Environmental Impact Assessment of the FOX-D Remedial Action Plan Kivitoo, NU

PUBLIC WORKS AND GOVERNMENT SERVICES

November 2014

FOX-D (Kivitoo) DEW Line Site: Environmental Impact Assessment Screening Report
Kivitoo, NU

PUBLIC WORKS AND GOVERNMENT SERVICES

13-7942

Project Manager:
Douglas Bell P. Geo

Submitted by:

DILLON CONSULTING LIMITED

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(in reply, please refer to)
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Northern Contaminated Sites
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Attention: Ms. Janice Lee
Project Manager

RE: Environmental Impact Assessment – FOX-D

Dear: Ms. Lee

Please find enclosed one (1) digital copy of the above mentioned report and six (6) hard copies. If you have any questions or comments, please feel free to contact either Douglas Bell, M.Sc., P.Geo., or Indra Kalinovich, Ph.D., C.Chem. E.I.T., at 204-453-2301.

Yours truly,

DILLON CONSULTING LIMITED

Doug Bell, M.Sc., P.Geo
Partner

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Attached:

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1.0 INTRODUCTION

Aboriginal Affairs and Northern Development Canada (AANDC) has responsibility for most federal lands in the North. Through the Northern Contaminated Sites Program (NCSP), AANDC is responsible for managing contaminated properties that are no longer maintained by the original occupant. The former FOX-D (Kivitoo) Intermediate Distant Early Warning (DEW) line site in Nunavut, a former military base, is one of these sites. The FOX-D site was constructed in 1957 and operated until October 1963.

On behalf of AANDC, Public Works and Government Services Canada (PWGSC) retained Dillon Consulting Limited (Dillon) to complete a Phase III Environmental Site Assessment (ESA), a Remedial Action Plan (RAP), and an Environmental Impact Assessment (EIA) of the RAP for the former military base FOX-D. A Heritage Resource Impact Assessment (HRIA) was also completed by Golder Associates Ltd. (Golder) in 2013 on behalf of Dillon. Field work necessary to complete these phases of this project was undertaken in August of 2013.

Section 12.2.4 of the Nunavut Land Claims Agreement (NLCA) requires that the Nunavut Impact Review Board (NIRB) screen project proposals based on defined criteria. Project proposals are provided to NIRB by regulatory agencies as part of the overall project approval process. This EIA was undertaken in accordance with these legislative requirements.

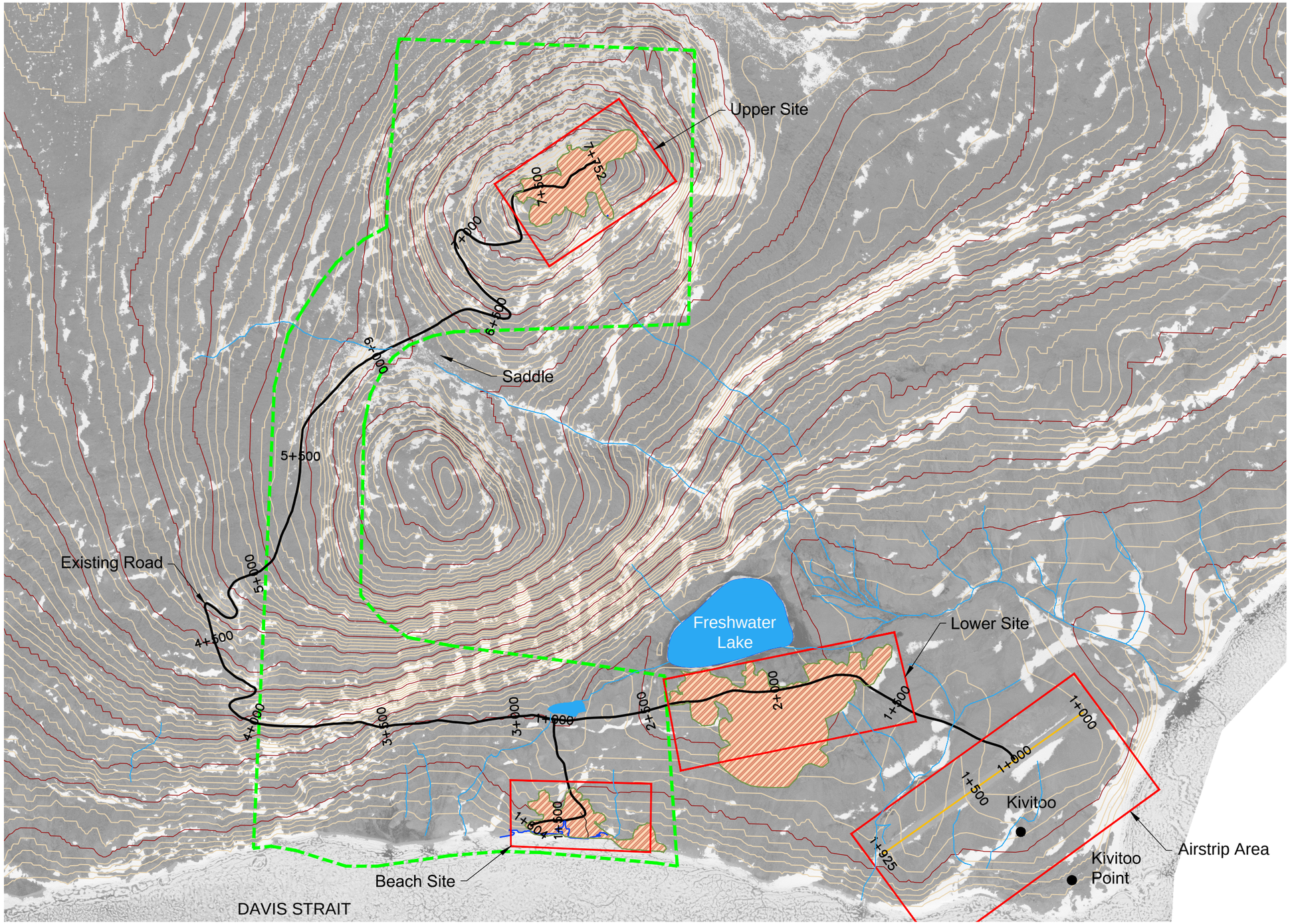
2.0 PROJECT CONTEXT

DEW stations were established in the Canadian North post World War II as a first line of defense for North America against potential enemy aircraft. Over 50 sites were positioned along the same latitude covering 3,000 miles across the North. First developed in 1957, several sites were abandoned in 1963 with the advent of more modern technology. Many of the abandoned sites became the responsibility of Parks Canada, the federal department which undertook initial decommissioning. Parks Canada managed the sites until 1992 when the custody of the facilities transferred to the former Indian and Northern Affairs (INAC) (INAC has since been renamed to Aboriginal Affairs and Northern Development Canada (AANDC)). Figure 1 is the identified property boundary which demarcates Inuit-owned versus Crown-owned land. The FOX-D site and affected area encompasses both properties. AANDC has taken on ownership for remediating the FOX-D Site.

The sites were operated as former military bases with infrastructure to support the operation of the activities. Although generally inaccessible by road, the sites were serviced by aircraft and where possible supply vessels. Camp installations were provided for military personnel to permit year round occupation in what would be considered inhospitable conditions. Fuel storage was provided to heat the buildings as well as support any land-based motorized vehicles. Other hazardous materials were commonly used without a full understanding of the potential environmental effects. Following 1963, the sites were left unattended until Parks Canada initiated removal of building and structures.

Through the Federal Contaminated Sites Action Plan (FCSAP), the federal government is addressing numerous contaminated sites in the north which have been abandoned by previous occupants. The primary goal of the plan is to ensure protection of the natural environment from contamination arising from previous federal government led initiatives. Borne out of the FCSAP, NCSP is funded to remediate contaminated sites to reduce and eliminate, where possible, the risks to human health and the environment (Northern Contaminated Sites Program – Progress Report 2005-2010, AANDC, 2010). Emphasis has been on high priority sites, many of which are in Nunavut (AANDC website).

Implementation of the program has initiated the development of protocols and procedures specific to conducting projects in the north. An overarching initiative is the implementation of an Environment, Health and Safety (EH&S) policy and the development of standard operating procedures. Through the EH&S, all staff working in the north receive regular training to ensure consistency in project delivery. In addition to the policy and the operating procedures, a number of protocols have been developed and are being implemented for the removal of contaminated materials from abandoned sites. An example is the Abandoned Military Site Remediation Protocol (AMSRP) DEW Line Cleanup (DLCU) Barrel Protocol developed for safe and complete removal of any barrels including the contents (INAC, 2009). Outlining the procedures for identifying and validating potential contamination in the barrels, the protocol provides specific details on ultimate removal of the contents and structures.



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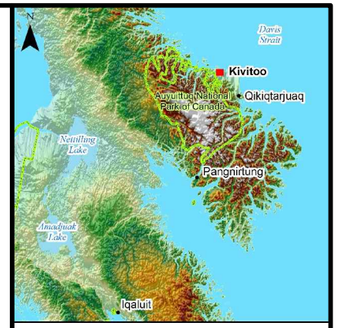

LEGEND

- Crown Land
- Water
- Area of Disturbance/Worked Area
- Road
- Drainage Pathways
- Airstrip
- 25m Index Contour
- 5m Contour

NOTES:

1. Imagery: 1:20,000 Scale Imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplies from NRCAN, derived from 1:60,000 stereo pair imagery.
3. Survey Completed by KGS Group, August 2013

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REVISIONS / ISSUE

KGS GROUP CONSULTING ENGINEERS

DILLON CONSULTING

ENVIRONMENTAL SITE ASSESSMENT
FOX-D

PROJECT SITE OVERVIEW

APRIL 2014 | FIGURE 1 | REV. 2

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Identified as a high priority site, the FOX-D Intermediate DEW Line site has been the subject of number of studies and investigations since the mid-1980s. Phase I – III environmental site assessments have been conducted and, in response, a RAP has been prepared which will guide the ultimate clean-up of the site. Prior to implementation of the plan, AANDC must complete an EIA to determine if any adverse environmental impacts will occur from site remediation. PWGSC has been identified as the primary contact to execute the studies and initiate the work.

The approach taken to this EIA is based on the understanding that the various applicable policies, protocols and procedures will be in place at the time that the remediation project is initiated. Recognizing that these procedural documents have been put in place to protect the biophysical and socioeconomic environment, the impact evaluation will focus on those potential interactions where there are no established protocols.

Within the lease-limits and the surrounding area, the FOX-D Kivitoo site has been previously disturbed in some well-defined, discrete areas, while in other areas the debris field is scattered and poorly defined. Few natural features, wildlife habitats or traditional uses remain within the area of disturbance, although natural features do occur within the lease limits and surrounding areas. The removal of contaminated material, physical hazards such as building debris, impacted soils as well as the Class C dumps, and Tier I and Tier II impacted soils will occur within the well-defined impacted areas. This includes the planned waste transfer area or Waste Handling Facility (WHF), construction camp and airstrip upgrades. The proposed Soil Treatment Area for hydrocarbon-impacted soils and cleanup of the scattered debris field will occur on lands that are less well defined, yet have been disturbed in the past to some level. The scope of this assessment therefore reviews the magnitude and significance of the additional environmental effects resulting from the cleanup activities, beginning from a common base where the existing conditions of the cleanup sites are previously disturbed and that new disturbances to the existing natural features will be very limited and narrow in scope.

3.0 PROJECT INFORMATION

3.1 Project Location

The FOX-D site is located on the Davis Strait at 67° 57' 01" N latitude and 64° 55' 04" W longitude on the northeast side of the Cumberland Peninsula and the northeast coast of Baffin Island (**Figure 2**). It is located on the highest of an east-west series of hills at an elevation of approximately 450 metres above sea level (masl). To the south, a coastal plain extends toward the ocean; the airstrip and the beaching area are located on this plain and a freshwater lake is situated at the base of the hill. For the purpose of reporting, the FOX-D site has been separated into two distinct areas connected along a gravel access road:

- The Upper Site, located on the crest of a hill 447 masl north; and,
- The Lower Site, located on a coastal plain to the south of the Upper Site and between sea level and 60 masl. Ancillary to the two main sites, a beach site is located at the mouth of the Kivitoo Harbour adjacent the Lower Site and an airstrip is located approximately 2 km east of the beach site.

The site is accessible by air and water as there are no defined roads leading to the area.

3.2 Project Overview

The DEW Line was an integrated chain of more than 50 radar and communication stations stretching 3,000 miles from the northwest coast of Alaska to the eastern shore of Baffin Island. The purpose of the DEW Line was to provide the United States and Canada with the earliest possible warning of the approach of airborne objects over the polar region (Lackenbauer et al, 2005).

FOX-D was an Intermediate DEW Line Site constructed in 1957 and operated until October 1963. The facility covered two distinct areas: the Upper Site and the Lower Site. After military operations ceased in 1963, the site became part of the Auyuittuq National Park and was under management of Parks Canada until 1992, when custody of the site was transferred to AANDC. During the period 1973 and 1983 Parks Canada managed a clean-up of both the Upper and Lower Sites which included the removal of all structures to their foundations, except for three tanks left in place at the Upper Site.

The majority of the original facilities at FOX-D have been demolished and partially buried. Based on the August 2013 site inspection, the following have been identified at the Upper Site:

- Transfer Tank;
- Petroleum, Oil and Lubricant (POL) Tanks;
- Antenna;
- Burnt Building Remains;
- Warehouse Foundation;
- Two Distinct Soil Stains in Former Garage;
- Burnt Debris; and,
- Dump Site.

The following have been identified at or adjacent to the Lower Site:

- Two POL Tanks;
- A Beach (barge) Landing Area;
- Drum Storage; and,
- An Airstrip.

Refer to **Figure 2** for the detailed drawing identifying the above infrastructure locations.

The Environmental Services Group (ESG) of the Royal Roads Military College in Victoria, BC conducted investigations on environmental conditions at former military stations in Canada's North on behalf of the federal government. As part of this study, a Phase I ESA was prepared of the FOX-D site in August 1994. A total of 70 soil samples and 36 plant samples were collected for evaluation of contaminants, potential migration pathways, and potential impacts on the terrestrial food chain. Soils were sampled and analysed for polychlorinated biphenyls (PCBs), metals, pesticides, polyaromatic hydrocarbons (PAHs). Plant samples were analysed for PCBs and metals. Data from previous assessments conducted by ESG (1994) and Franz Environmental Inc. (2011) (Phase II ESA) indicate that hydrocarbon, PCBs and metals contamination exists on the former DEW Line site.

In 2013, Dillon prepared a Phase III ESA which confirmed the previous assessments and in accordance with the National Classification System for Contaminated Sites (NCSCS) which is a method for evaluating contaminated sites based on their current or potential adverse impact on human health and the environment. Based on this assessment, the FOX-D site scored 87.9. According to the NCSCS Guidance Document (2008), for all scores ranked greater than 70, this site is classified as a "*Class 1: High Priority for Action*" site which requires remediation and clean-up to address existing concerns (CCME, 2008d)

Based on the outcome of the Phase III ESA, Dillon prepared a RAP. The RAP provides a conceptual remediation design and preliminary specifications for cleanup of the FOX-D site. In preparing the RAP, the AMSRP (INAC, 2009) was used which ensures that all legal requirements, health and safety issues, Territorial and Federal requirements, and standard environmental issues are considered.

The primary objectives, as outlined in the AMSRP (INAC 2009) for addressing site remediation are:

- Restore the site to an environmentally safe condition;
- Prevent the migration of contaminants into the Arctic ecosystem;
- Remove physical hazards for the protection of human health and safety; and,
- Implement a cost effective remediation solution.

In accordance with these objectives, evaluation of the various remedial options for the FOX-D site was completed using a systematic process to identify parameters against which to rank the options. A decision-making matrix based on the Kepner-Tregoe process was used and is presented in detail in the RAP report. **Table 3-1** provides a summary of the outcome of the process and the environmental issues.

Table 3-1 Summary of issues at FOX-D and the proposed remedial actions

Environmental Concern	Site Assessment Findings	Recommended Remediation Method
PCB[a]/Lead Amended Paint Products	Approximately 0.031 m^3 of PCB[a]/lead amended paint materials were discovered on site (not including metal)	Dismantle contaminated paint items and ship off-site to a licenced disposal facility.
Metals Contaminated Soils	193 m^3 of soils with concentrations of Cu, Cd, and Zn, which exceed the DCC Tier II criteria were identified on-site. This volume includes material that is co-contaminated with PAHs and PHCs.	Excavate, containerize, and label soils that exceed DCC Tier II criteria and dispose off-site at an appropriately licensed facility.
Petroleum Hydrocarbon Contaminated Soils	Approximately 3,205 m^3 of hydrocarbon contaminated soil in exceedance of the INAC Abandoned Military Site Remediation Protocol for PHC Soils.	Screen PHC Type B soils and treat in on-site constructed biological and/or aeration treatment unit (3,005 m^3). Excavate PHC Type A soils (200 m^3) and place into containers, and ship off-site to a licensed disposal facility.
Non-Hazardous Materials	Approximately 14,834 m^3 of non-hazardous debris consisting of heavy equipment, barrels, scrap metal, scrap wood, concrete, electrical equipment and plumbing parts to be handled and shipped off-site.	All buried and partially buried debris in Class B dumps (APEC 11) should be excavated, sorted and separated into different waste types where it is safe and practical to do so, and disposed off-site in an appropriate licensed facility. Buried debris that is inaccessible for excavation in Class C dumps (APECs[e] 9 and 10) should be buried and re-stabilized in-situ. Rocks and concrete foundations from APECs[e] 1-4 to be used as rip-rap and fill in void space at APEC 9. All other debris is to be consolidated, packaged and shipped off-site to an appropriate licenced disposal facility.
Hazardous Materials	Approximately 1.82 m^3 of hazardous materials were identified at the site. These materials consisted of lead acid batteries (0.22 m^3) and asbestos containing materials (1.32 m^3). There is potentially 0.25 m^3 of PCB[a] materials deposited in a buried transformer in APEC[e] 9.	All hazardous materials will be removed, containerized, labeled and shipped off-site to be disposed at a licensed facility.

Environmental Concern	Site Assessment Findings	Recommended Remediation Method
Water in Barrels	Analysis of collected water in the abandoned barrels indicates that the dissolved metals meet DLCU[f] barrel protocol.	Disposal on the ground will be permitted once water has been polished with an absorbent material. Additional sampling of more barrels during remediation program is required. Disposal will follow the INAC DLCU Barrel Protocol.
Structures	Upper Site POL[g] Tanks (2) Upper Site Transfer Tank (1) Concrete Foundations	All non-hazardous materials and debris from Upper Site structures buildings shall be demolished to their foundations and removed for off-site disposal.

Notes:
[a]PCB – Polychlorinated biphenyl, [b]DCC - Defence Construction Canada, [c]PHCs - Petroleum Hydrocarbons, [d]PAHs – Polycyclic Aromatic Hydrocarbon, [e]APEC – Area of Potential Environmental Concern, [f]DLCU – DEW Line Cleanup , [g]POL – Petroleum Oil and Lubricants

A detailed discussion of the disposal options is provided in the RAP. For the purposes of this EIA, and with input received from PWGSC, the disposal options have been grouped into three primary methods: disposal off-site, disposal on-site and soil treatment (biological and/or aeration). Each of these methods is carried through the impact assessment process to identify the potential for significant adverse effects.

