Remedial Action Plan, Coral Harbour Site, Nunavut

Final Report

March 26, 2021

Prepared for:

Northern Contaminated Sites Group
Public Services and Procurement Canada

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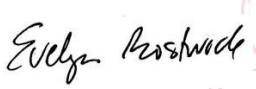
Reviewed by  Digitally signed by Evelyn Bostwick, M.Eng., P.Eng. Date: 2021.03.29 11:08:21 -03'00'

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The Site is located approximately 10 kilometres (km) northwest of the Hamlet of Coral Harbour, Nunavut, on Southampton Island. The former military base in Coral Harbour was used by Canadian and American forces during the construction of the Distant Early Warning (DEW) Line in Northern Canada during the Second World War and for various other northern projects. The Site was active from the 1940s until the 1970s and the on-site infrastructure included an airstrip, hospital, and housing for military personnel. When the Site was decommissioned in the 1970s, most buildings were decommissioned, and remaining equipment was abandoned.

There are several Areas of Environmental Concern (APEC) at the Site, that are a result of historical on-site activities. The RAP addresses APEC 1, APEC 2, APEC 3, APEC 4 and APEC 6.

Significant components at the Site include:

- Barrel caches containing approximately 2,775 barrels with unknown contents
- Surficial staining of soil around barrel caches
- Significant surface debris, including non-hazardous and hazardous waste materials
- One tank farm, consisting of 7 tanks with an estimated total capacity of 350,000 US gallons
- Buried debris
- Wooden sheds

The goal the RAP is to provide an objective-based approach to guide remedial activities at the Site. The objective of the proposed Site remedial activities is to reduce human health and environmental liabilities by consolidation and disposing of wastes and mitigating risks associated with the physical hazardous currently present.

The proposed remediation approaches were developed following the completion of the Human Health and Ecological Risk Assessment (HHERA) that was completed by Stantec in 2020 and incorporate the conclusions and recommendations that were drawn in that report. The RAP focuses primarily on addressing the risks identified in the HHERA while proposing solutions that are expected to be viewed positively by the community. The proposed approach factors in affordability, feasibility, technical effectiveness and industry best practices.

The RAP provides a detailed review of the selected remedial options and describes disposal methods (remedial action) for each category/component of waste. A summary of the recommended remedial options is provided in the table below.

Table ES.1 Summary of Proposed Remedial Approaches

Category/ Component	Estimated Area/Volume	Recommended Approaches
Non-Hazardous Waste (NHW)		
Empty Barrels	60 m^3 after crushing	To be emptied, cleaned, crushed, and disposed of in a non-hazardous waste (NHW) facility constructed at the Site
Infrastructure (tank farm and wooden sheds)	Minimum 80 m^3	To be dismantled, incinerated or compacted, and disposed of in the on-site NWH facility. Tank farm will require an assessment prior to remedial program to determine if/what contents are present and if the paint on tanks is amended paint.
Buried Debris	6,815 m^3	Classification of the waste disposal areas (WDAs) in accordance with the Abandoned Military Site Remediation Protocol (AMSRP) (INAC, 2008) to designate each as a Class A, B or C and determine the appropriate remedial action prior to the remedial program. Disposal of NHW in the on-site NHW facility.
Surface Debris	3,430 m^3	To be collected, segregated, shredded, compacted and disposed of in the on-site NWH facility. Note bare wooden materials will be segregated and incinerated on-site.
Soil		
Surficial Staining	1,950 m^3	Areas of surficial staining to be excavated to an assumed depth of 1 m and disposed of in the on-site NHW facility. Excavated areas to be filled with borrow material and regraded to match surrounding landscape.
Hazardous Waste (HW)		
Asbestos	Minimum 5 m^3	Abate, double bag and dispose of in the on-site NHW facility.
Lead amended paint	Minimum 100 m^2	Partial abatement on-site of poorly adhered paint and off-site disposal of removed paint at hazardous waste facility. Following partial abatement, materials with remaining well adhered paint will be treated with Lead Defender® and disposed of in the on-site NHW facility.
Batteries	Expected maximum of <10 m^3	Removal from vehicles and equipment, if present, and off-site disposal at a registered hazardous waste facility.
Aqueous Liquids	16,000 L	To be sampled, consolidated, and disposed of pending the criteria that they meet. Liquids that meet the incineration criteria will be incinerated, liquids that meet the wastewater discharge criteria will be discharged and liquids that do not meet the incineration or wastewater discharge criteria will be disposed of off-site.
Liquid Petroleum Products	134,100 L	To be sampled, consolidated, and disposed of pending the criteria that they meet. Liquids that meet the incineration criteria will be incinerated, liquids that meet the wastewater discharge criteria will be discharged and liquids that do not meet the incineration or wastewater discharge criteria will be disposed of off-site.
Buried Debris	Unknown	Classification of the WDAs in accordance with the AMSRP to designate each as a Class A, B or C and determine the appropriate remedial action prior to the remedial program. Dispose of as HW if indicated by results.

The statements made in this Executive Summary text are subject to the limitations included in Section 11.0 and are to be read in conjunction with the remainder of this report.

Abbreviations

ACM	Asbestos Containing Material
AHJ	Authorities Having Jurisdiction
AMSRP	Abandoned Military Site Remediation Protocol
APEC	Area of Potential Environmental Concern
CCEA	Canadian Council of Ecological Areas
CCME	Canadian Council of Ministers of the Environment
CEQG	Canadian Environmental Quality Guidelines
CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada
COC	Contaminant of Concern
COPC	Chemicals of Potential Concern
CWS	Canada Wide Standards
DEW	Distant Early Warning
DOE-GN	Department of Environment-Government of Nunavut
ECCC	Environment and Climate Change Canada
ESA	Environmental Site Assessment
FCSAP	Federal Contaminated Sites Action Plan
GNWT	Government of Northwest Territories
GNU	Government of Nunavut
HDPE	High-Density Polyethylene
HHERA	Human Health and Ecological Risk Assessment
km	kilometre
m	metre
NHW	Non-Hazardous Waste
NU	Nunavut
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PHC	Petroleum Hydrocarbon
POL	Petroleum, Oil, and Lubricants
PSPC	Public Services and Procurement Canada
RAP	Remedial Action Plan
ROA	Remedial Options Analysis
SSTL	Site-Specific Target Level
TDG	Transportation of Dangerous Goods
TOR	Terms of Reference
WDA	Waste Disposal Area
WSCC	Worker’s Safety and Compensation Commission

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by Public Services and Procurement Canada (PSPC) on behalf of Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) to complete a Remedial Action Plan (RAP) and associated supporting work (the Project) at the former military base located in Coral Harbour, Nunavut (the Site). The requirements of the Project are detailed in the Terms of Reference (TOR) dated July 7, 2020 (and revised July 29, 2020) (PSPC, 2020), along with Stantec's Response to Terms of Reference, dated August 5, 2020 (Stantec, 2020a).

The objective of the Project is to support the future detailed design and tender phase of a Remediation Program to effectively remediate and/or risk manage the Site to reduce environmental risks to human and ecological receptors, in the short and long-term.

This report presents the proposed RAP for the Site that was developed based upon the results and findings of the Phase III Environmental Site Assessment (ESA) (Stantec, 2021a) and the Human Health and Ecological Risk Assessment (HHERA) (Stantec, 2021b) that were completed for the Site. The purpose of this RAP is to identify remedial activities that will be undertaken to address areas of potential environmental concern (APECs) that were identified in the previous reports. The RAP provides guidance for addressing environmental impacts in soil, and hazardous and non-hazardous materials present as a result of the previous use of the Site.

2.0 SITE DESCRIPTION

2.1 SITE FEATURES

The Site is located approximately 10 kilometres (km) northwest of the Hamlet of Coral Harbour, Nunavut, on Southampton Island (Figure 1, Appendix A). The former military base in Coral Harbour was used by Canadian and American forces during the construction of the Distant Early Warning (DEW) Line in Northern Canada during the Second World War and for various other northern projects. The Site was active from the 1940s until the 1970s and the on-site infrastructure included an airstrip, hospital, and housing for military personnel. When the Site was decommissioned in the 1970s, most buildings were decommissioned, and remaining equipment was abandoned.

According to previous preliminary assessments at the Site (refer to Section 3.1), several environmental concerns including physical hazards related to unconsolidated surface debris and aged structures, and environmental impacts associated with soil contamination, remain on-site.

The Site consists of eight separate APECs as described in Table 2-1. The location of each APEC is shown in Figure 1, Appendix A.

Table 2-1 APEC Summary and Description

APEC	Description of APEC
APEC 1 – Tar Barrels	APEC 1 is located approximately 550 metres (m) northwest of the municipal airport building. (WESA, 2012) reported observing approximately 150 full and partially full barrels of tar stacked in a single cache. Several of the barrels had leaked and tar was observed on the ground surface.
APEC 2 – Full Barrels	APEC 2 is located approximately 350 m north of the municipal airport building. (WESA, 2012) reported that the area contained approximately 900 full barrels containing oils, fuel and unknown liquids in a single cache. Several of the barrels were leaking non-aqueous liquids.
APEC 3 – Barrel Cache	APEC 3 is located approximately 2.25 km northeast of the municipal airport building. (WESA, 2012) reported that the barrel cache area contained approximately 1000 barrels stacked in a single cache. Multiple barrels were observed to be leaking and staining was visible in the vicinity of the barrels.
APEC 4 – Former Army Base	APEC 4 is located approximately 1.9 km southeast of the municipal airport building. The former base area was the location of several buildings including a hospital, equipment storage, personnel housing and work areas. The buildings and equipment have been removed and the area has been regraded with fill material (EarthTech, 2008). A soil sampling program was conducted in areas of suspected fuel spills and buried debris.
APEC 5 – Vehicle Dump	The vehicle dump is located approximately 3 km north of the Hamlet of Coral Harbour (the Hamlet). The origin and history of the vehicle dump is unknown. Various surface debris was reported as present in the area including discarded snowmobiles, wood and metal barrels, scrap metal, tires, fuel tanks, heavy equipment and more than 100 derelict vehicles (EarthTech, 2008).
APEC 6 – Former Airport Debris	This APEC is located approximately 400 m southeast of APEC 2 and 200 m east of the current airport. The area has been cleared and buildings have been removed with the exception of seven large aboveground storage tanks (ASTs) which can be seen in aerial imagery dated 2018. ASTs were reported as potentially empty (EarthTech, 2008).
APEC 7 - Municipal Landfills	(WESA, 2012) reported that this APEC contains two former municipal landfills that are located 3 km north of the Hamlet. The origin and history, including the types and volume of waste in the landfills is unknown. No known historical analytical data are available.
APEC 8 - Contaminated Soil Landfill	APEC 8 contains a Contaminated Soil Landfill east of APEC 2, that was reportedly engineered and constructed for the disposal of polychlorinated biphenyl (PCB) impacted soil. The origin and history are unknown. No known historical analytical data are available for APEC 8.

At the time of the 2020 site visit, Stantec personnel confirmed through observations and communication with the Hamlet that APEC 5 (Vehicle Dump, used for large item disposal), APEC 7 (Municipal Landfill, used for municipal landfill material) and APEC 8 (Contaminated Soils Landfill, used for petroleum impacted soil), were actively being used by the community for disposal; as such, CIRNAC determined that the assessment of these APECs would not be included in this Project.

2.2 CLIMATE

The territory of Nunavut lies within the Arctic climate zone, with exceptionally cold winters, and cool to cold summers (CCEA, 2014). Based on the climate normals from 1981 – 2010 for the Environment and Climate Change Canada (ECCC) weather monitoring station located at the Coral Harbour Airport, the prevailing wind is from the north and the mean annual temperature is -11°C (ECCC, 2020). The area has a summer mean temperature of approximately 6.9°C (June, July, and August) and a winter mean temperature of approximately -23.5°C (November, December, January, February, March, April) (ECCC, 2020).

Precipitation throughout most of the Territory of Nunavut falls almost entirely as snow, with small quantities of rainfall during the summer months. The average annual precipitation in Coral Harbour ranges from 200-300 mm, with an average rainfall of 163 mm and average snowfall of 141.6 cm (ECCC, 2020).

2.3 VEGETATION

The Site is situated within the Southampton Island Plain ecoregion of the Southern Arctic Ecozone (CCEA, 2014). Permafrost is continuous across the ecoregion and contains medium ice content with ice wedges. The dominant soil in the ecoregion is static and turbic cryosols, although outcrops of bedrock are common. The ecoregion is characterized by its continuous coverage of low arctic shrub tundra vegetation including dwarf birch (Betula nana), Arctic willow (Salix arctica), northern Labrador tea (Rhododendron tomentosum), avens (Dryas spp.), and dwarf shrubs (Vaccinium spp); Wet sites are typically dominated by willow, sedge (Carex sp.), and mosses (Campbell et al., 2012).

The Site has been heavily modified by historical military use or municipal waste disposal activities and consists primarily of gravel surfaces with minimal vegetation. Where natural vegetation does occur, it tends to be in sparse, isolated clusters of a single species. Arctic draba (Draba corymbosa), mountain aven (Dryas integrifolia), purple saxifrage (Saxifraga oppositifolia), and other species tolerant of disturbed sites and gravel terrain are the dominant ground cover types observed at the Site. APEC 6 is the most densely vegetated, with approximately half of the APEC vegetated by herbaceous ground cover, mosses, and dense stands of willow along an intermittent stream channel that crosses the area.

2.4 WILDLIFE

Wildlife characteristic of the Southampton Island Plain ecoregion where the Site is located includes Arctic hare (Lepus arcticus), Arctic fox (Vulpes lagopus), caribou, ermine (Mustela erminea), polar bear (Ursus maritimus), wolverine (Gulo gulo), and many migratory and resident bird species including waterfowl, songbirds, and raptors (Stantec, 2021b).

In general, the lack of natural vegetation within the impacted areas provides limited habitat for most wildlife species. However, some ground nesting species such as arctic tern, horned lark (Eremophila alpestris) and snow bunting (Plectrophenax nivalis) prefer open, disturbed habitats. Remnant natural habitat present at APEC 6 may provide suitable habitat for a variety of ground and shrub nesting birds

such as hoary redpoll (Acanthis hornemanni), lapland longspur (Calcarius lapponicus), rock ptarmigan (Lagopus muta) and willow ptarmigan (Lagopus lagopus). No suitable amphibian habitat or reptile hibernacula were observed at the APECs, and fox tracks at APEC 3 were the only wildlife sign observed during the Stantec site visit (Stantec, 2021b).

2.5 SURFICIAL GEOLOGY

As described in Surficial Geology of Canada (GSC, 2014), the surficial geology at the Site is composed of glaciomarine and marine deposits deposited from meltwater and floating ice, in marine waters, during deglaciation and subsequent regression. The overburden at the Site consists of sand, gravel and finer sediment, thin to discontinuous sediment veneer and residual lag developed during marine submergence and includes areas of washed till and bedrock (GSC, 2014).

2.6 TOPOGRAPHY AND DRAINAGE

Based on Site observations, regional surface drainage (anticipated shallow groundwater flow direction) is dependent on location and appears to be generally to the south towards Hudson's Bay (Stantec, 2021a). As the topography is variable throughout the Site and the surrounding areas, surface water drainage will change depending on the land elevation. Seasonality may impact surface water drainage as well, as there are areas that are seasonally inundated. However, overall Site drainage is anticipated to be south towards the Hudson's Bay.

