APPENDIX 3

BATHURST REMEDIATION AND RISK MANAGEMENT PLAN

Remediation and Risk Management Plan for Bathurst Island (Bent Horn, Ile Vanier, Stokes Range, Young Inlet and G-07, K-07, M-21, N-12, J-34 Well Sites), Nunavut

Final Report
Project No. 122511001

Prepared for:
Public Works and Government Services Canada Public Works and Government Services Canada

Prepared by:
Stantec Consulting Ltd.
400-1331 Clyde Avenue
Ottawa, ON K2C 3G4

March 30, 2015

Table of Contents

LIST OF TABLES

LIST OF APPENDICES

Executive Summary

Aboriginal Affairs and Northern Development Canada (AANDC) has responsibility, through the Contaminated Sites Program (CSP), to manage a number of contaminated properties that are no longer maintained by the original occupant. The Bathurst Island Remediation Project in Nunavut (NU) is one such example (the Site). Public Works and Government Services Canada (PWGSC) has mandated Stantec Consulting Ltd. (Stantec) to develop a Remediation and Risk Management Plan (RRMP) and an associated indicative cost estimate based on the findings of recently completed investigations of the project Site(s). Contamination at the Sites within the Bathurst Island Remediation Project is a result of oil and gas exploration and extraction activities. The Bathurst Island Remediation Project includes seventeen (17) Areas of Potential Environmental Concern (APECs). Five of the APECs are on Bathurst Island, while eight are on Cameron Island (with five of those within the Bent Horn area) and four are on Ile Vanier. Based on the findings of the 2013 Phase III Environmental Site Assessment (ESA), Preliminary Quantitative Risk Assessment (PQRA) reports and the subsequent 2014 Remedial Options Analysis (ROA) report, for each environmental issue identified at Site, a remediation/risk management plan (RRMP) has been developed.

The decision-making process for the RRMP consisted of the following steps:

1. Identify and assess sites-waste streams: completed through Phase I/II and III Environmental Site Assessments (ESAs)
2. Assess (classify) waste streams based upon regulatory criteria:
    a) Regulatory requirements to remediate (e.g., *Canadian Environmental Protection Act* Schedule I)
    b) Federal guideline to remediate (i.e., Canadian Environmental Quality Guidelines (CEQG), Canada Wide Standard (CWS) for Petroleum Hydrocarbons in Soils)
    c) Federal guideline best practices (i.e., Abandoned Military Sites Remediation Protocol)
3. Select approach for site management strategy based on land use:
    a) Generic guideline approach (i.e., CEQG)
    b) Risk assessment approach (i.e., completion of Preliminary Quantitative Risk Assessments (PQRAs))
4. Develop remedial options (ROs) and risk management approaches (RMAs):
    a) Collect stakeholder input
    b) Define organizational objectives
    c) Evaluate options
5. Select strategy
6. Develop RRMP

7. Implementation

As a result of Step 3b of the above sequence, significant risks to human health or the environment were identified for three soil impacts areas, while the remaining soil impacts showed insignificant risk levels. Identified impacts to surface and groundwater were similarly characterized as posing insignificant levels of risk. The necessary waste requiring remediation was therefore narrowed down to the hazardous wastes identified as several sites (organic liquids, pressurized cylinders and batteries) along with the three areas of soils with impacts posing risk (an area of PCB-impacted soils at site N-12, an area of lead-impacted soil at Ile Vanier APEC 1, and an area with grease/tar impacts at Bent Horn APEC 6).

The RRMP has been developed as summarized in the following table.

Waste Categories		Waste Code	Bathurst Is. and Ile Vanier							Cameron Is.	
			Young Inlet	J-34	N-12	IV APEC 1	Stokes Range	IV APEC 2	IV APEC 4	BH APEC 3	BH APEC 6
Physical Hazards	Buildings	1.1	-	N	N	-	-	-	-	-	-
	Other (debris piles)	1.2	N	N	N	N	N	N	-	-	-
Non-Hazardous Waste	Drums	2.1	N	N	N	N	-	N	N	-	N
	Metal	2.2	N	N	N	N	-	N	-	-	-
	Wood	2.3	N	N	N	N	N	N	-	-	-
	Other	2.4	N	N	N	-	N	-	-	-	-
Hazardous Waste	Organic liquids	3.2	I	-	-	-	-	-	I	-	I
	Press. cylinders	3.4	-	D	-	-	-	-	D	-	-
	Other (batteries)	3.5	-	D	-	-	-	-	-	-	-
Soils	PCBs	4.1	-	-	D	-	-	-	-	-	-
	Metals & PHCs	4.2	R	-	-	E	R	R	-	-	D
	PHCs only	4.3	R	-	-	R	R	-	R	R	R
	Metals only	4.4	R	R	R	-	-	R	-	-	R
Water	Surface water	5.1	R	R	R	-	-	R	-	-	R
	Groundwater	5.2	-	-	-	-	-	R	-	-	R

Notes: **"-"** denotes hazard/waste stream was not identified at indicated Site(s); "N" denotes "No Action"; "I" denotes incineration; "D" denotes collection and off-site disposal; "E" denotes application of an engineered cover; "R" denotes risk management through land use monitoring

Abbreviations

A/C	Aircraft
AANDC	Aboriginal Affairs and Northern Development Canada
ACM	Asbestos Containing Material
APEC	Area of Potential Environmental Concern
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
CALA	Canadian Association for Laboratory Accreditation
CCME	Canadian Council of Ministers of the Environment
CEQG	Canadian Environmental Quality Guidelines
COC	Contaminants of Concern
COPC	Contaminants of Potential Concern
CRM	Certified Reference Material
CSA	Canadian Standards Association
CWQG	Canadian Water Quality Guidelines
CWS	Canada Wide Standard
DCC	Defence Construction Canada
EIA	Environmental Impact Assessment
ESA	Environmental Site Assessment
FCSAP	Federal Contaminated Sites Action Plan
FIGWQG	Federal Interim Groundwater Quality Guidelines
g	Grams
HHERA	Human Health and Ecological Risk Assessment
HW	Hazardous Waste
L	Litres
LCP	Lead Containing Paint
m	Metre
m AMSL	Metres Above Mean Sea Level
mbg	Metres Below Grade
MERA	Mineral and Energy Resource Assessment
MW	Monitoring Well
NCSCS	National Contaminated Site Classification System
ND	Non-detect
ng	Nanogram
NhW	Non-hazardous Waste
NIOSH	National Institute for Occupational Safety and Health
NVLAP	National Voluntary Laboratory Accreditation Program
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
Phase I ESA	Phase I Environmental Site Assessment
Phase II/III ESA	Phase II/III Environmental Site Assessment

PHCs	Petroleum Hydrocarbons
ppb	Parts per Billion
ppm	Parts per Million
PQRA	Preliminary Quantitative Risk Assessment
PWGSC	Public Works and Government Services Canada
QMS	Quality Management System
RAP	Remedial Action Plan
ROA	Remedial Options Analysis
R/RM	Remediation/Risk Management
RRMP	Remediation/Risk Management Plan
SOP	Standard Operating Procedure
SQG	Soil Quality Guideline
SSRA	Site-specific Risk Assessment
SWDA	Solid Waste Disposal Areas
SWE	Surface Water Equivalent
TBC	To Be Completed
TCLP	Toxicity Characteristic Leaching Procedure
TRV	Toxicity Reference Value
TSS	Total Suspended Solids
USCS	Unified Soil Classification System
VECs	Valued Ecosystem Components
VOCs	Volatile Organic Compounds
µg	Microgram

1.0 INTRODUCTION

Aboriginal Affairs and Northern Development Canada (AANDC) has responsibility, through the Contaminated Sites Program (CSP), to manage a number of contaminated properties that are no longer maintained by the original occupant. The Bathurst Island Remediation Project (the Site) in Nunavut (NU) is one such example. AANDC has retained Public Works and Government Services Canada (PWGSC) – Northern Contaminated Sites Group to assist in managing the project; coordination of the program is handled by AANDC. PWGSC has mandated Stantec Consulting Ltd. (Stantec) to develop a Remediation and Risk Management Plan (RRMP) based on the findings of recently completed investigations of the project Site(s), and an associated indicative cost estimate.

The AANDC Nunavut Regional Office Contaminated Sites Program and PWGSC Northern Contaminated Sites Group intend to eventually implement the RRMP. The RRMP is to be developed based on all existing Site information including but not limited to the findings of the Phase III Environmental Site Assessment (ESA) and Preliminary Quantitative Risk Assessment (PQRA) reports completed in 2013 and the subsequent Remedial Options Analysis (ROA) report completed in 2014, as well as on an appropriate regulatory framework. The project is being funded through the Federal Contaminated Sites Action Plan (FCSAP) and must be compliant with FCSAP requirements including reporting structures and submission deadlines.

Contamination at the Sites within the Bathurst Island Remediation Project is a result of oil and gas exploration and extraction activities. Many of the sites were accessed via helicopter during the Phase I/II ESA work and via helicopter and Twin Otter during the 2013 Phase III ESA/Geotechnical Assessment/Archaeological Impact Assessment field program. Airstrips have been identified at most of the Sites; however, most of them are in poor condition. The main Bent Horn Site was historically accessed via Sealift and also via CAT-Train from Rea Point located on Melville Island (approximately 120 km southwest of Bent Horn over sea ice). Some of the smaller sites may have been accessed via CAT-Train from Bent Horn.

The Bathurst Island Remediation Project includes seventeen (17) Areas of Potential Environmental Concern (APECs). Five of the APECs are on Bathurst Island, while eight are on Cameron Island (with five of those within the Bent Horn area) and four are on Ile Vanier (see Figure 1-1).

Based on the findings of the 2013 Phase III ESA and PQRA reports and the subsequent 2014 ROA report, for each environmental issue identified at Site, a remediation or risk management plan has been developed and recommendations are provided within this report.

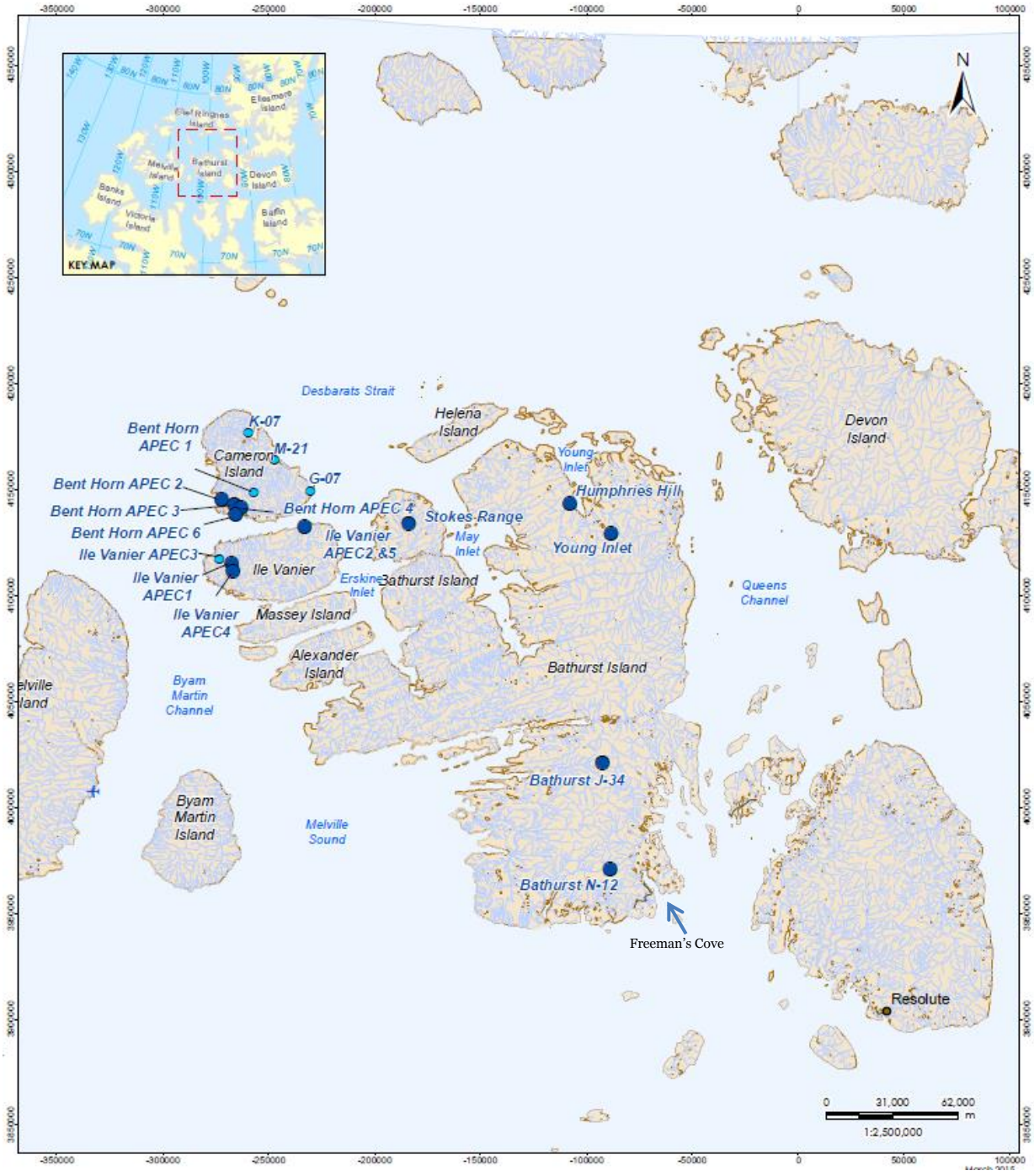


Figure 1-1 Bathurst, Cameron, and Ile Vanier Site Locations

2.0 BACKGROUND INFORMATION

2.1 BATHURST ISLAND

Historically, contamination at the Bathurst Island Sites is a result of oil and gas exploration activities. Three of the Sites were accessed via helicopter during Phase I/II ESA work completed by others (Young Inlet, Stokes Range, and Humphries Hill), while all five were accessed via helicopter or Twin Otter during the Phase III ESA. Airstrips have been identified at Young Inlet and Stokes Range; however, they are in poor condition. Well sites J-34 and N-12 (See Figure 1-1) had not been previously investigated to any extent prior to the 2013 Phase III ESA.

2.1.1 Well Site N-12

The N-12 well site (location referred to as Allison R. in historical well records) was originally drilled by the Sun-Panarctic Company and is located on the southeastern end of Bathurst Island, approximately 20 km from the south coast. Well site N-12 was accessed on July 30, 2013, during the Phase III ESA investigation, via helicopter from Resolute Bay, Nunavut (approximately 115 km away). During the site visit two building foot prints were observed on the northeast portion of the Site as depressions filled with wood debris and ponded water. A large ponded area was observed on the east portion of the Site which may have functioned as a sump for drilling/site operations. The ponded area was observed to contain various metal debris and storage drums. A large cuttings pile, old filters and debris pile were observed along the west bank of the pond. Six burn pits were observed throughout the Site which contained various types of metal and wood debris. A wooden well box with well marker was observed in the central portion of the Site (west of the ponded area). The wooden box was filled with various metal debris. A large area with buried debris was observed on the north portion of the Site which contained various types of metal debris such as cans, storage drums, wire, and strapping.

2.1.2 Well Site J-34

Well site J-34 (referred to as Bathurst Caledonian) was originally drilled by the Dominion Explorers-Canso Company and is located on the southern portion of the Polar Bear Pass National Wildlife Area. Well Site J-34 was accessed on July 31, 2013 during the Phase III ESA investigation, via helicopter from Resolute Bay, Nunavut (approximately 150 km away). During the primary aerial surveillance of the Site, distinct north and south areas were identified. The south area included two trailers on transportation pads and a ponded area (south of trailers). The contents of the trailers included two propane cylinders, beds with disintegrating mattresses, chairs and a stove. A third transportation pad was also observed and a small debris pile with various types of metal debris (crushed storage drums and cans). The ponded area was observed to contain various types of wood and metal debris such as crushed storage drums. During the aerial surveillance of the north area a well site (central), building foot print (north), suspected sump (north), three ponded areas (1 northwest and 2 southeast), and disturbed area (east) were observed. During the site visit the well marker and associated wooden well box was observed in the central portion of the Site. A debris pile with various types of rusted metal waste (crushed storage drums, three compressed gas cylinders, cans, wires, sheet metal, and miscellaneous drill pieces) was observed to the northeast of the well. A large disturbed area was observed east of the well area, along the disturbed area

two storage drums, one half submerged compressed gas cylinder, and a stained area were observed. A wooden box filled with water (suspected sump) was observed north of the well area. A large ponded area was observed on the northwest portion of the Site which contained various rusted metal debris (one compressed gas cylinder, crushed storage drums, and sheet metal). Other site observations include various debris piles with metal, plastic and wood.

2.1.3 Young Inlet

Young Inlet, located on the northeastern end of Bathurst Island south of Young Inlet, is approximately 145 km east of Bent Horn. The Site covers a relatively small area. Contamination at Young Inlet is a result of oil and gas exploration activities. Site operations took place in the early 1970s. No known remediation or cleanup activities took place at the Site.

Young Inlet was accessed on August 3 and 4, 2013, during the Phase III ESA investigation, via helicopter from Resolute Bay, Nunavut (approximately 220 km away). During the primary aerial surveillance of the Site a distinct airstrip and well site were identified. A north and south drum cache were observed on the airstrip portion of the Site. The north drum cache contained approximately 81 storage drums (205 L capacity) stacked in two lines, eight storage drums packed with miscellaneous rusted metal and wood debris, and a metal debris pile. In addition, four storage drums were observed on the north portion of the cache with suspected free product. The drums were opened and the contents assessed. A suspected petroleum hydrocarbon sheen was observed on the melt water on the north portion of the drum cache. The melt water was observed to flow in a north direction which was the inferred gradient at the site. Nine storage drums and one crushed storage drum were observed in the south drum cache. Four drums were confirmed to have fuel, three were suspected to have fuel and two were empty and observed to have large holes.

During the primary aerial surveillance of the well site area a large disturbed area was identified around the well head, and two suspected sumps (southeast of the well head). During the site visit a large sump located on the southeast portion of the Site was observed to contain various rusted metal and wood debris (storage drums, sheet metal, miscellaneous metal). A large metal debris piles, burn pit and two stained areas were observed around the large sump area. A second smaller sump and possible drainage ditch was identified in the south portion of the disturbed area. Two large stained areas with petroleum hydrocarbon odours were observed on the southwest portion of the disturbed area. Two debris piles with various types of metal debris (cans, wire, vehicle parts, and miscellaneous metal), a stained area, and burn pit were observed on the northeast corner of the disturbed area. Other site observations include a burn pit east of the disturbed area and four large pipes south east of the disturbed area, with plastic debris along a drainage ditch west of the disturbed area.

2.1.4 Humphries Hill

Humphries Hill, located on the northeastern end of Bathurst Island near the southeast end of Young Inlet, is approximately 130 km east of Bent Horn. It is located about 230 km north northwest of Resolute Bay, Nunavut. The Site covers a small area. Humphries Hill is suspected to have served as a fuel cache; however, the operator of the Site is unknown. Work at Humphries Hill during the Phase III investigation

consisted of transporting the abandoned nine empty drums, two partially full drums and one full drum at the site to Young Inlet. The drum count has been included with Young Inlet.

2.1.5 Stokes Range

Stokes Range, located on the northern end of Bathurst Island west of May Inlet, is approximately 65 km east of Bent Horn. The Site covers a relatively small area. Contamination at Stokes Range is a result of oil and gas exploration. The Site began operations in 1977 and was abandoned in 1982 when final clearance was given and the AANDC Land Use Permit was closed. Stokes Range was accessed on August 5 and 8, 2013, via helicopter from Resolute Bay, Nunavut (approximately 260 km away). During the primary aerial surveillance of the Site, a rectangular disturbed area, two suspected sump locations (north and northwest of the disturbed area) and an airstrip (west of the disturbed area) were identified. During the site visit, two debris piles, three burn pits and one disturbed area with PHC-suspect staining was observed around the identified well head. A burn pit with wood debris and a debris pile containing suspected drill cuttings was identified west of the disturbed area. A number of soil piles were observed east of the airstrip.

2.2 ILE VANIER

Historically, contamination at the Ile Vanier Sites was a result of oil and gas exploration activities. Three of the Sites were accessed via helicopter during the Phase I/II Environmental Site Assessment work by others (APECs 1, 2 and 4). Airstrips have been identified at three of the Sites (APECs 2/5, 3 and 4); however, most of them are in poor condition.

2.2.1 APEC 1 (Hotspur J-20 well site)

The site began operation prior to 1977 and was abandoned in 1988. During the decommissioning effort, all waste was to have been removed to Panarctic's Bent Horn site on nearby Cameron Island. Based on information from the previous Phase I ESA conducted by WESA (March, 2007), petroleum well J-20 was operated by BP Resources Canada Ltd (BP) and Panarctic Oil Ltd. (Panarctic) of Calgary, Alberta.

APEC 1 Hotspur J-20 was accessed on August 9, 2013, during the Phase III ESA investigation, via helicopter from Resolute Bay, Nunavut (approximately 300 km away). During the site visit a central disturbed area was identified with a well area, and wooden debris from a former building. Suspected sumps were identified north and east of the disturbed area with crushed and submerged drums within the latter, along with other types of metal debris (steel cables, pipes, etc.). An area with ponded water and stains was identified southeast of the disturbed area with multiple crushed drums. A second disturbed area was observed west of the central disturbed area and south of the former building footprint, with two metal posts, ground surface stains, wood and metal debris. Other Site observations include drums in the northeast portion of the APEC containing drill parts, a suspected sump in the southwest portion of the APEC with a crushed drum, and miscellaneous debris around the site (plywood, and other wood debris and metal pipes.

2.2.2 APEC 2 (Sophie Point G-19 well site)

Based on information from the previous Integrated Phase I and Phase II ESA by WESA (January, 2012), a land use permit (N77A522) was granted for the site on March 24, 1977. The Panarctic Sophie Point G-19 well site consists of a well head, a supporting camp area and at least one suspected sump. All major buildings and drilling materials were removed from the site.

APEC 2 (Sophie Point) was accessed on August 10 and 12, 2013 during the Phase III ESA investigation, via helicopter from Resolute Bay, Nunavut (approximately 290 km away). During the primary aerial surveillance of APEC 2 a large main disturbed area was identified bordering two suspected sumps and four ponded areas. The suspected sumps were observed to the northeast and northwest of the main disturbed area, and a stream was observed extending in an east to west direction along the south portion of the APEC south of the disturbed area. During the primary aerial surveillance of APEC 5, a large rectangular disturbed area was identified (remains of the airstrip). During the site visit to APEC 2 the well area was identified on the north portion and east of a suspected sump. The ponded areas were connected by an observed saturated area which extended in a westerly direction to a west drainage ditch and southerly to a south drainage ditch. Both the west and south drainage ditches flowed into a small stream south of APEC 2, the stream was observed to flow in a westerly direction into a larger river (west of APEC 2). During the delineation investigation of the previous investigation sampling, multiple impacts (staining and odours) were observed both up and down gradient of the sampling points. No sampling or screening was conducted at APEC 5.

2.2.3 APEC 4 (Panarctic Hotspur)

Based on information from the previous Integrated Phase I and Phase II ESA by WESA (January, 2012), this Site was operated by BP Resources Canada Ltd. and Panarctic Oil Ltd. of Calgary, Alberta. Site operation began prior to 1977 and it was abandoned in 1988. During the Phase I ESA more than 200, 205 L drums were located in two separate drum caches with an estimated three quarters of the drums containing fuel.

APEC 4 Hotspur was accessed on August 22, 2013, during the Phase III ESA investigation, via Twin Otter from Resolute Bay, Nunavut (approximately 295 km away). During the primary aerial surveillance of APEC 4, first occurring on August 2, 2013, in order to complete the assessment of the runway suitability for Buffalo aircraft, two large drum caches along the northeast portion of the airstrip were observed. The start of the roadway leading to APEC 1 was also observed north of the eastern end of the airstrip. During the site visit a survey of the barrel caches was completed on arrival, followed by test pit investigation/delineation of observed impacts around both barrel caches. No surface water sample was taken from the stream shown on the NTS topographic map due to lack of water and snow cover.

2.2.4 APEC 3 (Key Point)

APEC 3 Key Point (well name O-51) was operated by the Panarctic Company. The site has not been previously assessed and there was no information available to review. The site was reportedly comprised of a well head, former supporting camp area, suspected sumps and an airstrip. As a result of executing a reduced field program for the Phase III ESA, APEC 3 Key Point was only given a fly-over on August 15,

2013, with the collection of photographs across the full extent of the site. Based on that information, the site appears to consist of an airstrip of approximately 1000 m length running northwest-southeast, with several small ponded areas approximately 150 m south of the airstrip, with a stream channel south of that. A stream channel also parallels the airstrip to the north approximately 50 m away. Evidence of a former crossing over the north stream is suggested in the photos taken from helicopter, with a disturbed area to the north (i.e., it appears that ground access was built to an area north of the north stream). A standing well marker is clearly visible south of the western end of the airstrip with a brown stained area to its west, and one empty drum can be seen in the north stream bed. Overall APEC 3 shows a lesser degree of disturbance when viewed from the air than any of the other Ile Vanier APECs.

2.3 BENT HORN

Bent Horn is located on Cameron Island, about 310 km northwest of Resolute Bay, Nunavut. It covers a large area with five identified APECs located up to 15 km apart – APECs 4 and 6 were involved with oil production, while APECs 1, 2 and 3 were exploration sites, along with well sites K-07, M-21 and G-07 along the east coast of Cameron Island. Contamination at Bent Horn is a result of oil and gas exploration and production activities. The Bent Horn oil field was discovered in 1974 and produced 4.5×10^5 m^3 (2.8 million barrels) between 1985 and 1996. The field was abandoned before being fully depleted.

2.3.1 APEC 6 (Main camp, production facility and tank farm)

A cleanup of this site was conducted between 1996 and 1998 during which most of the equipment was removed from the site. Two waste disposal pits were constructed to dispose of the remaining materials (mainly inert or relatively low toxicity compounds such as steel from casings, tanks, buildings and heavy equipment). Currently at the Main Camp Site there are an unmaintained airstrip, infrastructure footprints, areas of disturbed ground, well markers, as well as visible roads and trails. All of the historical buildings and equipment have been removed from the site and only a small amount of debris (metal and wood) remains visible. During the Phase I/II ESA fieldwork in 2011 it was noted that the airstrip appeared to be in relatively good condition.

Bent Horn APEC 6 was accessed on August 15, 19 and 21, 2013, during the Phase III ESA investigation, via helicopter or Twin Otter from Resolute Bay, Nunavut (approximately 320 km away). During the primary aerial surveillance of the Site a distinct airstrip and disturbed areas were visible in the approximate location of the former camp facility, landfill, and tank farm.

During the site visit, the previous WESA sampling locations in a disturbed area southeast of the airstrip were located. Closer inspection of the former WESA sampling location showed the presence of an oily residue on the surface of the soils. The former WESA sampling location with the oily residue was re-sampled. The previous WESA sampling location in the disturbed area northeast of the airstrip, which was observed to slope in a northern direction towards a ponded/saturated area, was investigated. During the delineation investigation multiple impacts (staining and odours) were observed both up and down gradient of the previous sampling point.

2.3.2 APEC 3 (M-12 WELL SITE [Delta Area])

As a result of executing a reduced field program, APEC 3 was not investigated by the Phase III ESA field team. A fly-over and site investigation was completed during the geotechnical investigation, and updated site photographs were taken.

2.3.3 APEC 4

As a result of executing a reduced field program, APEC 4 was not investigated, nor was a new fly-over completed. It was visited during a previous investigation.

2.3.4 APEC 1 (A-57 WELL SITE)

As a result of executing a reduced field program, APEC 1 was not investigated, nor was a new fly-over completed. A fly-over was completed during a previous investigation.

2.3.5 APEC 2 (C-44 AND E-43 WELL SITES)

As a result of executing a reduced field program, APEC 2 was not investigated, nor was a new fly-over completed. A fly-over was completed during a previous investigation.

2.3.6 Well Site K-07

As a result of executing a reduced field program, the K-07 well site was only given a fly-over, with collection of photographs across the full extent of the site. Based on that information, the site appears to consist of a disturbed area around a standing well marker next to a major stream entering a bay, with a large strip that may have been cleared for use as a temporary airstrip to the southeast. A square area approximately 20 m on a side appears to be a backfill area, perhaps for a dump, and a tire sits along one edge. An empty drum sits within the stream channel. Overall the K-07 well site shows a lesser degree of disturbance when viewed from the air than the more heavily impacted Bent Horn APECs.

2.3.7 Well Site M-21

As a result of executing a reduced field program, the M-21 well site was only given a fly-over, with collection of photographs across the full extent of the site. Based on that information, the site appears to consist of a disturbed area around a standing well marker, a major stream is located approximately 1 km northwest of the Site, and the well marker is approximately 4.5 km west of the coast. A ponded area, which may be a sump, lies on the edge of the disturbed area. Two empty drums sit partially buried in the sandy surface materials approximately 200 m north from the well marker. An airstrip is next to the site. Overall the M-21 well site, as with the K-07 well site, shows a lesser degree of disturbance when viewed from the air than the more heavily impacted Bent Horn APECs.

2.3.8 Well Site G-07

As a result of executing a reduced field program, the G-07 well site was only given a fly-over, with collection of photographs across the full extent of the site. Based on that information, the site appears to

consist of a disturbed area with a standing well marker and well box at its northern edge approximately 1 km inland (west) from the coast. The area of disturbance consists of cobble and boulder materials. A large rust coloured stained area can be seen along the northern edge of the disturbed area, in proximity to a square area of apparent backfill – suggests a metal-containing dump site or similar. A further square area is located west of the well marker, and may mark another area of backfill or may be a borrow pit. An airstrip is marked on the NTS map at the Site; however, no evidence of an airstrip was seen from the air. Overall the G-07 well site, as with the K-07 and M-21 well sites, shows a lesser degree of disturbance when viewed from the air than the more heavily impacted Bent Horn APECs.

2.4 SCOPE OF WORK

The scope of work for the RRMP was as follows:

- Based on the findings of the 2013 Phase III ESA and PQRA reports and the subsequent 2014 ROA, for each environmental issue identified at Site, a remediation or risk management plan was developed through:
    - Development of the preferred remedial options identified in the ROA,
    - Prioritization of the remedial action of the various categories of environmental issues (i.e. hazardous wastes, non-hazardous wastes, physical hazards, contaminated soils) present on site,
    - Solicitation of input from representatives from the surrounding communities in order to utilize their knowledge of the Site and determine the local support services that are available,
    - Development of companion risk management plans to address environmental issues that are deemed to be lower priorities (i.e. no regulatory requirement for remediation),
    - Evaluation of remediation and risk management approaches on the basis of the following factors:
        - potential risks,
        - value to the Crown,
        - resources available for implementation, and
        - degree that they reduce the environmental liabilities
    - Preparation of indicative (Class C/D[1]) cost estimates (based on the AANDC Contaminated Sites Cost Estimating Guide, May 3, 2013) for the implementation of both the remediation and risk management plans to allow the Crown to fully evaluate all options available and appropriately prioritize allocation of resources (cost estimate to be reported in a separate letter report), and
    - Adherence to the overall RRMP goals of reducing the environmental liabilities present at the site, maximizing benefits to local community members and Inuit, and ensuring good value for the Crown;

[1] An indicative cost estimate (level of accuracy +/- 15-20%) provides a rough cost for budget planning, which can be used to seek preliminary project approval (c.f. Treasury Board) – it encompasses Classes C and D. Estimates relating to remedial options have been completed to Class D (+/- 20%), while estimates relating to logistics and overall project support (e.g., transport, field camps) have been completed to Class C (+/- 15%)

2.5 PREVIOUS WORK

Table 2-1 List of Previous Reports

Report Title	Date
Integrated Phase I and Phase II Environmental Site Assessment NB038 Ile Vanier, prepared by WESA	January 2012
Limited Phase I Environmental Site Assessment of Site Number NB038, BP et al Panarctic Hotspur Petroleum Well Site, Ile Vanier, Nunavut, prepared by WESA	March 2007
Limited Phase II Environmental Site Assessment of Site Number NB038, BP et al Panarctic Hotspur Petroleum Well Site, Ile Vanier, Nunavut	March 2007
Integrated Phase I and Phase II Environmental Site Assessment NB014 Bent Horn Project (Cameron Island), prepared by WESA	January 2012
Integrated Phase I and Phase II Environmental Site Assessment NB010 Bathurst Island (Humphries Hill), prepared by WESA	January 2012
Integrated Phase I and Phase II Environmental Site Assessment Stokes Range, prepared by WESA	January 2012
Integrated Phase I and Phase II Environmental Site Assessment NB007 Bathurst Island (East of Humphries Hill), prepared by WESA	January 2012
Bathurst Island Phase III Environmental Site Assessment and Geotechnical Assessment Report: Sites NB003, NB007, NB010, N-12, and J-34, prepared by Stantec Consulting Ltd.	January 2014
Ile Vanier Phase III Environmental Site Assessment and Geotechnical Assessment Report: Sites NB038, prepared by Stantec Consulting Ltd.	January 2014
Bent Horn Phase III Environmental Site Assessment and Geotechnical Assessment Report: Sites NB014, prepared by Stantec Consulting Ltd.	January 2014
Archaeological Impact Assessment, Bent Horn, Cameron Island, prepared by Golder Associates Ltd.	February 2014
Archaeological Impact Assessment, Sites N-12 and J-34, prepared by Golder Associates Ltd.	February 2014
Archaeological Impact Assessment, Ile Vanier, prepared by Golder Associates Ltd.	February 2014
Archaeological Impact Assessment, Stokes Range, prepared by Golder Associates Ltd.	February 2014
Archaeological Impact Assessment, Young Inlet and Humphries Hill, prepared by Golder Associates Ltd.	February 2014
Preliminary Quantitative Risk Assessment for Bathurst Island Sites, prepared by Stantec Consulting Ltd.	February 2014
Preliminary Quantitative Risk Assessment for Bent Horn, prepared by Stantec Consulting Ltd.	February 2014
Preliminary Quantitative Risk Assessment for Ile Vanier, prepared by Stantec Consulting Ltd.	March 2014
Bathurst Island Remediation Project Remedial Options Analysis, prepared by Stantec Consulting Ltd	March 2014

2.6 SUMMARY OF RESULTS

Stantec completed field work which included a Phase III ESA, geotechnical investigation and archaeological impact assessment from July 30 to August 23, 2013. Table 2-2 summarizes the types of investigations which occurred at each Site, and Table 2-3 summarizes the results of the Phase III ESAs - note that soil entries refer to estimates that exceed CCME Tier I guideline values.

Table 2-2 Summary Table of Site Visits

Site	Date(s) Assessed	Discipline (Notes)		
		ESA	Geo	AIA
Bathurst Island				
N-12	30/7/2013	X	-	X

Site	Date(s) Assessed	Discipline (Notes)		
		ESA	Geo	AIA
J-34	31/7/2013	X	-	X
Young Inlet	3-4/8/2013	X	X	X
Stokes Range	5,8/8/2013	X	X	X
Humphries Hill (2)	4/8/2013	-	-	-
Ile Vanier				
APEC 1 Hotspur	9/8/2013	X	-	X
APEC 2/5 Sophie Point	10/8/2013 12/8/2013	X (3)	X (3)	X
APEC 4 Hotspur	22/8/2013	X (4)	X	X
APEC 3 Key Point	-	-	-	-
Bent Horn				
APEC 1	-	-	-	-
APEC 2	-	-	-	-
APEC 3	15/8/2013	O	X	-
APEC 4	-	O	-	-
APEC 6	15,19,21/8/2013	X	X	X
K-07	-	-	-	-
M-21	-	-	-	-
G-07	-	-	-	-

Notes:
1. 'X' denotes supplemental site investigation by Stantec; 'O' denotes preliminary investigation by others only. ESA – Environmental Site Assessment, Geo – Geotechnical Investigation, AIA- Archaeological Impact Assessment
2. Site removed from scope once on-site drums relocated to Young Inlet
3. ESA at APEC 2 only, and geotechnical investigation at APEC 5 only
4. Partial

Table 2-3 Summary of Phase III ESA Results

Waste Category		Quantity	Uncertainty (Notes)	Description
J-34				
Physical Hazards	Buildings	2	Low	Two trailers
	Other	1	Low	Debris pile
Non-hazardous Waste	Drums	30	Low	Empty drums
	Metal	82 m^3	Low to moderate	Misc. metal debris in dumps and in sumps
	Wood	6.6 m^3	Low to moderate	Beams, pallets, plywood
	Other	23 m^3	Low to moderate	Plastic, concrete bags
Hazardous Waste	Press. cylinders	8	Low	Cylinders in trailers and in sumps
	Other	4	Low	Batteries
Soils	Metals only	70 m^3	High	Debris pile
Water	Surface water	NA	NA	Ponded water

Waste Category		Quantity	Uncertainty (Notes)	Description
N-12				
Physical Hazards	Building footprints	2	Low	-
	Other	9	Low	Cuttings pile, debris piles (2), burn pits (6)
Non-hazardous Waste	Drums	6	Low	Empty drums
	Metal	44 m^3	Low to moderate	Misc. metal, food cans, etc.
	Wood	51 m^3	Low to moderate	Planks, beams, plywood
	Other	5 m^3	Low to moderate	Misc. plastic, drill cuttings, etc.
Soils	PCBs, Metals & PHCs	33 m^3	High	PCB impacts co-mingled with PHC in burn pit
	Metals	18 m^3	High	Barium impacts
Water	Surface water	NA	NA	Big pond
Young Inlet				
Physical Hazards	Other	2	Low	Debris pile, wood chip pile
Non-hazardous Waste	Drums	119	Low	-
	Metal	120 m^3	Low to moderate	Misc. metal debris, pipes, etc.
	Wood	23 m^3	Low to moderate	Wood chips
	Other	20 m^3	Low to moderate	Plastic, styrofoam, concrete, etc.
Hazardous Waste	Organic Liquids	2.5 m^3	Low	10 full, 4 partial drums
Soils	Metals & PHCs	723 m^3	High	Various areas in disturbed area
	PHCs	1.4 m^3	High	Drum Cache 1
	Metals	120 m^3	High	Large stained area
Water	Surface water	NA	NA	Sumps
Stokes Range				
Physical Hazards	Other	3	Low	Debris piles
Non-hazardous Waste	Wood	4 m^3	Low	Misc. wood.
	Other	15 m^3	Moderate	Misc. plastic, drill cuttings
Soils	Metals & PHCs	133 m^3	High	Disturbed area
	PHCs	3.8 m^3	Low to Medium	Drilling area, burn pit
Ile Vanier APEC 1				
Physical Hazards	Other	2	-	Debris piles
Non-hazardous Waste	Drums	10	Low	Empty
	Metal	34 m^2	Low	Cans, pipes, wire
	Wood	13 m^3	Low	Beams, debris
Soils	Metals & PHCs	100 m^3	High	Central disturbed area
	PHCs	236 m^3	Very High	Central disturbed area, west disturbed area, stained area

Waste Category		Quantity	Uncertainty (Notes)	Description
Ile Vanier APEC 2/5				
Physical Hazards	Other	NA	-	Debris
Non-hazardous Waste	Drums	5	Low	Empty
	Metal	5 m^3	Low	Pipes, and misc. metal
	Wood	5 m^3	Low	Minor debris
Soils	Metals & PHCs	1276 m^3	High	Central ponded area, sump area
	Metals	50 m^3	Very High	Sump
Water	Surface water	NA	NA	Sump, ponded and background
	Groundwater	NA	NA	Central ponded area
Ile Vanier APEC 4				
Non-hazardous Waste	Drums	224	Low	221 empty, 3 partial
Hazardous Waste	Organic Liquids	0.5 m^3	Low	-
	Press. Cylinders	8	Low	Empty
Bent Horn APEC 3- M-12 Well Site				
Non-hazardous Waste	Drums	8	-	Drums reported by WESA
Soils	PHCs	3000 m^3	Very High	-
Bent Horn APEC 6 Main Site (camp, production facility, tank farm)				
Non-hazardous Waste	Drums	10	Low	Full
Hazardous Waste	Organic Liquids and Grease Globules	2 m^3	-	-
Soils	Metals & PHCs	90 m^3	Low	North disturbed area
	PHCs	2 m^3	Low	South disturbed area
	Metals	490 m^3	High	Proximity to landfill
Water	Surface water	NA	NA	Pond 1 (north disturbed area)
	Groundwater	NA	NA	North disturbed area

Notes: For all wastes except soil: "Low" denotes that in some instances exact quantities/volumes were measured in the field. "Moderate" denotes that exact quantities/volumes were not calculated; however, were reasonably derived based on the visual assessment. "High" denotes that due to field program limitations actual horizontal and vertical extents were not obtained and quantities/volumes were estimated.
For soil: Low = Horizontal boundary samples below criteria; Medium = Single sample, minor (< 50 m^2) disturbed area; High = One or more boundary sample exceeds criteria; Very high = Single sample, major (> 50 m^2) disturbed area. These uncertainty levels can be associated with the following range bounds: low = ± 10%, medium = ± 25%, high = -50%/+100%, very high = ± factor of 10.
"NA" denotes not assessed/determined.