3.3 Regulatory Environment

Due to the nature of the site remediation activities, the project is subject to various federal, and territorial acts, regulations and guidelines. For this reason, the AMSRP (INAC, 2009) was developed to provide a consistent approach for designing RAPs for abandoned military sites. This protocol was designed to address all legal requirements, health and safety issues, territorial and federal requirements, and standard environmental issues. A summary of some of the typical environmental legislation and guidelines used for remedial action procedures as well as other general federal and territorial legislation requirements is provided below on **Table 3-2.** It should be noted that other legislation requirements may become more apparent during the life of the project activities and consultation with regulatory authorities will be required throughout the process to ensure adherence to all proper legislation and guidelines.

Table 3-2 Summary of applicable legislation, authorizations and guidelines

Legislation/Guidance Document	Responsible Authority or Department	Description or Potential Trigger/Authorization
FEDERAL LEGISLATION, GUIDELINES AND PERMITS		
Species at Risk Act (SARA)	Environment Canada	Commits the federal government, provinces and territories to establish complementary legislation and programs to protect Canada's species at risk. Obliges the Minister responsible for an activity to protect species at risk. Activities that may harm, harass or disturb a listed species, or its critical habitat, may require a SARA Permit. Recovery Strategies may be in place for species listed on Schedule 1 of the *Act*.
Fisheries Act	Fisheries and Oceans Canada (DFO)	Aims to provide for the sustainability and ongoing productivity of commercial, recreational and Aboriginal fisheries. The four factors to be taken into account by the Minister in decision-making (e.g., issuing authorizations) or making regulations are: • The contribution of the relevant fish to the on-going productivity of commercial, recreational or Aboriginal fisheries; • Fisheries management objectives; • Whether there are measures and standards to avoid, mitigate or offset serious harm to fish that are part of a commercial, recreational or Aboriginal fishery; and, • The public interest. Taken together, these provide a framework and direction to the Minister and Fisheries and Oceans Canada staff for decision-making, developing regulations and implementing the regulatory regime and program.
Freshwater Intake End-of-Pipe Fish Screen Guidelines, 1995	Fisheries and Oceans Canada (DFO)	Freshwater Intake End-of-Pipe Fish Screen Guidelines (DFO) provide instructions for the protection of anadromous and resident fish where freshwater is extracted from fish-bearing waters.
Migratory Birds Convention Acts(MBCA) and Regulations	Environment Canada	Effects on migratory birds or their habitat
Canadian Environmental Protection Act	Environment Canada/Health Canada	Accidents or spills leading to potential pollution or impacts to the environment and human health

Legislation/Guidance Document	Responsible Authority or Department	Description or Potential Trigger/Authorization
Canadian Environmental Protection Act -PCB Regulations	Environment Canada	Waste remediation and landfill guideline (2011)
Industrial Treated Wood Users Guidance Document	Environment Canada	Management of treated wood (2004)
Canada Labour Code	Human Resources and Skills Development Canada	Provides direction on safety issues to ensure that all projects must be conducted in a safe manner and ensure that no environmental aspects infringe on the safety of a federal site, workers or occupants
Canada Shipping Act	Transport Canada	Applies to all Canadian territorial waters and fishing zones. Arctic shipping in Canada is governed by several pieces of legislation. Principally these are the *Arctic Waters Pollution Prevention Act* and its regulations, the *Canada Shipping Act 2001*, the *Marine Liability Act*, the *Marine Transportation Security Act*, the *Coasting Trade Act* and the *Canada Labour Code*, as well as the *Charts and Nautical Publications Regulations, 1995*, and *Navigation Safety Regulations* made pursuant to the *Canada Shipping Act*. These acts and regulations were created to enhance safety and to protect life, health, property and the marine environment. It is the responsibility of ship owners and operators to ensure that they comply with all applicable acts and regulations.
Arctic Waters Pollution Prevention Act	Transport Canada	Act to prevent pollution of areas of the arctic waters adjacent to the mainland and islands of the Canadian arctic
Transportation of Dangerous Goods Act	Transport Canada	The Act applies to all shipping and handling dangerous goods, offering for transport and transporting of dangerous goods by any means of transport whether or not the goods originate from or are destined for any place or places in Canada.
Nunavut Land Claim Agreement	Aboriginal Affairs and Northern Development Canada	Use, management and conservation of land, water, and resources of Nunavut and identifies the need to complete an environmental impact assessment for specific projects.

Legislation/Guidance Document	Responsible Authority or Department	Description or Potential Trigger/Authorization
Territorial Lands Act	Aboriginal Affairs and Northern Development Canada	Provides the authority for administering and protecting lands under the direct control of the Minister of AANDC. The following regulations are pursuant to this Act: • The *Territorial Lands Regulations* provide regulatory control for maintaining sound environmental practises for any land use activities on Territorial lands. • The land use permits are under the authority of the *Territorial Land Use Regulations*. For Crown land in Nunavut the application acceptance and issuance process is the responsibility of AANDC. Class "A" permits are screened by NIRB. Class "B" are distributed amongst a Land Advisory Committee for comments. *The Territorial Quarrying Regulations* establish the procedures for extracting Crown-owned limestone, granite, slate, marble, gypsum, loam, marl, gravel, sand, clay or stone from Territorial lands.
Navigable Waters Protection Act[1]	Transport Canada	Supports the regulation of works constructed or placed in, on, over, under, through, or across, navigable waters in Canada.
Canada Shipping Act, 2001	Transport Canada	Shipping and navigation considerations
Abandoned Military Site Remediation Protocol, 2005	Aboriginal Affairs Northern Canada (Formerly Indian and Northern Affairs Canada)	Guiding principles for the remediation of the contaminated sites under the control of AANDC (INAC)
DEW Line Cleanup Protocol, 1993	Department of National Defence	Criteria for a specific limited set of contaminants for the effective remediation of the DEW Line sites
DEW Line Cleanup Barrel Protocol, 2005	Aboriginal Affairs Northern Canada (Formerly Indian and Northern Affairs Canada)	For determination of correct disposal method for barrels and their contents in accordance with the DEW Line Cleanup standard.

Legislation/Guidance Document	Responsible Authority or Department	Description or Potential Trigger/Authorization
TERRITORIAL LEGISLATION AND GUIDELINES		
Nunavut Wildlife Act	Government of Nunavut (Environment)	Established comprehensive regime for the management of wildlife and habitat in Nunavut, including the conservation, protection and recovery of species at risk, in a manner that implements provisions of the Nunavut Land Claims Agreement respecting wildlife, habitat and the rights of Inuit in relation to wildlife and habitat.
Nunavut Environmental Protection Act	Government of Nunavut (Environment)	Responsible for ensuring that Nunavut's environment is protected, promoted and enhanced, while encouraging responsible development through input and direction into various permit applications
Nunavut Environmental Right Act	Government of Nunavut (Environment)	Establishes a right to a healthy environment and provides the people of Nunavut the means to protect the environment by authorizing public prosecutions for violations of the Act.
Nunavut Fire Prevention Act	Government of Nunavut	Implementation of fire safety and fire prevention.
Nunavut Territorial Archaeological Sites Regulation	Government of Nunavut	Responsible for protection of Nunavut's archaeological and paleontological heritage
Nunavut Waters and Surface Rights Tribunal Act	Government of Nunavut	Responsible for regulating entry and access to lands, for determining rights of, and compensation payable to, the titleholder and for determining the amount for wildlife compensation claims in the Nunavut Settlement Area.
Environmental Guideline for Waste Lead and Waste Paint	Government of Nunavut	Lead paint waste guideline (2011)
Environmental Guideline for Waste Paint	Government of Nunavut	Waste paint guideline (2010)
Environmental Guideline for Mercury-Containing Products and Waste Mercury	Government of Nunavut	Mercury disposal guideline (2010)
Environmental Guideline for the General Management of Hazardous Waste	Government of Nunavut	Reference and waste guidelines (2010)

Legislation/Guidance Document	Responsible Authority or Department	Description or Potential Trigger/Authorization
Environmental Guideline for the Burning and Incineration of Solid Waste	Government of Nunavut	Guidelines for incineration considerations (2012)
Environmental Guideline for Waste Asbestos	Government of Nunavut	Guideline required for handling and abatement (2011)
Environmental Guideline for Waste Batteries	Government of Nunavut	Guideline and disposal options (2011)
Environmental Guideline for Waste Solvent	Government of Nunavut	Waste solvent disposal options (2011)
Water Licence	Nunavut Water Board	All uses of water and disposal of waste into water, with the exception of domestic or emergency use, require NWB approval. This includes municipal activities, mining exploration activities, mining operations, camps, etc. • Permits require that all waste disposal locations, including sewage treatment systems, grey water discharge areas, and fuel storage areas be located a minimum of 31 m from the high water mark of any water body or drainage course.
Land Use Permit	Nunavut Impact Review Board, Lands Advisory Committee and AANDC (see Territorial Lands Act description above)	Class "A" permits are screened by NIRB. Class "B" are distributed amongst a Land Advisory Committee for comments.

Notes: *[1]The Navigable Waters Protection Act will be replaced by the Navigation Protection Act (anticipated in spring 2014)*

3.3.1 Scope of Assessment

In accordance with Section 12.5.2 of the Nunavut Land Claim Agreement (NCLA) and the Terms of Reference issued by PWGSC (May 2013), the EIA shall include consideration of:

- Project description, including the purpose and need for the project;
- Anticipated ecosystem and socio-economic effects impacts of the project;
- Anticipated effects of the environment on the project;
- Identify steps for contingency plans to avoid and mitigate adverse impacts;
- Identify steps to optimize benefits of the project, with specific consideration being given to expressed community and regional preferences as to benefits;
- Identify steps to compensate adversely affected interests by the project;
- Identify a monitoring program to ensure the protection of ecosystem functions and reduction of socio-economic impacts;
- Identify the interests in lands and waters which has been secured, or seeks to secure;
- Identify options for implementing the proposed remediation activities; and,
- Identify any other matters that NIRB considers relevant.

The scope of the assessment shall consider potential environmental effects on the following environmental components:

- Atmospheric Environment (air quality and climate);
- Physical Environment (geomorphology, soils, groundwater);
- Aquatic Environment (freshwater and marine environments);
- Terrestrial Environment (vegetation, wildlife and wildlife habitat);
- Protected Areas and Species (protected natural areas and species at risk);
- Socio-Economic and Land Use (community, traditional land use, archaeological and culturally important areas); and,
- Human Environment (health and safety).

3.3.2 Purpose/Rationale and Need for the Project

As the custodian of most federal lands in the North, AANDC has responsibility, through the NCSP, to manage contaminated properties that are a liability to the Crown. As part of the INAC AMSRP (INAC, 2009) and responsibility through the NCSP, the purpose of the project is to remediate the FOX-D former military base in compliance with the protocol. This EIA is designed to evaluate the potential for impacts arising from the remediation activities and to identify appropriate mitigation, if required, to address and minimize significant adverse effects.

3.3.3 Project Alternatives

3.3.3.1 Alternatives to the project

The proposed remediation project is being driven by regulatory requirements. As such, the only alternative is the Null or Do Nothing approach which may result in prolonged environmental impacts and continued risk exposure. Maintaining the site in its current state was not considered a viable alternative to the proposed project.

3.3.3.2 Alternative means for carrying out the project

Evaluation of the various remedial options as part of the RAP was completed using a systematic process that identifies parameters by which to rank the options, and the relative importance of those parameters. A decision-making matrix based on the Kepner-Tregoe process was used. The detailed options analysis is reflected in the RAP.

Upon further review of the results of the RAP analysis, the decision has been taken to render the site clean by removing the majority of the debris, regardless of level of contamination. The remaining debris, already located in a prior disposal site, will be stabilized and capped.

3.4 Project Scope

For the purpose of this EIA, the project is defined as the physical works related to the site preparation, the construction specifically-designed for the implementation of the remedial activities, as well as the decommissioning and ultimately the closure of the FOX-D site.

The main project components for this project include:

- Site Preparation and Construction;
- Site Remediation Activities; and,
- Site Closure.

The project components are summarized below.

3.4.1 Site Preparation and Construction Activities

Successful implementation of the recommended remedial actions will require logistical coordination of various on-site elements as outlined below.

3.4.1.1 Infrastructure, Roads and Site Access

Infrastructure/Roads - The Upper and Lower Sites and ancillary areas are connected by an existing access road, established at the time the DEW Line site was operational. The access road varies in width from less than 5 m to greater than 6 m and has a variety of grades depending on the terrain (KGS, 2013). Due to lack of upkeep and erosion, some portions of the existing road will require repair and upgrading. Areas requiring rebuilding, regrading and significant drainage control are shown on **Figure 2** as "heavy regrading". The remainder of the road will require some patching and topping up (medium grading) and/or localized grading (light grading). All of this repair work can be completed using existing fill from

the main station area and borrow material from the borrow source areas shown on **Figure 2**. General photos of the various site areas are included in **Appendix A**.

An extension of the road to the Upper Site will be constructed on the northern side of the hill for access to the existing dump site, identified as APEC 9. A single lane road will be constructed to accommodate heavy equipment traffic and a turn-around loop will be constructed at the dump site. To construct the road, the alignment will be graded to achieve evenness of the surface and then will be built up with the placement and compaction of fill material from the borrow area. There will be no excavation to prepare the road. Road surface contouring will provide for adequate storm water drainage and in low lying areas, small diameter pipe will be installed below the road surface to provide for proper drainage if required. No major watercourses will be crossed in the completion of this project. Upon site closure, the road will be decommissioned with the extra fill material scraped off the surface and the area being re-contoured to the previous state. Access roads already existing will remain.

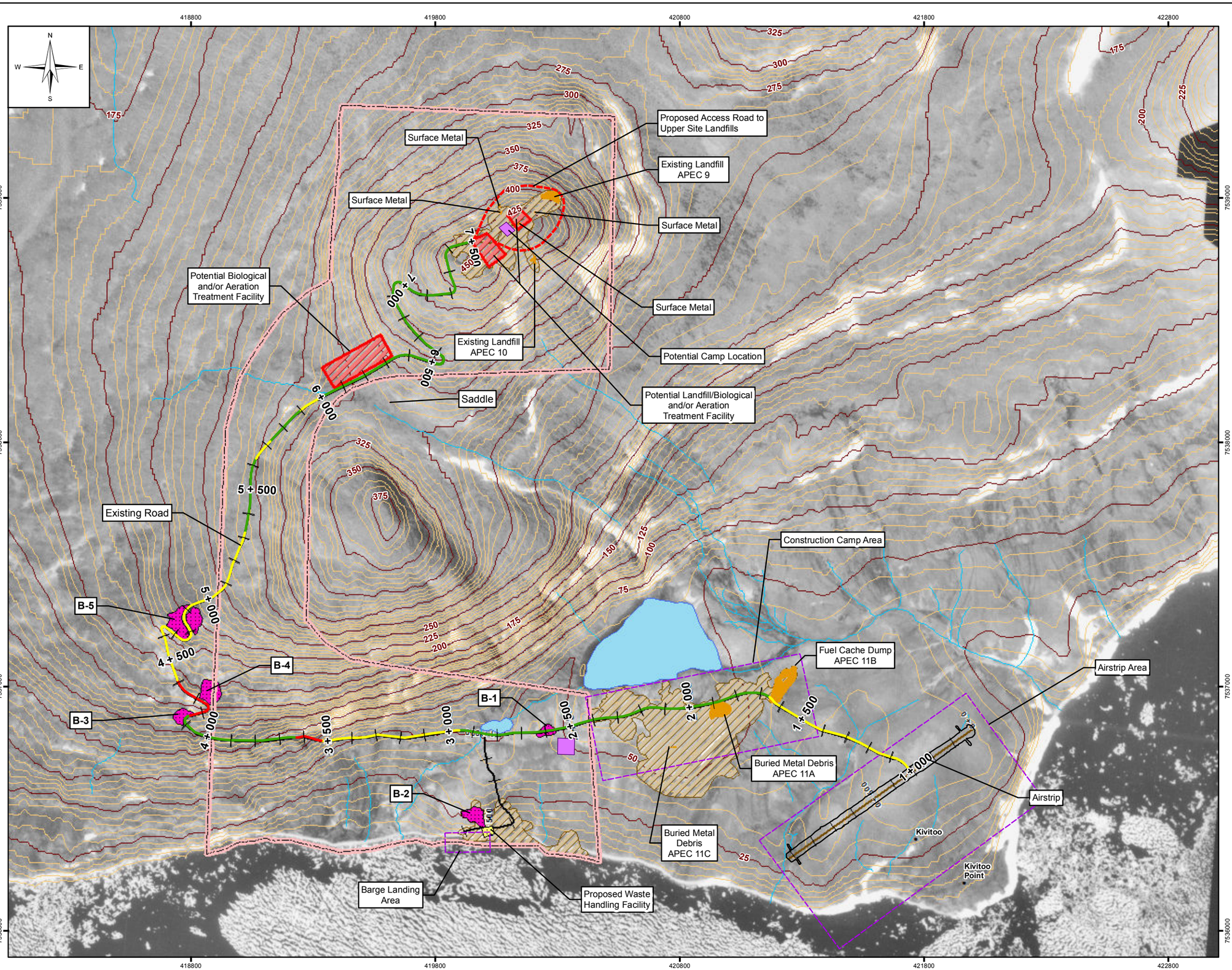
Borrow Source Development – Borrow sources for granular material will be required for the construction of the road and for general site grading purposes. Borrow material shall be drawn preferentially from the main station area gravel source. The sand and gravel borrow sources are estimated to contain approximately 42,200 m^3, which will be adequate for the remedial activities. Borrow sources (identified in **Figure 2**) will be developed in accordance with the AMSRP (INAC, 2009) and upon closure, will be re-contoured.

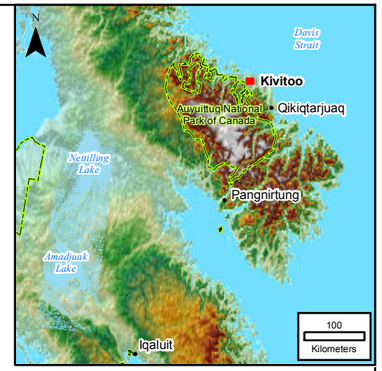
Table 3-3 Borrow Source Location and Description

Borrow Source	Location	Estimated Volume of Material (m^3)	Description
B1	(2+600) main road	9,000	Cleaner gravel, (less boulders/cobbles)
B2	(500) Barge road	3,000	Cleaner gravel, (less boulders/cobbles)
B3	(4+125) main road	3,200	Clean ggravel, higher amount boulders/cobbles
B4	(4+250) main road	10,000	Generally cleaner sands and gravel (some boulders/cobbles)
B5	(4+800) main road	17,000	Mixed sand, gravel and cobbles.

Storm water Management – Where necessary, work areas will be protected from storm water influences by low profile drainage channels and silt control fencing to re-direct water away from the working areas of the site. Activities in borrow pits close to the marine environment (such as B2) should be restricted to not closer than 30 m from the shoreline, are to be protected with sediment control fencing and should be revegetated upon closure.

Airstrip – The Kivitoo airstrip is located on Inuit Owned Land (IOL), 1.2 km east of the Crown Land property boundary, southeast of the Lower Site. The site has suitable areas for both helicopter and fixed wing aircraft landing (**Figure 1**). The airstrip may require modifications to meet current Transport Canada standards. It is anticipated that the Kivitoo airstrip will remain intact once the clean-up work is completed. All movement to and from the site will take place via sealift, with support and re-supply service provided by helicopter and/or fixed wing aircraft.