3.0 BACKGROUND

3.1 HISTORICAL REPORTS

Over the past 30 years, numerous investigations have been conducted to assess the condition of the Site with respect to existing contamination from the former military operations. The following reports document previous site investigations and assessment activities that have been conducted at the Site since 1991. The reports listed below were provided to Stantec by PSPC and reviewed prior to the preparation of the RAP and supporting activities:

- Phase I/II Environmental Site Assessments, Remote Sites in Nunavut – Coral Harbour. Prepared by EarthTech Canada Inc. for Indian and Northern Affairs Canada, dated March 2008 (EarthTech, 2008).
- Integrated Phase I and Phase II Environmental Site Assessment, KW005, Coral Harbour. Prepared by WESA for Aboriginal Affairs and Northern Development Canada, dated February 2012 (WESA, 2012).
- Phase III Environmental Site Assessment, Near Airport Site, Coral Harbour, NU. Prepared by Nunami Stantec Limited for Department of Environment, Government of Nunavut (DOE-GN), dated December 15, 2017 (Nunami Stantec, 2017a).
- Human Health and Ecological Risk Assessment, Near Airport Site, Coral Harbour, NU. Prepared by Nunami Stantec Limited for DOE-GN, dated December 15, 2017 (Nunami Stantec, 2017b).

- Remedial Action Plan, Near Airport Site, Coral Harbour, NU. Prepared by Nunami Stantec Limited for DOE-GN, dated March 9, 2018 (Nunami Stantec, 2018).
- Draft Archaeological Overview - Coral Harbour Former Military Base Phase III Environmental Site Assessment and Associated Supporting Work. Prepared by Stantec for PSPC, dated August 13, 2020 (Stantec, 2020b).
- Phase III Environmental Site Assessment, Coral Harbour, Nunavut. Prepared by Stantec for PSPC, dated March 19, 2021 (Stantec, 2021a).
- Human Health and Ecological Risk Assessment, Various Areas of Potential Environmental Concern, Coral Harbour, Nunavut. Prepared by Stantec for PSPC, dated March 26, 2021 (Stantec, 2021b).
- Site Wide Hazard Assessment, Coral Harbour, Nunavut. Prepared by Stantec for PSPC, dated March 26, 2021 (Stantec, 2021c).

Based on the reports listed above, the following sections describe the relevant findings/work complete.

3.1.1 Stantec – Phase III Environmental Site Assessment, 2020

A Phase III ESA (including a Hazardous and Non-Hazardous Materials Survey and a Borrow Source Assessment) was conducted for the Site in 2020 (Stantec, 2021a). The purpose of the Phase III was to delineate previous soil exceedances, characterize chemicals of potential concern (COPC), determine soil volumes that exceeded the generic Tier I guidelines, record quantities of hazardous and non-hazardous materials present at the Site, determine possible locations of borrow materials, review potential landfill locations, and evaluate Site access conditions. The conclusions drawn from the Phase III ESA are broken down by individual APECs assessed (i.e., APECs 1, 2, 3, 4 and 6) and materials and summarized in Table 3-1.

Table 3-1 Summary of the Phase III ESA (2020) Conclusions

Location	Conclusion
APEC 1 – Tar Barrels	• Concentrations of petroleum hydrocarbons ([PHCs] including toluene, ethylbenzene, xylenes, F2 to F4 fractions) and polycyclic aromatic hydrocarbons ([PAHs] naphthalene) above the applicable guidelines[1] for soil have been vertically and horizontally delineated; approximately 40 m^3 of impacted soil exceed applicable guidelines. • No further assessment is warranted for soil, sediment, or surface water.
APEC 2 – Full Barrels	• Impacted soil was identified in two locations: North of the Full Barrel Cache and the Full Barrel Cache. • PHCs in soil above applicable guidelines have been vertically and horizontally delineated in the area North of the Full Barrel Cache; approximately 89 m^3 of impacted soil in this area exceeds the applicable guideline for PHC fraction F3. • Soils with concentrations of PHCs and PAHs (including PHC fractions F2, F3, F4, fluorene, naphthalene and phenanthrene) above applicable guidelines have not been vertically or horizontally delineated in the area of the Full Barrel Cache, specifically to the northwest and southwest. The estimated volume of impacted soil is 2,528 m^3. • Where detected, contaminant of concern (COC) concentrations in the groundwater/active zone water sample did not exceed the applicable guidelines.

Table 3-1 Summary of the Phase III ESA (2020) Conclusions

Location	Conclusion
APEC 3 – Barrel Cache	• Impacted soil was identified in two locations: Barrel Cache Area and East of the Access Road. • Concentrations of PHC toluene above applicable guidelines in soil have been horizontally and vertically delineated in the area East of the Access Road; approximately 100 m^3 of soil in this area exceeds applicable guidelines. • Due to a discrepancy between the Field Work Plan and the field program, a groundwater sample was not collected from 17-MW-12 to determine whether the nitrate exceedance detected in 2017 was reproducible. • In the area of the barrel cache, delineation of PHC and/or PAH impacts in soil has been achieved (volume of impacted soil estimated at 67 m^3) with the exception of PHC, PAH and phenol impacts northwest of the barrel cache. Based on partial delineation in this area, the estimated volume of PHC/PAH/phenol impacted soil in the barrel cache area is 3,170 m^3.
APEC 4 – Former Army Base	• Impacted soil was identified in two locations: the Former Army Base and South of the Former Army Base. • Concentrations of PHCs and PAHs in soil above applicable guidelines have been horizontally delineated in the area of the Former Army Base and vertical delineation was assumed at permafrost; approximately 17,849 m^3 of soil exceeds applicable guidelines. • In the area South of the Former Army Base, concentrations of PHCs and PAHs in soil above applicable guidelines have been horizontally delineated and vertical delineation has been assumed at permafrost; approximately 43,206 m^3 of soil exceeds applicable guidelines. • No further assessment is warranted for soil, groundwater/active zone water, sediment, or surface water at APEC 4, however, additional sampling in the area between 04-SO-2020-068 and KW005-SS-032 may result in a reduced estimated volume of PHC and PAH impacted soil.
APEC 6 – Former Airport Debris	• Impacted soil and groundwater were primarily identified in two locations: the Debris Pile near the Tank Farm (preliminary estimated volume of impacted soil is 13,105 m^3) and the East Debris Pile (estimated volume of impacted soil is 485 m^3). Concentrations of PHCs (fractions F2 and/or F3) and PAHs (naphthalene and phenanthrene) exceeded the applicable guidelines in these areas. • There was one exceedance of nitrate in surface water. • Based on observations from the 2020 field assessment, there was evidence of surficial staining and potentially buried debris along the access road to APEC 6; analytical data was not been collected from this area. • One test pit was located based on community members' traditional knowledge of fuel contamination in the area of APEC 6, and an additional nine test pits were advanced to visually assess for the presence/absence of impacted soil and/or active zone water. Samples were not collected from these test pits; however, visual indication of contamination was observed in four of these test pits located south/southwest of the debris pile near the tank farm. • Additional assessment would be required to delineate soil impacts to generic Tier 1 guidelines.

Table 3-1 Summary of the Phase III ESA (2020) Conclusions

Location	Conclusion
Hazardous and Non-Hazardous Materials	• Several buried debris locations were identified across the Site in the vicinity of APEC 4 and APEC 6. A buried concrete bunker with unknown contents was located at APEC 4. • Approximately 5 m^3 of asbestos-containing material was observed at APEC 4. • Approximately 100 m^2 of hazardous lead amended paint was identified at the Site associated with painted surfaces at APEC 6. • Approximately 134,100 L of hazardous liquid contents from the potential petroleum, oil, and lubricants (POLs) located at APEC 6 and the barrels observed at APEC 1, APEC 2, APEC 3, and APEC 6. • Approximately 69 m^3 of other hazardous materials was identified. • Approximately 10,171 m^3 of non-hazardous waste (e.g., wood debris, concrete, scrap metal, buried debris) was observed at the Site. • Existing infrastructure including several wooden sheds and a tank farm were identified at the Site. • Vehicles, including heavy equipment and large pieces of debris were observed at APEC 6.
Borrow Source Assessment	• That local aggregate materials are associated with a vast glaciomarine lag deposit. The material consists mainly of medium to coarse shale gravels, with variable amounts of sand, and trace amounts of silt and clay sized particles. The gravel fragments are derived from local frost shattered shale deposits and are generally angular in shape. • Limited volumes of granular aggregate materials are available from the three existing borrow sources located alongside Airport Road. Volume estimates inferred on the basis of direct and indirect evidence such as desktop terrain analysis, and limited sampling suggest a total recoverable volume less than 50,000 m^3. • A search for new borrow source deposits suggested that vast untapped resources of granular materials are present in the same general location as the on-site APECs, including both south and northeast of the airport.

Notes:
1. applicable guidelines as defined in the Phase III ESA (Stantec, 2021a) typically being Tier 1 guidelines for commercial land use, which consider both human and ecological health

3.1.2 Stantec – Human Health and Ecological Risk Assessment, 2021

The purpose of the HHERA that followed the completion of the Phase III ESA was to determine whether identified COPCs were posing unacceptable risks to human and ecological receptors at the Site. Based on the activities conducted during the HHERA, the following conclusions were reached:

- COPC at the Site were generally limited to PHC F1, F2, F3, and F4 impacts in surface soil
- A qualitative assessment of PHC management limits did not identify potential issues related to formation of free phase product, fire and explosive hazards, or aesthetic considerations.
- The presence of hundreds of full and partially full barrels at the Site presents uncertainty in the risk assessment. Future releases from these barrels could result in higher concentrations of COPCs in the environment or increase the area of impacts, either of which may change the conclusions of the HHERA.

Human Health Risk Assessment

- The human activities around each APEC were determined to be self-limiting based on the remote locations and the nature of the Site activities.
- A human health based site-specific target level (SSTL) for PHC F3 of 51,000 mg/kg was calculated based on a potential exposure of casual visitor to the site (toddler) to impacted surface soil; this SSTL is applicable to each of the five APECs.
- Potential risk from exposure of construction/utility workers to impacted soil may be addressed through risk mitigation/management measures.
- No active remediation is required to address potential risk to human health at the five APECs based on the available data; however, areas of APEC 6 (i.e., visual observations of petroleum impacts at four test pits) will require additional assessment to determine potential remedial requirements.

Ecological Risk Assessment

- The APECs at the Site do not provide suitable habitat for ecological receptors.
- While maximum concentrations of some COPCs suggest that very localized effects to vegetation or soil invertebrates are possible, the areas of impact (mostly gravel) and the sparse natural vegetation indicate that the COPC impacts can remain in place without concerns for the larger vegetation / ecological community.
- Based on the results of the 2020 Phase III ESA, the impacted areas at each APEC exceeding Tier 1 guidelines are relatively small in size, ranging in extent from approximately 100 m^2 to <10,000 m^2. Overall, the impacted areas are localized and do not provide habitat of sufficient quantity or quality to support populations of ecological receptors.
- Overall, unacceptable risks from exposure to COPC impacts in soil at APEC 1 and APEC 4 to aquatic receptors in Coral Creek are not expected as COPC in surface water or sediment were either not detected or were detected below ecological screening guidelines.

3.1.3 Stantec – Site Wide Hazard Assessment

The SWHA included confirming previously documented hazards and identifying additional hazards observed during the most recent site assessment. The SWHA provided recommendations for additional control measures or risk management mitigations to reduce the hazard risk for future site visits, site work or public access. In short, the SWHA recommended development of plans to address site hazards to prevent impacts to wildlife and human health, including site workers during a remedial program.

4.0 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. The primary applicable reference guidelines for the RAP include:

- Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines (CEQGs)
- Federal Contaminated Sites Action Plan (FCSAP) Decision-Making Framework (GC, 2018)
- Abandoned Military Site Remediation Protocol (INAC, 2008)
- Various federal and territorial regulations/guidelines related to defining waste streams and transportation and disposal of wastes

4.1 CCME CEQG

The CCME CEQGs provide limits for contaminants in soil, sediment, water, and tissue. 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 assessment and remediation of contaminated sites in the context of agricultural, residential/parkland, commercial, and industrial land uses. Generic numerical guidelines are derived using toxicological data to determine the threshold level to the most sensitive receptor(s). These generic numerical guidelines include:

- Soil Quality Guidelines for the Protection of Environmental and Human Health
- Sediment Quality Guidelines for the Protection of Aquatic Life
- Water Quality Guidelines for the Protection of Aquatic Life
- Water Quality Guidelines for the Protection of Agricultural Water Uses
- Tissue Residue Quality Guidelines for the Protection of Wildlife Consumers of Aquatic Biota

The latest updates of these guidelines are published on-line through the CCME's website (www.ccme.ca).

In addition, the CCME has produced the Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil (CCME, 2008) which provides generic Tier 1 criteria intended to protect environmental quality and human health, reported against four PHC fractions (F1 through F4).

Details on the applicable generic numerical guidelines for media assessed to date are provided in (Stantec, 2021a) and (Stantec, 2021b).

4.2 FCSAP DECISION MAKING FRAMEWORK

As outlined in the FCSAP Decision-Making Framework (GC, 2018), the Decision-Making Framework (DMF) is a roadmap that outlines the specific activities and requirements for addressing federal contaminated sites in Canada. The DMF is a 10-step process guiding federal custodians in all aspects of working with contaminated sites.

In accordance with the FCSAP DMF, remediation or risk management objectives may be developed for a site using a guideline approach where published guidelines are selected as the remediation objectives. Where site conditions, land use, receptors, or exposure pathways differ slightly from those set out for the generic guidelines, modified guidelines may be selected (i.e., site-specific criteria). At “Step 7: Develop Remediation/Risk Management Strategy” of the federal approach, determination as to whether a generic guideline (Tier 1) or a risk assessment approach (Tier 3) is made for the purposes of establishing remedial/risk management objectives.

Having adopted a risk assessment approach for the Site, a CCME Tier 3 approach of deriving SSTLs was selected and completed as part of the 2021 HHERA. A SSTL for PHC F3 impacted soils was derived and other COPCs present in concentrations above generic federal criteria (in soil, surface water, groundwater, and sediment) were determined not to be a risk to human health or the environment and therefore are not carried forward for remedial consideration.

4.2.1 Site Specific Target Level – Total Petroleum Hydrocarbons

SSTLs were calculated for the Site using the CCME Protocol for the Derivation of Environmental and Human Health Soil Quality Guidelines (CCME, 2006) and the CCME CWS for Petroleum Hydrocarbons in Soil: Scientific Rationale (CCME, 2008). The derivation of the SSTLs factored in the site conditions, human exposure pathways and land-use. As the Site APECs have common COPCs, receptors and exposure pathway, the SSTLs can be applied to each of them, as required.

Based on the findings of the HHERA (Stantec, 2021b) the SSTL for human health is recommended at 51,000 mg/kg of PHC F3 for protection of casual visitors (including all life stages i.e., infants, toddlers, children, teenagers and adults). The HHERA determined that risks related to the Site’s COPCs were determined to be acceptable for human and ecological receptors under the current land use and exposure scenarios, with the exception of APEC 6, which requires additional assessment to determine potential remedial requirements. The PHC F3 SSTL of 51,000 mg/kg would be applicable to petroleum impacts in this area (APEC 6).