PQRAs were completed by using site-specific soil, surface water, and groundwater data collected by Stantec in 2013 and WESA in 2011. The purpose of the PQRAs was to identify the presence or absence of impacts to soil, surface water and groundwater at the Bathurst Island, Bent Horn and Ile Vanier Sites, and

to determine whether or not concentrations of contaminants of potential concern (COPCs) posed unacceptable risk to human or ecological receptors.

Table 2-4 summarizes human health risk assessment (HHRA) and ecological risk assessment (ERA) results outlined in the PQRAs.

Table 2-4 Summary of PQRA Results

Site/Receptor	PQRA Results
Bathurst Island	
Human Health Risk Assessment	• PHC F3, aluminum, chromium VI, lead, and manganese in soil, and lead in surface water, were carried through for risk assessment. • The results of the HHRA suggest that there are no risks to any of the three human receptors (Inuit Toddler, Inuit Adult, and Remediation Worker) due to direct exposure pathways (i.e., soil ingestion, soil dermal contact, inhalation of suspended soil particulate), ingestion of surface water, and/or consumption of small wild game from any of the Bathurst Island Sites (J-34, N-12, Young Inlet, and Stokes Range). • Bathurst Island Sites can be considered to present "essentially negligible" risks with removal of PCB-impacted soils at a small burn pit area at N-12. • As part of an uncertainty evaluation it is noted that assumptions were made regarding potential pathways such as consumption of vegetation, due to the sparse availability of vegetation at the sites. Should vegetation at the sites become available for collection and consumption in the future, this pathway may need to be re-evaluated.
Ecological Risk Assessment	• PHCs, antimony, barium, chromium (VI), lead, molybdenum, nickel and zinc in soil, and aluminum, boron, cadmium, chromium (VI), copper, iron, lead, mercury and zinc in surface water, were carried through for risk assessment. • Results of the ERA suggest that while HQs identified potential risks to the Spotted Sandpiper surrogate VEC receptor at N-12, Young Inlet, and Stokes Range, the actual risks to this receptor at the population level are expected to be negligible. • Potential risk to terrestrial plant and soil invertebrate populations from barium in soil. Cadmium and lead in surface water may pose a potential risk to freshwater aquatic receptors at Stokes Range; however, these impacts are likely to be negligible at the population level. • PCB contamination exceeded health-based guidelines and HQs identified potential risks to avian receptors at a small burn pit area at the N-12 site. It is recommended that this one area be remediated, either by capping with clean material or by excavation.
Ile Vanier	
Human Health Risk Assessment	• Aluminum, antimony, cadmium, chromium VI, lead, manganese, total PCBs, benzo(b)pyridine (quinoline), 2-methylnaphthalene, and naphthalene in soil were carried through for risk assessment. • The results of the HHRA suggest that there are no risks to any of the three human receptors (Inuit Toddler, Inuit Adult, Remediation Worker) due to direct exposure pathways (i.e. soil ingestion, soil dermal contact, inhalation of suspended soil particulate), ingestion of surface water, and/or consumption of small wild game from any of the Ile Vanier APECs (APEC 1, 2, and 4). • Remediation of lead hotspot at J-20 (i.e. excavation, capping, etc.) may be warranted to eliminate any risk concerns. • As part of an uncertainty evaluation it is noted that assumptions were made

Site/Receptor	PQRA Results
	regarding potential pathways such as consumption of vegetation, due to the sparse availability of vegetation at the sites. Should vegetation at the sites become available for collection and consumption in the future, this pathway may need to be re-evaluated.
Ecological Risk Assessment	• PHCs, barium, chloride, chromium (VI), lead, naphthalene and 1,3,5-trimethylbenzene in soil, and bromide, chloride, aluminum, boron, copper, iron, lead, and mercury in surface water were carried through for risk assessment • Potential risks were identified for: Spotter Sandpiper (PHC F2, F3 and lead in APEC 1; PHC F2 and F3 in APEC 2); terrestrial plants and soil invertebrates (PHCs, barium, and lead); and freshwater aquatic organisms (copper, iron, and mercury) • It is not expected that exposure to these COPCs will pose a risk these VECs at the population level due to the sparse vegetation that makes the habitat less desirable for VECs
Bent Horn	
Human Health Risk Assessment	• PHC F3, chromium VI, and 1,1,2-trichloroethane in soil, and selenium in surface water, were carried through for risk assessment. • The results of the HHRA suggest that there are no risks to any of the three human receptors (Inuit Toddler, Inuit Adult, Remediation Worker) due to direct exposure pathways (i.e., soil ingestion, soil dermal contact, inhalation of suspended soil particulate), ingestion of surface water, and/or consumption of small wild game from any of the Bent Horn APECs (APEC 3, 4, and 6). • Bent Horn APECs can be considered to present "essentially negligible" risks with removal of grease globules at surface at APEC 6. • As part of an uncertainty evaluation it is noted that assumptions were made regarding potential pathways such as consumption of vegetation, due to the sparse availability of vegetation at the sites. Should vegetation at the sites become available for collection and consumption in the future, this pathway may need to be re-evaluated.
Ecological Risk Assessment	• PHCs, chloride, chromium (VI), total chromium and 1,3,5-trimethylbenzene in soil, and aluminum, boron, cadmium, copper, iron, lead, mercury, selenium, bromide, chloride, fluoride, anthracene, benz(a)anthracene and pyrene in surface water, were carried through for risk assessment. • Potential risks to the Spotted Sandpiper surrogate VEC receptor at APEC 6, the actual risks to this receptor at the population level are expected to be negligible. • Potential risk to terrestrial plant and soil invertebrate populations from PHCs in soil. Iron and selenium in surface water may pose a potential risk to freshwater aquatic receptors at APEC 6. However, these impacts are likely to be negligible at the population level.

HQ: Hazard Quotient

VEC: Valued Ecosystem Component

The Phase III ESA, Hazardous and Non-hazardous Materials Inventory, and Geotechnical Evaluation of these Sites were required to plan and support future work. Field work was completed from July 30, 2013, to August 23, 2013. The Terms of Reference (TOR) also included the development of a Remedial Action Plan (RAP) – this item was re-scoped to a Remedial Options Analysis (ROA) after completion of the PQRAs. Based on the results of the Phase III ESA, PQRAs were completed to determine the level of human health and ecological risk posed by identified contaminants of concern. The ROA was completed

in April, 2014, with provision of a summary of the results of the Phase III ESAs and the PQRAs, identified impacts at the Sites, identified remedial options for the impacts, assessment of remedial options against a defined set of selection criteria, and recommended supplementary site assessment and risk assessment work, along with geotechnical and site access considerations.

In order to identify remedial options for the identified impacts, two aspects needed to be considered: identification of remedial technologies that would potentially be applicable for remediating a given impact, and consideration of remedial approaches that would be appropriate for the project. Technologies and approaches that would not be relevant were excluded from further consideration through a screening process, leaving a short list of applicable remedial technologies-approaches that were then assessed through semi-quantitative selection criteria. Scored remedial options were then ranked, and the highest ranking option was selected as the recommended option. The last step was to provide preliminary considerations for supplementary site assessment and risk assessment work, along with geotechnical and site access considerations, as drawn from previous work.

The preferred remedial options for the identified waste streams from March, 2014, were as follows:

- Physical Hazards:
    - Buildings – E2 Demolition without pre-assessment
    - Other – C2 Central Site Disposal
- Non-Hazardous Waste:
    - Drums – C2 Central Site Disposal
    - Metal – C2 Central Site Disposal
    - Wood – D1 On-site Burn
    - Other – C2 Central Site Disposal
- Hazardous Waste:
    - Organic liquids – D2 On-site Incineration
    - Press. Cylinders – A1 Off-site Disposal
    - Other – A1 Off-site Disposal
- Soils:
    - PCBs – F2 Engineered Cover
    - Metals & PHCs – H No Action (except for F2 Engineered Cover for lead-impacted soils at Ile Vanier APEC 1)
    - PHCs only – H No Action (except for A1 Off-site Disposal for PHC-impacted ‘tar’ globules at Bent Horn APEC 6)
    - Metals only – H No Action
- Water:
    - Surface water – H No Action
    - Groundwater – H No Action

3.0 REGULATORY FRAMEWORK

In Canada, guidance documents have been published by various agencies to help maintain, improve and/or protect environmental quality and human health in the context of contaminated sites. Due to the locations of the Bathurst Island, Ile Vanier and Bent Horn sites, five guidelines/criteria have been used as assessment and clean-up reference points. The sections that follow discuss these. The contaminants of potential concern (COPCs) for these Sites as identified in the referenced reports were benzene, toluene, ethylbenzene, total xylenes (BTEX), volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), select metals and general chemistry, pesticides/herbicides, and CCME Canada Wide Standard (CWS) petroleum hydrocarbon (PHC) fractions F1 to F4. The 2011 Phase I/II ESA program, the representative Tier I CWS and CCME Soil Quality Guideline (SQG) values for PHCs, BTEX and PAHs (where available) were applied, irrespective of the pathway/receptor scenarios used in the derivation of the guidelines. Of the COPCs listed, pesticides/herbicides were not identified in any of the analyses undertaken. The start-point contaminants of concern (COCs) are therefore the COPCs listed above minus pesticides/herbicides.

With respect to metals and inorganics overall, Tier I exceedances were noted for aluminum, barium, cadmium, chloride, chromium (VI), copper, fluoride, iron, lead, mercury, molybdenum, nickel, selenium, sulphate, total dissolved solids (TDS), and zinc on at least one occasion (i.e., at least one media at one APEC). Of those parameters, none were noted to exceed in any of the background samples collected from any of the Sites. In the Phase III ESA, only selected metals that exceeded in the previous investigations were analyzed as COPCs and not the full CCME metals list. Salt is a common component of drilling fluid, and chromium was reportedly a component of drilling fluid additives that were historically used at the drilling sites.

3.1 CANADIAN ENVIRONMENTAL QUALITY AND INTERIM GROUNDWATER QUALITY GUIDELINES

The CCME Canadian Environmental Quality Guidelines (CEQG) provides limits for contaminants in soil and water. They are intended to maintain, improve, and/or protect environmental quality and human health at contaminated sites in general. These criteria include generic numerical values for the assessment and remediation of soil and water in the context of agricultural, residential/parkland, commercial, and industrial land uses. Environmental soil and water quality guidelines are derived using toxicological data to determine the threshold level to the most sensitive receptors. These criteria include the recommended CCME Soil Quality Guidelines, and the Canadian Water Quality Guidelines (CWQG). The latest updates of these CCME Guidelines are now kept on-line through the CCME Web site.

In addition, CCME has produced the Canada-Wide Standards (CWS) for PHCs in Soil, which provides generic Tier 1 criteria intended to protect environmental quality and human health, reported against the four PHC fractions (F1 through F4). The CWS for PHC were revised and re-released in January 2008. Stantec has adopted the agricultural land use designations for the Sites as a conservative approach – results are also compared to residential/parkland criteria for reference. An agricultural land use is defined by the CCME where the primary activities involve growing crops or tending livestock. This also includes agricultural lands that provide habitat for resident and transitory wildlife and native flora. A

residential/parkland land use is defined by the CCME where the primary activity is residential or recreational. These definitions can be applied to the Site and surrounding areas.

Based on the agricultural and recreational land use designation and observations made during field activities, which identified both coarse and fine soil textures during test pit activities and the dominant soil texture varied by location, the soil results were compared to:

- *Canadian Soil Quality Guidelines for Protection of Environment and Human Health* (agricultural and residential land uses for both fine and coarse textured soil), CCME, on-line summary tables viewed in October 2013.
- *Canada-Wide Standards for PHC in Soil* (agricultural and residential land uses, non-potable groundwater and for both fine and coarse textured soil), CCME, 2001, as updated in January 2008.

All of the above guidelines are not referenced in federal Acts or Regulations and are used as guidance values for the protection of Human Health and the Environment. These guidelines are referenced in the Treasury Board of Canada Policy on the Management of Federal Real Property.

3.2 INAC ABANDONED MILITARY SITES REMEDIATION PROTOCOL

The Abandoned Military Site Remediation Protocol (AMSRP) (Volume I – Main Report, March 2009, Indian and Northern Affairs Canada (formerly INAC, now known as AANDC)) was prepared to address those factors that must be considered when determining the most suitable approach to site remediation for remote sites in the Arctic environment. The AMSRP is based on an approach that addresses legal requirements, AANDC's Contaminated Sites Policy (including risk management requirements), and standard environmental management practices. It covers cleanup objectives; assessment protocols for background conditions, soils, solid waste disposal areas (SWDA), debris, buildings, natural environment and archaeological areas; remediation protocols for contaminated soils, debris, SDWA, landfills, borrow source development; construction-related implementation requirements; and post-construction monitoring.

Specific guidance on remediating areas of impact from the AMSRP is as follows:

- Waste Disposal Areas (WDAs):
    - if the WDA is located in an unstable, high erosion location, it shall be relocated to a properly engineered landfill
    - if the WDA is located in a suitable, stable location, but there is evidence of contaminant migration, potential remedial solutions include excavation or provision of a suitably engineered containment system
    - if the WDA is located in a suitable, stable location, with no evidence of contaminant migration, it may be left in place

- Surface Debris:
    - Classification: site debris shall be classified as inert, non-hazardous wastes or hazardous wastes in accordance with the following Acts and Regulations - Federal *Transportation of Dangerous Goods Act* (TDGA) and Regulations, *Canadian Environmental Protection Act* (CEPA), and *Nunavut Environmental Protection Act* (NEPA)
    - Barrels:
        - the number of barrels containing product shall be inventoried where it is safe to do so. A statistically relevant number of barrels shall be sampled and analyzed for parameters in accordance with the barrel protocol: Organic Phase - Total Chlorine, PCBs, Cadmium, Chromium, Lead; Aqueous Phase - % Alcohols and Glycols, Total Chlorine, Cadmium, Chromium, Lead.
        - Empty barrels shall be crushed and disposed in an on-site engineered landfill.
        - Filled or Partially Filled Barrels: Barrel contents shall be inspected and tested if necessary and disposed of appropriately (off-site or incinerated).
        - Wastewater generated during barrel cleaning shall be treated to meet discharge criteria in accordance with permits and licenses issued for cleanup activities.
    - Non-hazardous materials: volume of the materials shall be minimized through crushing, shredding, or incineration, prior to placement in an on-site engineered landfill. If there is no existing landfill on-site, and no suitable location for a new engineered landfill, non-hazardous materials shall be disposed of off-site. Compressed gas cylinders with known contents shall be vented. Once empty, the metal cylinder shall be disposed on-site in an engineered landfill. Where no on-site facility is available, compressed gas cylinders shall be shipped off-site for disposal.
    - Hazardous materials: disposed of off-site, in accordance with the current regulations governing the handling and disposal of hazardous materials.
        - PCB paint and PCB painted components that are regulated under the CEPA, shall be collected and transported off site, in accordance with the TDGA and CEPA, to a licensed hazardous waste disposal facility. PCB painted materials are considered regulated under CEPA when the component, (paint and substrate) contain greater than 50 ppm PCBs total.
        - Lead-based painted components that are classified as hazardous material shall be collected and transported off site, in accordance with the Transportation of Dangerous Goods Act to a licensed hazardous waste disposal facility. Painted components that exceed the relevant federal or Territorial criteria but are not considered hazardous shall be collected and disposed in an on-site engineered

landfill. Lead-based painted materials are considered hazardous when the lead leachate concentrations from a test of the component (paint and substrate) exceed 5 mg/L or the concentration as provided in the latest schedule of the TDGA.

- Asbestos waste shall be collected, double bagged and disposed of in an on-site engineered landfill, in accordance with the appropriate legislation. Where no on-site facility is available, asbestos waste shall be shipped off-site for disposal. Where asbestos materials are painted, disposal requirements are based on paint analyses.

- Petroleum products, such as gasoline or diesel, which do not contain other hazardous products (chlorine, PCB, metals, etc.) will be incinerated on-site under appropriate emissions controls. Heavier petroleum products such as lubricating oil will be disposed of off-site or mixed with lighter petroleum products and incinerated on-site under appropriate emissions controls.

- Buildings/Infrastructure:
  - building contents shall be inventoried and classified as non-hazardous or hazardous wastes. Hazardous building materials may include, but not be limited to: PCB and lead-amended paint, asbestos containing materials (ACMs), fluorescent lights, and mercury containing switches.
  - existing buildings and infrastructure at a site will be demolished down to their foundations as part of the cleanup. See above for disposal of non-hazardous and hazardous materials.

- Contaminated soils:
  - DCC Tier I: excavate and place in an on-site engineered landfill or cap in place under 0.3 m of clean fill if in a stable location
  - DCC Tier II: excavate and dispose of in an on-site Tier II facility or containerize for off-site disposal
  - Inorganic Elements Leaching: transport in accordance with the TDGA for disposal at an off-site facility
  - PCB Contaminated Soil in excess of CEPA: store in accordance with Storage of PCB Material Regulations pending a decision regarding disposal
  - Type A TPH (Non-Mobile Hydrocarbon Contaminated Soil): excavate and place in an on-site engineered landfill or scarify surficial stains that meet PHC criteria.

- DCC Tier I -Type A TPH: excavate and place in an on-site engineered landfill or cap in place under 0.3 m of clean fill if in a stable location
- DCC Tier II -Type A TPH: excavate and place in an on-site Tier II disposal facility or containerize for off-site disposal
- Type B TPH (Mobile Hydrocarbon Contaminated Soil): in-situ or ex-situ treatment to reduce environmental risk to meet guidelines
- DCC Tier I -Type B TPH: ex-situ treatment to meet guidelines and place in an on-site engineered landfill or cap under 0.3 m of clean fill in a stable location after treatment. Small areas of contamination may be excavated and disposed of in a Tier II disposal facility
- DCC Tier II -Type B TPH: excavate and place in an on-site Tier II Facility or containerize for off-site disposal
- Hazardous Soil: dispose in compliance with applicable regulations

The Bathurst Island Remediation project is not an abandoned military site – it consists of oil and gas exploration sites. In addition, sites on Bathurst Island and Ile Vanier are within a proposed national park, and PQRAs have been completed with specific guidance on risks associated with impacted soils, surface water and groundwater. Much of the guidance outlined above is still considered relevant to this project, adjusted as appropriate based upon the results of the PQRAs.

3.3 OTHER JURISDICTION GUIDELINES WITH POTENTIAL RELEVANCE

Any contaminated sites that are on Commissioner's Lands in Nunavut are subject to the Environmental Guideline for Contaminated Site Remediation (Revised March, 2009). The Sites in question are not Commissioner's Lands; however, awareness of the Guideline requirements is relevant. Criteria governing discharges from non-point sources have also been established, as outlined in Nunavut Department of Environment, Environmental Guideline for Industrial Waste Discharges Schedule II: Standards for Non-Point Source Discharges (Revised January 2011). This criterion might be referenced for example with respect to the discharge from any future on-site wastewater treatment system.

The disposal of hazardous waste may involve waste traversing Commissioner's lands or municipal lands – the Nunavut Environmental Protection Division has prepared the Environmental Guideline for the General Management of Hazardous Waste (EGGMHW) (Revised October 2010) to inform such activities, regulated under NEPA.

3.4 FCSAP DECISION-MAKING FRAMEWORK

As outlined in the Introduction to the Decision-Making Framework (DMF) for FCSAP, the DMF is a roadmap that outlines the specific activities and requirements for addressing federal contaminated sites

in Canada. The DMF is based on *A Federal Approach to Contaminated Sites*, a 10-step process guiding federal custodians in all aspects of working with contaminated sites.

At Step 7 of FSCAP: Develop Remediation/Risk Management (R/RM) Strategy of the federal approach, determination as to whether a guideline approach or a risk assessment approach will be used to establish what R/RM objectives will be applied is made. Having adopted a risk assessment approach, the Bathurst Island Remediation project has specific recommendations in the PQRAs that outline the assessed levels of risk from COPCs. The applicability of the recommendations is subject to the context within which the PQRAs are set: necessary RM measures are derived from the context, and have been included in Table 3-1.

Table 3-1 Summary of Recommended Clean-up Criteria Guidelines

Waste Stream		Relevant Guideline
Physical Hazards	Buildings	Modified AMSRP (1)
	Other	Modified AMSRP (1)
Non-Hazardous Waste	Drums	Modified AMSRP (1)
	Metal	Modified AMSRP (1)
	Wood	Modified AMSRP (1)
	Other	Modified AMSRP (1)
Hazardous Waste	Asbestos	CEPA, EGGMHW, Modified AMSRP (1)
	Organic liquids	CEPA, EGGMHW, AMSRP
	Leachable Lead Paint	CEPA, EGGMHW, AMSRP
	Pressurized cylinders	CEPA, EGGMHW, Modified AMSRP (1)
	Other	CEPA, EGGMHW, Modified AMSRP (1)
Soils	PCBs	CEPA, EGGMHW, PQRAs (2)
	Metals & PHCs (4)	EGGMHW, PQRAs (2)
	PHCs Only (4)	PQRAs (2)
	Metals Only	CEPA, EGGMHW, PQRAs (2)
Water	Surface Water	PQRAs (2)
	Groundwater	PQRAs (2) (3)

Notes:
1. Modification to AMSRP guidance refers to application of guidance with respect to non-hazardous waste at sites with consideration for the results from the PQRAs
2. The conclusions drawn and recommendations made in the PQRAs would need to be revisited if the following were to occur:
   a. for all Bathurst Is. and Ile Vanier sites: any change to designation as a national park (i.e., land use)
   b. for all Bent Horn (Cameron Is.) sites: land use changes to a more restrictive designation (e.g., national park)
   c. change to local Inuit traditional use practices (i.e., hunting, camping, food gathering) on any of the Islands
   d. increase in (re)vegetation of disturbed areas to the point where food gathering activity becomes a possibility
3. Viable groundwater regimes were identified at 2 sites only: Ile Vanier APEC 2 and Bent Horn APEC 6. The PQRAs assumed that groundwater would not be used as drinking water, therefore any changes in land use that alters this assumption would require that the conclusions drawn and recommendations made in the PQRAs with respect to risk from groundwater would need to be revisited
4. PAH-impacted soils have been included within the PHC-impacted soil category within this report

3.5 RISK MANAGEMENT

Once a risk assessment is completed, the proponent can decide if the resulting risk is acceptable or not and opt for risk management or mitigation strategies in order to reduce the resulting risk to an acceptable level, as appropriate. Risk management is the systematic process of minimizing, monitoring, and controlling the probability and/or impact of identified risks. These mitigation strategies and approaches

form the basis of the risk management strategy. The key to risk management is to identify risks that are intolerable and to mitigate them to a tolerable level. The benefit of using a risk matrix is that it identifies those elements of risk that drive the resulting risk level that can then be targeted for mitigation. This targeted approach allows for more effective risk mitigation. Table 3-2 below summarizes the standards and guidelines related to risk management, some of which are specific to contaminated sites.

Table 3-2 Summary of Risk Management Standards and Guidelines

Relevant Standard/Guideline	Details Related to Risk Management
Government of Canada FCSAP - Decision Making Framework - May 2013	Once a risk assessment approach is selected, Step 7 of the FCSAP decision making framework outlines development of a risk management strategy. It states that the options for risk management typically involve engineering or institutional controls that can a) interrupt the exposure pathways; b) remove receptors; or c) change the form of the contaminant to make it less accessible.
CAN/CSA-Q850-97 - Risk Management Guideline for Decision Makers	The CSA-Q850 guideline is intended to assist with the effective decision-making for managing different types of risks (health, property, environment, etc.). It describes the step-by-step process that can be used to develop a risk management framework. The steps included in this process are: 1. Initiation 2. Preliminary Analysis 3. Risk Estimation 4. Risk Evaluation 5. Risk Control 6. Action/Monitoring
Health Canada - Decision-Making Framework for Identifying, Assessing, and Managing Health Risks (April 2000)	In the summer of 1997, Health Canada launched a fundamental review of its health protection operations. This effort, known as "Health Protection Branch (HPB) Transition," was aimed at helping Health Canada and its partners to better manage risks to the health of Canadians into the next century [Health Canada, 1998]. Through HPB Transition, Health Canada developed a decision-making framework and a number of documents that provide guidance in dealing with related considerations. Health Canada's decision making framework references the Guidelines for Decision-Making (U.S. Presidential/Congressional Commission).
Policy for Management of Risks at Contaminated Sites in Alberta	The document includes Alberta Environment's risk assessment and management policy for contaminated sites. It provides direction for site managers, stakeholders and professional environmental consultants who are familiar with risk assessment techniques. It provides general guidance for establishing or modifying risk-based remediation (cleanup) objectives and applying site-specific risk assessment and management to meet Alberta Environment requirements. Examples of site-specific risk management by exposure barriers and administrative controls are provided in the document. The document also discusses risk management and monitoring on a long-term basis.
Technical Assistance Bulletin (TAB 17) prepared by Environment Canada - Risk Management for Contaminated Sites Framework	Discusses the risk management process, which includes the scope definition, establishing target levels, quantitative risk target criteria, non-risk target criteria, hazard identification and risk estimation and evaluation. Additional information also provided in Tab #18 (acceptable vs. non-acceptable risks).

4.0 METHODOLOGY

In satisfying the scope of work, Stantec undertook the following activities:

- Development of risk management approaches (RMAs) and updating of the selection criteria for the ROA to include RMAs,
- Evaluation of ROs and RMAs,
- Stakeholder and community engagement for input at preliminary draft and final draft stages,
- Prioritization of the preferred ROs and RMAs of the various categories of environmental issues (i.e. hazardous wastes, non-hazardous wastes, physical hazards, contaminated soils) present on site, based on evaluation criteria and stakeholder and community feedback,
- Definition of project-level considerations with scope to override or preclude certain ROs or RMAs, selection of the preferred project scenario, and integration with preferred ROs and RMAs into a Remediation and Risk Management Plan (RRMP),
- Preparation of a work breakdown structure (WBS) and project schedule for the RRMP, and a cost estimate, reflecting the RRMP, WBS and schedule.

Details on the methodologies employed in executing the above activities are provided in the following sections.

4.1 RISK MANAGEMENT APPROACHES

For the development of the ROA, various remedial approaches were considered. This included the identification of remedial technologies that would potentially be applicable for remediating a given impact, and consideration of remedial approaches that would be appropriate for the project. Table E-1, Appendix E, provides a full listing of the remedial technologies considered. Remedial technologies applicable to the Sites have been screened from Table E-1 and coupled with the following approaches to generate the set of applicable remedial options outlined in Table 4-1:

- Consolidation/excavation (assumed to precede disposal activities, as applicable)
- On-site treatment or disposal
- Central-site treatment or disposal (i.e., at one of the Sites)
- Off-site disposal
- Cap or cover
- No action (i.e., risk manage)

Table 4-1 Summary of Remedial Options by Waste Stream

Waste Categories		Remedial Options																		
		Off-site disposal		On-site Disposal			Central-site Disposal			On-site Treatment					Demolition	Cap & Cover		Mon.		No Action*
		HW	NhW	HW	NhW	Soil	HW	NhW	Soil	Wood burn	Organics Incinerate	PHC Soil on-site	PHC Soil Central site	Water		Engineered cap	Engineered cover	Annual 5-year	Specific	
Remedial Option IDs		A1	A2	B1	B2	B4	C1	C2	C3	D1	D2	D3	D4	D5	E	F1	F2	G1	G2	H
Physical Hazards:	Buildings														X					X
	Other		X		X			X												X
Non-Hazardous Waste	Drums		X		X			X												X
	Metal		X		X			X												X
	Wood		X					X		X										X
	Other		X		X			X												X
Hazardous Waste	Asbestos	X		X			X											M		
	Organic liquids	X									X							M		
	Leach. lead paint	X					X											M		
	Press. cylinders	X					X											M		
	Other	X					X											M		
Soils	PCBs					X			X			X					X			
	Metals & PHCs					X			X			X	X				X			X
	PHCs only											X	X							X
	Metals only	X				X											X			X
Water	Surface water													X					X	X
	Groundwater													X					X	X

Notes: **"X"** denotes remedial options applicable to each waste stream
"M" denotes central site disposal of hazardous waste materials would require the initiation of a landfill monitoring plan
"HW" denotes hazardous waste; "NhW" denotes non-hazardous waste
* "No Action" denotes consideration of a risk management approach for the listed waste stream

The first step of updating the ROA included the consideration of RMAs for those Site-waste streams where, through the ROA (and as a result of the PQRAs), the recommended remedial approach was determined to be "No Action" (i.e. risk manage).

The FCSAP DMF states that approaches for risk management typically involve engineering or institutional controls that can either interrupt the exposure pathways, remove receptors, or change the form of the contaminant to make it less accessible. These principles, along with reference to the step-by-step process for risk management outlined in CSA-Q850, as summarized in Table 3-2, assisted with the development of the risk management approaches. Table 4-2 details the six step process provided in CSA Q850 and its application to the Bathurst RRMP.

Table 4-2 Application of CSA Q850 Framework to Bathurst RRMP

CSA Q850 Steps	Step Details	Applicability to Bathurst RRMP
Step 1 - Initiation	Define the problem and associated risk	To evaluate potential adverse risk to human and ecological receptors from contaminants of potential concern at Bathurst Island Project Sites and implement risk management approaches and monitoring of the system
	Identify the risk team and roles	Team shall include technical, communications, legal and financial experts and a responsibility for the risk management plan shall be assigned to each
	Risk communication	Solicitation of community and stakeholder input
	Engage stakeholders for input	
Step 2 - Preliminary Analysis	Identify hazards	Completed through PQRA with results summarized in Table 2-4
	Review causes, triggers and consequences	
Step 3 - Risk Estimation	Apply methodology for estimating frequency and consequence of risk scenarios	
Step 4 - Risk Evaluation	Compare estimated risk to stakeholder acceptance criteria and acceptance of residual risk	Development of factors for evaluation options and obtaining stakeholder input
	Requirements for risk reduction	Stakeholder input required
	Integrate costs	Integrate information obtained from RRMP cost estimate
Step 5 - Risk Control	Discuss risk control/mitigation options	Development of risk management approaches and options
Step 6 - Action/Monitoring	Implement risk control strategies	Development of the risk management plan
	Re-assess residual risk	Development of action plan for routine monitoring to evaluate changes to risk management options
	Establish a monitoring process	

To evaluate the risks and satisfy Steps 1-4 of the CSA Q850, following the completion of the PQRAs, the following factors were considered for each RMA:

1) Cost
2) Effectiveness in meeting targets
3) Timeframe to implement

4) Ease of implementation
5) Regulatory Acceptability
6) Community/Stakeholder Acceptability
7) Monitoring

As with ROs, a score from 1-5 was calculated for each Site-waste stream item for which a RMA was being considered: the weighting applied to the seven factors was as follows: Cost*0.2 + Effectiveness*0.25 + Timeframe*0.1 + Ease*0.1 + Regulatory*0.1 + Community*0.15 + Monitoring* 0.1. Weighting factors were selected on the basis of professional judgment. Due to the influence that an individuals' unvoiced assumptions can have on an evaluation of this type, scores were produced by a team, after discussing the unstated assumptions that came to mind when scoring each item.

4.2 REMEDIAL OPTIONS UPDATE

The options summarized in Section 2.6 were updated to include both ROs and RMAs. RMAs can be classified as either engineered or administrative controls, and are described below:

Table 4-3 Summary of Risk Management Approaches

Risk Management Approach	Description	Applicable Waste Streams	Site-specific Considerations
ENGINEERED CONTROLS			
Containment			
Engineered Cover	Engineered covers are used for contaminant source control. Cover material is low permeability material sourced at site (where possible) and compacted to a high degree	HW-Solids; Soils-Organics; Soils-Metals	• Reduces migration of impacts offsite • Resists impacts from weather conditions • Requires suitable material at site • Potential damage to natural resources • Requires monitoring
Impermeable Barrier	Impermeable barriers are used for contaminant source control and can be either horizontal or vertical	HW-Solids; Soils-Organics; Soils-Metals Surface water Groundwater	• Reduces migration of impacts offsite • Resists impacts from weather conditions • Potential damage to natural resources • Installation may be difficult • Requires monitoring
ADMINISTRATIVE CONTROLS			
Site Access			
Fencing	Erected fencing that surrounds the contaminated area to restrict access	HW-Solids; Soils-Organics; Soils-Metals Surface water	• Helps prevent exposure of unauthorized and unprotected individuals to site hazards • Simple installation • Requires signage • No reduction of migration of impacts off site • Requires monitoring
Security Program	Security programs restrict access to site to authorized personnel only, through control of access points/routes	HW-Solids; Soils-Organics; Soils-Metals Surface water	• Helps prevent exposure of unauthorized and unprotected individuals to site hazards • May require a guard or technician

Risk Management Approach	Description	Applicable Waste Streams	Site-specific Considerations
		Groundwater	• No reduction of migration of impacts off site • Requires monitoring
Land Use Control			
Restricted Building Placement	Restriction for placement of new buildings on the site through building permit process	HW-Solids; Soils-Organics; Soils-Metals Surface water Groundwater	• Helps prevent exposure of unauthorized and unprotected individuals to site hazards • Requires collaboration with external agencies • No reduction of migration of impacts off site • Requires monitoring
Restricted Caveats on Land Titles	Restriction to the type of development on the site through caveats written into land agreements/titles	HW-Solids; Soils-Organics; Soils-Metals Surface water Groundwater	• Helps prevent exposure of unauthorized and unprotected individuals to site hazards • Requires collaboration with external agencies • No reduction of migration of impacts off site • Requires monitoring

The risk options were scored based on the considered factors, after which they were ranked and the highest ranking option was selected as the recommended risk management option. The RO and RMA selection criteria were updated and are shown in Table 4-4 below.

Table 4-4 Updated Remedial and Risk Options Selection Criteria

#	Factor	5	4	3	2	1
1	Cost	Lowest cost	Lower than average cost	Average cost	Above average cost	Highest cost
2	Effectiveness in Meeting Targets	Best in class ability to meet targets	Well demonstrated ability to meet targets	Generally able to meet targets	Often able to meet targets	Limited demonstrated ability to meet targets
3	Timeframe to implement	Implement assuredly within one field season	Implement possibly within one field season	Implement assuredly within two field seasons	Implement possibly within two field seasons	Three plus field seasons to implement
4a	Ease of Implementation (ROs)	Can be implemented with helicopter- or Twin Otter-transportable equipment/ materials, no specialty equipment	Can be implemented with helicopter- or Twin Otter-transportable equipment/ materials and specialty equipment	Equipment/ materials requires heavy airlift (Hercules or equivalent)	Equipment/ materials requires barge or overland transport, no specialty equipment	Equipment/ materials requires barge or overland transport and specialty equipment
4b	Ease of Implementation (RMAs)	Requires the land use change/restriction and	Requires binding agreement with external agencies	Multiple external agency endorsements	Within the mandate of the department, few external	Within the mandate and authority of the

#	Factor	5	4	3	2	1
		legislative approval		required	agency endorsements	department
5	Regulatory Acceptability	Jurisdictional regulator has endorsed or supported option	A regulator has endorsed or supported option	No regulatory rejection has occurred	A regulator has rejected analogous case	Jurisdictional regulator has rejected analogous case
6	Community/ Stakeholder Acceptability	A local community has endorsed or supported option	A community has endorsed or supported option	No community rejection has occurred	A community has rejected analogous case	A local community has rejected analogous case
7a	Monitoring (ROs)	No follow-up required	Annual follow-up required	Annual follow-up required (< 3 yrs.)	Annual follow-up required (< 5 yrs.)	> 5 yrs. follow-up required
7b	Monitoring (RMAs)	Internal monitoring program, within the department	Mostly internal monitoring program, with minimum external resources	Internal monitoring program, with periodic external resources	Establish a dedicated resource/ process to track external program changes on a periodic basis	Establish a full-time dedicated resource/ process to track external program changes

Monitoring was included as a separate factor from Time to Implement, for clarity and because of the difference in application to ROs versus RMAs – for RMAs, Monitoring refers to potential organisational resources impacts, the costs for which cannot be externalised (i.e., would not be captured under a remediation contract).

Project considerations were also added to the RO and RMA assessment, in recognition of the fact that they can override the applicability of a given RO or RMA, i.e., an iterative assessment, selection and prioritization process is required, whereby the continuing applicability of ROs and RMAs is confirmed after an overall project approach (with its considerations) is made. Project considerations were assessed through production of a requirements matrix for ROs and RMAs against the following (Table A-4, Appendix A):

1) Equipment (Light or Heavy earth moving)

2) Special requirements (Burner/incinerator or Pile driver)

3) Transportation (Light aircraft, Heavy aircraft or Barge/Overland)

4) Materials (Local engineered fill and airstrip improvement, Road improvement, and Fencing)

5) Logistics/Administrative (Staging area, Land use control, and Activity monitoring)

6) Stakeholder Acceptance Criteria

7) Owner (Departmental) Direction

The site impacts, project level considerations, ROs and RMAs, and quantity totals by waste stream were listed in an Excel file with worksheets for each subject, to support the option assessment and selection effort. Specific hazard/waste stream categories were assigned unique Waste IDs, and ROs and RMAs were assigned unique Remedial Option and Risk Management Approach IDs.