LEGEND:

- Proposed Access Road to Upper Site Landfill
- Light Grading
- Medium Grading
- Heavy Grading
- Drainage Pathway
- 5 m Contour
- 25 m Index Contour
- Crown Land
- Existing Landfills
- Freshwater Lake
- B-1 Potential Borrow Areas
- Area of Disturbance/Worked Area
- Proposed Waste Handling Facility
- Potential Camp Location
- Potential Landfill/Biological and/or Aeration Treatment Facility

NOTES:

1. Imagery: 1:20,000 scale imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplied from NRCAN, derived from 1:60,000 stereo pair imagery.
3. APEC 9 and APEC 10 located at Upper Site identified as Class C landfills.
4. APEC 11A, APEC 11B and APEC 11C at former construction camp identified as Class A landfills.

FINAL

200 0 200 400 600
Metres

SCALE: 1:15,000 METRIC 11"x17"

All units are metric and in metres unless otherwise specified.
Transverse Mercator Projection, NAD 1983, Zone 20
Elevations are in metres above sea level (MSL)

NO.	YY/MM/DD	DESCRIPTION	BY
2	14/11/03	RE-ISSUED WITH REVISED FINAL ENVIRONMENTAL ASSESSMENT	AMH

REVISIONS / ISSUE

KGS GROUP CONSULTING ENGINEERS

DILLON CONSULTING

HAZARDOUS MATERIALS ASSESSMENT
SITE SURVEY & GEOTECHNICAL SERVICES
FOX D DEW LINE SITE BAFFIN ISLAND

PROPOSED SITE PROJECT INFRASTRUCTURE AND REMEDIATION ACTIVITIES

NOVEMBER 2014 | FIGURE 2 | REV: 2

FileName: P:\Projects\2013\13-0163-002\Dwg\GIS\MXDs\Dillon_EA_Report\Rev2\13-0163-002-F02_Rev2.mxd
11"x17" PLOT SCALE 1:1

Beach Landing -The majority of the waste will be shipped off site to an approved, licensed, waste disposal facility. To accommodate the movement of waste from the site, the existing barge landing area (**Figure 2**), will be repaired where necessary. It is not anticipated that there will be any reconstruction of the barge landing in the marine environment. While ships will be moored offshore in the fjord, the site will be accessed by barges.

Waste Handling Facility - A WHF will be developed to receive and sort all waste from the site. The WHF area shall be near the barge landing area as shown on **Figure 2** surrounded by a temporary road to provide access to vehicles and equipment required in the delivery, sorting and transport of the site waste. Located at the Lower Site inland and away from the shore, this area will be bermed and underlain with an engineered liner which will have fill cover to protect the liner integrity. Surface water will also be controlled and directed around the pad by way of low profile ditching.

Areas within the overall facility will be designated for specific functions. Any liquids collected from the Upper and Lower Sites will be stored in containers in the WHF, clearly labelled and capped. In particular, a fluids handling area will designed with an engineered liner to prevent the migration of contaminants resulting from any accidental spills.

Existing Dumps - The existing Class C dumps located at the Upper Site have been identified in the RAP as APECs 9 and 10. Although no construction is required for these sites, during the project materials will be moved and relocated within the areas on designated roads as per the AMSRP.

Soil Treatment Area - An area below the summit of the Upper Site, referred to as the "saddle", has been identified for a Soil Treatment Area for remediation of petroleum contaminated soils. This area will encompass 6,000 m^2 and will be constructed above grade. As well, the area will be bermed to control runoff and the potential for movement of soil from the influence of winds.

Construction Camp - Although the community of Qikiqtarjuaq is nearby, the ability to house and efficiently mobilize workers to the Site from this community is not deemed to be feasible. The on-site camp will be large enough to support approximately 20 site workers and approximately three to five camp staff (**Figure 2**). Due to the harsh weather conditions, activities on-site will only occur during the summer months (i.e., June to September); therefore the camp will only be operational during this time. The camp will include a potable water source available from the lake, sewage collection, and waste collection. Fuel required to operate the camp and to complete remedial activities will be stored on-site in accordance with applicable Territorial legislation and licenses. The associated disposal of sewage, grey water, and waste disposal at the camp will be conducted in accordance with a Water Use License and Land Use Permit as noted on **Table 3-2**.

All non-hazardous solid waste generated from the operation of the camp will be incinerated on-site. The ash will be collected and at the end of each construction season will be shipped off-site to an approved disposal facility. All hazardous wastes will be shipped off-site.

In the event of an emergency at the camp site, an emergency shelter (separate from the camp) will be available on-site and used as a muster station. This shelter may be comprised of tents that are set up on an as-need basis.

Facilities will include:

- Sleeping quarters;
- Office (contains communications area);
- Kitchen and dining area;
- Bathroom and showers;
- Laundry facilities;
- First aid facilities (may depend on the number of workers);
- Incinerator;
- Mechanics and equipment area that would have a petroleum and lube containment area, tanks and drums;
- Water supply and pumps;
- Diesel powered generator and back-up; and,
- Emergency shelter.

It is anticipated that potable water sources will be obtained from the freshwater lake located adjacent the FOX-D site. A water sample was collected by Dillon from the freshwater lake and submitted for routine potable and total metals analysis in 2013. Results for major ion and total metals in the water sample were found to be below the *Health Canada Guidelines for Canadian Drinking Water Quality (HC, 2012).* If it is determined that the lake is suitable to supply potable water for the on-site activities, on-going monitoring of this potable water source would be conducted during remediation. Contingencies for water supply will include filters, and a supply of bottled water.

3.4.2 Site Remediation Activities

The primary objective of the remediation activities is to create a site clear of any contamination which may pose a hazard to wildlife and/or humans. To achieve this objective, three disposal methods will be employed at the site: shipment off-site to an approved facility, stabilization and containment on-site in an existing area, and biological treatment and aeration for soil remediation.

The disposal options described in detail in the RAP (**Table 3-1**) were evaluated further relative to being able to meet the intent of leaving the site as clean as possible. Recognizing this, the majority of the waste will be shipped off-site. Of the total volume of hazardous and non-hazardous material including soil, 58 % will be shipped off-site and of the remaining 42%, 15% will be treated (soil) and 27% will be left in place in the existing dump site. A detailed description of the waste types and volumes is provided in the *Dillon 2013 Phase III ESA and RAP* documentation. The disposal methods will be implemented in accordance with the applicable protocols and legislation governing these activities in the northern environment as outlined in **Table 3-2**.

3.4.2.1 Transfer to Waste Handling Facility for Off-site Disposal

Materials which will be removed from the FOX-D site to an off-site location approved for the specific disposal/treatment method include hazardous and non-hazardous materials. It is generally understood that the off-site waste disposal locations are located in Québec. All materials for off-site transport will be collected by truck and assembled in the Waste Handling Facility (WHF) for packaging. Collection and movement around the sites will be executed in accordance with specific operating procedures designed to minimize environmental impact.

Hazardous Materials

Fluorescent Lights and Lead-Acid Batteries

Hazardous materials such as fluorescent lights and batteries at the Upper and Lower Sites will be transported to the WHF for sorting and packaging. These materials will be containerized and labelled in accordance with the *Transportation of Dangerous Goods Act* and the AMSRP (INAC, 2009) protocol and shipped to an off-site approved facility.

Asbestos Containing Materials

Asbestos poses an inhalation hazard requiring special handling precautions and disposal methods. Asbestos containing material is located throughout the remaining structures and within the buried debris piles. Asbestos was found in floor tiles, pipe insulation, fire door insulation, transit board, and vermiculite insulation. Asbestos containing materials will be properly abated, in accordance with applicable regulations, prior to any demolition activities. The asbestos-containing materials will be transported to the WHF, packaged and then shipped to an off-site approved disposal facility.

Contaminated Barrels

Barrels located at the site will be addressed in accordance with the *DLCU Barrel Protocol* (INAC, 2009). The barrels will be collected and located to the WHF where the contents of filled barrels will be inspected and tested. Liquids will be removed using absorbent materials. Once empty, the barrels will be prepared for shipping to an offsite approved disposal facility. The absorbent materials will be sorted and packaged according to the degree of contamination prior to being shipped off-site.

Polychlorinated Biphenyls (PCBs) and Lead Containing Paint

PCB and lead paint abatement consists of removing the contaminated paint from the substrate. This is accomplished by physical scrapping, chemical stripping, sand blasting and various other abrasive physical removal techniques. As the paint fragments contain lead and or PCBs, abatement methods will be conducted in a manner that protects the worker and the environment from potential contamination. Paint removed from barrels will be collected and removed off site to a licenced disposal facility for hazardous waste. Given the materials on-site, no current plans are in place for removing paint prior to shipping.

Buildings and Infrastructure

All existing buildings and infrastructure will be inspected for potential hazardous materials. Any identified hazardous materials will be removed prior to demolition of the building or structure where feasible. If removal is possible during demolition, workers will wear the necessary protective equipment to manage potential risks. Demolition waste material will be transported to the WHF for sorting and removal to an approved facility off-site. Likewise, hazardous waste materials will be transported to the WHF for sorting, segregation and shipping off-site to an approved facility. Foundations will be removed in the same manner; however, clean concrete waste will be put in the existing on-site APEC-9 Class C landfill as per the AMSRP.

Metal Contaminated Soil

A number of areas have been identified with Type A soil contamination. Soils containing heavy metals and PCBs will be excavated to a depth of 0.3 m and transported by truck to the WHF. These soils will be containerized for removal to an off-site, approved disposal facility.

Non-hazardous Materials

Approximately 21,827 m^3 of non-hazardous materials are estimated to exist at the FOX-D site as summarized on **Table 3-2**.. All non-hazardous material, except for the material identified at APEC 9, will be collected and relocated to the WHF where it will be sorted, packaged or containerized and then shipped off-site to an approved facility. Approximately 14,834 m^3 of non-hazardous debris consisting of heavy equipment, barrels, scrap metal, scrap wood, concrete, electrical equipment and plumbing parts to be handled and shipped off-site. Remaining non-hazardous materials in Class C dumps will not be handled.

Wood Waste

Wood waste associated with previous buildings and structures which may be contaminated with paint will be collected and located to the WHF for sorting, packaging and removal.

Debris

At various locations throughout the FOX-D site, metal, plastic, concrete, and rubber have been identified. These materials will be collected in trucks and transported to the WHF for sorting to off-site disposal, packaging and removal.

Physical hazards (buildings, structures)

All physical hazards such as dilapidated buildings and unspecified garbage (broken glass) will be collected and transported to the WHF for sorting to disposal, packaging and removal. Where required, areas will be raked to ensure all pieces have been collected.

3.4.2.2 On-site Disposal

The Phase III ESA identified APEC 9 at the Upper Site as an area where there had been previous dumping (**Figure 2**). The estimated volume of material exceeds any other area at the FOX-D site. Some of the waste was exposed and easily identified as being metal cabinets, metal waste, drums and asbestos-

containing materials. Based on the soil sample results and visual inspections, the buried debris areas at both APECs 9 and 10 are classified as Class "C" landfills in accordance with the AMSRP (INAC, 2009). A Class C landfill is situated in a stable location, with no contaminant release. Class C landfills can be left in place and if needed, additional granular material can be placed to prevent erosion and promote proper drainage.

The large volume of material precludes complete removal from APEC 9. Hazardous materials (Class B material, including asbestos) will be removed. Class C material (Inert non-hazardous material) will be arranged in the dump and covered with borrow material. This process will be executed over a number of shallow lifts to ensure complete coverage of the material, filling the voids and spaces, and to reduce the potential for leachate generation.

3.4.2.3 Soil Treatment Area

Type B Hydrocarbon impacted soils will be excavated to a depth of 0.3 m and relocated to the Soil Treatment Area in the saddle area as identified in **Figure 1**. Type B Hydrocarbon impacted soils will be rotated regularly (on-site) to allow for vaporization of the volatile organic compounds. Regular (i.e., weekly) testing will be completed to monitor residual levels of petroleum products. Once the concentration of petroleum has reduced to meet the *DLCU Criteria* (INAC, 2009) for contaminated soil, the Soil Treatment Area will be decommissioned with the remaining soil levelled and stabilized.

The Soil Treatment Area site will be accessed from the access road leading to the Upper Site. The contaminated soil will be placed at the Soil Treatment Area early during the site clean-up process to permit maximum time for remediation. Equipment will be dedicated to the Soil Treatment Area to minimize the potential for cross contamination of other sites.

3.4.2.4 Operation of Camp

The camp will be operated during the summer months (June to September). All waste will be collected and stored to eliminate the potential for predators, off-shore migration and legacy issues. Procedures for dealing with human waste collection and disposal will meet water licence requirements and will be determined by the selected contractor. Fresh water will be withdrawn from the lake with appropriate screens and filters to eliminate the potential for fish impingement. The water will be tested regularly (i.e., weekly) following the *Health Canada Drinking Water Quality Guidelines* (2012). All food and supplies will be brought to the site by aircraft or by ship. Waste disposal will be determined by the selected contractor.

All heavy equipment will be stored on a dedicated pad when not in use on-site. Fuel and hydraulic fluids will be stored in a designated area and in accordance with applicable legislation. Refuelling of equipment will follow standard operating procedures in compliance with territorial and federal guidelines. Emergency clean-up materials and a spill kit will be maintained on-site at all times.

3.4.3 Site Closure and Re-Contouring

Site closure will logically commence at the Upper Site. The existing Class C dumps (APECs 9 and 10) will be capped with a minimum of 0.5 m of clean material taken from the existing borrow sites

(as identified in **Table 3-3**, above). As the activities are completed on the Upper Site, the previously disturbed areas will be re-contoured to allow for regrowth where possible. The new portion of road leading to the APEC 9 area will be removed and the area contoured to its original elevations. To eliminate the risk of erosion, all sloped areas will be protected with riprap.

Following remediation of the petroleum contaminated soils in the Soil Treatment Area; the site will commence closure operations. Following the treatment period, the Soil Treatment Area will be decommissioned by levelling the soils to their original grades to encourage regrowth where possible. Remediated hydrocarbon soil will be used as a capping material for site recontouring.

At the Lower Site, the WHF will be deconstructed with the liner removed and packaged for shipment off site. The Lower Site will be re-contoured to allow for drainage. Slopes will be stabilized with riprap. The beach landing will remain intact to permit final site closure. No deconstruction will take place of the ramp of this previously existing structure.

The construction camp will likely be the last component of the project to be deconstructed. All materials, waste products and equipment will be removed by sealift. The area will be contoured to the original elevations as needed.

3.4.3.1 Post Demobilization Revegetation

3.4.4 Project Schedule

The project schedule is subject to contract award. The actual schedule will be refined and finalized when the contract is awarded and a contractor is in place. Assuming the project is tendered in the summer of 2015, the following is a proposed schedule for the remediation of the FOX-D site:

- Community meetings (Winter 2015);
- Permitting (Winter 2015 to Spring 2016);
- Bidders site meeting (Summer 2015);
- Contract tender (Summer 2015);
- Contract award (Fall 2015);
- Mobilization (Summer 2016);
- Year one Remedial Activities (Summer 2017);
- Year two Remedial Activities (Summer 2018);
- Demobilization (Summer 2018); and,
- Sea-lift Demobilization of Equipment (Summer/Fall 2019).

4.0 DESCRIPTION OF EXISTING ENVIRONMENT

4.1 Atmospheric Environment

4.1.1 Climate

Environment Canada's (EC) closest weather reporting station to FOX-D is located in Iqaluit, Nunavut (Latitude 63°45' N and Longitude 68°33' W) and is situated at an elevation of 33.50 masl approximately 500 km south of FOX-D. According to the *Canadian Climate Normals* (1971 to 2000) recorded at the Iqaluit weather station, the annual daily mean temperature is -9.8°C with daily mean temperatures ranging from -26.6°C (January) to 7.7°C (July). The daily maximum temperatures range from -22.5°C (January) to 11.6°C (July), and daily minimum temperatures range from -32.2°C (February) to 3.7°C (July). The extreme temperature range is from -45.6°C (February) to 25.8°C (July). In general, precipitation falls primarily as snow during the winter months, with the greatest snowfalls occurring in October, November and April. Rainfall dominates during the summer season, with overall levels of precipitation peaking in July and August. Annually, the average precipitation level is about 412 mm. Average wind speeds recorded at Iqaluit are fairly constant throughout the year, ranging from approximately 12 to 17 km per hour and are most frequently coming from the northwest (EC, 2013). Refer to **Table 4-1** for a summary of the climate normals.

Table 4-1 Canadian Climate Normals Summary for Iqaluit, Nunavut (1971-2000) [1]

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Average Temperature (°C)	-26.6	-28	-23.7	-14.8	-4.4	3.6	7.7	6.8	2.2	-4.9	-12.8	-22.7	-9.8
Daily Maximum (°C)	-22.5	-23.8	-18.8	-9.9	-0.9	6.8	11.6	10.3	4.7	-2	-8.9	-18.5	-6
Daily Minimum (°C)	-30.6	-32.2	-28.6	-19.6	-7.8	0.3	3.7	3.3	-0.4	-7.7	-16.7	-26.9	-13.6
Rainfall (mm)	0.1	0	0	0.2	2.8	24.7	59.2	64.8	41.5	4.5	0.5	0	198.3
Snowfall (cm)	22.8	16.8	25.3	32.4	25.1	9.8	0.1	0.8	13.7	34.9	32.4	21.7	235.8
Precipitation (mm)	21.1	15	21.8	28.2	26.9	35	59.4	65.7	55	36.7	29.1	18.2	412
Windspeed (km/h)	15	14.8	14.1	15.8	17.3	15.3	12.4	13.9	15	17.6	17.6	15.4	15.4
Most Frequent Direction	NW	NW	NW	NW	NW	SE	SE	SE	SE	NW	NW	NW	NW

[1] Data acquired from Environment Canada's National Climate Archive

4.1.2 Air Quality

The "*Environmental Guideline for Ambient Air Quality establishes standards for common air contaminants in ambient air throughout Nunavut. Numeric standards for fine particulate matter, total suspended particulate, nitrogen dioxide, sulphur dioxide and ground level ozone are adopted under the Guideline*" (Government of Nunavut, 2011a).

The Government of Nunavut Department of Environment's (NDE) Environmental Protection Division (EPD) is the primary agency responsible for the management of air contaminants. The *Environmental Protection Act* provides the Government of Nunavut with authority to implement measures to preserve, protect and enhance the quality of the natural environment. Environment Canada (EC) partners with the EPD to operate a National Air Pollution Surveillance (NAPS) Network air monitoring station in Iqaluit, with long term plans to establish monitoring stations at other key locations in Nunavut (Government of Nunavut, 2011a). There was no data available for Nunavut.

Ambient air quality standards are to be used to assess the impact emissions from proposed and existing sources that may have impacts on the environment. **Figure 3**, obtained from the Government of Nunavut, Environmental Guideline for Ambient Air Quality provides a listing of standards that have been adopted for use in Nunavut and will assist with regional air quality management planning and as benchmarks for reporting on the state of air quality in the project areas.

