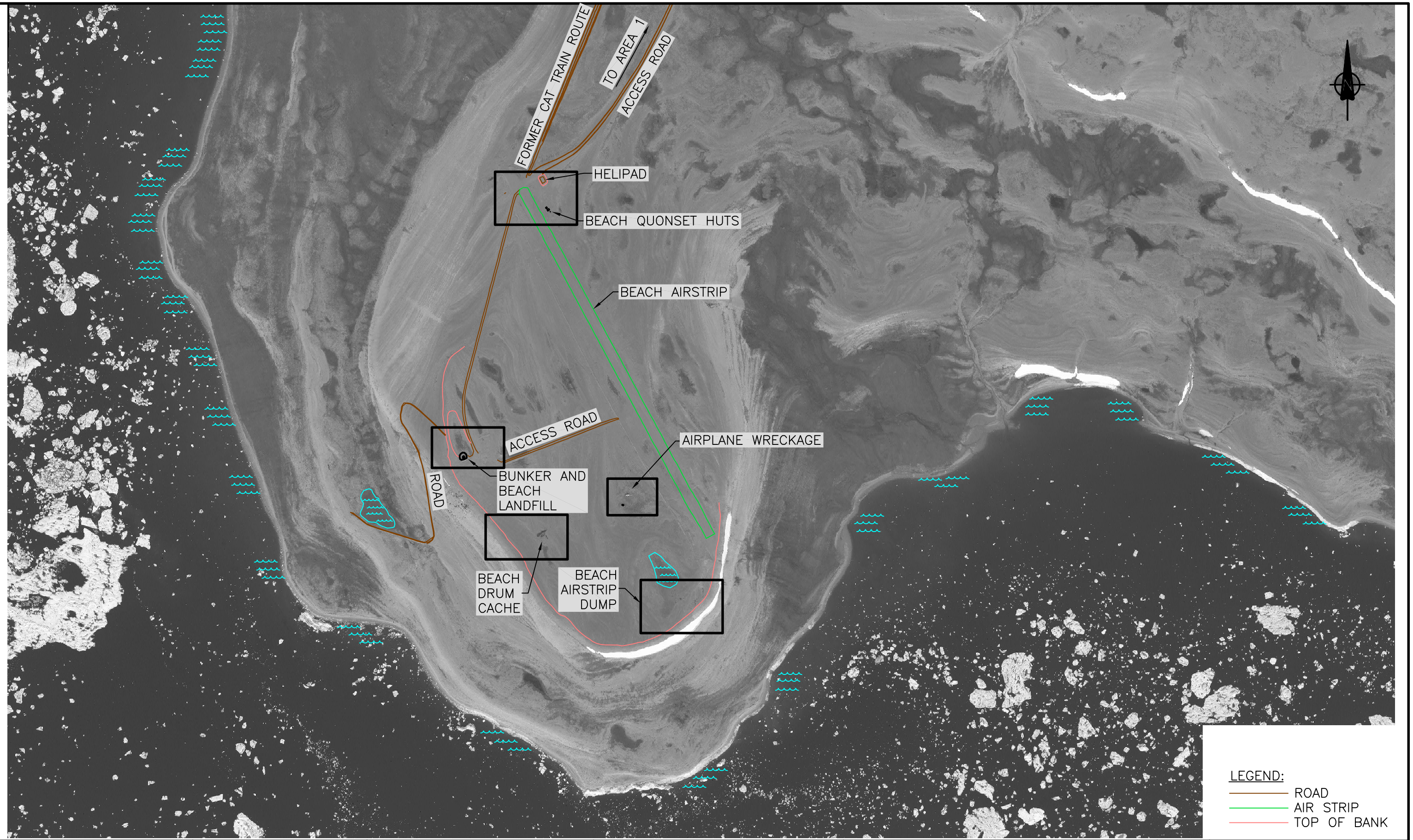

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Stantec

LEGEND:

ROAD

AIR STRIP

AREA OF TIER II EXCEEDING SOIL

AREA OF TIER I EXCEEDING SOIL

AREA OF TYPE B HYDROCARBON EXCEEDING SOIL

0 5 10 20m

BAR SCALE

QUONSET HUT 2

ROAD TO AIRSTRIP

WOODEN STEPS

WAREHOUSE

ANTENNA TOWER

GARAGE

STATION PAD

ELEVATED STATION PAD

ANTENNA TOWER CENTER ANCHOR

MODULE TRAIN AND FORMER ANTENNA CONTROL CENTRE DEBRIS

FORMER POL FOUNDATIONS

PUMP

SEWAGE LAGOON AREA

Ø100 SANITARY SEWER PIPE

FORMER CAT TRAIN ROUTE

ROAD TO AREA 2

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Reference:	Job No.: 122510734 Scale: 1:750 Date: 2013/12/12 Dwn. By: P.J.SOO App'd By:	Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA Site Address: CAM-E (KEITH BAY), NUNAVUT	Project: REMEDIAL ACTION PLAN	Drawing Title: SOIL PLUMES – INUIT HOUSE	Dwg. No.: R5

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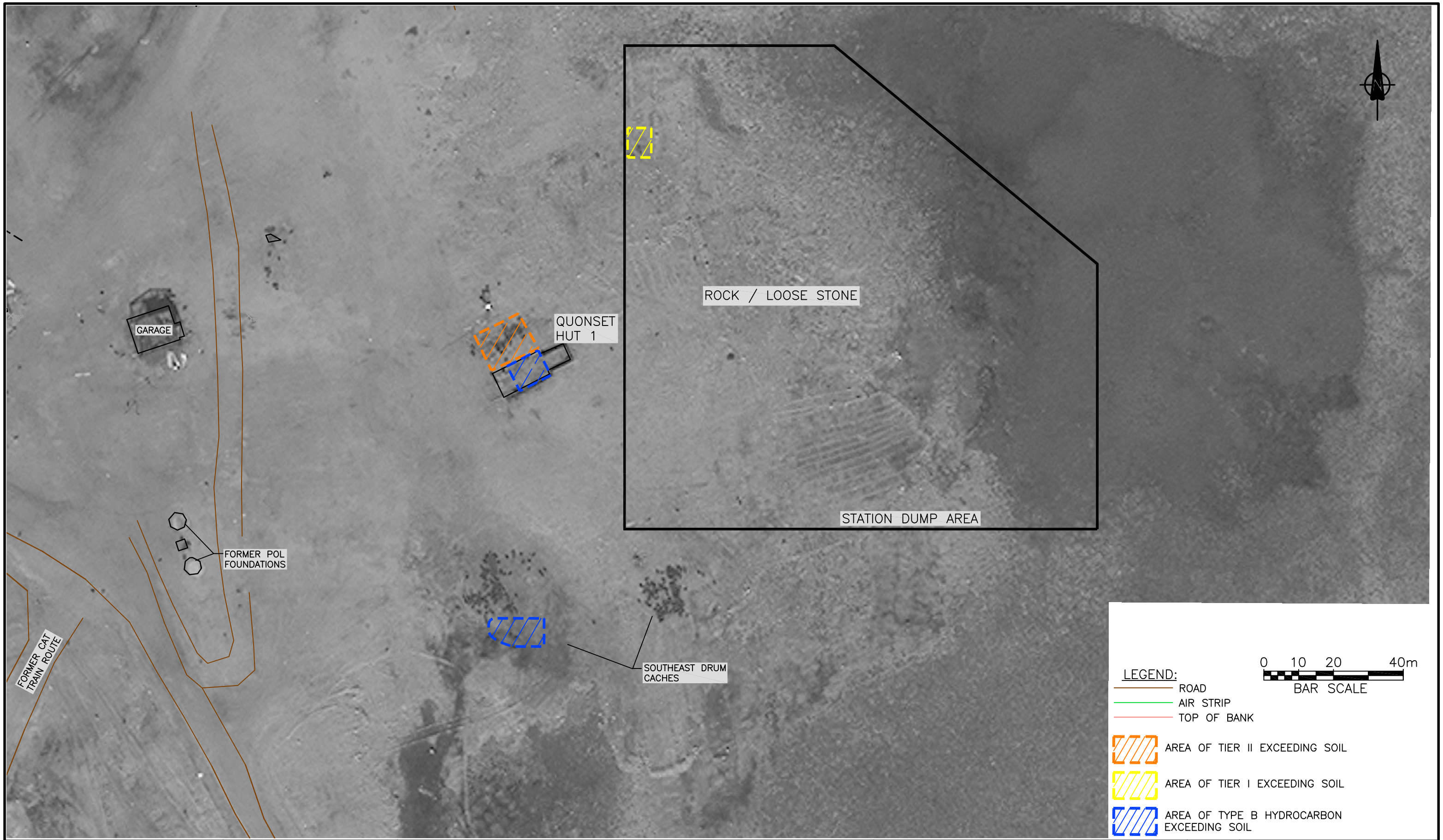

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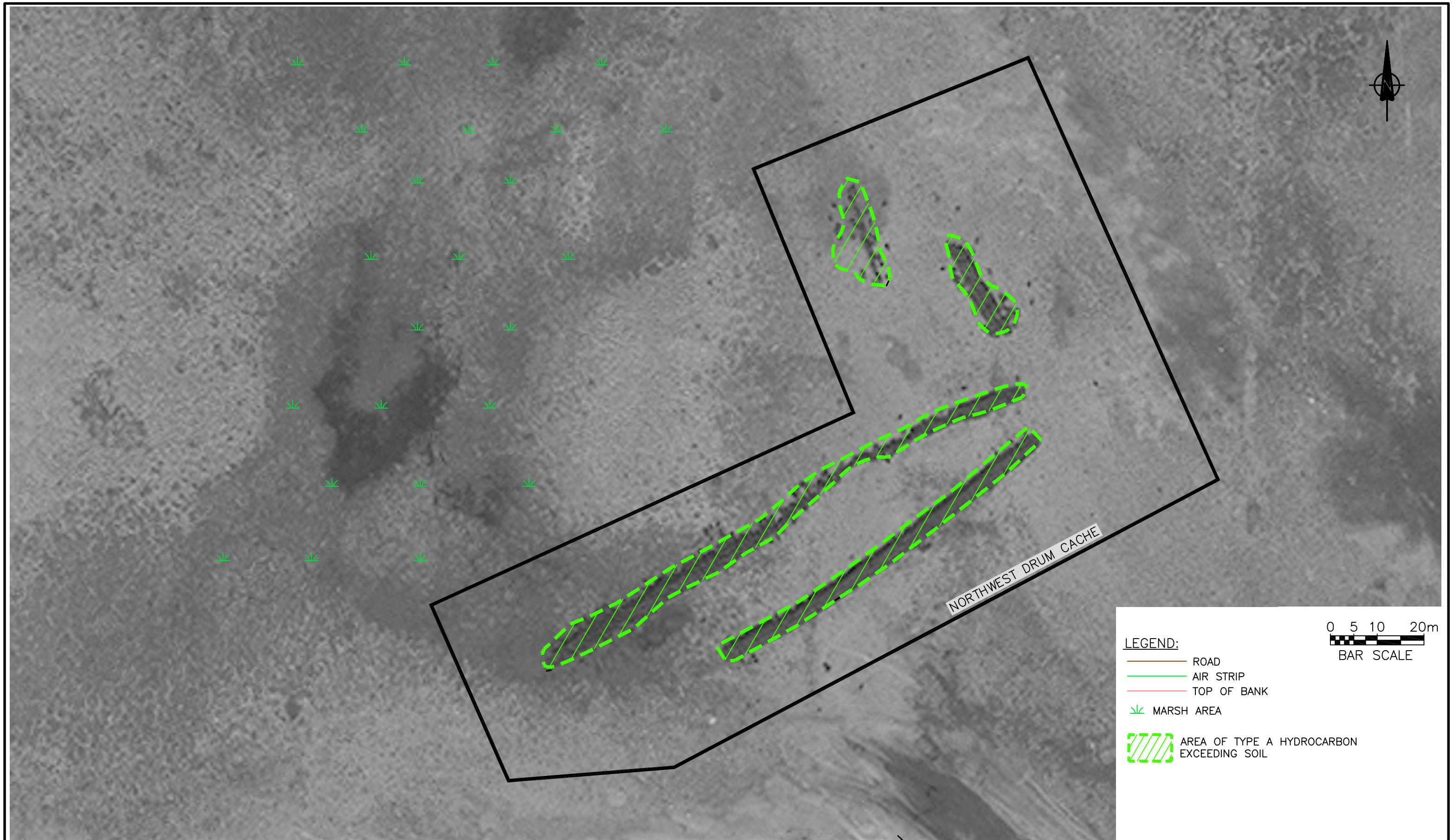

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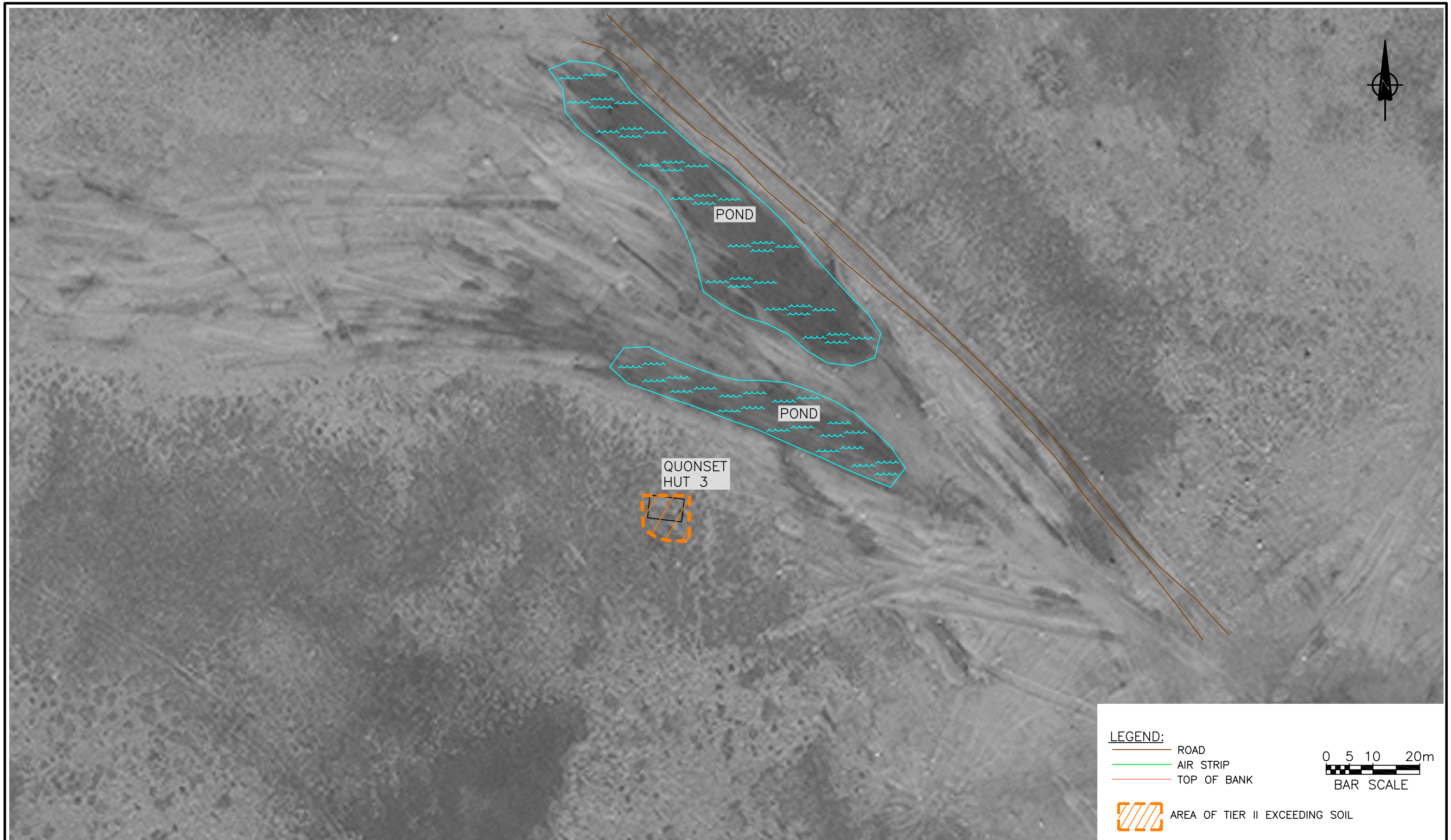

LEGEND:

- ROAD
- AIR STRIP
- TOP OF BANK

0 5 10 20m
BAR SCALE

AREA OF TIER II EXCEEDING SOIL

Reference:	Job No.: 122510734 Scale: 1:750 Date: 2013/12/12 Dwn. By: P.J.SOO App'd By:	Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA Site Address: CAM–E (KEITH BAY), NUNAVUT	Project: REMEDIAL ACTION PLAN	Drawing Title: SOIL PLUMES – QUONSET HUT 3	Dwg. No.: R8

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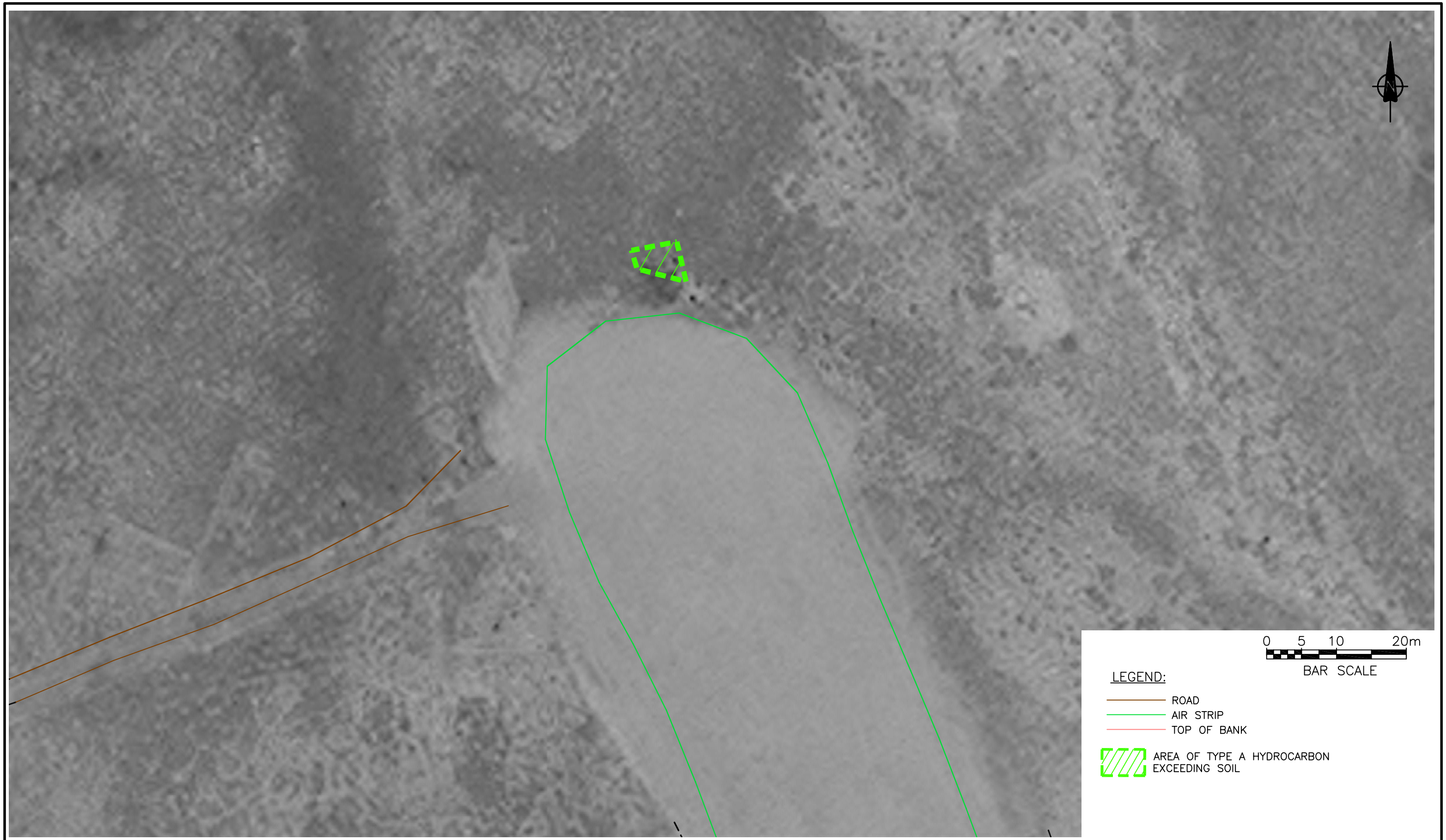

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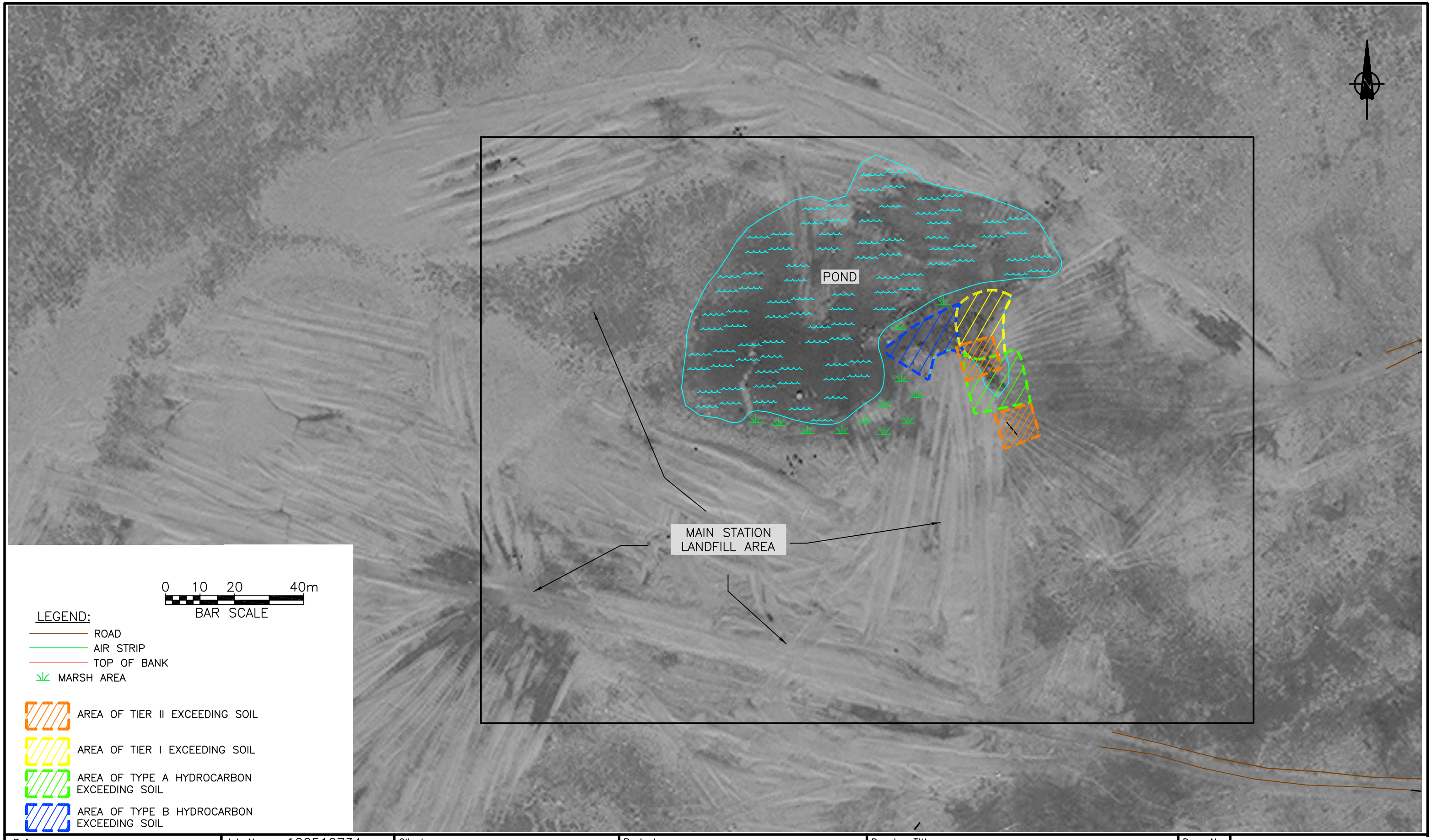