The final step was to define feasible remediation/risk management projects, reflecting the selected ROs and RMAs, adjusted on the basis of project considerations (#1 to #6 above), and then to apply direction from the Owner (AANDC) (#7 above) as part of final option selection.

4.3 COMMUNITY INPUT AND ENVIRONMENTAL SCREENING RISK MITIGATION MEASURES

Stantec solicited input from representatives from the nearest community (Resolute Bay) in order to utilize their knowledge of the Site, determine their concerns regarding the Sites and associated loss of traditional use, and determine the local support services that are available. A transcript of the initial community consultation is included in Appendix E, followed by the record and attendance list of the follow-up community meeting held in March, 2015 in Resolute Bay.

A separate Environmental Screening report outlines the Valued Ecosystem Components (VECs) within the project area, along with potential project environmental impacts and mitigation measures. Mitigation measures than present constraints to the project have been carried into the selection of ROs/RMAs and the overall project approach with associated activities.

4.4 PROJECT WBS/SCHEDULE AND OPTIMIZATION

A work breakdown structure (WBS) was prepared for the selected project scenario. The WBS has been included herein for reference, such that activities associated with the overall logistics and execution of the project are defined and have been subjected to the same considerations for environmental impacts and mitigation measures.

4.5 COST ESTIMATION

The overall objective of the RRMP cost estimation effort was to produce a cost estimate for the Site that meets the definition of an indicative estimate (Treasury Board) / Class C/D (PWGSC), which can be used to seek preliminary project approval.

The results of the RRMP costing are provided separately.

4.6 DEVIATION FROM SCOPE OF WORK

As a result of the later-than-planned community meeting in Resolute Bay, the Environmental Screening report was only taken to the draft report stage. This RRMP Report received two rounds of revision as opposed to one. Responsibility for planning and coordination for the community meeting was shifted to Stantec from AANDC.

5.0 INTEGRATED REMEDIAL ACTION/RISK MANAGEMENT PLAN

The integrated remedial action/risk management plan has been updated on the basis of the site impacts definitions, remedial options, and/or remedial actions (selected options) as taken from the ROA and updated herein, to integrate the risk management options and to include the project level considerations.

5.1 SUMMARY OF SITE IMPACTS

The sites that compose the Bathurst Island RRMP Project, in order of priority from left to right, are summarized in Table 5-1 below, with the corresponding estimated volume of waste.

Table 5-1 Prioritized Summary of Site Impacts

Waste Categories		Waste Code	Bathurst Is. and Ile Vanier							Cameron Is.	
			Young Inlet	J-34	N-12	IV APEC 1	Stokes Range	IV APEC 2	IV APEC 4	BH APEC 3	BH APEC 6
Physical Hazards - (m^2)	Buildings	1.1	-	320	750	-	-	-	-	-	-
	Other (debris piles)	1.2	400	150	1000	600	15	100	-	-	-
Non-Hazardous Waste - (# drums or m^3)	Drums	2.1	119	30	6	10	-	5	224	-	10
	Metal	2.2	120	82	44	34	-	5	-	-	-
	Wood	2.3	23	6.6	51	13	4	5	-	-	-
	Other	2.4	20	20	5	-	15	-	-	-	-
Hazardous Waste - (m^3)	Organic liquids	3.2	2.5	-	-	-	-	-	0.5	-	2
	Press. cylinders	3.4	-	2	-	-	-	-	2	-	-
	Other (batteries)	3.5	-	0.3	-	-	-	-	-	-	-
Soils - (m^3)	PCBs	4.1	-	-	33	-	-	-	-	-	-
	Metals & PHCs	4.2	723	-	-	100	133	1276	-	-	2
	PHCs only	4.3	1.4	-	-	236	3.8	-	13	3000	90
	Metals only	4.4	120	70	18	-	-	50	-	-	490
Water	Surface water	5.1	X	X	X	-	-	X	-	-	X
	Groundwater	5.2	-	-	-	-	-	X	-	-	X

Notes: **"-"** denotes hazard/waste stream was not identified at indicated Site(s); "X" denotes hazard/waste stream identified but not quantified at indicated site

The features of the Sites are listed below in Table 5-2.

Table 5-2 Site Features

Site Features		Bathurst Is. and Ile Vanier								Cameron Is.	
		Free-man's Cove	Young Inlet	J-34	N-12	IV APEC 1	Stokes Range	IV APEC 2	IV APEC 4	BH APEC 3	BH APEC 6
Distances from Site	To Resolute Bay	100	213	150	117	304	261	292	300	317	312
	To Ile Vanier APEC 4	204	143	156	187	6	68	31	0	25	22
	To Freeman's Cove	0	136	50	16	205	170	194	204	219	215
Airstrips	Used by Twin Otter 2013	X						X	X		X
	Twin Useable with Repair		X				X				
	Buffalo Usable with Repair	X (1)							X		
	Herc Usable with Repair	X (1)							X		
Roadways	Existing, unmaintained					To IV-4			To IV-1	To BH-6	To BH-3
Potential Borrow Sources	Approx. volume (m^3)	(2)	500 gravel	(2)	(2)	(2)	50,000 gravel	50,000 sand with silt/ gravel	60,000 gravel/ sand	50,000 sand	5,000 silty sand with gravel

Notes: 1. Anecdotally
2. Not assessed

.

5.2 SELECTED REMEDIAL OPTIONS AND RISK MANAGEMENT APPROACHES

A summary of identified waste streams at the Bathurst Island, Ile Vanier and Bent Horn sites is provided in Table 5-3, with the analyzed remedial and risk management options and associated rankings. Scorings of the assessed options, reflecting application of the selection criteria, are provided in Tables A-2 and A-3, Appendix A. After evaluation and selection of the preferred project approach (Section 5.3), the ROs/RMAs were revisited, to remove those that would not be available under the chosen project scenario and to determine the highest ranking option/approach that would be available – this is shown in the final column of Table 5-3.

Table 5-3 Summary of Remedial Options Evaluated

Waste Stream	Applicable Sites	Ranked Remedial/Risk Management Options				Deciding Factors	Selected Remedial Option
RO/RMA Rankings		**1**	**2**	**3**	**4**	**Comments**	**#1 Ranked Avail.? Y/N**
Physical Hazards – Buildings	N-12	Central site disposal	Off-site disposal	On-site disposal	No action	As only footprints with debris present, scoring same as non-hazardous wastes except for cost	N – see Non-Hw #4 No action
	J34	Demolition	No action	-	-	Low likelihood of encountering hazardous building materials renders demolition with no pre-assessment lowest cost	N – see Non-Hw #2 No action
Physical Hazards – Debris Piles	Young Inlet, J-34, N-12, IV APEC 1, Stokes Range, IV APEC 2 & 5	Central site disposal	Off-site disposal	On-site disposal	No action	Good regulatory and community acceptability coupled with medium cost. Effectiveness score for 'No Action' adjusted from ROA, reflecting lack of regulatory driver for removal of N-Hw. Follow up for on-site disposal option should not be more than 3 years	N – Non-Hw to not be cleaned up #4 No action
Non-Hazardous Wastes	Young Inlet, J-34, N-12, IV APEC 1, Stokes Range, IV APEC 2 & 5, IV APEC 4, BH APEC 6	Central site disposal	Off-site disposal	On-site disposal	No action		

Waste Stream	Applicable Sites	Ranked Remedial/Risk Management Options				Deciding Factors	Selected Remedial Option
RO/RMA Rankings		**1**	**2**	**3**	**4**	**Comments**	**#1 Ranked Avail.? Y/N**
Non-Hazardous Wastes (wood)	Young Inlet, J-34, N-12, IV APEC 1, Stokes Range, IV APEC 2 & 5	Burn on-site	Central site disposal	Off-site disposal	No action	Cost advantage over disposal options greater than somewhat lesser degree of acceptability. Effectiveness score for 'No Action' adjusted from ROA, reflecting lack of regulatory driver for removal of N-Hw	N – Non-Hw to not be cleaned up #4 No action
Hazardous waste	J34, IV APEC 4	Hazardous waste disposal off-site	Hazardous waste central site disposal	No action	-	Low volume of hazardous materials makes any options except off-site disposal non-viable. RMA added since ROA	Y
Hazardous waste (fuel in drums)	Young Inlet, IV APEC 4, BH APEC 6	Incinerate organic liquids on-site	Off-site disposal	No action	-	An air-transportable incinerator offers the most cost-effective approach for addressing this waste item. Evaluation assumes transport via helo/Twin is viable	Y

Waste Stream	Applicable Sites	Ranked Remedial/Risk Management Options				Deciding Factors	Selected Remedial Option
RO/RMA Rankings		1	2	3	4	Comments	#1 Ranked Avail.? Y/N
PCB Impacted Soils	N12	Hazardous soil off-site disposal	Engineered cover	Soil central site disposal	Soil on-site treatment	Easier to implement an on-site cover solution than excavating and moving soil, however need for follow-up on site renders score same as central site disposal. Thermal treatment acceptability by regulators unproven in north. In situ treatment cost, given energy requirements, will be highest of all options. Engineered cover should be cheaper than on-site disposal (smaller equipment, shorter time-frame), though equally effective. No follow-up needed for off-site disposal	Y
Metals and PHC-impacted Soils	BH APEC 6	Hazardous soil off-site disposal	Engineered Cover	Soil on-site disposal	Soil on-site treatment	Small volume of soil overriding factor for off-site disposal as preferred option	Y
Metals & PHC Impacted Soils (Lead)	IV APEC 1	Soil central site disposal	Engineered Cover	Soil on-site disposal	Soil on-site treatment	Assumed that large volume may require an additional field season with use of small equipment	N – given that Non-Hw to be left at sites, no central or site disposal facilities to be constructed #2 Engineered cover
Metals Only Impacted Soils	Young Inlet, N12, J34, IV APEC 2 & 5, BH APEC 4, BH APEC 6	Monitor PQRA Context Conditions	Land Use Restriction	Engineered Cover (Metals-Soils)	Access Control (Fencing)	Risk assessment results showing negligible risk, associated with these impacts – RMAs evaluated	Y

Waste Stream	Applicable Sites	Ranked Remedial/Risk Management Options				Deciding Factors	Selected Remedial Option
RO/RMA Rankings		**1**	**2**	**3**	**4**	**Comments**	**#1 Ranked Avail.? Y/N**
PHCs Only Impacted Soils	Young Inlet, IV APEC 1, Stokes Range, IV APEC 4, BH APEC 3, BH APEC 6	Monitor PQRA Context Conditions	Land Use Restriction	Monitored Natural Attenuation (MNA)	Engineered Cover (PHC-Soils)		
Metals & PHC Impacted Soils	Young Inlet, Stokes Range, IV APEC 1, IV APEC 2 & 5, BH APEC 6	Monitor PQRA Context Conditions	Land Use Restriction	Engineered Cover (Metals-Soils)	Access Control (Fencing)		
Impacted Surface Water	N12, J34, Young Inlet, IV APEC 2 & 5, BH APEC 6	Monitor PQRA Context Conditions	Monitored Natural Attenuation (MNA)	Access Control (Fencing)	Impermeable Barriers (Prevent contaminant migration)		
Impacted Groundwater	IV APEC 2 & 5, BH APEC 6	Monitor PQRA Context Conditions	Land Use Restriction	Monitored Natural Attenuation (MNA)	Impermeable Barriers (Prevent contaminant migration)		
Undermined	Ile Vanier APEC 3, BH APEC 1, BH APEC 2, BH APEC 3, BH APEC 4, K-12, M-21, G-07	Central site disposal	Off-site disposal	On-site disposal	-	Good regulatory and community acceptability coupled with medium cost. Effectiveness score for 'No Action' adjusted from ROA, reflecting lack of regulatory driver for removal of N-Hw. Presence/extent not established for these sites	N – given that Non-Hw to be left at sites, no central or site disposal facilities to be constructed #4 No action*

* Unless hazardous waste found: if so, action as per Hazardous Waste

5.2.1 Selected Remedial Options

The selected remedial options for the identified waste streams are discussed below. The locations and quantities of hazardous and non-hazardous wastes at all Sites are shown in Drawings 1-14, Appendix D.

Hazardous Waste – Off-site Disposal: the small quantities of hazardous waste present will require collection, proper containerization for air and sea transport and then disposal at a licensed facility.

Hazardous Waste (Organic Liquids) – Incineration: full or partially full drums will require classification of contents as either: organic and able to be incinerated, organic but not able to be incinerated, or impacted water. An air transportable incinerator approved for incineration of organic liquids can be used to incinerate suitable liquids. Given the relatively small volume of organic liquids, retrograde of liquids south for disposal is also a feasible option that could be considered should the transportation of a suitable incinerator prove too logistically challenging.

Non-hazardous Waste – No action: these materials, posing no unacceptable human health or ecological risks, would be left at site.

PCB Impacted Soils – Off-site Disposal: the volume and location of PCB-impacted soils (33 m^3 at N-12) are amendable to excavation, containerization and off-site disposal.

Metals and PHC Impacted Soils:

- Lead–impacted soils at Ile Vanier APEC 1 – Engineered Cover: the volume and location of lead-impacted soils (100 m^3 at Ile Vanier APEC 1) preclude off-site disposal; however, the proximity of the site to Ile Vanier APEC 4 via an existing (improvement-required) roadway allows for access to the site by light earth-moving equipment, for use in developing and applying local materials as an engineered cover. The conceptual design for this cover is shown in Drawing 15, Appendix D.

- Metals- and tar globules-impacted soils at Bent Horn APEC 6 – Collection and Off-site Disposal: the volume of soils associated with the tar globules at Bent Horn APEC 6 is small (2 m^3) and is hazardous, requiring collection, containerization, and off-site disposal along with other hazardous wastes.

- Metals-impacted, metals and PHC-impacted, and PHC-impacted soils with non-significant risk (based upon PQRA results) – No action. Application of risk management measures to maintain conditions within which the PQRAs apply (i.e., land use); see Section 5.2.2.

5.2.2 Selected Risk Management Approaches

The selected risk management approaches for the identified waste streams are discussed below.

Metals Only Impacted Soils/PHCs Only Impacted Soils/Metals and PHC Impacted Soils/Impacted Surface Water/Impacted Groundwater – Risk Management: those soil, surface water and groundwater impacts found to be within acceptable human health and ecological risk limits in the PQRAs must be subject to monitoring of the PQRA context conditions under which the findings remain valid, i.e. the

conclusions drawn and recommendations made in the PQRAs would need to be revisited if the following were to occur:

a. for all Bathurst Is. and Ile Vanier sites: any change to designation as a national park (i.e., land use)

b. for all Bent Horn (Cameron Is.) sites: land use changes to a more restrictive designation (e.g., national park)

c. change to local Inuit traditional use practices (i.e., hunting, camping, food gathering) on any of the Islands

d. increase in (re)vegetation of disturbed areas to the point where food gathering activity becomes a possibility

Viable groundwater regimes were identified at two sites only: Ile Vanier APEC 2 and Bent Horn APEC 6. The PQRAs assumed that groundwater would not be used as drinking water, therefore any changes in land use that alters this assumption would require that the conclusions drawn and recommendations made in the PQRAs with respect to risk from groundwater would need to be revisited.

5.3 SELECTED PROJECT SCENARIO

Five broad project approaches were considered, as follows:

- Scenario 1 – Minimum Mandatory Remediation/RM (MMRRM): Remediation of regulation-mandated waste streams (i.e., Solid hazardous waste at J-34 and Ile Vanier APEC 4; liquid hazardous waste at Young Inlet, Bent Horn APEC 6 and Ile Vanier APEC 4; PCB-impacted soils at N-12, lead-impacted soils at Ile Vanier APEC 1 and tar globules at Bent Horn APEC 6)

- Scenario 2 – MMRRM Plus Empty Drums: add non-hazardous waste drums (i.e., at N-12, J-34, Young Inlet, Ile Vanier APECs 1/2/4, and Bent Horn APEC 6)

- Scenario 3 – MMRRM / Empty Drums Plus Debris at J-34 and N-12: add all debris at J-34 and N-12

- Scenario 4 – MMRRM / Empty Drums / Debris at J-34 and N-12 Plus Debris at Young Inlet: add all debris at Young Inlet

- Scenario 5 – Full Remediation/RM: all waste streams addressed

The assumptions made with respect to the necessary project support actions for the evaluated scenarios are as follows:

1. Current airstrips at Ile Vanier APECs 2 and 4 and Bent Horn APEC 6 assumed suitable for Light A/C; Freeman's Cove assumed suitable for Heavy A/C

2. Access improvements required for MMRRM as follows: Ile Vanier APEC 4 made suitable for Heavy A/C (max. ALR 5); roadway from Ile Vanier APEC 1 to 4 made suitable for vehicles

3. Additional access improvements required for debris removal: airstrip at Stokes Range made suitable for Light A/C

4. Helicopter access to Young Inlet assumed suitable for empty drum removal but not for debris removal. Helicopter access assumed suitable for all N-12 and J-34 transport

The evaluation of each of the projects against selection factors is as follows:

1. Potential risks: the potential risks for these scenarios scale up from the least risk for the MMRRM project, which would require the least amount of access improvement, logistic support and movement of material, through to the most for the full remediation scenario, which would require the most access improvement, logistic support and movement of material

2. Value to the Crown: value to the Crown is determined on the basis of the magnitude of risk reduced for the cost of reduction. By looking at the number of waste IDs addressed for each project scenario (with hazardous wastes, representing greater risks, being allocated greater weight) and dividing by the approximate cost, the value to the Crown also scales from highest for the MMRRM scenario to the least for the full remediation scenario, albeit in a much narrow band than for the first criteria

3. Resources available for implementation: for this factor, the availability of resources to support the given project scenario is considered – what resources are available (human resources – size of project team; logistics resources –movement of cargo, equipment both common and specialized; and transportation resources – air transport, land transport, sea/barge transport). The assumptions regarding project support actions listed above drive evaluation of this factor: All scenarios require the upgrade of the airstrip at Ile Vanier APEC 4 for heavy A/C and the upgrade of the roadway from Ile Vanier APEC 4 to APEC 1. With the addition of drum removal from Scenario 2 onwards the volume of waste to be transported increases significantly, giving Scenarios 2 and 3 a lower rating for this criteria than Scenario 1. Scenario 4 drops lower again as a result of the requirement for airstrip improvement at Young Inlet to support debris removal, and Scenario 5 similarly scores lower due to the requirement for airstrip improvement at Stokes Range to support debris removal.

Taking these factors into consideration, the recommended scenario is Scenario 1, entailing the minimum mandatory remediation, with its associated project considerations.

6.0 PROJECT CONSIDERATIONS

6.1 SUMMARY OF ENVIRONMENTAL SCREENING IMPACTS AND MITIGATION MEASURES

The activities that comprise the project approaches outlined and evaluated in Section 5.0, as well as those that define the selected remedial options and risk management approaches, have been summarized in Table 6-1, which also lists the potential for environmental impacts due to these activities. These potential environmental effects are discussed below, and appropriate mitigation measures or justifications (in cases where impacts cannot, by their nature, be mitigated) are provided for each activity. This outline presents a summary of the information that is treated in more detail in the Environmental Screening Report for this project.

6.1.1 Physical Environmental Components

The following potential environmental effects to the physical environment have been noted for each of the Sites on Bathurst Island, Ile Vanier, and Cameron Island (Bent Horn). The proposed mitigation measures are therefore applicable to all of these Sites.

Designated Environmental Areas

Each of the three Islands fully or in part encompasses a designated environmental area. The northern portion of Bathurst Island, as well as all of Ile Vanier, is designated to form the proposed Qausuittuq National Park. Bathurst Island, Ile Vanier and Cameron Island (Bent Horn) also encompass muskox management areas, as designated by the Government of Nunavut Department of Environment. Additionally, the northeastern portion of Bathurst Island is noted to be Peary Caribou habitat, the whole central portion of Bathurst Island makes up the Polar Bear Pass National Wildlife Area, and all of Cameron Island is known to be a caribou wintering area.

The proposed Qausuittuq National Park will be maintained to permanently protect endangered species and other wildlife, as well as to preserve regional natural and cultural heritage features. Currently, Parks Canada and the Qikiqtani Inuit Association are completing an Inuit Impact and Benefit Agreement, which includes impacts or benefits to Inuit such as cooperative management, continuation of Inuit harvesting rights within the park, and establishment of outpost camps. Once ratified, the Minister responsible for Parks Canada will recommend permanent protection of Qausuittuq National Park under the *Canada National Parks Act*.

Muskox management areas in Nunavut are divided into six management groups, one of which is the Bathurst Island Group (BIG). The management groups have been designed to reflect traditional hunting patterns with the overall objective of protecting, conserving and managing wildlife in the region.

The BIG muskox population experienced significant die-offs in the early 1970's and mid-90's, likely due to severe weather and icing events (Ferguson, 1986; Jenkins, 2011). A critical time period for muskoxen is calving and post-calving rearing, which generally occurs in April-June (Jenkins et al., 2011; Anderson,

2014); additionally, foraging throughout spring, summer and fall is important to increase winter fat reserves. Muskoxen have historically been observed around central Bathurst Island, with highest population density reported in Polar Bear Pass, however scattered groups have been observed in south and central Bathurst Island including the southern lowlands, as well as in the river valleys in northeast Bathurst Island (Anderson, 2014).

Peary caribou in the BIG have experienced similar population crashes to muskoxen (Anderson, 2014), and it has been proposed that both species may be similarly negatively affected by deep snow and ice cover (Ferguson, 1986). Cameron Island has been identified as a main caribou wintering (October to March) area for Peary caribou, but this population has been recorded utilizing all islands in the Bathurst Island Group (Jenkins & Lecomte, 2012). Calving occurs in June to July (COSEWIC, 2004; Jenkins & Lecomte, 2012); calving grounds have been documented on Melville Island, along most of northeast Bathurst Island, and Vanier Island (Jenkins & Lecomte, 2012). Rutting season occurs in early winter (October-November). Caribou are most vulnerable in congregation areas during calving, post-calving, rutting, and late winter (due to environmental stresses); these areas have been identified as likely critical habitats during corresponding seasons (COSEWIC, 2004). During the summer, Peary caribou can be found in areas where vegetation is most dense (river valleys, upland plains); winter habitat typically includes more exposed areas with less snow cover (COSEWIC, 2004). Forage consists of grasses, forbs, willows, sedges, mosses (and mushrooms) in the summer, and less nutritious lichens and sedges in the winter (COSEWIC, 2004).

Polar Bear Pass is a National Wildlife Area (NWA) created for the protection and conservation of wildlife and their habitat under the *Canada Wildlife Act*. Polar Bear Pass is also designated a rare high arctic wetland site under the *Ramsar Convention*, as it contains marine and coastal wetlands, and inland freshwater features that support a number of regionally significant wildlife populations, including polar bears, Peary caribou, ringed seals and muskoxen, as well as breeding shorebirds and migrating birds. Polar bears use the area in spring and summer, and as a winter denning area. Critical periods for polar bear are from October to May (denning season) (COSEWIC, 2008).

The following activities have the potential to have adverse effects on these designated environmental areas:

- Preparation and Site Access (airstrip improvement, roadway improvement, and staging area establishment) – development of borrow areas and materials with potential stripping of vegetation, transport of materials and placement/compaction of materials, construction of temporary camps and laydown areas, temporary storage of fuels

- Site Mobilisation – air transport with traverse of airspace, generation of noise and production of exhaust gases

- Site Work, specifically including:

    - Waste consolidation – wheeled (or in some cases tracked) vehicle movement across terrain

  - Soil excavation – removal of surficial soils from borrow areas and impacted soil areas with reduction in the surface elevation and lessening of vertical distance to zones of permafrost

  - Containerization/Placement – placement of waste materials into containers suitable for air or ground transport to staging areas or into local engineered facilities (i.e., landfill or landfarm)

  - Transport to Staging Areas (by air or land) - wheeled (or in some cases tracked) vehicle movement across terrain, air transport with traverse of airspace, generation of noise and production of exhaust gases

  - Backfill & Compaction – placement of borrow materials into excavations or as cover with subsequent compaction using mechanical means, with potential for generation of dust and siltation of surface runoff

- Site Demobilisation – air transport with traverse of airspace, generation of noise and production of exhaust gases

The effects created by the airstrip and roadway improvement, transport of waste to staging areas, as well as mobilisation and demobilisation activities are non-mitigatable. However, the impacts of these project activities on the designated environmental areas are minor, and on a broader scale, the project has an overall positive impact on designated environmental areas by improving the environmental conditions at these areas.

There are ways to mitigate the impacts of the other project activities. As such, the following mitigation measures are proposed:

- Confine project activities and project-related construction (i.e., staging areas, camps) to previously disturbed portions of the Sites, access roads, and airstrips

- Restrict use of Project-related vehicles from any off-road/off-disturbed area travel, unless necessary to complete project activities

- Keep all equipment in good working order and not left running needlessly

Table 6-1 Potential for Environmental Impacts

	Environmental Components	**Physical**	Designated environmental areas (i.e. Parks, Wildlife Protection areas)	ground stability	permafrost	hydrology/ limnology	water quality	climate conditions	eskers and other unique or fragile landscapes	surface and bedrock geology	sediment and soil quality	tidal processes and bathymetry	Air Quality	**Biological**	vegetation	terrestrial wildlife, including habitat and migration patterns	marine wildlife, including habitat and migration patterns	aquatic species, including habitat and migration/spawning	birds, including habitat and migration patterns	wildlife protected areas	**Socio-Economic**	archaeological and cultural habitat sites	employment	community wellness	community infrastructure	human health	traditional hunting sites		
PROJECT ACTIVITIES																													
Preparation and Site Access:																													
Airstrip improvement			**N**	**P**	**N**	**N**	**M**		**N**	**N**	**M**		**N**		**N**	**M**	**M**			**N**			**P**	**P**	**P**		**P**		
Roadway improvement			**N**	**P**	**N**	**N**	**M**		**N**	**N**	**M**		**N**		**N**	**M**				**N**			**P**	**P**	**P**		**P**		
Staging Area Establishment			**M**	**M**		**M**	**M**		**M**	**M**	**M**		**N**		**M**	**M**			**N**	**M**			**P**		**P**		**M**		
Mobilisation			**N**					**N**					**N**			**M**	**M**		**M**	**M**			**P**				**M**		
Site Work:																													
Waste Consolidation			**M**								**M**				**M**	**M**			**M**	**M**			**P**	**P**		**P**	**P**		
Soil Excavation (Borrow and Impacted)			**M**	**M**	**N**	**M**	**M**		**N**	**N**	**M**		**M**		**N**	**M**	**M**	**M**	**M**	**M**			**P**	**P**		**M**	**M**		
Containerization/Placement			**M**								**M**				**M**	**M**			**M**	**M**			**P**	**P**		**P**	**P**		
Transport to Staging Areas (by air or land)			**N**					**N**					**N**			**M**			**M**	**M**			**P**				**M**		
Incineration					**M**			**N**					**M**										**P**			**M**	**N**		
Landfarm Tilling						**M**	**M**				**P**		**M**										**P**	**P**		**M**	**M**		
Backfill & Compaction			**M**	**M**	**P**	**M**	**M**		**N**	**P**	**M**		**M**		**N**	**M**	**M**	**M**	**M**	**M**			**P**			**M**	**P**		
Waste Transport (to disposal, by air or sea)								**N**					**N**										**P**	**P**			**M**		
Demobilisation			**N**					**N**					**N**			**M**	**M**		**M**	**M**			**P**				**M**		

Notes:

Please note that in the matrix cells above the following symbols have been used to indicate whether the interaction causes an impact and whether the impact is:

- **P** Positive
- **N** Negative and non-mitigatable
- **M** Negative and mitigatable
- **U** Unknown

If no impact is expected, the cell has been left blank

In addition to these mitigation measures, in order for project activities to have minimal effects on the designated environmental areas, the following should be prepared:

- A Spill Contingency Plan be developed and implemented
- Emergency spill kits be kept with all working equipment and at fuel storage areas
- All on-site personnel be trained in the proper handling procedures for all wastes, and in spill response procedures

Ground Stability and Permafrost

Due to the project location within a zone of continuous permafrost, activities which involve removal of surficial materials, or which have the potential to transfer heat to the sub-surface, have the potential to impact permafrost. Changes in permafrost are dependent on several factors: ground ice content, ground temperature, snow and vegetation cover. The removal of vegetation may cause a thawing of the ground surface, which over time may cause settlement, ground instability, and erosion, as well as the permafrost layer deepening (SENES, 2005).

In order to mitigate these effects, significant heat sources (e.g., generators) should be thermally shielded from the ground. Effort should be made to restrict excavation to the active layer in borrow sources where possible. Excavations should not be left open for longer than is strictly necessary. Frozen granular materials must not be used as backfill to ensure ground stability and prevent destruction of the permafrost layer.

The proposed improvements to existing airstrips and roadways will improve ground stability, through increasing the erosion-resistance of surficial materials through compaction.

Hydrology / Limnology

Changes to land cover, such as through expansion of the areal extent of airstrips, will have a negative impact upon hydrology, as the behaviour of the land surface in response to rainfall is modified (i.e., retention and slow release within vegetated areas, faster and increased runoff in un-vegetated areas). The extent of vegetation removal is expected to be minor, and to be within the footprints of previously disturbed areas. Steps should also be taken to prevent obstruction of natural drainage, flooding, and/or channel diversion during all project activities.

Water Quality

Any activity which involves disturbing/excavating surficial soils has the potential to affect water quality, through generation of siltation in surface runoff. All such activities shall make use of erosion control fencing to maintain water quality. Such steps should be outlined in an Erosion and Sediment Control Plan, outlining practices to minimize the exposure of loosened surface materials to rainfall/runoff and other best practices across all relevant Sites.

In addition, any excavations that occur during the active season have some potential to generate standing water within excavations. Best practices will be defined for these instances, maintaining sump locations within excavations to keep water within the excavation. If the quantity of water is too great to permit proper backfill, then dewatering and appropriate water treatment would be required.

Surface and Bedrock Geology (Eskers, and other unique or fragile landscapes)

Esker formations are present on Bathurst Island, although none were noted within project Sites during earlier work. Eskers are often the source of the highest quality of borrow materials; while borrow areas will be negatively impacted through removal of material, the extent of impact can be minimized through recontouring to match the existing terrain after use. The borrow sources identified at Young Inlet, Stokes Range, Ile Vanier APECs 2 and 4, Bent Horn APEC 3, and Bent Horn APEC 6 are not within esker or fragile landscape formations.

Sediment and Soil Quality

Deposition of deleterious materials, such as dust or siltation mobilised from impacted areas, and the release of impacted water, can negatively impact sediments/soils. To mitigate this risk, a Dust Management Plan must be developed and implemented, to control fugitive dust through such measures as: limiting traffic speeds on access roads and on-site trails; ensuring a minimum 2:1 slope on all soil piles; orienting any borrow pit faces with consideration to prevailing winds; closing borrow sources on high wind days; watering any landfarms during soil tilling/rotation events, if necessary; and, watering borrow source pit floors, if necessary. In addition, use of clean equipment and clean granular material is required.

Landfarm (if applicable) and Soil Covers: impact mitigation measures for operation of a landfarm include:

- Design landfarm to prevent migration of contaminants i.e. berms are of sufficient height to contain wastes, use of geomembrane liner
- Design grading of landfarm area to promote surface water runoff
- Compact and contour soil covers to promote surface water runoff and prevent water intrusion

Climate Conditions / Air quality

Use of incineration to transform organic liquids, also the use of aircraft, vehicles and equipment, results in the generation of greenhouse gases, which is not practically mitigatable. The quantity of organic liquids present across all sites is not large. Air quality can be affected by soil disturbing activities that generate dust and by potential dispersion of contaminated soil, and by fuel storage/use.

Impact mitigation measures for operation of an incinerator include:

- Conduct waste incineration in accordance with Government of Nunavut Environmental Guidelines for Burning and Incineration of Solid Waste

- Containerize all generated ash and disposal of as required based on characterization
- Restrict incineration to non-hazardous, combustible wastes and non-hazardous, petroleum product waste only

6.1.2 Biological

As previously mentioned in Section 6.1.1, all of the Sites are found within designated environmental areas. The following mitigation measures are proposed in order to mitigate any impacts to vegetation, wildlife including habitat and migration patterns, and wildlife protected areas.

Vegetation

Most of the project activities, including preparation and site access, soil excavation and backfill and compaction, will have non-mitigatable impacts on vegetation. However, the impact of these activities will have a minor effect on vegetation on the three Islands, and the Project will have an overall positive effect on vegetation health, as vegetation recovery will be facilitated as a result of waste removal.

However, in order to mitigate potential impacts where possible it is recommended that:

- Excavation footprints are minimized wherever possible to avoid unnecessary vegetation removal
- Project activities avoid the destruction of vegetation

Terrestrial wildlife, including habitat and migration patterns

Bathurst Island, Ile Vanier and Cameron Island (Bent Horn) also encompass muskox management areas. Additionally, the northeastern portion of Bathurst Island is noted to be Peary Caribou habitat, the central portion of Bathurst Island makes up the Polar Bear Pass National Wildlife Area, and all of Cameron Island is known to be a caribou wintering area. Very little is known about the individual effects of development (roads, increased access), or potential cumulative effects, on muskox in the Bathurst Island Group (BIG). Intensive disturbance of Peary caribou during critical periods (late winter, calving) could be harmful. Both Peary caribou and muskoxen are very susceptible to population-wide die-offs due to weather events such as large snowfall events, hard snow, and ice rain (Ferguson, 1986; Jenkins, 2011). Polar bears are widely dispersed on sea ice in the winter until ice break-up, but in the summer they tend to be found along the edge of persistent pack ice or on land. In the summer, when food is unavailable, polar bears are known to hunt (e.g. caribou), and scavenge (e.g. bird nests, carcasses, human garbage, etc.) (COSEWIC, 2008).

In order to mitigate negative impacts of any project activities the following are recommended:

- Restrict Project activities to non-critical wildlife periods; if avoidance is not possible, contact local Wildlife Officers to obtain advice/assistance on how to proceed
- Restrict project activities to designated work areas to minimize the spatial extent of project effects
- Minimise waste during project activities, and keep waste materials properly contained/secured

- All Sites are found within muskox distribution range. Therefore, restrict project to non-critical wildlife periods, i.e. impose work restrictions between April to June (calving season)

- Polar Bear Pass is a protected Polar Bear denning area. Therefore, restrict project activities near this area (Site J-34) to non-critical wildlife periods, i.e. impose work restrictions between October to May (mating and denning season)

- Cameron Island (location of all Bent Horn Sites) encompasses caribou wintering area. Therefore, restrict project activities to non-critical wildlife periods, i.e. impose work restrictions between October to March, and ideally not between May and June (mating and calving season) if caribou are still found to be present at the Bent Horn sites

Marine wildlife, including habitat and migration patterns

Most of the Sites are found a considerable distance inland, and it is therefore unlikely that project activities will have an impact on marine life. However, Ile Vanier APEC 2/5 and Bent Horn APECs 2, 3, 4, and 6 are all found within proximity to coastal waters. Therefore, there is a potential for project activities such as soil excavation, backfilling and compaction, as well as site mobilisation and demobilisation to have an effect on marine wildlife and their environment through sediment loading into waterways and deposition into adjacent marine waterways. Project activities may also disturb near-shore marine wildlife through heavy equipment disturbance/noise, and low flying aircraft entering or leaving sites. Ringed seal pupping occurs on sea ice from March to April; prime ringed seal habitat includes large, sheltered bays and sounds protected from off-shore storm influences, with persistent fast ice in winter and spring (Harwood et al., 2012). Important bearded seal habitat is located on sea ice (i.e. ice cracks, polynyas), where breeding, pupping, and denning occur, during periods of ice cover. Data for high arctic populations are limited, however, in the Beaufort Sea (Barrow, Alaska) breeding occurs in March to June (MacIntyre et al., 2013), and bearded seals in the Barents Sea (Svalbard, Norway) give birth between April and May (Gjertz et al., 2000).

The following are recommended mitigation measures:

- Where Bearded Seal and Ringed Seals may come on land (though likelihood of this is low), restrict project activities to non-critical wildlife periods

- Where remediation activities may impact the surrounding water, which includes Narwhal summer habitat, plan for mitigation measures to be in place in order to preserve water quality

Aquatic species, including habitat and migration/spawning

As mentioned above, Ile Vanier APEC 2/5 and Bent Horn APECs 2, 3, 4, and 6 are all found within proximity to coastal waters. Therefore, there is a potential for project activities such as soil excavation, backfilling and compaction to have an effect on the aquatic environment through the release of material (siltation, contaminated water).

The following are recommended mitigation measures:

- Where remediation activities may impact the surrounding water, including Arctic Char habitat, restrict activities to non-critical periods

- If there is potential for project activities to affect water quality, follow DFO's 'Measures to Avoid Causing Harm to Fish and Fish Habitat', including restrictions on timing of work, and putting in place erosion and sediment control measures

Birds, including habitat and migration patterns

Although significant bird numbers and bird habitat are not expected to be found directly at any of the sites, there is a potential for nesting colonies to reside in the coastal areas, such as those located at Ile Vanier APEC 2/5 and Bent Horn APECs 2, 3, 4, and 6. Therefore, as there is potential for project activities such as staging area establishment, waste consolidation, waste transport, as well as mobilisation and demobilisation to have an impact, the following mitigation measures are proposed:

- Prior to dismantling and removal of on-site debris (i.e., buildings), area will be checked for nesting birds or signs of burrowing; if evidence is present, the area will be avoided until nesting/burrowing is complete

- If avoidance is not possible, contact local Wildlife Officers to obtain advice/assistance on how to proceed

- Where remediation activities may impact Ivory Gull colonies, if they are found in any of the project areas, restrict project activities to non-critical wildlife periods, and respect terrestrial, marine, and aerial buffer/protection zones

Wildlife protected areas

In order to minimize impact to all wildlife protected areas, it is proposed to restrict project activities to designated work areas to minimize the spatial extent of Project effects (designated environmental areas are found within the boundaries of all Sites.)

6.1.3 Socio-Economic

As noted in Section 2.0 of this report, there are various types of debris that are found in each of the seventeen (17) Areas of Potential Environmental Concern (APECs). This includes metal, plastic, wood, and other debris dispersed across sites, as well as various buried debris located in made-shift landfills. As per information obtained through interviews with local community representatives, in addition to information available from the Nunavut Planning Commission (NPC) *Community Priorities and Values Interactive Map*, the debris of greatest concern are the storage drums that are found in several caches across Bathurst Island, Ile Vanier, and Cameron Island. These storage drums, as well as other visible debris, are perceived by the community to be contaminating food that is hunted within the area of the Bathurst Remediation Project, as well as leaching contaminants into the local environment, including wildlife and plants.