Figure 3 Ambient Air Quality Standards [1]

Parameter	Standard ($\mu g/m^3$)*	Standard (ppb)**
Fine Particulate Matter		
24 hour average	30	
Total Suspended Particulate		
24 hour average	120	
Annual geometric mean***	60	
Nitrogen Dioxide		
1 hour average	400	213
24 hour average	200	106
Annual arithmetic mean****	60	32
Sulphur Dioxide		
1 hour average	450	172
24 hour average	150	57
Annual arithmetic mean****	30	11
Ground Level Ozone		
8 hour average		65

* By weight - micrograms per cubic metre
** By volume - parts per billion
*** The average of the logarithmic values of a data set converted back to a base 10 number
**** The sum of all the numbers of a data set divided by the count of all the numbers
All ambient air quality standards are references to standard conditions of 25 degrees Celsius and 101.3 kilopascals

[1] Obtained from the Government of Nunavut, Environmental Guideline for Ambient Air Quality, http://env.gov.nu.ca/sites/default/files/guideline_-_ambient_air_quality_2011.pdf

4.2 Physical Environment

During the summer of 2013, as part of a collaborative, interdisciplinary team with Dillon, KGS Group completed a geotechnical and geophysical field investigation program at the former FOX-D site where 42 test pits were investigated for subsurface conditions (KGS, 2013). In addition to the test pitting program dynamic cone penetration testing (DCP) was completed adjacent to 19 of the 42 test pits to estimate the *in-situ* California Bearing Ratio (CBR) and bearing capacity along the road, airstrip and at potential landfill sites. This section provides a summary of the results of this report provided by KGS Group. Additional information provided by other background documents and website searches were also used to characterize the general physical environment of the FOX-D site.

4.2.1 Physiography

The FOX-D site is located north of the Pangnirtung Upland Ecoregion which is part of the Northern Arctic and occupies the lower coastal uplands of Baffin Island surrounding Cumberland Sound. The area is characterized by its rapid rise from sea level and consists of a belt of deeply dissected, crystalline Archean aged rocks. The general aspect consists of broad, gently warped, old erosion surfaces created by the erosion along joint systems, and zones of weakness (Smith *et al*. 1998).

The topographic survey was performed by KGS (2013) to delineate the entire property including the Upper Site, Lower Site, access road, airstrip, barge landing area, Soil Treatment Area and borrow source areas. All survey information was completed in Universal Transverse Mercator (UTM) NAD 83 CSRS and NAD83 Zone 20 projection and the CGVD28 for elevation datum. All topographical survey capture was completed using Global Positioning System (GPS) RTK style surveying. Interim geodetic control benchmarks were established using known geodetic control monuments found on the Canadian Spatial Reference System (CSRS) and were verified by having a GPS receiver collect static data during the field investigation program. The static data was then post-processed using available data from the Canadian Active Control System (CACS) to determine more accurate geodetic locations.

Through these investigations it was determined that the Lower Site is situated on a relatively flat coastal plain approximately 50 m above sea level and the Upper Site, situated at the top of a plateau, is approximately 425 to 450 masl.

4.2.2 Bedrock Geology

According to the geophysical report (KGS, 2013), bedrock within the northern portion of the Cumberland Peninsula is dominated by the Proterozoic aged rocks of the Cumberland Batholith. The site has been mapped as charnockite, enderbite and granoenderbite which are igneous and/or metamorphic rocks typically associated with granulite facies metamorphism (high pressure and high temperature). The bedrock at the site was observed to be primarily brown to rust in colour and highly weathered in appearance.

4.2.3 Permafrost

The FOX-D site is located in the zone of continuous permafrost which is defined as those areas where 90% to 100% of the soil and rock remains at a temperature continuously below 0^{o}C for a period of at least two years. Overburden material at the site consists of till and granular deposits that are free of ground ice (KGS, 2013).

In order to estimate the depth to permafrost and/or bedrock at both the Upper and Lower Sites at the FOX-D site, geophysical investigations were conducted by KGS using ground penetrating radar (GPR) surveys and test pitting. Evidence of permafrost was not observed in the overburden soils during the test pitting program. Results of the GPR survey at the FOX-D site indicated that the depth to permafrost is approximately 1.4 to 1.5 m below grade. Local expertise, (H. Alookie, pers. comm. 2013), suggested that the typical depth to permafrost in this area is approximately 1.5 m.

4.2.4 Surficial Geology and Geomorphology

According to the ESG (2010) report, many coastlines are characterized by wide flat plains that extend up to 10 km inland. Following their release from the crushing weight of glacial ice, they have rebounded over the past few thousand years. Ancient beach terraces that now lie far from shore testify to the uplifting. Some shorelines are closely paralleled by lines of "boulder barricades" pushed there by sea ice carried ashore by strong tides and storm waves (ESG, 2010).

The east coast of Baffin Island is dominated by the Arctic Cordillera which is characterized by sharp peaks and ridges. The Penny Ice Cap, located west of the site, is a remnant of the last ice age which forms a 6,500 m± high barrier on the Cumberland Peninsula in an area of deep fjords and glaciated valleys. Regionally, the overburden is dominated by till deposits overlying bedrock (KGS, 2013).

The surficial geology at the FOX-D site is dominated by marine deposits consisting of deltaic gravel, sand and silt which formed during times of glaciation when sea level was relatively higher (KGS, 2013). These accumulations are thick (>10 m) and surround till material found at higher elevations. The till is reported to be 1 to 2 m thick and consists of varying amounts of gravel, sand, clay and outcrops of ice-moulded bedrock. The ESG 2010 report identifies the higher elevations in the middle of the peninsula contains diamictic glacial till derived from bedrock consisting of two distinct ranges of grain sizes: pebbles to boulders and sand to silt. An end or lateral moraine ridge separates the hilltop till from the near-shore marine deposits (ESG, 2010).

The FOX-D site morphology is characterized by hummocks, low rolling hills, one freshwater lake, and raised beaches composed of coarse-grained gravel over bedrock. Regional overland drainage from the FOX-D site is generally eastward to the Davis Strait.

4.2.5 Hydrogeology and Groundwater

Groundwater resources are permanently bound above the permafrost layer which acts as an aquitard; however, small amounts of interflow occur during the warmer months of the year. In general, precipitation and snow melt do not penetrate the ground to support groundwater resources, but drain quickly to the nearest receiving water body (ESG, 2010).

4.3 Aquatic Environment

4.3.1 Freshwater Environment

As noted during the August 2013 field investigations, the FOX-D site contains an ephemeral stream, freshwater lake and several surface water drainages located within the areas of the proposed project activities (**Figure 4**).

Ephemeral Stream (Outlet to the Freshwater Lake)

At the time of the field investigations, an ephemeral stream was identified as the outlet to the freshwater lake which drained from the lake to Davis Strait, part of the Arctic Ocean. This stream is characterized as having intermittent flow with connectivity to the ocean at periods of high flow during the melting season (July/August). The channel varies in width, (1-4 m) and consists of sandy substrates with large boulder gardens between well-defined banks. A thick overhanging moss layer provides cover for small fish along the steam's edges. During the investigation, one small Arctic char (*Salvelinus alpinus*) fry was observed under the moss cover near the mouth of the lake.

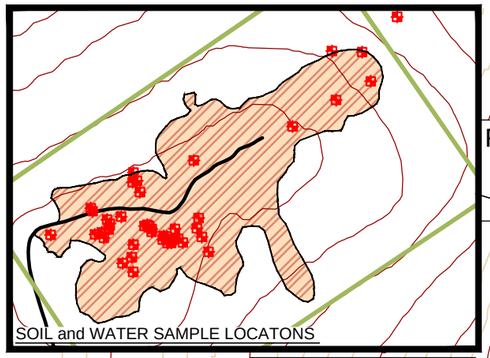
Freshwater Lake

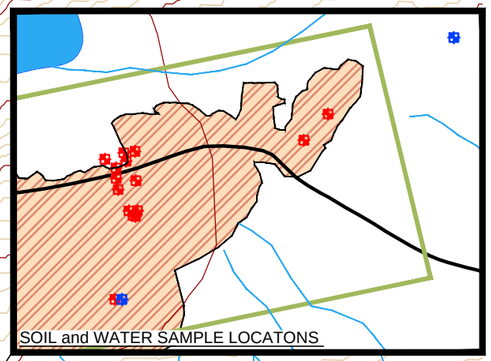
The freshwater lake is located adjacent to the Lower Site, south of the Upper Site **(Figure 4**). The lake is approximately 250 m wide x 600 m long, or roughly 15 ha, and is identified as being a shallow, permanent lake with sandy substrates and some boulders. The lake collects runoff from the surrounding lands and mountain side during the spring/summer melt. At the time of the site survey (August 2013), the lake had limited connectivity to the ocean located 1.5 km downstream. Year round connectivity does not exist; therefore fish passage capability is infrequent.

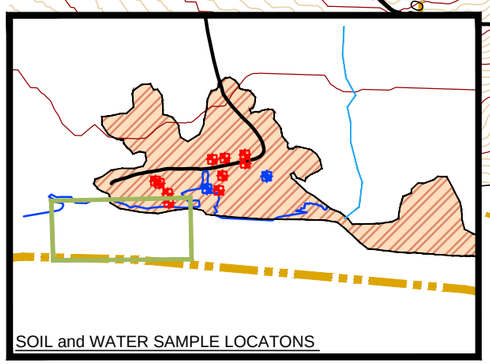
The freshwater lake is assumed to have been used as a potable water source for hunters and trappers in the area. A water sample was collected by Dillon and analyzed for routine potable water parameters, PCBs, major ions and total metals (copper, nickel, cobalt, chromium, cadmium, lead, zinc and arsenic) (Dillon, 2013). Results for major ion and total metals in the water sample were found to be below the *Health Canada Guidelines for Canadian Drinking Water Quality* (2012) and the CCME Guidelines for the protection of aquatic life.

Fish and Fish Habitat

Arctic Char (*Salvelinus alpinus*) has the most northerly distribution of any of the freshwater fish and is the only fish species found on Baffin Island. It breeds in fresh water, and populations can be either landlocked or anadromous. According to H. Alookie (pers. comm., August 2013), the wildlife monitor from the community of Qikiqtarjuaq, Arctic char is the only fish species that inhabits the freshwater lake. This population of char is normally landlocked and may migrate to the ocean only after spawning occurs (H. Alookie, August 2013, pers. comm.).







Potential Biological and/or Aeration Treatment Facility

Potential Biological and/or Aeration Treatment Facility

Proposed Access Road to Upper Site Landfills

Existing Landill APEC 9

Upper Site

Potential Camp Location

Existing Landill APEC 10

Saddle

B-5

B-4

B-3

B-2

B-1

Existing Road

Ephemeral Stream

Freshwater Lake

Fuel Cache Dump APEC 11B

Buried Metal Debris APEC 11A

Buried Metal Debris APEC 11C

Airstrip

Airstrip Area

Kivitoo

Kivitoo Point

Barge Landing Area

Proposed Waste Handling Facility

DAVIS STRAIT

5+500

6+000

6+500

7+000

7+500

5+000

4+500

4+000

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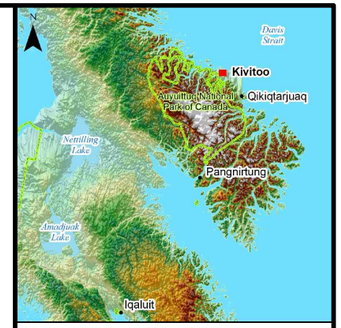


LEGEND

- Crown Land
- Water
- Area of Disturbance/Worked Area
- Proposed Waste Handling Facility
- Potential Soil Treatment Area
- Borrow Areas
- Potential Camp Location
- Road
- Drainage Pathways
- Airstrip
- 25m Index Contour
- 5m Contour
- Testpit Location
- Water Sample
- Wildlife Evidence
- Artic Char Observation

NOTES:

1. Imagery: 1:20,000 Scale Imagery, 1948. National Air Photo Library (NAPL).
2. Contours are supplies from NRCAN, derived from 1:60,000 stereo pair imagery.
3. Survey Completed by KGS Group, August 2013

NO.	YYMMDD	DESCRIPTION	BY
0			

REVISIONS / ISSUE

KGS GROUP CONSULTING ENGINEERS

DILLON CONSULTING

ENVIRONMENTAL SITE ASSESSMENT
FOX-D

PROJECT SITE OVERVIEW

NOVEMBER 2014 | FIGURE 4 | REV. 0

G:\GIS\137942 FOX-D EA\05-Environmental\03-Reports\137942-05-03-FIG 4.dwg

Surface Water Drainage

The surface water drainage patterns noted throughout the FOX-D site are a result snow melt thaw during the summer months (July and August). They are located in stiff till or are controlled by bedrock; therefore erosion and deposition are not important factors in their morphology.

During the investigations of the surface water drainages, water samples were obtained from two surface water areas in the Lower Site (**Figure 4**) and analyzed for BTEX/TPH and total metals (copper, nickel, cobalt, chromium, cadmium, lead, zinc, and arsenic. One of the surface water locations was determined to have heavy metal contamination and exceeding the CCME FWAL guidelines for lead. Refer to **Appendix B** for the water quality analytical results. It should be noted that the volumes of surface water where the exceedances were noted are minimal. Removal of the source contamination (buried barrels) would likely address this exceedance issue

Based on observations made during the 2013 site visit, there are no areas of site activities exhibiting signs of erosion as a result of existing site drainage. None of the soil types identified are particularly prone to erosion.

4.3.1 Marine Environment

The FOX-D beaching area is located within a fjord-like embayment which is protected from wave action. The inner portion of the embayment is very shallow and is fed by a small stream. The beach area consists of cobble, sand and boulders with sparse vegetation. . A defined, pre-existing beach landing area includes sand filled ramps leading from the shoreline. No permanent structures exist at the beach head other than the sand ramps.

According to Fisheries and Oceans Canada Canadian tides and water level data information at Qikiqtarjuaq (Broughton Island) (67.5167º N 64.0667º W) (Station 3980), a mean tidal range at Kivitoo, is between 0 to 1 m.

During an underwater debris assessment performed in 1995 by ESG SCUBA divers, water depths within 1 km of the shoreline were generally less than 60 m on the southern side of Kivitoo point. The shoreline steepens dramatically on the east side of the point. Substrates of the seabed were characterized as being coarser sediment with abundant boulders and cobbles (Bright *et al.*, 1995). During these investigations, no observations were identified.

A large number of soft-shell clams as well as other invertebrate species such as brittle starfish (*Ophiuroidea sp.*), saltwater clam (*Mya truncata)* and sea urchins (*Echinoidea sp.*) (Bright *et al.*, 1995) were noted by the ESG SCUBA divers during their 1995 investigations.

4.4 Vegetation

The FOX-D site is characterized by sparse and stunted vegetation which is typical of the Pangirtung Upland Ecoregion. Plant species are perennial due to the limited germination during the brief summers. Only the hardiest species can survive due to its dry climate, permafrost, calcareous soils, and gale force winter winds. Moss and lichen thrive in this ecosystem and the vegetation is generally characterized by a cover of dwarf tundra vegetation such as dwarf birch (*Betula glandulosa*), willow (*Salix sp.*), northern Labrador tea (*Rhododendron tomentosum*), *Dryas spp.*, and *Vaccinium spp*. Tall dwarf birch, willow, and alder occur in less exposed areas and wet areas are dominated by willow and sedge (ESG, 1996). On August 7, 2013, a site vegetation survey was undertaken. The investigation areas were divided into three survey areas: the "Upper Site", the "Lower Site" and the "Beach/Coastal Area" (**Figure 4**).

The Upper Site consists of exposed rocks and boulders with little soil to support vegetative growth. Arctic poppy (*Papaver radicatum*) was the most abundant flowering plant observed. Less dominant plant species in this area also included: moss campion (*Silene acaulis*), river beauties (*Chamerion latifolium*) and tufted saxifrage (*Saxifraga cespitosa*). Map lichens (*Rhizocarpon* spp.) were noted covering many of the exposed rocks and Bigelow's sedge (*Carex bigelowii*), reindeer lichen (*Cladnia* spp.) and various mosses were found growing sparsely in the shallow sandy soils found between the rocks.

The Lower Site vegetation consisted of a more diverse community and provided a fairly continuous vegetative cover in the undisturbed areas between the road and the freshwater lake. Arctic willows (*Salix arctica*) along with Arctic lousewort (*Pedicularis dasyantha*), Arctic poppy, mountain sorrel (*Oxyria digyna*), nodding saxifrage (*Saxifraga cernua*), river beauties, yellow oxytope (*Oxytropis oxyphylla*) were observed in these areas. An abundance of Arctic cottongrass (*Eriophorum callitrix*) and sedges (*Carex sp.*) were noted in the deeper sandy soils surrounding the freshwater lake. The airstrip and construction camp in this area consisted of a large disturbed sandy area with limited to no vegetation growth.

The Beach/Coastal Areas vegetation communities located between the gravel roadway and the coastline had deeper hummocky soils allowing for more diverse vegetation dominated by Arctic willows as well as Arctic white heather (*Cassiope tetragona*), Arctic chickweed (*Stellaria humifusa)*, Arctic wintergreen (*Pyrola grandiflora*) and Arctic cottongrass. Closer to the coastline, more species were observed, including: Arctic mountain avens (*Dryas integrifolia*), Arctic parrya (*Parrya arctica*), mountain sorrel, moss campion, nodding saxifrage, pygmy buttercup (*Ranunculus pygmaeus*), river beauties, spider saxifrage (*Saxifraga flagellaris*), sedges, and tufted saxifrage.

During the site investigations, there were no plant species at risk or species of conservation concern identified in the vicinity of the proposed project activities. A listing of all plant species observed along is provided on **Table 4-2**.

Table 4-2 Plant Species observed at the FOX-D site, August, 2013

Scientific name	Common name
Carex bigelowii	Bigelow's sedge
Cassiope tetragona	Arctic white heather
Chamerion latifolium	River beauty
Dryas integrifolia	Arctic mountain avens
Eriophorum callitrix	Arctic cottongrass
Oxyria digyna	Mountain sorrel
Oxytropis oxyphylla	Yellow oxytope
Papaver radicatum	Arctic poppy
Parrya arctica	Arctic parrya
Pedicularis dasyantha	Arctic lousewort
Pyrola grandiflora	Arctic wintergreen
Ranunculus pygmaeus	Pygmy buttercup
Salix arctica	Arctic willows
Saxifraga cernua	Nodding saxifrage
Saxifraga cespitosa	Tufted saxifrage
Saxifraga flagellaris	Spider saxifrage
Silene acaulis	Moss campion

4.5 Wildlife and Wildlife Habitat

Base mapping, aerial photographs and historical reports were used to provide a preliminary assessment of habitat at the FOX-D site. Habitat types were confirmed in the field through the study area assessment.

During various field visits to the site, observations of animal signs (actual sightings as well as auditory detections, tracks, bones, scat, and dens/nests) were documented. General wildlife habitat conditions were also noted to indicate the type of wildlife that the study area has the potential to support. Additional historical information was provided by H. Alookie, Wildlife Monitor from Qikiqtarjuaq during the 2013 site visit.

The Northern Arctic Ecozone's extreme cold, harsh soils and limited plant communities are reflected in the relatively low diversity and abundance of mammals. Of the approximately 200 species of mammals found in Canada, fewer than 20 occur in this ecozone. There are few insect species and a total absence of reptiles and amphibians (ESG 1996).