4.3 ABANDONED MILITARY SITE REMEDIATION PROTOCOL

The Abandoned Military Site Remediation Protocol (AMSRP) was developed by CIRNAC (formerly Indian and Northern Affairs Canada [INAC]) in 2008 to provide a consistent approach for site remediation of remote sites in the Arctic environment. The AMSRP approach factors in legal requirements, INAC’s Contaminated Sites Policy and standard environmental practices (INAC, 2008) and was used as a guidance document while developing the RAP.

4.4 FEDERAL AND TERRITORIAL GUIDELINES AND REGULATIONS

Table 4-1 summarizes the federal and territorial guidelines and/or regulations referenced and considered under their respective jurisdiction as they relate to handling, transporting, and/or disposing of the Site waste streams.

Table 4-1 Applicable Federal and Territorial Guidelines and Regulations

Authority/Author	Guideline/Regulation/Reference	Version (Year of Publication)	Use
Fuel Systems			
Government of Canada (GC)	Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations (GC, 2008)	2008, as amended	Decommissioning of on-site (APEC 6) tank farm
Hazardous Waste			
CCME	Canada-Wide Standards for Dioxins and Furans (CCME, 2001)	2001	Incineration guidance
CCME	Canada-Wide Standards for Mercury Emissions (CCME, 2000)	2000	Incineration guidance
Environment Canada (EC)	Technical Document for Batch Waste Incineration (EC, 2010)	2010	Incineration guidance
GC	Transportation of Dangerous Goods (TDG) Act (GC, 1992)	1992, as amended	Transportation of hazardous wastes
INAC	Abandoned Military Site Remediation Protocol (INAC, 2008)	2008	Organic liquid held within waste drums
Workers' Safety and Compensation Commission (WSCC)	Asbestos Abatement – Code of Practice (WSCC, 2018)	2018	Asbestos abatement guidance
Government of Nunavut (GNU)	Environmental Guideline for Waste Asbestos (GNU, 2011)	2011	Asbestos abatement guidance
GC	Surface Coating Materials Regulation – Lead (GC, 2016)	2016	Lead abatement guidance
GNU	Environmental Guideline for Waste Lead and Lead Paint (GNU, 2014)	2014	Lead abatement guidance
WSCC	Working with Lead Guideline (WSCC, 2017)	2017	Lead abatement guidance
GNU	Environmental Guideline for the General Management of Hazardous Waste (GNU, 2010)	2010	Disposal requirements for hazardous wastes
WSCC	Personal Protective Equipment Respiratory Protection (WSCC, 2016)	2016	Health and safety requirements for working with silica, asbestos, and abrasive blasting
GNU	Environmental Guideline for Used Oil and Waste Fuel (GNU, 2012)	2012	Management and disposal requirements for organic liquid waste
Non-Hazardous Waste			
INAC	AMSRP (INAC, 2008)	2008	Management and disposal options for non-hazardous waste, including surface and buried debris
General			
WSCC	Camp Set Up and Management	2017	Regulations, hazards, and risks to consider for the set up and management of camps.

5.0 REMEDIAL OPTIONS ANALYSIS OBJECTIVES AND METHODOLOGY

5.1 OBJECTIVE

The objective of the RAP is to describe the approach to remedial activities at the Site including the rationale for option selection, while the objective for the proposed Site remedial activities is to reduce risk to human health and the environment by addressing site wastes and physical hazards that currently exist on-site. This RAP has been developed to meet the requirements of the FCSAP process.

5.2 DEVELOPMENT OF PROPOSED REMEDIATION APPROACHES

The proposed remediation approaches were developed following the completion of the HHERA and incorporate the conclusions and recommendations that were drawn in that report. The RAP focuses primarily on addressing the risks identified in the HHERA while proposing solutions that can be evaluated against selected criteria to determine the best overall option for the community. The proposed approach factors in affordability, feasibility, technical effectiveness and industry best practices.

5.3 REMEDIAL OPTIONS ANALYSIS METHODOLOGY

A variety of potential remedial solutions were evaluated that considered the environmental effectiveness relative to the specific-site conditions. The remedial options analysis (ROA) was prepared to provide PSPC/CIRNAC with information on costs, benefits and feasibility of potential remedial options and to support making an informed recommendation for a remedial approach.

Each option was reviewed considering factors such as technical practicability, permanence, and risk mitigation. From this review, a short list of remedial options was compiled. This short list was then further assessed against evaluation criteria and weighted to identify the best recommended approach.

5.3.1 Evaluation Criteria

Evaluation criteria were developed to allow a qualitative comparison of the remedial options and included:

- Stakeholder Acceptance
- Cost Effectiveness
- Effectiveness (ability to mitigate risks to human and environmental health)
- Ease of Implementation and Timeliness
- Indigenous Participation

An overview of each evaluation criteria is described below.

Stakeholder Acceptance

This criterion evaluates the remedial option based on how likely stakeholders are to accept the proposed option. The stakeholders considered include regulatory agencies, community members and the Site owner. This criterion will qualitatively review the option to determine if it is a go or no go. A 'go' would be an option that is acceptable to stakeholders and a 'no go' would be an option that would likely not meet acceptance by stakeholders. As stakeholder acceptance is a determining factor for the remedial option, it will not be included in the scoring and will take precedence over the outcome of the scores.

Cost Effectiveness

This criterion evaluates the remedial option based on its estimated cost compared to the other remedial options. The estimated cost for each remedial option will factor in associated costs for the entirety of the remedial option (including long term monitoring and liability, if applicable). Each remedial option will be assessed for estimated cost and then evaluated.

Effectiveness

This criterion evaluates the remedial method for its ability to mitigate risks to human and environmental receptors that were identified in the HHERA at the Site. Consideration such as the ability of the remedial option to meet the applicable criteria, reduce the risk to receptors and minimize or eliminate the exposure pathway will be factored into the evaluation. Each remedial option will be rated against its demonstrated ability to mitigate risk.

Ease of Implementation and Timeliness

This criterion evaluates the feasibility and ease of implementation of the remedial option in the remote northern location of Coral Harbour, NU. Considerations such as equipment requirements, climate conditions, and site access will be factored into the evaluation. The length of time required for the remedial option to meet the applicable remedial criteria, including management of any residual risk (i.e., long-term monitoring) will also be factored into this evaluation.

Indigenous Participation

The criterion evaluates the remedial option for its ability to create opportunities for indigenous participation. Considerations such as potential employment opportunities and positive impact on the northern communities are included in this criterion.

5.3.2 Evaluation Criteria Scoring

To identify the most suitable remedial option for the Site, potential remedial options were scored using the evaluation criteria matrix. Each remedial option was qualitatively assessed against each evaluation criteria and compared to the other remedial options. Waste components with three or more remedial options were scored. Weightings were applied to each criterion based on the assumed importance (i.e., effectiveness of the remedial option is weighted as 20% of the overall score). The weighting applied to the four evaluation criteria was as follows:

*Cost*0.3 + Effectiveness*0.2 + Ease of Implementation*0.15 + Indigenous Participation*0.35.*

An overview of the remedial option evaluation criteria that were applied are presented in Table 5-1.

Table 5-1 Remedial Options Evaluation Criteria Scoring

Factor		3	2	1
1	Cost Effectiveness	Cost for this option is less than 70% of the most expensive option.	Cost for this option is between 70% and 99% of the most expensive option.	Most expensive option.
2	Effectiveness	Completely eliminates the risk to receptors, fully removes source of contamination or exposure pathway. Aesthetics of Site are similar to pre-disturbance conditions.	Reduces risk to receptors. Reduces or contains source of contamination. Aesthetics of Site are moderately improved.	Does not reduce risks. Sources of contamination remain in place. Aesthetics of Site remain the same.
3	Ease of Implementation and Timeliness	Can be completed well within the estimated time frame of the project, may shorten overall schedule. Will require minimal material imported to Site.	Can be completed within the estimated time frame of the project. Will require moderate effort and/or material imported to Site.	Could impact overall project schedule, will be on the critical path. Requires most material to be imported to Site or requires or may require permission by other agencies.
4	Indigenous Participation	This remedial option maximizes local and Indigenous employment and subcontracting opportunities.	This remedial option will include some local and Indigenous employment and subcontracting opportunities but a significant portion of the work will be completed by southern companies and subcontractors.	This remedial option will be completed mainly by southern labour and subcontractors with minimal opportunities for local and Indigenous employees and companies, or requires no labour (leave in place options).

6.0 REMEDIAL OPTIONS EVALUATION

The RAP evaluates items that trigger remedial action. Triggers for remedial action include but are not limited to the following: aesthetics, physical hazards, potential sources of contamination and regulatory requirements. Each item is divided into waste streams (liquid waste [LW], hazardous waste [HW] and non-hazardous waste [NHW]) based on the output that is created by managing or remediating it. Once the item has been broken down into waste streams, the waste streams are evaluated through the ROA analysis and scored to determine the best and most appropriate solution for remediation.

The HHERA (Stantec, 2021b) concluded that concentrations of PHC F3 detected in previous assessments undertaken at the Site do not exceed the SSTL, and that removal of soil to specifically address risk to human and ecological receptors was not required. The following exceptions are noted:

- Additional assessment is required at APEC 6 to delineate impacted areas and assess areas that were unable to be fully assessed in the 2020 field program. The additional assessment includes the following:
  - delineation of soil impacted with PHCs and/or PAHs.
  - assessment of soil from test pits that were suspected to contain impacts based on visual and olfactory observations.
  - acquisition of locations of underground utilities and infrastructure.
  - tank farm assessment.
  - heavy equipment survey.
  - buried debris assessment.
- Although exceedances of SSTLs are not currently present, the primary remediation actions will address on-site contamination sources (drums, tanks, hazardous materials) to prevent potential future contamination.

In addition to addressing the remaining sources, the remedial program will also address the physical hazards and aesthetics of the Site. A summary of items that will be addressed as part of the ROA is provided in Table 6-1.

Table 6-1 Summary of Waste Streams Requiring Remedial Action

Item/ Location	Remediation Trigger(s) [1]	Waste Stream [2]	Waste Components	Estimated Volume
Barrels/ APECs 1, 2, 3 and 6	A, PH and RR	LW	- barrel contents meeting incineration requirements - barrel contents not meeting incineration requirements	134,000 L
		HW	- barrels with amended paint[3] - residual petroleum product and/or tar	Unknown material quantity
		NHW	- barrels without amended paint, cleaned and compacted	60 m^3
Infrastructure/ APECs 3 and 6	A, PH and RR	LW	- contents from the tank farm and associated piping meeting the incineration requirements - contents from the tank farm and associated piping not meeting the incineration requirements	Unknown material quantity
		HW	- amended paint - asbestos containing materials (ACMs)	Unknown material quantity
		NHW	- general NHW debris	Minimum of 80 m^3
Surface Debris/	A, PH and RR	LW	- POLs meeting incineration criteria - POLs not meeting incineration criteria	<100 L

Table 6-1 Summary of Waste Streams Requiring Remedial Action

Item/ Location	Remediation Trigger(s) [1]	Waste Stream [2]	Waste Components	Estimated Volume
APECs 1, 2, 3, 4 and 6		HW	- ACMs - amended paint - batteries	5 m^3 of ACM, minimum of 100 m^2 of amended paint, and an expected maximum of <10 m^3 of batteries.
		NHW	- general NHW debris including unpainted metal, painted wood (below amended paint guidelines), rubber and glass - vehicles and heavy equipment unpainted wood	3,430 m^3
Stained Surficial Soil/ APECs 1, 2, 3 and 6	A	NHW	- stained surficial soil	1,950 m^3
Buried Debris/ APECs 4 and 6	PH and PSC	NHW	- general NHW debris including unpainted metal, painted wood (below amended paint guidelines), rubber and glass	6,815 m^3
		HW	- general HW debris	
Buried Infrastructure/ APECs 4 and 6	A, PH and PSC	LW	- residual petroleum product	Unknown material quantity.
		NHW	- intact concrete and construction materials	Unknown material quantity.

Notes:
1. A – Aesthetics; PH – Physical hazard; RR - Regulatory requirement; PSC – Potential source of contamination
2. LW – liquid waste; NHW – non-hazardous waste; HW – hazardous waste
3. Lead and/or PCB amended paint; herein referred to as 'amended paint'

6.1 LIQUID WASTE

LW consists of barrel contents, tank farm and associated piping contents, POLs, residual product and wash water that may be generated on-site during the remediation. At this time, the nature of liquid waste has not been determined. There is the potential for aqueous liquids and liquid petroleum products to be present on-site. Further assessment will be required prior to the remedial program to determine the quality and quantity of the contents.

As discussed in Section 4.3, the AMSRP was used as a guidance document while developing the RAP. The Barrel Protocol from the AMSRP provides guidance for determining the correct disposal method for barrels and their contents (INAC, 2008). The Barrel Protocol provides considerations for inspection, sampling, testing, disposal of contents, disposal of barrels and personal protective equipment, all of which can be applied to the management of liquid waste present on-site. The Barrel Protocol provides criteria for determining the appropriate disposal method for aqueous and organic products based on their characteristics and contents. The Barrel Protocol criteria and disposal recommendation were adapted for the RAP.

The remedial options for aqueous liquids and liquid petroleum products are summarized in Table 6-2. An overview of each remedial option and the evaluation of each remedial option against the selected evaluation criteria is discussed in detail below. The 'leave in place' approach was considered as a remedial option, however it did not seem an appropriate solution to leave liquid waste on-site. The leave in place approach would not remove the risk to receptors, reduce liability, or eliminate exposure pathways, as a result it not carried forward and evaluated as a remedial option.

Table 6-2 Summary of LW Components Remedial Options

LW Components	Considerations	Remedial Options Evaluated
Aqueous Liquids	Contents do not meet incineration criteria.	Off-site disposal in southern Canada
	Contents meet incineration criteria.	Incinerate on-site
	Contents meet wastewater discharge criteria.	Discharge
Liquid Petroleum Products (including residual product)	Contents meet incineration criteria.	Off-site disposal in southern Canada Incineration on-site
	Contents do not meet incineration criteria.	Off-site disposal in southern Canada

6.1.1 Aqueous Liquids Remedial Options

The remedial options below were considered for aqueous barrel contents:

Off-Site Disposal - Aqueous products that do not meet the incineration criteria would be consolidated for off-site treatment at an appropriate disposal facility (southern Canada). As the quantity and quality of the aqueous liquids are unknown, the cost and timeframe of this option cannot be estimated at this time. This option would require consideration for transportation logistics, as it would require moderate effort to transport the material off-site via trucks and barge. Off-site disposal can likely be completed within the estimated time frame of the project. The consolidation and transportation of aqueous liquids would require labourers, which would provide opportunities for Indigenous participation. This option would likely be accepted by regulators and the community.

Incineration - Aqueous products that meet the incineration criteria would be consolidated on-site and incinerated. As the quantity and quality of the liquids are unknown, the cost and timeframe of this option cannot be estimated at this time, however, the incineration of aqueous products that meet the criteria would reduce the overall volume of barrel contents that require off-site disposal, which would ultimately reduce the transportation cost. This option would be relatively simple to implement on-site and would

require specialty equipment (i.e., incinerator) to be mobilized to the Site. On-site incineration would be an effective method to remove and dispose of aqueous liquids and could be completed during the remedial timeframe. This option would provide opportunities for unskilled labour and heavy equipment operators, which could provide opportunities for Indigenous participation.