Employment

Overall, the project activities will have a positive effect on employment in the local community. However, in order for this to occur, it will be essential to engage local communities prior to the commencement of project activities in order to inform locals of proposed activities and, if there is interest, to offer them employment opportunities. This will align individuals that have knowledge of the areas and are interested in participating in remediation efforts to become engaged in the project and be given the opportunity to actively participate.

Community Wellness

Overall, the currently selected project activities, which solely include the removal of hazardous materials from the 17 APECs, are likely to have a net negative effect on community wellness as. Although the removal of hazardous material will be perceived as a step in the right direction, leading to a positive impact, it is likely that the community will have a negative perception of a remediation project that does not lead to the removal of visible debris, specifically storage drums.

Traditional Hunting Sites

Overall, the project activities will have a net positive effect on traditional hunting sites as hazardous waste will be remediated. However, it is important that prior to any project activities, local communities are notified of Project timelines, in order to inform local individuals that work will be taking place near or in Traditional Hunting Areas.

Community Infrastructure

Overall, the project activities will have a net positive effect on community infrastructure. As part of the proposed project activities the airstrips and roadways that are currently used by local communities during spring/summer hunting trips, will be improved and allow for safer travel to camping and hunting areas.

Human Health

Overall, the project activities will have a net positive effect on human health of any individuals coming into contact with the Sites, as contaminants of potential concern will be removed from the sites thus eliminating the sources of concern. Note that in most cases, with the exception of the PCB-impacted soils at N-12 and the lead-impacted soils at Ile Vanier APEC 1, all media with identified impacts have been found to pose negligible human health or ecological risks.

However, in order to protect the health and safety of all individual present at the sites during project activities, the following are suggested:

- Develop and enforce a site-specific Health and Safety Plan covering all project activities; including the awareness and training of all on-site personnel of Health and Safety measures

- Maintain records that show that all on-site personnel have read and reviewed all applicable Safe Work Practices (SWPs) relating to physical conditions, biological components, as well as how to remain safe near all of the project activity equipment present at sites (e.g., ATVs, excavator, etc.)

- Conduct daily Health and Safety meetings, including "Fit for Work" tailgate meetings 2-3 times/day, to promote the safety of all on-site personnel

6.2 SUPPLEMENTARY ASSESSMENT

Table 6-2 outlines recommended supplementary site assessment activities for the Sites. These activities were recommended as part of the PQRAs and ESAs conducted for Bathurst Island, Ile Vanier and Bent Horn (Cameron Island).

Table 6-2 Supplementary Site Assessment/Risk Assessment

Site	Media			Description
	Soil	Surface Water	Ground-water	
N-12	X			• Collect confirmatory soil samples following excavation of PCB-impacted soils
Young Inlet	X			• Re-evaluate airstrip condition prior to use
Stokes Range	X			• Re-evaluate airstrip condition prior to use
Ile Vanier APEC 1	X			• Collect confirmatory soil samples following capping of lead-impacted soil
Ile Vanier APEC 2/5	X		X	• Re-evaluate airstrip condition prior to use
Ile Vanier APEC 3	X		X	• Complete an ESA
Ile Vanier APEC 4	X			• Re-evaluate airstrip condition prior to use
Bent Horn APEC 1				• Evaluate condition of airstrip
Bent Horn APEC 2	X		X	• Complete an ESA • Evaluate condition of airstrip
Bent Horn APEC 3	X		X	• Complete a supplementary ESA
Bent Horn APEC 6	X			• Collect confirmatory soil samples following excavation of tar globule • Re-evaluate airstrip condition prior to use
K-12	X	X	X	• Complete an ESA
M-21	X	X	X	• Complete an ESA
G-07	X	X	X	• Complete an ESA

It should be noted that surface water samples collected from each of the sites were conservatively assumed to serve as sources of drinking water as part of the PQRA reports. However, the surface water bodies that were sampled are unlikely to be sources for drinking water during hunting/camping activities on Bathurst Island, Ile Vanier, or Cameron Island. Therefore, although no risks to human health were found as a result of ingestion of surface water, this is not an indication that water from any surface water body on Bathurst Island, Ile Vanier, or Cameron Island may be used as a source of drinking water. Any potential potable water sources will need to be sampled and analyzed prior to consumption.

In the absence of a regulatory driver for remediation of non-hazardous wastes at the Sites, the priority for action will likely be low – this may result in the Sites not being subject to remediation for a number of years. Some minor risk avoidance measures may be appropriate in this interim period, such as:

- Information on locations of physical hazards made available to future park users, with instructions to avoid such areas
- Information on locations of surface water pools/ponds to not use for potable water purposes made available to future park users

6.3 MONITORING

Table 6-3 outlines recommended long-term monitoring (LTM) activities for the Sites once remediation activities are completed. It should be noted that PQRA context conditions refer to monitoring of any changes of site conditions, such as an increase in vegetation which may be collected and consumed by human health receptors, or changes in land use (see Table 3-1 Note 2 for further details). An LTM Plan should be prepared during remediation, detailing the quantity and frequency of required visual and media sampling.

Table 6-3 Long-term Monitoring

Site	Monitoring				Description
	Land Use	Soil	Surface Water	Ground-water	
N-12	X				• Monitor PQRA Context conditions
J-34	X				• Monitor PQRA Context conditions
Young Inlet	X				• Monitor PQRA Context conditions
Stokes Range	X				• Monitor PQRA Context conditions
Ile Vanier APEC 1	X	X			• Monitor PQRA Context conditions • Monitor performance of soil cover
Ile Vanier APEC 2/5	X	X	X	X	• Monitor PQRA Context conditions • Monitor metals- and PHC-impacted soils left in place • Short-term monitoring of surface and groundwater
Ile Vanier APEC 3					• TBC based upon supplementary assessment
Ile Vanier APEC 4	X	X			• Monitor PQRA Context conditions
Bent Horn APEC 1					• TBC based upon supplementary assessment
Bent Horn APEC 2					• TBC based upon supplementary assessment
Bent Horn APEC 3	X	X			• Monitor PQRA Context conditions
Bent Horn APEC 4	X				• Monitor PQRA Context conditions
Bent Horn APEC 6	X	X	X	X	• Monitor PQRA Context conditions • Monitor metals-impacted soils left in place • Monitor metals- and PHC-impacted soils left in place • Monitor PHC-impacted soils left in place • Short-term monitoring of surface and

Site	Monitoring				Description
	Land Use	Soil	Surface Water	Ground-water	
					groundwater
K-12					• TBC based upon supplementary assessment
M-21					• TBC based upon supplementary assessment
G-07					• TBC based upon supplementary assessment

6.4 GEOTECHNICAL CONSIDERATIONS

The availability, quantity and quality of borrow materials was evaluated at the following sites:

- Bathurst Island:
    - Young Inlet: a potential gravel borrow source was identified near the north end of the airstrip. It is estimated that 500 m^3 of gravel is available at this location
    - Stokes Range: a potential gravel borrow source was identified near the existing airstrip, this material could potentially be crushed and used as a gravel source. It is estimated that approximately 50,000 m^3 of gravel is available at this location
- Ile Vanier:
    - APEC 4: a gravel and sand borrow source was identified beside the airstrip. It is estimated that approximately 60,000 m^3 of material is available
    - APEC 5: native material at APEC 5 consisted of well-graded sand with silt and gravel which could be used as a borrow source. It is estimated that approximately 50,000 m^3 of material is available
- Bent Horn:
    - APEC 3: the hills north of the airstrip were identified as a possible borrow source for sand material. It is estimated that approximately 50,000 m^3 of material is available at this location. No sufficient source of gravel material was identified at the Site
    - APEC 6: a potential borrow source for silty sand with gravel and cobbles was identified south of the exiting airstrip. It is estimated that approximately 5,000 m^3 of material is available at this location

At Bent Horn APEC 6, an existing landfill was identified east of the airstrip. The surface area of the landfill is estimated to be 3800 m^2. The existing landfill has approximately one metre of cover material with signs of minor cracks to deep ruts on the east side. The cracks should be filled with site generated material. A potential land farm location was identified on the east side of the existing landfill.

6.5 SITE ACCESS AND STAGING AREAS

As a result of the ESA/geotechnical work, airstrips were identified and utilized as follows:

- Bathurst Island:
    - Young Inlet: minor airstrip, not used, poor condition. The airstrip is considered suitable for use by aircraft with aircraft load rating (ALR) of 4 with a tire pressure restriction of 0.3 MPa; however, hazards such as ponding water and rocks were observed. The condition of the airstrip should be re-evaluated prior to use by any aircraft
    - Stokes Range: minor airstrip, not used, poor condition. The airstrip is considered suitable for use by aircraft with ALR of 5 with a tire pressure restriction of 0.4 MPa; however, hazards such as loose rocks, potholes, and rutting will need to be removed. The condition of the airstrip should be re-evaluated prior to use by any aircraft
- Ile Vanier:
    - APEC 3: minor airstrip, not used, condition unknown
    - APEC 4: major airstrip, used by Twin Otter, fair condition. The airstrip was assessed by a DHC5 Buffalo pilot for a DHC5 Buffalo plane on August 2013. The airstrip was assessed to be unsafe due to uneven surfaces, loose rocks and boulders. A DHC6 Twin Otter completed two successful landings and takeoffs on the airstrip in August 2013. The material on the airstrip surface is fairly soft and the tires of the Twin Otter created a 40 mm deep depression. The strip is considered suitable for use by aircraft with ALR of 4 with a tire pressure restriction of 0.5 MPa. The condition of the airstrip should be re-evaluated prior to use by any aircraft
    - APEC 5: minor airstrip, used by Twin Otter, poor condition. The airstrip at APEC 5 is considered suitable for use by aircraft with ALR of 4 with a tire pressure restriction of 0.3 MPa; however, hazards such as soft soils, large washout areas and overgrown areas need to be removed. The condition of the airstrip should be re-evaluated prior to use by any aircraft
- Bent Horn:
    - APEC 1: minor airstrip, not used, condition unknown
    - APEC 2: minor airstrip, not used, condition unknown
    - APEC 3: minor airstrip, not used, poor condition. The airstrip at APEC 3 was assessed by a DHC6 Twin Otter certified pilot for suitability in August 2013. The airstrip was assessed to be unsafe for a DHC6 Twin Otter plane to land due to uneven ground, washout areas

and soft material on the surface. The surface of the airstrip will need to be rehabilitated before it can be used by any aircraft

- APEC 6: major airstrip, used by Twin Otter, fair condition. A DHC6 Twin Otter plane completed a successful landing and takeoff on the airstrip in August 2013. The airstrip was in good condition with very few ruts or pothole. The airstrip is considered suitable for use by aircraft with aircraft load ratings (ALR) of 5 with a tire pressure of 0.2 MPa; however, hazards such as loose gravel, slight break up and slight overgrowth needs to be removed. The condition of the airstrip should be re-evaluated prior to use by any aircraft

Local contractors in Resolute Bay report the regular use of the airstrip at Freeman's Cove (proposed Staging Area #2) by Twin Otter aircraft, and that the airstrip is suitable for heavy (up to Hercules) aircraft – the Freeman's Cove airstrip was not assessed as part of the Phase III ESA/Geotechnical Assessment. No assessment of potential barge landing sites was undertaken: there are historical reports of barge landing at Bent Horn and at Freeman's Cove.

Access roads between Bent Horn APECs 4 and 6, and Ile Vanier APECs 1 and 4, were observed. Only the first 400 m of the access roadway from Bent Horn APEC 6 was assessed. The access roadway was observed to be in poor condition and will require re-grading, and roadway crown and drainage paths re-establishment. Only the first 500 m of the access roadway starting at Ile Vanier APEC 4 airstrip was assessed. The portion of the access roadway assessed is generally in good condition with some soft spots in low lying areas. There are large ruts in these low lying areas and at water crossings. The access roadway may need re-grading, roadway crown re-established and drainage paths established in low lying areas.

7.0 PROJECT WBS AND SCHEDULE

A WBS had been prepared for the project, encompassing all remedial and risk management activities as well as necessary project preparation, site access, mobilization/demobilization, supplementary assessment, and monitoring tasks.

7.1 PROJECT WBS

The WBS for the project can be found in **Appendix B**. The Level 1 and 2 task breakdown is outlined in Table 7-1.

Table 7-1 Level 1 and Level 2 Project WBS

WBS 1	WBS 2	Task/Sub-task
1		Detailed Design & Tendering
	1.1	Detailed Design
	1.2	Tendering
	1.3	Remediation Contract Award
2		Remediation & Risk Management
	2.1	Subcontracting
	2.2	Permitting
	2.3	Reconnaissance and Access Improvement
	2.4	Ile Vanier, Bent Horn & North Bathurst Consolidation (Staging Area #1 – Ile Vanier APEC 4)
	2.5	Central and South Bathurst Consolidation (Staging Area #2 – Freeman's Cove)
	2.6	Waste Transport to Resolute Bay
	2.7	Waste Transport to Disposal (Sealift)
	2.8	Demobilisation
	2.9	QA/QC and Project Management
3		Supplementary Assessment and Monitoring

7.2 SCHEDULE

For cost estimation purposes, a remediation scenario schedule has been defined, outlined in the RRMP Costing spreadsheet (provided separately). The project scenario Gantt chart is provided in **Appendix C**.

8.0 CLOSURE/LIMITATIONS

This report documents work that was performed in accordance with generally accepted professional standards at the time and location in which the services were provided. No other representations, warranties or guarantees are made concerning the accuracy or completeness of the data or conclusions contained within this report, including no assurance that this work has uncovered all potential liabilities associated with the identified property.

This report provides an evaluation of selected environmental conditions associated with the identified portion of the property that was assessed at the time the work was conducted and is based on information obtained by and/or provided to Stantec at that time. There are no assurances regarding the accuracy and completeness of this information. All information received from the client or third parties in the preparation of this report has been assumed by Stantec to be correct. Stantec assumes no responsibility for any deficiency or inaccuracy in information received from others.

The opinions in this report can only be relied upon as they relate to the condition of the portion of the identified property that was assessed at the time the work was conducted. Activities at the property subsequent to Stantec's assessment may have significantly altered the property's condition. Stantec cannot comment on other areas of the property that were not assessed.

Conclusions made within this report consist of Stantec's professional opinion as of the time of the writing of this report, and are based solely on the scope of work described in the report, the limited data available and the results of the work. They are not a certification of the property's environmental condition. This report should not be construed as legal advice.

This report has been prepared for the exclusive use of the client identified herein and any use by any third party is prohibited. Stantec assumes no responsibility for losses, damages, liabilities or claims, howsoever arising, from third party use of this report.

This report is limited by the following:

- Previous report data as reported was assumed to be accurate

The locations of any utilities, buildings and structures, and property boundaries illustrated in or described within this report, if any, including pole lines, conduits, water mains, sewers and other surface or sub-surface utilities and structures are not guaranteed. Before starting work, the exact location of all such utilities and structures should be confirmed and Stantec assumes no liability for damage to them.

The conclusions are based on the site conditions encountered by Stantec at the time the work was performed at the specific testing and/or sampling locations, and conditions may vary among sampling locations. Factors such as areas of potential concern identified in previous studies, site conditions (e.g., utilities) and cost may have constrained the sampling locations used in this assessment. In addition, analysis has been carried out for only a limited number of chemical parameters, and it should not be inferred that other chemical species are not present. Due to the nature of the investigation and the limited data available, Stantec does not warrant against undiscovered environmental liabilities nor that the

sampling results are indicative of the condition of the entire site. As the purpose of this report is to identify site conditions which may pose an environmental risk; the identification of non-environmental risks to structures or people on the site is beyond the scope of this assessment.

Should additional information become available which differs significantly from our understanding of conditions presented in this report, Stantec specifically disclaims any responsibility to update the conclusions in this report.

This report was prepared by Marc Bouchard, Alicja Wierzbicka and David Wilson, and reviewed by François Lauzon.

Prepared by _____
(signature)

Marc Bouchard, P.Eng.

Prepared by _____
(signature)

David Wilson, M.A.Sc., P.Eng.

Reviewed by _____
(signature)

François Lauzon, M.Eng., P.Eng.

v:\01225\active\122511001\reports\rrmp\122511001_rpt_rrmp_final_30Mar15.docx

9.0 REFERENCES

CCME, 2008a. National Classification System for Contaminated Sites Guidance Document. PN 1403. ISBN 978-1-896997-80-3 PDF

CCME, 2008b. Canada-Wide Standards for Petroleum Hydrocarbons in Soil: Scientific Rationale Supporting Technical Document

Fisheries and Oceans Canada, 2013. Measures to Avoid Causing Harm to Fish and Fish Habitat. http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/index-eng.html

Government of Canada FCSAP - Decision Making Framework - May 2013

CAN/CSA-Q850-97 - Risk Management Guideline for Decision Makers

Health Canada - Decision-Making Framework for Identifying, Assessing, and Managing Health Risks (April 2000)

Policy for Management of Risks at Contaminated Sites in Alberta

Technical Assistance Bulletin (TAB 17) prepared by Environment Canada - Risk Management for Contaminated Sites Framework

Appendix A

Site Impacts, RO and RMA Selection Worksheets

Appendix A
Site Impacts, RO and RMA Selection Worksheets

Table A-1 Site Impacts

Table A-1. Site Impacts

ID	Site	Site Description	Waste Code		Description	Area (m2)	Vol./Quant.	Units	Uncert.	Location in APEC	Basis	SW Present?	Distance (m)
1-1.1	1 N-12	Well site N-12 was accessed on July 30, 2013, via helicopter from Resolute Bay, Nunavut (approximately 115 km away). During the site visit two building foot prints were observed on the northeast portion of the Site as depressions filled with wood debris and ponded water. A large ponded area was observed on the east portion of the Site which may have functioned as a sump for drilling/site operations. The ponded area was observed to contain various metal debris and storage drums. A large cuttings pile, old filters and debris pile were observed along the west bank of the pond. Six burn pits were observed throughout the Site which contained various types of metal and wood debris. A wooden well box with well marker was observed in the central portion of the Site (west of the ponded area), the wooden box was filled with various metal debris. A large area with buried debris was observed on the north portion of the Site which contained various types of metal debris such as cans, storage drums, wire, and strapping.	1.1	1 PH-Buildings	Two building foot prints were observed on the northeast portion of the Site as depressions filled with wood debris and ponded water. A large cuttings pile, old filters and debris pile were observed along the west bank of the pond. Six burn pits were observed throughout the Site which contained various types of metal and wood debris. A large area with buried debris was observed on the north portion of the Site which contained various types of metal debris such as cans,	750				Northeast portion of the Site.	AMSRP		
1-1.2	1 N-12		1.2	1 PH-Other	storage drums, wire, and strapping.	1000				Various.	AMSRP		
1-2.1	1 N-12		2.1	1 NhW-Drums	6 empty drums.		6	drums		East ponded area and north waste disposal area. In well head box, in buried debris area, north end of east former building, and in buried debris area, north end of east former building.	AMSRP		
1-2.2	1 N-12		2.2	1 NhW-Metal	Scrap metal, misc. metal, and old food cans.		44	m3			AMSRP		
1-2.3	1 N-12		2.3	1 NhW-Wood	Plywood 4x8 sheets.		20	sheets		Former building areas.	AMSRP		
1-2.3-2	1 N-12		2.3	2 NhW-Wood	Wood planks and beams.		49	m3		Former building areas, around well head, scattered around the Site.	AMSRP		
1-2.4	1 N-12		2.4	1 NhW-Other	Plastic blue scrubbers, filters, and drill cuttings.		5	m3		West side of big sump.	AMSRP		
1-4.1	1 N-12		4.1	1 Soils-PCBs	Burn pits. Barium, PHC F2, F3, F4 (grav), PCBs.		33	m3	High	Burn pits.	CCME-Ag.		
1-4.4	1 N-12		4.4	1 Soils-Metals	North area with metal debris. Barium.		18	m3	High	North area with metal debris.	CCME-Ag.		
1-5.1	1 N-12		5.1	1 Surface Water	Big pond. Aluminum, Cadmium, Lead.					Big pond.	CWQG-PFAL		
2-1.1	2 J-34	Well Site J-34 was accessed on July 31, 2013, via helicopter from Resolute Bay, Nunavut (approximately 150 km away). During the primary aerial surveillance of the Site, distinct north and south areas were identified. The south area included two trailers on transportation pads and a ponded area (south of trailers). The contents of the trailers included two propane cylinders, beds with disintegrating mattresses, chairs and a stove. A third transportation pad was also observed and a small debris pile with various types of metal debris (crushed storage drums and cans). The ponded area was observed to contain various types of wood and metal debris such as crushed storage drums. During the aerial surveillance of the north area a well site (central), building foot print (north), suspected sump (north), three ponded areas (1 northwest and 2 southeast), and disturbed area (east) were observed. During the site visit the well marker and associated wooden well box was observed in the central portion of the Site. A debris pile with various types of rusted metal waste (crushed storage drums, three compressed gas cylinders, cans, wires, sheet metal, and miscellaneous drill pieces) was observed to the northeast of the well. A large disturbed area was observed east of the well area, along the disturbed area two storage drums, one half submerged compressed gas cylinder, and a stained area were observed. A wooden box filled with water (suspected sump) was observed north of the well area. A large ponded area was observed on the northwest portion of the Site which contained various rusted metal debris (one compressed gas cylinder, crushed storage drums, and sheet metal). Other site observations include various debris piles with metal, plastic, and wood.	1.1	1 PH-Buildings	Two trailers	320				700 m southeast of wellhead	AMSRP		
2-1.2	2 J-34		1.2	1 PH-Other	Debris pile	150				North area, central-east portion.	AMSRP		
2-2.1	2 J-34		2.1	1 NhW-Drums	Empty drums		30	drums			AMSRP		
2-2.2	2 J-34		2.2	1 NhW-Metal	Metal pipes, misc metal waste		82	m3		Trailers, sumps, landfill pit, northeast corner	AMSRP		
2-2.3	2 J-34		2.3	1 NhW-Wood	Plywood 4x8 sheets.		16	sheets		Trailers	AMSRP		
2-2.3-2	2 J-34		2.3	2 NhW-Wood	Wooden beams (13) and pallets (7)		5	m3		Centre of Site	AMSRP		
2-2.4	2 J-34		2.4	1 NhW-Other	White plastic pieces, bags of hardened concrete (3)		20	m3		South of sump, centre of Site, at trailers	AMSRP		
2-3.4	2 J-34		3.4	1 HW-Press. cylind	Compressed gas cylinders (8)		8	cylinders					
2-3.5	2 J-34		3.5	1 HW-Other	Batteries (4)		4	batteries			AMSRP		
2-4.4	2 J-34		4.4	1 Soils-Metals	North of water pond with metal debris, Barium		50	m3	High	North of water pond	CCME-Ag.		
2-4.4-2	2 J-34		4.4	2 Soils-Metals	Debris pile, Barium		20	m3	High	Debris pile	CCME-Ag.		
2-5.1	2 J-34		5.1	1 Surface Water	Ponded water with metal debris: Aluminum, Cadmium					Ponded water with metal debris	CWQG-PFAL		
3-1.2	3 Young Inlet	Young Inlet was accessed on August 3 and 4, 2013, via helicopter from Resolute Bay, Nunavut (approximately 220 km away). During the primary aerial surveillance of the Site a distinct airstrip and well site were identified. A north and south drum cache were observed on the airstrip portion of the Site. The north drum cache contained approximately 81 storage drums (45 gallon capacity) stacked in two lines, eight (8) storage drums packed with miscellaneous rusted metal and wood debris, and a metal debris pile (Figure 6, Appendix A). In addition, four (4) storage drums were observed on the north portion of the cache with suspected free product. The drums were opened and the contents assessed. A suspected petroleum hydrocarbon sheen was observed on the melt water on the north portion of the drum cache. The melt water was observed to flow in a north direction which was the inferred gradient at the site. Nine (9) storage drums and one (1) crushed storage drum were observed in the south drum cache. Four (4) drums were confirmed to have fuel, three (3) were suspected to have fuel and two (2) were empty and observed to have large holes. A photograph log and photograph location key are available in Appendix B.	1.2	1 PH-Other	Debris pile, wood chip pile.	400				Well site, centre of disturbed area and southeast of it.	AMSRP		
3-2.1	3 Young Inlet		2.1	1 NhW-Drums	Airstrip: 6 full, 4 partial, 99 empty		109	drums		Airstrip	AMSRP		
3-2.1-2	3 Young Inlet		2.1	2 NhW-Drums	Well Site: 4 full, 6 empty		10	drums		Well site	AMSRP		
3-2.2	3 Young Inlet		2.2	1 NhW-Metal	Airstrip: Long pipes, misc metal, metal hood		15	m3		Southeast and northeast of airstrip	AMSRP		
3-2.2-2	3 Young Inlet		2.2	2 NhW-Metal	Well Site: misc metal		105	m3		Southeast by sump and northeast by burn pit	AMSRP		
3-2.3	3 Young Inlet		2.3	1 NhW-Wood	Centre of Site and northeast of Site: Wood chip piles		23	m3		Centre of Site and northeast of Site	AMSRP		
3-2.4	3 Young Inlet		2.4	1 NhW-Other	Plastic, styrofoam, mud pile, bags of concrete		20	m3		Southwest side of Site, east side of Site	AMSRP		
3-3.2	3 Young Inlet		3.2	1 HW-Organic liqu	Aged fuel in drums		2.5	m3		Airstrip and wellsite.	AMSRP		
3-4.2	3 Young Inlet	During the primary aerial surveillance of the well site area a large disturbed area was identified around the well head, and two suspected sumps (southeast of the well head). During the site visit a large sump located on the southeast portion of the Site was observed to contain various rusted metal and wood debris (storage drums, sheet metal, miscellaneous metal). A large metal debris piles, burn pit and two stained areas were observed around the large sump area. A second smaller sump and possible drainage ditch was identified in the south portion of the disturbed area. Two large stained areas with petroleum hydrocarbon odours were observed on the southwest portion of the disturbed area. Two debris piles with various types of metal debris (cans, wire, vehicle parts. and miscellaneous metal), a stained area, and burn pit were observed on the northeast corner of the disturbed area. Other site observations include a burn pit east of the disturbed area and a four (4) large pipes south east of the disturbed area, plastic debris along a drainage ditch west of the disturbed area.	4.2	1 Soils-Metals & Pl	Stained area: Molybdenum, PHC F1, Phenanthrene, Naphthalene		25	m3	Medium	West portion of disturbed area	CCME-Ag.		
3-4.2-2	3 Young Inlet		4.2	2 Soils-Metals & Pl	Debris pile and stained area: Barium, Nickel, Molybdenum, Zinc, PHC F2, F3, F4		23	m3	High	Debris pile and stained area on northeast corner of disturbed area	CCME-Ag.		
3-4.2-3	3 Young Inlet		4.2	3 Soils-Metals & Pl	Perimeter and downgradient of former WESA exceedances: Barium, Lead, Moybdenum, PHC F2, F3, F4, F4(grav)		100	m3	High	Perimeter and downgradient of former WESA exceedances	CCME-Ag.		
3-4.2-4	3 Young Inlet		4.2	4 Soils-Metals & Pl	Remaining disturbed area: Barium, Molybdenum, PHC F3		480	m3	High	Coverage of remaining disturbed area (central and western)	CCME-Ag.		
3-4.2-5	3 Young Inlet		4.2	5 Soils-Metals & Pl	Drum cache 2: Molybdenum, Nickel, PHC F1		95	m3	High	Drum Cache 2	CCME-Ag.		
3-4.3	3 Young Inlet		4.3	1 Soils-PHCs	Drum cache 1: PHC F3		1.4	m3	High	Drum Cache 1	CWS-PHCs		
3-4.4	3 Young Inlet		4.4	1 Soils-Metals	Stained area in southwest portion of disturbed area: Barium, Molybdenum, Zinc, Chromium IV, Phenanthrene		120	m3	High	Stained area in southwest portion of disturbed area	CCME-Ag.		
3-5.1	3 Young Inlet		5.1	1 Surface Water	Suspected sump: Cadmium					Suspected sump	CWQG-PFAL		
3-5.1-2	3 Young Inlet		5.1	2 Surface Water	Suspected sump southeast of disturbed area: Cadmium, Copper					Suspected sump southeast of disturbed area	CWQG-PFAL		
4-1.2	4 Stokes Range	Stokes Range was accessed on August 5 and 8, 2013, via helicopter from Resolute Bay, Nunavut. During the primary aerial surveillance of the Site, a rectangular disturbed area, two suspected sump locations (north and northwest of the disturbed area) and an airstrip (west of the disturbed area) were identified. During the site visit, two debris piles, three burn pits and one disturbed area with PHC-suspect staining was observed around the identified well head. A burn pit with wood debris and a debris pile containing suspected drill cuttings was identified west of the disturbed area. A number of soil piles were observed east of the airstrip.	1.2	1 PH-Other	3 small debris piles.	15				West/southwest of disturbed area.	AMSRP		
4-2.3	4 Stokes Range		2.3	1 NhW-Wood	Debris pile 1 central: misc wood		2	m3		Debris pile 1 central	AMSRP		
4-2.3-2	4 Stokes Range		2.3	2 NhW-Wood	Debris pile 3 south: shredded wood		2	m3		Debris pile 3 south	AMSRP		
4-2.4	4 Stokes Range		2.4	1 NhW-Other	Debris pile 1 central, Debris pile 3 south: misc plastic		10	m3		Debris pile 1 central, debris pile 3 south	AMSRP		
4-2.4-2	4 Stokes Range		2.4	2 NhW-Other	Debris pile 2 south: brown clay silt material		5	m3		Debris pile 2 south	AMSRP		
4-4.2	4 Stokes Range		4.2	1 Soils-Metals & Pl	Previous detected PHC exceedance: Barium, Chromium VI, Lead, PHC F3		133	m3	High	Previous detected PHC exceedance	CCME-Ag.		
4-4.3	4 Stokes Range		4.3	1 Soils-PHCs	Historic drilling activity area: PHC F2		3.4	m3	Low	Historic drilling activity area	CWS-PHCs		
4-4.3-2	4 Stokes Range		4.3	2 Soils-PHCs	Burn pit: Naphthalene, Ethylbenzene, Toluene		0.4	m3	Medium	Burn pit	CWS-PHCs		
5-1.2	5 Ile Vanier APEC 1	APEC 1 Hotspur J-20 was accessed on August 9, 2013, via helicopter from Resolute Bay, Nunavut. During the site visit a central disturbed area was identified with a well area, and wooden debris from a former building. Suspected sumps were identified north and east of the disturbed area with crushed and submerged drums within the latter, along with other types of metal debris (steel cables, pipes, etc.). An area with ponded water and stains was identified southeast of the disturbed area with multiple crushed drums. A second disturbed area was observed west of the central disturbed area and south of the former building footprint, with two metal posts, ground surface stains, wood and metal debris. Other Site observations include drums in the northeast portion of the APEC containing drill parts, a suspected sump in the southwest portion of the APEC with a crushed drum, miscellaneous debris around the site (plywood, and other wood debris and metal pipes).	1.2	1 PH-Other	2 minor wooden debris piles, wooden beams, crushed metal cans, metal pipes	600				Various.	AMSRP		
5-2.1	5 Ile Vanier APEC 1		2.1	1 NhW-Drums	10 empty drums		10	drums			AMSRP		
5-2.2	5 Ile Vanier APEC 1		2.2	1 NhW-Metal	West side: crushed metal cans		30	m3		West side of Site	AMSRP		
5-2.2-2	5 Ile Vanier APEC 1		2.2	2 NhW-Metal	Southeast corner: metal pipes and wire		4	m3		Southeast corner of Site	AMSRP		
5-2.3	5 Ile Vanier APEC 1		2.3	1 NhW-Wood	Wellhead: wooden beams and minor debris		10	m3		Wellhead	AMSRP		
5-2.3-2	5 Ile Vanier APEC 1		2.3	2 NhW-Wood	Former building: minor debris		3	m3		Former building	AMSRP		
5-4.2	5 Ile Vanier APEC 1		4.2	1 Soils-Metals & Pl	Central disturbed area: Barium, Lead, PHC F1, F2, F3, Naphthalene, Trichlorobenzene 1,2,4, Dichlorobenzene 1,2, Dichlorobenzene 1,4, Benzo (b) pyridine, Ethylbenzene, Toluene, Fluorene, Benzene, Total Xylenes		100	m3	High	Central disturbed area	CCME-Ag.		
5-4.3	5 Ile Vanier APEC 1		4.3	1 Soils-PHCs	West disturbed area: PHC F1, F2, Phenanthrene, Benzo (b) pyridine		36	m3	Low	West disturbed area	CWS-PHCs		
5-4.3-2	5 Ile Vanier APEC 1		4.3	2 Soils-PHCs	Stained area: PHC F2, F3		200	m3	Very High	Stained area with water	CWS-PHCs		
6-1.2	6 Ile Vanier APEC 2	APEC 2 and 5 Sophie Point was accessed on August 10 and 12, 2013, via helicopter from Resolute Bay, Nunavut. During the primary aerial surveillance of APEC 2 a large main disturbed area was identified bordering two suspected sumps and four ponded areas. The suspected sumps were observed to the northeast and northwest of the main disturbed area, and a stream was observed extending in an east to west direction along the south portion of the APEC south of the disturbed area. During the primary aerial surveillance of APEC 5, a large rectangular disturbed area was identified (remains of the airstrip). During the site visit to APEC 2 the well area was identified on the north portion and east of a suspected sump. The previous WESA sampling point NB038-SS-022 was observed between two ponded areas, and WESA sampling point NB038-SS-023 was observed to the east (up gradient of the ponded areas). The ponded areas were connected by an observed saturated area which extended in a westerly direction to a west drainage ditch and southerly to a south drainage ditch. Both the west and south drainage ditches flowed into a small stream south of APEC 2, the stream was observed to flow in a westerly direction into a larger river (west of APEC 2). During the delineation investigation of the previous sampling points NB038-SS-022 and NB038-SS-023, multiple impacts (staining and odours) were observed both up and down gradient of the sampling points. No sampling or screening was conducted on APEC 5.	1.2	1 PH-Other	Minor wooden and metal debris	100				Various.	AMSRP	Y	0-200
6-2.1	6 Ile Vanier APEC 2		2.1	1 NhW-Drums	5 empty drums		5	drums		Various.	AMSRP	Y	0
6-2.2	6 Ile Vanier APEC 2		2.2	1 NhW-Metal	Central: metal pipes and misc metal		5	m3		Central disturbed area	AMSRP	Y	0
6-2.3	6 Ile Vanier APEC 2		2.3	1 NhW-Wood	Wellhead: minor wooden debris		5	m3		Wellhead	AMSRP	Y	50
6-4.2	6 Ile Vanier APEC 2		4.2	1 Soils-Metals & Pl	Central ponded area: Barium, Chromium VI, PHC F1, F2, Benzene, Ethylbenzene, Toluene, Total Xylenes, Naphthalene, Benzo (b) pyridine		1276	m3	High	Central ponded area	CCME-Ag.	Y	0-20
6-4.4	6 Ile Vanier APEC 2		4.4	1 Soils-Metals	Sump: Barium, Lead		50	m3	Very High	Sump	CCME-Ag.	Y	0-20
6-5.1	6 Ile Vanier APEC 2		5.1	1 Surface Water	Northeast sump: Iron, Chloride					Northeast sump	CWQG-PFAL	Y	50
6-5.1-2	6 Ile Vanier APEC 2		5.1	2 Surface Water	Ponded water: Aluminum, Copper, Iron, Selenium, Chloride					Ponded water	CWQG-PFAL	Y	0