4.5.1 Birds

According to Smith *et al*. (1998), in the spring, thousands of migrant birds are seen along the Davis Strait. Snow Goose (*Chen caerulescens*), Brant (*Branta bernicla*), and Canada Geese (*Branta canadensis*) will nest in moist wetlands that line coastal areas and river valleys. Eider (*Somateria mollissima*) and Oldsquaw (*Clangula hyemalis*) will nest beside small ponds on the grassy tundra areas. These areas also support a number of shorebirds, including the black-bellied plover (*Pluvialis squatarola*), Ruddy

Turnstone (*Arenaria interpres*), and Red Phalarope (*Phalaropus fulicarius*). Other species such as the Hoary redpolls (*Carduelis hornemanni*), Horned Larks (*Eremophila alpestris*), and Snow Buntings (*Plectrophenax nivalis*) need very little vegetation cover for nesting and thus can survive in the sparse arctic landscape (Smith *et al*. 1998).

According to H. Alookie (pers. comm., August, 2013), the Snow Goose and Canada Goose have been seen breeding along the shoreline in the vicinity of the FOX-D site. Although no geese were observed during the site visit, signs (droppings and feathers) of Canada Goose and Canada Loon were observed around the shoreline of the lake and the coastal beach. Other bird species observed during the site visit included Black-bellied Plovers (*Pluvialis squatarola*), Lapland longspur (*Calcarius lapponicus*), a Rock Ptarmigan (*Lagopus muta*) and a Snow Bunting. A mating pair of Red-throated Loons (*Gavia stellate*) was observed on the nearby freshwater lake. A Peregrine Falcon (*Falco peregrinus*) was also noted flying over the area. A summary of the bird species known to occur or observed in the area is provided on **Table 4-3**.

Table 4-3 Bird species observed within the area of the FOX-D site

Scientific name	Common name
Falco peregrinus	Peregrine Falcon
Calcarius lapponicus	Lapland Longspur
Gavia stellate	Red-throated Loon
Lagopus muta	Rock Ptarmigan
Plectrophenax nivalis	Snow Bunting
Pluvialis squatarola	Black-bellied Plover

4.5.2 Small Mammals

The Arctic lemming (*Dicrostonyx torquatus*) is one of the only small mammals hardy enough to survive the harsh climate of this region. The Arctic lemming will seek protection from frigid winter temperatures under a protective blanket of snow and is active all winter, scurrying through tunnels to well-stocked food chambers (ESG, 1996).

During the site investigation surveys in August 2013, several Arctic hare (*Lepus articus*) and Arctic lemmings were observed, including a small lemming den located at the Upper Site (**Figure 4**). There were no other small mammal observations located at the Lower Site or the Coastal (beach) Area.

4.5.3 Large Mammals

Polar bears are known to frequent the area of the FOX-D site in the summer where they will rest during their long trips along the coast. During the site investigations in August, 2013, several polar bears were observed over the course of several days by the field crew.

Barren-ground caribou on Baffin Island are in a state of decline and populations are at a historic low (Gunn *et al*. 2011). In the 1950's, caribou herds used to frequent the FOX-D area during their long

migrations. The lack of adequate food sources in the area is thought to contribute to the diminishing size of the caribou populations at present time (E. Kopalie, pers. comm., August, 2013). Currently the closest caribou herd can be found approximately 200 km north of the FOX-D area (E. Kopalie, pers. comm., August 2013).

A listing of all species observed during the site investigation surveys are summarized on **Table 4-4**.

Table 4-4 Wildlife Species Observed within the area of the FOX-D site

Scientific name	Common name
Dicrostonyx torquatus	Arctic lemming
Lepus arcticus	Arctic hare
Ursus maritimus	Polar Bear
Pusa hispida	Ring Seal
Balaena mysticetus	Bowhead Whales
Monodon monoceros	Narwhal
Odobenus rosmarus	Walrus

4.6 Species at Risk

A search of the federal Species at Risk Act (SARA) Public Registry (EC, 2011) showed there were no federally-listed vegetation species expected within the FOX-D area based on the known distribution and habitat requirements of the species listed for the region. Wildlife species including birds and mammals listed on Schedule 1 of the SARA and by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) were identified as potentially being within the area. **Table 4-5** provides a list of possible species at risk that could be found around the FOX-D site.

Table 4-5 Potential occurrence of species listed under the *Species at Risk Act* (*SARA)*

Scientific Name	Species	Species Type	COSEWIC Status	*SARA* Status	Known to occur in the area of the FOX-D site (Y/N)
Ursus maritimus	Polar bear	Mammal	Special Concern	Special Concern	Y
Histrionicus histrionicus	Harlequin Duck	Bird	Special Concern	Special Concern	N
Pagophila eburnea	Ivory Gull	Bird	Endangered	Endangered	N
Falco peregrinus	Peregrine Falcon	Bird	Special Concern	Special Concern	Y
Balaena mysticetus	Bowhead whale	Marine Mammal	Special Concern	Special Concern	Y – off the coast
Monodon monoceros	Narwhal	Marine Mammal	Special Concern	Special Concern	Y – off the coast
Odobenus rosmarus	Walrus	Marine Mammal	Special Concern	Special Concern	Y – off the coast

Polar Bear and Peregrine Falcon were observed at the FOX-D site during the 2013 site visit. Although these species have been identified in the area, according to the draft Nunavut Land Use Plan data files, there are no sensitive polar bear habitats or migrations routes in this area. Peregrine Falcons were noted flying over the site but no nesting habitat was noted in the area. Peregrine habitually nest on cliffs or elevated promontories, which are not represented at the FOX-D site. Both species, therefore, may frequent the area, and may come into contact with workers or equipment, but appear to have no critical habitats occurring within the limits of the project. No other species at risk were observed in the immediate vicinity of the proposed project activities, nor are anticipated.

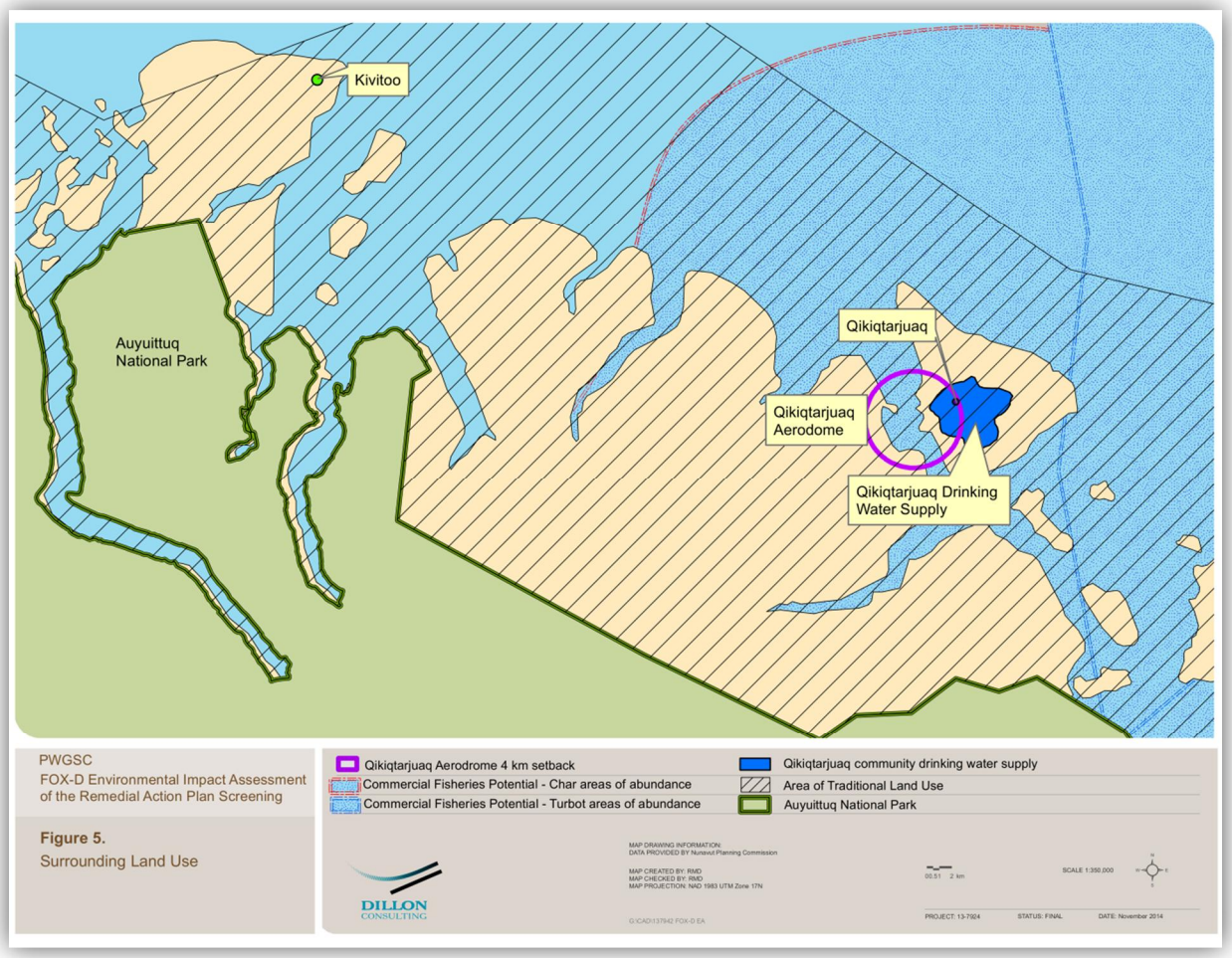
4.7 Protected Areas

Auyuittuq National Park is located approximately 15 km southwest of the FOX-D site and Kivitoo (**Figure 5**). Kivitoo was formerly within Auyuittuq National Park and was under the management of Parks Canada. In 1992, management of the site reverted to INAC (AANC).

The Park covers over 19,000 km^2 and includes the highest peaks of the Canadian Shield, the Penny Ice Cap, marine shorelines along coastal fiords, and Akshayuk Pass. This area is a traditional travel corridor used by the Inuit for thousands of years. The national park was established in 1976 through the Nunavut Land Claims Agreement. Inhabited and influenced by a number of different peoples, the park possesses abundant cultural heritage resources.

The park receives on average 500 visitors each year who enjoy hiking, mountaineering, climbing, ski touring, glacier travel, guided snowmobile visits, dog team trips, boating and, more recently via cruise ship expeditions (Auyuittuq National Park of Canada Management Plan, 2010).

Figure 5 Land use in the area of the FOX-D site.



4.8 Socio-Economic and Cultural Environment

4.8.1 Population

The FOX-D site is located near Kivitoo, which was formerly an Inuit camp and whaling station. The area was abandoned when the settlement was moved approximately 50 km southeast to nearby Qikiqtarjuaq (previously known as Broughton Island) in the 1950s (Golder, 2013).

Qikiqtarjuaq is located on the west coast of the Arctic Ocean, in the Davis Strait, and is the closest community to FOX-D. According to Statistics Canada 2011 census, the population of this community is approximately 520 people. The median age is 25.5 years old.

4.8.2 Land Use

Baffin Island has a long and rich history with evidence of human habitation dating back several centuries (Golder, 2013). Traditional land uses related directly to the subsistence lifestyle, with the population moving in response to the seasons and available resources. An HRIA which provides more detail on the history of land uses was prepared by Golder in 2013 in support of the remediation.

The FOX-D site is situated in an area designated as Traditional Land Use (Nunavut Land Use Plan, 2000). Currently under review, a draft revised plan was released in 2012 the draft for review and comment. Although yet to be approved and implemented, the draft plan shows that the project area will continue to be characterized as a traditional land use area and that any development or projects should consider cultural values (Nunavut Planning Commission, 2011).

4.8.3 Economy

Historically, the people of Nunavut maintained a subsistence lifestyle. According to the 2011 Census (Stats Canada, 2011), fishing and hunting are not recorded as primary economic drivers. The people derive their incomes from construction and the provision of support services.

4.8.4 Historic and Culturally Significant Areas

According to the Golder 2013 HRIA report, ten heritage resource sites were recorded in the area in either the Nunavut database or the Canadian Museum of Civilization (CMC) database. The sites include stone features, semi-subterranean houses, a historic whaling station, and a lithic scatter site. These sites are all well-defined and located outside of, and away from, the Lower Site. Within 300 m of the project site, two graveyards have been identified: one is a whaler's graveyard and the other is an Aboriginal people's graveyard (**Figure 4**). There is no intent to conduct any project activities in close proximity to these cultural heritage sites.

5.0 COMMUNITY CONSULTATION

A community consultation was scheduled for January 28, 2014, but was postponed and rescheduled to January 29, 2014 due to weather. The event was advertised locally over the radio and by posters. Presentation handouts were printed in English and Inuktitut. Information on AANDC's contaminated sites program were made available in English, French and Inuktitut. All information was presented on a table near the entrance. A sign-in sheet was also provided.

The consultation was attended by 58 individuals from the community of Qikiqtarjuaq. A presentation was given outlining:

- AANDC's contaminated sites program;
- The bidding and tender process;
- The applicable guidelines and site criteria relevant to the FOX-D site;
- Environmental concerns at FOX-D;
- Archaeological areas of interest near the site; and,
- The proposed remedial action plan and the project timeline.

The presentation was delivered in English by Erika Solski (AANDC) and Indra Kalinovich (Dillon), and translated to Inukitut in real-time. Hard copies of the translated presentation were also available at the door.

After the presentation, a question and answer period was held. Participants were invited to share stories and any knowledge about activities (be it traditional or related to the former DEW Line) with AANDC. There were a number of general comments and questions from community members about where to submit applications for work and when the work was going to start. AANDC and Dillon re-iterated the bidding and tender contracting process, and that site mobilization activities were tentatively scheduled for 2015. Once the contract is awarded, a separate contractor other than AANDC would be arranging for employment. A second community consultation has been tentatively scheduled for winter of 2016 after the contract has been awarded.

In accordance with the NIRB, employment opportunities for local community members and Inuit must be considered. The successful contractor will be required to provide the necessary training to both local and non-local employees. Local knowledge will be obtained from Inuit workers and the local community.

6.0 EVALUATION OF ENVIRONMENTAL IMPACTS

6.1 Approach to the Assessment of Environmental Impacts

Those aspects of the biophysical and socioeconomic environments deemed to have specific value to the ecosystem are identified as Valued Ecosystem Components (VEC) or Valued Socioeconomic Components (VSC's). VEC's and VSC's have been identified for this project based on their intrinsic value to the ecosystem, heritage and culture, protection afforded by legislation, and professional judgement. For the purposes of this project, the following have been identified as a VEC/VSC:

- Climate and Air quality;
- Permafrost;
- Fish and Fish Habitat;
- Marine Environment;
- Vegetation;
- Terrestrial Wildlife;
- Birds/Bird Habitat;
- Species at Risk;
- Community;
- Traditional Land Use; and,
- Heritage Resources/Culturally Important Areas.

A central feature of the EIA process is to identify the anticipated impacts on the environmental components resulting from the site preparation, construction, remediation and closure activities of the proposed project. The approach taken involves identifying the potential for the Project Activities to interact with the existing Valued Environmental and Socioeconomic Components which are present at the project location. This step is shown in a simple matrix format (**Table 6-1**). Following this identification of potential interactions, the effect of the interaction is evaluated with consideration of the time in which it may occur and the space in which it may occur (**Tables 6-2 – 6-8**). Mitigation is identified for each effect and the significance of the residual impact is established. The significance of the effect was evaluated using the following questions as a guide:

- What is the magnitude of the effect?
- What is the geographic extent of the effect?
- What is the duration (short or long term) and frequency of the effect?
- How does the net effect compare to the existing environment? Does it represent a substantive or order of magnitude negative change in baseline conditions?
- Is there a substantive public, government or agency concern?
- What is the ecological and/or social context for the effect?
- Is the effect permanent or reversible?

6.2 Project Interaction Matrix

The project components identified in Section 2 are indicated under "Project Activities" on **Table 6-1**. The valued ecosystem/socioeconomic components (VEC's/VSC's) of the existing environment identified in **Section 5.1** are indicated under "VECs". Only the VEC's/ VSC's related to the previously disturbed areas are considered, as the natural features within the lease limits have been previously scoped out. Within the concerned areas of disturbance, this is the initial screening to determine if an interaction between a project activity and a valued environmental component has the potential to result in an effect on the environment. Those activities indicated with a "P" are identified as those project activities which may cause a potential effect on the previously disturbed environment.

In addition to evaluating the environmental effects of the project on the environment, it is also necessary to consider those impacts which may arise as a result of the environment affecting the project activities due to naturally occurring events like severe weather, floods and nuisance wildlife. A significant adverse effect of the environment on the project may result in damage to infrastructure, resulting in interruption of the project schedule. The effects of the environment on the proposed project are addressed within the matrix table (**Table 6-1**) as "E" and are discussed further in **Section 8.0**.

Table 6-1 Project Interaction Matrix

VECs (Valued Ecosystem Components)		Project Activity										
		Site Preparation and Construction				Site Remediation Activities				Site Closure		Accidents/ Malfunctions and Unplanned Events
		Infrastructure Roads and Site Access	Waste Management	Barge Landing	Construction Camps	Waste Handling Facility	On-site Disposal	Soil Treatment Activities	Operation of Camps	Site Recontouring	Demobilization	
Atmospheric Environment	Climate and Air Quality		P						P			P
Physical Environment	Permafrost	P						P				P
Aquatic Environment	Fish and Fish Habitat											P
	Marine Environment			P/E		P/E						P
Terrestrial Environment	Vegetation	P			P					P		P
	Birds/Bird Habitat											P
	Terrestrial Wildlife								E			P
	Species at Risk								E			P
Socio-Economic Environment	Community	P	P	P	P	P	P	P	P	P	P	P
Land Use	Traditional Land Use											P
	Heritage Resources/ Culturally Important Areas			P	P	P			P			P

Notes: "P" = Potential effect of project on environment, “E” – Potential of environment to effect project; Blank = No interaction with project activities

6.3 Potential Effects

As indicated on **Table 6-1**, few interactions are anticipated. The project will take place on previously disturbed land and when executed, will follow all applicable protocols and regulatory requirements.

An analysis of the potential effects of the interactions identified on **Table 6-1** is presented on **Table 6-2** to **Table 6-8**. For each of these effects, proposed mitigation, and predicted residual effects were determined. The predicted residual effect assumes that each of the recommended mitigation measures are implemented as recommended. The significance of the residual effect is based upon an evaluation of the effect's magnitude, geographic extent, duration/frequency, irreversibility and ecological context.