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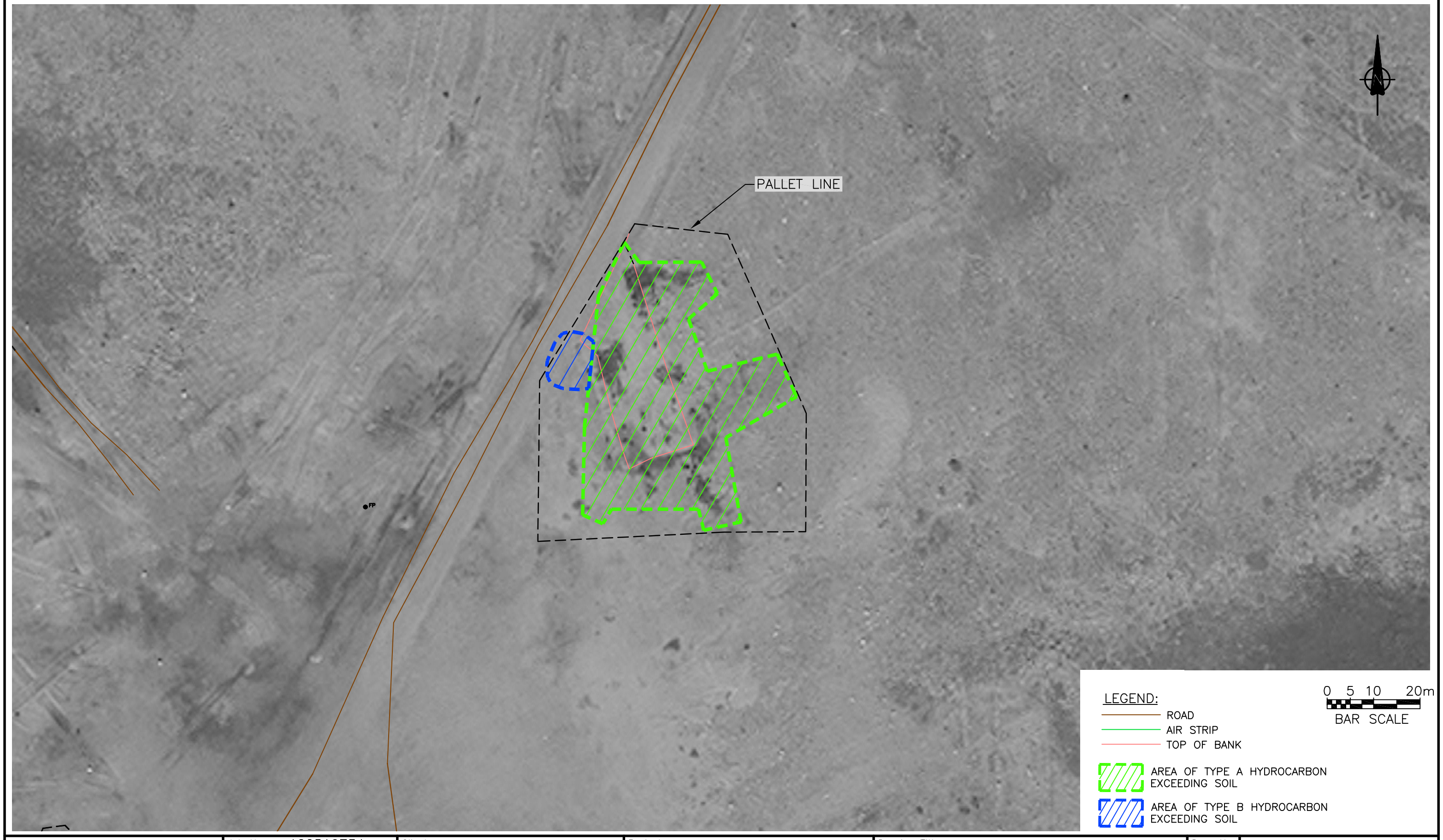

LEGEND:

- ROAD
- AIR STRIP
- TOP OF BANK
- AREA OF TYPE A HYDROCARBON EXCEEDING SOIL
- AREA OF TYPE B HYDROCARBON EXCEEDING SOIL

0 5 10 20m
BAR SCALE

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Reference:	Job No.: 122510734 Scale: 1:750 Date: 2013/12/12 Dwn. By: P.J.SOO App'd By:	Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA Site Address: CAM–E (KEITH BAY), NUNAVUT	Project: REMEDIAL ACTION PLAN	Drawing Title: SOIL PLUMES – PALLET LINE	Dwg. No.: R11

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BEACH
DRUM
CACHE

LEGEND:

MARSH AREA

AREA OF TYPE A HYDROCARBON EXCEEDING SOIL

AREA OF TYPE B HYDROCARBON EXCEEDING SOIL

0 5 10 20m

BAR SCALE

Reference:	Job No.: 122510734 Scale: 1:750 Date: 2013/12/12 Dwn. By: P.J.SOO App'd By:	Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA Site Address: CAM–E (KEITH BAY), NUNAVUT	Project: REMEDIAL ACTION PLAN	Drawing Title: SOIL PLUMES – BEACH DRUM CACHE	Dwg. No.: R14	Stantec

BUNKER

BEACH
LANDFILL

BEACH
DUMP

0 10 20 40m
BAR SCALE

LEGEND:

ROAD
AIR STRIP
TOP OF BANK
MARSH AREA

AREA OF TYPE B HYDROCARBON EXCEEDING SOIL

Reference:	Job No.: 122510734 Scale: 1:1000 Date: 2013/12/12 Dwn. By: P.J.SOO App'd By:	Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA Site Address: CAM–E (KEITH BAY), NUNAVUT	Project: REMEDIAL ACTION PLAN	Drawing Title: SOIL PLUMES – BUNKER AND BEACH LANDFILL	Dwg. No.: R15	Stantec

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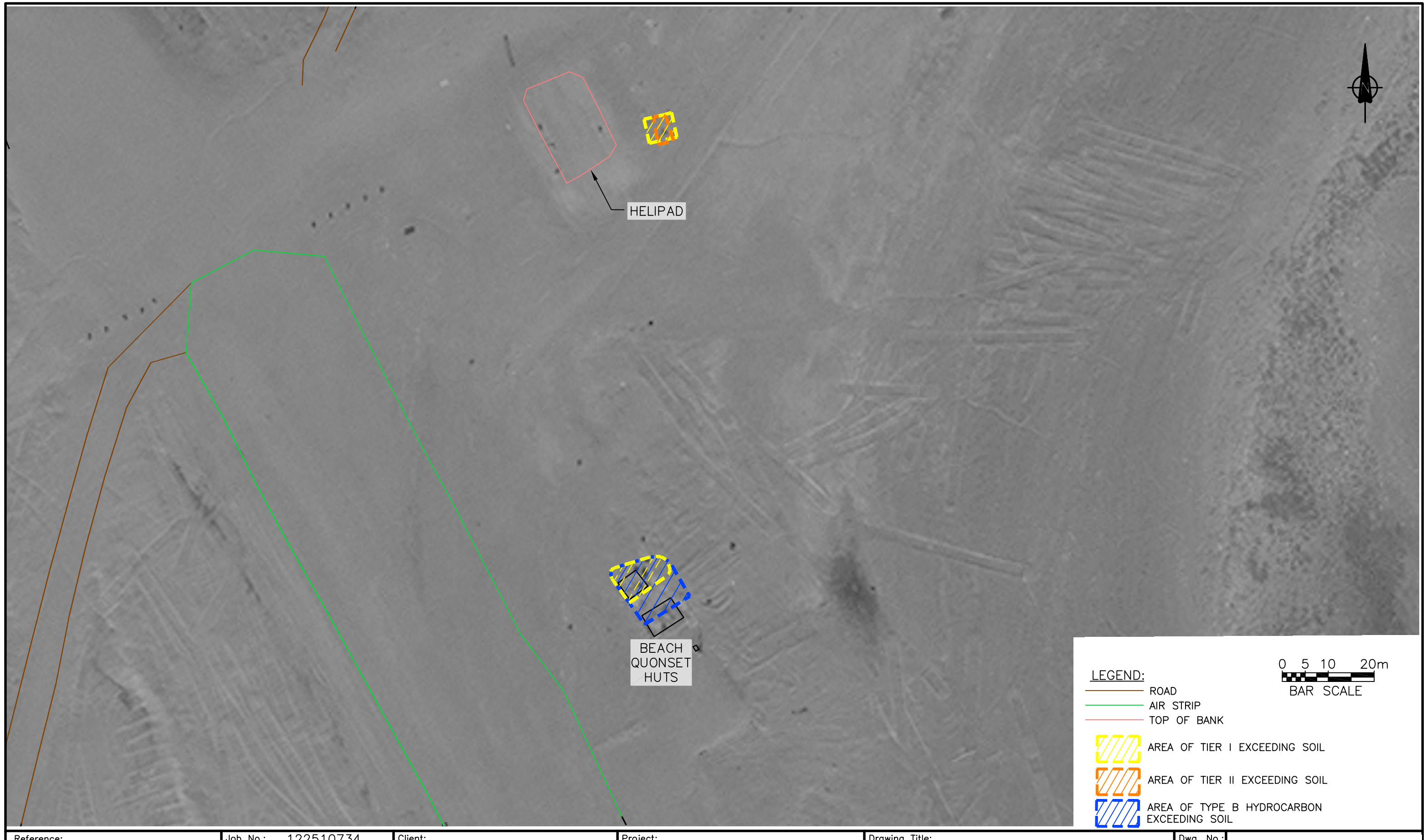

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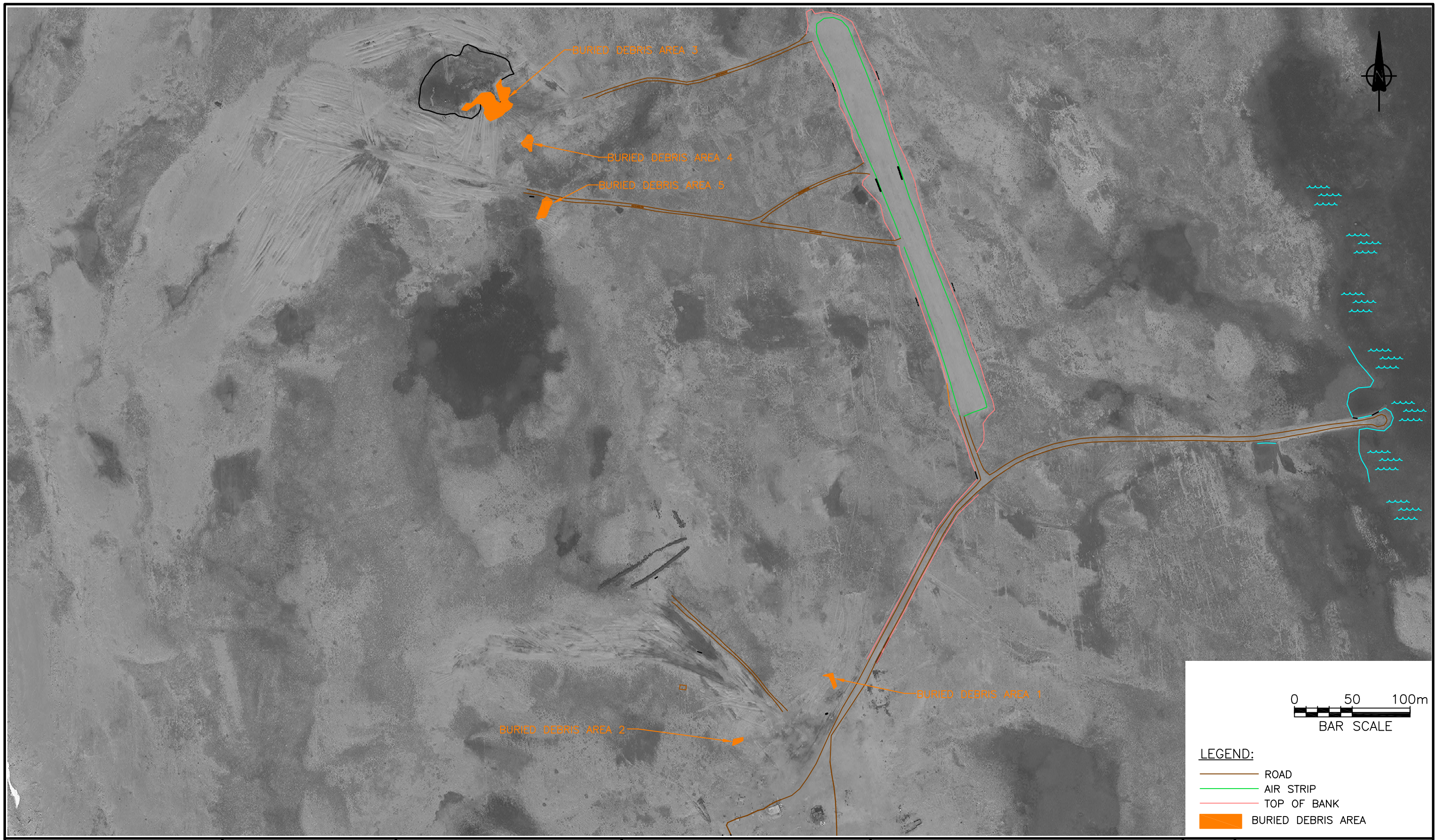

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Reference:	Job No.: 122510734 Scale: 1:1000 Date: 2013/12/12 Dwn. By: P.J.SOO App'd By:	Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA Site Address: CAM–E (KEITH BAY), NUNAVUT	Project: REMEDIAL ACTION PLAN	Drawing Title: BURIED DEBRIS IN AREA 2	Dwg. No.: R18

Stantec

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POTENTIAL BORROW SOURCE 8 (21,441m²)

POTENTIAL BORROW SOURCE 4 (21,441m²)

POTENTIAL LANDFILL/ LANDFARM SITE 5 (57,905m²)

POTENTIAL LANDFILL/ LANDFARM SITE 4 (96,580m²)

POTENTIAL BORROW SOURCE 7 (15,237m²)

POTENTIAL LANDFILL/LANDFARM SITE 3 (27,818m²)

ACCESS ROADWAY

POTENTIAL BORROW SOURCE 6 (17,768m²)

FORMER CAT TRAIN PATH

POTENTIAL BORROW SOURCE 5 (12,030m²)

POTENTIAL LANDFILL/ LANDFARM SITE 2 (26,188m²)

POTENTIAL BORROW SOURCE 4 (26,188m²)

POTENTIAL BORROW SOURCE 3 (26,542m²)

EXISTING AIRSTRIP

POTENTIAL BORROW SOURCE 1 (43,422m²)

POTENTIAL BORROW SOURCE 2 (64,307m²)

POTENTIAL LANDFILL/ LANDFARM SITE 1 (46,895m²)

LEGEND:

ROAD
AIR STRIP
TOP OF BANK
LANDFILL LOCATION
BORROW SOURCE LOCATION

0 100 200 400m
BAR SCALE

BORROW SOURCES AND LANDFILL LOCATIONS REMEDIAL ACTION PLAN

CAM–E (KEITH BAY), NUNAVUT

Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Job No.:	122510734
Scale:	1:15000
Date:	2013/12/12
Dwn. By:	P.J.SOO
App'd By:	

Dwg. No.: R19

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Appendix B Photographs

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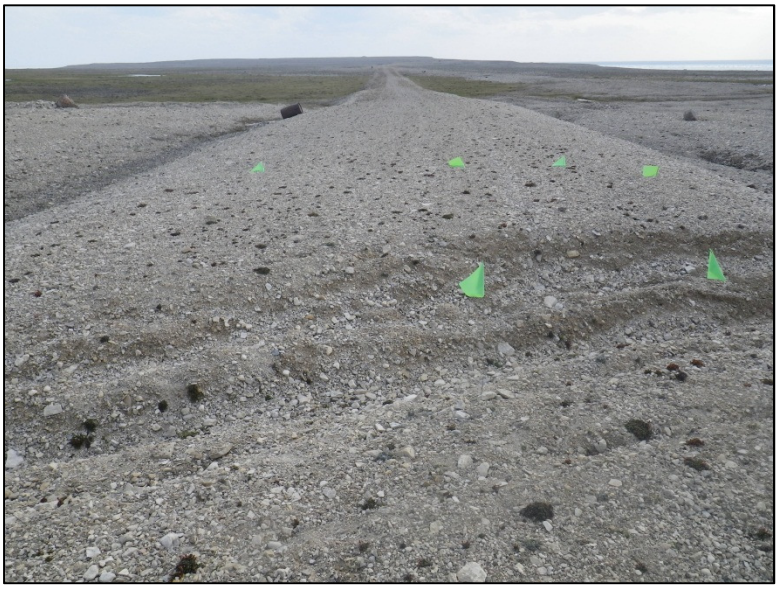

Photo 1: Washout of main access roadway between Area 1 and Area 2; south aspect.

Photo 2: Washout of main access roadway between Area 1 and Area 2; west (downstream) aspect.

Photo 3: Washout of main access roadway between Area 1 and Area 2; east (upstream) aspect.

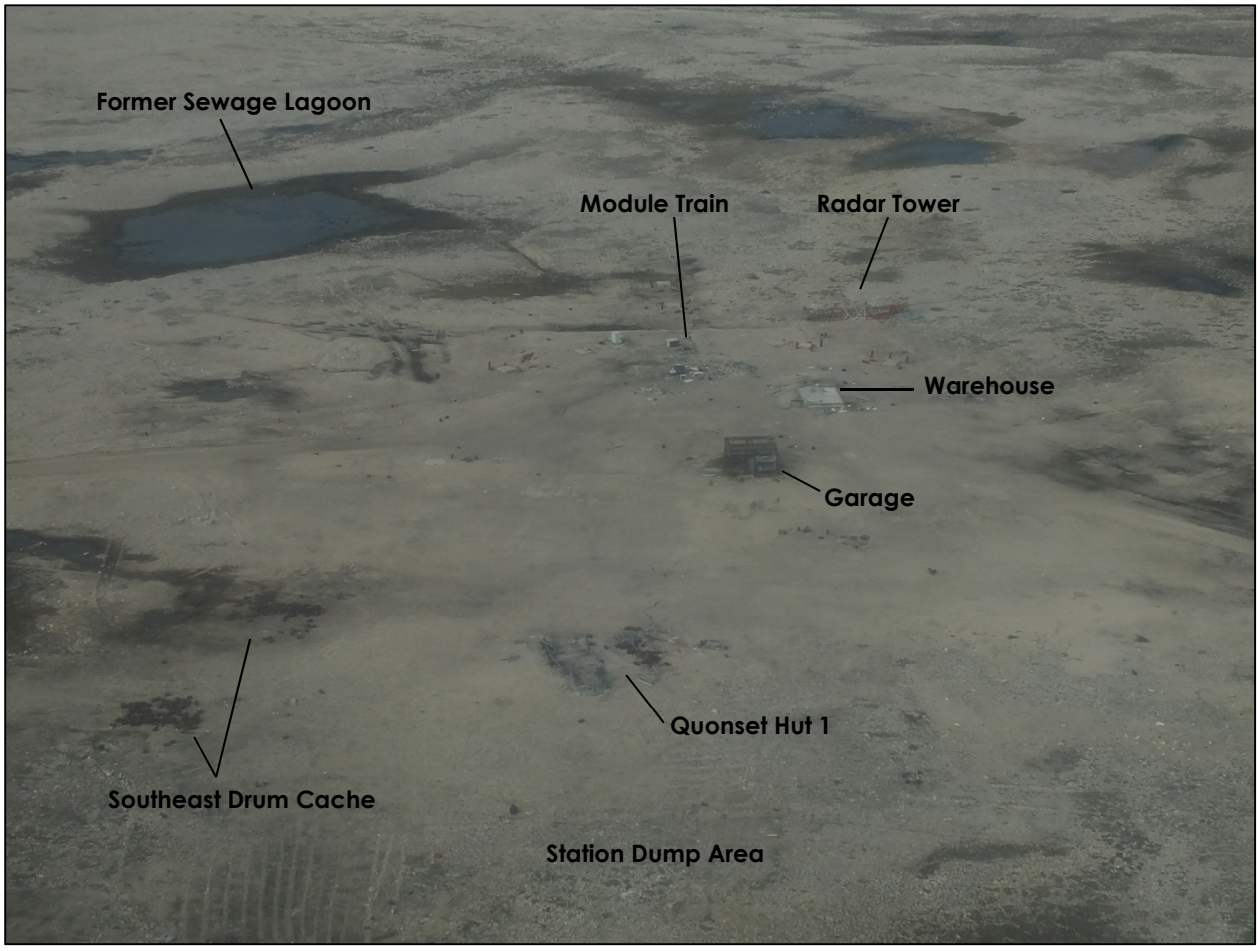

Photo 4: Overview of Area 1 Main Station Area with remaining infrastructure and dump areas; west aspect.