ID	Site	Site Description	Waste Code	Description	Area (m2)	Vol./Quant.	Units	Uncert.	Location in APEC	Basis	SW Present?	Distance (m)
6-5.2	6 Ile Vanier APEC 2		5.2 1 Groundwater	Central ponded area: Aluminum, Cadmium, Iron, Selenium, Zinc, Chloride, pH, Sulphate, PHC F1, Naphathalene					Delineation of impacts - central ponded area	CWQG-PFAL	Y	0
7-1.2	7 Ile Vanier APEC 3	As a result of executing a reduced field program, APEC 3 Key Point was only given a fly-over on August 15, 2013, with the collection of photographs across the full extent of the site	1.2 1 PH-Other	Undetermined								
8-2.1	8 Ile Vanier APEC 4	APEC 4 Hotspur was accessed on August 22, 2013, via Twin Otter from Resolute Bay, Nunavut. During the primary aerial surveillance of APEC 4, first occurring on August 2, 2013,	2.1 1 NhW-Drums	3 partial, 221 empty drums		224	drums		Barrel cache	AMSRP		
8-3.4	8 Ile Vanier APEC 4	in order to complete the assessment of the runway suitability for Buffalo aircraft two large drum caches along the northeast portion of the airstrip were observed. The start of the	3.4 1 HW-Press. cylind	Empty compressed gas cylinders (8)		8	cylinders		Barrel cache	AMSRP		
8-3.2	8 Ile Vanier APEC 4	roadway leading to APEC 1 was also observed north of the eastern end of the airstrip. During the site visit a survey of the barrel caches was completed on arrival, followed by test	3.2 1 HW-Organic liqu	Aged fuel in drums		0.5	m3		Barrel cache	AMSRP		
8-4.3	8 Ile Vanier APEC 4	pit investigation/delineation of observed impacts around both barrel caches. No surface water sample was taken from the stream shown on the NTS topographic map due to lack of water and snow cover.	4.3 1 Soils-PHCs	Southern drum cache: PHC F1, F2, Benzo (b) Pyridine, Naphthalene, Phenanthrene, Benzene, Ethylbenzene, Hexane, Toluene		13	m3	High	Southern drum cache	CWS-PHCs		
9-1.2	9 Bent Horn APEC 1	As a result of executing a reduced field program, APEC 1 was not investigated, nor was a new fly-over completed. A fly-over was completed during the previous investigation	1.2 1 PH-Other	Undetermined								
10-1.2	10 Bent Horn APEC 2	As a result of executing a reduced field program, APEC 2 was not investigated, nor was a new fly-over completed. A fly-over was completed during the previous investigation.	1.2 1 PH-Other	Undetermined								
11-1.2	11 Bent Horn APEC 3	As a result of executing a reduced field program, APEC 3 was not investigated by the ESA field team. A fly-over was completed during the geotechnical investigation, and updated	1.2 1 PH-Other	Undetermined								
11-4.3	11 Bent Horn APEC 3	site photographs were taken.	4.3 1 Soils-PHCs	Vicinity of previous WESA sample: PHC F3		600	m3	Very High	Vicinity of WESA sample NB014-SS017	CWS-PHCs		
11-4.3-2	11 Bent Horn APEC 3		4.3 2 Soils-PHCs	Vicinity of previous WESA sample: PHC F2, F3		600	m3	Very High	Vicinity of WESA sample NB014-SS020/21	CWS-PHCs		
11-4.3-3	11 Bent Horn APEC 3		4.3 3 Soils-PHCs	Vicinity of previous WESA sample: PHC F2, F3		600	m3	Very High	Vicinity of WESA sample NB014-SS022/23	CWS-PHCs		
11-4.3-4	11 Bent Horn APEC 3		4.3 4 Soils-PHCs	Vicinity of previous WESA samples: PHC F1, F2, Ethylbenzene, fluorene, naphthalene		600	m3	Very High	Vicinity of WESA sample NB014-SS024/25	CWS-PHCs		
11-4.3-5	11 Bent Horn APEC 3		4.3 5 Soils-PHCs	Vicinity of previous WESA samples: PHC F1, F2, naphthalene		600	m3	Very High	Vicinity of WESA sample NB014-SS027/28	CWS-PHCs		
12-1.2	12 Bent Horn APEC 4	As a result of executing a reduced field program, APEC 4 was not investigated, nor was a new fly-over completed. It was visited during the previous investigation.	1.2 1 PH-Other	Undetermined								
12-4.4	12 Bent Horn APEC 4		4.4 1 Soils-Metals	East edge of disturbed area: Boron, Undetermined		0	m3	Medium	East edge of disturbed area			
13-2.1	13 Bent Horn APEC 6	Bent Horn APEC 6 was accessed on August 15, 19 and 21, 2013, via helicopter or Twin Otter from Resolute Bay, Nunavut. During the primary aerial surveillance of the Site a	2.1 1 NhW-Drums	10 full drums		10	drums			AMSRP		
13-3.2	13 Bent Horn APEC 6	distinct airstrip and disturbed areas were visible in the approximate location of the former camp facility, land fill, and tank farm. During the site visit, the previous WESA sampling	3.2 1 HW-Organic liqu	Aged fuel in drums		2	m3			AMSRP		
13-4.2	13 Bent Horn APEC 6	locations NB014-SS-009/010, and 011 were located in a disturbed area southeast of the airstrip. Closer inspection of the former WESA sampling location (NB014-SS-009/010) showed the presence of an oily residue on the surface of the soils. The former WESA sampling location with the oily residue was re-sampled (NB014-6-SS6). Based on the visual evidence of suspected impacts, six (6) soil samples were collected and submitted for laboratory analysis of the COCs around the perimeter of the former WESA sampling locations	4.2 1 Soils-Metals & P	South disturbed area: Copper, PHC F1, F2, F3, F4, most PAH parameters, ethylbezene		2	m3	Low	APEC 6 Main Camp and Production Facility	CCME-Ag.		
13-4.3	13 Bent Horn APEC 6	(down gradient). The previous WESA sampling location NB014-SS-004 was located in a disturbed area northeast of the airstrip, which was observed to slope in a northern	4.3 1 Soils-PHCs	North disturbed area: PHC F1 & F2, Ethylbenzene, Total Xylenes, Tetrachloroethane 1,1,2,2, trichloroethane, 1, 1, 2		90	m3	Low	APEC 6 Main Camp and Production Facility	CWS-PHCs		
13-4.4	13 Bent Horn APEC 6	direction towards a ponded/saturated area. During the delineation investigation multiple impacts (staining and odours) were observed both up and down gradient of the	4.4 1 Soils-Metals	Proximity to landfill: Chromium		490	m3	High	APEC 6 Main Camp and Production Facility	CCME-Ag.		
13-4.4-2	13 Bent Horn APEC 6	previous sampling point. Based on the visual evidence of suspected impacts, eleven (11) soil samples were collected and submitted for laboratory analysis of the COCs around the	4.4 2 Soils-Metals	Disturbed area northeast of airstrip: Chromium		0	m3	Low	Disturbed area northeast of airstrip	CCME-Ag.		
13-5.1	13 Bent Horn APEC 6	perimeter of the former WESA sampling locations.	5.1 1 Surface Water	Near landfill: Iron, Selenium, Chloride					Near landfill	CWQG-PFAL		
13-5.1-2	13 Bent Horn APEC 6		5.1 2 Surface Water	Pond 1 north disturbed area: Aluminum, Iron, Chloride, Anthracene, Benzo(a)anthracene, Pyrene					Pond 1 north disturbed area	CWQG-PFAL		
13-5.1-3	13 Bent Horn APEC 6		5.1 3 Surface Water	Pond 2 north disturbed area: Aluminum, Iron, Selenium, Copper, Chloride					Pond 2 north disturbed area	CWQG-PFAL		
13-5.2	13 Bent Horn APEC 6		5.2 1 Groundwater	North disturbed area: Cadmium, Copper, Iron, Selenium, Zinc, PHC F1, F2, Benzo(b)pyridine, Naphthalene, Chloride, pH					North disturbed area	CWQG-PFAL		
14-1.2	14 K-12	As a result of executing a reduced field program, the K-07 well site was only given a fly-over, with collection of photographs across the full extent of the site. Based on that information, the site appears to consist of a disturbed area around a standing well marker next to a major stream entering a bay, with a large strip that may have been cleared for use as a temporary airstrip to the southeast. A square area approximately 20 m on a side appears to be a backfill area, perhaps for a dump, and a tire sits along one edge. An empty drum sits within the stream channel. Overall the K-07 well site shows a lesser degree of disturbance when viewed from the air than the more heavily impacted APECs.	1.2 1 PH-Other	Undetermined								
15-1.2	15 M-21	As a result of executing a reduced field program, the M-21 well site was only given a fly-over, with collection of photographs across the full extent of the site. Based on that information, the site appears to consist of a disturbed area around a standing well marker, a major stream is located approximately 1 km northwest of the Site, and the Site is approximately 3 km west from the coast. A ponded area, which may be a sump, lies on the edge of the disturbed area. Two empty drum sit partially buried in the sandy surface materials approximately 200 m north from the well marker. An airstrip is marked on the site plan. Overall the M-21 well site, as with the K-07 well site, shows a lesser degree of disturbance when viewed from the air than the more heavily impacted APECs.	1.2 1 PH-Other	Undetermined								
16-1.2	16 G-07	As a result of executing a reduced field program, the G-07 well site was only given a fly-over, with collection of photographs across the full extent of the site. Based on that information, the site appears to consist of a disturbed area with a standing well marker and well box at its northern edge approximately 1 km inland (west) from the coast. The area of disturbance consists of cobble and boulder materials. A large rust coloured stained area can be seen along the northern edge of the disturbed area, in proximity to a square area of apparent backfill – suggests a metal-containing dump site or similar. A further square area is located west of the well marker, and may mark another area of backfill or may be a borrow pit. An airstrip is marked on the NTS map at the Site, however no evidence of an airstrip was seen from the air. Overall the G-07 well site, as with the K-07 well site, shows a lesser degree of disturbance when viewed from the air than the more heavily impacted APECs.	1.2 1 PH-Other	Undetermined								

Codes

Sites

1	N-12	
2	J-34	
3	Young Inlet	
4	Stokes Range	
5	Ile Vanier APEC 1	
6	Ile Vanier APEC 2	
7	Ile Vanier APEC 3	
8	Ile Vanier APEC 4	
9	Bent Horn APEC 1	
10	Bent Horn APEC 2	
11	Bent Horn APEC 3	
12	Bent Horn APEC 4	
13	Bent Horn APEC 6	
14	K-12	
15	M-21	
16	G-07	

Basis

CWQG-PFAL	Canadian Water Quality Guidelines For the Protection of Freshwater Aquatic Life	
CCME-Ag.	Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health Residential/Parkland Land Use	
CWS-PHCs	Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil	
PQRA	Stantec PQRAs	
AMSRP	Abandoned Military Site Remediation Protocol	

Waste Code

1	Physical Hazards:	4.2	Soils-Metals & PHCs
1.1	PH-Buildings	4.3	Soils-PHCs
1.2	PH-Other	4.4	Soils-Metals
2	Non-hazardous Waste:	5	Water:
2.1	NhW-Drums	5.1	Surface Water
2.2	NhW-Metal	5.2	Groundwater
2.3	NhW-Wood		
2.4	NhW-Other		
3	Hazardous Waste:		
3.1	HW-Asbestos		
3.2	HW-Organic liquids		
3.3	HW-Leach. lead paint		
3.4	HW-Press. cylinders		
3.5	HW-Other		
4	Soils:		
4.1	Soils-PCBs		

Table A-2 ROs

Table A-2. Remedial Options

1=Cost, 2=Effectiveness, 3=Timeframe, 4=Ease, 5=Regulatory, 6=Community, 7=Monitoring, W=W.Score [weights: 1=0.2, 2=0.25, 3=0.1, 4=0.1, 5=0.15, 6=0.1, 7=0.1]

ID					Site	RO 1	1	2	3	4	5	6	7	W	Rank	RO 2	1	2	3	4	5	6	7	W	Rank	RO 3	1	2	3	4	5	6	7	W	Rank	RO 4	1	2	3	4	5	6	7	W	Rank	Rec. RO	Description	Linkages	Rationale	Updated	Upd. Basis
1-1.1	750	m2		depressions filled with wood debris and ponded water.	1 N-12	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	1	5	5	1	1	1	2.6	4	C2	NhW-Central-site disposal		As only footprints with debris present, scoring same as non-haz wastes except for cost. Follow-up still		
1-1.2	1000	m2		pond. Six burn pits were observed throughout the Site which contained various types of	1 N-12	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	1	5	5	1	1	1	2.6	4	C2	NhW-Central-site disposal	1-2.x	As only footprints with debris present, scoring same as non-haz wastes except for cost. See comments for		
1-2.1	6	drums		6 empty drums.	1 N-12	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	2	5	5	1	1	1	2.85	4	C2	NhW-Central-site disposal		Good regulatory and community acceptability coupled with medium cost. Effectiveness score for 'No Action' adjusted from ROA, reflecting lack of regulatory driver for removal of N-Hw. Follow up for on-site disposal option should not be more than 3 years		
1-2.2	44	m3		Scrap metal, misc. metal, and old food cans.	1 N-12	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	2	5	5	1	1	1	2.85	4	C2	NhW-Central-site disposal		Good regulatory and community acceptability coupled with medium cost. Effectiveness score for 'No Action' adjusted from ROA, reflecting lack of regulatory driver for removal of N-Hw. Follow up for on-site disposal option should not be more than 3 years		
1-2.3	20	sheets		Plywood 4x8 sheets.	1 N-12	A2	1	5	5	2	4	4	5	3.65	3	D1	4	5	5	5	3	3	5	4.3	1	C2	2	4	5	4	4	4	4	3.7	2	H	5	2	5	5	1	1	1	2.85	4	D1	Wood-On-site burn		Cost advantage over disposal options greater than somewhat lesser degree of acceptability. Effectiveness score for 'No Action' adjusted from ROA, reflecting lack of regulatory driver for removal of N-Hw		
1-2.3-2	49	m3		Wood planks and beams.	1 N-12	A2	1	5	5	2	4	4	5	3.65	3	D1	4	5	5	5	3	3	5	4.3	1	C2	2	4	5	4	4	4	4	3.7	2	H	5	2	5	5	1	1	1	2.85	4	D1	Wood-On-site burn		Cost advantage over disposal options greater than somewhat lesser degree of acceptability. Effectiveness score for 'No Action' adjusted from ROA, reflecting lack of regulatory driver for removal of N-Hw		
1-2.4	5	m3		Plastic blue scrubbers, filters, and drill cuttings.	1 N-12	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	2	5	5	1	1	1	2.85	4	C2	NhW-Central-site disposal		Good regulatory and community acceptability coupled with medium cost. Effectiveness score for 'No Action' adjusted from ROA, reflecting lack of regulatory driver for removal of N-Hw		
1-4.1	33	m3		Burn pits. Barium, PHC F2, F3, F4 (grav), PCBs.	1 N-12	A1	1	5	4	3	4	4	5	3.65	1	C3	2	4	4	4	3	3	4	3.35	3	F2	3	4	5	5	3	3	1	3.45	2	D3	1	3	4	1	3	3	3	2.5	4	A1	HW-Off-site disposal		Easier to implement an on-site cover solution than excavating and moving soil, however need for follow-up on site renders score same as central site disposal. Thermal treatment acceptability by regulators unproven in north. In situ treatment cost, given energy requirements, will be highest of all options. Engineered cover should be cheaper than on-site disposal (smaller equipment, shorter time-frame), though		
1-4.4	18	m3		North area with metal debris. Barium.	1 N-12	B4	2	3	5	4	2	2	2	2.75	4	F2	3	4	5	5	3	3	1	3.45	1	H	5	2	5	5	3	3	1	3.35	2	A1	1	4	5	2	4	4	4	3.3	3	F2	Engineered cover		Risk assessment results show negligible risk associated with these impacts - effectiveness of off-site removal not that great given low risk to begin with. Effectiveness of engineered cap relative increase	Y	PQRA
1-5.1	0		0	Big pond. Aluminum, Cadmium, Lead.	1 N-12	D6	2	2	4	4	3	3	2	2.65	3	G2	4	2	1	5	3	3	4	3.05	2	H	5	2	5	5	2	2	5	3.5	1									0	4	H	No Remediation - RMA		Risk assessment results show negligible risk associated with these impacts. Water treatment alone probably not very effective - sediment dredging required - effectiveness score for water treatment decreased from ROA. Water treatment cost not that high, increased score to 2	Y	PQRA
2-1.1	320	m2		Two trailers	2 J-34	E1	1	5	4	4	3	3	4	3.4	2	E2	3	4	5	4	3	3	4	3.65	1	H	5	1	5	5	2	2	1	2.85	3									0	4	E2	Demolition: w/o pre-assessment		Low likelihood of encountering hazardous building materials renders no pre-assessment demolition lowest		
2-1.2	150	m2		Debris pile	2 J-34	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	1	5	5	1	1	1	2.6	4	C2	NhW-Central-site disposal		As per N-hw		
2-2.1	30	drums		Empty drums	2 J-34	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	2	5	5	1	1	1	2.85	4	C2	NhW-Central-site disposal	2-2.x	Good regulatory and community acceptability coupled with medium cost level		
2-2.2	82	m3		Metal pipes, misc metal waste	2 J-34	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	2	5	5	1	1	1	2.85	4	C2	NhW-Central-site disposal		Good regulatory and community acceptability coupled with medium cost level		
2-2.3	16	sheets		Plywood 4x8 sheets.	2 J-34	A2	1	5	5	2	4	4	5	3.65	3	D1	4	5	5	5	3	3	5	4.3	1	C2	2	4	5	4	4	4	4	3.7	2	H	5	2	5	5	1	1	1	2.85	4	D1	Wood-On-site burn		Cost advantage over disposal options greater than somewhat lesser degree of acceptability		
2-2.3-2	5	m3		Wooden beams (13) and pallets (7)	2 J-34	A2	1	5	5	2	4	4	5	3.65	3	D1	4	5	5	5	3	3	5	4.3	1	C2	2	4	5	4	4	4	4	3.7	2	H	5	2	5	5	1	1	1	2.85	4	D1	Wood-On-site burn		Cost advantage over disposal options greater than somewhat lesser degree of acceptability		
2-2.4	20	m3		White plastic pieces, bags of hardened concrete (3)	2 J-34	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1									0	4	C2	NhW-Central-site disposal		Good regulatory and community acceptability coupled with medium cost level		
2-3.4	8	cylinders		Compressed gas cylinders (8)	2 J-34	A1	2	5	5	2	4	4	5	3.85	1	C1	3	3	5	5	3	3	2	3.3	2	H	5	1	5	5	1	1	1	2.6	3									0	4	A1	HW-Off-site disposal		Low volume of hazardous material makes any options except off-site disposal non-viable. RMA added since		
2-3.5	4	batteries		Batteries (4)	2 J-34	A1	2	5	5	2	4	4	5	3.85	1	C1	3	3	5	5	2	2	2	3.05	2	H	5	1	5	5	1	1	1	2.6	3									0	4	A1	HW-Off-site disposal		Low volume of hazardous material makes any options except off-site disposal non-viable. RMA added since		
2-4.4	50	m3		North of water pond with metal debris, Barium	2 J-34	B4	3	3	5	4	2	2	2	2.95	4	F2	4	3	5	5	4	4	2	3.75	1	H	5	2	5	5	3	3	1	3.35	3	A1	1	5	5	2	4	4	5	3.65	2	F2	Engineered cover		Risk assessment results show negligible risk associated with these impacts	Y	PQRA
2-4.4-2	20	m3		Debris pile, Barium	2 J-34	B4	3	3	5	4	2	2	2	2.95	4	F2	4	3	5	5	4	4	2	3.75	1	H	5	2	5	5	3	3	1	3.35	3	A1	1	5	5	2	4	4	5	3.65	2	F2	Engineered cover		Risk assessment results show negligible risk associated with these impacts	Y	PQRA
2-5.1	0		0	Ponded water with metal debris: Aluminum, Cadmium	2 J-34	D6	2	2	4	4	3	3	2	2.65	3	G2	4	2	1	5	3	3	4	3.05	2	H	5	2	5	5	3	3	1	3.35	1									0	4	H	No Remediation - RMA		Risk assessment results show negligible risk associated with these impacts. Water treatment alone probably not very effective - sediment dredging required - effectiveness score for water treatment decreased from ROA. Water treatment cost not that high, increased score to 2	Y	PQRA
3-1.2	0	m2		Debris pile, wood chip pile.	3 Young Inlet	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	1	5	5	1	1	1	2.6	4	C2	NhW-Central-site disposal	3-2.x	As per N-hw		
3-2.1	109	drums		Airstrip: 6 full, 4 partial, 99 empty	3 Young Inlet	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	2	5	5	1	1	1	2.85	4	C2	NhW-Central-site disposal				
3-2.1-2	10	drums		Well Site: 4 full, 6 empty	3 Young Inlet	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	2	5	5	1	1	1	2.85	4	C2	NhW-Central-site disposal				
3-2.2	15	m3		Airstrip: Long pipes, misc metal, metal hood	3 Young Inlet	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	2	5	5	1	1	1	2.85	4	C2	NhW-Central-site disposal				
3-2.2-2	105	m3		Well Site: misc metal	3 Young Inlet	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	2	5	5	1	1	1	2.85	4	C2	NhW-Central-site disposal				
3-2.3	23	m3		Centre of Site and northeast of Site: Wood chip piles	3 Young Inlet	A2	1	5	5	2	4	4	5	3.65	3	D1	4	5	5	5	3	3	5	4.3	1	C2	2	4	5	4	4	4	4	3.7	2	H	5	2	5	5	1	1	1	2.85	4	D1	Wood-On-site burn				
3-2.4	20	m3		Plastic, styrofoam, mud pile, bags of concrete	3 Young Inlet	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	2	5	5	1	1	1	2.85	4	C2	NhW-Central-site disposal		I'm assuming it's possible to do off-site disposal with twin otter or helo		
3-3.2	2.5	m3		Aged fuel in drums	3 Young Inlet	A1	1	5	5	2	4	4	5	3.65	2	D2	4	4	5	5	3	3	5	4.05	1	H	5	1	5	5	1	1	1	2.6	3									0	4	D2	OL-On-site incineration		I'm assuming it's possible to do off-site disposal with twin otter or helo		
3-4.2	25	m3		Stained area: Molybdenum, PHC F1, Phenanthrene, Naphthalene	3 Young Inlet	D3	1	4	4	1	3	3	3	2.75	3	D5	2	4	3	2	4	4	4	3.3	2	H	5	2	5	5	3	3	1	3.35	1									0	4	H	No Remediation - RMA		stains and soil impacts not as a significant an issue for acceptance as debris	Y	PQRA
3-4.2-2	23	m3		Debris pile and stained area: Barium, Nickel, Molybdenum, Zinc, PHC F2, F3, F4	3 Young Inlet	D3	1	4	4	1	3	3	3	2.75	3	D5	2	4	3	2	4	4	4	3.3	2	H	5	2	5	5	3	3	1	3.35	1									0	4	H	No Remediation - RMA		stains and soil impacts not as a significant an issue for acceptance as debris	Y	PQRA
3-4.2-3	100	m3		Perimeter and downgradient of former WESA exceedances: Barium, Lead, Moybdenum, PHC F2, F3, F4, F4(grav)	3 Young Inlet	D3	1	4	4	1	3	3	3	2.75	3	D5	2	4	3	2	4	4	4	3.3	2	H	5	2	5	5	3	3	1	3.35	1									0	4	H	No Remediation - RMA			Y	PQRA
3-4.2-4	480	m3		Remaining disturbed area: Barium, Molybdenum, PHC F3	3 Young Inlet	D3	1	4	4	1	3	3	3	2.75	3	D5	2	4	3	2	4	4	4	3.3	2	H	5	2	5	5	3	3	1	3.35	1									0	4	H	No Remediation - RMA			Y	PQRA
3-4.2-5	95	m3		Drum cache 2: Molybdenum, Nickel, PHC F1	3 Young Inlet	D3	1	4	4	1	3	3	3	2.75	3	D5	2	4	3	2	4	4	4	3.3	2	H	5	2	5	5	3	3	1	3.35	1									0	4	H	No Remediation - RMA			Y	PQRA
3-4.3	1.4	m3		Drum cache 1: PHC F3	3 Young Inlet	D3	1	4	4	1	3	3	3	2.75	3	D4	2	4	3	4	4	4	3	3.4	1	H	5	2	5	5	3	3	1	3.35	2									0	4	D4	PHC Soil-On-site Ex-situ treatment			Y	PQRA
3-4.4	120	m3		Stained area in southwest portion of disturbed area: Barium, Molybdenum, Zinc, Chromium IV, Phenanthrene	3 Young Inlet	B4	2	3	5	4	2	2	2	2.75	4	F2	4	3	5	5	4	4	2	3.75	1	H	5	2	5	5	3	3	1	3.35	3	A1	1	5	5	2	4	4	5	3.65	2	F2	Engineered cover		needed to tweak this one to avoid off-site disposal for what should be considered low risk impacts	Y	PQRA
3-5.1	0		0	Suspected sump: Cadmium	3 Young Inlet	D6	2	2	4	4	3	3	2	2.65	3	G2	4	2	1	5	3	3	4	3.05	2	H	5	2	5	5	2	2	1	3.1	1									0	4	H	No Remediation - RMA			Y	PQRA
3-5.1-2	0		0	Suspected sump southeast of disturbed area: Cadmium, Copper	3 Young Inlet	D6	2	2	4	4	3	3	2	2.65	3	G2	4	2	1	5	3	3	4	3.05	2	H	5	2	5	5	2	2	1	3.1	1									0	4	H	No Remediation - RMA			Y	PQRA
4-1.2	15	m2		3 small debris piles.	4 Stokes Range	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	1	5	5	1	1	1	2.6	4	C2	NhW-Central-site disposal	4-2.x	As per N-hw		
4-2.3	2	m3		Debris pile 1 central: misc wood	4 Stokes Range	A2	1	5	5	2	4	4	5	3.65	3	D1	4	5	5	5	3	3	5	4.3	1	C2	2	4	5	4	4	4	4	3.7	2	H	5	2	5	5	1	1	1	2.85	4	D1	Wood-On-site burn				
4-2.3-2	2	m3		Debris pile 3 south: shredded wood	4 Stokes Range	A2	1	5	5	2	4	4	5	3.65	3	D1	4	5	5	5	3	3	5	4.3	1	C2	2	4	5	4	4	4	4	3.7	2	H	5	2	5	5	1	1	1	2.85	4	D1	Wood-On-site burn				
4-2.4	10	m3		Debris pile 1 central, Debris pile 3 south: misc plastic	4 Stokes Range	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	2	5	5	1	1	1	2.85	4	C2	NhW-Central-site disposal				
4-2.4-2	5	m3		Debris pile 2 south: brown clay silt material	4 Stokes Range	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	2	5	5	1	1	1	2.85	4	C2	NhW-Central-site disposal				
4-4.2	133	m3		Previous detected PHC exceedance: Barium, Chromium VI, Lead, PHC F3	4 Stokes Range	D3	1	4	4	1	3	3	3	2.75	3	D5	2	4	3	2	4	4	4	3.3	2	H	5	2	5	5	3	3	1	3.35	1									0	4	H	No Remediation - RMA			Y	PQRA
4-4.3	3.4	m3		Historic drilling activity area: PHC F2	4 Stokes Range	D3	1	4	4	1	3	3	3	2.75	3	D5	2	4	3	2	4	4	4	3.3	2	H	5	2	5	5	3	3	1	3.35	1									0	4	H	No Remediation - RMA			Y	PQRA
4-4.3-2	0.4	m3		Burn pit: Naphthalene, Ethylbenzene, Toluene	4 Stokes Range	D3	1	4	4	1	3	3	3	2.75	3	D5	2	4	3	2	4	4	4	3.3	2	H	5	2	5	5	3	3	1	3.35	1									0	4	H	No Remediation - RMA			Y	PQRA
5-1.2	600	m2		2 minor wooden debris piles, wooden beams, crushed metal cans, metal pipes	5 Ile Vanier APEC 1	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	1	5	5	1	1	1	2.6	4	C2	NhW-Central-site disposal	5-2.x	As per N-hw		
5-2.1	10	drums		10 empty drums	5 Ile Vanier APEC 1	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	2	5	5	1	1	1	2.85	4	C2	NhW-Central-site disposal				
5-2.2	30	m3		West side: crushed metal cans	5 Ile Vanier APEC 1	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	2	5	5	1	1	1	2.85	4	C2	NhW-Central-site disposal				
5-2.2-2	4	m3		Southeast corner: metal pipes and wire	5 Ile Vanier APEC 1	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	2	5	5	1	1	1	2.85	4	C2	NhW-Central-site disposal				
5-2.3	10	m3		Wellhead: wooden beams and minor debris	5 Ile Vanier APEC 1	A2	1	5	5	2	4	4	5	3.65	3	D1	4	5	5	5	3	3	5	4.3	1	C2	2	4	5	4	4	4	4	3.7	2	H	5	2	5	5	1	1	1	2.85	4	D1	Wood-On-site burn				
5-2.3-2	3	m3		Former building: minor debris	5 Ile Vanier APEC 1	A2	1	5	5	2	4	4	5	3.65	3	D1	4	5	5	5	3	3	5	4.3	1	C2	2	4	5	4	4	4	4	3.7	2	H	5	2	5	5	1	1	1	2.85	4	D1	Wood-On-site burn				
5-4.2	100	m3		Central disturbed area: Barium, Lead, PHC F1, F2, F3, Naphthalene, Trichlorobenzene 1,2,4, Dichlorobenzene 1,2, Dichlorobenzene 1,4, Benzo (b) pyridine, Ethylbenzene, Toluene, Fluorene, Benzene, Total Xylenes	5 Ile Vanier APEC 1	B4	2	3	4	4	2	2	2	2.65	3	C3	1	4	5	4	4	4	4	3.5	1	F2	3	4	5	5	3	3	1	3.45	2	D3	1	3	4	1	3	3	4	2.6	4	C3	Soil-Central-site disposal		large volume may require an additional field season with small equipment		
5-4.3	36	m3		West disturbed area: PHC F1, F2, Phenanthrene, Benzo (b) pyridine	5 Ile Vanier APEC 1	D3	1	4	4	1	3	3	3	2.75	3	D5	2	4	3	2	4	4	4	3.3	2	H	5	2	5	5	3	3	1	3.35	1									0	4	H	No Remediation - RMA			Y	PQRA
5-4.3-2	200	m3		Stained area: PHC F2, F3	5 Ile Vanier APEC 1	D3	1	4	4	1	3	3	3	2.75	3	D5	2	4	3	2	4	4	4	3.3	2	H	5	2	5	5	3	3	1	3.35	1									0	4	H	No Remediation - RMA			Y	PQRA
6-1.2	100	m2		Minor wooden and metal debris	6 Ile Vanier APEC 2	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	1	5	5	1	1	1	2.6	4	C2	NhW-Central-site disposal	6-2.x			
6-2.1	5	drums		5 empty drums	6 Ile Vanier APEC 2	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	2	5	5	1	1	1	2.85	4	C2	NhW-Central-site disposal				
6-2.2	5	m3		Central: metal pipes and misc metal	6 Ile Vanier APEC 2	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	2	5	5	1	1	1	2.85	4	C2	NhW-Central-site disposal				
6-2.3	5	m3		Wellhead: minor wooden debris	6 Ile Vanier APEC 2	A2	1	5	5	2	4	4	5	3.65	3	D1	4	5	5	5	3	3	5	4.3	1	C2	2	4	5	4	4	4	4	3.7	2	H	5	2	5	5	1	1	1	2.85	4	D1	Wood-On-site burn				
6-4.2	1276	m3		Central ponded area: Barium, Chromium VI, PHC F1, F2, Benzene, Ethylbenzene, Toluene, Total Xylenes, Naphthalene, Benzo (b) pyridine	6 Ile Vanier APEC 2	D3	1	4	4	1	3	3	3	2.75	3	D4	2	4	3	2	4	4	3	3.2	2	H	5	2	5	5	3	3	1	3.35	1									0	4	H	No Remediation - RMA		heavy machinery needed here given volume	Y	PQRA
6-4.4	50	m3		Sump: Barium, Lead	6 Ile Vanier APEC 2	B4	2	3	5	4	2	2	2	2.75	4	F2	4	3	5	5	4	4	2	3.75	1	H	5	2	5	5	3	3	1	3.35	3	A1	1	5	5	2	4	4	5	3.65	2	F2	Engineered cover			Y	PQRA
6-5.1	0		0	Northeast sump: Iron, Chloride	6 Ile Vanier APEC 2	D5	2	4	3	4	4	4	4	3.5	1	G2	4	2	1	5	3	3	4	3.05	3	H	5	2	5	5	3	3	1	3.35	2									0	4	D5	PHC Soil-Central-site treatment			Y	PQRA
6-5.1-2	0		0	Ponded water: Aluminum, Copper, Iron, Selenium, Chloride	6 Ile Vanier APEC 2	D6	2	2	4	4	3	3	2	2.65	3	G2	4	2	1	5	3	3	4	3.05	2	H	5	2	5	5	3	3	1	3.35	1									0	4	H	No Remediation - RMA			Y	PQRA
6-5.2	0		0	Central ponded area: Aluminum, Cadmium, Iron, Selenium, Zinc, Chloride, pH, Sulphate, PHC F1, Naphathalene	6 Ile Vanier APEC 2	D6	2	2	4	4	3	3	2	2.65	3	G2	4	2	1	5	3	3	4	3.05	2	H	5	2	5	5	3	3	1	3.35	1									0	4	H	No Remediation - RMA			Y	PQRA
7-1.2	0		0	Undetermined	7 Ile Vanier APEC 3	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1									0	4	C2	NhW-Central-site disposal		Unknown		
8-2.1	224	drums		3 partial, 221 empty drums	8 Ile Vanier APEC 4	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1	H	5	2	5	5	1	1	1	2.85	4	C2	NhW-Central-site disposal				
8-3.4	8	cylinders		Empty compressed gas cylinders (8)	8 Ile Vanier APEC 4	A2	1	5	5	2	4	4	5	3.65	1	B2	4	3	5	4	2	2	3	3.25	2	H	5	1	5	5	1	1	1	2.6	3									0	4	A2	NhW-Off-site disposal		I'm assuming it's possible to do off-site disposal with twin otter or helo		
8-3.2	0.5	m3		Aged fuel in drums	8 Ile Vanier APEC 4	A1	1	5	5	2	4	4	5	3.65	2	D2	4	4	5	5	3	3	5	4.05	1	H	5	1	5	5	1	1	1	2.6	3									0	4	D2	OL-On-site incineration		I'm assuming it's possible to do off-site disposal with twin otter or helo		
8-4.3	13	m3		Southern drum cache: PHC F1, F2, Benzo (b) Pyridine, Naphthalene, Phenanthrene, Benzene, Ethylbenzene, Hexane, Toluene	8 Ile Vanier APEC 4	D3	1	4	4	1	3	3	3	2.75	3	D4	2	4	3	4	4	4	3	3.4	1	H	5	2	5	5	3	3	1	3.35	2									0	4	D4	PHC Soil-On-site Ex-situ treatment			Y	PQRA
9-1.2	0		0	Undetermined	9 Bent Horn APEC 1	A2	1	5	5	2	4	4	5	3.65	2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1									0	4	C2	NhW-Central-site disposal				

1=Cost, 2=Effectiveness, 3=Timeframe, 4=Ease, 5=Regulatory, 6=Community, 7=Monitoring, W=W.Score [weights: 1=0.2, 2=0.25, 3=0.1, 4=0.1, 5=0.15, 6=0.1, 7=0.1]

ID				Site	RO 1	1	2	3	4	5	6	7	W	Rank
10-1.2	0	0	Undetermined	10 Bent Horn APEC 2	A2	1	5	5	2	4	4	5	3.65	2
11-1.2	0	0	Undetermined	11 Bent Horn APEC 3	A2	1	5	5	2	4	4	5	3.65	2
11-4.3	600 m3		Vicinity of previous WESA sample: PHC F3	11 Bent Horn APEC 3	D3	1	4	4	1	3	3	3	2.75	3
11-4.3-2	600 m3		Vicinity of previous WESA sample: PHC F2, F3	11 Bent Horn APEC 3	D3	1	4	4	1	3	3	3	2.75	3
11-4.3-3	600 m3		Vicinity of previous WESA sample: PHC F2, F3	11 Bent Horn APEC 3	D3	1	4	4	1	3	3	3	2.75	3
11-4.3-4	600 m3		Vicinity of previous WESA samples: PHC F1, F2, Ethylbenzene, fluorene, naphthalene	11 Bent Horn APEC 3	D3	1	4	4	1	3	3	3	2.75	3
11-4.3-5	600 m3		Vicinity of previous WESA samples: PHC F1, F2, naphthalene	11 Bent Horn APEC 3	D3	1	4	4	1	3	3	3	2.75	3
12-1.2	0	0	Undetermined	12 Bent Horn APEC 4	A2	1	5	5	2	4	4	5	3.65	2
12-4.4	0 m3		East edge of disturbed area: Boron, Undetermined	12 Bent Horn APEC 4	B4	2	3	4	4	2	2	2	2.65	3
13-2.1	10 drums		10 full drums	13 Bent Horn APEC 6	A2	1	5	5	2	4	4	5	3.65	2
13-3.2	2 m3		Aged fuel in drums	13 Bent Horn APEC 6	A1	1	5	5	2	4	4	5	3.65	2
13-4.2	2 m3		South disturbed area: Copper, PHC F1, F2, F3, F4, most PAH parameters, ethylbezene	13 Bent Horn APEC 6	B4	2	3	4	4	2	2	2	2.65	3
13-4.3	90 m3		North disturbed area: PHC F1 & F2, Ethylbenzene, Total Xylenes, Tetrachloroethane 1,1,2,2, trichloroethane, 1, 1, 2	13 Bent Horn APEC 6	A2	1	5	5	2	4	4	5	3.65	2
13-4.4	490 m3		Proximity to landfill: Chromium	13 Bent Horn APEC 6	F1	2	4	5	4	3	3	1	3.15	4
13-4.4-2	0 m3		Disturbed area northeast of airstrip: Chromium	13 Bent Horn APEC 6	F1	2	4	5	4	3	3	1	3.15	3
13-5.1	0	0	Near landfill: Iron, Selenium, Chloride	13 Bent Horn APEC 6	D6	2	2	4	4	3	3	2	2.65	2
13-5.1-2	0	0	Pond 1 north disturbed area: Aluminum, Iron, Chloride, Anthracene, Benzo(a)anthracene, Pyrene	13 Bent Horn APEC 6	D6	2	2	4	4	3	3	2	2.65	2
13-5.1-3	0	0	Pond 2 north disturbed area: Aluminum, Iron, Selenium, Copper, Chloride	13 Bent Horn APEC 6	D6	2	2	4	4	3	3	2	2.65	2
13-5.2	0	0	North disturbed area: Cadmium, Copper, Iron, Selenium, Zinc, PHC F1, F2, Benzo(b)pyridine, Naphthalene, Chloride, pH	13 Bent Horn APEC 6	D6	2	2	4	4	3	3	2	2.65	2
14-1.2	0	0	Undetermined	14 K-12	A2	1	5	5	2	4	4	5	3.65	2
15-1.2	0	0	Undetermined	15 M-21	A2	1	5	5	2	4	4	5	3.65	2
16-1.2	0	0	Undetermined	16 G-07	A2	1	5	5	2	4	4	5	3.65	2

ID	RO 2	1	2	3	4	5	6	7	W	Rank	RO 3	1	2	3	4	5	6	7	W	Rank
10-1.2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1
11-1.2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1
11-4.3	D5	2	4	3	2	4	4	4	3.3	2	H	5	2	5	5	3	3	1	3.35	1
11-4.3-2	D5	2	4	3	2	4	4	4	3.3	2	H	5	2	5	5	3	3	1	3.35	1
11-4.3-3	D5	2	4	3	2	4	4	4	3.3	2	H	5	2	5	5	3	3	1	3.35	1
11-4.3-4	D5	2	4	3	2	4	4	4	3.3	2	H	5	2	5	5	3	3	1	3.35	1
11-4.3-5	D5	2	4	3	2	4	4	4	3.3	2	H	5	2	5	5	3	3	1	3.35	1
12-1.2	B2	4	3	5	4	2	2	3	3.25	3	C2	2	4	5	4	4	4	4	3.7	1
12-4.4	F2	3	3	5	5	3	3	1	3.2	2	H	5	2	5	5	3	3	1	3.35	1
13-2.1	C2	2	4	5	4	4	4	4	3.7	1	H	5	1	5	5	1	1	1	2.6	3
13-3.2	B1	3	3	5	4	2	2	2	2.95	3	D2	4	5	5	4	4	4	5	4.45	1
13-4.2	A1	1	4	5	4	4	4	4	3.5	1	F2	3	4	5	5	3	3	1	3.45	2
13-4.3	D4	3	4	3	4	4	4	4	3.7	1	H	5	2	5	5	3	3	1	3.35	3
13-4.4	F2	4	3	5	5	4	4	2	3.75	1	H	5	2	5	5	3	3	1	3.35	3
13-4.4-2	F2	3	3	5	5	3	3	1	3.2	2	H	5	2	5	5	3	3	1	3.35	1
13-5.1	H	5	2	5	5	3	3	1	3.35	1									0	3.5
13-5.1-2	H	5	2	5	5	3	3	1	3.35	1									0	3.5
13-5.1-3	H	5	2	5	5	3	3	1	3.35	1									0	3.5
13-5.2	H	5	2	5	5	3	3	1	3.35	1									0	3.5
14-1.2	B2	5	3	5	4	2	2	3	3.45	3	C2	2	4	5	4	4	4	4	3.7	1
15-1.2	B2	5	3	5	4	2	2	3	3.45	3	C2	2	4	5	4	4	4	4	3.7	1
16-1.2	B2	5	3	5	4	2	2	3	3.45	3	C2	2	4	5	4	4	4	4	3.7	1

ID	RO 4	1	2	3	4	5	6	7	W	Rank	Rec. RO	Description	Linkages	Rationale	Updated	Upd. Basis
10-1.2									0	4	C2	NhW-Central-site disposal				
11-1.2									0	4	C2	NhW-Central-site disposal				
11-4.3									0	4	H	No Remediation - RMA		barge/overland needed due to large quantity	Y	PQRA
11-4.3-2									0	4	H	No Remediation - RMA		barge/overland needed due to large quantity	Y	PQRA
11-4.3-3									0	4	H	No Remediation - RMA		barge/overland needed due to large quantity	Y	PQRA
11-4.3-4									0	4	H	No Remediation - RMA		barge/overland needed due to large quantity	Y	PQRA
11-4.3-5									0	4	H	No Remediation - RMA		barge/overland needed due to large quantity	Y	PQRA
12-1.2									0	4	C2	NhW-Central-site disposal				
12-4.4									0	4	H	No Remediation - RMA			Y	PQRA
13-2.1									0	4	C2	NhW-Central-site disposal				
13-3.2									0	4	D2	OL-On-site incineration				
13-4.2	D3	1	3	4	1	3	3	4	2.6	4	A1	HW-Off-site disposal				
13-4.3									0	4	D4	PHC Soil-On-site Ex-situ treatment			Y	PQRA
13-4.4	A1	1	5	5	2	4	4	5	3.65	2	F2	Engineered cover		500 cubes probably not feasible via herc	Y	PQRA
13-4.4-2									0	4	H	No Remediation - RMA		I don't see that there is a significant cost differential associated with distance within the APEC	Y	PQRA
13-5.1									0	3.5	H	No Remediation - RMA			Y	PQRA
13-5.1-2									0	3.5	H	No Remediation - RMA			Y	PQRA
13-5.1-3									0	3.5	H	No Remediation - RMA			Y	PQRA
13-5.2									0	3.5	H	No Remediation - RMA			Y	PQRA
14-1.2									0	4	C2	NhW-Central-site disposal		implementation scored conservatively		
15-1.2									0	4	C2	NhW-Central-site disposal		implementation scored conservatively		
16-1.2									0	4	C2	NhW-Central-site disposal		implementation scored conservatively		

(1) Codes

Remedial Options

A	Off-site Disposal:
A1	HW-Off-site disposal
A2	NhW-Off-site disposal
B	On-site Disposal:
B1	HW-On-site disposal
B2	NhW-On-site disposal
B4	Soil-On-site disposal
C	Central-site Disposal:
C1	HW-Central-site disposal
C2	NhW-Central-site disposal
C3	Soil-Central-site disposal
D	On-site Treatment:
D1	Wood-On-site burn
D2	OL-On-site incineration
D3	PCB/PHC Soil-On-site ex-situ thermal treatment
D4	PHC Soil-On-site Ex-situ treatment
D5	PHC Soil-Central-site treatment
D6	Water-On-site treatment
E	Demolition
F	Cap/cover:
F1	Engineered cap
F2	Engineered cover
G	Monitoring:
G1	Annual-5-yr-monitoring
G2	Specific monitoring
H	No Remediation - RMA

Table A-3 RMAs

Table A-3. Risk Management Approaches

Code	Type	IDs	Vol. (m^3)	RMA 1	1	2	3	4	5	6	7	WA	Rank	RMA 2	1	2	3	4	5	6	7	WA	Rank	RMA 3	1	2	3	4	5
4.2	Soils-Metals & PHCs	3-4.2, 3-4.2-2, 3-4.2-3, 3-4.2-4, 3-4.2-5, 4-4.2, 6-4.2, 13-4.2	2134	H1b	1	4	4	5	3	3	3	3.2	3	H4a	3	3	4	4	3	2	3	3.1	4	H5	4	5	4	2	3
4.3	Soils-PHCs	3, 11-4.3-4, 11-4.3-5, 13-4.3	3344	H1a	1	4	4	5	3	3	3	3.2	4	H3	3	3	5	5	3	2	3	3.3	3	H5	4	5	4	2	3
4.4	Soils-Metals	1-4.4, 2-4.4, 2-4.4-2, 3-4.4, 6-4.4, 12-4.4, 13-4.4, 13-4.4-2	748	H1b	1	4	4	5	3	3	3	3.2	3	H4a	3	3	4	4	3	2	3	3.1	4	H5	4	5	4	2	3
5.1	Surface Water	3		H2	1	3	3	4	3	3	4	2.8	4	H3	3	3	5	5	3	2	3	3.3	2	H4a	3	3	4	4	3
5.2	Groundwater	6-5.2, 13-5.2		H2	1	3	3	4	3	3	4	2.8	4	H3	3	3	5	5	3	2	3	3.3	3	H5	4	5	4	2	3

Risk Management		**Weighted**	
H1a	Engineered Cover (PHC-Soils)	1=Cost	0.2
H1b	Engineered Cover (Metals-Soils)	2=Effectiveness	0.25
H2	Impermeable Barriers (Prevent contaminant migration)	3=Timeframe	0.1
H3	Monitored Natural Attenuation (MNA)	4=Ease	0.1
H4a	Access Control (Fencing)	5=Regulatory	0.15
H4b	Access Control (Security programs to restrict access to a	6=Community	0.1
H5	Land Use Restriction	7=Monitoring	0.1
H6	Monitor PQRA Context Conditions	Total	1

Table A-3.