Discharge – Aqueous products that meet the AMSRP Barrel Protocol criteria for wastewater discharge would be discarded/discharged into the environment in accordance with the wastewater discharge requirements as identified in any permits and/or licences issued for cleanup activities by the Nunavut Water Board and/or other agencies. This option would require sampling of the barrel contents and the cost would be a result of laboratory fees and on-site labour for consolidation and handling of the barrels. As the quantity and quality of the liquids are unknown, the cost of this option cannot be estimated at this time. This option would be an effective method for disposal of the aqueous liquids and would likely be accepted by regulators and the community.

6.1.2 Liquid Petroleum Products Remedial Options

The options below were considered for liquid petroleum products:

Off-Site Disposal - Liquid petroleum products that do not meet incineration criteria would be consolidated for off-site treatment at an appropriate disposal facility (southern Canada). This is an effective solution as the off-site disposal of liquid petroleum products would remove on-site hazards and sources of contamination. This option is likely to meet the acceptance of regulators and the community stakeholders. The estimated cost of off-site disposal would include the consolidation, transport and disposal of approximately 26,100 L. This option could be completed during the remedial program with limited impact on schedule. The consolidation would require labourers and provide opportunities for Indigenous participation.

Incineration - Once the chemistry of the liquid petroleum products has been determined, they will be consolidated by similar products. Those liquids that meet the criteria for on-site incineration will be combined and incinerated in accordance with the Technical Document for Batch Waste Incineration (EC, 2010). Liquids that do not meet the incineration criteria will require disposal off-site, as described above. After incineration, ash generated by the incineration process would be analyzed to determine whether its leachate would be classified as a hazardous waste. Ash determined to be NHW will be disposed of in the on-site NHW facility, while ash determined to be hazardous would be disposed of at an off-site licenced hazardous waste facility in accordance with the TDG Act. This is an effective method that can be used to reduce the volume of waste requiring management and disposal. The estimated volume of liquid petroleum products requiring incineration is 108,000 L. The cost of incineration would include the incinerator rental, labour for consolidation and operating the incinerator, laboratory fees for leachate sampling and mobilization/demobilization costs for the equipment. This option could be completed during the remedial program with limited impact on schedule. The consolidation would require labourers which would provide opportunities for Indigenous participation, although operation of the incinerator may be limited to trained operators.

6.1.3 Recommended Liquid Waste Remedial Approach

The recommended approach for the management of LW is a hybrid approach using all of the remedial options described above. As there are varying criteria and disposal options for aqueous and organic products, implementing a hybrid approach would be less expensive than shipping LW off-site and would allow for elimination of on-site hazards associated with the barrels. A hybrid approach for the remedial activities would likely be accepted by regulators and the community stakeholders. The hybrid approach would provide Indigenous participation opportunities. An overview of the recommended LW remedial approach is summarized in Table 6-3.

Prior to any remedial activities, it is recommended that the AMSRP Barrel Protocol be reviewed and a site-specific barrel protocol be created and implemented to ensure the safety of workers and to provide a cohesive plan for inspection, sampling, consolidation, handling and transportation.

Table 6-3 Summary of Recommended Liquid Waste Remedial Approaches

LW Component	Approximate Volume	Recommended Remedial Approach	Comments
Aqueous Products	16,000 L	- characterize the material and incinerate on-site for those liquids that meet the incineration criteria. - any liquids deemed unfit for on-site incineration will be combined and transported off-site for disposal at a licenced facility (southern Canada). -any liquids that meet the wastewater discharge criteria will be combined and disposed in accordance with applicable licenses and permits.	- Barrels should be inspected to identify symbols, words, labels, and marks on the barrel as well as signs of deterioration, damage, pressure (i.e., bulging and swelling) and evidence of spillage. - A representative number of barrels from each APEC should be sampled and analyzed to characterize the contents. Analytical testing of the organic liquid waste will need to conform with territorial requirements (GNU, 2012). -wash water from the barrels will require sampling to determine if it meets the requirements for wastewater discharge, incineration, or off-site disposal. Additional information on barrel processing is provided in Section 6.2.
Liquid Petroleum Products (Barrel contents, potential tank farm contents, POLs)	134,000 L	- characterize the material and incinerate on-site for those liquids that meet the incineration criteria. - any liquids deemed unfit for on-site incineration will be combined and transported off-site for disposal at a licenced facility (southern Canada).	- Barrels should be inspected to identify symbols, words, labels, and marks on the barrel as well as signs of deterioration, damage, pressure (i.e., bulging and swelling) and evidence of spillage. - A representative number of barrels from each APEC should be sampled and analyzed to characterize the contents. Analytical testing of the organic liquid waste will need to conform with territorial requirements (GNU, 2012). - Vehicles and machinery will have to be inspected to determine if POL are present. - Barrels, drums and tanks discussed in Section 6.2.

6.2 NON-HAZARDOUS WASTE

NHW consists of barrels once emptied, infrastructure that requires demolition, stained surficial soil, surface debris, buried debris, and buried infrastructure.

As discussed in Section 4.3, the AMSRP was used as a guidance document while developing the RAP. The AMSRP provides guidance for the management of on-site non-hazardous waste, including surface debris, buried debris, waste debris areas, and building materials (i.e., demolition debris), and the disposal options (INAC, 2008). The AMSRP criteria and disposal recommendation for NHW were adapted for the RAP.

The remedial options for the NHW are summarized in Table 6-4 and described in detail below. An overview of each remedial option and the evaluation of each remedial options against the selected evaluation criteria is discussed in detail below. The associated remedial options scoring for NHW is presented in Table B-1, B-2, B-3 and B-4, Appendix B.

Table 6-4 Summary of NHW Components Remedial Options

NHW Component	Considerations	Remedial Options Evaluated
General NHW Debris (Table B-1, Appendix B)	General NHW debris is not appropriate for incineration.	1. Leave in place (do nothing) 2. On-Site Disposal 3. Off-Site Disposal in Coral Harbour 4. Off-Site Disposal in South 5. Incineration
	General NHW debris is appropriate for incineration.	
Buried Debris (Table B-2, Appendix B)	Buried debris designated as a Class A * waste disposal area (WDA)	1. Leave in place (do nothing) 2. Partial Excavation and Disposal* 3. Full Excavation and Disposal* 4. Cover
	Buried debris designated as a Class B * WDA	
	Buried debris designated as a Class C * WDA	
Buried Infrastructure (Table B-3, Appendix B)	n/a	1. Leave in place (do nothing) 2. Excavate and Dispose** 3. Regrade
Stained Surficial Soil (Table B-4, Appendix B)	Surficial staining is moderate or significant and covers a large geographical area	1. Leave in place (do nothing) 2. On-Site Disposal 3. Off-Site Disposal in Coral Harbour 4. Off-Site Disposal in South 5. Cover 6. Scarification
	Surficial staining is minor and covers a small geographical area	

Notes:
(*) – Refer to Section 6.2.2 for WDA classifications
(**) – Disposal option will align with remedial option selected for general NHW debris.

6.2.1 General NHW Debris Remedial Options

The following remedial options were assessed for general NHW debris:

Leave in Place - This option would involve leaving the non-hazardous debris on-site in its current condition and location. The NHW poses a potential physical hazard to human or ecological receptors on-site. Leaving the NHW on-site would not likely meet the criteria for regulatory acceptance. Although the most inexpensive and timesaving remedial option for NHW, this option would not return the Site to its pre-disturbed condition and may not satisfy the expectations of the local community stakeholders. As the likelihood of approval of the community stakeholders is anticipated to be low, this remedial option is considered a no-go.

Disposal – NHW would be collected, segregated and compacted prior to disposal. The disposal options for debris include the following:

- On-Site Disposal: This option would include constructing a NHW facility on-site, to which NHW would be transported for disposal after compacting. After all items are placed in the waste facility, it would be capped with either a liner and/or borrow material (dependent on the design), and long-term monitoring would be required, as discussed in Section 10.3. This option offers a balance of reduced cost and Indigenous participation opportunities compared to other options, while managing waste that the Crown is responsible for in a dedicated location. It is likely that this option will be accepted by regulators, however it is possible the community will not support this option as the waste will be located within community limits. This option would likely have limited impact on the schedule.
- Off-Site Disposal in Coral Harbour: This option would include compacting of NHW and transport off-site for disposal in the local community landfill owned and operated by the Hamlet of Coral Harbour. This option requires an agreement with the Hamlet of Coral Harbour and is anticipated to include a long-term monitoring component. When comparing the disposal options, this solution is anticipated to be the least costly, however the community may not support this option, and the Crown will still maintain liability for the waste, and therefore a long-term monitoring program would still be anticipated. This option would provide Indigenous participation opportunities as unskilled labourers would be required for the collection, compaction and transportation of the NHW. This option would likely have limited impact on the schedule.
- Off-Site Disposal in a Southern Location: This option would include compacting, packaging and transport (initially by barge) of NHW for disposal in a licensed landfill in a location in southern Canada (anticipated to be Quebec). This option is the costliest approach, and has the potential to impact the schedule as transportation is based on a strict external schedule, however, is expected to be supported by the community as there is no permanent disposal in or near the community. The Crown would have no long-term monitoring requirement. This option would provide some Indigenous participation, however not nearly as much as the other options.

Incineration - Incineration is a standard approach for waste minimization prior to disposal and reduces the volume of debris that needs to be managed. Materials that are appropriate to burn will be incinerated on-site under controlled conditions. Residual ash will require testing and disposal in accordance with the results. Incineration of non-hazardous debris only applies to unpainted wood debris at the Site. This option would be relatively simple to implement on-site and would require specialty equipment (i.e., incinerator) to be mobilized to the Site. On-site incineration would be an effective method to remove and dispose of NHW and could be completed during the remedial timeframe. This option would provide Indigenous participation opportunities for unskilled labour and heavy equipment operators. The cost of this options is lower than the disposal options and would effectively remove on-site hazards that are associated with NHW.

6.2.1.1 Proposed Remedial Approach - General NHW Debris

The recommended approach for the management of general NHW is a hybrid approach using two remedial options: incineration of materials that are appropriate to burn and disposal at an on-site NHW facility. Implementing a hybrid approach would be less expensive than shipping NHW off-site and would allow for elimination of on-site hazards associated with the debris and infrastructure. A hybrid approach for the remedial activities would likely be accepted by regulators and the community stakeholders. The hybrid approach would provide Indigenous participation opportunities. An overview of the recommended NHW remedial approach for general NHW debris is summarized in Table 6-5 and the scoring for General NHW Debris is presented in Table B-1, Appendix B.

6.2.2 Buried Debris Remedial Options

AMSRP provides guidance for determining the most appropriate remedial actions for WDAs using a classification system (INAC, 2008) that evaluates erosion potential, stability and evidence of contamination to determine the appropriate category for the WDA. There are three broad categories that the WDA can be classified as:

Class A: The WDA is located in an unstable, high erosion location, and/or the WDA is located at an elevation of less than two metres above mean sea level (INAC, 2008). The appropriate remedial action for a Class A WDA is full or partial excavation and disposal.

Class B: 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 (INAC, 2008).

Class C: If the WDA is located in a suitable, stable location, with no evidence of contaminant migration, it may be left in place. If required, additional granular fill shall be placed to ensure erosion protection and proper drainage. Consideration must be given to surrounding topography (to blend into existing terrain) and long term monitoring costs (INAC, 2008). The appropriate remedial action for a Class C WDA is leave in place and/or cover.

The following remedial options were assessed for buried debris:

Leave in Place - This option would involve leaving the buried debris on-site in its current condition and location. Areas of exposed buried waste poses potential physical hazard to human or ecological receptors on-site. Leaving the buried waste on-site would likely meet the criteria for regulatory acceptance if it aligns with the AMSRP recommendations for WDAs based on an evaluation of erosion potential, stability and evidence of contamination. Although the most inexpensive and timesaving remedial option for buried debris, this option would not return the Site to its pre-disturbed condition and may not satisfy the expectations of the local community stakeholders. This option would not provide Indigenous participation opportunities.

As the likelihood of approval of the community stakeholders is anticipated to be low, this remedial option is considered a no-go.

Partial Excavation and Disposal – This option would involve partial excavation of buried debris areas up to a depth of 0.5 mbgs. Buried debris would be excavated, segregated, and removed from the buried debris area and disposed of in accordance with the selected remedial options for NHW and HW, depending on its composition. Once segregated, the soil that was mixed in with the debris will be analyzed to determine soil quality and used as fill where appropriate. Additional borrow material will be used to fill the excavation to meet the surrounding grade. Conversely, if the buried debris area is mounded above grade to a height of 2 m or less, the material will be excavated, and the area will be regraded. This option would be effective at removing potential physical hazards from exposed debris but may not fully reach and identify deeper potential sources of contamination. This option is less expensive and intensive than the full excavation effort but does require more labour than the cover option. Unskilled labour would be required for excavation, waste segregation and disposal which would provide Indigenous participation opportunities. Overall, the partial excavation and disposal option is anticipated to meet the approval of regulators and the community.

Full Excavation and Disposal - This option would involve full excavation of buried debris areas up to a depth of 1.5 mbgs or the depth of permafrost, below which buried debris would not be expected. Buried debris would be excavated, segregated, and removed from the buried debris area and disposed of in accordance with the selected remedial options for NHW and HW, depending on its composition. Once segregated, the soil that was mixed in with the debris will be analyzed to confirm soil quality and used as fill where appropriate. Additional borrow material will be used to backfill the resulting excavation to meet the surrounding grade. If the buried debris area is mounded above grade to a height of 2 m or less, the material will be excavated, and the area will be regraded. This option would be effective at removing potential physical hazards from exposed debris and would remove waste including potential contamination sources. This option is the most expensive and intensive as it would require the most labourers and equipment usage, and would generate the largest volume of waste for disposal. Unskilled labour would be required for excavation, waste segregation and disposal which would provide Indigenous participation opportunities. The full excavation and disposal option would likely meet the approval of regulators and the community, however, the costs of the additional excavation may outweigh the benefits of the effectiveness of the remedial option.

Cover – This option would involve covering the buried debris areas with borrow material to conceal potentially exposed portions of buried debris. Areas of exposed buried waste poses potential physical hazard to human or ecological receptors on-site and covering the waste would mitigate that risk. Leaving the buried waste on-site would likely meet the criteria for regulatory acceptance as it aligns with the recommendations for WDAs in the AMSRP, as long as the WDAs do not exhibit signs of contamination. Covering the buried debris with borrow material would be an inexpensive and timesaving remedial option which could be completed during the remedial phase. This option would provide Indigenous participation opportunities as there would be a need for heavy equipment operators.

This remedial option is not viewed as the preferred option as the likelihood of acceptance of stakeholders is anticipated to be low.

6.2.2.1 Proposed Remedial Approach - Buried Debris

The recommended approach for the management of buried debris is a hybrid approach using the AMSRP classification of WDAs. Each WDA would be evaluated for erosion potential, stability and evidence of contamination to designate each WDA as a Class A, B or C and determine the appropriate remedial action. Waste recovered from the WDAs will be segregated and managed by the remedial approaches selected for NHW and HW, depending on composition. The remedial options will apply to the AMSRP designated classes as follows:

Class A – Partial Excavation and Disposal
Class B – Excavation and Disposal
Class C – Cover

Implementing a hybrid approach would be less expensive than completing full excavations of the WDAs and would eliminate on-site hazards associated with the buried debris. This remedial approach would provide a balance of cost and effectiveness. A hybrid approach for the remedial activities would likely be accepted by regulators and the community stakeholders. An overview of the recommended remedial approach for buried debris is summarized in Table 6-5 and the scoring for buried debris is presented in Table B-2, Appendix B.