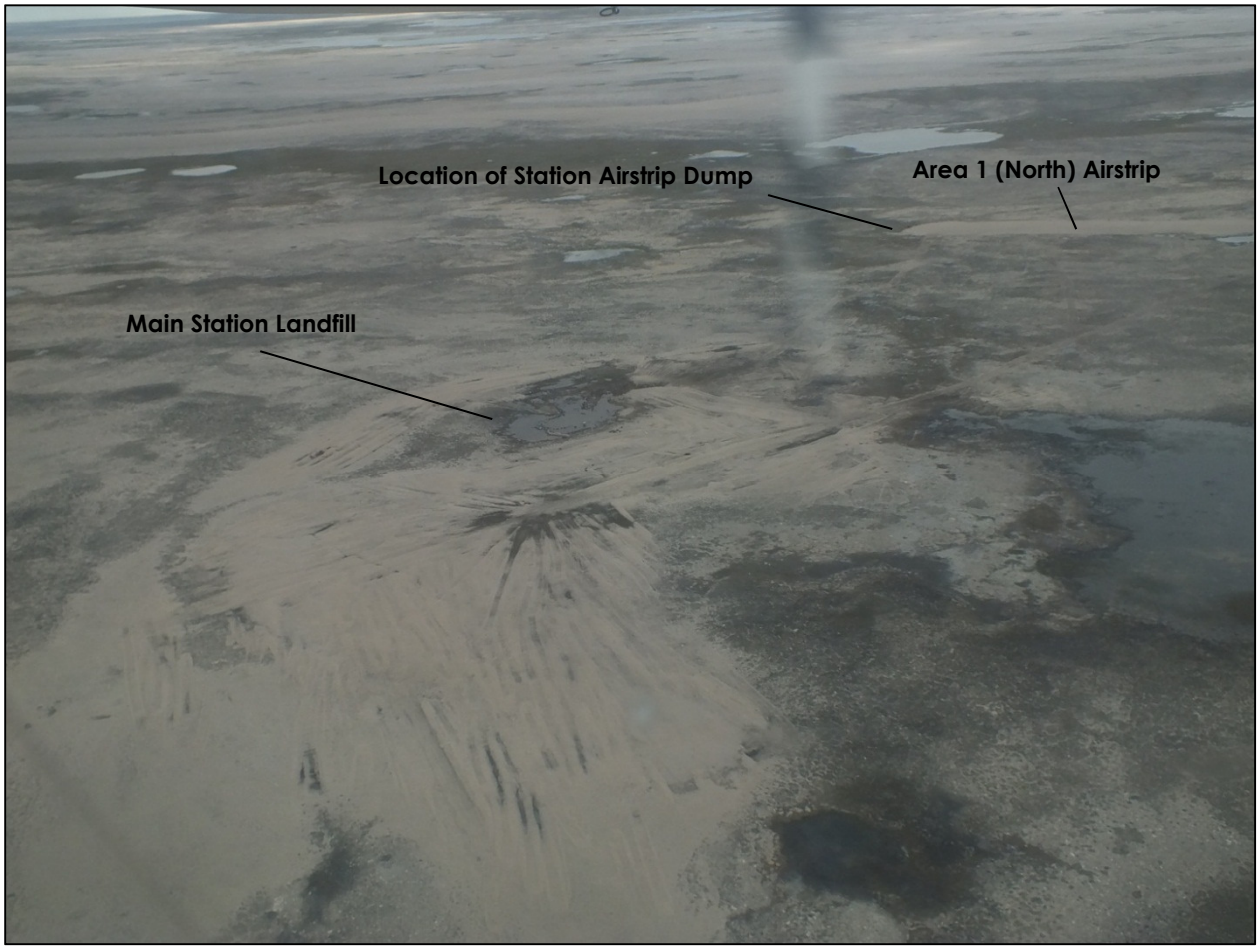

Photo 5: **Overview of Area 1 Main Station Landfill with Area 1 (North) airstrip and location of Station Airstrip Dump; east aspect. Note small pond in the center of the Main Station Landfill and wetland along the south edge.**

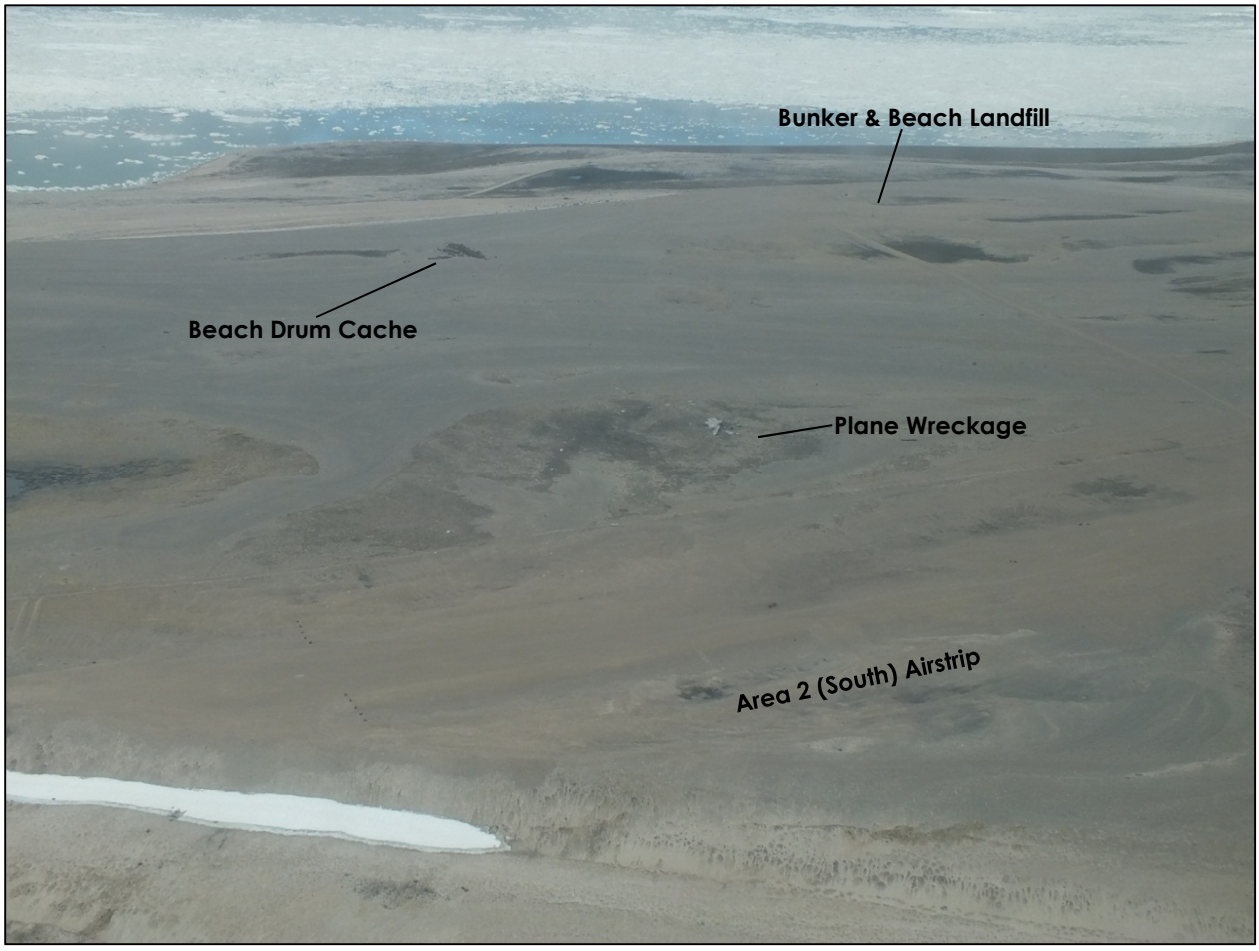

Photo 6: **Overview of Area 2 with airstrip, plane wreckage, beach drum cache, and bunker and beach landfill; west aspect. Note heavy ice in Keith Bay (marine) in background.**

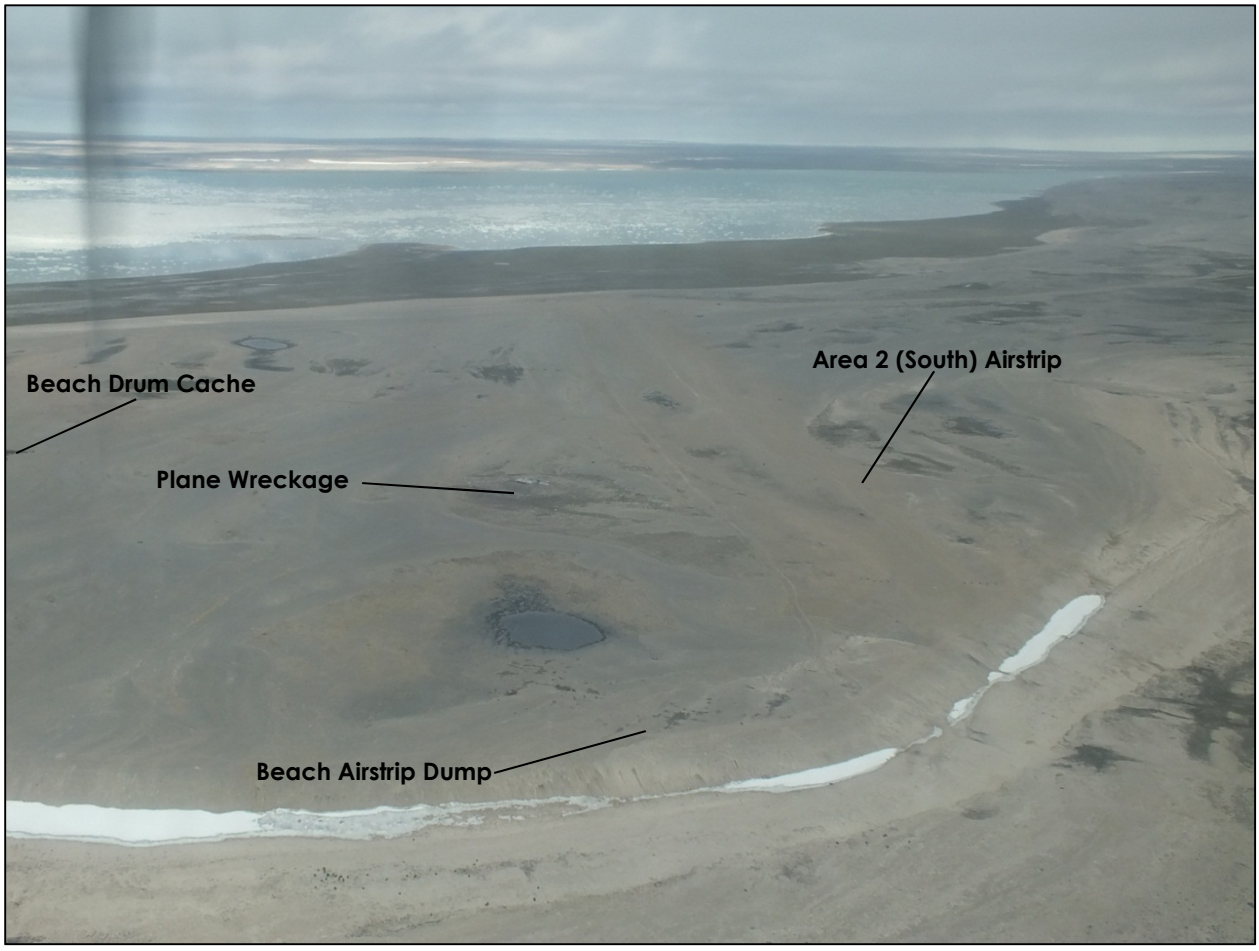

Photo 7: **Overview of Area 2 with airstrip, plane wreckage, beach drum cache, and beach airstrip dump; northwest aspect. Note heavy ice in Keith Bay (marine) in background.**

Photo 8: Area of Potential Borrow Source No. 1, located in Area 2; north aspect.

Photo 9: Area of Potential Borrow Source No. 3, located between Area 1 and Area 2; south aspect.

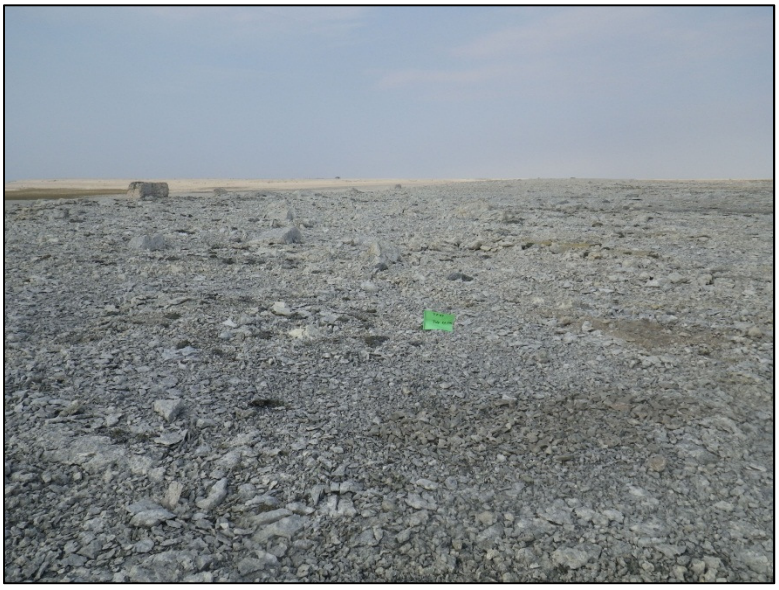

Photo 10: Area of Potential Borrow Source No. 4, located between Area 1 and Area 2; east aspect.

Photo 11: Area of Potential Borrow Source No. 5, located between Area 1 and Area 2; south aspect.

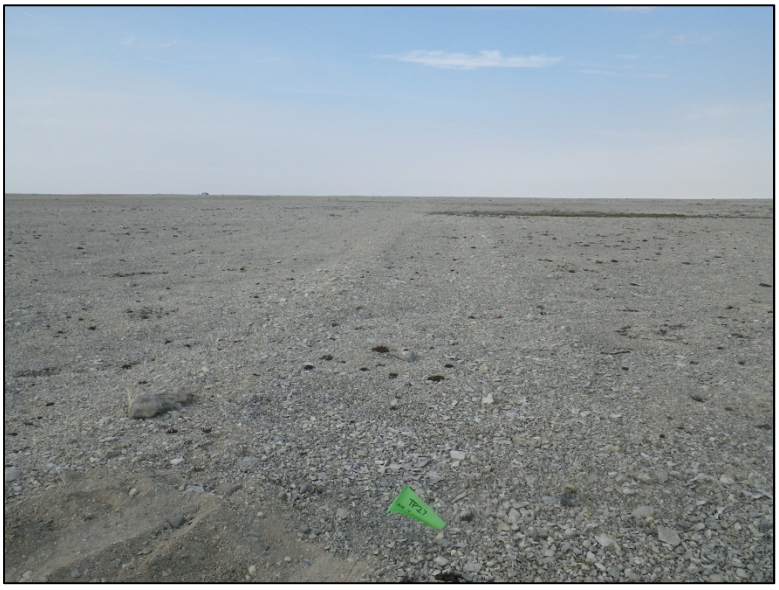

Photo 12: Area of Potential Borrow Source No. 6, located between Area 1 and Area 2; north aspect.

Photo 13: Area of Potential Borrow Source No. 8, located in Area 1 near the Main Station Landfill; north aspect.

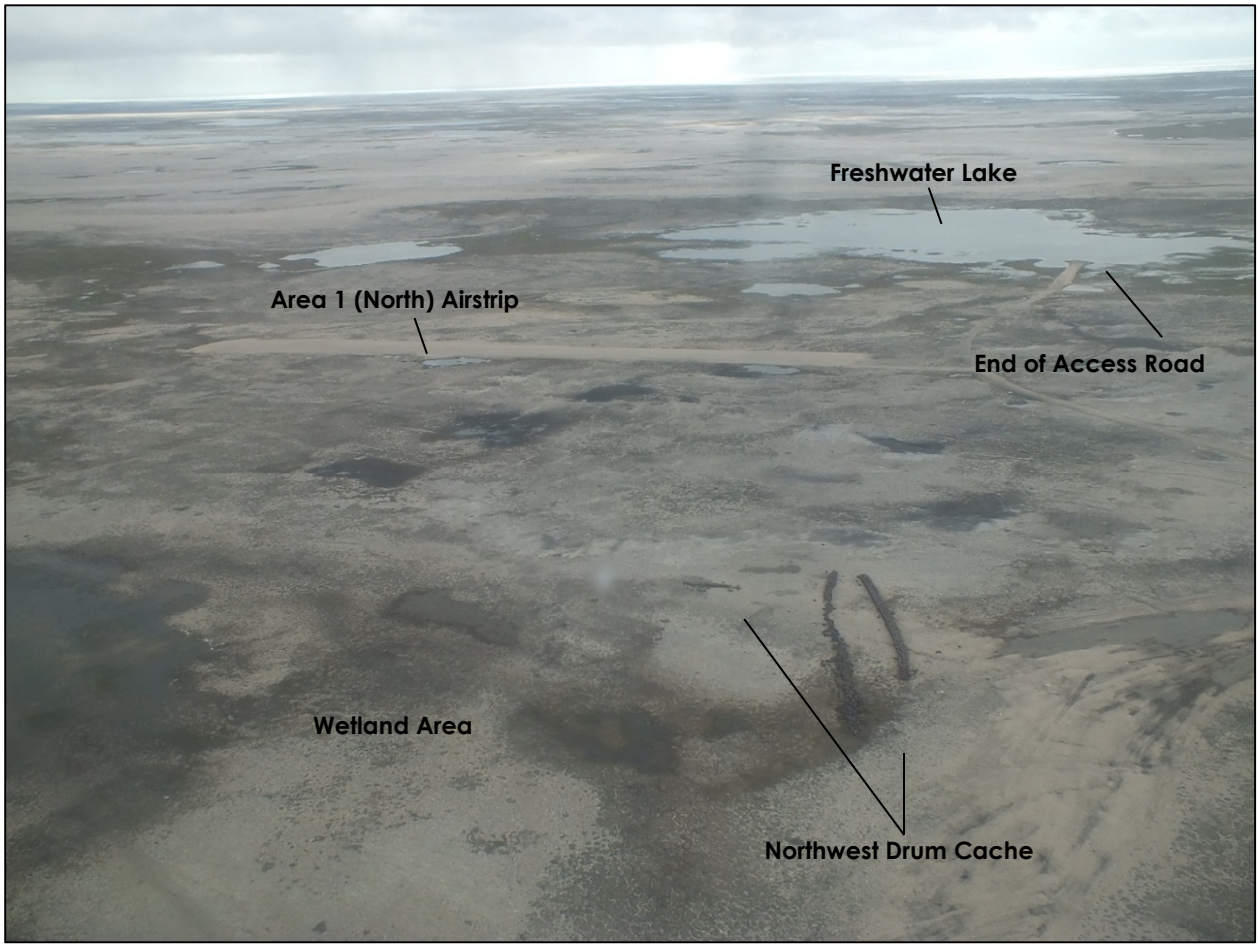

Photo 14: Overview of the Freshwater Lake and nearby infrastructure/areas; east aspect. Note the access road that extends into the lake.

Photo 15: Shoreline of the Freshwater Lake; north aspect from road built into the lake.

Photo 16: Shoreline of the Freshwater Lake and end of the access road; east aspect from road built into the lake.

Photo 17: Shoreline of the Freshwater Lake; south aspect from road built into the lake.

Photo 18: Typical substrate of the Freshwater Lake.

Photo 19: Pond within the Main Station Landfill, note scattered debris throughout; west aspect.

Photo 20: Pond within the Main Station Landfill, note scattered debris throughout; east aspect.

Photo 11: Wetland area south of the Main Station Landfill; east aspect from northern edge of wetland.

Photo 22: Wetland area south of the Main Station Landfill; south aspect from northern edge of wetland.

Photo 23: End-of-pipe area in the former Sewage Lagoon Area; west aspect. Note pond downstream from end-of-pipe area.

Photo 24: South edge of former Sewage Lagoon Area; north aspect. Note Main Station in background.

Photo 25: Area of NHW Landfill (Potential Landfill/Landfarm Site 5) with small pond; east aspect.

Photo 26: Overview of the Beach Airstrip Dump in Area 2 with small pond nearby (approximately 50 m north of dump site); northeast aspect.

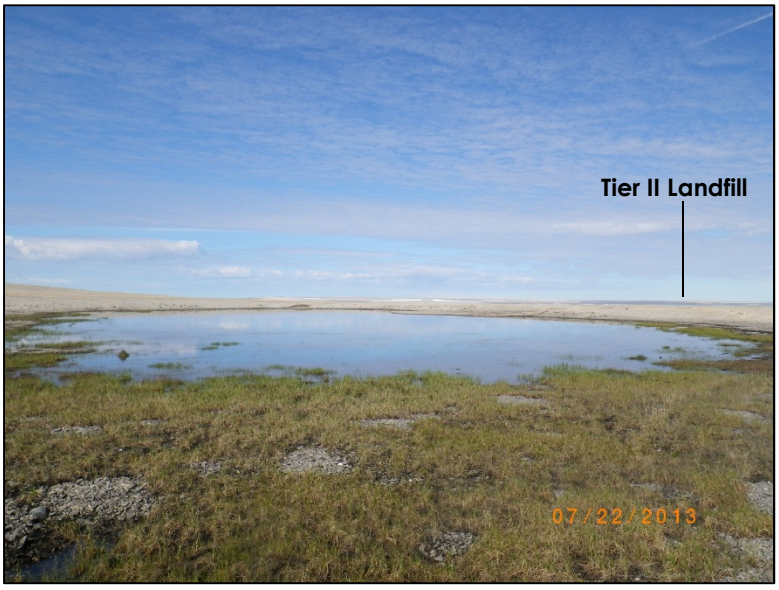

Photo 27: Small pond near the Tier II Landfill (Potential Landfill/Landfarm Site 1), situated approximately 50 m from south edge of the site; northwest aspect. Note proposed location for Tier II Landfill in background.