Code	6	7	WA	Rank	RMA 4	1	2	3	4	5	6	7	WA	Rank	Rec. RMA	Description	Rationale
4.2	2	5	3.8	2	H6	5	4	5	5	3	3	4	4.2	1	H6	Monitor PQRA Context Conditions	absence of significant risk at site for this waste
4.3	2	5	3.8	2	H6	5	4	5	5	3	3	4	4.2	1	H6	Monitor PQRA Context Conditions	absence of significant risk at site for this waste
4.4	2	5	3.8	2	H6	5	4	5	5	3	3	4	4.2	1	H6	Monitor PQRA Context Conditions	absence of significant risk at site for this waste
5.1	2	3	3.1	3	H6	5	4	5	5	3	3	4	4.2	1	H6	Monitor PQRA Context Conditions	absence of significant risk at site for this waste
5.2	2	5	3.8	2	H6	5	4	5	5	3	3	4	4.2	1	H6	Monitor PQRA Context Conditions	absence of significant risk at site for this waste

Appendix A
Site Impacts, RO and RMA Selection Worksheets

Table A-4 Project Requirements Matrix

		ROs										RMAs					
Project	Considerations	D - Site Treatment			A - Off-site Disposal			C - Central Site Disposal			E - Demo	Engineered Cover (3)		Impermeable	Access Control		Land Use
		PHC Soil-Landfarm	Wood-Burn	Organic Liquids	Metals-Soils	HW	N-hW	PHC-Soils	Metals-Soils	N-hW	Buildings	PCB-Soils	Metals-Soils	Barrier	Fencing	Security	Restriction
Equipment	Light Earth Moving (Note 2)	X			X		X	X	X	X	X	X	X				
	Heavy Earth Moving (Note 2)	X			X			X	X	X				X			
Special	Burner/Incinerator/Driver		X	X										X			
Transport	Light A/C (Note 1)	X	X	X	X	X	X	X	X	X	X	X					
	Heavy A/C (Note 1) (Note 4)	O			O		O	O	O	O				O			
	Barge/Overland (Note 4)	O			O		O	O	O	O				O			
Materials	Local Engineered Fill (Note 5)	A	A	A	A	A	A	A	A	A		X	X	A			
	Airstrip Improvement (Note 5)	A	A	A	A	A	A	A	A	A				A			
	Road Improvement							X	X	X			X				
	Fencing							X							X		
Logistics/	Staging Area				X		X										
Admin	Land Use Control	X															X
	Activity Monitoring															X	X
Stakeholders	Acceptance Criteria	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes

1. Aircraft ratings:
   Light: ALR ≤ 4/MPa ≤ 0.4
   Heavy: ALR > 4/MPa > 0.4

A/C	Weight (kN) Max./Min.	Tire Press. (MPa)	ALR Max./Min.
DHC-6 Twin	56/35	0.26	1.0/1.0
DC-03	147/80	0.31	4.1/2.3
DHC-5 Buffalo	187/115	0.41	4.3/2.5
Hercules	778/360	0.67	9.1/6.0

2. Earth moving equipment:

	Weight (kg) Max./Min.	E.g.s	L/W/H (m)
Light	2375	Bobcat	2.42/1.57/1.96
	1850	Mini-Excavator	1.57/1.28/2.4(a)
Heavy	20800	Sm-Excavator	9.75/2.99/3.18(b)
	7040-8190	Dozer	4.18/2.55/2.76(c)

3. Evaluated as part of ROs
4. 'X' = Required, 'N' = Not avail.
5. 'O' = Or ; 'A' = And
6. Identified from air only

a. Hitachi ZAXIS17U
b. Hitachi ZX210
c. Komatsu D31EX-22

7. Site Access

Site	APEC	Airstrip Current	Airstrip w/ Improve	Road to Coast Current	Road to Coast w/ Improve
N-12		-			
J-34		-			
Young Inlet			ALR 4/0.3 MPa		
Stokes Range			ALR 5/0.4 MPa		
Ile Vanier	1	-			
	2/5	ALR 4/0.3 MPa		X	
	4	ALR 4/0.5 MPa			
Bent Horn	3		ALR<1/0.1 MPa		X
	6	ALR 5/0.2 MPa			X
Ile Vanier	3	(6)			
Bent Horn	1	(6)			
	2	(6)			
	4	-			
M-21		(6)			
K-07		(6)			
G-07		-			

Table A-5 Overall Project Approaches - Constraints

Project Scenarios (Note 4)		Equipment		Special	Transport			Materials				Logistics/Admin.			Selected ?	Relative Cost (Cost Spreadsheet)		
		Light Earth Moving (2)	Heavy Earth Moving (2)	Burner/Incin./ Driver/Scrnr	Light A/C (1)	Hvy A/C(1)(5)	Barge/ Overland (5)	Local Engr Fill (5)	Airstrip Improv't (5)	Road Improv't	Fencing	Staging Area	Land Use Control	Activity Monitoring		# Transport Units	# Other Units	Cost Scr
1 - RM	No Physical Works	N	N	N	N	N	N	N	N	N	N	N				0	79	5
2 - By air, no camp, no airstrip improvements	Light Fixed Wing A/C Only		N			N	N	N		N						151	139	4.6
3 - By air, small camp, limited airstrip improvements	Light A/C (FW and Helo)		N			N	N	N		N					Y	1928	199	2.1
4 - By air, large camp, major airstrip improvements	Heavy A/C (Max. Airborne)														Y	907	459	1.2
5 - Overland, winter mob, staging	Overland (No Restrictions)															798	549	1

Appendix B

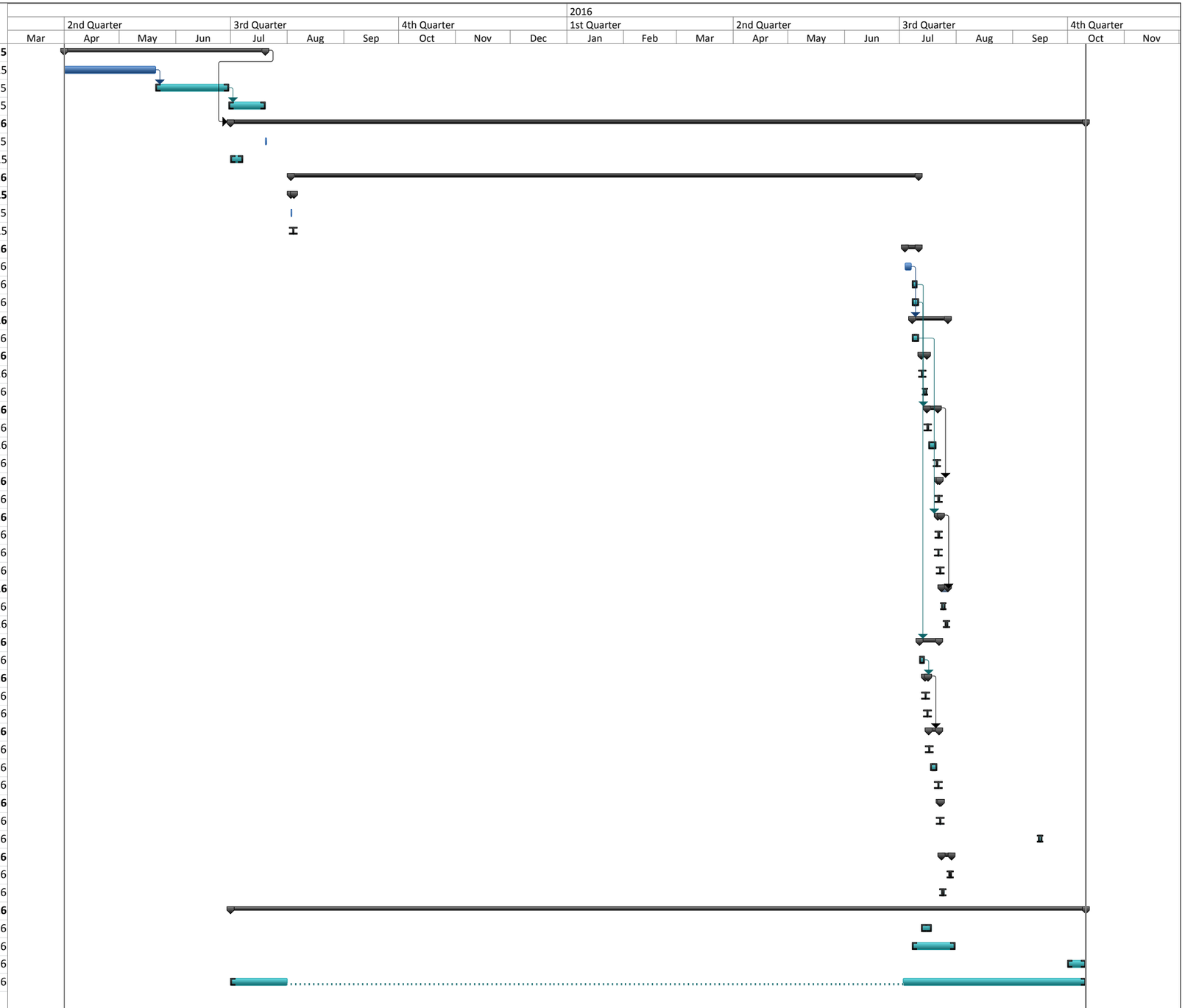
Project WBS

WBS	Task Name
1	**Detailed Design & Tendering**
1.1	Detailed Design
1.2	Tendering
1.3	Remediation Contract Award
2	**Remediation & Risk Management**
2.1	Subcontracting
2.2	Permitting
2.3	**Reconnaissance and Access Improvement**
2.3.1	**Reconnaissance**
2.3.1.1	Staging Area #1: Ile Vanier APEC 4
2.3.1.3	Staging Area #2: Freeman's Cove
2.3.2	**Access Improvement**
2.3.2.1	Ile Vanier APEC 4 Airstrip (Twin to Buffalo/Herc)
2.3.2.3	Roadway Ile Vanier APEC 1-4
2.3.2.4	Staging Area #2: Freeman's Cove
2.4	**Ile Vanier, Bent Horn & North Bathurst Consolidation**
2.4.1	Mobilisation
2.4.2	**Young Inlet**
2.4.2.1	Transport Drums to IV 4 (Helo)
2.4.2.2	OL Collection/Incineration
2.4.3	**Ile Vanier APEC 1**
2.4.3.1	Transport Equipment to Site (Road)
2.4.3.2	Metals-Impacted Soil Cover Placement
2.4.3.3	Transport Equipment to IV 4
2.4.6	**Ile Vanier APEC 4**
2.4.4.1	OL Incineration
2.4.5	**Bent Horn APEC 6**
2.4.5.1	Transport Drums to IV 4 (Helo)
2.4.5.2	Collect Tar Globules & Soil
2.4.5.2	OL Incineration
2.4.6	**BH APECs 1/2 - IV 3 - M-21 - J-34 - G-07**
2.4.6.1	Transport Drums to IV 4
2.4.6.2	OL Incineration
2.5	**Central and South Bathurst Consolidation**
2.5.1	Mobilisation
2.5.2	**J-34**
2.5.2.1	Hw Debris Collection (Helo)
2.5.2.2	Containerization at Freeman's Cove
2.5.3	**N-12**
2.5.3.1	Transport Equipment to Site (Helo)
2.5.3.2	PCBs-Impacted Soil Excavation and Containerization
2.5.3.7	Transport Equipment to Freeman's Cove
2.6	**Waste Transport to Resolute Bay**
2.6.2	Transport from Freeman's Cove (Herc/Buffalo)
2.7	Waste Transport to Disposal (Sealift)
2.8	**Demobilisation**
2.8.1	Demob - Ile Vanier APEC 4
2.8.2	Demob - Freeman's Cove
2.9	**QA/QC and Project Management**
2.9.1	Supplementary Assessment
2.9.2	Construction Supervision
2.9.3	Reporting
2.9.4	Project Management
3	Monitoring

Appendix C

Project Schedule (Gantt Chart)

ID		WBS	Task Name	Duration	Start	Finish
1		**1**	**Detailed Design & Tendering**	**165 days**	**Wed 4/1/15**	**Sun 7/19/15**
2		1.1	Detailed Design	75 days	Wed 4/1/15	Wed 5/20/15
3		1.2	Tendering	60 days	Thu 5/21/15	Mon 6/29/15
4		1.3	Remediation Contract Award	30 days	Tue 6/30/15	Sun 7/19/15
5		**2**	**Remediation & Risk Management**	**702 days**	**Wed 7/1/15**	**Mon 10/10/16**
6		2.1	Subcontracting	1 day	Mon 7/20/15	Mon 7/20/15
7		2.2	Permitting	10 days	Wed 7/1/15	Tue 7/7/15
8		**2.3**	**Reconnaissance and Access Improvement**	**515 days**	**Mon 8/3/15**	**Mon 7/11/16**
9		**2.3.1**	**Reconnaissance**	**2.5 days**	**Mon 8/3/15**	**Tue 8/4/15**
10		2.3.1.1	Staging Area #1: Ile Vanier APEC 4	0.5 days	Mon 8/3/15	Mon 8/3/15
11		2.3.1.2	Staging Area #2: Freeman's Cove	1 day	Tue 8/4/15	Tue 8/4/15
12		**2.3.2**	**Access Improvement**	**11 days**	**Mon 7/4/16**	**Mon 7/11/16**
13		2.3.2.1	Ile Vanier APEC 4 Airstrip (Twin to Buffalo/Herc)	5 days	Mon 7/4/16	Thu 7/7/16
14		2.3.2.2	Roadway Ile Vanier APEC 1-4	4 days	Fri 7/8/16	Sun 7/10/16
15		2.3.2.3	Staging Area #2: Freeman's Cove	5 days	Fri 7/8/16	Mon 7/11/16
16		**2.4**	**Ile Vanier, Bent Horn & North Bathurst Consolidation**	**29 days**	**Fri 7/8/16**	**Wed 7/27/16**
17		2.4.1	Mobilisation	5 days	Fri 7/8/16	Mon 7/11/16
18		**2.4.2**	**Young Inlet**	**4.5 days**	**Wed 7/13/16**	**Fri 7/15/16**
19		2.4.2.1	Transport Drums to IV 4 (Helo)	1.13 days	Wed 7/13/16	Wed 7/13/16
20		2.4.2.2	OL Collection/Incineration	3 days	Thu 7/14/16	Fri 7/15/16
21		**2.4.3**	**Ile Vanier APEC 1**	**8.63 days**	**Sat 7/16/16**	**Thu 7/21/16**
22		2.4.3.1	Transport Equipment to Site (Road)	1.13 days	Sat 7/16/16	Sat 7/16/16
23		2.4.3.2	Metals-Impacted Soil Cover Placement	6 days	Sun 7/17/16	Wed 7/20/16
24		2.4.3.3	Transport Equipment to IV 4	1.13 days	Thu 7/21/16	Thu 7/21/16
25		**2.4.4**	**Ile Vanier APEC 4**	**1.13 days**	**Fri 7/22/16**	**Fri 7/22/16**
26		2.4.4.1	OL Incineration	1.13 days	Fri 7/22/16	Fri 7/22/16
27		**2.4.5**	**Bent Horn APEC 6**	**2.5 days**	**Fri 7/22/16**	**Sat 7/23/16**
28		2.4.5.1	Transport Drums to IV 4 (Helo)	1.13 days	Fri 7/22/16	Fri 7/22/16
29		2.4.5.2	Collect Tar Globules & Soil	1 day	Fri 7/22/16	Fri 7/22/16
30		2.4.5.2	OL Incineration	1 day	Sat 7/23/16	Sat 7/23/16
31		**2.4.6**	**BH APECs 1/2 - IV 3 - M-21 - J-34 - G-07**	**5 days**	**Sun 7/24/16**	**Wed 7/27/16**
32		2.4.6.1	Transport Drums to IV 4	3 days	Sun 7/24/16	Mon 7/25/16
33		2.4.6.2	OL Incineration	2 days	Tue 7/26/16	Wed 7/27/16
34		**2.5**	**Central and South Bathurst Consolidation**	**16 days**	**Tue 7/12/16**	**Fri 7/22/16**
35		2.5.1	Mobilisation	4 days	Tue 7/12/16	Thu 7/14/16
36		**2.5.2**	**J-34**	**2.5 days**	**Fri 7/15/16**	**Sat 7/16/16**
37		2.5.2.1	Hw Debris Collection (Helo)	1 day	Fri 7/15/16	Fri 7/15/16
38		2.5.2.2	Containerization at Freeman's Cove	1 day	Sat 7/16/16	Sat 7/16/16
39		**2.5.3**	**N-12**	**8.5 days**	**Sun 7/17/16**	**Fri 7/22/16**
40		2.5.3.1	Transport Equipment to Site (Helo)	1 day	Sun 7/17/16	Sun 7/17/16
41		2.5.3.2	PCBs-Impacted Soil Excavation and Containerization	5 days	Mon 7/18/16	Thu 7/21/16
42		2.5.3.3	Transport Equipment to Freeman's Cove	1 day	Fri 7/22/16	Fri 7/22/16
43		**2.6**	**Waste Transport to Resolute Bay**	**1 day**	**Sat 7/23/16**	**Sat 7/23/16**
44		2.6.1	Transport from Freeman's Cove (Herc/Buffalo)	1 day	Sat 7/23/16	Sat 7/23/16
45		2.7	Waste Transport to Disposal (Sealift)	3 days	Thu 9/15/16	Fri 9/16/16
46		**2.8**	**Demobilisation**	**8 days**	**Sun 7/24/16**	**Fri 7/29/16**
47		2.8.1	Demob - Ile Vanier APEC 4	2 days	Thu 7/28/16	Fri 7/29/16
48		2.8.2	Demob - Freeman's Cove	2 days	Sun 7/24/16	Mon 7/25/16
49		**2.9**	**QA/QC and Project Management**	**702 days**	**Wed 7/1/15**	**Mon 10/10/16**
50		2.9.1	Supplementary Assessment	8 days	Wed 7/13/16	Mon 7/18/16
51		2.9.2	Construction Supervision	35 days	Fri 7/8/16	Sun 7/31/16
52		2.9.3	Reporting	15 days	Sat 10/1/16	Mon 10/10/16
53		2.9.4	Project Management	196.13 days	Wed 7/1/15	Mon 10/10/16
54		3	Monitoring			

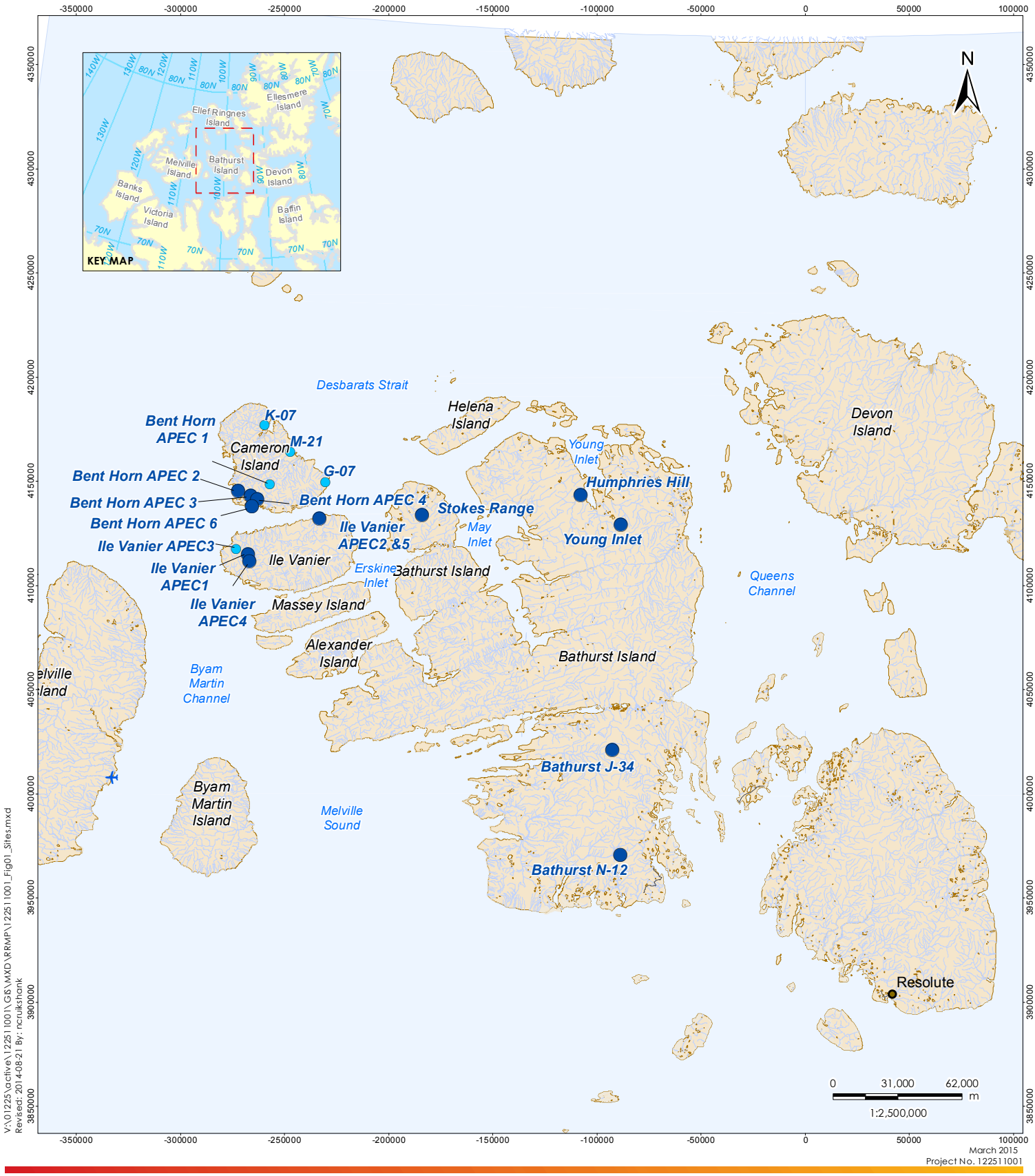


Project: 122511001_Bathurst_RR
Date: Tue 2/17/15

Task
Split
Milestone
Summary
Project Summary
External Tasks
External Milestone
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
Deadline
Progress

Appendix D

Drawings



V:\01225\active\122511001\GIS\MXD\RRMP\122511001_Fig01_Sites.mxd
Revised: 2014-08-21 By: ncruikshank

March 2015
Project No. 122511001

Stantec

Legend

- Site Location
- Site Location (approx. - Aerial Reconnaissance Only)

Notes

1. Coordinate System: North America Lambert Conformal Conic
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

Client/Project

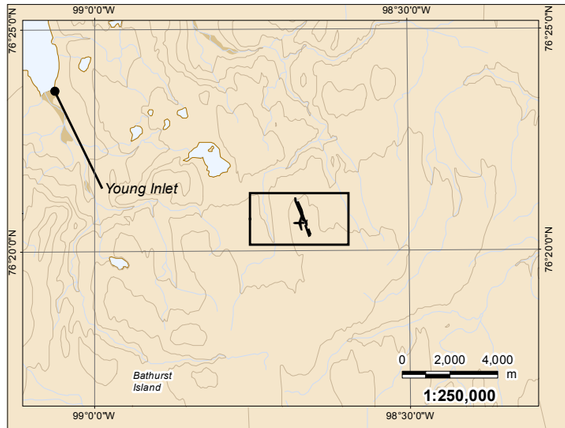
PWGSC
Bathurst, Cameron and Ile Vanier
Remediation & Risk Management Plan

Figure No.

1

Title

Study Area



North Drum Cache

South Drum Cache

Well Site

V:\01225\active\122511001\GIS\MXD\RRMP\122511001_RRMP_Fig02_YoungInlet.mxd
Revised: 2014-08-22 By: rcrukshank

March 2015
Project No.: 122511001

Stantec

Legend

- Runway
- Elevation (m)
- Drum Cache
- Disturbed Area (Geotechnical)
- Inferred Direction of Surface Drainage
- Airstrip

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2.

Client/Project

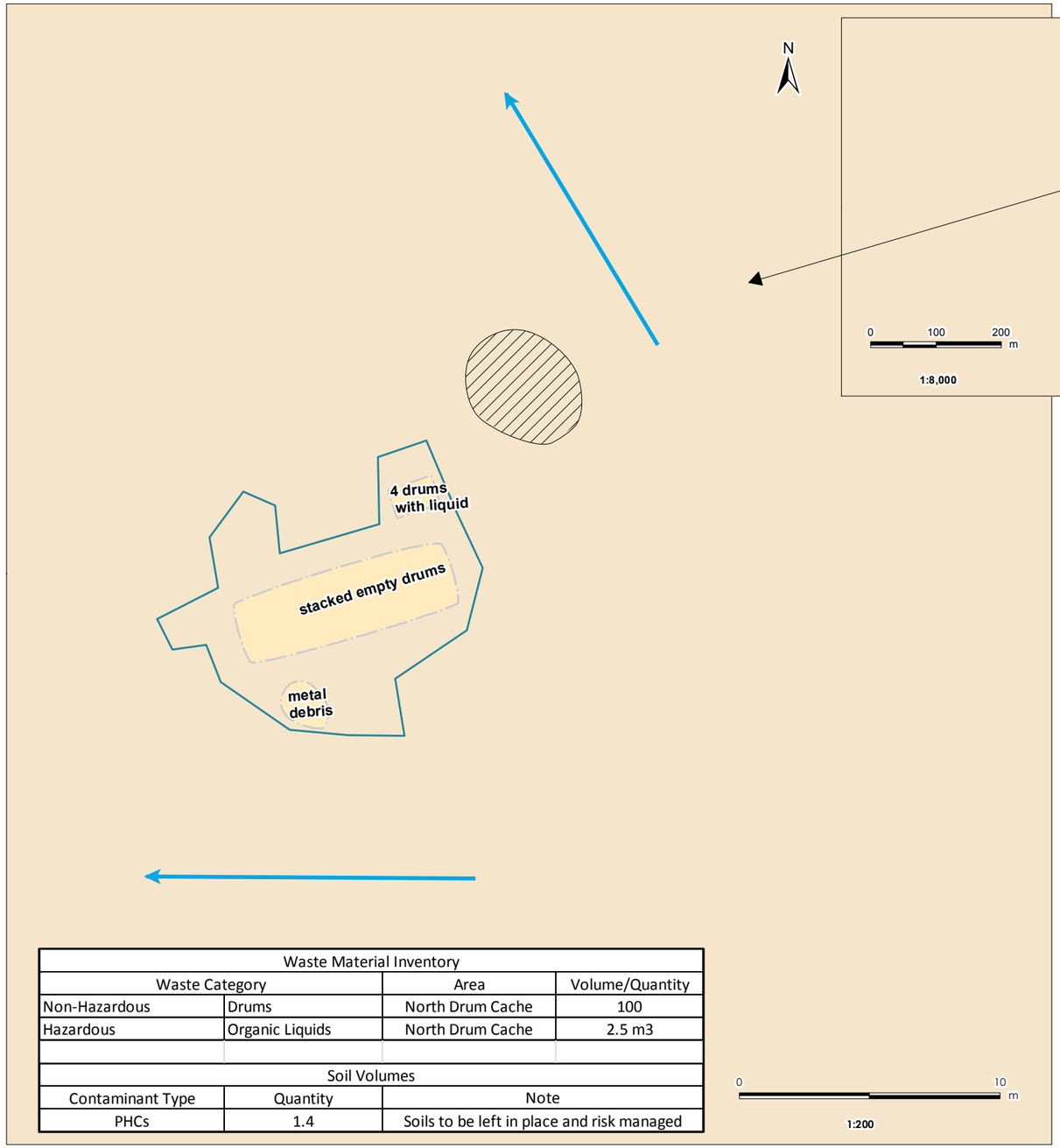
PWGSC
Bathurst, Cameron, and Ile Vanier
Remediation & Risk Management Plan

Figure No.

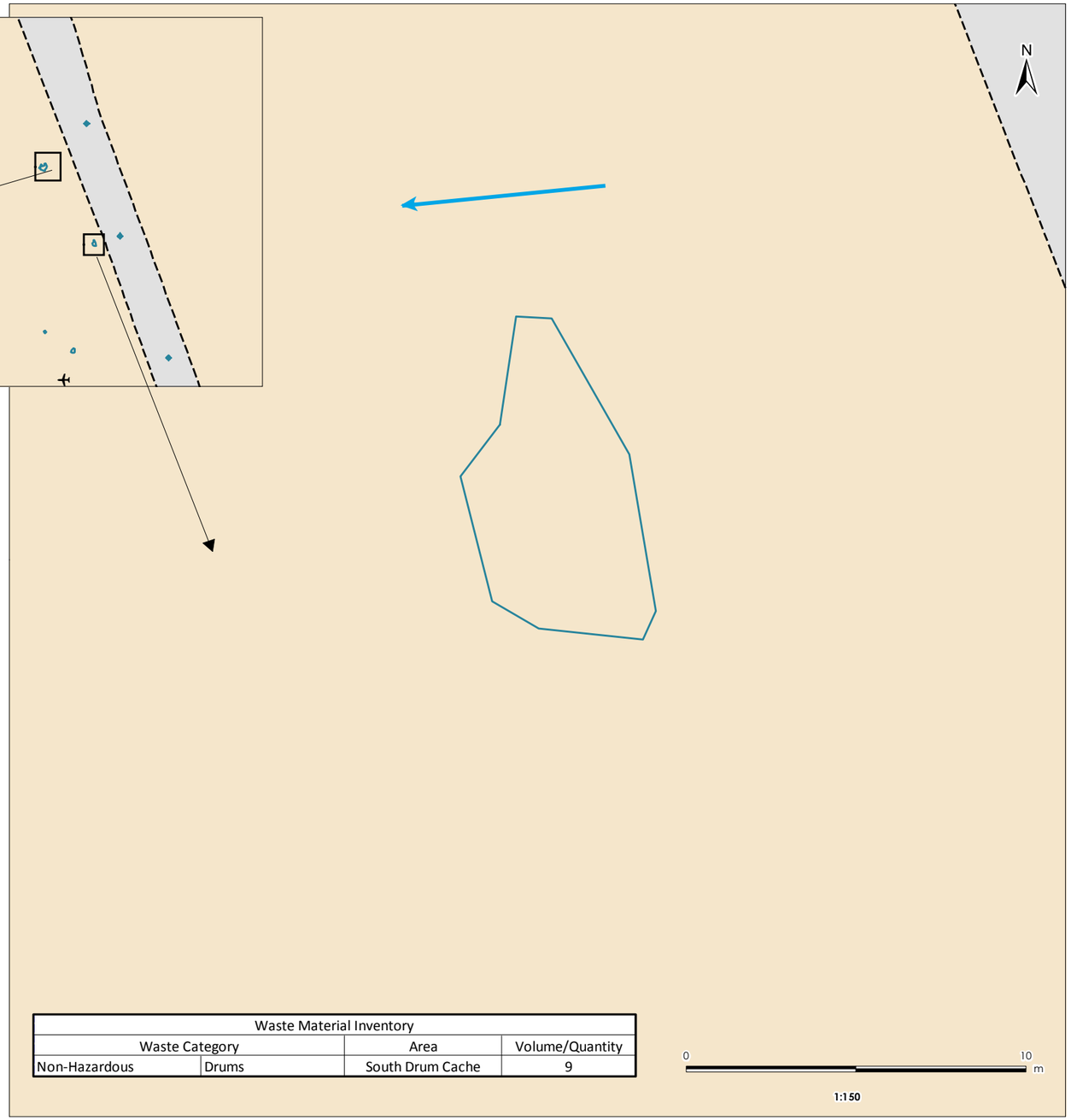
2

Title

Young Inlet



Waste Material Inventory			
Waste Category		Area	Volume/Quantity
Non-Hazardous	Drums	North Drum Cache	100
Hazardous	Organic Liquids	North Drum Cache	2.5 m3
Soil Volumes			
Contaminant Type	Quantity	Note	
PHCs	1.4	Soils to be left in place and risk managed	



Waste Material Inventory			
Waste Category		Area	Volume/Quantity
Non-Hazardous	Drums	South Drum Cache	9

March 2015
Project No.: 122511001

V:\01225\active\122511001\GIS\MXD\RRMP\122511001_RRMP_Fig3_YI_NDCcache.mxd
Revised: 2014-08-22 By: nicholstrank

Stantec

Legend

- Elevation (m)
- North Drum Cache (Geotechnical)
- Inferred Direction of Surface Drainage
- Estimated Area with Soil Impacts
- Airstrip

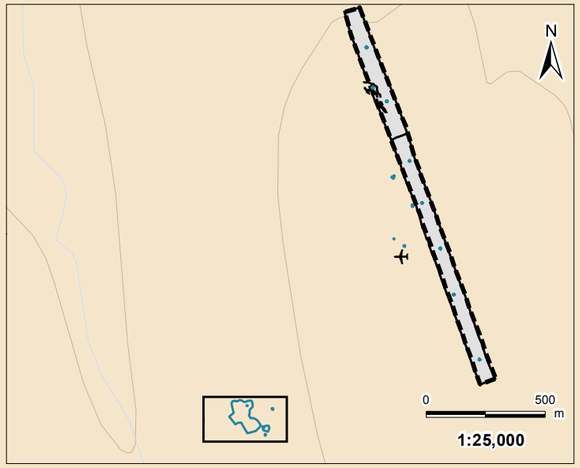
Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2.