Table 6-2 Impacts and Mitigation on Air Quality

Climate and Air Quality				
Project Activity	**Potential Impact**	**Impact Rating**	**Mitigation**	**Residual Impacts**
Site Preparation and Construction N/A **Site Remediation Activities** Waste Management Soil Treatment Activities Operation of Camps **Site Closure** N/A	Off gas from soil treatment activities Incineration of non-hazardous camp waste	Direction: Negative Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Negligible Probability: High Significance: Insignificant	- Contractors are to ensure that construction equipment is well maintained - Burning of debris on-site will follow the Government of Nunavut *Environmental Guideline for the Burning and Incineration of Solid Waste (2012)*.	No

Table 6-3 Impacts and Mitigation on Permafrost

Permafrost				
Project Activity	**Potential Impact**	**Impact Rating**	**Mitigation**	**Residual Impacts**
Site Preparation and Construction Infrastructure Roads and Site Access **Site Remediation Activities** Soil Treatment Activities **Site Closure** N/A		Direction: Negative Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Negligible Probability: High Significance: Insignificant	- Road upgrades shall be constructed and used in a manner protect the vegetated areas protecting the permafrost soil from thermal or physical damage - Crews shall be restricted to using machinery (i.e., construction equipment, ATVs and vehicles) to the existing roads to avoid impacting the rutting and causing potential damage to the permafrost - Materials shall not be stored directly on unprotected ground surfaces - Disturbed areas shall be reseeded to minimize the risk of erosion	No

Table 6-4 Impacts and Mitigation on Marine Environment

Marine Environment				
Project Activity	**Potential Impact**	**Impact Rating**	**Mitigation**	**Residual Impacts**
Site Preparation and Construction Barge Landing **Site Remediation Activities** Waste Handling Facility **Site Closure** N/A	Disturbance to beach area along the shoreline from heavy equipment use and use of the waste handling facility. Activities may result in debris and deleterious substances affecting marine water quality.	Direction: Negative Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Negligible Probability: High Significance: Insignificant	- Work will be scheduled to avoid periods of heavy precipitation. Erosion control structures (temporary matting, geotextile filter fabric) are to be used, to prevent erosion and release of sediment and/or sediment laden water. - Equipment will be cleaned of sediments and washed with freshwater prior to being mobilized to the project site. - A floating silt curtain should be installed around the work sites to prevent suspended solids and/or debris from entering the marine environment. The stability of the silt curtain is to be monitored on a daily basis to ensure it is functioning as intended. - Borrow areas near the shoreline (e.g. B2) require a minimum setback of 30 m from the top of the bank will be required to minimize erosion and sedimentation. Appropriate erosion and sediment control measures will also be installed in these areas. - Workers shall be restricted to using machinery (i.e., construction equipment, ATVs and vehicles) to the existing roads to avoid impacting the beach area.	No

Table 6-5 Impacts and Mitigation on Vegetation

Vegetation				
Project Component	**Potential Impact**	**Impact Rating**	**Mitigation**	**Residual Impacts**
Site Preparation and Construction Infrastructure Roads and Site Access **Site Remediation Activities** Construction Camps **Site Closure** Site Recontouring	Plant mortality or permanent displacement of plants Introduction of invasive species Long term bare ground results in wind erosion of covering soil and potential permafrost degradation.	Direction: Negative Scope: Entire site. Duration: Long-term Frequency: Throughout Construction Period. Magnitude: Large Probability: High Significance: Insignificant	- Cleaning and inspecting construction equipment prior to transport from elsewhere to ensure that no plant matter is attached to the machinery. Vehicles should be pressure washed to clean vehicles prior to transport to avoid the introduction/transfer of invasive species. - Contractors to limit the amount of vegetation removal to the extent possible. - Reseeded with local species where feasible. Reseeding with agronomic cover crops (grasses) undesirable. - Movement of equipment and vehicles outside of the access roads shall be minimized and avoided to prevent damage to the vegetation or underlying soils/permafrost.	Not expected to affect plant species at a population level. Regraded areas will be stabilized with riprap and could be reseeded to further control wind erosion losses of soil cover.

Table 6-6 Impacts on the Community

Project Component	Potential Impact	Impact Rating	Mitigation	Residual Impacts
Site Preparation and Construction All Project Activities **Site Remediation Activities** All Project Activities **Site Closure** All Project Activities	Economy	Direction: Positive Scope: Life of project Duration: Long-term Frequency: Throughout Construction Period. Magnitude: Moderate Probability: High Significance: Significant	- Employment and local business opportunities in the region are to be maximized as much as possible.	Capacity building for the community through work experience, economic stimulus and training opportunities

Table 6-7 Impacts on the Heritage Resources/ Culturally Important Areas

Project Component	Potential Impact	Impact Rating	Mitigation	Residual Impacts
Site Preparation and Construction Barge Landing Construction Camps **Site Remediation Activities** Waste Handling Facility Operation of Camps **Site Closure** N/A	Disruption of Burial Sites	Direction: Positive Scope: Life of project Duration: Long-term Frequency: Throughout Construction Period. Magnitude: Moderate Probability: High Significance: Significant	- The burial site locations will be fenced off to avoid any potential disruption or destruction of these sites - Workers will avoid any disruption to the burial sites - If a suspected site is discovered during the project activities, the crew will not disturb the site and will contact the Department of Culture, Language, Elders and Youth for further mitigation and protection measures.	Capacity building for the community through work experience and training opportunities

Table 6-8 Potential Impacts the Environment has on Project

Marine Environment and Wildlife				
Project Component	**Potential Impact**	**Impact Rating**	**Mitigation**	**Residual Impacts**
Site Preparation and Construction Infrastructure Roads and Site Access **Site Remediation Activities** Waste Handling Facility **Site Closure** Site Recontouring	Severe storm events leading to flooding Increase in Nuisance Wildlife	Direction: Negative Scope: Entire site. Duration: Long-term Frequency: Throughout Construction Period. Magnitude: Large Probability: High Significance: Significant	- Project personnel will monitor weather forecast for storm events and protect the loss of equipment through proper storage on site - Any material lost or destroyed as a result of wave or storm action is to be immediately recovered or restored by the project personnel when safe to do so. - General camp food will be properly stored to discourage wildlife - A dedicated wildlife monitor(s) will be on site at all time - Project personnel shall be properly trained in bear safety - Project personnel are not to feed, injure or harass local wildlife - Food waste and camp garbage will be properly stored in sealed containers	No

7.0 ACCIDENTS, MALFUNCTIONS AND UNPLANNED EVENTS

Potential accidents, malfunctions and unplanned events associated with the activities of this project may include:

- Release of hazardous materials (e.g., fuel, hydrocarbons) to undesignated areas;
- Failure of erosion and sediment control measures;
- Health and safety; and,
- Fire and explosion.

This section outlines standard mitigation measures that will be applied for those VEC's/VSC's identified on **Table 6-1** to reduce potential environmental effects from accidents, malfunctions and unplanned events.

Chemical and Fuel Spills

Accidental events involving equipment, aircraft or marine vessels could range from minor fuel spills to catastrophic disasters, such as crashes or explosions. Malfunctions or accidents may result in spills of hydrocarbons or other substances during construction and operation of the project. Such spills may contaminate soils and, through runoff, contaminate the freshwater and/or marine environments. Contaminants may adversely affect surface water quality, fish and fish habitat, and wildlife habitat.

An emergency spill response plan will be implemented to provide guidance on containing and remediating releases of hazardous materials into sensitive environments. With preventive and mitigative measures and the low probability of spills, the effects of accidental spills of contaminants during construction are considered not significant.

In the event of a catastrophic disaster, resources available beyond the project site will be required. While such an event is not planned, it is anticipated that pending the severity, the project schedule may be impacted. Any environmental effect will likely be localized.

Erosion and Sediment Control Failure

An erosion and sediment control plan will be prepared prior to on-site activities. Rain falls very infrequently, so runoff impacts into the freshwater lake system or the marine environment are not expected to be a significant source of deleterious substances affecting water quality. Temporary erosion controls will be installed prior to disturbance and will be properly maintained throughout construction until recontouring is completed. Of greater concern is the period of snow melt in the late spring/early summer. Monitoring of the sediment and erosion controls and repairing the damage occurring over the winter will be the key time for control of sediments entering the drainage system.

Long term wind erosion effects may result in significant losses of the cover soil from the landfill site(s) and disturbed areas unless revegetation occurs within a reasonable time frame. Rip rap is proposed as the final cover material, however, some level of revegetation of these areas will also be important to re-establish wildlife habitats and traditional land uses. Plants will be very slow (many decades long) to regenerate and therefore an advanced, detailed revegetation blended with the rip rap solution, will need to

be prepared in advance, to ensure the landfill caps remain in place, yet provide sustainable, ecological functions over the long term.

Permafrost

As discussed in **Section 3.2.3** the depth to permafrost at the FOX-D site is approximately 1.4 to 1.5 m below grade. Excavation proposed on site is not to exceed 0.3 m. Any excavation beyond 0.3 m is considered an unplanned event and thus may result in an impact to the permafrost layer. Permafrost degradation can occur when the thermal barrier is removed and the top layer is exposed to the elements. All employees will be aware of the excavation limits to prevent accidental impacts to the permafrost layer. If accidental excavation or permafrost exposure occurs, excavated areas shall be backfilled immediately with granular fill and further work in that area will cease until further impacts can be assessed. Where feasible, reseeding of disturbed areas with native species should be considered to provide additional protection. Plants will aid in the stabilization of soil, the primary barrier to permafrost.

Health and Safety

To ensure the safety of all personnel on site, a site specific health and safety plan will be created and will include all necessary precautions while working on the FOX-D site including but not limited to:

- Safe handling, containment and transportation of hazardous material and contaminated soil and water;
- Personnel working on-site will be trained in the requirements of the Workplace Hazardous Materials Information System (WHMIS) program;
- Proper preparations in dealing with extreme weather conditions and events;
- Proper first aid, bear safety awareness training and wilderness survival training; and,
- Proper protocol and safety procedures for polar bear and other wildlife encounters;
    - Implement a wildlife management strategy that includes noise abatement;
    - Pre-disturbance surveys, avoid active nesting structures when present, and if species of concern are present remove structure once nesting is complete;
    - Bear proof containers for domestic waste;
    - Wildlife Monitors will be kept on-site for safety of site workers; and,
    - Bear deterrent will be kept at all sites.

Project personnel will be properly trained in the cultural heritage resources and traditional uses of the land.

Fires and Explosions

Accidental fires and explosions could potentially be caused during construction or remedial activities. During construction, sources of fire include hot exhaust or equipment, discarded cigarettes, or sparks.

8.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

The environmental effects on the project may be defined as any change to the project that may be caused by the environment. Typical effects considered in describing the environmental effects on the project include climatic events such as flooding, fog, heavy precipitation, and frost. For this project, potential environmental effects on the proposed project include the following:

- Extreme Weather; and,
- Nuisance Wildlife.

8.1 Extreme Weather

Planning and design of the project activities has considered extreme weather criteria and the potential delay or loss of equipment due to extreme weather events, primarily heavy rainfall, storm surges or sub-zero temperatures (during the summer months).

Storm surge along the coast and at the barge landing have the potential to cause permanent damage and/or loss of gear in the marine environment area for the duration of the construction project. The issues have been considered as part of the project plans and are deemed mitigable through design, location selection, standard operating, and maintenance and repair procedures. Weather conditions will be assessed on a daily basis to determine the potential risk of climate on the project activities and worker safety. With regard to storm surges, advisory and warning bulletins are issued by Environment Canada when there is a potential for or likelihood of coastal flooding events. Such bulletins typically include a meteorological description of the event, information on coastlines most likely to be affected, a discussion of complicating factors such as ocean waves and pack ice, and an assessment of the severity of the event.

The contractor will be required to ensure that proper material management and construction measures are employed including:

- Monitoring extended weather forecasts to schedule activities to avoid significant storm events;
- Ceasing activities during significant storm events; and,
- Increasing monitoring and inspection of sediment control devices immediately after a storm event.

8.2 Nuisance Wildlife

The proposed project activities, in particular the camp operations, have the potential to create an abundance of human-produced waste. Human-produced waste can create a higher potential for wildlife attraction which is one of the major problems with polar bears. This interaction has the potential to cause effects on-site personnel, the camp infrastructure and equipment associated with the project activities. Human waste such as human food, food waste, garbage, water or wastewater, sewage and petroleum-based products may attract bears or other wildlife to areas of human use.

Bears or other wildlife that become conditioned to feeding on human- produced attractants are considered to be "food-conditioned". Food-conditioning in bears compromises both human and bear safety and needs to be strictly avoided. Even a low rate of exposure to human food or garbage can reinforce behaviour in bears that leads to conflicts with people. Proactive management and control of potential attractants is one of the most important ways to ensure safe interaction between people and bears (Parks Canada, 2005).

Based on Parks Canada Polar Bear Safety Plan (2005), the following mitigation is recommended to provide a deterrent to nuisance wildlife and more specifically polar bears which may access the site during the project activities.

- Except as otherwise provided in these Regulations, no person shall touch or feed wildlife or entice wildlife to approach by holding out or setting out decoys or any such devices, foodstuffs or bait of any kind;
- No person shall discard or dispose of or deposit garbage anywhere in a work zone except in such places and at such times and under such conditions as the superintendent may authorize;
- Bears will be denied access to all unnatural food sources, such as human food, garbage, sewage, pet food, domestic animal food, and grain spills;
- All project personnel will be informed of proper food storage and garbage handling procedures;
- Where garbage receptacles are provided or permitted, "bear proof" garbage containers will be used where practicable; and,
- All non-natural attractants used or produced by project personnel will be incinerated or removed from the site.

9.0 RESIDUAL EFFECTS AND CUMULATIVE EFFECTS

The residual impacts to the area are positive, as reclamation of the land will create job opportunities, and restore the environment to safe levels for wildlife and generations to come. Cumulative effects are changes to the environment that are caused by an action in combination with other past, present and future human actions. The proposed remediation of the FOX-D site will aid in restoring the area to as close to pre-disturbed conditions as possible. With the removal of hazardous material, remediation of impacted soils, and mitigation measures to aid in preventing further environmental consequences, no adverse cumulative effects are anticipated from related project activities.

It is anticipated that the area will be frequented by hunters who gain access by aircraft. Continued operation of the airstrip will permit this access. Clean-up of the site will reduce the potential risks of contamination to human health, wildlife and the coastal environment.

There may be increased pressure on wildlife populations although the site investigations indicate that caribou populations are declining and are no longer frequent in the area. Polar Bear are protected under federal legislation and are not to be harmed through the project activities. No adverse cumulative effects are therefore anticipated from present and anticipated future activities.

10.0 STATEMENT OF LIMITATIONS AND METHODOLOGY

This EIA has been prepared in accordance with the agreed scope of work between AANDC and PWGSC. The conclusions presented herein are based on information gathered by federal coordination, report reviews and site visit(s). Should significant changes to the project scope and location occur, this EIA should be revisited to ensure compliance with regulatory requirements and consideration of potentially new interactions with Valued Ecosystem Components.

11.0 PART IV RECOMMENDATIONS AND SIGN-OFF

EIA Report prepared by:

Gay Drescher, MES MCIP RPP

DILLON CONSULTING LIMITED

Signature	Date

12.0 LIMITATIONS

This report was prepared exclusively for the purposes, project and site location(s) outlined in the report. The report is based on information provided to, or obtained by Dillon Consulting Limited as indicated in the report, and applies solely to site conditions existing at the time of the site investigation(s). Dillon Consulting Limited's report represents a reasonable review of available information within an agreed work scope, schedule and budget. It is therefore possible that currently unrecognized contamination or potentially hazardous materials may exist at the site(s), and that the levels of contamination or hazardous materials may vary across the site(s). Further review and updating of the report may be required as local and site conditions, and the regulatory and planning frameworks, change over time.

This report was prepared by Dillon Consulting Limited for the sole benefit of our Client (Public Works and Government Services Canada). The material in the report reflects Dillon Consulting Limited's judgment in light of the information available to Dillon Consulting Limited at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon Consulting Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Respectfully Submitted:

DILLON CONSULTING LIMITED

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APPENDIX A

Site Photos

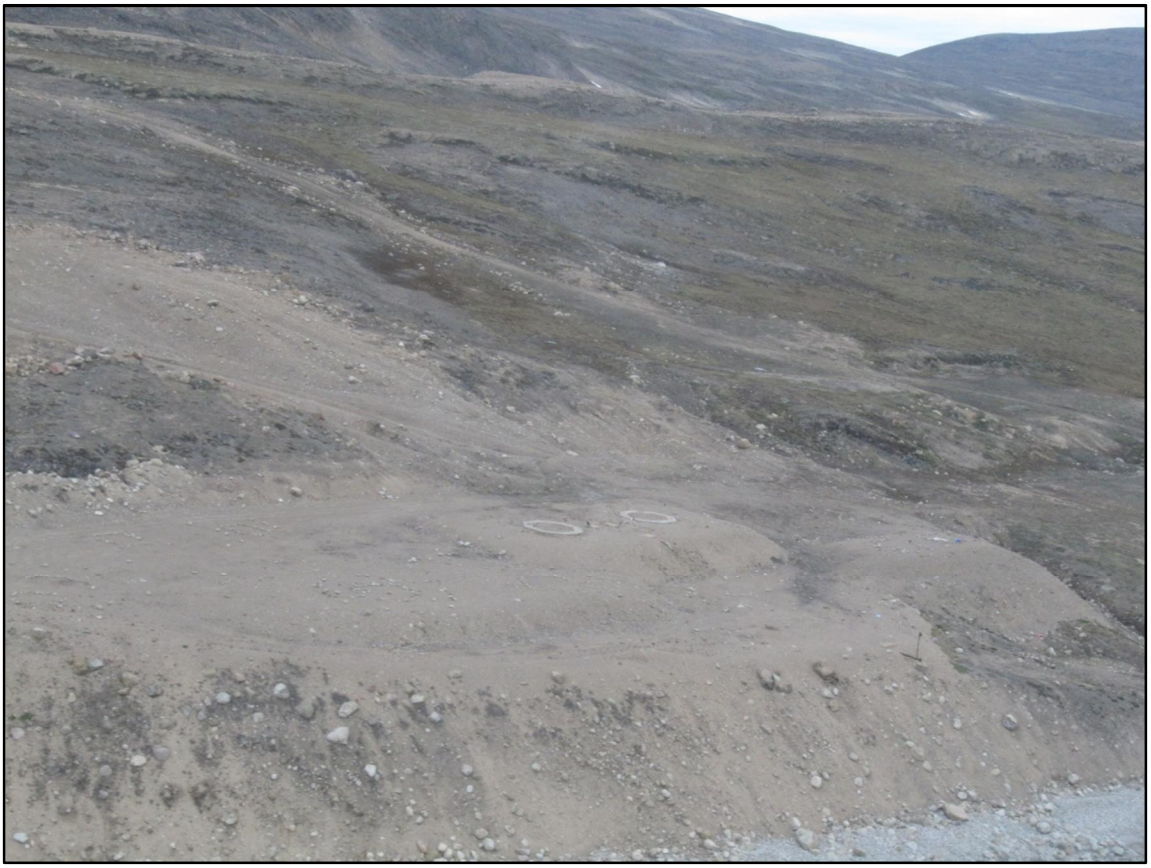
Picture 1: View of Airstrip

Picture 2: View of Freshwater Lake from above

Picture 3: View of Lake

Picture 4: View of Road Section Heading Uphill from Freshwater Lake to Summit

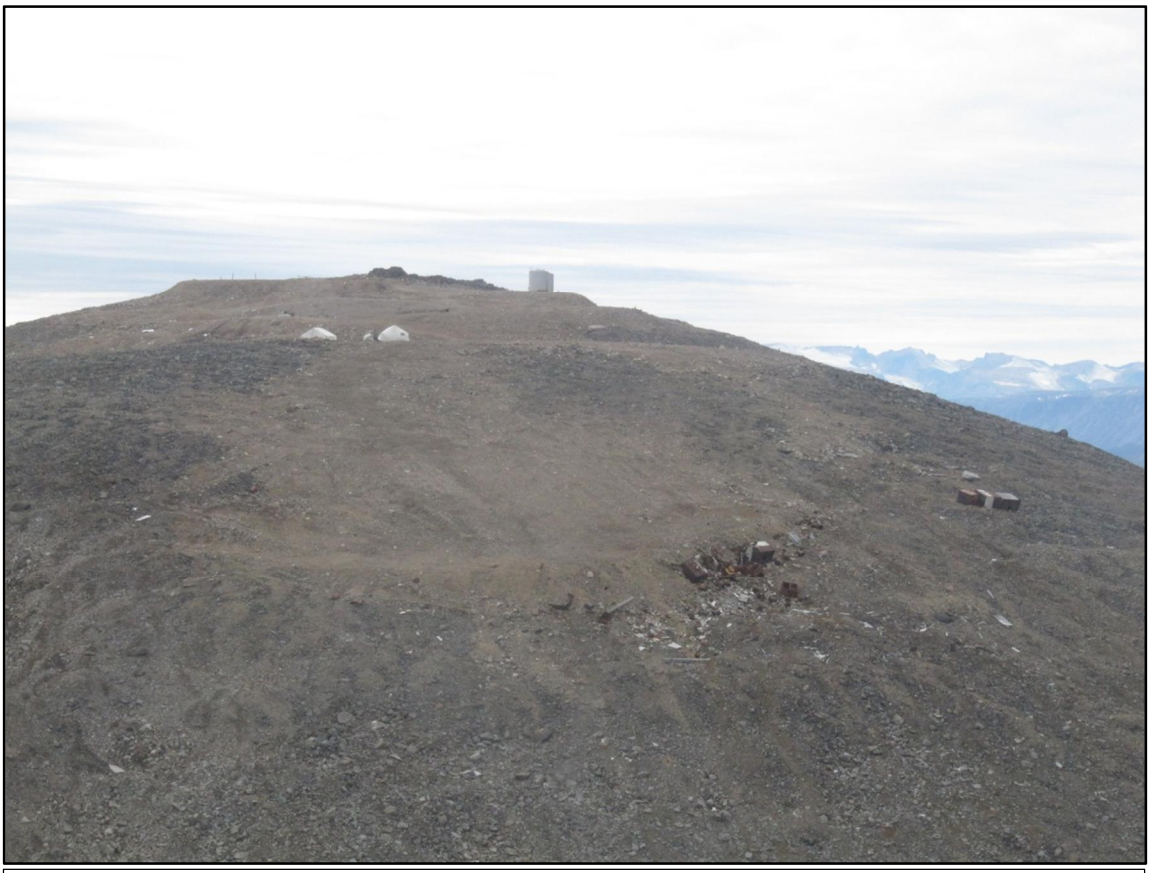
Picture 5: Shelter along Coast



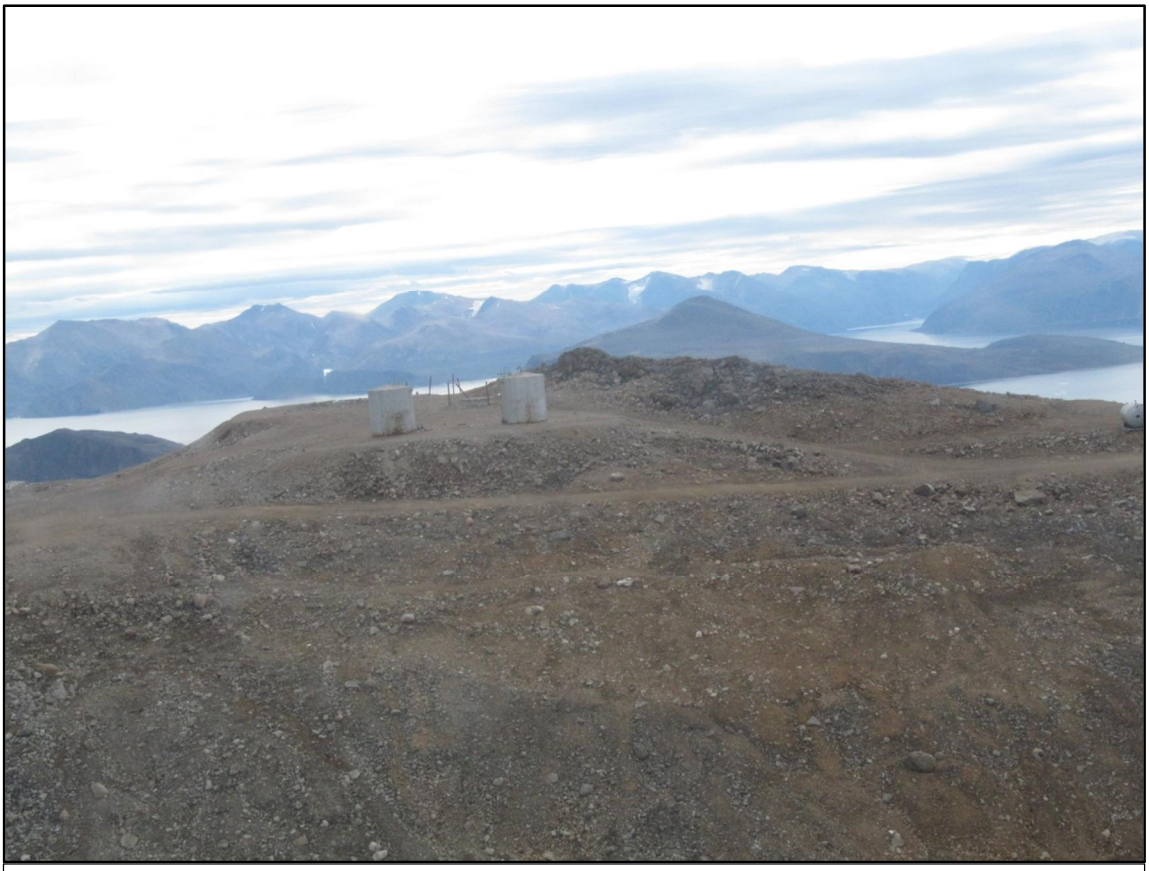
Picture 6: Large Gravel Borrow Area

Picture 7: Coastline East of the Site

Picture 8: View of Hill From the East



Picture 9: Close Up View of Summit from the North



Picture 10: View of Summit from the North

Picture 11: View of Lake from the West

Picture 12: Arctic Poppy at Summit (Upper Site)

Picture 13: Sedge at Upper Site.

Picture 14: Close-Up of Sedge at Upper Site

Picture 15: Fox Skull at Upper Site

Picture 16: Map Lichen and Rock Tripe at Upper Site

Picture 17: East View from Upper Site

Picture 18: Lemming Droppings Near Den (Upper Site)

Picture 19: View of Upper Site from North

Picture 20: Seal bone.

Picture 21: East View of Upper Site, Looking Over Antenna

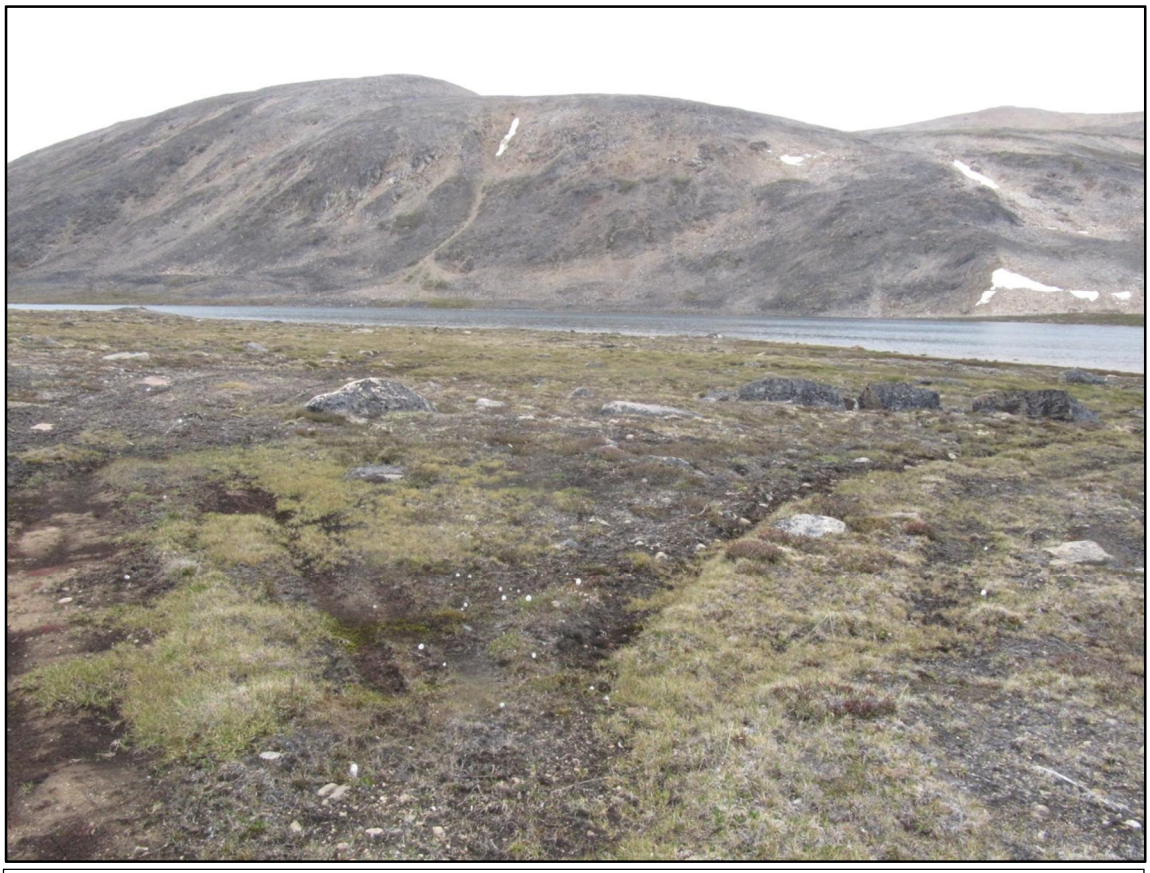
Picture 22: Arctic Heather (Upper Site)

Picture 23: Walrus Bone Found Near Antenna

Picture 24: Arctic Sorrel at Lower Site near Freshwater Lake

Picture 25: River Beauty (Dwarf Fireweed) on Lower Site, near Freshwater Lake

Picture 26: Cottongrass between Freshwater Lake and Gravel Road



Picture 27: View of Lake and Mountain Looking North from Road

Picture 28: Goose Droppings near Freshwater Lake

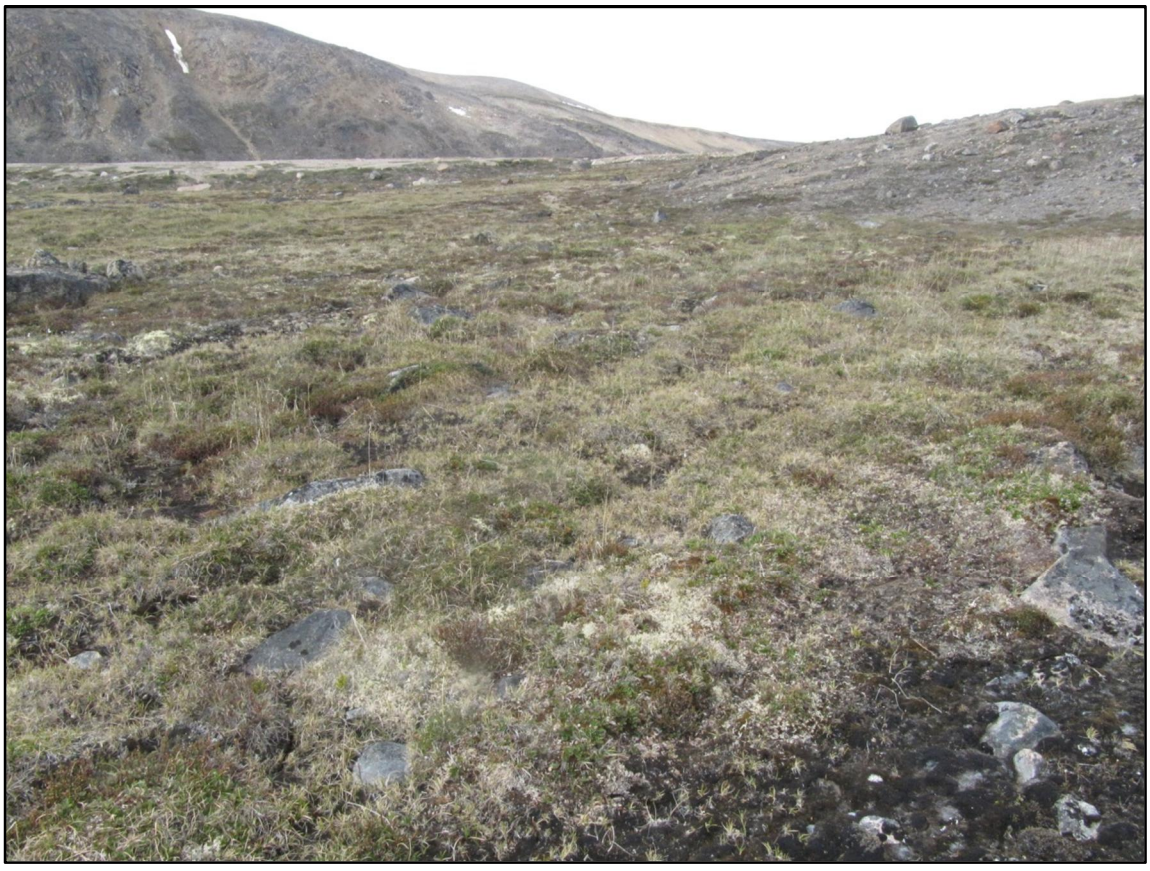
Picture 29: Loon on Freshwater Lake

Picture 30: Two Loons on Freshwater Lake

Picture 31: Stream Exiting Freshwater Lake to the East

Picture 32: Gravel Access Road, Looking West

Picture 33: Arctic Wintergreen (near coastline)



Picture 34: Typical Undisturbed Landscape Between Road and Ocean

Picture 35: WP 104, Old Walrus Skull and Bones

Picture 36: WP 104, Walrus Skull

Picture 37: Arctic Chickweed at Lower Site

Picture 38: Nodding Saxifrage

Picture 39: WP105 Thule tent Ring

Picture 40: WP 105, Walrus Bones

Picture 41: WP 105, Walrus Skull

Picture 42: WP 105, Walrus Bones (2)

Picture 43: WP 106, Seal Bone

Picture 44: WP 106, Seal Vertebrae

Picture 45: WP 106, Seal Skull

Picture 46: WP 106, Whale Baleen

Picture 47: WP 107, Modern Tent Ring

Picture 48: WP 108, Whaler Cemetary

Picture 49: WP 108, Whaler Cemetary

Picture 50: WP 109, Seal Carcass

Picture 51: WP 110, Polar Bear Bones

Picture 52: WP 111, Polar Bear Spine

Picture 53: WP 112, Fresh Seal Carcass

Picture 54: Lapland Longspur

Picture 55: Lapland Longspur 2

Picture 56: Gravel Borrow Pit Area Facing South

Picture 57: Inuit Burial Tomb

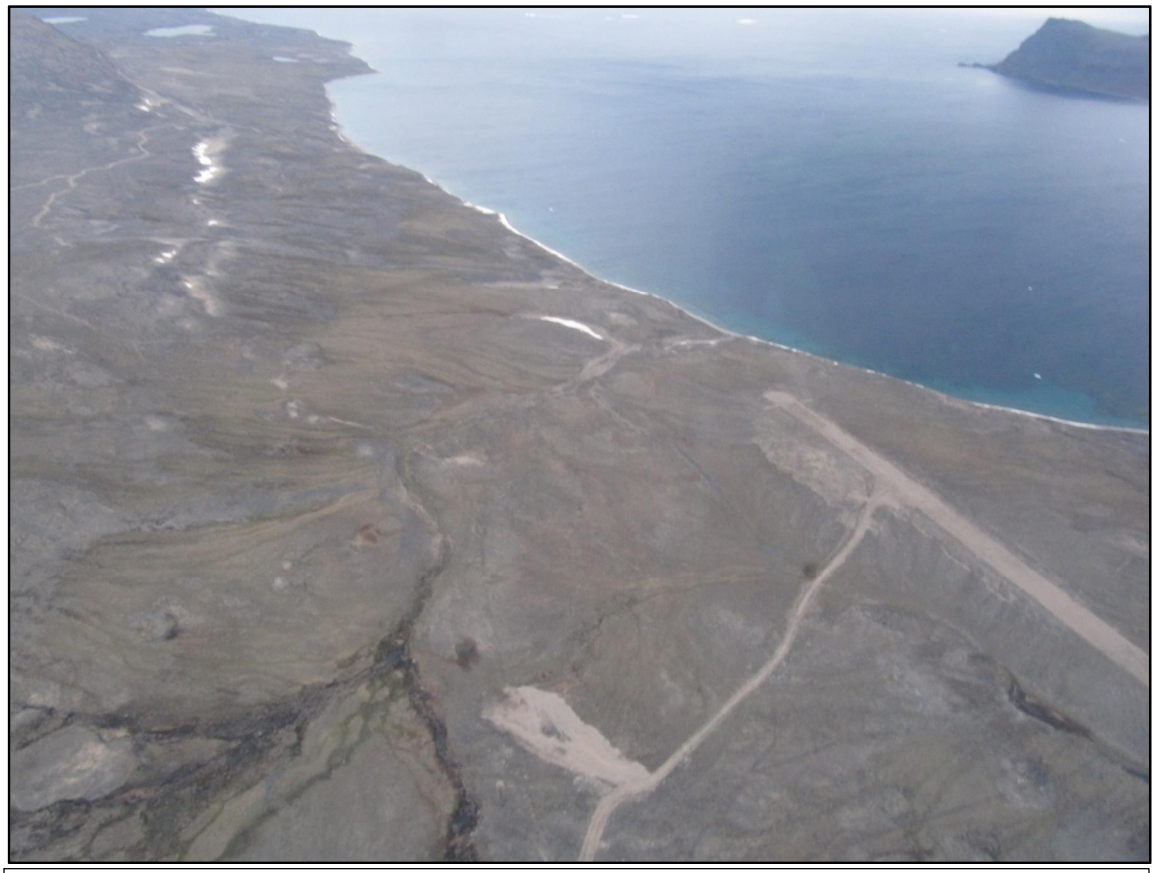
Picture 58: Inuit Burial Tomb 2

Picture 59: Modern Tent Ring on Gravel Area

Picture 60: WP 113, Arctic Hare Mandible

Picture 61: WP 113, Goose Bones

Picture 62: Hunting Shack on Shoreline



Picture 63: Aerial View of Stream

APPENDIX A

SITE PHOTOGRAPHS (2013)

Photo 1 - Aerial view of road section requiring light grading.

Photo 2 - Typical road requiring light grading.

Photo 3 - Typical material used to construct road. TP23 (Station 5+800).