Appendix C List of Vegetation and Wildlife Species at the former CAM-E DEW Line Site

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Table C-1: Vegetation Species Identified at the Former CAM-E DEW Line site, Keith Bay, Nunavut

English Name	Latin Name	Territorial Ranking[1]	Survey[2]
Polargrass species	*Arctagrostis* spp.	Secure	1
Foxtail	*Alopecurus alpinus*	Secure	1
Water sedge	*Carex aquatilis*	Secure	1, 2
Dark-brown sedge	*Carex atrofusca*	Secure	1
Fragile sedge	*Carex membranacea*	Secure	1
Short-leaved sedge	*Carex fuliginosa* ssp. *misandra*	Secure	1
Sedge species	*Carex* spp.	-	2
Cuckoo flower	*Cardamine pratensis*	Secure	1
Alpine chickweed	*Cerastium alpinum*	Secure	1
Mouse-ear chickweed	*Cerastium arvense*	Undetermined	2
Chickweed species	*Cerastium* spp.	-	1
Entire-leaved daisy	*Chrysanthemum integrifolium (Leucanthemum integrifolium)*	Secure	1
Common Scurvy-grass	*Cochlearia officinalis*	-	2
Cushioned whit-low grass	*Draba corymbosa*	Secure	2
Whit-low grass species	*Draba* spp.	-	1
Mountain avens	*Dryas integrifolia*	Secure	2
Avens species	*Dryas* spp.	-	1
Wheatgrass species	*Elymus* spp.	-	2
Variegated horsetail	*Equisetum variegatum*	Secure	1
Narrow-leaved cotton-grass	*Eriophorum angustifolium*	Secure	1
Scheuchzer's cotton-grass	*Eriophorum Scheuchzeri*	Secure	1, 2
Tussock cotton-grass	*Eriophorum vaginatum*	Secure	2
Cotton-grass species	*Eriophorum* spp.	-	1
Edwards' mock wallflower	*Eutrema edwardsii*	Secure	1
Fescue species	*Festuca* spp.	-	1
Rush species	*Juncus* spp.	-	1, 2
Arctic wood rush	*Luzula nivalis (Luzula arctica)*	Secure	1
Arctic poppy	*Papaver radicatum*	Undetermined	1, 2
Poppy species	*Papaver* spp.	-	1, 2
Wooly lousewort	*Pedicularis lanata*	Secure	1, 2
Lousewort species	*Pedicularis* spp.	-	1
Alpine bluegrass	*Poa alpina*	Secure	1
Arctic bluegrass	*Poa arctica*	Secure	1
Glaucous bluegrass	*Poa glauca*	Secure	1
Bluegrass species	*Poa* spp.	-	1, 2
Bistort	*Polygonum viviparum*	Secure	1, 2
Sulphur buttercup	*Ranunculus sulphureus*	Secure	2
Arctic willow	*Salix arctica*	Secure	1, 2
Willow species	*Salix* spp.	-	1, 2
Tufted saxifrage	*Saxifraga caespitosa*	Secure	1
Nodding saxifrage	*Saxifraga cernua*	Secure	2
Yellow-marsh saxifrage	*Saxifraga hirculus*	Secure	1
Purple mountain saxifrage	*Saxifraga oppositifolia*	Secure	2
Prickly saxifrage	*Saxifraga tricuspidata*	Secure	2
Purple-bladder campion	*Silene uralensis*	Secure	2
Long-stalked starwort	*Stellaria monantha (Stellaria longipes)*	Secure	1
Reindeer lichen species	*Clandina* spp.	-	2
Lichens (fruticose)	n/a	-	2
Lichens (foliose)	n/a	-	2
Moss	n/a	-	1, 2

NOTES:

1. Territorial Ranking from CESCC (2011)
2. Surveys and dates conducted include:
   1 = ESG (July/August 1994)
   2 = Stantec (July 2013)

Table C-2: Terrerstrial and Marine Mammal Species which may occur At or Near the Former CAM-E DEW Line site, Keith Bay, Nunavut

English Name	Latin Name	Territorial Ranking[1]	COSEWIC Status[2]
Terrestrial Mammals			
Arctic Fox	*Vulpes lagopus*	Secure	-
Arctic Ground Squirrel	*Spermophilus parryii*	Secure	-
Arctic Hare	*Lepus arcticus*	Secure	-
Barren-ground Shrew	*Sorex ugyunak*	Undetermined	-
Barren-ground Caribou	*Rangifer tarandus groenlandicus*	Secure	-
Ermine	*Mustela erminea*	Secure	-
Grizzly Bear	*Ursus arctos*	Sensitive	Special Concern
Meadow Vole	*Microtus pennsylvanicus*	Secure	-
Muskox	*Ovibos moschatus*	Secure	-
Nearctic Brown Lemming	*Lemmus trimucronatus*	Secure	-
Nearctic Collared Lemming	*Dicrostonyx groenlandicus*	Secure	-
Northern Red-backed Vole	*Myodes rutilus*	Secure	-
Red Fox	*Vulpes vulpes*	Secure	-
Richardson's Collared Lemming	*Dicrostonyx richardsoni*	Secure	-
Root Vole	*Microtus oeconomus*	Undetermined	-
Snowshoe Hare	*Lepus americanus*	Sensitive	-
Northern Grey Wolf	*Canis lupus occidentalis*	Secure	Not at Risk
Wolverine	*Gulo gulo*	Secure	Special Concern
Marine Mammals			
Polar Bear	*Ursus maritimus*	Sensitive	Special Concern

NOTES:

1. Territorial Ranking from CESCC (2011)
2. Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status from SARPR (2013)

Table C-3: Avifauna Species which may occur At or Near the Former CAM-E DEW Line site, Keith Bay, Nunavut

English Name	Latin Name	Migration Habit	Territorial Ranking[1]	COSEWIC Status[2]
Common Redpoll	*Acanthis flammea*	Migratory	Secure	-
Hoary Redpoll	*Acanthis hornemanni*	Migratory / Resident	Sensitive	-
Northern Pintail	*Anas acuta*	Migratory	Secure	-
Greater White-fronted Goose	*Anser albifrons*	Migratory	Secure	-
American Pipit	*Anthus rubescens*	Migratory	Sensitive	-
Ruddy Turnstone	*Arenaria interpres*	Migratory	Sensitive	-
Brant	*Branta bernicla*	Migratory	Secure	-
Canada Goose	*Branta canadensis*	Migratory	Secure	-
Snowy Owl	*Bubo scandiacus*	Resident	Secure	Not at Risk
Rough-legged Hawk	*Buteo lagopus*	Migratory	Sensitive	Not at Risk
Lapland Longspur	*Calcarius lapponicus*	Migratory	Secure	-
Sanderling	*Calidris alba*	Migratory	Sensitive	-
Dunlin	*Calidris alpina*	Migratory	Sensitive	-
Baird's Sandpiper	*Calidris bairdii*	Migratory	Secure	-
Red Knot	*Calidris canutus rufa*	Migratory	At Risk	Endangered
White-rumped Sandpiper	*Calidris fuscicollis*	Migratory	Secure	-
Purple Sandpiper	*Calidris maritima*	Migratory	Secure	-
Semipalmated Sandpiper	*Calidris pusilla*	Migratory	Sensitive	-
Semipalmated Plover	*Charadrius semipalmatus*	Migratory	Secure	-
Snow Goose	*Chen caerulescens*	Migratory	Secure	-
Ross's Goose	*Chen rossii*	Migratory	Secure	-
Long-tailed Duck	*Clangula hyemalis*	Migratory	Sensitive	-
Common Raven	*Corvus corax*	Resident	Secure	-
Tundra Swan	*Cygnus columbianus*	Migratory	Secure	-
Horned Lark	*Eremophila alpestris*	Migratory	Secure	-
Peregrine Falcon	*Falco peregrinus anatum/tundrius*	Migratory	Secure	Special Concern
Gyrfalcon	*Falco rusticolus*	Resident	Sensitive	Not at Risk
Yellow-billed Loon	*Gavia adamsii*	Migratory	Secure	Not at Risk
Pacific Loon	*Gavia pacifica*	Migratory	Secure	-
Red-throated Loon	*Gavia stellata*	Migratory	Secure	-
Sandhill Crane	*Grus canadensis*	Migratory	Secure	-
Willow Ptarmigan	*Lagopus lagopus*	Resident	Secure	-
Rock Ptarmigan	*Lagopus muta*	Resident	Secure	-
Glaucous Gull	*Larus hyperboreus*	Migratory	Sensitive	-
Thayer's Gull	*Larus thayeri*	Migratory	Sensitive	-
Savannah Sparrow	*Passerculus sandwichensis*	Migratory	Secure	-
Red Phalarope	*Phalaropus fulicarius*	Migratory	Sensitive	-
Red-necked Phalarope	*Phalaropus lobatus*	Migratory	Sensitive	-
Snow Bunting	*Plectrophenax nivalis*	Migratory	Sensitive	-
American Golden-Plover	*Pluvialis dominica*	Migratory	Sensitive	-
Black-bellied Plover	*Pluvialis squatarola*	Migratory	Sensitive	-
Common Eider	*Somateria mollissima*	Migratory	Sensitive	-
King Eider	*Somateria spectabilis*	Migratory	Sensitive	-
Long-tailed Jaeger	*Stercorarius longicaudus*	Migratory	Secure	-
Parasitic Jaeger	*Stercorarius parasiticus*	Migratory	Secure	-
Pomarine Jaeger	*Stercorarius pomarinus*	Migratory	Secure	-
Common Tern	*Sterna hirundo*	Migratory	Undetermined	-
Arctic Tern	*Sterna paradisaea*	Migratory	Sensitive	-
Sabine's Gull	*Xema sabini*	Migratory	Secure	-
White-crowned Sparrow	*Zonotrichia leucophrys*	Migratory	Sensitive	-

NOTES:

1. Territorial Ranking from CESCC (2011)
2. Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status from SARPR (2013)

Appendix D Draft Spill Contingency Plan

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Draft Spill Contingency Plan for Remediation at the former CAM-E DEW Line Site, Keith Bay, NU

Draft

Prepared for:
Public Works and Government Services Canada
500, 10025 Jasper Avenue
Edmonton, AB T5J 1S6

Prepared by:
Stantec Consulting Ltd.
5021 – 49 Street
Yellowknife, NT X1A 2N4

March 31, 2014

Revision Record							
Revision	**Description**	**Prepared By**		**Checked By**		**Approved By**	
0	Original	Feb. 14/14	VG	Mar. 31/14	CS		

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Abbreviations

masl	metres above sea level
AANDC	Aboriginal Affairs and Northern Development Canada
ATV	All-terrain vehicle
Contractor	The remedial contractor (to be selected)
DEW	Distant Early Warning
INAC	Indian and Northern Affairs (now AANDC)
PCBs	Polychlorinated biphenyls
PHC	Petroleum hydrocarbons
POL	Petroleum, oil and lubricant
PWGSC	Public Works and Government Services Canada
SCP	Spill Contingency Plan
Site	The former CAM-E DEW Line site

1.0 Introduction

This draft Spill Contingency Plan (SCP) has been developed for use by Public Works and Government Services (PWGSC), Aboriginal Affairs and Northern Development Canada (AANDC) and the remedial contractor (the Contractor) during the remediation of the former CAM-E Distant Early Warning (DEW) Line site, near Keith Bay, Nunavut (the Project). The CAM-E site is located on the eastern shore of the Simpson Peninsula at Cape Barclay (68° 15' 45" N, 88° 8' 38" W) near the shores of Keith Bay, in the Gulf of Boothia (see Figure 1-1). Remedial activities will generally include excavation of identified borrow sources, and of contaminated soil; disposal or treatment of contaminated soil, as well as appropriate disposal of hazardous and non-hazardous wastes. Mobilization via winter access trail and cat train is tentatively scheduled to begin in February/March 2016 with remedial activities occurring during the summer months in 2016, 2017 and 2018, and demobilization in February/March 2019.

The purpose of the draft SCP is to provide a guide to all site personnel in the event of an accidental release of fuel or other waste during the Project. The SCP provides the protocols for personnel to follow in response to a spill. All persons involved with the Project should read and be familiar with the SCP. To be effective, it is important that all personnel are familiar with their responsibilities and steps to take in the event of a spill. Personnel should not read the SCP for the first time during an emergency.

This draft SCP has been developed for the Project and regulatory approvals in accordance with the *Guidelines for Spill Contingency Planning* prepared by Indian and Northern Affairs Canada (INAC 2007) and the Spill Contingency Planning and Reporting Regulations issued under the territorial *Environmental Protection Act*. The Contractor completing the remedial work (including the winter access trail) will be required to submit a detailed SCP which meets or exceeds the commitments in this draft SCP prior to Project start-up. Once approved by PWGSC and AANDC, the Contractor's SCP will be submitted to the appropriate regulatory authorities.

In the absence of the Contractor's SCP at this time, the effective date of this draft SCP is March 1, 2016. The draft SCP will be updated and revised to reflect site-specific conditions, as needed.

LEGEND:

SITE

NOTE:
- CO-ORD SYSTEM: CANADA LAMBERT CONFORMAL CONIC
- BASE FEATURES PRODUCED BY ESRI

GENERAL SITE LOCATION
REMEDIAL ACTION PLAN
CAM-E (KEITH BAY), NUNAVUT

Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Job No.:	122510734
Scale:	BAR SCALE
Date:	2013/12/12
Dwn. By:	P.J.SOO
App'd By:	

Dwg. No.: 1-1

Stantec

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2.0 Project Details

The Site is comprised of two areas: Area 1 (north portion of the Site) and Area 2 (south portion of the Site); an existing access road connects the two areas (see Figure 2-1). Remediation of the former CAM-E DEW Line site (the Site), involves the following:

- Construction of a temporary winter access trail for mobilization and demobilization to/from the Site via cat train.
- Construction of two new landfill containment cells.
- Construction of a temporary Staging Area at the Site for the purpose of handing wastes requiring off-site disposal.
- Construction of a Treatment Cell for the treatment of Type B hydrocarbon-contaminated soil using Biopiles.
- Construction and operation of borrow sources.
- Set-up of temporary camps (two winter camps and one summer camp) including water treatment system to supply potable water.
- Collection, segregation, transportation and off-site disposal of hazardous waste.
- Collection, segregation and on-site disposal of non-hazardous waste within one of the landfill containment cells.
- Excavation, transportation, and on-site disposal of Tier I and Tier II contaminated soil.
- Excavation, transportation, and on-site disposal of Type A and Type B contaminated soil.
- Collection, cleaning, crushing and on-site disposal of drums; clean drums will be disposed of in the on-site landfill containment cell while any drum contents will be collected and disposed of appropriately.
- Treatment of contaminated water (generated during equipment/drum rinsing, and contact water in excavations).
- Backfilling excavated areas and final grading to match contours.
- Landfill containment cell closure and placement of final cover.
- Operation of Biopiles and closure of the Treatment Cell.
- Post-closure monitoring.

Construction of the winter access trail and mobilization via cat train are tentatively scheduled to take place during February/March 2016. All on-site construction and remedial activities will take place during June to September 2016, 2017 and 2018. Demobilization will occur via winter access trail and cat train during February/March 2017.

Project activities require the use of heavy equipment for borrow source and contaminated soil excavation, construction of Project facilities, and transportation of soil, granular materials, and wastes. Workers for remedial activities will be housed in a temporary camp on the Site. Two temporary camps will be associated with the winter access trail; one at the Site and the other at a location to be determined.

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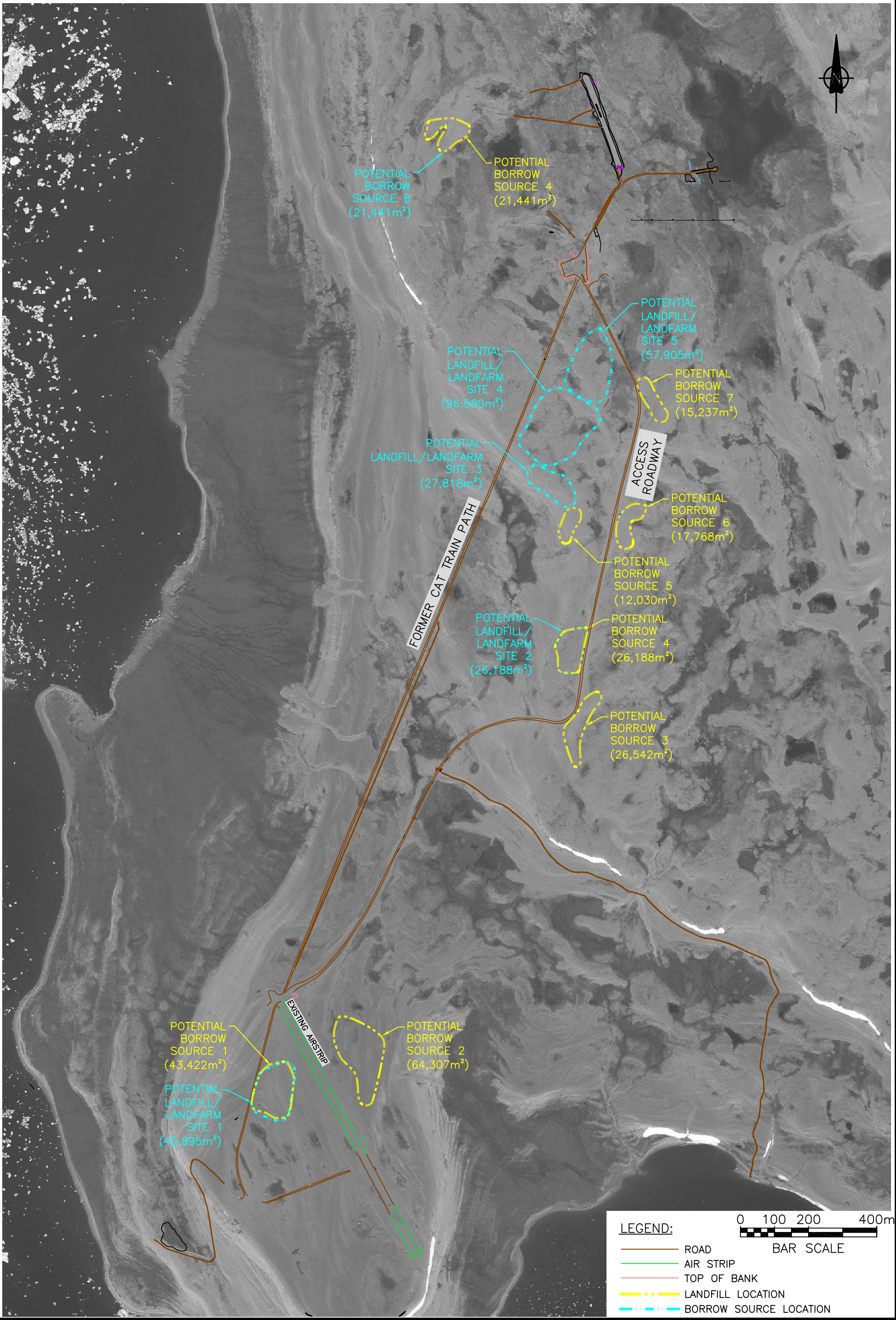

BORROW SOURCES AND LANDFILL LOCATIONS REMEDIAL ACTION PLAN

CAM–E (KEITH BAY), NUNAVUT

Client:	PUBLIC WORKS AND GOVERNMENT SERVICES CANADA
Job No.:	122510734
Scale:	1:15000
Date:	2013/12/12
Dwn. By:	P.J.SOO
App'd By:	
Dwg. No.:	2-1

Stantec

2.1 SITE DESCRIPTION

Surficial geology at the Site consists of marine sediments, primarily gravel and sand, with 1 to 5 m thick ridge and swale formations (GSC 1985). Granular materials at the potential borrow sources are generally well-drained and include: well-graded sands and gravel with < 5% fines; well-graded sands and gravel with <10% fines; sands and gravel with < 20% fines; and granular soil with ≥ 20% fines (Stantec 2013). The area is dominated by mineral static cryosol soils with continuous permafrost and abundant ice wedges (ESWG 1995). At the Site, ground ice was typically encountered between 0.4 to 1.0 m below the surface, depending on the terrain and landform (Stantec 2013).

Vegetation at the Site is sparse and intermittent in upland areas, primarily occurring in tufts or as individual plants on the rocky talus. Upland vegetation was primarily comprised of purple saxifrage, mountain avens (*Dryas integrifolia*), willows (*Salix* spp.), Arctic poppy (*Papaver radicatum*), cushioned whit-low grass (*Draba corymbosa*) and lichens. Within wetlands, or around areas with ponded water, vegetation was more abundant and typically included buttercup species (*Ranunculus* spp.), Arctic cottongrass (*Eriophorum vaginatum*), purple bladder-campion (*Melandrium apetalum*), willows, rushes (*Juncus* spp.), sedge, grass, and moss.

At the Site, surface waters include small freshwater ponds, ephemeral and non-ephemeral streams, and the marine waters of Keith Bay. The marine waters of Keith Bay will not be affected by Project activities; works will be limited to Area 1 and Area 2 only, as well as the existing road between the two areas. Several small freshwater waterbodies are located near areas were remediation activities will occur.

2.2 POTENTIAL CONTAMINANTS

Over the course of the Project, several materials may be used or generated that could potentially be contaminants if released to the environment; this includes:

- Fuels – gasoline and diesel
- Lubricating oils and grease
- Hydraulic and motor oil
- Antifreeze and other coolants
- Drilling fluids – bentonite
- Drill cuttings
- Contaminated soil, water, snow
- Sewage.

At the date of this draft SCP, the volume of fuel and other potential contaminants required for the Project is unknown. This will updated following the detailed design phase of the Project, and once the Contractor is selected. The exact equipment used will also be selected by the Contractor, however the anticipated equipment required for Project activities are outlined in Table 2-1.

Table 2-1: Anticipated equipment required for remediation of the former CAM-E DEW Line site, Keith Bay, Nunavut

Type	Proposed Use
Excavator, dozers, graders and loaders	Excavating, transporting, placing and compacting of granular material and/or wastes
Water truck	Dust suppression
Haul/dump trucks	Transporting loads of granular material for construction of Project facilities, as well as transportation of contaminated soil and/or wastes
Pick-up trucks and all-terrain vehicles (ATVs)	Crew transportation around the Site; manual remedial work (i.e., drum collection in sensitive areas)
Incinerators	Burning combustible wastes, including domestic waste
Generators	Camp operation and some specific remedial activities
Fuel truck	Fuelling equipment and camp facilities
Water treatment system	Treatment of potable water
Contaminated water treatment system	Treatment of contaminated water
Water storage tanks	Storage of untreated and treated water
Tracked ATVs (e.g., Hagglunds)	Opening the winter access trail and transporting crew during the winter operations
Tracked grooming equipment (e.g., snowmobiles, snow groomer)	Winter trail maintenance and trail breaking
Tracked heavy equipment (e.g., Challenger tractor)	Winter transportation of sleds loaded with equipment to Site (during mobilization and demobilization)

As Project activities are occurring in the both the winter and the summer, contaminant spills may occur on snow or ice, on cleared/previously disturbed land at the Site, and natural land at the Site. Spills may result from any of the following occurrences:

- Leaks or ruptures of fuel storage drums or tanks
- Valve or line failure in systems, vehicles or heavy equipment
- Heat expansion due to overfilling or improper storage
- Improper storage or contaminants
- Vehicular accidents
- Spill during transfer of contaminant(s)
- Vandalism.

3.0 Response Organization

A qualified company with experience in northern construction and remediation will manage execution of the Project. The Contractor will be identified through a public tender process. The Contractor, once selected, will be responsible for preparing and implementing a detailed SCP during the entire Project duration.

Whenever a spill is identified, the Contractor and the AANDC/PWGSC site representative will be contacted as soon as possible. Contact information for AANDC and PWGSC are provided in Table 3-1 below; the table will be updated following selection of the Contractor.