6.2.3 Buried Infrastructure Remedial Options

The buried infrastructure NHW relates to the concrete bunker and foundations observed at APEC 4 and the anticipated concrete pad under the tank farm at APEC 6. In regard to the bunker at APEC 4, the contents would have to be sampled and assessed to determine the characteristics and quantity of the contents. Depending the results, the contents may have to be removed and disposed of following the selected LW or HW remedial options, depending on composition.

The following remedial options were assessed for buried infrastructure:

Leave in Place - This option would involve leaving the buried infrastructure on-site in its current condition and location. This poses a potential physical hazard to human or ecological receptors on-site. Leaving the buried infrastructure on-site in its current condition would not likely meet the criteria for regulatory acceptance. Although the most inexpensive and timesaving remedial option for buried infrastructure, this option would not return the Site to its pre-disturbed condition and may not satisfy the expectations of the community stakeholders.

Excavate and Dispose - This option would involve full extraction of buried infrastructure. Buried infrastructure would be excavated and disposed of in accordance with the selected remedial options for NHW and HW, depending on its composition. Borrow material will be used to backfill the resulting excavation(s) to meet the surrounding grade. This option would be effective at removing potential physical hazards and would remove waste including potential contamination sources. This option is the most expensive and intensive as it would require the most labourers and equipment usage, and would generate the largest volume of waste for disposal. Unskilled labour would be required for excavation, waste segregation and disposal which would provide Indigenous participation opportunities. The full excavation and disposal option would likely meet the approval of regulators and the community; however, the costs of the additional excavation may outweigh the benefits of the effectiveness of the remedial option.

Regrading – This option would involve re-grading the areas of buried infrastructure to meet the grade of the surrounding landscape. This could be done by either covering or filling the buried infrastructure with borrow or demolishing existing infrastructure (i.e., foundations) to meet the grade of the surrounding ground surface. This option would require some monitoring over time to confirm the cover is stable and no erosion is occurring. This option would remove physical hazards, be cost effective and could be completed during the remediation phase. Unskilled labour would be required which would provide Indigenous participation opportunities. The full excavation and disposal option would likely meet the approval of regulators and the community.

6.2.3.1 Proposed Remedial Approach - Buried Infrastructure

The recommended approach for the management of buried infrastructure is to regrade. Waste recovered (e.g., concrete from foundations) from the debris areas will be segregated and managed by the remedial approaches selected for NHW and HW, depending on its composition. The regrading approach would provide a balance of cost and effectiveness. The Site would be returned to a pre-disturbance condition, eliminate the on-site hazard from buried infrastructure, and would not require intensive excavation to remove. This approach for the remedial activities would likely be accepted by regulators and the community stakeholders. An overview of the recommended remedial approach for buried debris is summarized in Table 6-5 and the scoring for buried debris is presented in Table B-3, Appendix B.

6.2.4 Stained Surficial Soil Remedial Options

Stained surficial soil was primarily limited to around the barrel caches in APECs 1, 2, 3 and 6. As discussed in Section 6.0, the surficial staining at the Site is not considered a risk to human or ecological receptors and is considered a secondary (aesthetic) objective for the RAP. Addressing the surficial staining at the Site will help to return the Site to its pre-disturbed condition, aid natural revegetation and improve the state of the local environment. Figures 2, 3, 4 and 6, Appendix A, show locations of stained surficial soil at the Site.

The following remedial options were assessed:

Leave in Place - This option would involve leaving the soil conditions (i.e., surficial staining) as they are. As surficial staining does not pose a risk to human or ecological receptors, this is an acceptable option and would likely meet the criteria for regulatory acceptance. Although the most inexpensive and timesaving approach, this option would not return the Site to its pre-disturbed condition and may not satisfy the expectations of the local community.

Removal - Areas of surficial staining would be excavated to a depth of approximately 0.5 m and disposed of at a waste disposal facility. For either of the three identified removal options below, borrow material would be required for backfill and all options would require more labour than the other identified remedial options. Further details on each disposal option are discussed below.

- On-Site Disposal: This option would include the design and construction of an on-site waste disposal facility to which excavated soil would be trucked from each APEC for disposal. It is likely that the design of the waste disposal facility would include capping with a liner to reduce the potential of contaminants mobilizing. Construction would require a significant volume of borrow material, regulatory approval, and a long-term monitoring program. This option would be less expensive than off-site disposal in southern Canada and would effectively improve the on-site aesthetic and likely meet the approval of the regulators and community stakeholders. Labourers would be required for construction of the on-site facility, excavating stained surficial soil, and transporting the soil to the facility which would provide Indigenous participation opportunities.
- Off-Site Disposal in Coral Harbour: This option would include disposing of the soil in the existing Hamlet contaminated soil cell located near the Site. This option is ideal in that the cell appears to have sufficient capacity (approximately 120 m by 60 m [7,200 m^2]). Based on the estimated volume of soil for disposal, it would cover 0.5 m across 3,900 m^2 of the facility. This option would need to be negotiated with the Hamlet and is anticipated to include a long-term monitoring component. When comparing the removal options, this solution is anticipated to be the least costly, however the community may not support this option, and the Crown will still maintain liability for the waste, and therefore a long-term monitoring program would be anticipated. This option would effectively improve the on-site aesthetic and likely meet the approval of the regulators. Labourers would be required for excavating stained surficial soil and transporting the soil to the facility which would provide Indigenous participation opportunities.

- Off-Site Disposal in a Southern Locations: This option would include packaging excavated soil in lined bins or super sacs placed in bins for barging to a disposal location outside of Coral Harbour (most likely Quebec). This option would result in the most greenhouse gas emissions as packing the material for barging would require considerable effort, and the waste would be barged a significant distance. This option would be the most expensive and has the potential to impact the remediation schedule as the transportation (i.e., barge) runs on a strict schedule and has limited capacity which requires pre-booking. The barge schedule is determined by the operating company and is based around seasonal conditions (i.e., ice-free conditions). This option would effectively improve the on-site aesthetic and would likely meet the approval of the regulators and community stakeholders. Labourers would be required for excavating, packaging and transporting the packed soil to the barge which would provide Indigenous participation opportunities.

Scarification - Areas of surficial staining would be mechanically scarified by an excavator using attachments that promote soil mixing. This option removes the aesthetic component of the surface staining. The selected attachment would need to break up the top layer of soil (0 m to 0.15 m) and depending on the effectiveness of the selected attachment, the excavator may be required to go over the area more than once to achieve the desired aesthetic. Mechanical scarification is ideal for smaller areas with minimal surface staining and is less ideal for large areas or areas with heavy soiling. It is expected that equipment to do so would be available in the community, making execution efficient. This option is the most cost effective, although the level of acceptance by the local community is anticipated to be relatively low. It is anticipated that the application of mechanical scarification for large areas and heavy soiling will not be approved by the community stakeholder, although it may be applicable for small areas of light staining.

Cover - Borrow material would be used to cover the areas of surficial staining. It is expected that borrow would be taken from the existing borrow source areas and spread over the stained surficial soil at a depth of 0.1 m to 0.5 m. If sufficient borrow material is not available, an additional borrow site may need to be developed at additional cost. This option would have limited impact on the schedule and would be simple to execute. This option would require some monitoring over time to confirm the cover is stable and no erosion is occurring. This option is relatively cost effective and the anticipated level of acceptance by the local community is low to medium. This option would be effective at improving the aesthetic of the Site and would provide Indigenous participation opportunities for unskilled labourers.

6.2.4.1 Proposed Remedial Approach - Stained Surficial Soil

The recommended approach for addressing stained surficial soil is on-site disposal in an engineered NHW facility. This is an effective approach that would address the aesthetics of the Site and meet the acceptance of regulatory and community stakeholders. Additionally, the surficial soil material could be used as the lift material between layers of compacted NHW in the NHW facility. This approach does require borrow material and significantly reduces shipping costs. This approach has been used effectively at other abandoned military sites. An overview of the remedial options evaluation and scoring for stained surficial soil is presented in Table B-4, Appendix B.

6.2.5 Summary of Recommended NHW Remedial Approaches

Table 6-5 provides a summary of the recommended remedial approaches for the NHW components.

Table 6-5 Summary of Recommended NHW Remedial Approaches

NHW Component	Approximate Quantity	Proposed Remedial Approach	Comments
General NHW Debris			
Barrels	2,775 barrels, estimated 60 m^3 following compaction	- Empty, wash on-site to remove residual product, strip of amended paint or treated with Lead Defender® if applicable (not anticipated) - Crush and dispose of cleaned barrels in on-site NHW facility	Liquid waste (barrel contents, wash water) to be addressed as per Section 6.1.3. Contents and amended paint materials to be addressed as per Section 6.3.2.1.
Infrastructure – Wooden Sheds	4 m^3	- Demolish - Segregate demolition waste - Incinerate (on-site) combustible materials (assuming no amended paint) - Dispose of remainder in on-site NHW facility	Amended paint to be addressed as per Section 6.3.2.1.
Infrastructure – Tank Farm	1 tank farm consisting of 7 tanks with an approximate total capacity of 350,000 US gallons, associated piping, high-density polyethylene (HDPE) liner and geotextile	- Empty, wash on-site to remove residual product, strip of amended paint or treated with Lead Defender® if applicable (not anticipated) - Shred, crush, compact and dispose of resulting debris in on-site NHW facility	Liquid waste (tank and line contents, wash water) and amended paint to be addressed as per Section 6.1.3 and 6.3.2.1, respectively.
Surface Debris	3,430 m^3	- Collect, sort and classify debris - Dispose of NHW in on-site NHW facility	Hazardous waste found during collection and sorting will be addressed as per Section 6.3.
Buried Debris			
Buried Debris	Estimated area of buried debris in APECs 4 and 6 of 6,815 m^3	NHW - Collect, sort and classify, and dispose in on-site NHW facility HW - Collect, sort and classify, and dispose as per Section 6.3	No testing or visual identification of type of debris (hazardous or non-hazardous) undertaken to date.

Table 6-5 Summary of Recommended NHW Remedial Approaches

NHW Component	Approximate Quantity	Proposed Remedial Approach	Comments
Buried Infrastructure			
Buried Infrastructure	Concrete Bunker with unknown origin, size and quality of any contents at APEC 4 Concrete foundations with unknown size and dimensions One structure with unknown quantity of liquid waste	- Determine composition of contents, remove and dispose of accordingly (refer to Section 6.1 and 6.3) - Remove structure from ground and dispose in on-site NHW facility - If structure cannot be removed from ground, bury in place (including all voids) and grade area to match surroundings	Sampling and analysis of bunker contents should occur prior to the remedial program - If structure can be removed, backfill the resulting excavation and grade area to match surrounding area - If structure cannot be removed, grade area to match surrounding area following burial in place
Stained Surficial Soil			
Stained Surficial Soil	1,950 m^3	- Excavate stained soil to a depth of approximately 0.5 m and disposal of in the on-site NHW facility - Use borrow material to ensure that the area is graded to match the surrounding landscape	

6.3 HAZARDOUS WASTE

Site materials that were identified as HW include ACMs, lead-amended paint, and unknown liquid contents in barrels. The hazardous materials present on-site are considered past and/or potential future sources of contamination. Removal of these materials from Site removes the contaminant source and the potential exposure hazard for future receptors. Figures 2 through 6, Appendix A show the locations of hazardous materials that were identified during the Phase III ESA (Stantec, 2021a).

The ‘leave in place’ approach was considered as a remedial option, but would not remove the risk to receptors, reduce liability, or eliminate exposure pathways, and as a result was not carried forward or evaluated as a remedial option.

The remedial options for HW are summarized in Table 6-6. An overview of each remedial option and the evaluation of each remedial option against the selected evaluation criteria is discussed in detail below.

Table 6-6 Summary of Hazardous Waste Remedial Options

HW Component	Considerations	Remedial Options Evaluated
Asbestos	n/a	1. On-site disposal 2. Off-site disposal in southern Canada
Amended Paint	Amended paint is in poor to fair condition (i.e., chipping, flaking and peeling from substrate). Amended paint is in good condition (i.e., well adhered to substrate).	1. Full abatement 2. Partial abatement 3. Off-site disposal 4. Application of Lead Defender®
Batteries	n/a	1. Off-site disposal in southern Canada
Residual Product (Petroleum)	Residual product does meet criteria for incineration. Residual product does not meet criteria for incineration.	1. Off-site disposal* 2. Incineration
Notes: (*) – Disposal option will align with remedial option selected for general LW debris.		

6.3.1 Asbestos Remedial Options

The current understanding of the quantity of ACMs present on-site is limited to 5 m^3. The remedial options below were considered for ACMs:

Disposal – ACMs would be collected and double bagged prior to disposal. The disposal options for ACMs include the following:

- On-Site Disposal - the ACMs would be handled and removed by trained personnel in accordance with the applicable guidelines and regulations. The ACMs would be double bagged and placed in the on-site NHW facility. The location of the ACMs within the NHW facility would be recorded. This option would be effective and would eliminate the on-site hazard. This option is likely to be accepted by regulators and community stakeholders. This option would not provide any Indigenous participation opportunities as trained abatement contractors would be required to handle the ACMs.
- Off-Site Disposal - Upon proper removal, the ACMs would be readied for off-site transport to an appropriate facility (southern Canada). This option would be equally effective and would eliminate the on-site hazard. This option is likely to be accepted by regulators and community stakeholders. This option would not provide any Indigenous participation opportunities as trained abatement contractors would be required to handle the ACMs. This option would be more costly as the ACMs would have to be shipped to a southern location for disposal.

6.3.1.1 Asbestos Proposed Remedial Approach

The proposed remedial approach for ACMs is on-site disposal in the NHW facility. Both remedial options present similar levels of effectiveness, ease of implementation, timeliness, and Indigenous participation. The differentiating factor is the cost, with on-site disposal in the NHW facility being lower. An overview of the recommended remedial approach for ACMs is summarized in Table 6-7.

6.3.2 Amended Paint Remedial Options

The current understanding of the quantity of amended paint present on-site is limited to a minimum of 100 m^2 of lead amended paint. For the purposes of this RAP, it is assumed that lead has not leached significantly into any metal substrates. If leachate testing indicates that concentrations of lead in paint and substrate are greater than 5 mg/L, these materials will require off-site disposal. The associated remedial options scoring for amended paint is presented in Table B-5, Appendix B.