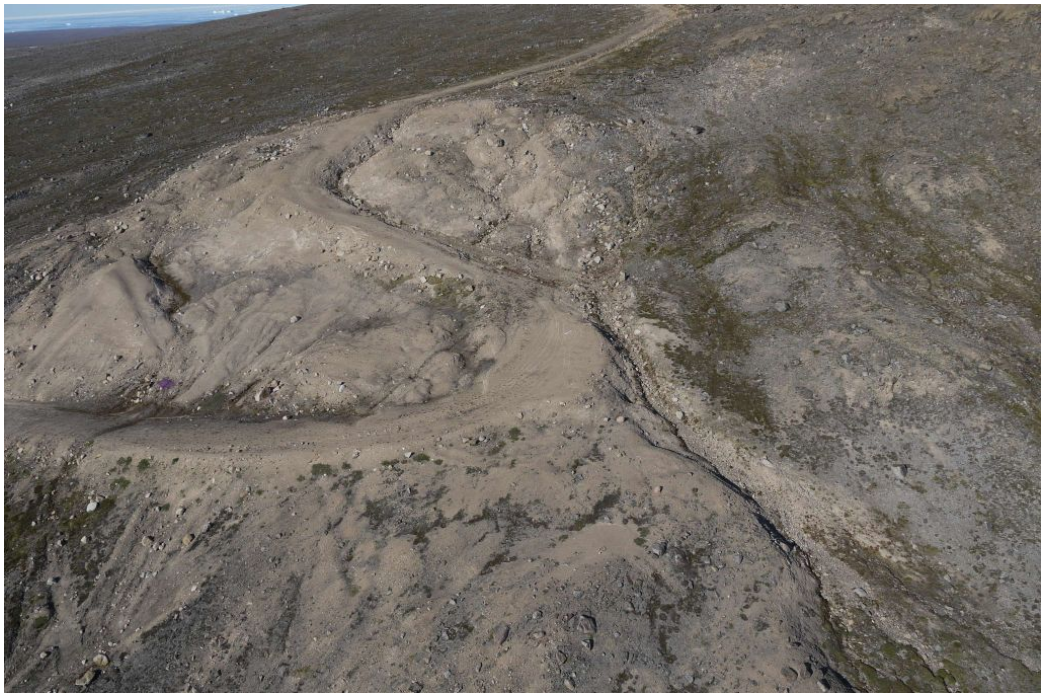


Photo 4 - Aerial view of road requiring medium grading and potential borrow area near Station 4+700.

Photo 5 - Typical road requiring medium grading.

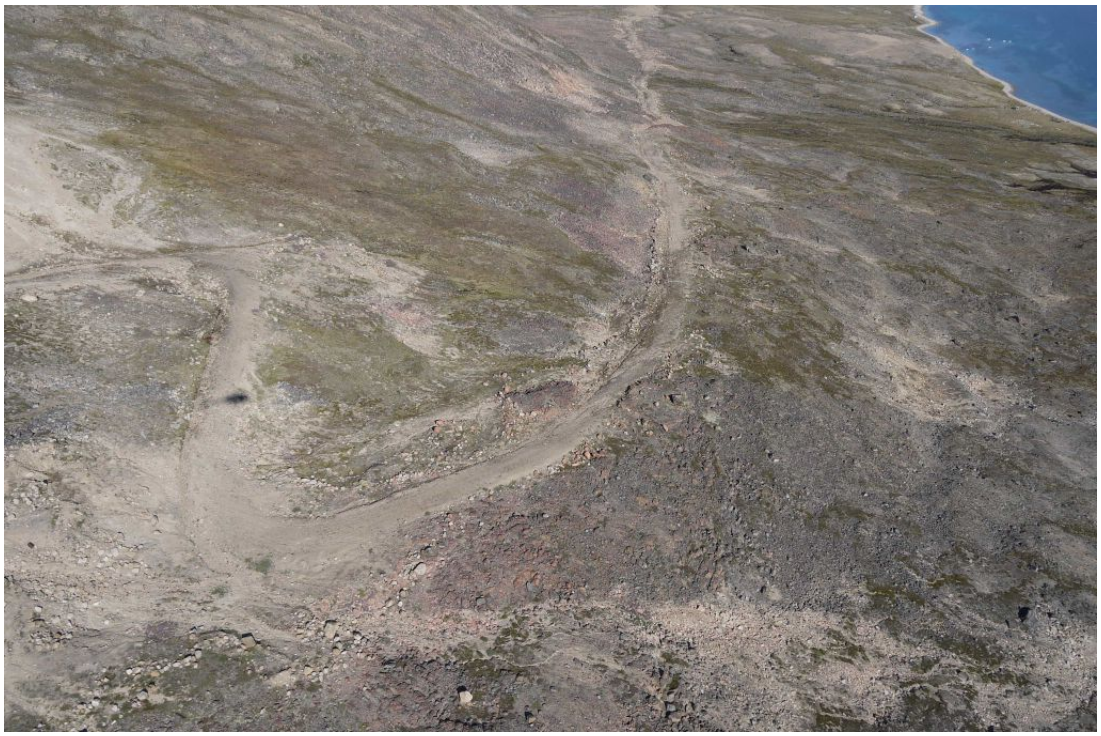


Photo 6 - Aerial view of the road requiring heavy grading and potential borrow area near Station 4+100.

Photo 7 - Typical road requiring heavy grading.

Photo 8 - Typical road requiring heavy grading.

Photo 9 - Aerial view of airstrip (looking southeast).

Photo 10 - View of airstrip looking towards the northeast (upslope).

Photo 11 - Southwest view of airstrip down slope.

Photo 12 - Typical boulder on airstrip.

Photo 13 - Typical material used to construct airstrip (TP34).

Photo 14 - Aerial view of Upper Site. Potential Non-Hazardous Landfill and/ or Landfarm areas. Note potential borrow material present at Upper Site.

Photo 15 - Aerial view of the Potential Landfarm located in the saddle.

Photo 16 - Typical material in Potential Landfarm in saddle (TP25).

Photo 17 - Aerial view of the barge landing area, proposed waste transfer area and borrow area.

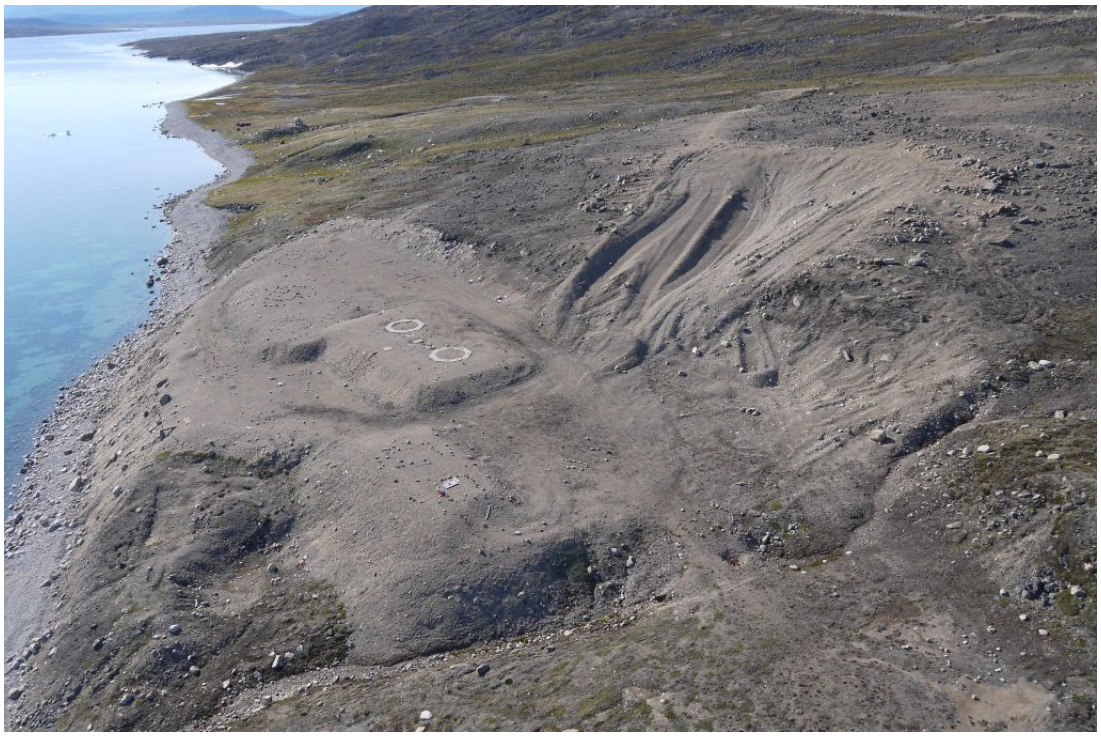


Photo 18 - Aerial view of the barge landing area, proposed waste transfer area and borrow area.

Photo 19 - Aerial view of Existing Landfill APEC 9 (Upper Site).

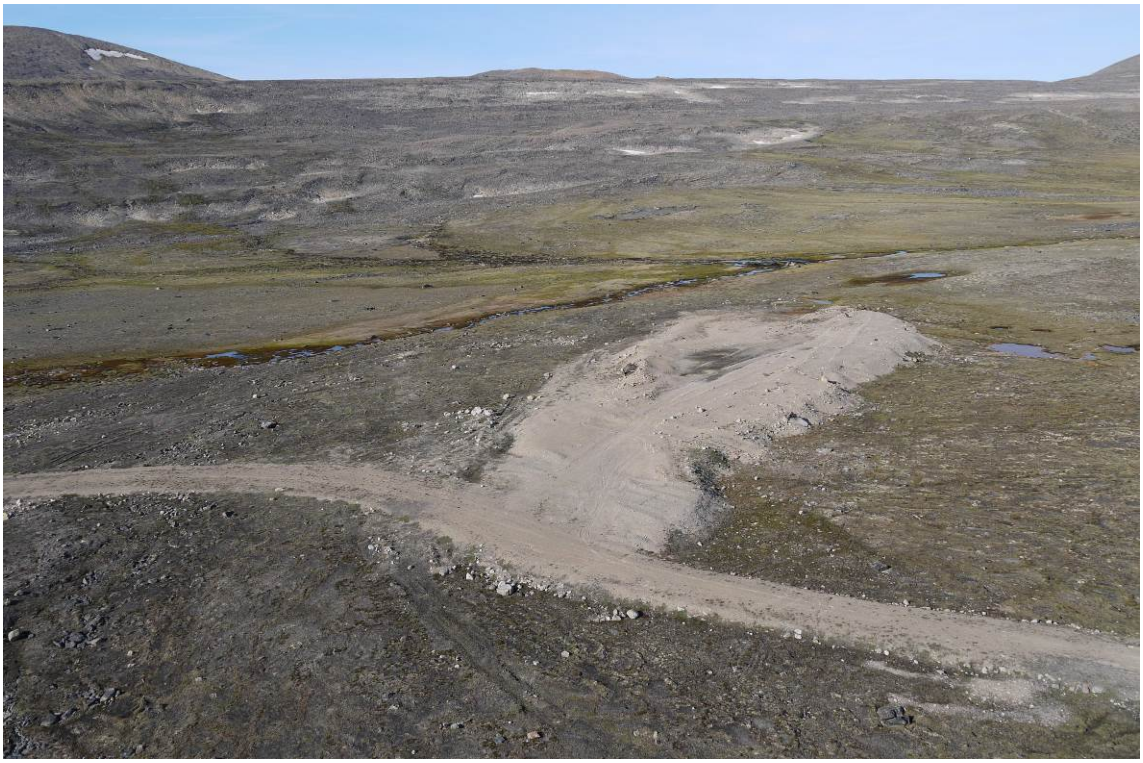


Photo 20 - Aerial view of Fuel Cache Dump APEC 11B (former construction camp area).

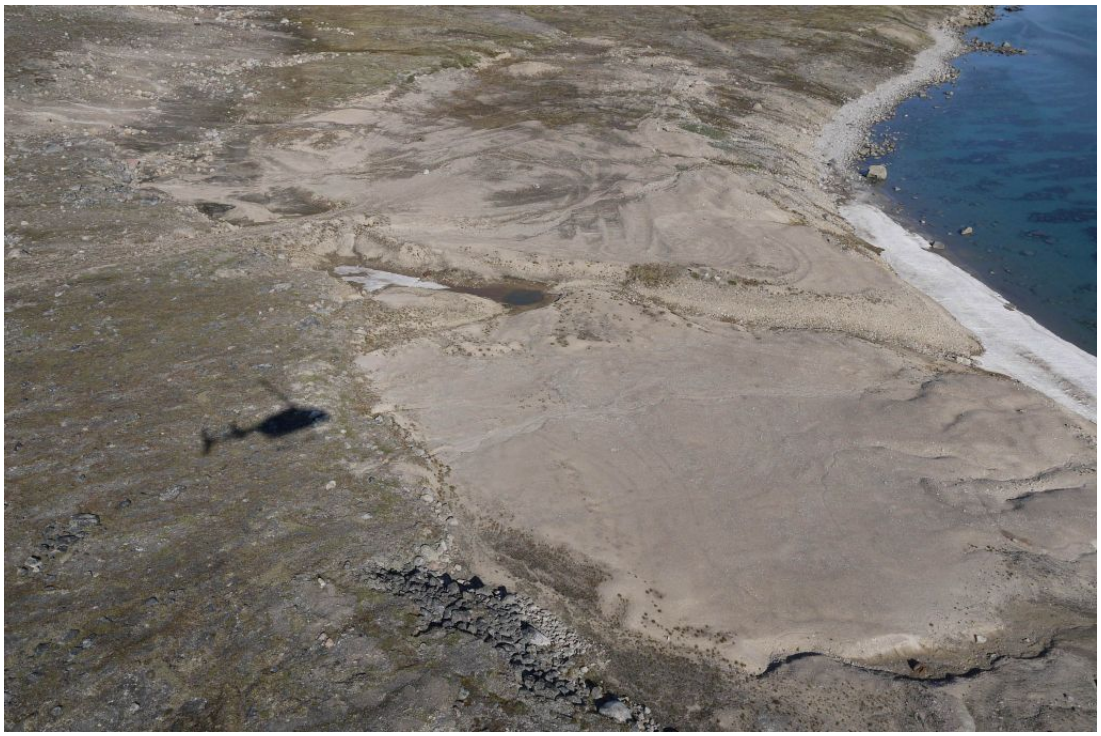


Photo 21 - Aerial view of the potnetial borrow area south of the airstrip.

Photo 22 - Aerial view of the borrow area south of the airstrip and access road to the borrow area.

APPENDIX B

Water Quality Analytical Results

TABLE 1
PETROLEUM HYDROCARBONS AND POLYCHLORINATED BIPHENYLS IN POTENTIAL WATER SOURCES
FOX-D - KIVITOO, NUNAVUT

Sample ID	Potential Water Source Location	Date	Parameter [1]	
			Total Petroleum Hydrocarbons	Total PCBs
2013-203	Freshwater Lake	11-Aug-13	-	<0.1
2013-205	Freshwater Lake	11-Aug-13	-	<0.1
2013-331	Freshwater Lake	11-Aug-13	<0.1	<0.1
2013-338	Freshwater Lake	11-Aug-13	<0.1	<0.1
HC-CDWQ [3]				
Drinking Water Quality			-	-
CCME [2]				
Freshwater Aquatic Life			-	-

Notes:
EQL = Estimated Quantitation Limit = Lowest level of the parameter that can be quantified with confidence.
"-" = No Data

1. All concentrations in micrograms per litre (µg/L).
2. CCME - Canadian Council of Ministers of the Environment. Canadian Environmental Quality Guidelines 1999. Updated November 2012.
   Chapter 2 - Community Water
   Chapter 4 - Aquatic Life
   MAC - Maximum Acceptable Concentration
   AO - Aesthetic Objective
3. Health Canada - Canadian Drinking Water Quality Guidelines (HC-CDWQ). Updated August 2012.

	- Exceedance of HC-CDWQ Criteria
BOLD	- Exceedance of CCME Criteria

TABLE 2
GENERAL WATER QUALITY
FOX-D - KIVITOO, NU

Sample ID	Potential Water Source Location	Date	E. Coli (CFU/100 mL) [11]	Total Coliform (1 CFU/100mL) [11]
DRINKING_S_1	Freshwater Lake	19-Aug-13	0	0
DRINKING_S_2	Freshwater Lake	19-Aug-13	0	0
HC-CDWQ [2]				
Drinking Water			None Detectable per 100 mL (MAC) [6]	None Detectable per 100 mL (MAC) [7]
CCME / Health Canada [3]				
Freshwater Aquatic Life			-	-

Notes:

	- Exceedance of HC-CDWQ Guidelines
Bold	- Exceedance of CCME Guidelines

TABLE 3
METALS IN POTENTIAL WATER SOURCES
FOX-D FORMER DEW LINE STATION, KIVITOO, NUNAVUT

Sample ID	Potential Water Source Location	Date	Cadmium	Chromium	Cobalt	Copper	Lead	Nickel	Zinc
2013-263	Freshwater Lake	11-Aug-13	<0.001	<0.005	<0.003	<0.005	<0.010	<0.005	<0.010
2013-267	Freshwater Lake	11-Aug-13	<0.001	<0.005	<0.003	<0.005	<0.010	<0.005	<0.010
HC-CDWQ [2]									
Drinking Water			0.005 (MAC)	0.05 (MAC)	-	1.0 (AO)	0.010 (MAC)	-	5 (AO)
CCME[3]									
Freshwater Aquatic Life			(8)	0.0089 (III), 0.001 (VI)	-	(8)	(8)	(8)	0.03

Notes:
"-" = No Data

1. All values are expressed in milligrams per litre (mg/L).
2. Health Canada - Canadian Drinking Water Quality Guidelines (HC-CDWQ). Updated August 2012.
   MAC - Maximum Acceptable Concentration
   AO - Aesthetic Objectives
   OG - Operational Guideline
3. CCME - Canadian Council of Ministers of the Environment. Canadian Environmental Quality Guidelines, 1999. Updated November 2012.
   Guidelines for Canadian Drinking Water Quality.
   Chapter 2 - Community Water (Health Canada - Canadian Drinking Water Quality Guidelines)
4. This is an operational guidance value, designed to apply only to drinking water treatment plants using aluminum-based coagulants.
   The operational guidance value of 0.1 mg/L applies to conventional treatment plants, and 0.2 mg/L applies to other types of treatment systems.
5. Total aluminum should not exceed 0.005 mg/L in waters with a pH below 6.5.
   The concentration of total aluminum should not exceed 0.1 mg/L in waters with a pH greater or equal to 6.5.
6. Short-term exposure (24 to 96 hours) concentrations which indicate potential for severe effects during transient events
   (spill events to aquatic receiving environments and infrequent releases of short-lived/non-persistent substances).
   These are NOT protective guidelines.
7. Long-term exposure guideline that protects all forms of aquatic life for indefinite exposure periods (>7d exposures for fish and invertebrates, 24h exposures for aquatic plants and algae).
8. For the following equations, hardness is expressed as $CaCO_3$ in mg/L and the guideline is in µg/L. **Cadmium** Guideline = 10^{0.86[log(hardness)] - 3.2} µg/L;
   Copper Guideline = e^(0.8545[ln(hardness)]-1.465) * 0.2 µg/L; **Lead** Guideline = e^(1.273[ln(hardness)]-4.705) µg/L; **Nickel** Guideline = e^(0.76[ln(hardness)]+1.06) µg/L
9. If trigger ranges for total phosphorous are exceeded, the potential exists for an environmental impact. If trigger range is not exceeded,
   but TP is more than 50% above baseline values, the potential exists for an environmental impact.
   Trigger ranges (µg/L): ultra-oligotrophic
   oligotrophic

	- Exceedance of HC-CDWQ Criteria
BOLD	- Exceedance of CCME Criteria