Table 3-1: Spill Contingency Contacts for Remediation of the Former CAM-E DEW Line Site, Keith Bay, Nunavut

Contact	Contact Numbers
AANDC: Dele Morakinyo Project Manager Contaminated Sites Program Aboriginal Affairs and Northern Development Canada 1000, 25 Eddy Street Gatineau, PQ K1A 0H4	Phone: (819) 934 9224 Cell: Fax: (819) 934 9229 Email:
PWGSC: Matthew McElwaine Senior Environmental Engineer Northern Contaminated Sites Public Works and Government Services Canada 500, 10025 Jasper Avenue Edmonton, AB T5J 1S6	Phone: (780) 497-3690 Cell: Fax: (780) 497-3842 Email: matthew.mcelwaine@pwgsc-tpsgc.gc.ca
Remedial Contractor: To be determined	Phone: Cell: Fax: Email:

4.0 Initial Actions

The following actions should be taken by the first person(s) who identifies a spill:

1. Be alert and considerate of your safety and of those around you.
2. If possible, identify the spilled contaminant.
3. Assess the hazard to persons in the area of the spill.
4. If possible, without further assistance, control any danger to human life or the environment.
5. Assess whether the spill can be readily stopped or brought under control.
6. If safe to do so, and if possible, try to stop the spillage of contaminant.
7. Gather information about the status of the situation.
8. Report the spill immediately to the Contractor or the AANDC site representative who will report the spill to the 24-Hour Emergency Spill Report Line – **(867) 920-8130**.
9. Resume any effective action to contain, clean up or stop the flow of spilled contaminant. See Section 6.2 for more information on spill response procedures.

5.0 Reporting Procedure

All spills or potential spills of contaminants must be reported to the 24-hour Northwest Territories – Nunavut Emergency Spill Report Line to ensure that an investigation may be undertaken by the appropriate government authority. Reporting of any spills associated with the Project should be completed by the Contractor or the AANDC/PWGSC site representative.

To Report a Spill:

1. Fill out the Northwest Territories – Nunavut Spill Report Form (found in Appendix A of this draft SCP) as completely as possible before calling in the spill report.
2. Contact the Government of the Northwest Territories 24-hour Emergency Spill Report Line:
   24-HOUR EMERGENCY SPILL REPORT LINE (867) 920-8130
3. Where fax is available, fax the completed Northwest Territories Spill Report Form to (867) 873-6924. Alternatively, if email is available, email the completed Northwest Territories – Nunavut Spill Report Form to spills@gov.nt.ca.

Any person reporting a spill is required to give as much information as possible. However, reporting of a spill should not be delayed if all of the necessary information is not known. Additional information can be provided later. From the Consolidation of Spill Contingency Planning and Reporting Regulations (1998), as much of the following information should be reported during the initial spill report:

- Date and time of spill
- Location of spill
- Direction if the spill is moving
- Name and phone number of a contact person close to the location of the spill
- Type of contaminant spilled and quantity
- Cause of spill
- Whether spill is continuing or has stopped
- Description of existing contaminant
- Action taken to contain, recover, clean up, and dispose of spilled contaminant
- Name, address and phone number of person reporting the spill
- Name of owner or person in charge, management or control of contaminants at the time of the spill.

In addition to reporting to the 24-hour Emergency Spill Report Line, an AANDC Inspector must be notified of a spill immediately after occurrence. The AANDC Inspector should be contacted at (867) 975-4298. A copy of the completed Spill Report Form should be forwarded to them.

6.0 Action Plans

6.1 SPILL PREVENTION

The most likely spill possibilities during the Project would be leakage or line failure from heavy equipment or other vehicles; leakage from the on-site POL tanks; spilling during fuel transfer; or, a vehicular accident. Primary spill prevention measures will include:

- All Project personnel will receive SCP training prior to beginning work.
- Pre-Project and tailgate safety meetings will be held on a regular basis throughout the Project schedule to minimize accidents and malfunctions in the field.
- All contaminants will be stored at a designated storage area more than 100 m from the high-water mark of any waterbody.
- All fuel storage vessels will have secondary containment such as containment trays, berms, and/or double-walled tanks designed to hold 110% of total volume of stored fuel.
- Other contaminants will be stored within a containment berm with capacity to hold 110% or more of the stored contaminants.
- All fuel storage and transfer operations will take place at a designated fuel storage area, a minimum of 100 m from any waterbody or watercourse, and will be conducted by trained personnel.
- An emergency spill response kit will be kept on site, at the camp and designated fuel storage area, in case of fluid leaks or spills from machinery.
- Spill mats and/or drip pans/trays will be placed under all mobile fueling containers and under equipment when not in use.
- All stationary activities (i.e., camp activities) will be conducted at least 31 m from the ordinary high water mark of any waterbody or watercourse.
- All equipment used for operations will be in good working order and free of leaks.
- Regular inspection and maintenance will be conducted for all heavy equipment and vehicles associated with the Project, including fuel transfer hoses and fuel/oil lines.
- Identified equipment or vehicle deficiencies will be repaired.
- All sewage and solid waste will be contained and sealed in watertight containers.
- Drips will be cleaned up immediately.

6.2 SPILL RESPONSE

The following steps outline the general spill response procedures for initial actions to be taken to contain and clean up a contaminant spill, as well as disposing of contaminated materials. Procedures have been developed for handling contaminant spills, depending on where the spill has occurred (i.e., on snow/ice, on land, or in water).

6.2.1 Spills on Snow/Ice

1. Once a spill is identified, all sources of ignition should be turned off (e.g., no smoking, shut off engines).
2. The spilled material (e.g., gasoline, diesel, antifreeze, etc.) should be identified, if possible.
3. The affected area should be secured, ensuring the area is safe for entry and does not represent a threat to human health and safety of the spill responders. Public access (if any) of the area should be restricted.
4. If possible, identify where the spill is coming from (the source). Determine if the spill is still occurring (i.e., still leaking) or if the spillage has stopped. If the spill has not stopped, determine if it is safe to stop or control the spill (e.g., plug hole, close valve, upright container).
5. If the spill is too large to be controlled with the spill materials at hand, contact the Contractor or the AANDC/PWGSC site representative to report the spill immediately and request assistance (see Section 3.0 for contact information). Use materials on hand to attempt to control the spill.
6. If the spill is small enough to be controlled with the spill response materials at hand, prevent spilled contaminants from spreading or entering waterways by using sorbent materials or a snow/soil dyke down slope from the spill. This is especially the case with liquid contaminants (e.g., gasoline, diesel).
7. Once the spill has been controlled and further spreading prevented, contact the Contractor or the AANDC site representative and report the spill (see Section 3.0 for contact information). The Contractor or the AANDC/PWGSC site representative is responsible to report the spill to the 24-Hour Emergency Spill Report Line.
8. If possible with the spill response materials at hand, clean up the remaining spilled contaminant and store contaminated materials in a secure container for disposal. Impacted snow should be stored in drums for proper disposal.

6.2.2 Spills on Land

1. Once a spill is identified, all sources of ignition should be turned off (e.g., no smoking, shut off engines).
2. The spilled material (e.g., gasoline, diesel, antifreeze, etc.) should be identified, if possible.
3. The affected area should be secured, ensuring the area is safe for entry and does not represent a threat to human health and safety of the spill responders. Public access (if any) of the area should be restricted.
4. If possible, identify where the spill is coming from (the source). Determine if the spill is still occurring (i.e., still leaking) or if the spillage has stopped. If the spill has not stopped, determine if it is safe to stop or control the spill (e.g., plug hole, close valve, upright container), or contain the spill (e.g., place a container or tarp with built up edges under the spill source to contain the spill).
5. If the spill is too large to be controlled with the spill materials at hand, contact the Contractor or the AANDC/PWGSC site representative and report the spill immediately and request assistance (see Section 3.0 for contact information). Use materials on hand to attempt to control the spill.
6. If the spill is small enough to be controlled with the spill response materials at hand, prevent spilled contaminants from spreading or entering waterways by using sorbent (oil-absorbing) materials or a soil dyke down slope from the spill. This is especially the case with liquid contaminants (e.g., gasoline, diesel).
7. If some contaminant has entered a waterway, follow procedures in Section 6.2.3 to contain and clean-up the contaminant in the water.
8. Once the spill has been controlled and further spreading prevented, contact the Contractor or the AANDC/PWGSC site representative and report the spill (see Section 3.0 for contact information). The Contractor or the AANDC site representative is responsible to report the spill to the 24-Hour Emergency Spill Report Line.
9. If possible with spill response materials at hand, clean up the remaining spilled contaminant and store contaminated materials in a secure container for proper disposal. Do not flush the affected area with water.
10. If possible, remove any contained liquid by pumping into secure drums.

6.2.3 Spills in Water

1. Once a spill is identified, all sources of ignition should be turned off (e.g., no smoking, shut off engines).
2. The spilled material (e.g., gasoline, diesel, antifreeze, etc.) should be identified, if possible.
3. The affected area should be secured, ensuring the area is safe for entry and does not represent a threat to human health and safety of the spill responders. Public access (if any) of the area should be restricted.
4. If possible, identify where the spill is coming from (the source). Determine if the spill is still occurring (i.e., still leaking) or if the spillage has stopped. If the spill has not stopped, determine if it is safe to stop or control the spill (e.g., plug hole, close valve, upright container).
5. If the spill is too large to be controlled with the spill materials at hand, contact the Contractor or the AANDC/PWGSC site representative and report the spill immediately and request assistance (see Section 3.0 for contact information). Use materials on hand to attempt to control the spill.
6. If the spill is small enough to be controlled with the spill response materials at hand, use sorbent booms to contain the spill for recovery. Place sorbent sheets on the water within the boomed area to help contain the contaminant. For narrow waterways such as streams, place one or more sorbent booms across the waterway, downstream of the spill location, and anchor the booms on each bank.
7. Once the spill has been controlled and further spreading prevented, contact the Contractor or the AANDC/PWGSC site representative and report the spill (see Section 3.0 for contact information). The Contractor or the AANDC site representative is responsible to report the spill to the 24-Hour Emergency Spill Report Line.
8. If possible with spill response materials at hand, clean up the remaining spilled contaminant within the boom area. Store contaminated materials in a secure container for proper disposal.

6.3 ADDITIONAL SPILL DELINEATION OR MONITORING

In the event of a large spill or a spill in which not all of the spilled contaminant can be readily cleaned up with materials at hand (as described in Section 6.2), delineation of the affected area may be required. This would include subsurface investigation of the area (i.e., digging of test pits, soil sampling, installation of monitoring wells) to determine how large and how deep the contaminant affected the subsurface soil and/or groundwater (horizontal and vertical extent of the spill). The delineation would result in the development of an appropriate remediation plan for the affected area. In this case, a qualified environmental consultant should be retained to provide advice on how to proceed with delineation and remediation of a large spill.

7.0 Environmental Mapping

Remedial activities will primarily be restricted to previously disturbed and built-up areas around the Site. However, excavation of borrow sources, construction of some Project facilities, and construction and operation of the winter access trail will occur over natural ground. Impacts from spills could occur within these areas and possibly on adjacent lands and waters should a large volume of material be released. Spills into water can dissipate and affect a larger area than on land. Spills into creeks or other waterbodies could impact the downstream environment creek, including water quality, fish and fish habitat. The environment of the Project has been described in the Environmental Screening document, which will be made available to the Contractor.

8.0 Resource Inventory

8.1 ON-SITE RESOURCES

8.1.1 Personnel

All personnel hired to work on the Project will be trained on-site in spill prevention, response and clean-up measures (see Section 9.0).

8.1.2 Equipment

The following is a list of equipment available to respond to possible spills.

- Loader
- Dozers
- Haul/dump trucks
- Excavator
- Personnel pick-up trucks, ATVs and snowmobiles.

8.1.3 Spill Kits

8.1.3.1 Spill Kit Locations

At least one spill kit will be clearly marked and present at designated fuel storage area and the camp. Additional spill kits will be placed with working equipment and crews.

8.1.3.2 Spill Kit Contents

The following outlines the recommended minimum requirements for contents of spill kits to be used during the Project; the Contractor is responsible to supply the spill kits. Each spill kit will be regularly inspected to ensure it always contains the following, at a minimum:

- 1 – 205 L open top steel drum with lid, bolting ring and gasket (spill kit container)
- 10 disposable large 5 mil polyethylene bags (dimensions 65 cm x 100 cm) with ties
- 4 – 12.5 cm x 3 m (5 in. x 10 ft.) sorbent booms
- 10 kg bag of sorbent particulate
- 100 sheets (1 bale) of 50 cm x 50 cm sorbent sheets
- 2 large (5 m x 5 m) plastic tarps
- 1 roll duct tape
- 1 utility knife
- 1 field notebook and pencil
- 1 rake
- 1 pick-axe
- 3 spark-proof shovels
- 4 Tyvex® splash suits

- 4 pairs chemical resistant gloves
- 4 pairs of splash protective goggles
- Instruction binder, including Spill Contingency Plan.

The entire spill kit contents, with the exception of the spark-proof shovels, can be stored within the 205 L steel drum. The drum should be sealed securely to protect the spill kit contents though should always be accessible without the use of tools (i.e., finger tight bolt ring). The drum's bolt ring should be inspected regularly during facility inspections to ensure it turns freely and is lubricated.

Extra spill response materials should also be available for use, in addition to the spill kit contents. These include:

- 10 – 205 L open top steel drum with lid, bolting ring and gasket
- 2 spark-proof shovels
- 50 disposable large 5 mil polyethylene bags (dimensions 65 cm x 100 cm)
- 10 – 12.5 cm x 3 m (5 in. x 10 ft.) sorbent booms
- 5 – 10 kg bags of sorbent particulate
- 500 sheets (5 bales) of 50 cm x 50 cm sorbent sheets
- 2 Tyvex® splash suits
- 2 pairs of chemical resistant gloves
- 2 pairs of splash protective goggles.

8.2 OFF-SITE RESOURCES

The following agencies can be contacted for assistance in spill reporting, response and/or clean-up and remediation.

Table 8-1: Regulatory agencies' contact information for spill contingency planning

Agency	Legislation	Contact Information
Nunavut Water Board	*Nunavut Waters and Surface Right Tribunal Act*	Phone: (867) 360-6338 Fax: (867) 360-6369
Nunavut Impact Review Board	*Nunavut Land Claims Agreement Act*	Phone: (867) 983-2593
Government of Nunavut Department of Environment	*Nunavut Environmental Protection Act*	Phone: (867) 975-7700 Fax: (867) 975-7740
Environment Canada	Canadian *Environmental Protection Act*, 1999	Phone: (867) 975-4464 Fax: (867) 975-4645
Fisheries and Oceans Canada (Iqaluit)	*Fisheries Act*	Phone: (867) 979-8000 Fax: (867) 979-8039
Transport Canada (Coast Guard)	*Transportation of Dangerous Goods Act*	Phone: (867) 979-5269 Fax: (867) 979-4260

9.0 Training and Exercises

9.1 OUTLINE

The Contractor will be responsible for providing a qualified supervisor and training site workers in spill response. All individuals hired to work on the Project should have their basic first aid and WHMIS (Workplace Hazardous Materials and Information System) training before working on site.

A training session on spill prevention and response will be held for all individuals prior to the start of the remediation project. Training exercises, including proper use of spill kits, will provide hands-on training for individuals on spill response procedures and equipment. Training exercises can be held during the training session for all individuals or at another time for individuals directly involved with handling of hazardous materials.

The training session should review the Project's SCP and include information on:

- Individuals roles and responsibilities in regards to spill prevention, detection, response and clean-up
- Location(s) of hard copies of the SCP, maps and spill kits
- Equipment available for spill response
- Content of spill kits
- Initial actions and spill reporting procedures and,
- Spill response and clean-up actions.

9.2 SCHEDULE

The training session and exercises will be held prior to the start of winter access trail construction and (de)mobilization each year, and prior to the start of remedial activities; it will be provided as part of a Worker Orientation Seminar. This will ensure all returning individuals receive a refresher while any new individuals become familiar with on-site spill prevention and response measures.

The Contractor will keep records of all individuals who attend the training session and exercises, as well as copies of their training certificates (e.g., first aid, WHMIS).

10.0 References

Environmental Sciences Group (ESG). *Environmental Study of Abandoned DEW Line Sites, Volume One: Overview* and *Volume Three: Appendices*. Environmental Sciences Group, Royal Roads Military College. Prepared for Indian and Northern Affairs Canada, March 1995.

Geological Survey of Canada (GSC). 1985. Surficial Geology: Boothia Peninsula. Map 1570A, scale 1:500,000. Accessed: October 16, 2013. Available at: http://ftp2.cits.rncan.gc.ca/pub/geott/ess_pubs/119/119742/gscmap-a_1570a_e_1984_mn01.pdf.

Indian and Northern Affairs Canada (INAC). 2007. Guidelines for Spill Contingency Planning. Water Resources Division, INAC, Yellowknife, NT. Accessed 14 February 2014. Available at: http://www.aadnc-aandc.gc.ca/eng/1100100024236/1100100024253.

Stantec Consulting Ltd. *Phase III Environmental Site Assessment: CAM-E (Keith Bay), Nunavut*. Prepared for Public Works and Government Services Canada, October 2013.

Appendix A Northwest Territories – Nunavut Spill Report Form

NT-NU SPILL REPORT

OIL, GASOLINE, CHEMICALS AND OTHER HAZARDOUS MATERIALS

NT-NU 24-HOUR SPILL REPORT LINE
TEL: (867) 920-8130
FAX: (867) 873-6924
EMAIL: spills@gov.nt.ca

REPORT LINE USE ONLY

A	REPORT DATE: MONTH – DAY – YEAR	REPORT TIME	☐ ORIGINAL SPILL REPORT, OR ☐ UPDATE # _____ TO THE ORIGINAL SPILL REPORT	REPORT NUMBER ____-_____
B	OCCURRENCE DATE: MONTH – DAY – YEAR	OCCURRENCE TIME		

C	LAND USE PERMIT NUMBER (IF APPLICABLE)	WATER LICENCE NUMBER (IF APPLICABLE)
D	GEOGRAPHIC PLACE NAME OR DISTANCE AND DIRECTION FROM NAMED LOCATION	REGION ☐ NWT ☐ NUNAVUT ☐ ADJACENT JURISDICTION OR OCEAN
E	LATITUDE DEGREES MINUTES SECONDS	LONGITUDE DEGREES MINUTES SECONDS

F	RESPONSIBLE PARTY OR VESSEL NAME	RESPONSIBLE PARTY ADDRESS OR OFFICE LOCATION	
G	ANY CONTRACTOR INVOLVED	CONTRACTOR ADDRESS OR OFFICE LOCATION	
H	PRODUCT SPILLED	QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER
	SECOND PRODUCT SPILLED (IF APPLICABLE)	QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER
I	SPILL SOURCE	SPILL CAUSE	AREA OF CONTAMINATION IN SQUARE METRES
J	FACTORS AFFECTING SPILL OR RECOVERY	DESCRIBE ANY ASSISTANCE REQUIRED	HAZARDS TO PERSONS, PROPERTY OR ENVIRONMENT
K	ADDITIONAL INFORMATION, COMMENTS, ACTIONS PROPOSED OR TAKEN TO CONTAIN, RECOVER OR DISPOSE OF SPILLED PRODUCT AND CONTAMINATED MATERIALS		

L	REPORTED TO SPILL LINE BY	POSITION	EMPLOYER	LOCATION CALLING FROM	TELEPHONE
M	ANY ALTERNATE CONTACT	POSITION	EMPLOYER	ALTERNATE CONTACT LOCATION	ALTERNATE TELEPHONE

REPORT LINE USE ONLY

N	RECEIVED AT SPILL LINE BY	POSITION STATION OPERATOR	EMPLOYER	LOCATION CALLED YELLOWKNIFE, NT	REPORT LINE NUMBER (867) 920-8130

LEAD AGENCY ☐ EC ☐ CCG ☐ GNWT ☐ GN ☐ ILA ☐ INAC ☐ NEB ☐ TC | SIGNIFICANCE ☐ MINOR ☐ MAJOR ☐ UNKNOWN | FILE STATUS ☐ OPEN ☐ CLOSED

AGENCY	CONTACT NAME	CONTACT TIME	REMARKS
LEAD AGENCY			
FIRST SUPPORT AGENCY			
SECOND SUPPORT AGENCY			
THIRD SUPPORT AGENCY			

Appendix E Draft Waste Management Plan

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Draft Waste Management Plan for the Remediation of the former CAM-E DEW Line Site, Keith Bay, Nunavut

Draft

Prepared for:
Public Works and Government Services Canada
10025 Jasper Avenue
Edmonton, AB T5J 1S6

Prepared by:
Stantec Consulting Ltd.
5021 – 49 Street
Yellowknife, NT X1A 2N4

March 31, 2014

Revision Record							
Revision	**Description**	**Prepared By**		**Checked By**		**Approved By**	
0	Original	Feb. 26/14	VG	Mar. 31/14	CS		

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1.0 Introduction

This draft Waste Management Plan (WMP) documents waste management activities to avoid or reduce potential environmental effects during the remediation of the former CAM-E Distant Early Warning (DEW) Line site located at Keith Bay, NU (the Project). The draft WMP has been developed for use by Public Works and Government Services (PWGSC), Aboriginal Affairs and Northern Development Canada (AANDC) and the remedial contractor (the Contractor) during the Project.

1.1 PURPOSE

The purpose of the WMP is to provide a guide to all site personnel on the waste management goals, objectives and procedures to be followed during all phases of the Project. The goal of the WMP is to:

- Ensure components of the environment, including the air, water, land, vegetation, wildlife and fish, are not negatively affected by Project activities.
- Ensure aesthetic and land use values of the Project area remain intact following Project completion.
- Ensure the Project will comply with all applicable acts and regulations, as well as conditions outlined in the regulatory approvals and/or authorizations.

The Project will be completed by a Contractor, selected by PWGSC and AANDC through a competitive process. The selected Contractor will be required to submit a detailed WMP that addresses the specific activities of the Project and meets or exceeds the commitments contained in this WMP. This draft WMP is prepared to address regulatory requirements and provide guidance to the Contractor.

2.0 Project Description

CAM-E (the Site) is located on the eastern shore of the Simpson Peninsula at Cape Barclay (68° 15' 45" N, 88° 8' 38" W) near the shores of Keith Bay, in the Gulf of Boothia (see Figure 2-1). The Project will include the excavation of identified borrow sources, and of contaminated soil; disposal or treatment of contaminated soil, as well as appropriate disposal of hazardous and non-hazardous wastes.