Client/Project
PWGSC
Bathurst, Cameron, and Ile Vanier
Remediation & Risk Management Plan

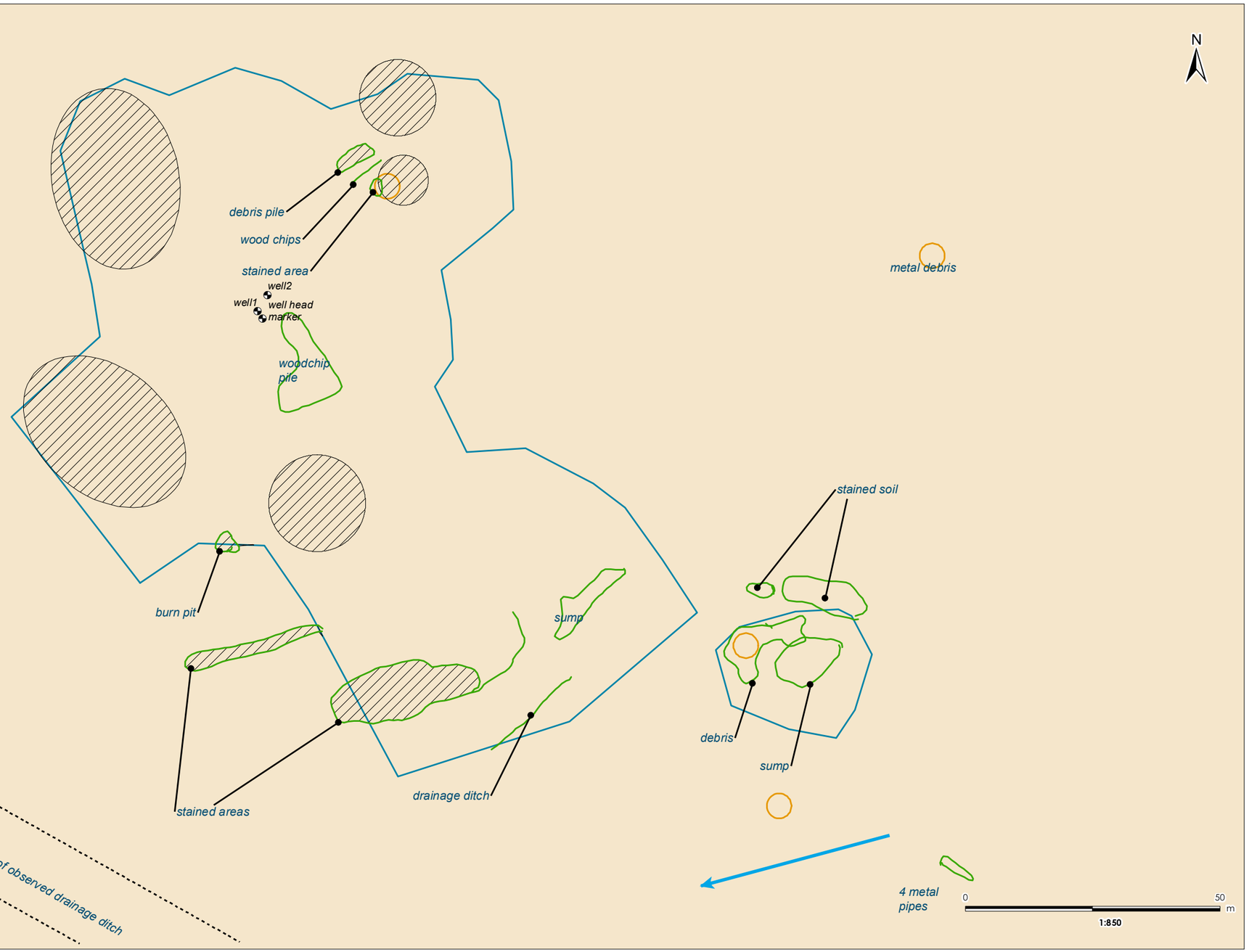
Figure No.
3

Title
Young Inlet - North & South Drum Caches
Waste Material Inventory & Soil Volumes



Waste Material Inventory			
Waste Category		Area	Volume/Quantity
Non-Hazardous	Drums	Well Site	10
	Metal	Southeast of well site	5 m3
		Northeast of Well Site	10 m3
		Debris pile by southeast sump	100 m3
		By northeast burnpit	5 m3
	Wood	South of well markers	20 m3
		Northeast	3 m3
	Other debris	Southwest	10 m3
		East	10 m3

Soil Volumes		
Contaminant Type	Quantity	Note
Metals & PHCs	723	Soils to be left in place and risk managed
Metals	120	Soils to be left in place and risk managed



V:\01225\active\122511001\GIS\MXD\RRMP\122511001_RRMP_Fig4_YI_WellDetail.mxd
Revised: 2014-08-22 By: ncruikshank

March 2015
Project No.: 122511001

Stantec

Legend

- Elevation (m)
- WATERCOURSES
- Well Marker
- Stantec Field Observation
- Drainage ditch

Geotechnical Field Observation

- Burn Pit
- Disturbed Area
- Inferred Direction of Surface Drainage
- Estimated Area with Soil Impacts

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2.

Client/Project

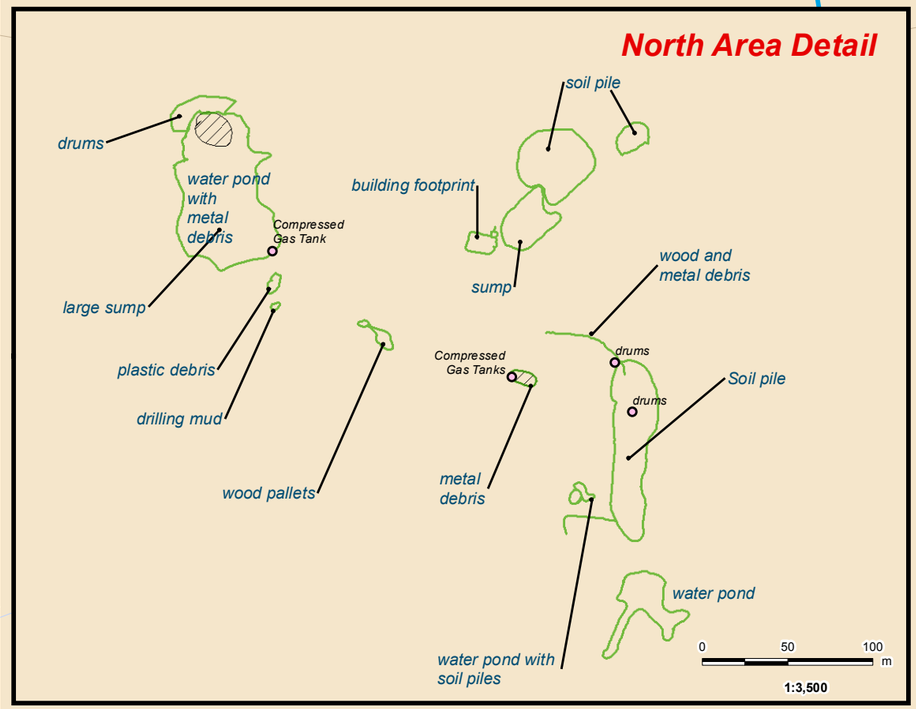
PWGSC
Bathurst, Cameron, and Ile Vanier
Remediation & Risk Management Plan

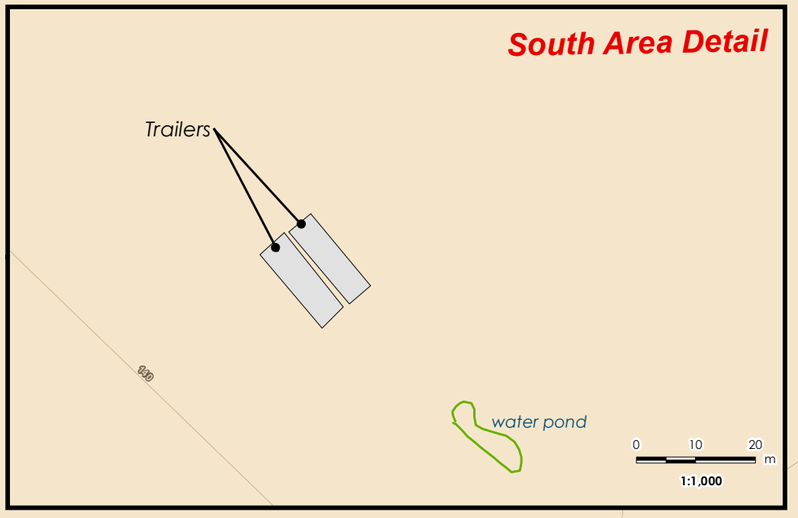
Figure No.

4

Title

Young Inlet - Well Site Detail
Waste Material Inventory & Soil Volumes





Waste Material Inventory			
Waste Category		Area	Volume/Quantity
Non-Hazardous	Drums	Around North Area	30
	Metal	At trailers in South Area, landfill pit, northeast sump	75 m3
		North end of large sump	5 m3
		Northeast corner	2 m3
	Wood	Central of North Area	4 m3
		Central of North Area	1.1 m3
		Trailers in South Area	1.5 m3
	Other (Debris piles)	South of big sump	20 m3
Hazardous Waste	Batteries	Trailers in South Area	0.3 m3
	Pressurized Cylinders	At trailers in South Area, landfill pit, northeast sump	2 m3

Soil Volumes		
Contaminant Type	Quantity	Note
Metals	70 m3	Soils to be left in place and risk managed

0 100 200 300 400 m

1:10,000

March 2015
Project No.: 122511001

V:\01225\active\122511001\GIS\MXD\RRMP\122511001_Fig5_Bathurst_J-34.mxd
Revised: 2014-08-22 By: lnicholichank

Stantec

Legend

- Elevation (m)
- Observation
- WATERCOURSES
- Stantec Field Observation
- Inferred Direction of Surface Drainage
- Estimated Area with Soil Impacts

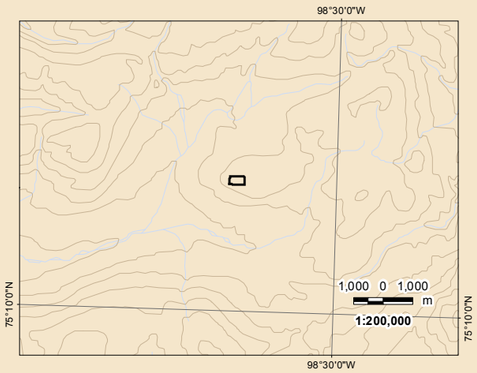
Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2.

Client/Project
PWGSC
Bathurst, Cameron, and Ile Vanier
Remediation & Risk Management Plan

Figure No.
5

Title
Bathurst Island J-34
Waste Material Inventory & Soil Volumes



Waste Material Inventory			
Waste Category		Area	Volume/Quantity
Non-Hazardous	Drums	Big Pond	6
	Metal	Well head	21 m3
		Former building areas	23 m3
	Wood	Former building areas	2.4 m3
		Well head, around site	48.6 m3
	Other (Debris piles)	West side of big pond	5 m3

Soil Volumes		
Contaminant Type	Quantity	Note
PCBs	33 m3	Soils to be excavated for off-site disposal
Metals	18 m3	Soils to be left in place and risk managed

V:\01225\active\122511001\GIS\MXD\RRMP\122511001_RRMP_Fig6_Bathurst_N-12.mxd
Revised: 2014-08-22 By: rcruikshank

March 2015
Project No.: 122511001

Stantec

Legend

- Stantec Field Observation
- Inferred Direction of Surface Drainage
- Estimated Area with Soil Impacts

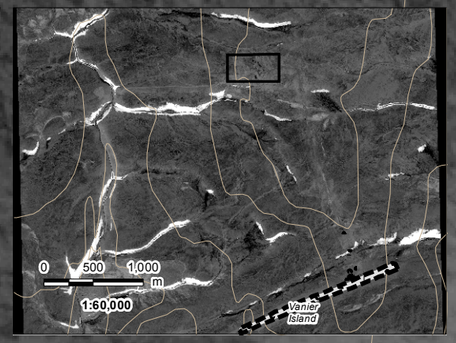
Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2.

Client/Project
PWGSC
Bathurst, Cameron, and Ile Vanier
Remediation & Risk Management Plan

Figure No.
6

Title
Bathurst Island N-12
Waste Material Inventory & Soil Volumes



Waste Material Inventory			
Waste Category		Area	Volume/Quantity
Non-Hazardous	Drums	Around the site	10
	Metal	west of site	30 m3
		southeast corner of site	4 m3
	Wood	around well head	10 m3
		around former building	3 m3

Soil Volumes		
Contaminant Type	Quantity	Note
Lead	100 m3	Soils to be left in place and engineered cover to
PHCs	236 m3	Soils to be left in place and risk managed

V:\01225\active\122511001\GIS\MXD\RRMP\122511001_RRMP_Fig7_JV_APEC1_fly.mxd
Revised: 2014-08-22 by: mcrukshank

March 2015
Project No.: 122511001

Stantec

Legend

- Runway
- Elevation (m)
- Observations
- Stantec Field Observation
- Inferred Direction of Surface Drainage
- Airstrip
- Estimated Area with Soil Impacts

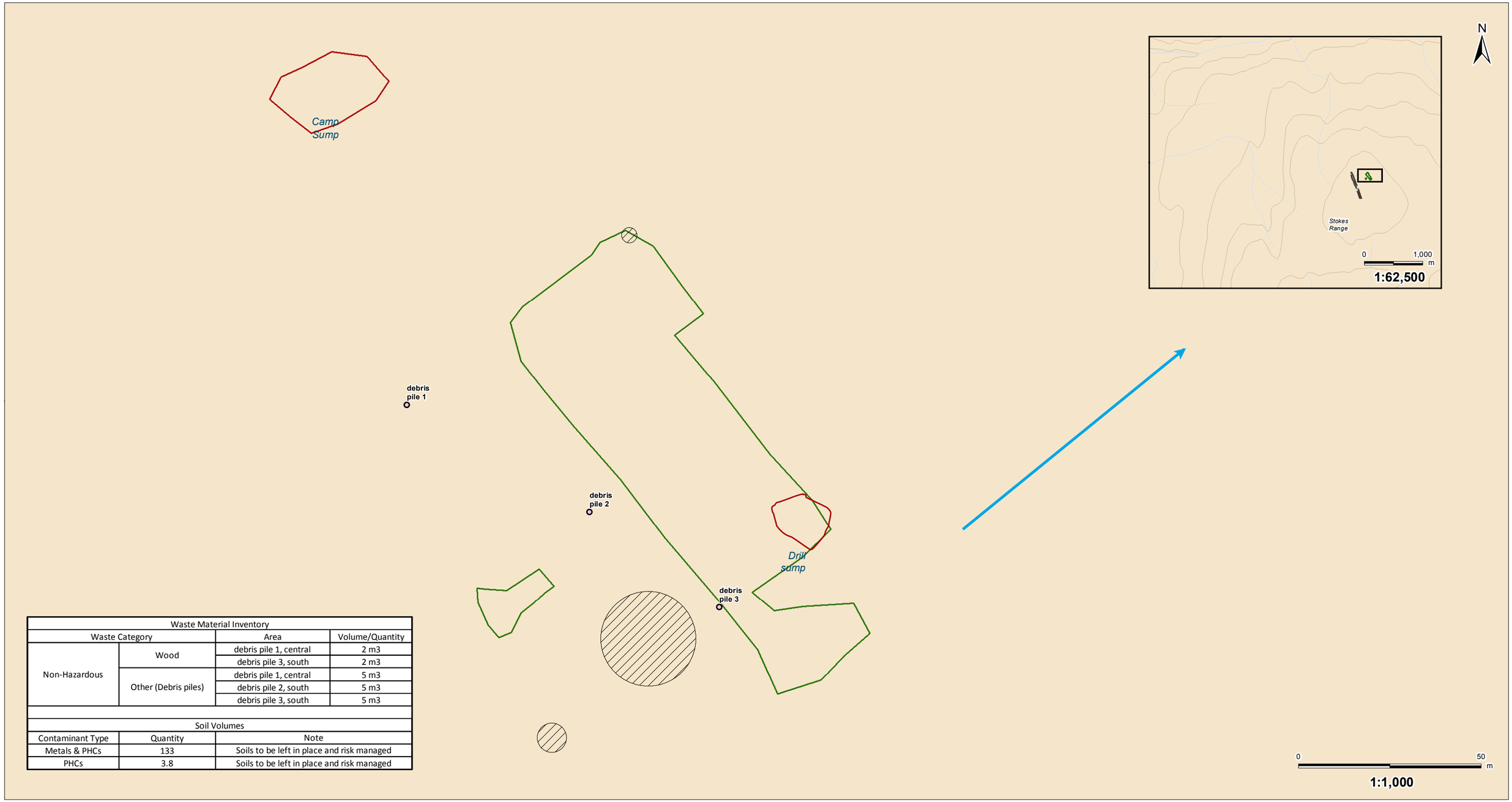
Notes

1. Coordinate System: NAD 1983 UTM Zone 13N
2.

Client/Project
PWGSC
Bathurst, Cameron and Ile Vanier
Remediation & Risk Management Plan

Figure No.
7

Title
Ile Vanier APEC1
Waste Material Inventory & Soil Volumes



Waste Material Inventory			
Waste Category		Area	Volume/Quantity
Non-Hazardous	Wood	debris pile 1, central	2 m3
		debris pile 3, south	2 m3
	Other (Debris piles)	debris pile 1, central	5 m3
		debris pile 2, south	5 m3
		debris pile 3, south	5 m3

Soil Volumes		
Contaminant Type	Quantity	Note
Metals & PHCs	133	Soils to be left in place and risk managed
PHCs	3.8	Soils to be left in place and risk managed

V:\01225\active\122511001\GIS\MXD\RRMP\122511001_RRMP_Fig8_StokesRange.mxd
Revised: 2014-08-22 By: nctukshark

March 2015
Project No.: 122511001

Stantec

Legend

- Runway
- Elevation (m)
- Stantec Field Observation (Disturbed Area)
- Stantec Field Observation (sump)
- Inferred Direction of Surface Drainage
- Estimated Area with Soil Impacts

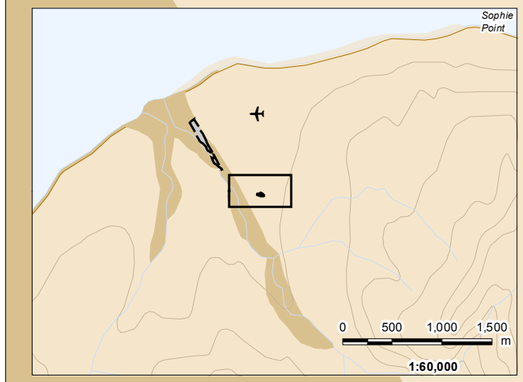
Notes

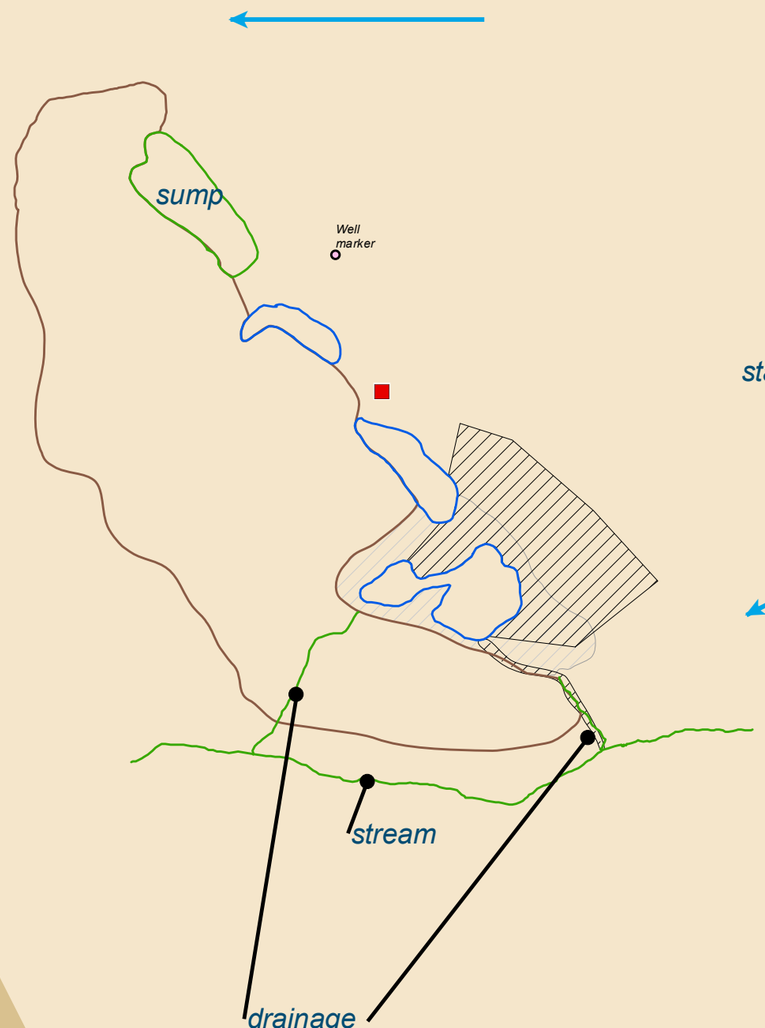
1. Coordinate System: NAD 1983 UTM Zone 14N
2.

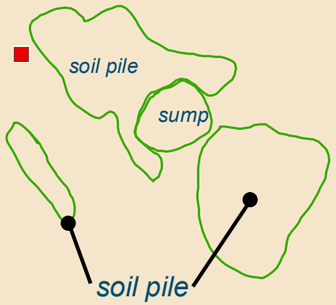
Client/Project
PWGSC
Bathurst, Cameron and Ile Vanier
Remediation & Risk Management Plan

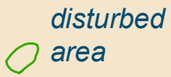
Figure No.
8

Title
Stokes Range
Waste Material Inventory & Soil Volumes









Waste Material Inventory			
Waste Category		Area	Volume/Quantity
Non-Hazardous	Drums	Drum caches	5
	Metal	Central	5 m3
	Wood	South of sump around well head	5m3

March 2015
Project No.: 122511001

V:\01225\active\122511001\GIS\MXD\RRMP\122511001_RRMP_Fig9_SophiesPt_APEC2.mxd
Revised: 2014-08-22 By: rachakranik

Stantec

Legend

- Runway
- Elevation (m)
- Dry Riverbed
- Waterbody
- Drum Cache
- Stantec Field Observation
- Ponded Water
- Observed Disturbed Area
- Inferred Direction of Surface Drainage
- Estimated Area with Soil Impacts
- Observed Saturated Area
- Airstrip

Notes

1. Coordinate System: NAD 1983 UTM Zone 13N
2.

Client/Project

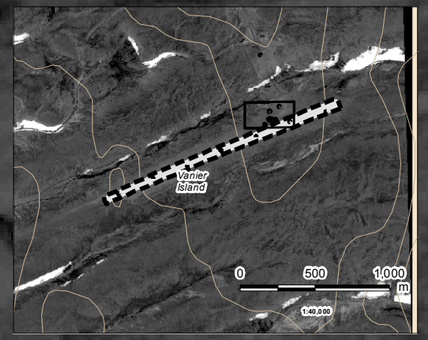
PWGSC
Bathurst, Cameron and Ile Vanier
Remediation & Risk Management Plan

Figure No.

9

Title

Ile Vanier APEC 2
Waste Material Inventory & Soil Volumes



Waste Material Inventory			
Waste Category		Area	Volume/Quantity
Non-Hazardous	Drums	East Drum Cache	124
	Drums	West Drum Cache	100
Hazardous	Organic Liquids	East Drum Cache	0.5 m3
	Pressured Cylinders	East Drum Cache	2
Soil Volumes			
Contaminant Type	Quantity	Note	
PHCs	13 m3	Soils to be left in place and risk managed	

V:\01225\active\122511001\GIS\MXD\RRMP\122511001_RRMP_Fig10_IV_APEC4.mxd
Revised: 2014-08-22 By: nicholschank

March 2015
Project No.: 122511001

Stantec

Legend

- Elevation (m)
- Stantec Field Observations
- Gravel Path
- Disturbed Area (Geotechnical)
- Estimated Area with Soil Impacts
- Airstrip

Notes

1. Coordinate System: NAD 1983 UTM Zone 13N
2.

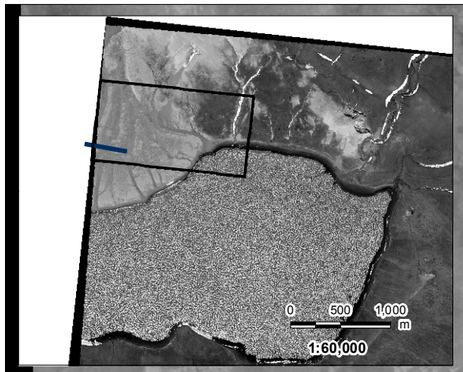
Client/Project

PWGSC
Bathurst, Cameron and Ile Vanier
Remediation & Risk Management Plan

Figure No.
10

Title

Ile Vanier APEC 4
Waste Material Inventory & Soil Volumes



Soil Volumes		
Contaminant Type	Quantity	Note
PHCs	3000 m3	Soils to be left in place and risk managed

V:\01225\active\122511001\GIS\MXD\RRMP\122511001_RRMP_Fig11_BH_APEC3.mxd
Revised: 2014-08-22 By: ncruikshank

March 2015
Project No.: 122511001

Stantec

Legend

- Runway
- Elevation (m)
- Borehole/DCPT Location (Geotechnical)
- Disturbed Area (Geotechnical)
- Inferred Direction of Surface Drainage
- Airstrip
- Estimated Area with Soil Impacts

Notes

1. Coordinate System: NAD 1983 UTM Zone 13N
2.

Client/Project

PWGSC
Bathurst, Cameron and Ile Vanier
Remediation & Risk Management Plan

Figure No.
11

Title

Bent Horn APEC 3
Soil Volumes

Soil Volumes		
Contaminant Type	Quantity	Note
Metals	490 m3	Soils to be left in place and risk managed

V:\01225\active\122511001\GIS\MXD\RRMP\122511001_RRMP_Fig12_BH_APEC6.mxd
Revised: 2014-08-22 By: rcrukshank

March 2015
Project No.: 122511001

Stantec

Legend

- Runway
- Stantec Field Observation
- Disturbed Area (Geotechnical)
- Inferred Direction of Surface Drainage
- Airstrip
- Estimated Area with Soil Impacts

Notes

1. Coordinate System: NAD 1983 UTM Zone 13N
2.

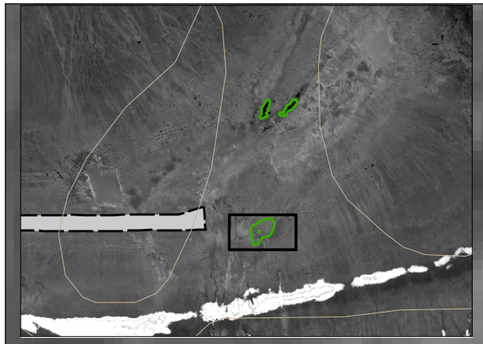
Client/Project

PWGSC
Bathurst, Cameron and Ile Vanier
Remediation & Risk Management Plan

Figure No.
12

Title

Bent Horn APEC 6
Waste Material Inventory & Soil Volumes



Waste Material Inventory			
Waste Category		Area	Volume/Quantity
Hazardous Waste	Organic liquids and Grease	South Disturbed Area	2 m^3
Soil Volumes			
Contaminant Type	Quantity	Note	
PHCs	2 m^3	Soils to be left in place and risk managed	

V:\01225\active\122511001\GIS\MXD\RRMP\122511001_RRMP_Fig13_BH_APEC6South.mxd
Revised: 2014-08-22 By: nicolkstrnk

March 2015
Project No.: 122511001

Stantec

Legend

- Runway
- Elevation (m)
- Stantec Field Observation
- Inferred Direction of Surface Drainage
- Airstrip
- Estimated Area with Soil Impacts

Notes

1. Coordinate System: NAD 1983 UTM Zone 13N
2.

Client/Project

PWGSC
Bathurst, Cameron and Ile Vanier
Remediation & Risk Management Plan

Figure No.

13

Title

Bent Horn APEC 6 South
Waste Material Inventory & Soil Volumes

N

Soil Volumes		
Contaminant Type	Quantity	Note
Metals & PHCs	90 m^3	Soils to be left in place and risk managed

0 10 20 m

1:400

V:\01225\active\122511001\GIS\MXD\RRMP\122511001_RRMP_Fig14_BH_APEC6North.mxd
Revised: 2014-08-22 By: rcruikshank

March 2015
Project No.: 122511001

Stantec

Legend

- Runway
- Stantec Field Observation
- Disturbed Area (Geotechnical)
- Inferred Direction of Surface Drainage
- Airstrip
- Estimated Area with Soil Impacts

Notes

1. Coordinate System: NAD 1983 UTM Zone 13N
2.

Client/Project

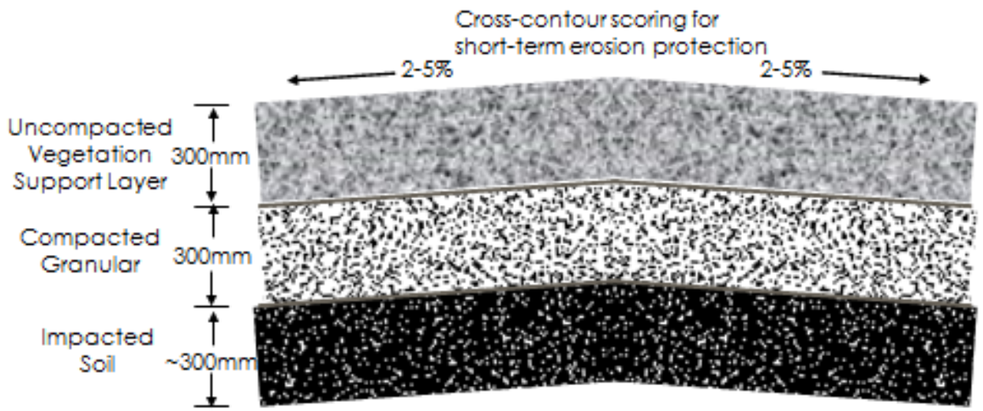
PWGSC
Bathurst, Cameron and Ile Vanier
Remediation & Risk Management Plan

Figure No.

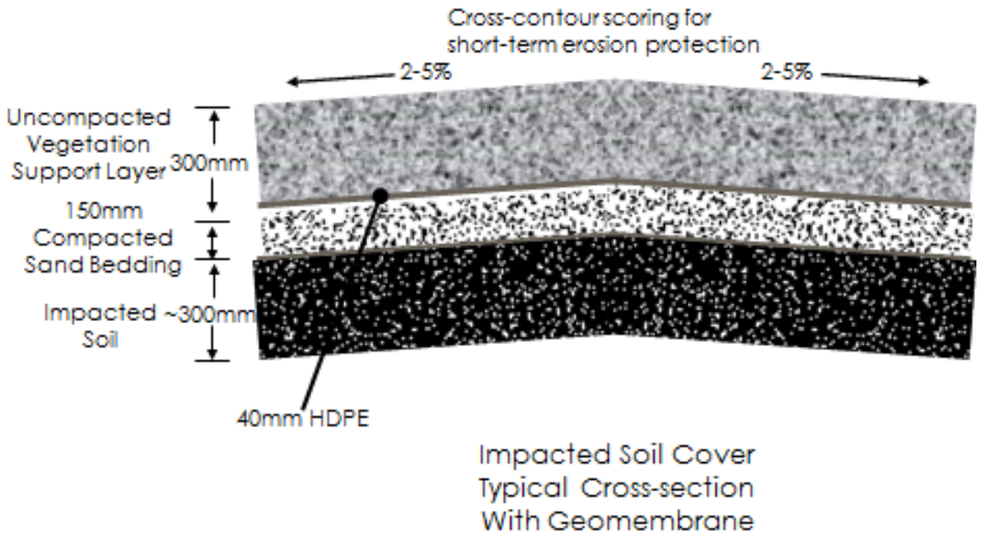
14

Title

Bent Horn APEC 6 North Disturbed Area Soil Volumes



Impacted Soil Cover
Typical Cross-section
No Geomembrane



Impacted Soil Cover
Typical Cross-section
With Geomembrane

March 2015
Project No.: 122511001

Stantec

Client/Project

PWGSC
Bathurst, Cameron, and Ile Vanier
Remediation & Risk Management Plan

Figure No.

15

Title

Design for Engineered Cover

V:\01225\active\122511001\GIS\MXD\RRMP\122511001_RRMP_Fig15_Design.mxd
Revised: 2014-08-22 By: ncruikshank

Stantec

Legend

- BIRDS/MAMMALS - LAND
- MAMMALS - LAND
- BIRDS - LAND
- BIRDS/MAMMALS - SEA
- FISH/MAMMALS - SEA
- MAMMALS - SEA
- BIRDS - SEA

- Stantec APECs 2013
- Arctic Char Traditional Harvest Area - Domestic (NPC)
- Arctic Char, Clam, Atlantic Cod and Halibut Traditional Harvest Area - Domestic (NPC)
- Land
- Water
- Seymour Island Migratory Bird Sanctuary
- Proposed National Park - Quasuittuq (Bathurst Island)
- National Wildlife Area (Protected - Polar Bear Pass)

Notes

1. Coordinate System: North America Lambert Conformal Conic
2. Canvec data provided by GeoBase®, 2013
3. Canadian Wildlife Service (CWS) Data digitized by the Government of Canada (Environment Canada).
4. Draft Nunavut Land Use Plan Data (DNLUP) Provided by Nunavut Planning Commission, 2014. Shapefiles provided by Government of Nunavut, Department of Environment Planning Commission.
5. For details on species constituting identified animal class constraints, refer to the Environmental Screening Report.

March 2015
Project No. 122511001

Client/Project

PWGSC
Bathurst, Cameron and Ile Vanier
Remediation & Risk Management Plan

Figure No.

16

Title

Environmental Constraints

N

Desbarats Strait
Helena Island
Cameron Island
Young Inlet
May Inlet
Erskine Inlet
Ile Vanier
Bathurst Island
Massey Island
Alexander Island
Byam Martin Channel
Melville Island
Byam Martin Island
Melville Sound
Devon Island
Queens Channel
Resolute

0 37,500 75,000 m
1:1,500,000

4000000

V:\01225\active\122511001\GIS\MXD\RRMP\122511001_RRMP_Fig16_EnvConstr.mxd
Revised: 2014-08-22 By: ncruikshank

Appendix E

Additional Data

Appendix E
Additional Data

Table E-1 Summary of Remedial Technologies

Remedial Technology (1)	Description	Applicable Waste Streams (2)	Site-specific Considerations
Ex Situ Biological Treatment (assumes excavation for soils)			
Landfarming	Contaminated soil, sediment, or sludge is excavated, applied into lined beds, and periodically turned over or tilled to aerate the waste.	Soils-Organics	• Effective for PHC contaminant remediation • Impacted material would be remediated on-site • Historically a regulatory-accepted remediation strategy in isolated areas • Not recommended for inorganic contaminant remediation • Large capital and operating costs with potentially lengthy O&M • Increased time to closure as landfarming requires continual monitoring (repeat mobilizations), and aeration to be effective
Containment			
Physical Barriers	These subsurface barriers consist of vertically excavated trenches filled with slurry. The slurry, usually a mixture of bentonite and water, hydraulically shores the trench to prevent collapse and retards ground water flow.	Groundwater	• High construction costs • Challenging installation • Seasonal constraints • Not applicable due to potential destruction to environment • Moderate O&M
Engineered Cap	Engineered caps are used for contaminant source control. Caps are non-permeable materials or concrete.	HW-Solids; Soils-Organics; Soils-Metals	• Reduces migration of impacts offsite • Resists impacts from weather conditions • High construction costs • Potential damage to natural resources • Installation extremely difficult • Requires monitoring
Engineered Cap Enhancements/ Alternatives	The purpose of engineered cover enhancement is to reduce or eliminate contaminant migration (e.g. percolation). Water harvesting and vegetative cover are two ways for landfill cover enhancements. Water harvesting uses runoff enhancement to manage landfill site water balance. Vegetative cover reduces soil moisture via plant uptake and evapotranspiration.	HW-Solids; Soils-Organics; Soils-Metals	• Reduces migration of impacts offsite • Resists impacts from weather conditions • High construction costs • Potential damage to natural resources • Installation can be difficult • Requires monitoring
Engineered Cover	Engineered covers are used for contaminant source control. Cover material is low permeability material sourced at site (where possible) and compacted to a high degree.	HW-Solids; Soils-Organics; Soils-Metals	• Reduces migration of impacts offsite • Resists impacts from weather conditions • Requires suitable material at site • Potential damage to natural resources • Requires monitoring

Remedial Technology (1)	Description	Applicable Waste Streams (2)	Site-specific Considerations
Other Treatment			
Demolition	Buildings and other structures are disassembled/broken into constituent components for disposal as appropriate by material type.	PH	• Pre-assessment for hazardous materials (e.g., lead- or PCB-paint, asbestos, mercury, formaldehyde, silica) often required
Excavation, Retrieval, Off-Site Disposal	Contaminated material is removed and transported to permitted off-site treatment and disposal facilities. Pre-treatment may be required.	NhW-All; HW-All; Soils-All	• Material is removed from the site • Costs and time for pre-treatment, if needed • Costs and time involved to transport the material south for disposal

Notes: 1. List of remedial technologies references from the United States Federal Remediation Technologies Roundtable, "Remediation Technologies Screening Matrix and Reference Guide, Version 4.0" accessed at http://www.frtr.gov/matrix2/top_page.html, August 21, 2013.