- Full On-Site Abatement - A paint abatement area will be constructed at the Site which would include a negative air chamber in an airtight system. The abatement will be conducted by physically removing the lead containing paint (scraping, chemical stripping, or sand blasting) from the associated substrate. This option will require water collection and treatment making it a costly option when considering materials, water treatment and disposal of removed paint. After abatement, the equipment and substrate will be disposed of in the on-site NHW facility. The paint flakes would be collected and shipped for off-site disposal at a licensed hazardous waste facility (southern Canada) in accordance with the TDG Act. This option would not provide any Indigenous participation opportunities as trained abatement contractors would be required to complete the work.
- Partial On-Site Abatement - Abatement will be conducted manually in an enclosed area (such as inside a temporary enclosure) and will focus on removal of poorly adhered paint. Removed paint will be collected and disposed of off-site at a licensed hazardous waste facility in accordance with the TDG Act. The mass of the remaining substrate would be incorporated into the calculation to determine the lead concentration weight per volume. If the weight per volume meets the Environmental Guideline for Waste Lead and Lead Paint (GNU, 2014), the remaining substrate would be disposed of in the on-site NHW facility. However, if the substrate exceeds the weight per volume guidelines, it would be shipped for disposal off-site at a licensed hazardous waste facility (southern Canada) in accordance with the TDG Act. This option would not provide any Indigenous participation opportunities as trained abatement contractors would be required to complete the work.
- Treatment and Disposal - Materials and equipment coated in lead amended paint will be treated on-site with Lead Defender® by ECOBOND, a paint product which when applied reduces the toxicity and leachability of the lead. Once coated in Lead Defender®, the materials would be disposed of in the on-site NHW facility. This option would be effective in immobilizing the lead however the long-term durability and acceptance of the application of this product by regulators is unknown. The product may reduce the leachability of lead from the amended paint but it would not reduce the exposure hazards associated with disturbing the amended paint. This option would only be applicable for lead amended paint and could not be used for metals or PCB amended paint. The Lead Defender® product is not readily available and would require transportation of the material to the Site. This option would not provide any Indigenous participation opportunities as trained abatement contractors would be required to complete the work.

- Off-Site Disposal in a Southern Location - Materials and equipment coated in amended paint will be consolidated and transported for disposal off-site at a licensed hazardous waste facility (southern Canada) in accordance with the TDG Act. This option is the costliest approach and has the potential to impact the schedule as transportation is based on a strict external schedule, however, is expected to be supported by the community as there is no permanent disposal in or near the community. The Crown would have no long-term monitoring requirement. This option would provide some Indigenous participation opportunities as labourers would be required to collect and load the materials for transportation.

6.3.2.1 Amended Paint Proposed Remedial Approach

The recommended approach for the management of amended paint is partial abatement and disposal. The partial abatement would provide a balance of cost and effectiveness, as this option is less costly than full abatement or off-site disposal in a southern location. Unlike the treatment and disposal options which are targeted at lead amended paint, this approach could be applied to varying types of amended paints. This approach for the remedial activities would likely be accepted by regulators and the community stakeholders. An overview of the recommended remedial approach for buried debris is summarized in Table 6-7.

6.3.3 Batteries

Although no batteries were identified during the Phase III ESA, there is the potential for batteries to be present in abandoned vehicles and equipment. The remedial option for batteries is limited to one option, off-site disposal at an appropriate disposal facility (southern Canada) in accordance with the TDG Act.

6.3.4 Recommended Hazardous Materials Remedial Approach

Table 6-7 provides a summary of the recommended remedial approaches for hazardous waste.

Table 6-7 Summary of Recommended Hazardous Waste Remedial Approaches

Hazardous Waste Component	Approximate Quantity	Proposed Remedial Approach	Comments
ACMs	Minimum 5 m^3	- Collect, double-bag and dispose of in on-site NHW facility	- Testing of shingles on wooden sheds in APEC 3 should be completed prior to finalization of ACM quantities - Removal of ACMs to be confirmed with on-site visual inspection and testing as necessary - Abatement should be completed by a certified contractor and handled in accordance with the applicable Federal and Territorial Asbestos regulations - Any suspected ACMs encountered during the remedial program to be collected and submitted for analysis to determine appropriate disposal options - Potential presence of ACMs in brake pads and shingles on wooden sheds (APEC 3) not assessed during the previous field programs and should be confirmed prior to completing the remedial program

Table 6-7 Summary of Recommended Hazardous Waste Remedial Approaches

Hazardous Waste Component	Approximate Quantity	Proposed Remedial Approach	Comments
Batteries	Estimated <10 m^3	- Consolidate and package for disposal at a licensed off-site facility (southern Canada)	- Abandoned vehicles and machinery will have to be inspected to create inventory prior to remedial program. - Any batteries encountered on the ground during the remedial program should be collected and the soil beneath the battery should be tested for inorganic metals to determine if the soil has been impacted.
Amended paint	Minimum 100 m^2	Partial On-Site Abatement	- Testing of paint on wooden sheds in APEC 3 and paint on tank farm should be completed prior to finalization of amended paint quantities - Prior to the remedial program, samples of lead paint with the substrate should be collected to determine if lead has leached into the substrate - Materials with poorly adhered lead paint will be partially abated, removed paint will be collected and shipped for disposal at a licensed hazardous waste facility (southern Canada) - Weight per volume calculations will be carried out for remaining substrates; those that meet the guideline will be disposed of in the on-site NHW facility and those that do not will be disposed of off-site (southern Canada)

6.4 PROPOSED REMEDIAL APPROACH SUMMARY

Table 6-8 summarizes the recommended remedial approach for each waste stream component.

Table 6-8 Summary of Recommended Remedial Approaches

Category/ Component	Estimated Area / Volume	Recommended Option
Liquid Waste		
Aqueous Liquids	16,000 L	To be sampled, consolidated, and disposed of pending the criteria that they meet. Liquids that meet the incineration criteria will be incinerated, liquids that meet the wastewater discharge criteria will be discharged and liquids that do not meet the incineration or wastewater discharge criteria will be disposed of off-site (southern location).
Liquid Petroleum Products	134,100 L	To be sampled, consolidated, and disposed of pending the criteria that they meet. Liquids that meet the incineration criteria will be incinerated, liquids that meet the wastewater discharge criteria will be discharged and liquids that do not meet the incineration or wastewater discharge criteria will be disposed of off-site (southern location).
Non-Hazardous Waste		
Empty Barrels	60 m^3 after crushing	To be emptied, cleaned, crushed, and disposed of in a non-hazardous waste facility constructed at the Site

Table 6-8 Summary of Recommended Remedial Approaches

Category/ Component	Estimated Area / Volume	Recommended Option
Infrastructure	Minimum 80 m^3	To be dismantled, incinerated or compacted, and disposed of in the on-site NWH facility. The tank farm will require an assessment prior to the remedial program to determine if/what contents are present and if the paint on tanks is amended with lead.
Surface Debris	3,430 m^3	To be collected, segregated, shredded, compacted and disposed of in the on-site NWH facility. Note bare wooden materials will be segregated and incinerated on-site.
Buried Debris	6,815 m^3	Classification of the WDAs in accordance with the AMSRP to designate each as a Class A, B or C and determine the appropriate remedial action prior to the remedial program. Dispose of as NHW or HW based on results.
Buried Infrastructure	Unknown	Regrade the infrastructure to meet the grade of the surrounding landscape.
Stained Surficial Soil	1,950 m^3	Excavate soil and disposed of in on-site NHW facility.
Hazardous Waste		
Asbestos	Minimum 5 m^3	Abate, double bag and dispose of in the on-site NHW facility.
Amended paint	Minimum 100 m^2	Partial abatement on-site of poorly adhered paint and off-site disposal of removed paint at hazardous waste facility (southern Canada). Weight per volume calculations will be carried out for remaining substrates; those that meet the guideline will be disposed of in the on-site NHW facility and those that do not will be disposed of off-site (southern Canada).
Batteries	Unknown (expected to be no more than 10 m^3)	Removal from vehicles and equipment, if present, and off-site disposal at a registered hazardous waste facility (southern Canada). If batteries are found on the ground at the Site, confirmatory soil samples should be collected and submitted for analysis of lead to determine if lead had leached into the soil.

7.0 CONTINGENCY

7.1 PHC CONTAMINATED SOIL

Any soil impacted above the SSTL identified during the recommended additional assessment at APEC 6 will require further remedial considerations beyond what is recommended for the surficial staining. Note this contingency only accounts for soil that exceeds the PHC F3 SSTL calculated in the HHERA (Stantec, 2021b). The remedial options for soil exceeding the SSTL include:

Excavation and On-Site Disposal - The delineated area of impacted soil would be excavated, and impacted soil would be disposed of in a separate cell of the on-site NHW facility, which would be designed with a specialized engineered liner to reduce the potential of contaminants mobilizing. Impacted soil disposed of in the facility would be capped. This would require a long-term monitoring program to monitor the facility, and the permafrost for stability.

Excavation and Off-Site Disposal

Off-Site Disposal in Coral Harbour: Impacted soil would be excavated and transported off-site for disposal in the local community contaminated soil cell that is owned and operated by the Hamlet of Coral Harbour. Off-site disposal would require permission from the Hamlet. It is anticipated that further management and monitoring of the soil would likely be required.

Off-Site Disposal in southern Canada: Impacted soil would be excavated, bagged and transported (initially by barge) for disposal in a licensed landfill in a location outside of Coral Harbour (anticipated to be Quebec). This option is the costliest approach, and results in the most greenhouse gas emissions overall; however, is expected to be supported by the community as there is no permanent disposal in or near the community. This option would allow the Crown to have no long-term monitoring requirement.

While is it expected that the preferred remedial option would be the same as for stained surficial soil (i.e., excavate and dispose in the on-site NHW facility), the final decision will be based on the nature and extent of identified PHC impacts.

7.2 OTHER CONTAMINATED SOIL

Based on the existing site data, only PHCs were carried forward for evaluation in the HHERA. However, it is recognized that during remediation, new, potential sources of soil contamination could be encountered, such as batteries located on the ground surface, and previously unidentified sources in buried debris. Because these potential sources are not confirmed to exist, any contaminated soil that may be associated with them cannot be quantified. Therefore, a contingency plan is required in the event that these sources are identified during the remedial program. This contingency plan would be developed during the detailed design phase, and would include guidance on sampling and assessment requirements. It is expected that remedial options for any soil identified by the sampling and assessment as presenting unacceptable risk to human or ecological health will be similar to those identified in Section 7.1:

Excavation and On-Site Disposal
Excavation and Off-Site Disposal in Coral Harbour
Excavation and Off-Site Disposal in southern Canada

These options can not be evaluated at this time given uncertainties such as contaminant type and contaminated soil quantities.

8.0 STAKEHOLDER CONSULTATION

On March 2, 2021 a community meeting was held with residents of the Hamlet of Coral Harbour at the community hall in the Hamlet of Coral Harbour, NU. The purpose was to present the preliminary RAP and to allow an opportunity for feedback from the community. The consultation was advertised by the Hamlet Office prior to the meeting and began at 7:15 pm. In attendance were approximately 6 people from the community, in addition to Ms. Charlotte Lamontagne from CIRNAC and Mr. Isaac Freda from Stantec. Mr. Dele Morakinyo from CIRNAC, Ms. Amy Elder from CIRNAC, Ms. Caitlin Moore from PSPC, and Mr. Michael Doucet of Stantec attended the community meeting virtually.

The general plan for remediation as outlined in this RAP was presented by Mr. Morakinyo. After the presentation was completed, an opportunity for feedback was provided to the attendees. Comments included questions about community involvement and employment opportunities, questions about the material remaining at the Site and if it could be salvaged, and a reference to buried debris and contaminated areas that were not addressed by the RAP.

With respect to the community involvement and employment opportunities, the attendees were advised that there would be further consultation with the community as the remedial process progresses. In addition, the attendees were advised that the successful contractor would be strongly encouraged and held accountable for a local hiring commitment. For material that remains at the Site, if it is deemed to be non-hazardous or not contaminated, CIRNAC has a release process whereby a community member may take the material if they sign for the liability associated with it. Finally, the location of the buried debris and contaminated areas were indicated roughly on a map. As such, these locations should be clearly identified to determine what jurisdiction that they fall under and if a preliminary assessment is required.

9.0 LOGISTICS AND REMEDIATION DEVELOPMENT

Table 9-1 Proposed Schedule

Activity	Timing
Consultation meeting with stakeholders	March 2, 2021
Additional assessment/investigation/sampling - Phase III ESA at APEC 6 - Assessment of the tank farm for contaminated soil under and immediately around the tanks, extent of associated piping, determination of content characteristics and quantity, and assessment of paint on the tanks for lead and PCBs (APEC 6) - Assessment of concrete bunker (APEC 4) (contents, size, construction, etc.) - Further assessment of buried debris areas - Heavy equipment and large bulk item inventory, including detailed inventory of batteries, sampling of brake pads for ACMs	April 1, 2021 – September 30, 2021

Table 9-1 Proposed Schedule

Activity	Timing
- Assessment of wooden sheds for lead paint, asbestos, etc. - Barrel sampling program - Assessment if access road from barge landing - Archaeology assessment Borrow source assessment	
Complete detailed design, specifications and supporting permitting documents	September 30, 2021 – December 31, 2021
Apply for permits	April 1, 2021 to December 31, 2021
Tendering process	January 1, 2022 to June 30, 2022
Community Meeting – Start of Site Remediation at Coral Harbour	July 2022
Mobilize equipment to Site	July 2022
Construct on-site NHW facility	July 2022 – October 2022
Conduct Active Remediation - Collection, segregation, and compaction of surface debris - Collection and consolidation of barrel contents, compaction of barrels - Dismantling, cleaning, and compaction of tank farm - Incineration - Consolidate, package and transport materials for disposal off-site in a southern location if they do not meet the incineration criteria - Regrade the infrastructure to meet the grade of the surrounding landscape. - Excavate surficial stained soil and place in on-site NHW facility - ACM and paint abatement - Consolidate, package and transport HW materials for disposal off-site in a southern location	July 2022 – September 2023
Demobilize from Site	September 2023
Final Community Meeting	October 2023
NHW Facility Monitoring	2024 – 2049
Final Site Closure	2050

9.1 SCHEDULE

A proposed schedule for the remediation is present in Table 9-1. Based on the location of the Site, it is assumed that active remediation can only be completed in the late spring and summer months (i.e., June to September). It is noted that construction of the on-site NHW facility can be undertaken in conjunction with the active remedial activities to reduce the duration of the remedial program.

9.2 FEDERAL / TERRITORIAL PERMITTING

The type of permits required for the remedial program depend solely on the remedial approaches selected. Preparation of the permit applications will start prior to the remedial program to allow the authorities having jurisdiction (AHJ) time to review and approve prior to on-site activity.

9.3 SITE DEVELOPMENT

9.3.1 Access Roads

There is presently an existing access road that connects the Site to the Hamlet of Coral Harbour as well as a diverging access road that accesses the Hamlet's barge landing area west of the Site. The access road will be the primary route for equipment required for the remedial program. At the time of the Phase III ESA (Stantec, 2021a), the access roads were observed in good condition. It is recommended that all access roads be re-assessed closer to the active remediation phase.

Additionally, access to APEC 1 requires crossing the active airstrip, which is dangerous and may damage the airstrip. It is recommended that an access road be developed around the airstrip to eliminate vehicles and equipment traveling over it during the pre-remedial activities and remedial program. Current access roads are illustrated on Figure 1, Appendix A.