LEGEND:

SITE

NOTE:
- CO-ORD SYSTEM: CANADA LAMBERT CONFORMAL CONIC
- BASE FEATURES PRODUCED BY ESRI

GENERAL SITE LOCATION
REMEDIAL ACTION PLAN
CAM-E (KEITH BAY), NUNAVUT

Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Job No.:	122510734
Scale:	BAR SCALE
Date:	2013/12/12
Dwn. By:	P.J.SOO
App'd By:	

Dwg. No.: **2-1**

Stantec

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2.1 PROJECT FOOTPRINT

- The Project footprint incorporates two main areas of the Site: Area 1 and Area 2. Area 1 is situated in the northern portion of the Site while Area 2 is situated in the southern portion of the Site on a beach plateau approximately 5.6 km from Area 1 (see Figure 2-2). In addition, the Project footprint also incorporates the winter access trail that will be used to transport equipment and supplies to the Site; at the date of this draft WMP, the routing of the winter access trail has yet to be selected.

2.1.1 Mobilization/Demobilization

The majority of equipment and construction supplies will be mobilized/demobilized to/from the Site using a winter access trail and cat train. During the summer months, site personnel and other supplies (i.e., groceries, etc.) will be transported to the Site via fixed-wing aircraft.

Mobilization to the site via the winter access trail is presently scheduled to occur during March 2016. On-site remedial work will occur during the summer months of 2016, 2017 and 2018. Demobilization of equipment and supplies will take place the winter following remedial work, in March 2019.

Although the alignment of the winter access trail has yet to be selected, three potential departure communities (Repulse Bay, Taloyoak, and Hall Beach) have been identified based on the ability to get all needed supplies into the community via barge. The departure community will be selected by the Contractor.

2.1.2 Construction

Construction activities will be completed during the summer months (June to September) of 2016 at the Site. These activities would include:

- Construction of two new landfills (Tier I Landfill and the Tier II Landfill).
- Construction of a temporary Staging/Abatement Area for the purpose of handing wastes requiring off-site disposal.
- Construction of a temporary Treatment Cell for the construction and operation of *ex-situ* treatment of contaminated soil (via Biopiles).
- Construction and operation of a maximum of eight borrow sources.

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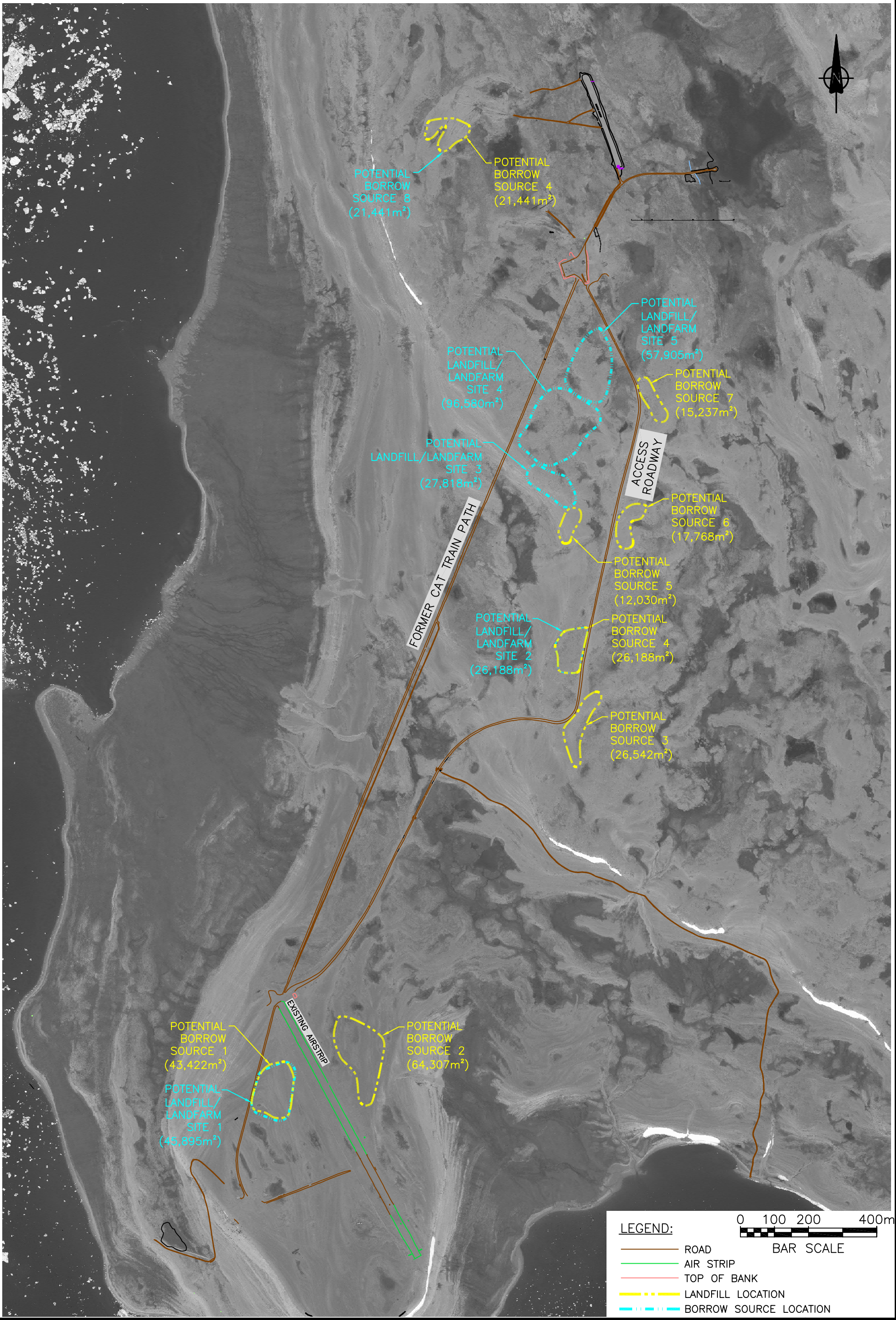

BORROW SOURCES AND LANDFILL LOCATIONS REMEDIAL ACTION PLAN

CAM–E (KEITH BAY), NUNAVUT

Client:	PUBLIC WORKS AND GOVERNMENT SERVICES CANADA
Job No.:	122510734
Scale:	1:15000
Date:	2013/12/12
Dwn. By:	P.J.SOO
App'd By:	
Dwg. No.:	2-2

Stantec

2.1.3 Remediation

Similar to the construction activities, remediation activities will be completed during the summer months of 2017 and 2018. These activities would include:

- Collection, segregation, packaging of hazardous waste for off-site disposal.
- Collection, segregation and disposal of non-hazardous waste within the Tier I Landfill.
- Excavation, transportation, and disposal of Tier I and Type A contaminated soil in the Tier I landfill.
- Excavation, transportation, and disposal of Tier II contaminated soil in the Tier II Landfill.
- Excavation, transportation, and treatment of Type B contaminated soil in the Treatment Cell via Biopiles.
- Collection, cleaning, and disposal of drum and drum contents; clean drums will be crushed and disposed of in the Tier I Landfill while any drum contents will be collected and disposed of appropriately, based on their characteristics.
- Treatment of contaminated water (generated during equipment and drum cleaning, and contact water within remedial excavations).
- Site maintenance activities including backfilling of excavations, grading of existing on-site roads and the airstrip, and installation and removal of a culvert under the access road.
- Closure of the Landfills and Treatment Cell.

Post-closure monitoring of the landfills, and other post-closure inspection activities will take place following the completion of remedial work.

2.2 INFRASTRUCTURE REQUIREMENTS

Completion of the Project will require support services including a winter access trail, camps, and equipment and fuel storage.

2.2.1 Winter Access Trail

Equipment and supplies required for the Project will be brought to Site via a winter access trail and cat train. The selection of the departure community and final trail routing will be completed by the chosen Contractor, following contract tendering and award. Depending on the final route, the winter access trail is expected to have several water crossings. It is expected these will crossings will primarily be constructed snow fills and ice bridges; the final number and location of water crossings will be confirmed in late 2014.

2.2.2 Camps

To facilitate the winter access trail operation, two temporary mobile winter camps will be established to accommodate personnel. The winter camps will house up to 30 workers and will be active during the mobilization and demobilization of equipment during the winter months (February to March) for two seasons (pre and post remediation). One of the winter camps will

constructed at the Site (likely in the same location as the summer camp), with the other located midway between departure community and the Site. The winter camp locations will be finalized by the successful Contractor. The configurations of the winter camps will be similar to the summer camp constructed at the Site.

A temporary summer camp will be established at the Site to support the Project activities. The summer camp will house up to 30 workers and will be active for three summer construction seasons (June to September, approximately 100 days per year).

The final camp configurations will be determined by the chosen Contractor, but they are anticipated to consist of the following:

- Sleeping quarters
- Kitchen/dining area
- Washroom/shower and laundry facilities
- Office area
- First aid facilities.

Additional auxiliary units required to support the camps include the following:

- Mechanics and equipment areas for equipment maintenance/repair
- Power unit housing generators
- Emergency shelter.

The camps will also have potable water supply and a basic water treatment system, a storage area for domestic refuse (including a camp incinerator for domestic waste), appropriate disposal systems for sewage and grey water, and fuel storage.

Upon completion of the remediation program, the summer camp will be prepared for transport and demobilized on the winter access road during the winter of 2019. The winter camps will be removed following each winter season.

2.2.3 Fuel and Fuel Storage

It is anticipated that fuel used on-site will consist of diesel and gasoline. Fuel will be transported to the Site via the cat train on the winter access trail. The designated fuel storage and re-fueling location at the Site will be determined during the design phase of the Project, but will be a minimum of 100 m from the high water mark of any waterbody. Fuelling at the Site will only be allowed in this designated area and will be performed via hand pump or electrical pump over spill pads or drip pans.

The exact quantity and types of fuel, details of the secondary containment, and methods of storage, will be provided by the chosen Contractor, once the contract has been awarded. However, fuel storage containers will adhere to the *Storage Tank Systems for Petroleum Products*

and Allied Petroleum Products Regulations (CEPA SOR/2008-197), and the Contractor will be expected to implement all mitigation measures identified in this document for fuel storage and handling.

3.0 Site Description

The Site is situated within the Gulf of Boothia Plain ecoregion of the Northern Arctic ecozone (ESWG 1995). The Gulf of Boothia Plain ecoregion is characterized by a gently south-sloping landscape and ranges in elevation from sea level to 300 m above sea level (ESWG 1995). Surficial geology at the Site consists of marine sediments, primarily gravel and sand, with 1 to 5 m thick ridge and swale formations (GSC 1985). Granular materials at the potential borrow sources are generally well-drained and include: well-graded sands and gravel with < 5% fines; well-graded sands and gravel with < 10% fines; sands and gravel with < 20% fines; and granular soil with ≥ 20% fines (Stantec 2013). The area is dominated by mineral static cryosol soils with continuous permafrost and abundant ice wedges (ESWG 1995). At the Site, ground ice was typically encountered between 0.4 to 1.0 m below the surface, depending on the terrain and landform (Stantec 2013).

Vegetation at the Site is sparse and intermittent in upland areas, primarily occurring in tufts or as individual plants on the rocky talus. Upland vegetation was primarily comprised of purple saxifrage, mountain avens (*Dryas integrifolia*), willows (*Salix* spp.), Arctic poppy (*Papaver radicatum*), cushioned whit-low grass (*Draba corymbosa*) and lichens. Within wetlands, or around areas with ponded water, vegetation was more abundant and typically included buttercup species (*Ranunculus* spp.), Arctic cottongrass (*Eriophorum vaginatum*), purple bladder-campion (*Melandrium apetalum*), willows, rushes (*Juncus* spp.), sedge, grass, and moss.

At the Site, surface waters include small freshwater ponds, ephemeral and non-ephemeral streams, and the marine waters of Keith Bay. The marine waters of Keith Bay will not be affected by Project activities; works will be limited to Area 1 and Area 2 only, as well as the existing road between the two areas. Several small freshwater waterbodies are located near areas were remediation activities will occur.

4.0 Identification of Waste Types

Over the course of the Project, several types of waste will be generated by equipment and crews working within the Project area. All potential waste are listed below and further descriptions are provided in Sections 4.1 to 4.2:

- Non-hazardous wastes:
  - Domestic wastes
  - Sanitary wastes
  - Ash by-product from the domestic waste incinerator
  - Survey and construction materials (i.e., wooden stakes, liner materials, etc.)
  - Overburden material from culvert installation.
- Hazardous wastes:
  - Used oil, fuel, lubricants, greases, oil, filters, and solvents
  - Contaminated soil, snow/ice and/or water
  - Contaminated spill response materials.

4.1 NON-HAZARDOUS WASTES

Non-hazardous wastes generated during the Project will primarily include domestic and sanitary wastes from camp operations, ash by-product, and construction materials.

An estimated 1,200 L (equivalent to 40 L per day per person) of sewage and 2,400 L (equivalent to 80 L per day per person) of grey water will be produced each day at the on-site summer camp during the remedial work. An estimated 520 L of sewage and 1,040 L of greywater will be produced each day per winter camp during winter access trail mobilization/demobilization.

Ash by-product will be generated during the incineration of combustible non-hazardous waste in the waste incinerator. Some waste construction material may also be generated during construction activities. These wastes may include liner materials, monitoring well supplies, plastic tubing, bailers, and scrap wood / metal. It is estimated less than 100 m^3 of ash by-product and construction waste will be generated during the Project.

The potential environmental effects arising from unmanaged non-hazardous, non-mineral wastes include increased wildlife attractants, potential for sanitary spills or leaks, a change in the aesthetics of the Project area, and degradation of water quality, and wildlife and fish habitat quality.

Granular material from the borrow sources will be used during the construction activities on-site. Excess overburden development during borrow source excavation is not anticipated. During culvert installation, excavated overburden will be stockpiled.

The potential environmental effects arising from unmanaged excess granular material involves an increased potential for erosion and sedimentation of surface runoff, as well as increased dust in the Project area.

4.2 HAZARDOUS WASTES

Potential hazardous wastes generated on-site include waste oil, fuel, lubricants, oil filters, and solvents from use and maintenance of heavy and light equipment. Most of the hazardous materials used during the Project will primarily include oils and lubricants for equipment. Other potential hazardous wastes may include contaminated soil, snow, water, and/or spill response materials (i.e. sorbent pads, etc.,) should a spill occur during the Project. Volume estimates for these types of materials will be determined during the design phase for the Project.

The potential environmental effects arising from unmanaged hazardous wastes include degradation of soil quality, degradation of water quality, and wildlife and fish habitat quality, and harm to on-site personnel.

5.0 Management of Waste Types

Within the Project area, the following management and mitigation techniques will be implemented to reduce the potential for environmental effects associated with various waste categories.

5.1 NON-HAZARDOUS NON-MINERAL WASTES

5.1.1 Domestic Wastes

- All Project personnel will be trained and familiar with the Site-specific WMP and be aware of the required waste management procedures.
- Waste management practices will be implemented to minimize attractants to wildlife, including:
  - Minimize and properly dispose of attractants to wildlife such as garbage, food wastes and other edible and aromatic substances.
  - Store all food and garbage in either: airtight sealed containers, bear-proof containers or in an enclosed bear proof area.
  - Store all on-site grease, oils, fuels in bear-proof containers or enclosed bear-proof areas.
- Combustible and non-combustible wastes will be separated into two streams as recommended in the *Northern Land Use Guidelines for Camp and Support Facilities* (INAC 2011). Non-combustible wastes include plastics, styrofoam and rubber.
- Emissions from the incinerator will comply with the Canada Wide Standards for Dioxins and Furans and Mercury and to *Environment Canada`s Technical Document for Batch Waste Incineration* (Environment Canada 2010). Ash by-product will be analyzed for compliance with the Nunavut Guideline for Industrial Waste Discharges. Ash by-product and incombustible waste will be stored in lined receptacles for transport and will be disposed of in the Tier I Landfill on a bi-weekly or weekly basis. Should ash by-product not achieve compliance, it will be transported out of the territory for disposal at an approved facility.
- Only trained operators will operate the incineration equipment and manage the waste manifest reporting, where required.
- Work crews will inspect areas surrounding each camp daily to collect and properly dispose of any waste material that has blown off-site.
- Open pit burning will not be permitted during the Project.

5.1.2 Sanitary wastes

Sanitary wastes will be disposed of in a separate on-site treatment or disposal system; the final configuration of the disposal system will be determined by the Contractor. The location of the sewage and grey water disposal system will comply with the requirements of the Water License and Land Use Permit.

5.1.3 Construction Materials

- All combustible solid waste generated by construction activities will be incinerated. Emissions from the incinerator will comply with the Canada Wide Standards for Dioxins and Furans and Mercury. Ash by-product will be analyzed for compliance with the NU Guideline for Industrial Waste Discharges. Ash by-product and incombustible waste will be stored in lined receptacles for transport and will be disposed of in the Tier I Landfill on a bi-weekly or weekly basis. Should ash by-product not achieve compliance, it will be transported out of the territory for disposal at an approved facility.
- No solid waste will be disposed of on the land.

5.2 HAZARDOUS WASTES

5.2.1 Chemical wastes

- Products will be transferred via hand into the equipment during regular equipment maintenance. This will occur within the lined and bermed Staging/Abatement Area only, over spills pads and a minimum of 100 m from the high water mark of any water body.
- Any hazardous wastes will be stored in clearly marked containers with lids (i.e., drums) and in clearly marked areas (e.g. signs and flagging). Containers will be kept clear of debris and snow to facilitate routine inspections for leaks. Hazardous wastes will be removed from the designated storage area as often as possible, but at the end of each season at a minimum.
- Used oil and waste fuel generated during the Project, including any used spill materials, will either be incinerated on-site or be shipped to an approved disposal facility, depending on type of material. Prior to incineration, samples will be collected of the used oil and/or waste fuel to confirm concentrations of contaminants are below applicable criteria for incineration.

5.2.2 Contaminated Soil, Snow/Ice and/or Water

- Contaminated soil generated during the Project will be disposed of at either the Tier I or the Tier II Landfill, depending on the type of contaminants present.
- During winter phases, contaminated snow and/or ice will be stored in storage containers and disposed of at an appropriate facility. During summer, any contaminated snow and/or ice will be stored in storage containers and allowed to melt for treatment in the on-site water treatment system (see below).
- Contaminated water will be processed in the on-site water treatment system. Following treatment, water will be contained in suitable storage containers until such time that the analytical results confirm concentrations of contaminants are below applicable discharge limits, as identified in the Project's water license. Once it is confirmed that the treated water meets the discharge limits, the water will be released onto the ground at the Site; the discharge location will be a minimum of 30 m from the high water mark of any waterbody, and be released in a manner such that direct flow into a waterbody is not possible. The discharge location will be confirmed upon completion of the design phase of the Project.

- If other contaminated materials require disposal (i.e., spill response materials), these will be disposed of through a licensed facility. Prior to shipment, the Contractor will provide all documentation necessary (i.e. waste manifests) to the Department of Environment.

5.2.3 Overburden Material

- Overburden excavated during culvert installation will be stockpiled. The piles will be situated a minimum of 30 m from the high water mark of any waterbody to prevent material from entering the waterbody. The piles will also be sloped a minimum 2:1 horizontal to vertical ratio to prevent wind and water erosion.
- Due to the prevalence of gravel at the Site in all identified borrow sources, excess overburden from borrow source excavation is not anticipated. However, if overburden is excavated, recommended procedures in the *Northern Land Use Guidelines: Pits and Quarries* (INAC 2009) for managing overburden will be implemented.

6.0 Infrastructure Required for Waste Management

The following types of infrastructure and equipment are expecting to be required for proper waste management of the Project:

- Incinerator.
- Sewage and grey water disposal system – to be determined by the Contractor.
- Water treatment systems – for both potable and contaminated water treatment; to be selected by the Contractor.
- Waste disposal facilities – either the Tier I or the Tier II Landfill, or the Treatment Cell.
- Hazardous Waste Disposal Facility – a licensed waste management company (i.e., licensed facility in southern Canada).
- Ash bins, shovels, wildlife-proof containers, pickup trucks, all-terrain vehicles (ATVs) with attached trailers.

7.0 References

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Stantec Consulting Ltd. *Phase III Environmental Site Assessment: CAM-E (Keith Bay), Nunavut*. Prepared for Public Works and Government Services Canada, October 2013.

Appendix F Draft Environmental Protection Plan

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Draft Environmental Protection Plan for Remediation of the Former CAM-E DEW Line Site, Keith Bay, Nunavut

Draft

Prepared for:
Public Works and Government Services Canada
500, 10025 Jasper Avenue
Edmonton, AB T5J 1S6

Prepared by:
Stantec Consulting Ltd.
5021 – 49 Street
Yellowknife, NT X1A 2N4

March 31, 2014

Revision Record							
Revision	**Description**	**Prepared By**		**Checked By**		**Approved By**	
0	Original	Feb. 26/14	CS	Mar. 31/14	CS		

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Abbreviations

AANDC	Aboriginal Affairs and Northern Development Canada
AMSRP	Abandoned Military Sites Remediation Protocol
Contractor	Remedial Contractor (to be selected)
DEW	Distant Early Warning
DFO	Department of Fisheries and Oceans
EPP	Environmental Protection Plan
GN-DOE	Government of Nunavut Department of Environment
Project	Remediation of the former CAM-E DEW Line Site, Keith Bay, Nunavut
PWGSC	Public Works and Government Services
SARA	*Species at Risk Act*
Site	Former CAM-E DEW Line Site

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1.0 Introduction

This draft Environmental Protection Plan (EPP) documents environmental protection measures to avoid or reduce potential environmental effects during remediation of the former CAM-E Distant Early Warning (DEW) Line site, at Keith Bay, Nunavut (the Project). The draft EPP has been developed for use by Public Works and Government Services (PWGSC), Aboriginal Affairs and Northern Development Canada (AANDC) and the remedial contractor (the Contractor) during the Project.

The CAM-E site is located on the eastern shore of the Simpson Peninsula at Cape Barclay (68° 15' 45" N, 88° 8' 38" W) near the shores of Keith Bay, in the Gulf of Boothia (see Figure 1-1). Remedial activities at the Site will generally include excavation of identified borrow sources, and of contaminated soil; disposal or treatment of contaminated soil, as well as appropriate disposal of hazardous and non-hazardous wastes. Mobilization via winter access trail and cat train is tentatively scheduled to begin in February/March 2016 with remedial activities occurring during the summer months in 2016, 2017 and 2018, and demobilization in February/March 2019.

1.1 PURPOSE

The purpose of this EPP is to describe the environmental mitigation measures and commitments to be carried out by AANDC, PWGSC and its Contractors during construction of the Project, to avoid or reduce potential environmental effects. This draft EPP includes current industry best practices where they are applicable to the Project activities, as well as general environmental protection measures.

Specifically, the draft EPP:

- Outlines environmental protection measures related to Project activities.
- Provides instructions for carrying out construction and operation activities to reduce potential environmental effects.
- Serves as reference information to on-site staff to support decision-making and provide links to more detailed information.

The Contractor will be identified through a public tender process. Once selected, the Contractor will be responsible to update this draft EPP to document specific work practices to demonstrate how commitments in this draft EPP and the conditions of regulatory approvals will be met or exceeded.