2. PH=physical hazards; NhW=Non-hazardous waste; HW=Hazardous waste; SW=Surface water

Table E-2 Bathurst RRMP Environmental Screening Requirements by Jurisdiction

Table E-2. Bathurst RRMP Environmental Screening Requirements by Jurisdiction

#	Leg./ Reg./ Guideline	Aprvl, Permit, or Auth.	Departme nt/ Agency	Activity or Compo-nent	Requirement	Important Notes
1	CEAA, 2012 RDPA, 2012		EC	n/a	Requirements set out for "designated projects" on federal land as defined in CEAA (Section 2(1), 84(a)) and RDPA Section 4(1). This project does not satisfy any these definitions, therefore an Assessment under CEAA is not required.	Federal authority must still ensure "that carrying out the project is not likely to cause significant adverse environmental effects." Also, the authority has the duty to consult with Aboriginal groups, and, where warranted, accommodate their concerns. In addition, conditions outlined in existing agreements (in this case, the NLCA) must be satisfied.
2	NLCA, 1993	Authoriza -tion for project from NPC	NPC	Remedia-tion work	As per Article 11.5.10: The NPC shall review all applications for project proposals. Upon receipt and review of a project proposal, the NPC or members thereof or officers reporting to the NPC shall: (a) determine whether the project proposals are in conformity with plans; and (b) forward the project proposals with its determination and any recommendations to the appropriate federal and territorial agencies. Article 11.5.11: Where the NPC has determined that a project proposal is not in conformity with the plan, the proponent may apply to the appropriate Minister for exemption. The Minister may exempt the project proposal from conformity with the plan and shall, subject to Sections 12.3.2 and 12.3.3, refer it to NIRB for screening. Nonconforming project proposals shall not be sent to NIRB until such	http://www.nunavut.ca/en/approved_plans/north_baffin All project proposals in the North Baffin Planning Region that require a licence or authorization from a land use authorizing agency must be assessed by the NPC for conformity with the NBRLUP. Bathurst Island, Ile Vanier and Cameron Island are located within the North Baffin Planning Region, Schedule 12-1 outlines exemptions: 1. Land use activities not requiring a permit or authorization from the government of Canada or Territorial Government. 2. Land use activities requiring only a Class B permit under the Territorial Land Use Regulations. 5. Water uses that do not require a public hearing under Section 13.7.3. 7. Such other categories of activities and projects

Table E-2. Bathurst RRMP Environmental Screening Requirements by Jurisdiction

#	Leg./ Reg./ Guideline	Aprvl, Permit, or Auth.	Departme nt/ Agency	Activity or Compo-nent	Requirement	Important Notes
					exemption is obtained or a variance has been approved. <u>Article 11.9.1:</u> The NPC shall identify and prioritize the requirement to clean-up waste sites in the Nunavut Settlement Area, including hazardous waste sites, inactive mining sites, abandoned DEW Line sites, and non-hazardous sites near communities. The NPC shall consider waste sites in the Kitikmeot region on a priority basis. To the extent possible, this initiative shall be coordinated with the development of land use plans.	as may be agreed upon by NIRB and the appropriate Minister.
3	NLCA, 1993 TLUR, 2014	Permit to do work	NPC NIRB AANDC		Obtain, from AANDC engineer, a **Permit A** if, as per Section 8 of the TLUR: (a) in any 30 day period, plan to use more than 150kg of explosives; (b) plan to use a vehicle that exceeds 10 t net weight on public roads or trails maintained wholly or in part by federal funds; (c) a power driven machinery for each drilling purposes whose operating weight exceeds 25 t, excluding ancillary equipment; (d) an established campsite is to be used for more than 400 man-days; (e) any petroleum fuel storage facility exceeds 80,000 L capacity, or any single container for storage of petroleum exceeds 4,000L capacity; (f) plan to use any stationary power driven machine for moving earth or clearing land vegetation; (g) plan to use any stationary power driven machine for hydraulic prospecting, moving	Where the engineer (AANDC rep.) receives an application for a Class A Permit that is not made in accordance with the regulations, he shall, ***within 10 days***, thereafter, notify the applicant in writing that his application cannot be accepted and give the reasons therefor. Eligibility for a Permit: Section 21 (a) through (c). Application for a Permit requires all the information outlined in Section 22 (1) to (3). As part of NIRB EIS, must include All information in PSIR. NB.Form 1 MUST be in English and Inuktitut As per Section 22 of the TLUR: (2) Every permit application submitted pursuant to subsection (1) shall be accompanied by the

Table E-2. Bathurst RRMP Environmental Screening Requirements by Jurisdiction

#	Leg./ Reg./ Guideline	Aprvl, Permit, or Auth.	Department/ Agency	Activity or Compo-nent	Requirement	Important Notes
					earth or clearing land, other than a power saw; (h) plan to level, grade, clear, cut or snow-plow any line, trail or right-of-way greater than 1.5 width and exceeding 4 ha in area.	application fee set out in Schedule I, the land use fee set out in Schedule II and a preliminary plan showing (a) the lands proposed to be used and an estimate of their area; and (b) the approximate location of all (i) existing lines, trails, rights-of-way and cleared areas proposed to be used in the land use operation, (ii) new lines, trails, rights-of-way and cleared areas proposed to be used in the land use operation, (iii) buildings, campsites, air landing strips, air navigation aids, fuel and supply storage sites, waste disposal sites, excavations and other works and places proposed to be constructed or used during the land use operation, and (iv) bridges, dams, ditches, railroads, highways and roads, transmission lines, pipelines, survey lines and monuments, air landing strips, streams and all other features, structures or works that, in the opinion of the applicant, may be affected by the land use operation.

Table E-2. Bathurst RRMP Environmental Screening Requirements by Jurisdiction

#	Leg./ Reg./ Guideline	Aprvl, Permit, or Auth.	Department/ Agency	Activity or Compo-nent	Requirement	Important Notes
4	NLCA, 1993 TLUR, 2014 NLCA Schedule 12-1 Exemptions from Screening AANDC Class B Land Use Permit		AANDC Land Admin Office		Obtain, from AANDC engineer, a **Permit B** if, as per Section 8 of the TLUR: (a) in any 30 day period, plan to use >50kg but <150kg of explosives; (b) plan to use a vehicle that is >5t but <10t net weight on public roads or trails maintained wholly or in part by federal funds; (c) a power driven machinery for earth drilling purposes whose operating weight is >500kg but <25t, excluding ancillary equipment; (d) an established campsite is to be used by 2+ people for >100 but <400 man-days; (e) any petroleum fuel storage facility >4,000 but <80,000 L capacity, or any single container for petroleum storage >2,000, but <4,000L capacity; (f) plan to level, grade, clear, cut or snow-plow any line, trail or right-of-way greater than 1.5 width but less than 4 ha in area. Above those thresholds, a Class A permit (and NIRB Screening) is required.	As per Section 31 of the TLUR: (1) The engineer may include in any permit terms and conditions respecting (a) the location and the area of territorial lands that may be used; (b) the times at which any work or undertaking may be carried on; (c) the type and size of equipment that may be used in the land use operation; (d) the methods and techniques to be employed by the permittee in carrying out the land use operation; (e) the type, location, capacity and operation of all facilities to be used by the permittee in the land use operation; (f) the methods of controlling or preventing ponding of water, flooding, erosion, slides and subsidence of land; (g) the use, storage, handling and ultimate disposal of any chemical or toxic material to be used in the land use operation; (h) the protection of wildlife and fisheries habitat; (i) the protection of objects and places of recreational, scenic and ecological value; (j) the deposit of security in accordance with section 36; (k) the establishment of petroleum fuel storage facilities; (l) the methods and techniques for debris and brush disposal; and (m) such other matters not inconsistent with these Regulations as the engineer thinks necessary for the protection of the biological or physical characteristics of the land management zone.

Table E-2. Bathurst RRMP Environmental Screening Requirements by Jurisdiction

#	Leg./ Reg./ Guideline	Aprvl, Permit, or Auth.	Department/ Agency	Activity or Compo-nent	Requirement	Important Notes
5	NLCA, 1993 NIRB, various		NIRB		As part of the NIRB application, will need to submit all information pertaining to the Project as a whole, including special focus on Section F of "Screening Part 2 Form of the Project Specific Information Requirements (PSIR)" for "Site Cleanup/Remediation" work	NIRB does not accept links to ftp sites Must provide NIRB with (1) electronic copy and (1) hardcopy in English All maps must follow specs outlined Must complete all information, i.e. indicate n/a if section not applicable
6	NLCA, 1993		NPC NIRB		Per NIRB Guide 3: "As of the date of this guide [August 2007], two (2) regions have approved land use plans, the North Baffin and the Keewatin. If the project is located within a land use planning region, the Proponent should contact the Authorizing Agencies, who then will forward the application on to the NPC in accordance with Section 11.5.10. If the NPC determines that the project proposal is in conformity with the approved land use plans, or a variance has been approved, NPC forwards the proposal to the NIRB for screening except the project is exempt under Schedule 12-1 of the NLCA unless NPC has concerns about the cumulative impact of that project proposal in relation to other development in the planning region". A proponent can contact NPC directly if they have questions regarding applicability of land use plans to their project: **1-867-983-2730** Approximate Timeline for NIRB review outlined in Guide 5	
7	NWNSRTA, 2002		NWB		As per Schedule 2, for "any other use of waters" (i.e. Schedule 1 "other undertaking"): -water use authorized without licence if use of less than 50 m^3 per day -water use requires **Type B licence** if use of more than 50 m^3 but less than 300 m^3 per day -water use requires **Type A licence** if use of more than 300 m^3 per day As per Schedule 3, for "other undertaking": -water use authorized without licence provided any deposit of sewage to a sump -water use requires **Type B licence** if have any other deposit of waste	

Table E-2. Bathurst RRMP Environmental Screening Requirements by Jurisdiction

#	Leg./ Reg./ Guideline	Aprvl, Permit, or Auth.	Department/ Agency	Activity or Compo-nent	Requirement	Important Notes
8	Arctic Waters Pollution Prevention Act, 1985		Govt of Canada (EC, TC?)		As per Section 4: (1) Except as authorized by regulations made under this section, no person or ship shall deposit or permit the deposit of waste of any type in the arctic waters or in any place on the mainland or islands of the Canadian arctic under any conditions where the waste or any other waste that results from the deposit of the waste may enter the arctic waters. (2) Subsection (1) does not apply to the deposit of waste in waters that form part of a water quality management area designated pursuant to the Canada Water Act if the waste so deposited is of a type and quantity and is deposited under conditions authorized by regulations made under paragraph 18(2)(a) of that Act with respect to that water quality management area. (3) The Governor in Council may make regulations for the purposes of this section prescribing (a) the type and quantity of waste, if any, that may be deposited by any person or ship in the arctic waters or in any place on the mainland or islands of the Canadian arctic under any conditions where that waste or any other waste that results from the deposit of that waste may enter the arctic waters; and (b) the conditions under which any such waste may be so deposited.	
9	CEPA, 1999 Storage Tanks for Petroleum Products and Allied Petroleum Products Regulations (STPPAPPR), 2008		EC	n/a	The regulation is set out for any "storage tank system" in Canada as defined in the STPPAPPR Section 2(1), The ASTs that are present at the Sites do not meet these criteria. The regulation could apply to installations provided by a remedial contractor. *Note that this could apply if plan to have an AST with capacity of 2,500L or more connected to a generator or any tank greater than 230L used for motive fuels.*	

Table E-2. Bathurst RRMP Environmental Screening Requirements by Jurisdiction

#	Leg./ Reg./ Guideline	Aprvl, Permit, or Auth.	Department/ Agency	Activity or Compo-nent	Requirement	Important Notes
10	Environmental Protection Act, RSNWT (Nu), 1988 EGBISW, 2010 (rev. 2012)	Environmental Branch at Government of Nunavut to be notified if incineration of waste to take place, and made aware of the type of equipment being used	Nunavut Department of Environment	Incineration of waste	http://env.gov.nu.ca/sites/default/files/guideline_burning_and_incineration_of_solid_waste_2012.pdf - As per spec, most effective method of incineration – to segregate waste before starting - Refers to CCME standards for dioxins, furans and mercury emissions for air emission standards. - Opacity in incinerator stack should be less than 5% (look at Figure 6) - Keep waste dry - Facility should be 100m from surface body of water (also at a far distance from sensitive areas – camp, work site, drinking water supply, etc). - Keep records of when, how much and what waste was burned, how the waste was loaded into the burning device or incinerator, the amount of smoke and bottom ash generated, how the fire was started, etc. - Operation of incinerators should be monitored using on-line instruments (Section 3.7) Other records to be kept: - Operating data including readings from the process and emissions monitoring instruments. - Weather conditions (i.e. air temperature and wind speed) at the time the incinerator is being operated. - Repairs and maintenance performed on the incinerator and monitoring instruments. - Major changes in operation. - Quantity, condition and disposal location of the collected bottom ash. - Operator training.	Notes as per: Department of Environment Government of Nunavut – Environmental Guideline for the Burning and Incineration of Solid Waste (EGBISW) From previous conversation between Harminder Kaur and Gov. of Nunavut: - Government of Nunavut does not have a formal process; they would like to "know" when incineration is taking place and what type of equipment is being used. They use this to verify if the equipment will sufficiently control air emissions. I [Harminder] provided the equipment model information to them in an email. They also wanted details on the type of feedstock. I stated that it will be tested to verify that it meets criteria for incineration (PCBs < 2 ppm, Chlorine < 1000 ppm, Cadmium < 2 ppm, Chromium < 10 ppm and Lead < 100 ppm). - As for the equipment, the representative did mention that they feel an added level of assurance when equipment that is CSA/ULC approved or if the specific equipment has been approved under other provincial jurisdictions. No specific jurisdictions were mentioned.

Table E-2. Bathurst RRMP Environmental Screening Requirements by Jurisdiction

#	Leg./ Reg./ Guideline	Aprvl, Permit, or Auth.	Department/ Agency	Activity or Compo-nent	Requirement	Important Notes
11	Environmental Protection Act, RSNWT (Nu), 1988 EGIWDMSWSTF, 2002		Nunavut Department of Environment	Discharge into municipal waste facilities	As per Section 2.2, process residuals that meet the outlined criteria in Table 1 may be disposed of in a municipal landfill. Otherwise, refer to Figure on page 6 of Guideline to determine method of disposal.	
12	Environmental Protection Act, RSNWT (Nu), 1988 EGGMHW, 1999		Nunavut Department of Environment	Manage-ment of Hazardous Waste	Refer to Appendix 3 for regulatory bodies depending on type of Hazardous Waste. Hazardous Waste may include: "discarded paint, used solvent, motor and lubricating oil, cleaning compounds, certain building construction and demolition waste and products with an expired shelf life."	
13	Fisheries Act, 1985 CEPA, 1999 CEAA, 2012 Migratory Birds Convention Act, 1994 Species at Risk Act, 2002		EC CCME		Per FCSAP, siting for Landfarm includes: -distance greater than 500m from residential boundary -distance greater than 500m from permanent surface water body -distance greater than 500m from potable groundwater well -ensure follow provisions set out in *Migratory Birds Convention Act (MCBA)* and *Species at Risk Act (SARA)*, i.e. may need to obtain permits under SARA where work is near sensitive species -liners/barriers are not required at site more than 5m of native underlying soil with low hydraulic conductivity ($<10^{-6}$ cm/s) -must be sited on location with natural slope less than 5% -groundwater table is greater than 3m from surface -should not be sited on land within a 50 year floodplain	
14	Fisheries Act, 1985	Authorization for harmful alteration, disruption or destruction of fish habitat	DFO	Any activity that may harm fish or fish habitat	As per Section 35 (1) "35. (1) No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery." It should also be noted that DFO provides measures to avoid harm, which they expect to be followed on any project. Currently, the proposed Project does not affect fish or fish habitat. However, in the event that water flow, quality, and fish or fish habitat may be affected, an authorization from DFO will need to be obtained.	

Table E-2. Bathurst RRMP Environmental Screening Requirements by Jurisdiction

#	Leg./ Reg./ Guideline	Aprvl, Permit, or Auth.	Department/ Agency	Activity or Compo-nent	Requirement	Important Notes
15	Fisheries Act, 1985 Guidelines for Effluent Quality and Wastewater Treatment at Federal Establishments, 1976		EC	Any discharge of effluent water	As AANDC (DIAND) and PWGSC are both listed in the Schedules set out in the Guideline, if any discharge of effluent will take place during the project, the water conditions set out in this guideline must be met.	
16	Migratory Birds Convention Act, 1994		EC	Any activity that may affect migratory birds	<u>As per Section 12 of the Act:</u> (1) The Governor in Council may make any regulations that the Governor in Council considers necessary to carry out the purposes and provisions of this Act and the Convention, including regulations (a) providing for the periods during which, and the areas in which, (i) migratory birds may be killed, captured or taken, (ii) nests may be damaged, destroyed, removed or disturbed (b) for limiting the number of migratory birds that a person may kill, capture or take in any period when doing so is permitted by the regulations, and providing for the manner in which those birds may then be killed, captured or taken and the equipment that may be used; (d) for granting permits to kill, capture, take, buy, sell, exchange, give or possess migratory birds, or to make migratory birds the subject of a commercial transaction; (f) respecting the issuance, renewal, revocation and suspension of permits; (h) for prohibiting the killing, capturing, injuring, taking or disturbing of migratory birds or the damaging, destroying, removing or disturbing of nests; (h.1) respecting the conditions and circumstances under which migratory birds may be killed, captured, injured, taken or disturbed, or nests may be damaged, destroyed, removed or disturbed; (i) prescribing protection areas for migratory birds and nests, and for the control and management of those areas; (k) authorizing the Minister to vary or suspend the application of any regulation made under this Act if the Minister considers it necessary to do so for the conservation of migratory birds.	

Table E-2. Bathurst RRMP Environmental Screening Requirements by Jurisdiction

#	Leg./ Reg./ Guideline	Aprvl, Permit, or Auth.	Department/ Agency	Activity or Compo-nent	Requirement	Important Notes
17	Species at Risk Act, 2002		DFO EC	Any work that may affect species at risk	As per Section 73(1) and (2): (1) The competent minister may enter into an agreement with a person, or issue a permit to a person, authorizing the person to engage in an activity affecting a listed wildlife species, any part of its critical habitat or the residences of its individuals. (2) The agreement may be entered into, or the permit issued, only if the competent minister is of the opinion that (a) the activity is scientific research relating to the conservation of the species and conducted by qualified persons; (b) the activity benefits the species or is required to enhance its chance of survival in the wild; or (c) affecting the species is incidental to the carrying out of the activity.	

Bathurst Island Project
- Community Consultation Summary -

DATE:	March 18, 2015
TIME:	1900-2030
LOCATION:	Resolute Bay Hamlet Office Gym
REPRESENTATIVES:	David Wilson (Stantec), Michael Bernardin (PWGSC), Mark Yetman (AANDC) Note: Jane Chisholm (Parks Canada) was also present as an observer.
ATTENDANCE:	4
NOTES:	There were 8 people that signed the attendance sheet but only 4 of them actually attended the meeting.

QUESTIONS & ANSWERS	
Q1) Are there airstrips at all the sites?	A1) DW: There is a fair sized airstrip at Ile Vanier APEC 4 that is in decent condition, and at Bent Horn APEC 6 there is also one. These are currently suitable for Twin Otter type aircraft. The other project sites were accessed via helicopter and either do not have airstrips or have airstrips that are not in usable condition.
Q2) The engineered cover proposed for the contaminated soils. Have you used similar covers in the past? Will we see years later?	A2) DW: Engineered covers are common practice for contaminated soils. The cover will be placed in two layers, one that is compacted to cover the soil and a looser layer to protect it and promote vegetation growth. As part of the project plan we will need to monitor the site/cover to see if it holds up.

Bathurst Island Project
- Community Consultation Summary -

Q3) There is a site with an old barge where there are drums, did you investigate this site? It is on the east coast of the island, people were told not to go close to the drums. You did not investigate all the sites on Bathurst Island? Concerned about who is responsible for contaminated sites on IOL. It was there before the land was IOL.	A3) DW: We did not look at that site specifically. MY: No, we did not. We investigated the ones were knew about. Part of the east coast of the island is IOL, it is possible this site is on IOL. MY: If the site is on IOL then it is the responsibility of QIA. Yes, the contamination may have been there before the land was IOL. **(See Follow-Up Actions below)**
Q4) Concerned about caribou in the area and how the project activities will impact them.	MY: We will take measures to minimize the impact of our activities on caribou. This includes things like shutting down operations when caribou are within 1 km of the site and restrictions on the height levels of flights. These items are usually required by the Land Use Permit.
Q5) Question on the procuement process and how proposals are evaluated.	MB: PWGSC typically uses a 60 percent technical and 40 percent cost weighting when evaluating proposals under the RFP process.
FOLLOW UP ACTIONS:	**Barge Site from Q3**: Attempt to locate this site and if it is on Crown land determine if there has been any investigation work done on it to date. If not decide if investigation work is required. Follow-up discussions with DW and Aziz Kheraj indicated the approximate location of the Barge Site is definitely on Crown land. Further follow-up is required.
MEDIA INQUIRIES:	None

* A copy of the Presentation and the Attendance Sheet is attached

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

Bathurst Island Project

Remediation and Risk Management Plan (RRMP)

Resolute Bay, Nunavut
March 18, 2015

Canada

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

Introductions

Mark Yetman

- Aboriginal Affairs and Northern Development Canada (AANDC)
- Project Role: Project owner, funding

David Wilson

- Stantec Consulting Ltd. (Stantec)
- Project Role: Consultant/Engineer hired to complete the Phase III Environmental Site Assessment and produce the Remediation & Risk Management Plan

Michael Bernardin

- Public Works and Government Services Canada (PWGSC)
- Project Role: Project and contract management

Young Inlet

2

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

Why Are We Here?

- **Share** information
- **Learn** what you know about the Bathurst Island sites
- **Communicate** our plans to deal with the risks at the Bathurst Island sites
- **Seek community input** so we can produce a better plan

3

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

Presentation Outline

1. **AANDC**
   - **1.1** Project Objectives
   - **1.2** Bathurst Island Project Location
   - **1.3** Bathurst Island Site History & Project Plan
2. **Stantec**
   - **2.1** Project Breakdown
   - **2.2** Phase III Environmental Site Assessment (ESA)
   - **2.3** Human Health and Ecological Risk Assessment (HHERA)
   - **2.4** Remedial Options Analysis (ROA)
   - **2.5** Remediation and Risk Management Plan (RRMP)
3. **PWGSC**
   - **3.1** Project Procurement
   - **3.2** Preliminary Project Schedule

4

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

1.1 Project Objectives

- Minimize environmental impacts to humans and wildlife
- Ensure the project complies with all legal requirements
- Ensure the project follows all Federal and Departmental policies
- Increase public awareness about clean up activities
- Provide employment opportunities for the local work force

5

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

1.2 Bathurst Island Project Location (~300 km Northwest of Resolute Bay)

6

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

1.3 Bathurst Island Site History & Project Plan

1970s - Oil and gas exploration activities
1985 - Oil production started at Bent Horn
1996 - Oil production ended at Bent Horn
2012 - Phase I/II Environmental Site Assessments
2014 - Phase III Environmental Site Assessments
- Archaeological Assessments
- Geotechnical Assessments
- Human Health and Ecological Risk Assessments*
- Remedial Options Analysis
2015 - Remediation/Risk Management Plan Community Consultation


J-34 Bathurst Caledonia

7

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

1.3 Bathurst Island Site History & Project Plan (continued)

2015 - Finalize Remedial Action Plan
2016 - Project Specifications
- Request for Proposal/Tender
- Hire a Contractor
- Apply for and obtain permits
2017 - Community consultation
- Mobilize to site
- Complete site work
- Demobilize from site
- Community consultation


Stokes Range

8

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2. Agenda

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

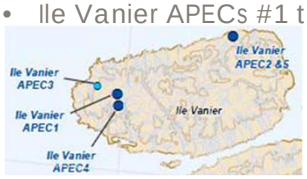
2.1 Project Breakdown

Bathurst Island

- Young Inlet, Stokes Range
- N-12, J-34

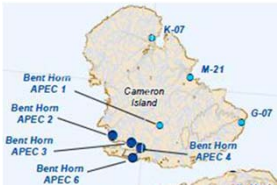
Ile Vanier

- Ile Vanier APECs #1 to 5



Bent Horn

- Bent Horn APECs #1 to 6
- G-07, M-21, K-07



Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.2.1 Phase III ESA - Results

Bathurst Island:

- Site N-12 has approximately 33 m^3 of metals and organics impacted soils above criteria levels that are of concern
- Remaining soil impacts at N-12 and soil impacts at Young Inlet and Stokes Range above criteria levels are not of concern, based on the HHERA
- Metals impacts in ponded water at N-12, J-34, Young Inlet and Stokes Range above criteria are not of concern, based on the HHERA

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.2.1 Phase III ESA - Results (continued)

Bathurst Island **Hazardous** & Non-Hazardous Materials

Site	# Drums			Metal Debris		
	Full	Partial	Empty	Description	Location	Vol. (m^3)
N-12	0	0	6	scrap metal	in well head box	21
				misc metal	in buried debris area, north end of east former building	
				old food cans	in buried debris area, north end of east former building	
J-34	0	0	30	compressed gas cylinders	at trailers, in sumps	# of 8
				misc. metal	at trailers, in landfill pit, at northeast sump	75
				large metal	at north end of large sump	5
				metal pipes	at north east corner	2
Young Inlet	Airstrip:	Airstrip:	Airstrip:	4 long pipes	southeast	5
	5 + 1 (1)	2 + 2 (1)	90 + 9 (1)	misc. metal, vehicle hood	northeast	10
				misc. metal	large debris pile southeast by sump	100
	Well Site:	Well Site:	Well Site:	misc. metal	northeast by burn pit	5
	4	0	6			
Stokes Range	0	0	0	-	-	-

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.2.1 Phase III ESA - Results (continued)

Bathurst Island **Hazardous** & Non-Hazardous Materials

Site	Wood Debris			Other Debris		
	Description	Location	Vol. (m^3)	Description	Location	Vol. (m^3)
N-12	plywood 4x8 sheets	former building areas	# of sheets 20	plastic blue scrubbers	west side of big sump	1
	wood planks	former building areas	0.45	filters	west side of big sump	1
	wood beams	around well head, scattered around the Site	48.6	drill cuttings	west side of big sump	3
J-34	wooden beams and pallets	central	# of beams 13	white plastic pieces	south of big sump	20
	wood pallets	central	# of pallets 7	**batteries**	at trailers	4 batteries
	plywood 4x8 sheets	at trailers	16	two trailers	700 m southeast of well head	2 x 160m^2 trailers
				bags of hardened concrete	central	3
Young Inlet	Wood chip pile	central (south of well)	20	plastic, styrofoam	southwest	5
	Wood chips	northeast	3	mud pile	southwest	5
				bags of concrete	east	10
Stokes Range	misc wood	debris pile 1, central		misc. plastic	debris pile 1, central	-
	shredded wood	debris pile 3, south	-	brown, clay-silt material	debris pile 2, south	-
				misc. plastic	debris pile 3, south	-

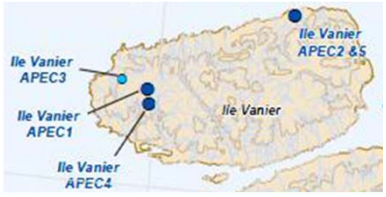
Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.2.1 Phase III ESA - Results (continued)

Ile Vanier:

- APEC 1 Hotspur J-20 Well Site has approximately 100 m^3 of organics and metals impacted soils above criteria levels that are of concern
- Remaining soil impacts at APEC 1, and soil impacts at APECs 2 and 4 above criteria levels are not of concern, based on the results of the HHERA
- Organics and metals impacts to surface water at APEC 2 above criteria levels are not of concern, based on the results of the HHERA




Well Marker APEC 1

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.2.1 Phase III ESA - Results (continued)

Ile Vanier **Hazardous** & Non-Hazardous Materials

Site	# Drums			Metal Debris		
	Full	Partial	Empty	Description	Location	Vol. (m^3)
APEC 1	0	0	10	Crushed metal cans	West side of Site	30
				Metal pipes and wire	Southeast corner of site	4
APEC 2	0	0	5	Metal pipes and misc metal	Central	5
APEC 4	0	3	221	6 empty compressed gas cylinders	Cache northeast	2

Site	Wood Debris			Other Debris		
	Description	Location	Vol. (m^3)	Description	Location	Vol. (m^3)
APEC 1	Wooden beams	Around well head	-	-	-	-
	Minor wooden debris	Around former building	3			
	Minor wooden debris	Around well head	5			
APEC 2	Minor wooden debris	Around well head	5	-	-	-
APEC 4	-	-	-	-	-	-

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.2.1 Phase III ESA - Results (continued)

Bent Horn:

- APECs 1 and 2 and well sites K-07, M-21 and G-07 appear from aerial survey to be disturbed to a comparatively lesser extent than many of the heavily impacted sites
- APEC 6 Main Camp has approximately 2 m^3 of soils above criteria levels that are of concern
- Remaining soils at APEC 6 and soil impacts at APEC 3 above criteria levels are not of concern, based on the HHERA
- Organics and metals impacts to surface water at APEC 6 above criteria levels are not of concern, based on the results of the HHERA


APEC 6 Aerial View

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.2.1 Phase III ESA - Results (continued)

Bent Horn **Hazardous** & Non-Hazardous Materials

# Drums			Metal Debris		
Full	Partial	Empty	Description	Location	Vol. (m^3)
8	-	-	-	-	-

Wood Debris			Other Debris		
Description	Location	Vol. (m^3)	Description	Location	Vol. (m^3)
-	-	-	-	-	-

Bent Horn APEC 3

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.2.2 Phase III ESA - Traditional Knowledge(TK)

During Completion of Phase III ESAs:

- Interviews in May, 2013. Main findings:
  - More than 200 caribou were present in the area in 2012
  - Many types of herbivores found all across the island
  - Caribou migrate from island to island, and migrate south in the winter due to the lack of vegetation
  - Fuel caches and debris sites still present, including Bateman Bay, East coast of the island near Polar Bear Pass, and Freeman Cove

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.2.2 Phase III ESA - Traditional Knowledge(TK)(continued)

During Completion of RRMP:

- Interviews in July, 2014. Main findings:
  - Main worry is the visible fuel caches; individuals feel that the drums on the land may be leaking
  - Similarly worry about old mining sites that are leaking into the environment
  - Individuals are concerned that contamination may be going into the food that they are eating (i.e. the wildlife and fish that they are hunting)

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.3.1 HHERA - Assumptions

Scenario

- Human Health: family, hunting, traditional food
- Receptors: Inuit Toddler, Inuit Adult, Remediation Worker
- Duration: 91 days/13 weeks of exposure averaged over a year to derive the chronic daily dose
- Direct exposure pathways: soil ingestion, soil contact with skin, inhalation of dust
- Indirect exposure pathways: drinking of surface water, and/or eating small wild game
- Organics and metals in soil, and metals in surface water, were screened, and applicable parameters were carried through for risk assessment

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.3.2 HHERA - Results

Bathurst Island:

- Human health risk: The results suggest that there are no risks to any of the three human receptors due to from any of the Bathurst Island Sites (J-34, N-12, Young Inlet, and Stokes Range)
- Bathurst Island Sites can be considered to present "essentially negligible" risks with removal of PCB-impacted soils at a small burn pit area at N-12

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.3.2 HHERA - Results (continued)

Bathurst Island (continued):

- Ecological risk:
  - Results suggest that while potential risks were identified to the Spotted Sandpiper surrogate at N-12, Young Inlet, and Stokes Range, the actual risks to this receptor at the population level are expected to be negligible
  - Potential risk to terrestrial plant and soil invertebrate populations from barium in soil. Some metals in surface water may pose a potential risk to freshwater aquatic receptors at Stokes Range; however, these impacts are likely to be negligible at the population level
- PCB contamination exceeded health-based guidelines and potential risk was identified to avian receptors at a small burn pit area at the N-12 site. It is recommended that this one area be remediated, either by capping with clean material or by excavation

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.3.2 HHERA - Results (continued)

Ile Vanier:

- Human health risk: The results suggest that there are no risks to any of the three human receptors due to direct exposure pathways, ingestion of surface water, and/or consumption of small wild game from any of the Ile Vanier APECs (APEC 1, 2, and 4)
- Remediation of lead hotspot at APEC 1 J-20 (i.e. excavation, capping, etc.) warranted to eliminate any risk concerns

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.3.2 HHERA - Results (continued)

Ile Vanier (continued):

- Ecological risk:
  - Potential risks from organics and metals were identified for Spotter Sandpiper; terrestrial plants and soil invertebrates; and freshwater aquatic organisms
  - It is not expected that exposure to these impacts will pose a risk at the population level

Ile Vanier APEC 2 Sump Pit

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.3.2 HHERA - Results (continued)

Bent Horn:

- Human health risk: The results suggest that there are no risks to any of the three human receptors (Inuit Toddler, Inuit Adult, Remediation Worker) due to direct exposure pathways, ingestion of surface water, and/or consumption of small wild game from any of the Bent Horn APECs (APEC 3, 4, and 6)
- Bent Horn APECs can be considered to present "essentially negligible" risks with removal of grease globules at surface at APEC 6

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.3.2 HHERA - Results (continued)

Bent Horn (continued):

- Ecological risk:
  - Potential risks to the Spotted Sandpiper surrogate at APEC 6, the actual risks to this receptor at the population level are expected to be negligible
  - Potential risk to terrestrial plant and soil invertebrate populations from PHCs in soil. Iron and selenium in surface water may pose a potential risk to freshwater aquatic receptors at APEC 6. However, these impacts are likely to be negligible at the population level

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.4 Remedial Options Analysis(ROA)

Criteria:

- Physical hazards/Non-hazardous Waste: no regulatory requirements
- Hazardous Waste: CEPA, Nunavut Environmental Guideline for the General Management of Hazardous Waste
- Soils, Surface Water, Groundwater: Canadian Environmental Quality and Interim Groundwater Quality Guidelines, Canada-Wide Standards for PHCs in Soil, Canadian Water Quality Guidelines for the Protection of Aquatic Life
- FCSAP Decision-Making Framework
- Factors used to evaluate different possible remedial options

Analysis & Selection:

- Application of criteria to the set of proposed remedial options for each site - waste stream
- Selection of highest ranked remedial option after analysis

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.4.1 ROA - Criteria

1. Cost:

- All costs for implementation of the remedial option including procurement, transportation, equipment, labour, special handling, environmental protection, and monitoring

2. Effectiveness of Meeting Goals:

- Evaluation of whether or not the remedial option will meet the applicable remedial target for the waste stream, such as a guideline criteria, including management of any residual risk for targets not fully met

3. Timeframe:

- Length of time required for the remedial option to meet the applicable remedial criteria, including management of any residual risk

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.4.1 ROA - Criteria (continued)

4. Ease of Implementation:
- How easily the remedial option can be implemented, with proven options for the waste stream and for remote sites given more favourable evaluations over unproven options; also considers any need for special equipment, logistical, organizational and transport requirements, any additional regulatory requirements, and any long term monitoring requirements

5. Regulatory Acceptance:
- Likelihood of the remedial option being accepted by applicable regulators (e.g., AANDC, EC, GN)

6. Community Acceptance:
- Likelihood of the proposed remedial option being accepted by applicable stakeholders

7. Monitoring:
- Whether follow-up monitoring will be required, and for what length of time

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.4.2 ROA - Options Considered

Physical Hazards (Debris and Structures):

1. **No action**
2. Collection/demolition and disposal on/off site

Non-Hazardous Waste:

- Wood (unpainted):
  1. **No action**
  2. Burn on-site
  3. Collection and disposal on/off site
- Other (steel, etc.):
  1. **No action**
  2. Collection and disposal on/off site

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.4.2 ROA - Options Considered (continued)

Hazardous Waste:

- Organic Liquids (diesel, etc.):
  1. Dispose of off-site
  2. **Incinerate**
- Other (batteries, etc.):
  1. **Dispose of off-site**

Soils:

- PCB Impacted Soils at N-12:
  1. **Excavation and off-site disposal**
  2. Excavation and on-site disposal
  3. Engineered cover
  4. On-site treatment

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.4.2 ROA - Options Considered (continued)

Soils (continued):

- Lead Impacted Soils at Ile Vanier APEC 1:
  1. Excavation and off-site disposal
  2. Excavation and on-site disposal
  3. **Engineered cover**
  4. On-site treatment
- Hydrocarbon impacted soils where the HHERA shows no risk:
  1. **Monitor land use**
  2. Land use restrictions
  3. Engineered cover
  4. Monitored natural attenuation

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.4.2 ROA - Options Considered (continued)

Soils (continued):

- Metal impacted soils where the HHERA shows no risk:

1. **Monitor land use**
2. Land use restrictions
3. Engineered cover
4. Access control (fencing)

Surface Water:

- Metal impacted surface water where the HHERA shows no risk:

1. **Monitor land use**
2. Impermeable barriers (prevent migration)
3. Access control (fencing)
4. Monitored natural attenuation

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.4.2 ROA - Options Considered (continued)

Ground Water (continued):

- Metal impacted ground water where the HHERA shows no risk:

1. **Monitor land use**
2. Impermeable barriers (prevent migration)
3. Land use restrictions
4. Monitored natural attenuation

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.5.1 Summary of Recommended Options for RRMP

Physical Hazards - Debris and Structures:

- No action

Non-Hazardous Waste - Wood (unpainted), Steel:

- No action

Hazardous Waste - Organic Liquids (diesel, etc.):

- Incinerate

Hazardous Waste - Other (batteries, etc.):

- Dispose of off-site

Soils - PCB Impacted Soils at N-12:

- Excavation and off-site disposal

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.5.1 Summary of Recommended Options for RRMP (continued)

Soils - Lead Impacted Soils at Ile Vanier APEC 1:

- Engineered cover

Soils - Hydrocarbon impacted soils where HHERA shows no risk:

- Monitor land use

Soils - Metal impacted soils where HHERA shows no risk:

- Monitor land use

Surface Water - Metal impacted surface water where HHERA shows no risk :

- Monitor land use

Ground Water - Metal impacted ground water where HHERA shows no risk :

- Monitor land use

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

2.5.2 RRMP - Other Considerations

Site Specific Conditions:

- Identification of potential borrow sources, camp areas, and site access (air)

Verification:

- Activities undertaken by departmental representatives during remediation to confirm that impacts have been addressed

Monitoring:

- Program to collect data after remediation to confirm the effectiveness of remedial activities, and to revisit remediation if shown to be ineffective

Stantec

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

3.1 Project Procurement

Use a Request for Proposal (RFP) process

Project will be posted on the Government of Canada's website:

www.buyandsell.gc.ca

Proposals will be evaluated based on the following components:

- Technical
- Management
- Aboriginal Opportunity Considerations
- Socioeconomic benefits for the community:
  - Subcontracting (goods, services, etc.)
  - Employment
  - Training
- Cost

Source: Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

38

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

3.2 Preliminary Project Schedule

Milestone	Completion Date
Finalize Remediation/Risk Mgmt Plan	March 2015
Environmental screening	May 2016
Regulatory Submissions	May 2016
Request for Proposal	March 2017
Award contract	April 2017
Community meeting – Resolute	July 2017
Mobilization*	August 2017
Site remediation*	August 2017
Demobilization*	September 2017
Community meeting – Resolute	December 2017
Final reporting/project closure	March 2018

* These timelines are highly dependent on site and weather conditions
The dates are rough estimates and will be refined once we select a contractor

39

Aboriginal Affairs and Northern Development Canada | Affaires autochtones et Développement du Nord Canada

End of Presentation

To date we have:

1. Assessed the sites (Environmental, Archaeological, Geotechnical, Risk)
2. Drafted a Remediation and Risk Management Plan (RRMP)
   – Remedial Options Analysis and selected what we believe to be the best options
3. Presented the **Draft** RRMP

Now we want:

4. Community Input

– Discussion and questions?

Then we will:

5. Finalize the RRMP
6. Do the Work/Implement the RRMP

40


Aboriginal Affairs and Northern Development Canada
Affaires autochtones et Développement du Nord Canada
THANK YOU!
Mark Yetman
Project Manager Lands & Contaminated Sites
AANDC Nunavut Regional Office
E-mail: mark.yetman@aandc-aadnc.gc.ca
Phone: 867-222-2014
41

Bathurst Island Remediation Project

#	NAME (Please Print)	SIGNATURE	TELEPHONE #
1	Sarah Sallurnig	Sallurnig	3995
2	Alice Sallurnig	A - Sl	3997
3	Martha Kalluk	Martha Kalluk	252-3028
4	Tagga Manik		252 3085
5	Philip Chubbs	ATCO	252-3737
6	Rick Gowlton	ATCO	252-3535
7	Martha Idlout	Martha Idlout	252-3621
8	Timothy Kautaq	Timothy Kautaq	252-3566
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			

Appendix F

DVD of Electronic Files