9.3.2 Active Airstrip

The Coral Harbour Airport (CYZS) is a small public use airport which serves the community of the Hamlet of Coral Harbour. The airport has operational staff on-site during regular hours and the active airstrip is maintained daily by the Coral Harbour Airport. The airport contains one gravel runway, a taxiway and an apron. The airstrip is an approximately 1,526 m long gravel airstrip located adjacent to the Site. The critical aircraft is the ATR-42-500, although aircraft larger than the critical aircraft may operate as long as it complies with the Canadian Aviation Regulations (GNU, 2021). The airstrip could potentially be used to bring in workers, materials and small pieces of equipment. As this is a commercially maintained runway, information for appropriate aircraft and authorizations can be obtained from the airport authority.

9.3.3 Barge Landing Area and Sealift

There is a barge landing area located approximately 15 km west of the Hamlet of Coral Harbour, approximately 5 km west of the Site. Coral Harbour is a location that is routinely accessed by various sealift companies that transport goods (including dangerous goods), construction materials and heavy equipment to Coral Harbour and other northern communities. It is anticipated that these companies would not provide transportation of any goods from the barge landing area to the Site. Many of the sealift and barge companies require advanced booking up to several months in advance.

The access roads from the barge landing area to the Site were not assessed in the Phase III ESA and should be assessed during the pre-remedial activities. They are expected to be in a condition that heavy equipment could operate due to their current use.

9.3.4 Borrow Sources

There are three existing borrow sources that have been identified and assessed to date (Stantec, 2021a). The borrow sources are illustrated in Figure 1, Appendix A.

Borrow Source – Airport Road Quarry #1: This existing source is managed by the Hamlet of Coral Harbour under a 10 year Quarry Administration Agreement. Small stockpiles of gravel were observed at the property with overall volumes estimated to be less than 10,000 m^3. No test pits were conducted during the borrow source assessment (included in the Phase III ESA) for this source.

Borrow Source – Airport Road Quarry #4, 5, 7: This existing source is managed by the Hamlet of Coral Harbour under a 10 year Quarry Administration Agreement. Stockpiled material consists predominantly of poorly graded gravel (mainly angular, medium to coarse shale gravels, variable amount of sand with trace amounts of silt and clay sized particles) and was classified as Class 3 Fair Quality under the Northwest Territories Granular Resource Directory (GNWT, 2015) (used in the absence of a similar guide for Nunavut). The footprint of the borrow source is constrained by the presence of active river channels to the east and west, and by standing water or poorly drained terrain to the north and south. The volume of source material was estimated to be less than 20,000 m^3.

Borrow Source – Airport Road Unnamed Quarry: This existing source is located within lands owned by the Federal Government (Transport Canada). No test pits were conducted during the borrow source assessment (Phase III ESA) for this source as the materials looked similar between this location and the Airport Road Quarry #4, 5, 7. The volume of source material was estimated to be less than 10,000 m^3.

9.3.5 Camp

Based on the limited availability of accommodations in the Hamlet of Coral Harbour and the COVID-19 pandemic, it is recommended that a camp be constructed at the Site to facilitate timely remediation. The on-site camp will need to be set-up in a location that will ensure workers are not affected by hazards during remediation. The camp is expected to require a capacity for as many as 18 on-site workers and associated camp staff. The camp will be constructed with suitable infrastructure to meet Nunavut guidelines for this type of temporary camp as applicable, including the WSCC's Camp Set Up and Management (WSCC, 2017), and will be constructed and prepared for weather and/or emergency situations. The camp will minimize contact between the workers and the local community. Additional COVID-19 related requirements will meet Territorial requirements in place at the time leading up to and during the remedial program. Specific locations were not identified for the camp during the Phase III ESA but there are numerous possibilities in close proximity to the APECs.

Facilities that will be required include the following:

- Sleeping quarters
- Offices
- Kitchen and dining areas
- Bathrooms and showers
- Laundry facilities

- First aid facilities
- Water treatment system for camp
- Mechanic and equipment area that would also have a petroleum and lube containment area
- Water supply and pumps
- Geotechnical laboratory
- Diesel powered generators
- Emergency shelter
- Quarantine building (for on-site workers who exhibit symptoms of COVID-19)

9.3.6 On-Site NHW Facility

The on-site NHW facility is anticipated to be constructed aboveground such that it will not rely on or disrupt the permafrost. Based on estimated volumes of waste, it is expected to cover an area of 3,000 m^2 and consist of a granular structured berm with a minimum layer of 1.0 m granular cover above the structured berm. However, the final design of the NHW facility will be completed once results of additional assessment, investigation and sampling are available.

Three potential locations for a NHW facility were identified during the field program portion of the Phase III ESA; all located between APEC 3 and APEC 6. Final potential locations will be confirmed after the archaeological program is completed, however, it is expected they would be located along the roadway.

The AMSRP will be used as a guidance document for the construction of the on-site NHW facility and the design should be reviewed by a geotechnical engineer prior to implementation. Monitoring wells will be installed around the perimeter of the waste facility and baseline conditions of the groundwater will be established prior to use. These will be further detailed and refined in the design stage of the project.

9.3.7 Remediation Equipment

An inventory of heavy and other equipment that will need to be mobilized to the Site for the duration or for an extended period of the work will be developed following selection of the final remedial approaches. APEC 4 is the proposed designated laydown areas for equipment storage. The list below identifies most of the equipment, based on Stantec's experience, that will be required to successfully complete the proposed remedial plan; however, it is not to be considered an exhaustive list.

- Excavator(s) to load borrow material
- Front-end loader to consolidate materials and surface debris
- Haul truck(s) to move borrow and waste materials to staging areas and the on-site NHW facility
- Tilling attachment for the dozer to scarify the areas of surficial staining
- Dozer or other grading equipment to be used for the construction of the on-site NHW facility
- Smooth drum compactor for the construction of the on-site NHW facility
- Waste incinerator(s)for incineration of organic liquids, unpainted wood and applicable camp waste
- Waste compactor
- Drum crusher
- Water treatment system for treatment of wash water generated by the on-site washing of barrels
- Generators for remedial equipment and camp operation

- Temporary enclosure for the partially abatement of lead containing paints and application of Lead Defender®
- Site vehicles for transportation of the site workers
- A refueling vehicle and/or aboveground storage tank for fuel storage
- Other miscellaneous equipment as determined by the contractor

10.0 ADDITIONAL ACTIVITIES

10.1 PRE-REMEDIAL ACTIVITIES

The following data gaps require action prior to, or during the early stages of the remedial program:

- Phase III ESA – Additional soil sampling at APEC 6 (east debris pile and debris pile near tank farm) to delineate the COCs and confirm the extent of surficial soil staining.
- Barrel Assessment - Complete a barrel assessment and sampling program to determine and quantify contents to determine the appropriate remedial option.
- Paint Sampling - Painted materials previously identified as being lead-leachate toxic paint above the 5 mg/L guideline will be resampled along with the associated substrate, if possible, to determine the material's leachate content for disposal. Samples will also be analyzed to determine if the paint is also PCB-amended. Paint samples should also be collected from the wooden sheds in APEC 3 and the tanks in APEC 6 to determine lead and PCB content.
- ACMs – samples of roofing materials should be collected from the wooden sheds in APEC 3 to determine whether they are considered ACMs.
- Buried Concrete Sump/Drain/Separator Assessment - Assessment and sampling of buried concrete structure to determine contents and options for remediation.
- Buried Debris Assessment – Conduct an assessment of the debris areas to determine volume and assess for the presence of buried hazardous waste.
- Tank Farm Assessment - Assessment of the tank farm and associated sampling of remaining contents.
- Heavy Equipment Inventory – Conduct an inventory of the heavy equipment and large bulk items that are present on-site. This activity should include inspecting each item for batteries, POLs and potential ACMs.
- Borrow Material Investigation - Identify source of borrow material to be used for construction of the on-site NHW facility.
- Archaeological Assessment - Conduct an archaeological assessment in the areas that required intrusive borrow investigations for new deposits and the area proposed for the on-site NHW facility.
- Visually assess the access road from the barge landing to the Site to determine the state of the conditions prior to remedial activities.
- Complete confirmatory soil sampling of the temporary storage areas (TSAs) to determine baseline site conditions, prior to Remediation Program.

10.2 DURING REMEDIATION ACTIVITIES

The active remediation and the construction of the on-site NHW facility will occur simultaneously to shorten the length of the remediation. The following activities will be undertaken during the remediation phase:

- Composite barrel contents and incinerate or dispose, as appropriate.
- Wash barrels containing residual product and compact/crush clean barrels.
- Dismantle tank farm. Composite remaining contents for incineration. Clean inside if residual product is present. Abate painted materials, if necessary.
- Remove contents of buried concrete bunker and wash, as required. Fill bunker with borrow material and compact, level to match surrounding grade.
- Scarification of areas containing relatively minor surficial staining.
- Abate and dispose of ACMs in the on-site NHW facility. Mark designated area with appropriate signage.
- Partial abatement of materials with lead containing paint and application of Lead Defender®. Materials coated with Lead Defender® can be disposed in NHW facility.
- Collect, segregate, compact and dispose of surface debris off-site and/or in the on-site NHW facility.
- Collect, compact, and dispose of exposed buried debris materials or cover with borrow material to eliminate physical hazard.
- Existing concrete foundations and slabs will be left in place and borrow material will be placed in these areas to match top-of-concrete to final surface grades.
- Once the remedial activities have been completed, the temporary camp will be deconstructed. Areas that are disturbed during the remedial activities (i.e., work areas, access roads and lay down areas) will be re-graded to match existing surface grades. The contractor(s) will be responsible for transporting the equipment off-site.
- Complete confirmatory soil sampling of the TSAs once all materials have been removed from Site to determine the site conditions, following the Remediation Program.

The above is not an extensive list of activities to be conducted during the remedial phase and will be further developed in the detailed design of the remediation program.

10.3 POST REMEDIAL ACTIVITIES

Residual contamination may be present at barrel processing areas, hazardous materials processing areas, lead abatement areas, and stockpile lay down areas following the completion of the remedial program. These areas will be visually assessed for contamination indicators such as staining, debris, or paint chips, and sampled if required.

The on-site NHW facility will require post-remedial monitoring. Currently, it is assumed that this will include:

- Visual monitoring to observe the physical integrity of the facility including observations for possible settling, erosion, frost action, vegetation, leachate, staining, etc.
- Long-term groundwater monitoring of three to four groundwater monitoring wells.

11.0 CLOSURE

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 areas 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.

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.

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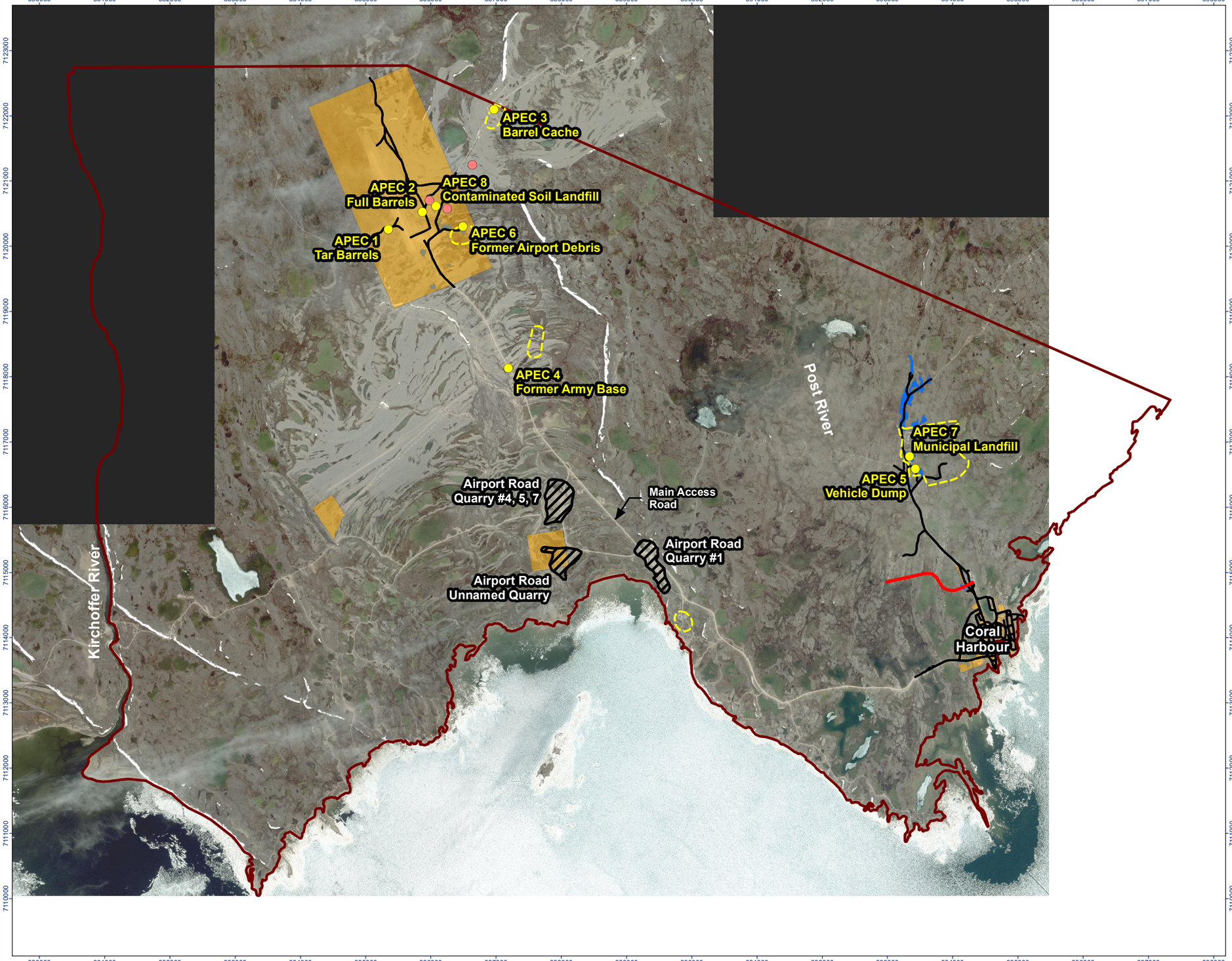
APPENDIX A

Figures



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Legend

- APEC
- Area to be further assessed for non-hazardous waste suitability
- Gravel Roads
- Pipeline to Water Source
- Quarries / Dumpsites
- Parcels
- Waste Disposal Sites
- Existing Borrow sources
- Municipal Boundary

Note: Interpretation of this Figure is dependent on coloured symbols. View in colour.

N

0 1 2 Kilometres

(At original document size of 11x17)
1:60,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Data Sources: Government of Nunavut

Project Location
Coral Harbour,
Nunavut

Prepared by ACampigotto on 2021-02-01
Technical Review by CB on 2021-02-01

Client/Project 121416787

Public Service and Procurement Canada
Remedial Action Plan

Figure No.
1

Title
Overview Map

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Stantec

Legend

- Debris Areas
- Approximate Area of Surficial Soil Staining

Note: Interpretation of this Figure is dependent on coloured symbols. View in colour.

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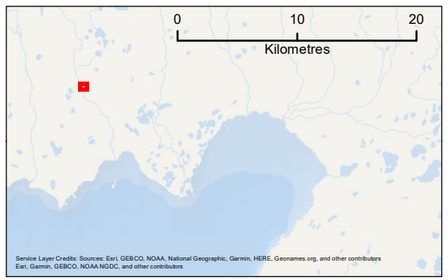

Project Location
Coral Harbour, Nunavut

Prepared by ACampigotto on 2021-02-01
Technical Review by CB on 2021-02-01

Client/Project 121416787
Public Service and Procurement Canada
Remedial Action Plan

Figure No.
2

Title
Remedial Action Plan - APEC 1 Tar Barrels

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Stantec

Legend

- Debris Areas
- Approximate Area of Surficial Soil Staining

Note: Interpretation of this Figure is dependent on coloured symbols. View in colour.