LEGEND:

SITE

NOTE:
- CO-ORD SYSTEM: CANADA LAMBERT CONFORMAL CONIC
- BASE FEATURES PRODUCED BY ESRI

GENERAL SITE LOCATION
REMEDIAL ACTION PLAN
CAM-E (KEITH BAY), NUNAVUT

Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Job No.:	122510734
Scale:	BAR SCALE
Date:	2013/12/12
Dwn. By:	P.J.SOO
App'd By:	

Dwg. No.: 1-1

Stantec

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2.0 Environmental Protection Plan Organization

This draft EPP addresses all Project activities and phases, and mitigation and reclamation. The draft EPP applies to all Project areas including the former CAM-E site at Keith Bay, NU (the Site), and the winter access trail alignment. At the date of this draft EPP, the routing for the winter access trail has yet to be selected.

Information in the draft EPP provides AANDC, PWGSC, their Contractor(s) and regulators with access to environmental information to facilitate execution of the Project in compliance with approvals, permits, and commitments. The draft EPP outlines protection measures that will reduce or avoid potential effects to the environment.

This draft EPP is organized to provide AANDC, PWGSC, their Contractor(s) personnel with an understanding of the general environmental setting of the Project, extent and limitations of the draft EPP, general mitigation measures or best practices that are typically applied to such projects and generally reflect the sequence of Project phases, including construction of Project facilities and remedial work.

The sections and appendices provide:

- A general overview applicable to the entire Project.
- The purpose and organization of the EPP, and places the EPP in context of geographic location.
- Information about the tools and process to facilitate compliance with all the regulatory approvals, permits, commitments and the specific requirements of the EPP.
- Information on specific activities to be followed to ensure compliance with regulatory requirements and to ensure all relevant stakeholders are properly notified of project activities before the commencement of construction.
- An outline of mitigation activities specific to the Project.
- Supporting documents or plans, including contingency and management plans, to support the mitigation measures identified in the EPP and to provide guidance to decision making processes should conditions arise that require implementation of contingency measures.

The EPP will be considered final once updated by the Contractor following detailed Project design and issuance of project approvals and permits. The final EPP will include detailed work practices in the appendices, such as operation and maintenance procedures for the Tier I and Tier II Landfills, Treatment Cell and Biopiles, and water treatment system.

2.1 PROJECT SETTING

The Project footprint incorporates two main areas of the Site: Area 1 and Area 2. Area 1 is situated in the northern portion of the Site while Area 2 is situated in the southern portion of the Site, on a beach plateau approximately 5.6 km from Area 1 (see Figure 2-1).

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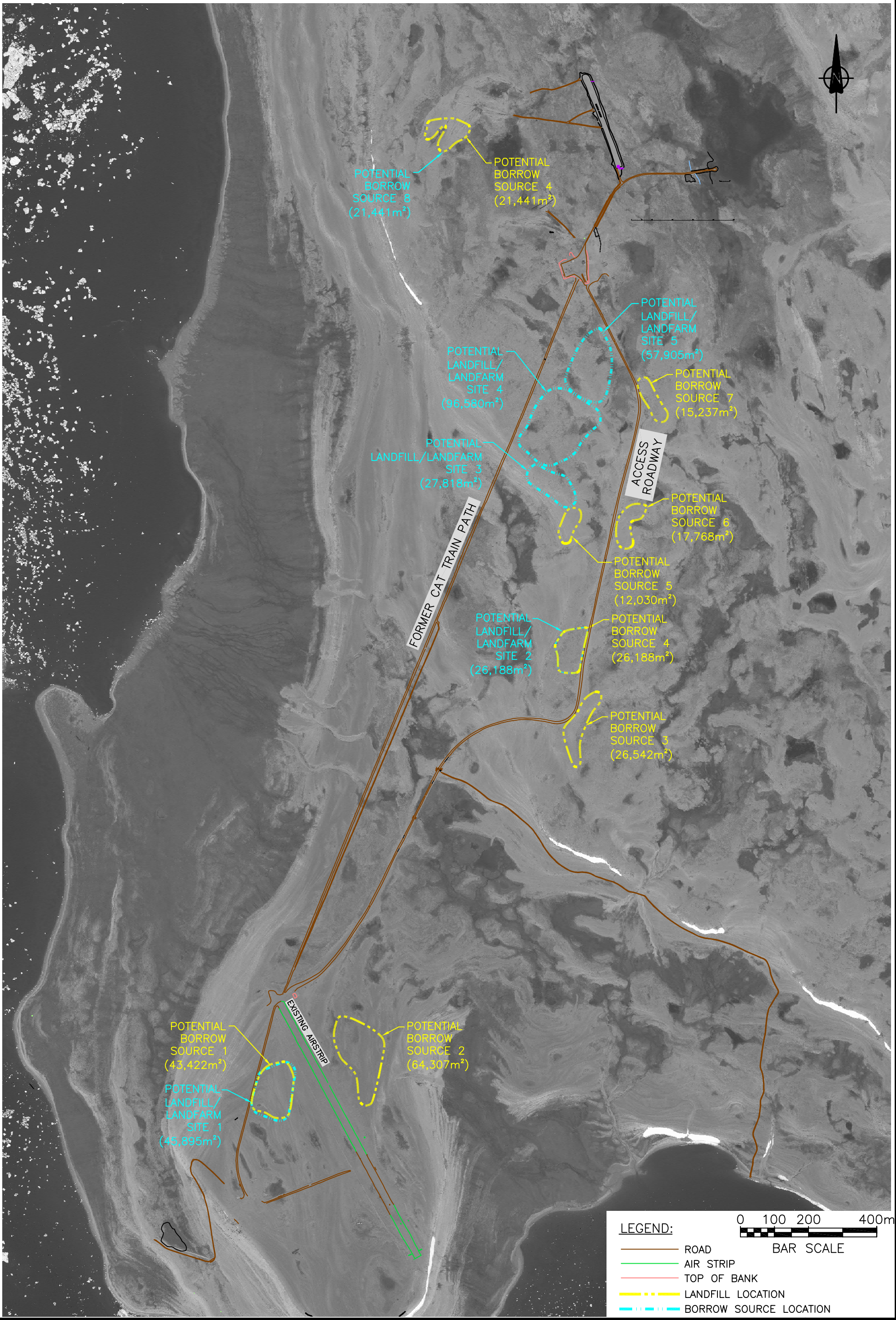

BORROW SOURCES AND LANDFILL LOCATIONS REMEDIAL ACTION PLAN

CAM–E (KEITH BAY), NUNAVUT

Client:	PUBLIC WORKS AND GOVERNMENT SERVICES CANADA
Job No.:	122510734
Scale:	1:15000
Date:	2013/12/12
Dwn. By:	P.J.SOO
App'd By:	
Dwg. No.:	2-1

Stantec

The Site is situated within the Gulf of Boothia Plain ecoregion of the Northern Arctic ecozone (ESWG 1995). The Gulf of Boothia Plain ecoregion is characterized by a gently south-sloping landscape and ranges in elevation from sea level to 300 m above sea level (ESWG 1995). Surficial geology at the Site consists of marine sediments, primarily gravel and sand, with 1 to 5 m thick ridge and swale formations (GSC 1985). Granular materials at the potential borrow sources are generally well-drained and include: well-graded sands and gravel with < 5% fines; well-graded sands and gravel with < 10% fines; sands and gravel with < 20% fines; and granular soil with ≥ 20% fines (Stantec 2013). The area is dominated by mineral static cryosol soils with continuous permafrost and abundant ice wedges (ESWG 1995). At the Site, ground ice was typically encountered between 0.4 to 1.0 m below the surface, depending on the terrain and landform (Stantec 2013).

Vegetation at the Site is sparse and intermittent in upland areas, primarily occurring in tufts or as individual plants on the rocky talus. Upland vegetation was primarily comprised of purple saxifrage, mountain avens (*Dryas integrifolia*), willows (*Salix* spp.), Arctic poppy (*Papaver radicatum*), cushioned whit-low grass (*Draba corymbosa*) and lichens. Within wetlands, or around areas with ponded water, vegetation was more abundant and typically included buttercup species (*Ranunculus* spp.), Arctic cottongrass (*Eriophorum vaginatum*), purple bladder-campion (*Melandrium apetalum*), willows, rushes (*Juncus* spp.), sedge, grass, and moss.

At the Site, surface waters include small freshwater ponds, ephemeral and non-ephemeral streams, and the marine waters of Keith Bay. The marine waters of Keith Bay will not be affected by Project activities; works will be limited to Area 1 and Area 2 only, as well as the existing road between the two areas. Several small freshwater waterbodies are located near areas were remediation activities will occur.

2.2 LIMITATIONS OF THE ENVIRONMENTAL PROTECTION PLAN

This draft EPP was created in consideration of Project phases in both summer and winter conditions. There will be a need to revise specific measures as a result of approval conditions, and ongoing consultation, or to address unforeseen site-specific conditions that might arise during detailed design and installation. If this were to occur, AANDC/PWGSC will resolve the issue with the Contractor in consultation with the appropriate regulators. The resolution and/or revision will be communicated to the appropriate parties.

3.0 Environmental Compliance

Environmental compliance is facilitated through sharing of information, providing orientations/training, hiring qualified staff, implementing mitigative measures, and performing on-site inspections over the duration of the Project.

The objective of this draft EPP is to ensure that:

- AANDC, PWGSC and their Contractor(s) are aware of relevant environmental regulatory requirements and approved mitigation measures, and consistently apply approved measures.
- Processes are defined to direct project managers and its Contractor on how to access relevant environmental information to aid in decision making at the field level.

3.1 SPECIFIC MEASURES

Specific measures will be taken to ensure environmental compliance. These measures include:

- Sharing Information: AANDC/PWGSC will facilitate the transfer of environmental information and information updates to all parties.
- EPP Distribution: controlled copies of the final EPP will be available to all key AANDC, PWGSC and Contractor staff members during all Project phases. A copy of the final EPP will be located in the Office of each camp.
- Identifying *Species At Risk Act* (SARA)-Listed or Sensitive Species: There may be areas within the Project footprint where SARA-listed species are found. Plant and wildlife photo reference sheets will be provided to all construction inspection staff to aid in identification and reporting of these species. Sightings of sensitive or species at risk will be reported to the on-site Project Manager who will in turn notify the appropriate regulatory agencies (e.g., Canadian Wildlife Service, Government of Nunavut Department of Environment [GN-DOE]) as needed. Specific protection measures may be implemented and the sighting will be recorded in daily reports.
- Following industry guidelines, codes of practice and Project-specific work practices: Industry guidelines and codes of practice have been considered in the creation of this draft EPP. This includes, but is not limited to, the Abandoned Military Sites Remediation Protocol (AMSRP) (INAC 2009a), Northern Land Use Guidelines for Pits and Quarries (INAC 2009b), Access: Roads and Trails (INAC 2010), and Camp and Support Facilities (INAC 2011); the former Department of Fisheries and Oceans (DFO) Nunavut Operational Statement for Ice Bridges and Snow Fills (DFO 2007); DFO Freshwater Intake End-of-pipe Fish Screen Guidelines (DFO 1995); DFO Fish Screen Design Criteria for Flood and Water Truck Pumps (DFO 2011); Environment Canada's Technical Guidance on Batch Waste Incineration (EC 2010); and, the GN's Environmental Guideline for Burning and Incineration of Solid Waste (GN 2012). The Contractor will prepare Project-specific work practices to be included in this EPP.

- Spill Reporting: As per the Spill Contingency Plan for the Project, the Contractor or the AANDC/PWGSC site representative will report any spills (Section 3 of the Spill Contingency Plan).
- Project Training and Orientation: AANDC/PWGSC and the Contractor will ensure that all on-site personnel working on the Project are informed of the environmental requirements and sensitivities. Workers will be orientated to the Spill Contingency Plan, the Waste Management Plan, and the final EPP.

4.0 Notification of Concerned Parties

Notification of the final Project schedule and timing of specific activities will facilitate awareness of upcoming activities, and allow interested community parties, regulatory agencies and other stakeholders to plan appropriately for activities in their area.

The objective of these commitments is to ensure:

- Interruption to other land-use activities are reduced during all Project phases.
- Affected communities and stakeholders are aware of Project activities.
- Relevant regulatory personnel are kept informed throughout the Project.

4.1 SPECIFIC MEASURES

All appropriate resource agencies and interested officials will be informed of project developments during project communications, as required. Affected communities will be updated on an annual basis regarding Project progress, timing, and any upcoming employment or business opportunities.

5.0 Project Phases

This section describes the environmental protection measures that will be implemented during all Project phases to protect environmental features within the Project Footprint at the Site and along the winter access trail route. The following general mitigation measures apply to all Project phases and will be implemented throughout the duration of the Project:

- Mammals and Avifauna:
  - Wildlife monitors will be present throughout all Project phases; wildlife monitors will record all daily wildlife sightings.
  - All on-site personnel will receive an orientation, which will include Project-specific wildlife protocols and bear awareness training.
  - Workers will not feed, harass or approach wildlife.
  - Hunting, fishing or egg collection by Project personnel will not be allowed; only wildlife monitors will be allowed to carry firearms.
  - All sightings of caribou, wolverine, grizzly bear or polar bear will be reported to the wildlife monitors and their location recorded; the information will be submitted to the GN-DOE following mobilization/demobilization activities.
  - Minimize Project footprint as much as possible.
  - All domestic wastes, food, and petroleum-based chemicals will be kept in secure locations, in appropriate wildlife-proof containers.
  - Project equipment and vehicles will not travel at speeds greater than 30 km/h.
  - Project activities will be suspended when caribou are within 500 m of operations.
  - Maintenance of minimum flight altitudes (650 m) throughout all Project phases (AANDC 2011).
  - During September 30 to March 30, maintenance of a minimum 800 m setback for general industrial activities from any known active bear or wolverine dens (AANDC 2011).
  - Avoid Project activities within 1.5 km of active raptor nests during the breeding season (March 1 to September 1) and within 500 m outside of the breeding season (September 2 to February 28) (AANDC 2011).
  - All human/caribou conflicts and incidents will be reported to the Wildlife Monitor and the GN-DOE Biologist will be contacted immediately.
  - The wildlife monitor and designated, trained staff will have access to bear deterrent materials including bear spray, cracker shells, and firearms with plastic slugs and bullets. The use of any wildlife deterrent will be reported to the GN-DOE.
- Air Quality:
  - Select equipment that complies with Nunavut (i.e., GN 2011) and Canadian emissions regulations.
  - Follow best practices to reduce vehicle/equipment exhaust emissions, including ensuring equipment is maintained regularly, properly muffled, and turned off when not in use, unless required for effective operation.
- Local Employment:

  - AANDC/PWGSC and its Contractor(s) will provide information to residents and businesses of Kugaaruk, and the selected winter access trail departure community, about potential employment and business opportunities, and potential skills required by employers.
- Human Health:
  - Development of Project-specific health and safety plan.
  - All Project personnel will receive appropriate health and safety training, applicable to the tasks they will be performing.
  - All Project personnel will attend an orientation, which will discuss site-specific health and safety protocols.
  - All Project personnel will be provided personnel protective equipment (PPE) necessary for the tasks they will be performing.
- Archaeological and Heritage Resources:
  - Avoidance of any Project activities within 30 of an identified archaeological site.

5.1 MOBILIZATION & DEMOBILIZATION

Primary Project activities during mobilization/demobilization phases will include construction and operation of the winter access trail (including cat training); establishment and operation of two temporary winter camps; and, fuel handling and storage.

Construction and Operation of the Winter Access Trail

- Temporary winter access trail route to be selected following consultation with the chosen departure community to avoid heavily used traditional areas, where practical.
- Conduct den surveys prior to winter access trail construction and operation.
- If active bear or wolverine dens are encountered within the Project footprint during the winter access trail construction and operation, the GN-DOE will be contacted immediately to determine appropriate mitigation. Activities may be temporarily suspended pending consultation with GN-DOE.
- Construction and operation of the winter access trail will only occur when the ground is frozen (e.g., December to April).
- Build-up and pre-packing of snow on winter access trail to a minimum of 0.10 m thickness to protect the underlying ground and vegetation.
- Equipment used for snow clearing will be equipped with mushroom shoes to prevent contact with root mat.
- Comply with the DFO *Protocol for Winter Water Withdrawal from Ice-covered Waterbodies* (DFO 2010) for build-up of the temporary winter access trail.
- Comply with AMSRP protocol for withdrawal of water for camp and remedial activities (i.e., not to exceed 10% of lake or flow volume).
- Comply with Water License conditions.
- Comply with mitigation measures in the former DFO *Operational Statement for Ice Bridges and Snow Fills* (DFO 2007) (see Appendix B of this document).
- Use of erosion control measures if ground is exposed.

- Use of clean snow, free of vegetation and debris.
- Notch or remove the winter water crossing after use.
- Screens used for water withdrawal will be designed and operated according to the DFO *Freshwater Intake End-of-pipe Fish Screen Guidelines* (DFO 1995) and DFO *Fish Screen Design Criteria for Flood and Water Truck Pumps* (DFO 2011).

Operation of Winter Camps

- Comply with appropriate guidelines for greywater and sewage disposal, including AANDC's *Northern Land Use Guidelines: Camps and Support Facilities* (INAC 2011).
- Camps and associated infrastructure will be designed to incorporate wildlife safety, including installing lighting, implementing strict waste management procedures, cleaning and maintaining the kitchen and dining area.
- Waste management practices that reduce attractants to wildlife, including the following measures:
  - Reduce and properly dispose of attractants to wildlife, such as garbage, food wastes and other edible and aromatic substances in appropriate wildlife-proof containers, until such as that it is incinerated.
  - Store all food and garbage in either airtight, sealed containers, wildlife-proof containers, or in an enclosed wildlife-proof area.
  - Store all on-site grease, oils and fuels in wildlife-proof containers, or in an enclosed wildlife-proof area.
- Work crews will inspect areas surrounding each camp to collect and properly dispose of any waste material that has blown off site.
- Implement sediment and erosion prevention and control measures, where necessary.
- Screens used for water withdrawal will be designed and operated according to the DFO *Freshwater Intake End-of-pipe Fish Screen Guidelines* (DFO 1995) and DFO *Fish Screen Design Criteria for Flood and Water Truck Pumps* (DFO 2011).

Fuel Handling and Storage

- The Contractor will comply with fuel storage and handling guidelines and best practices, including personnel training, storage setbacks, secondary containment, and regular storage inspection.
- Restriction of all fueling, servicing and staging of machines to a designated area(s), a minimum of 100 m from the high water mark of any waterbody.
- Regular inspections of all machinery to reduce the risk of a spill by identifying and correcting potential equipment failures.
- Emergency spill kits will be kept with all working machinery during all Project phases
- Development and implementation of Project-specific Spill Contingency Plan (SCP), including spill prevention and response.

5.2 CONSTRUCTION

Primary Project activities during the construction phase will include camp operation; excavation of borrow sources; construction of the Tier I and Tier II Landfills, Staging/Abatement Area, and Treatment Cell (for Biopiles); road/airstrip maintenance; and, fuel handling and storage.

Operation of Summer Camps

- Comply with appropriate guidelines for greywater and sewage disposal, including AANDC's *Northern Land Use Guidelines: Camps and Support Facilities* (INAC 2011).
- Camps and associated infrastructure will be designed to incorporate wildlife safety, including installing lighting, implementing strict waste management procedures, cleaning and maintaining the kitchen and dining area.
- Waste management practices that reduce attractants to wildlife, including the following measures:
  - Reduce and properly dispose of attractants to wildlife, such as garbage, food wastes and other edible and aromatic substances in appropriate wildlife-proof containers, until such as that it is incinerated.
  - Store all food and garbage in either airtight, sealed containers, wildlife-proof containers, or in an enclosed wildlife-proof area.
  - Store all on-site grease, oils and fuels in wildlife-proof containers, or in an enclosed wildlife-proof area.
- Work crews will inspect areas surrounding each camp to collect and properly dispose of any waste material that has blown off site.
- Implement sediment and erosion prevention and control measures, where necessary.
- Screens used for water withdrawal will be designed and operated according to the DFO *Freshwater Intake End-of-pipe Fish Screen Guidelines* (DFO 1995) and DFO *Fish Screen Design Criteria for Flood and Water Truck Pumps* (DFO 2011).
- Comply with AMSRP protocol for withdrawal of water for camp and remedial activities (i.e., not to exceed 10% of lake volume).
- Follow best practices to reduce incinerator emissions, including Environment Canada's *Technical Guidance on Batch Waste Incineration* (EC 2010) and the GN's *Environmental Guideline for Burning and Incineration of Solid Waste* (GN 2012).

Excavation of Borrow Sources

- Complete pre-construction nest surveys in areas of disturbance during the breeding season; if identified, nests or eggs of migratory birds will not be disturbed or destroyed.
- Maintenance of minimum setback of 250 m from any active nest sites during nesting (approximately mid-May to end of July), as well as from staging areas or avifauna concentrations.
- Minimize Project footprint in undisturbed, natural areas.

- Steep slopes will be avoided, where possible. Areas of sensitive terrain (e.g., polygons, ice-rich ground, wetlands) will be avoided, where practical.
- Sloping of borrow source floors to create positive drainage away from the face and floor.
- Installation of drainage ditches or channels, if necessary, to promote positive drainage in borrow source excavations.
- Progressive reclamation of depleted borrow sources, including applicable recommendations in AANDC's *Northern Land Use Guidelines: Pits and Quarries* (INAC 2009b).
- Follow best practices for development and operation of borrow sources to reduce releases of fugitive dust, including INAC (2009b).
- Implement dust suppression techniques in the borrow sources, including following best practices for dust suppression such as the GN's *Environmental Guideline for Dust Suppression* (GN 2002) and draft Project-specific dust management procedures (see Appendix A of this draft EPP).
- Use of water for dust suppression, as opposed to dust suppression products.
- Ensure natural drainage is not obstructed, or that flooding or channel diversion does not occur.
- Establishment of a minimum of 30 m buffer between any Project work site and the high water mark of a waterbody.
- Implement sediment and erosion prevention and control measures, where necessary.
- Implement spill prevention and response protocols.

Construction of the Tier I and Tier II Landfills, Staging/Abatement Area, and Treatment Cell

- Complete pre-construction nest surveys in areas of disturbance during the breeding season.
- Minimize Project footprint in undisturbed, natural areas.
- Frozen granular materials will not be used to reduce the potential for excessive settlement, slope failures and surface water ponding.
- End-dump method of construction for Project infrastructure to reduce the need for heavy equipment to travel directly on the terrain.
- Minimum of 0.6 m of compacted fill on constructed road beds and gravel pads before allowing equipment to travel on them.
- Engineered facilities will be designed according to best practices, including standards outlined in the AMSRP, to reduce potential for off-site migration of contaminants.
- A qualified contractor will be hired to oversee that construction quality is maintained through the construction of the engineered facilities.
- Construction monitoring and inspections will also be completed by an on-site Project Engineer to ensure adherence to design specifications.
- Ensure natural drainage is not obstructed, or that flooding or channel diversion does not occur.
- Establishment of a minimum of 30 m buffer between any Project work site and the high water mark of a waterbody.
- Implement sediment and erosion prevention and control measures, where necessary.
- Implement spill prevention and response protocols.