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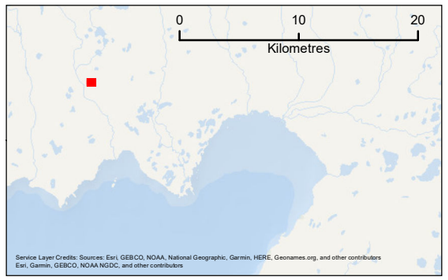

Project Location
Coral Harbour, Nunavut

Prepared by ACampigotto on 2021-02-01
Technical Review by CB on 2021-02-01

Client/Project
121416787
Public Service and Procurement Canada
Remedial Action Plan

Figure No.
3

Title
Remedial Action PLan - APEC 2 Full Barrels

G:_GIS_Project_Folder\121416787_Coral_Harbour\ArcMaps\Remedial Action Plan\Figure3_RemedialActionPlan_APEC2_Full_Barrels_20210118.mxd Revised: 2021-02-01 By: ACampigotto

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Legend

- Debris Areas
- Approximate Area of Surficial Soil Staining
- Municipal Boundary

Note: Interpretation of this Figure is dependent on coloured symbols. View in colour.

N

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(At original document size of 11x17)
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Notes

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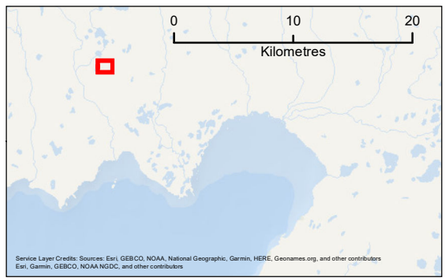
2. Data Sources: Government of Nunavut



Project Location
Coral Harbour, Nunavut

Prepared by ACampigotto on 2021-02-01
Technical Review by CB on 2021-02-01

Client/Project
Public Service and Procurement Canada
Remedial Action Plan

121416787

Figure No.
4

Title
Remedial Action Plan - APEC 3 Barrel Cache

G:_GIS_Project_Folder\121416787_Coral_Harbour\ArcMaps\Remedial Action Plan\Figure4_RemedialActionPlan_APEC3_BarrelCache_20210118.mxd Revised: 2021-02-01 By: ACampigotto

Stantec

Legend

- Asbestos containing material (ACM)
- Remnants of historic infrastructure
- Debris Areas
- Concrete Bunker (location and size approximate)

Note: Interpretation of this Figure is dependent on coloured symbols. View in colour.

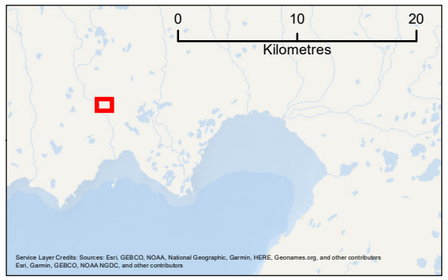
N

0 40 80 Metres

(At original document size of 11x17)
1:4,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Data Sources: Government of Nunavut



Project Location
Coral Harbour, Nunavut

Prepared by ACampigotto on 2021-02-01
Technical Review by CB on 2021-02-01

Client/Project 121416787

Public Service and Procurement Canada
Remedial Action Plan

Figure No.
5

Title
Remedial Action Plan - APEC 4 Former Army Base

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Stantec

Legend

- Lead amended paint
- Debris Areas

Note: Interpretation of this Figure is dependent on coloured symbols. View in colour.

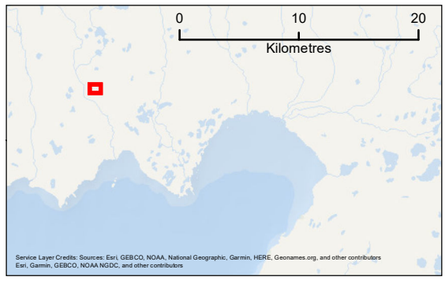
N

0 40 80 Metres

(At original document size of 11x17)
1:3,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Data Sources: Government of Nunavut



Project Location
Coral Harbour, Nunavut

Prepared by ACampigotto on 2021-02-01
Technical Review by CB on 2021-02-01

Client/Project
Public Service and Procurement Canada
Remedial Action Plan

121416787

Figure No.
6

Title
Remedial Action Plan - APEC 6 Former Airport Debris

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APPENDIX B

Remedial Options Weighting Tables

Table B-1: Non-Hazardous Waste Remedial Option Weighting (General NHW Debris)

		Method Ranking					Weighted Alternative Score				
Screening Criteria	**Factor Weighting**	**Leave In Place**	**On-Site NHW Landfill**	**Disposal Off-Site in Coral Harbour**	**Disposal Off-Site in southern Canada**	**Incineration**	**Leave in Place**	**On-Site NHW Landfill**	**Disposal Off-Site in Coral Harbour**	**Disposal Off-Site in southern Canada**	**Incineration**
Cost	0.3	3	2	2	1	3	0.9	0.6	0.6	0.3	0.9
Effectiveness	0.2	1	3	3	3	3	0.2	0.6	0.6	0.6	0.6
Ease of Implementation and Timeliness	0.15	3	2	1	2	3	0.45	0.30	0.15	0.30	0.45
Indigenous Participation	0.35	1	3	3	2	2	0.35	1.05	1.05	0.70	0.70
						Total Weighted Score:	1.9	2.55	2.4	1.9	2.65

Scoring Notes:

	3	**2**	1
Cost Effectiveness	Cost for this option is less than 70% of the most expensive option.	Cost for this option is between 70% and 99% of the most expensive option.	Most expensive option
Effectiveness	Completely eliminates the risk to receptors, fully removes source of contamination or exposure pathway. Aesthetics of Site are similar to pre-disturbance conditions.	Reduces risk to receptors. Reduces or contains source of contamination. Aesthetics of Site are moderately improved.	Does not reduce risks. Sources of contamination remain in place. Aesthetics of Site remain the same.
Ease of Implementation and Timeliness	Can be completed well within the estimated time frame of the project, may shorten overall schedule. Will require minimal material imported to Site.	Can be completed within the estimated time frame of the project. Will require moderate effort and/or material imported to Site.	Could impact overall project schedule, will be on the critical path. Requires most material to be imported to Site or requires or may require permission by other agencies.
Indigenous Participation	This remedial option maximizes local and Indigenous employment and subcontracting opportunities.	This remedial option will include some local and Indigenous employment and subcontracting opportunities but a significant portion of the work will be completed by southern companies and subcontractors.	This remedial option will be completed mainly by southern labour and subcontractors with minimal opportunities for local and Indigenous employees and companies, or requires no labour (leave in place options).

Table B-2: Non-Hazardous Waste Remedial Option Weighting (Buried Debris)

Screening Criteria	Factor Weighting	Method Ranking				Weighted Alternative Score			
		Leave In Place	Partial Excavation and Disposal	Full Excavation and Disposal	Cover	Leave in Place	Partial Excavation and Disposal	Full Excavation and Disposal	Cover
Cost	0.3	3	2	1	2	0.9	0.6	0.3	0.6
Effectiveness	0.2	1	2	3	2	0.2	0.4	0.6	0.4
Ease of Implementation and Timeliness	0.15	3	2	2	2	0.45	0.3	0.3	0.3
Indigenous Participation	0.35	1	3	3	3	0.35	1.05	1.05	1.05
					Total Weighted Score:	1.9	2.35	2.25	2.35

Scoring Notes:

	3	2	1
Cost Effectiveness	Cost for this option is less than 70% of the most expensive option.	Cost for this option is between 70% and 99% of the most expensive option.	Most expensive option
Effectiveness	Completely eliminates the risk to receptors, fully removes source of contamination or exposure pathway. Aesthetics of Site are similar to pre-disturbance conditions.	Reduces risk to receptors. Reduces or contains source of contamination. Aesthetics of Site are \moderately improved.	Does not reduce risks. Sources of contamination remain in place. Aesthetics of Site remain the same.
Ease of Implementation and Timeliness	Can be completed well within the estimated time frame of the project, may shorten overall schedule. Will require minimal material imported to Site.	Can be completed within the estimated time frame of the project. Will require moderate effort and/or material imported to Site.	Could impact overall project schedule, will be on the critical path. Requires most material to be imported to Site or requires or may require permission by other agencies.
Indigenous Participation	This remedial option maximizes local and Indigenous employment and subcontracting opportunities.	This remedial option will include some local and Indigenous employment and subcontracting opportunities but a significant portion of the work will be completed by southern companies and subcontractors.	This remedial option will be completed mainly by southern labour and subcontractors with minimal opportunities for local and Indigenous employees and companies, or requires no labour (leave in place options).

Table B-3: Non-Hazardous Waste Remedial Option Weighting (Buried Infrastructure)

		Method Ranking			Weighted Alternative Score		
Screening Criteria	**Factor Weighting**	**Leave In Place**	**Excavation and Dispose**	**Regrading**	**Leave in Place**	**Excavation and Dispose**	**Regrading**
Cost	0.3	3	1	3	0.9	0.3	0.9
Effectiveness	0.2	1	3	2	0.2	0.6	0.4
Ease of Implementation and Timeliness	0.15	3	2	3	0.45	0.3	0.45
Indigenous Participation	0.35	1	3	3	0.35	1.05	1.05
				Total Weighted Score:	1.9	2.25	2.8

Scoring Notes:

	3	**2**	1
Cost Effectiveness	Cost for this option is less than 70% of the most expensive option.	Cost for this option is between 70% and 99% of the most expensive option.	Most expensive option
Effectiveness	Completely eliminates the risk to receptors, fully removes source of contamination or exposure pathway. Aesthetics of Site are similar to pre-disturbance conditions.	Reduces risk to receptors. Reduces or contains source of contamination. Aesthetics of Site are \moderately improved.	Does not reduce risks. Sources of contamination remain in place. Aesthetics of Site remain the same.
Ease of Implementation and Timeliness	Can be completed well within the estimated time frame of the project, may shorten overall schedule. Will require minimal material imported to Site.	Can be completed within the estimated time frame of the project. Will require moderate effort and/or material imported to Site.	Could impact overall project schedule, will be on the critical path. Requires most material to be imported to Site or requires or may require permission by other agencies.
Indigenous Participation	This remedial option maximizes local and Indigenous employment and subcontracting opportunities.	This remedial option will include some local and Indigenous employment and subcontracting opportunities but a significant portion of the work will be completed by southern companies and subcontractors.	This remedial option will be completed mainly by southern labour and subcontractors with minimal opportunities for local and Indigenous employees and companies, or requires no labour (leave in place options).

Table B-4: Non-Hazardous Waste Remedial Option Weighting (Stained Surficial Soil)

		Method Ranking						Weighted Alternative Score					
Screening Criteria	**Factor Weighting**	**Leave In Place**	**On-Site NHW Landfill**	**Disposal Off-Site in Coral Harbour**	**Disposal Off-Site in South**	**Cover**	**Scarification**	**Leave in Place**	**On-Site NHW Landfill**	**Disposal Off-Site in Coral Harbour**	**Disposal Off-Site in South**	**Cover**	**Scarification**
Cost	0.3	3	1	2	1	2	3	0.9	0.3	0.6	0.3	0.6	0.9
Effectiveness	0.2	1	3	3	3	2	2	0.2	0.6	0.6	0.6	0.4	0.4
Ease of Implementation and Timeliness	0.15	3	2	2	1	2	2	0.45	0.3	0.3	0.15	0.3	0.3
Indigenous Participation	0.35	1	2	3	2	3	2	0.35	0.7	1.05	0.7	1.05	0.7
						Total Weighted Score:		1.9	1.9	2.55	1.75	2.35	2.3

Scoring Notes:

	3	**2**	1
Cost Effectiveness	Cost for this option is less than 70% of the most expensive option.	Cost for this option is between 70% and 99% of the most expensive option.	Most expensive option
Effectiveness	Completely eliminates the risk to receptors, fully removes source of contamination or exposure pathway. Aesthetics of Site are similar to pre-disturbance conditions.	Reduces risk to receptors. Reduces or contains source of contamination. Aesthetics of Site are moderately improved.	Does not reduce risks. Sources of contamination remain in place. Aesthetics of Site remain the same.
Ease of Implementation and Timeliness	Can be completed well within the estimated time frame of the project, may shorten overall schedule. Will require minimal material imported to Site.	Can be completed within the estimated time frame of the project. Will require moderate effort and/or material imported to Site.	Could impact overall project schedule, will be on the critical path. Requires most material to be imported to Site or requires or may require permission by other agencies.
Indigenous Participation	This remedial option maximizes local and Indigenous employment and subcontracting opportunities.	This remedial option will include some local and Indigenous employment and subcontracting opportunities but a significant portion of the work will be completed by southern companies and subcontractors.	This remedial option will be completed mainly by southern labour and subcontractors with minimal opportunities for local and Indigenous employees and companies, or requires no labour (leave in place options).

Table B-5: Hazardous Waste Remedial Option Weighting (Amended Paint)

		Method Ranking				Weighted Alternative Score			
Screening Criteria	**Factor Weighting**	**Full On-Site Abatement**	**Partial On-Site Abatement**	**Treatment and Disposal (Lead Defender®)**	**Off-Site Disposal in South**	**Full On-Site Abatement**	**Partial On-Site Abatement**	**Treatment and Disposal (Lead Defender®)**	**Off-Site Disposal in South**
Cost	0.3	2	3	3	1	0.6	0.9	0.9	0.3
Effectiveness	0.2	3	2	2	3	0.6	0.4	0.4	0.6
Ease of Implementation and Timeliness	0.15	1	2	2	2	0.15	0.3	0.3	0.3
Indigenous Participation	0.35	1	1	1	1	0.35	0.35	0.35	0.35
					Total Weighted Score:	1.7	1.95	1.95	1.55

Scoring Notes:

	3	**2**	1
Cost Effectiveness	Cost for this option is less than 70% of the most expensive option.	Cost for this option is between 70% and 99% of the most expensive option.	Most expensive option
Effectiveness	Completely eliminates the risk to receptors, fully removes source of contamination or exposure pathway. Aesthetics of Site are similar to pre-disturbance conditions.	Reduces risk to receptors. Reduces or contains source of contamination. Aesthetics of Site are moderately improved.	Does not reduce risks. Sources of contamination remain in place. Aesthetics of Site remain the same.
Ease of Implementation and Timeliness	Can be completed well within the estimated time frame of the project, may shorten overall schedule. Will require minimal material imported to Site.	Can be completed within the estimated time frame of the project. Will require moderate effort and/or material imported to Site.	Could impact overall project schedule, will be on the critical path. Requires most material to be imported to Site or requires or may require permission by other agencies.
Indigenous Participation	This remedial option maximizes local and Indigenous employment and subcontracting opportunities.	This remedial option will include some local and Indigenous employment and subcontracting opportunities but a significant portion of the work will be completed by southern companies and subcontractors.	This remedial option will be completed mainly by southern labour and subcontractors with minimal opportunities for local and Indigenous employees and companies, or requires no labour (leave in place options).