Road/Airstrip Maintenance

- Design of culverts using standard practices will provide adequate flow given the temporary nature of their placement, and the expected ephemeral nature of the drainage channels.
- Minimize Project footprint and number of water crossings.
- Ensure natural drainage is not obstructed, or that flooding or channel diversion does not occur.
- Implement sediment and erosion prevention and control measures, where necessary.
- Implement dust suppression techniques along roadways and airstrips, including following best practices for dust suppression such as the GN's *Environmental Guideline for Dust Suppression* (GN 2002) and draft Project-specific dust management procedures (see Appendix A of this draft EPP).
- Use of water for dust suppression, as opposed to dust suppression products.

Fuel Handling and Storage

- The Contractor will comply with fuel storage and handling guidelines and best practices, including personnel training, storage setbacks, secondary containment, and regular storage inspection.
- Restriction of all fueling, servicing and staging of machines to a designated area(s), a minimum of 100 m from the high water mark of any waterbody.
- Regular inspections of all machinery to reduce the risk of a spill by identifying and correcting potential equipment failures.
- Emergency spill kits will be kept with all working machinery during all Project phases.
- Development and implementation of Project-specific SCP, including spill prevention and response.

5.3 REMEDIATION/OPERATIONS

Primary Project activities during the remediation/operations phase will include camp operation; remedial excavations; handling and disposal of hazardous and non-hazardous wastes; operation of the Tier I and Tier II Landfills, Staging/Abatement Area, and Biopiles; treatment of contaminated water; road/airstrip maintenance; and, fuel handling and storage.

Operation of Summer Camps

- Comply with appropriate guidelines for greywater and sewage disposal, including AANDC's *Northern Land Use Guidelines: Camps and Support Facilities* (INAC 2011).
- Camps and associated infrastructure will be designed to incorporate wildlife safety, including installing lighting, implementing strict waste management procedures, cleaning and maintaining the kitchen and dining area.
- Waste management practices that reduce attractants to wildlife, including the following measures:

  - Reduce and properly dispose of attractants to wildlife, such as garbage, food wastes and other edible and aromatic substances in appropriate wildlife-proof containers, until such as that it is incinerated.
  - Store all food and garbage in either airtight, sealed containers, wildlife-proof containers, or in an enclosed wildlife-proof area.
  - Store all on-site grease, oils and fuels in wildlife-proof containers, or in an enclosed wildlife-proof area.
- Work crews will inspect areas surrounding each camp to collect and properly dispose of any waste material that has blown off site.
- Implement sediment and erosion prevention and control measures, where necessary
- Screens used for water withdrawal will be designed and operated according to the DFO *Freshwater Intake End-of-pipe Fish Screen Guidelines* (DFO 1995) and DFO *Fish Screen Design Criteria for Flood and Water Truck Pumps* (DFO 2011).
- Comply with AMSRP protocol for withdrawal of water for camp and remedial activities (i.e., not to exceed 10% of lake volume).
- Follow best practices to reduce incinerator emissions, including Environment Canada's *Technical Guidance on Batch Waste Incineration* (EC 2010) and the GN's *Environmental Guideline for Burning and Incineration of Solid Waste* (GN 2012).
- Appropriate winterization and closure procedures annually during remedial work to reduce potential for spills and leaks.

Remedial Excavations

- Complete pre-construction nest surveys in areas of disturbance during the breeding season; if identified, nests or eggs of migratory birds will not be disturbed or destroyed.
- Maintenance of minimum setback of 250 m from any active nest sites during nesting (approximately mid-May to end of July), as well as from staging areas or avifauna concentrations.
- Where possible, restriction of all Project activities to designated, previously-disturbed work areas and existing roads, or areas that have been built-up with gravel pad(s); where this is not possible, reduce Project footprint in natural, undisturbed areas.
- Where off-road travel is required for remedial work, activities will be completed with low ground pressure vehicles (e.g., rubber-tired ATVs, Argos) and sensitive land areas and features will be avoided.
- Steep slopes will be avoided, where possible. Areas of sensitive terrain (e.g., polygons, ice-rich ground, wetlands) will be avoided, where practical.
- Excavations will be backfilled with clean granular materials. Where surface soil is present and is not impacted by a contaminant, surface soils will be salvaged and returned to the surface of the affected area.
- Additional fill will be used where excavations are required in ice- or water-rich materials.
- Implement dust suppression techniques, if necessary, including following best practices for dust suppression such as the GN's *Environmental Guideline for Dust Suppression* (GN 2002) and draft Project-specific dust management procedures (see Appendix A of this draft EPP).

- Use of water for dust suppression, as opposed to dust suppression products.
- Ensure natural drainage is not obstructed, or that flooding or channel diversion does not occur.
- Establishment of a minimum of 30 m buffer between any Project work site and the high water mark of a waterbody.
- Implement sediment and erosion prevention and control measures, where necessary.
- Implement spill prevention and response protocols.
- Collect all water within remedial excavations for treatment.

Collection, Handling and Disposal of Hazardous and Non-hazardous Wastes

- Complete pre-construction nest surveys in areas of disturbance during the breeding season; if identified, nests or eggs of migratory birds will not be disturbed or destroyed.
- Maintenance of minimum setback of 250 m from any active nest sites during nesting (approximately mid-May to end of July), as well as from staging areas or avifauna concentrations.
- Where possible, restriction of all Project activities to designated, previously-disturbed work areas and existing roads, or areas that have been built-up with gravel pad(s); where this is not possible, reduce Project footprint in natural, undisturbed areas.
- Where off-road travel is required for remedial work, activities will be completed with low ground pressure vehicles (e.g., rubber-tired ATVs, Argos) and sensitive land areas and features will be avoided.
- Follow best practices to reduce incinerator emissions, including Environment Canada's *Technical Guidance on Batch Waste Incineration* (EC 2010) and the GN's *Environmental Guideline for Burning and Incineration of Solid Waste* (GN 2012).
- Complete any required in-water work by hand, and with clean equipment.
- In-water remedial work will only be conducted between July 15 and August 15 to avoid and potential harm to fish.

Operation of the Tier I and Tier II Landfills, Staging/Abatement Area, and Biopiles

- Complete pre-construction nest surveys in areas of disturbance during the breeding season.
- Where possible, restriction of all Project activities to designated, previously-disturbed work areas and existing roads, or areas that have been built-up with gravel pad(s); where this is not possible, reduce Project footprint in natural, undisturbed areas.
- Frozen granular materials will not be used to reduce the potential for excessive settlement, slope failures and surface water ponding.
- Inspections of engineered structures will be completed by an on-site Project Engineer throughout the Project to monitor structure integrity.
- Ensure natural drainage is not obstructed, or that flooding or channel diversion does not occur.
- Implement sediment and erosion prevention and control measures, where necessary.
- Implement spill prevention and response protocols.
- Implement dust suppression techniques in the borrow sources, including following best practices for dust suppression such as the GN's *Environmental Guideline for Dust Suppression*

(GN 2002) and draft Project-specific dust management procedures (see Appendix A of this draft EPP).
- Use of water for dust suppression, as opposed to dust suppression products.
- Annual closure of the utilized section(s) of the Tier I and Tier II Landfills to reduce wildlife attractants, off-site migration of contaminants, and wind-blown debris.
- Appropriate winterization and closure procedures of equipment staging areas (within Staging/Abatement Area) annually during remedial work to reduce potential for spills and leaks.

Treatment and Discharge of Contaminated Water

- Comply with appropriate regulations, guidelines and Project approvals, including treatment of contaminated water to approved discharge limits.
- Discharge of treated water at a location a minimum of 31 m from the high water mark of any waterbody, and where direct flow into a waterbody is not possible.

Road/Airstrip Maintenance

- Ensure natural drainage is not obstructed, or that flooding or channel diversion does not occur.
- Implement sediment and erosion prevention and control measures, where necessary.
- Implement dust suppression techniques along roadways and airstrips, including following best practices for dust suppression such as the GN's *Environmental Guideline for Dust Suppression* (GN 2002) and draft Project-specific dust management procedures (see Appendix A of this draft EPP).
- Use of water for dust suppression, as opposed to dust suppression products.

Fuel Handling and Storage

- The Contractor will comply with fuel storage and handling guidelines and best practices, including personnel training, storage setbacks, secondary containment, and regular storage inspection.
- Restriction of all fueling, servicing and staging of machines to a designated area(s), a minimum of 100 m from the high water mark of any waterbody.
- Regular inspections of all machinery to reduce the risk of a spill by identifying and correcting potential equipment failures.
- Emergency spill kits will be kept with all working machinery during all Project phases.
- Development and implementation of Project-specific SCP, including spill prevention and response.

5.4 CLOSURE

Primary Project activities during the closure phase will include camp operation; closure of Tier I and Tier II Landfills, Staging/Abatement Area, and Treatment Cell and Biopiles; and, fuel handling and storage. All closure activities will occur immediately following completion or

concurrently with remedial work in 2018. The same camp operation will be utilized during closure so mitigation measures for camp operation have been excluding from this section.

Closure of the Tier I and Tier II Landfills, Staging/Abatement Area, and Biopiles

- Implement specific closure procedures for each landfill type, as outlined in the AMSRP (INAC 2009a).
- Confirm granular material within the Staging/Abatement Area and Biopiles meets applicable soil quality criteria, as per the AMSRP (INAC 2009a).
- Grading, contouring and stabilization of built-up Staging/Abatement Area and Biopiles to match existing contours.
- Disturbed surfaces will be scarified, ripped or graded to promote drainage and natural growth of vegetation.
- Removal of any geosynthetic liners and disposal at an off-site facility.

5.5 POST-CLOSURE

Post-closure activities will include AMSRP Phase I (short-term) monitoring at the Site. Monitoring activities will examine soil quality, groundwater quality, thermal regime within landfills, inspection of engineered facilities, and general site inspection for any potential environmental issues. The Site will be accessed by air and minimum flight altitudes (650 m) will be carried through to the post-closure phase. Site features will be accessed via ATV and travel outside previously disturbed areas will be reduced. No other mitigation measures are required.

Additional AMSRP Phase II (long-term) monitoring may be required, but will not be confirmed until the conclusion of Phase I monitoring. The EPP will be updated at that time, if necessary, to include any additional mitigation measures needed for Phase II monitoring.

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Appendix A Draft Dust Management Procedures

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A.1 INTRODUCTION

The following details the draft dust management plan (DMP) prepared for the remediation of the former CAM-E DEW Line site (the Site), near Keith Bay, Nunavut. The purpose of this draft DMP is to provide the procedures used to manage potential dust emissions arising from remedial activities at the Site.

Watering will be the primary dust control technique used during the Project. Freshwater will be obtained from the Freshwater Lake for all on-site dust management activities by using an intake hose with an appropriately sized fish screen, connected to a pump; water will be pumped into a water truck. The final intake location, screen size, and intake flow rate will be determined by the Contractor and meet all required permit conditions. An estimated total of 604,800 L (605 m^3) of water will be withdrawn from the Freshwater Lake for the purposes of dust suppression. This equates to approximately 1,800 L (1.8 m^3) of water per day during three years of remedial work (336 days).

The primary Project activities that will produce dust emissions include:

- Excavation of borrow sources
- Access road and airstrip use and maintenance
- Operation of Biopiles.

Dust may also be generated during remedial excavations; however, watering these areas may produce contaminated water due to contact with contaminated soil. Therefore, remedial excavations will not be watered in effort to reduce the volume of water which requires treatment.

A.2 DUST MANAGEMENT PROCEDURES

A.2.1 Excavation of Borrow Sources

Borrow source excavations and other remedial activities (construction of Tier I and Tier II Landfills, Staging/Abatement Area, Treatment Cell) can be a large source of dust emissions. Some crushing and screening activities are also expected during the remedial work within the borrow sources. The exact location of crushing activities and quantity of material are unknown at this time. However, the standard practices, as outlined in INAC (2009), will be implemented to reduce the potential for fugitive dust from within the borrow sources:

- All material stockpiles will be sloped with a minimum 2:1 horizontal to vertical ratio to reduce wind erosion.
- Pit faces will be oriented with consideration to prevailing winds.
- Borrow source excavation and crushing activities will be halted on high-wind days.
- Limit speeds of heavy equipment and haul/dump trucks to reduce fugitive dust generated during material transport.
- Dump trucks hauling material will use fabric dust covers over top of the truck bed to prevent dust from blowing onto the site surfaces.

- Use water and dust skirt on conveyors to minimize dust.

If the above mitigation measures prove to be inadequate to control dust generation from the borrow sources, watering of the pit floor can also be employed to control fugitive dust. The application rate will be monitored to ensure adequate coverage of the floor without causing pooling or runoff. Watering of the pit floor is not expected to be routinely required and will only occur on an as-needed basis based on local conditions.

A.2.2 Maintenance of Access Roads and Airstrips and other Project Facilities

In the dry summer months, dust arising from the on-site access road will be primarily controlled by watering. Recommended vehicle speeds (30 km/h or less) will also posted along the access road; these speeds will be enforced to limit vehicle speed for safety reasons and to reduce fugitive dust by vehicle traffic. Lower speed limits will also be imposed on heavy equipment traffic using the access road to further reduce dust emissions.

Road watering will be carried out by the Contractor. Watering of other Project facilities (i.e., Tier I and Tier II Landfills, Staging/Abatement Area, and Treatment Cell, during construction and operation) may also be required depending on Site conditions.

The access roads and airstrips will typically be watered using the water truck equipped with a spray bar. Other Project facilities will be watered with a hose and appropriate sprayer. Watering is expected to occur once per week during the summer months. This frequency may be increased or decreased depending on the road/airstrip surface conditions, and weather conditions (e.g., temperature, precipitation), at the discretion of the Contractor. The application rate will be monitored to ensure adequate coverage without causing pooling or runoff.

Other dust suppression techniques, such as the use of dust suppression products, will be further investigated if the proposed road watering technique proves ineffective or impractical. Only dust suppression products approved for use in Nunavut (i.e., calcium chloride, Bunker C or DL 10; GN 2002) will be considered if this option is explored for future use on the access road. Application of any of these products will be discussed with appropriate regulators prior to use.

A.2.3 Biopile Operation

Fugitive dust can arise from the Biopiles throughout their operation due to wind erosion of the piles, and during soil rotation (aeration). The following measures will be implemented to reduce dust emissions from the Biopiles:

- Biopiles will be sloped with a minimum 2:1 horizontal to vertical ratio to reduce wind erosion.
- Biopiles will be watered before and during soil rotation.

Appendix G Former DFO Nunavut Operational Statement for Ice Bridges and Snow Fills

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ICE BRIDGES AND SNOW FILLS

Fisheries and Oceans Canada
Northwest Territories Operational Statement

Version 3.0

Ice bridges and snow fills are two methods used for temporary winter access in remote areas. Ice bridges are constructed on larger watercourses that have sufficient stream flow and water depth to prevent the ice bridge from coming into contact with the stream bed or restricting water movement beneath the ice. Snow fills, however, are temporary stream crossings constructed by filling a stream channel with clean compacted snow.

Ice bridge and snow fill crossings provide cost-effective access to remote areas when lakes, rivers and streams are frozen. Since the ground is frozen, ice bridges and snow fills can be built with minimal disturbance to the bed and banks of the watercourse. However, these crossings can still have negative effects on fish and fish habitat. Clearing shoreline and bank vegetation increases the potential for erosion and instability of the banks and can lead to deposition of sediments into fish habitat. There is also potential for blockage of fish passage during spring break-up.

Fisheries and Oceans Canada (DFO) is responsible for protecting fish and fish habitat across Canada. Under the *Fisheries Act* no one may carry out a work or undertaking that will cause the harmful alteration, disruption or destruction (HADD) of fish habitat unless it has been authorized by DFO. By following the conditions and measures set out below you will be in compliance with the subsection 35(1) of the *Fisheries Act*.

The purpose of this Operational Statement is to describe the conditions under which it is applicable to your project and the measures to incorporate into your project in order to avoid negative impacts to fish habitat. You may proceed with your ice bridge or snow fill project without a DFO review when you meet the following conditions:

- your planned work is not located in a critical area, as identified in a NWT Community Conservation Plan or other applicable land use plan,
- ice bridges are constructed of clean (ambient) water, ice and snow,
- snow fills are constructed of clean snow, which will not restrict water flow at any time,
- the work does not include realigning the watercourse, dredging, placing fill, or grading or excavating the bed or bank of the watercourse,
- materials such as gravel, rock and loose woody material are NOT used,
- where logs are required for use in stabilizing shoreline approaches, they are clean and securely bound together, and they are removed either before or immediately following the spring freshet,
- the withdrawal of any water will not exceed 10% of the instantaneous flow, in order to maintain existing fish habitat,
- water flow is maintained under the ice, where this naturally occurs,
- this Operational Statement is posted at the work site and is readily available for reference by workers, and
- you incorporate the *Measures to Protect Fish and Fish Habitat when Constructing an Ice Bridge or Snow Fill* listed below in this Operational Statement.

If you cannot meet all of the conditions listed above and cannot incorporate all of the measures listed below then your project may result in the violation of subsection 35(1) of the *Fisheries Act* and you could be subject to enforcement action. In this case, you should contact the DFO office in your area if you wish to obtain DFO's opinion on the possible options you should consider to avoid contravention of the *Fisheries Act*.

You are required to respect all local, municipal, territorial or federal legislation that applies to the work being carried out in relation to this Operational Statement. The activities undertaken in this Operational Statement must also comply with the *Species at Risk Act* (**www.sararegistry.gc.ca**). If you have questions regarding this Operational Statement, please contact the DFO office in your area (see Northwest Territories DFO office list).

We ask that you notify DFO, preferably 10 working days before starting your work by filling out and sending the Northwest Territories Operational Statement notification form (**www.dfo-mpo.gc.ca/regions/central/habitat/os-eo/prov-terr/index_e.htm**) to the DFO office in your area. This information is requested in order to evaluate the effectiveness of the work carried out in relation to this Operational Statement.

Measures to Protect Fish and Fish Habitat when Constructing an Ice Bridge or Snow Fill

1. Use existing trails, winter roads or cut lines wherever possible as access routes to limit unnecessary clearing of additional vegetation and prevent soil compaction.

2. Construct approaches and crossings perpendicular to the watercourse wherever possible.

3. Construct ice bridge and snow fill approaches using clean, compacted snow and ice to a sufficient depth to protect the banks of the lake, river or stream. Clean logs may be used where necessary to stabilize approaches.

4. Where logs are used to stabilize the approaches of an ice bridge or snow fill:

   4.1. The logs are clean and securely bound together so they can be easily removed.
   4.2. No logs or woody debris are to be left within the water body or on the banks or shoreline where they can wash back into the water body.

   Note: The use of material other than ice or snow to construct a temporary crossing over any ice-covered stream is prohibited under section 11 of the *Northwest Territories Fishery Regulations*, unless authorized by a Fishery Officer. Please contact the nearest NWT DFO office.

5. While this Operational Statement does not cover the clearing of riparian vegetation, the removal of select plants may be necessary to accommodate the road. This removal should be kept to a minimum and within the road right-of-way.

6. Install sediment and erosion control measures before starting work to prevent the entry of sediment into the watercourse. Inspect them regularly during the course of construction and decommissioning activities and make all necessary repairs if any damage occurs.

7. Operate machinery on land or on ice and in a manner that minimizes disturbance to the banks of the lake, river or stream.

   7.1. Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks.
   7.2. Wash, refuel and service machinery and store fuel and other materials for the machinery away from the water to prevent any deleterious substance from entering the water or spreading onto the ice surface.
   7.3. Keep an emergency spill kit on site in case of fluid leaks or spills from machinery.
   7.4. Restore banks to original condition if any disturbance occurs.

8. If water is being pumped from a lake or river to build up the bridge, follow DFO's *NWT Winter Water Withdrawal Protocol* (available from the DFO offices listed below), and ensure that the intakes are sized and adequately screened to prevent debris blockage and fish mortality (refer to DFO's *Freshwater Intake End-of-Pipe Fish Screen Guideline* (1995) available at **www.dfo-mpo.gc.ca/Library/223669.pdf**).

9. Crossings do not impede water flow at any time of the year.

10. When the crossing season is over and where it is safe to do so, create a v-notch in the centre of the ice bridge to allow it to melt from the centre and also to prevent blocking fish passage, channel erosion and flooding. Compacted snow should be removed from snow fills prior to the spring freshet.

11. Stabilize any waste materials removed from the work site to prevent them from entering the lake, river, or stream. This could include covering spoil piles with biodegradable mats or tarps or planting them with grass or shrubs.

12. Vegetate and stabilize (e.g., cover exposed areas with erosion control blankets or tarps to keep the soil in place and prevent erosion) any disturbed areas by planting and seeding preferably with native trees, shrubs or grasses. Cover such areas with mulch to prevent erosion and to help seeds germinate. If re-vegetation is not possible due to climatic extremes and/or lack of appropriate seed or stock, the site should be stabilized using effective sediment and erosion control measures. In areas with permafrost, care should be exercised to ensure these measures do not cause thawing or frost heave.

    12.1. Maintain effective sediment and erosion control measures until re-vegetation of disturbed areas is achieved or until such areas have been permanently stabilized by other effective sediment and erosion control measures, in the event that re-vegetation is not possible.

FISHERIES AND OCEANS CANADA OFFICES IN NORTHWEST TERRITORIES

Yellowknife Area Office
Fisheries and Oceans Canada
Suite 101 – Diamond Plaza
5204 - 50th Ave.
Yellowknife, NT X1A 1E2
Phone: (867) 669-4900
Fax: (867) 669-4940

Inuvik District Office
Fisheries and Oceans Canada
Box 1871
Inuvik, NT X0E 0T0
Phone: (867) 777-7500
Fax: (867) 777-7501

Aussi disponible en français

http://www.dfo-mpo.gc.ca/oceans-habitat/habitat/modernizing-moderniser/epmp-pmpe/index_f.asp

DFO/2007-1329

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This Operational Statement (Version 3.0) may be updated as required by Fisheries and Oceans Canada. It is your responsibility to use the most recent version. Please refer to the Operational Statements web site at **http://www.dfo-mpo.gc.ca/oceans-habitat/habitat/modernizing-moderniser/epmp-pmpe/index_e.asp** to ensure that a more recent version has not been released.

Appendix H Supporting Documentation

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Supporting Documentation will be provided upon submission of the Final Environmental Screening document to Regulatory Agencies