FINAL REPORT

Environmental Screening
of the Proposed Remediation
at the Former Navigational Aid and
Weather Station at Radio Island, Nunavut

PUBLIC WORKS AND
GOVERNMENT SERVICES CANADA,
WESTERN REGION

PROJECT NO. NTY71117

Jacques Whitford

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REPORT TO: **Public Works and Government Services Canada, Western Region**
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FOR: **Environmental Screening of the Proposed Remediation of Former Navigational Aid and Weather Station**
Radio Island, Nunavut

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EXECUTIVE SUMMARY

Public Works and Government Services Canada (PWGSC) Environmental Services, on behalf of Indian and Northern Affairs Canada (INAC) is planning to undertake a remedial action plan for the former Navigational Aid and Weather Station located at Radio Island, Nunavut. As required under the *Nunavut Land Claim Agreement* (*NLCA*) and the *Canadian Environmental Assessment Act* (*CEAA*), the activities proposed for the Radio Island site must undergo an environmental screening.

Activities for the remediation will consist of the establishment of a work camp and the remediation of the site, including demolition and collection and disposal of all waste at the site.

The remediation activities at the Radio Island Site will interact with the environment through vehicle and machinery emissions, waste disposal, surface disturbance and the provision of employment to local inhabitants. There is also the potential for spills of fuel or hazardous materials. The activities will be carried out following standard good operating practices for northern Canada, with spill prevention practices and contingency plans in place. The environmental effects of the activities are assessed as being of low magnitude and not significant. The activities will benefit the area through the short-term employment of local individuals and through the ultimate clean up of the site.

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1.0 INTRODUCTION

Environmental Services, Public Works and Government Services Canada (PWGSC) at the request of Indian and Northern Affairs Canada (INAC) has prepared a remedial action plan for the former Navigational Aid and Weather Station located at Radio Island, Nunavut (Radio Island site). Environmental site assessments have been conducted at this site in 1996 by the Environmental Sciences Group of Royal Military College, Kingston, Ontario and in 2001 by EarthTech Canada Inc., Edmonton, Alberta. This Environmental Screening assesses the potential impacts of the proposed remedial action plan for the Radio Island site.

2.0 REGULATORY CONTEXT

2.1 Permits, Licenses, and Authorizations - Current Regulatory Regime

Development of the Project (as it is presently conceived) will involve a number of distinct undertakings and activities, requiring authorizations from a variety of federal, territorial, Inuit, and resource co-management agencies. Table 2-1 provides a preliminary listing of permits, licenses, and authorizations that may be required to develop the Project. The specific permits, licenses, and authorizations that will be required will depend on the final configuration of the Project and all related activities, and may include others not listed here. Regulatory procedures that must be followed differ for each permitting, licensing, or authorizing agency. The application for a permit, license, or authorization will usually initiate a review of the Project under one or more environmental assessment processes, unless the proposed activity has been explicitly exempted from assessment.

Within Nunavut, INAC regulates land use on Crown (or federal) lands, whereas Nunavut Tungavik Incorporated (NTI) and the regional Inuit associations regulate subsurface and surface land use on Inuit Owned Lands. The Nunavut Water Board regulates water use in Nunavut. Environmental screening and assessment is the responsibility of the Nunavut Impact Review Board (NIRB). The *Nunavut Land Claim Agreement* (*NLCA*) established these new boards and regulatory processes, with the *Nunavut Land Claim Settlement Act* and the *Nunavut Act* being the federal legislation enabling the implementation of the provisions of the *NLCA*. Environmental screening and assessment also has to accommodate the requirements of the federal *Canadian Environmental Assessment Act (CEAA)*, in addition to the requirements of NIRB.

Table 2-1: Permits, Licenses, and Authorizations That May Be Required

Activity	Permit/Approval	Legislation	Agency
Remediation Phase			
Water use and waste water disposal at camps	Water License	*Nunavut Waters Act*	Nunavut Water Board
Sewage disposal, food premises, sanitation at camps	Permit	*Public Health Act* (*Nunavut*)	Nunavut Department of Health and Social Services
Archaeological research and investigations	Archaeological Research Permit	*Nunavut Archaeological Sites Regulations Nunavut Land Claims Agreement Heritage Canada*	Government of Nunavut
Camps, laydown and staging areas, borrow sources	Land Use Permit / Quarry Permit	*Territorial Lands Act and Regulations**	Lands Division INAC
Water use and wastewater disposal at camps, bridge crossings	Water License	*Nunavut Waters Act*	Nunavut Water Board
Transportation, use of heavy equipment	Vehicle Registration or Permit	*Motor Vehicles Act* (*Nunavut*)	Nunavut Department of Community Government and Transportation
Transportation of dangerous goods	Certificate / Permit	*Transportation of Dangerous Goods Act*	Transport Canada Nunavut Department of Sustainable Development

* indicates permits triggering *CEAA*

2.2 Existing Environmental Assessment and Review Process

This section provides a summary of the typical regulatory provisions for environmental assessment pursuant to the *NLCA* and the *CEAA*, as outlined in the agreement, enabling legislation, guidelines, and operational procedures, which may apply to any project within Nunavut.

Article 12 of the *NLCA* establishes processes for the screening and review of project proposals on land and marine areas within the Nunavut Settlement Area (including Inuit Owned Lands, Commissioners lands, and Crown lands) and to the Outer Land Fast Ice Zone. The NIRB was established in 1996, under Article 12.2.1 of the *NLCA*, as an institution of public government with responsibilities for environmental assessment. The NIRB's primary functions are to screen and review the ecosystemic and socio-economic effects of project proposals, and to make recommendations to the federal or territorial Minister(s) responsible for authorizing such projects to proceed. The NIRB also can issue recommendations for monitoring of project effects, but the responsibility for enforcement of such provisions lies with the agency issuing a permit, license, or authorization. The NIRB's objectives are to protect the ecosystemic integrity of Nunavut, and to protect and promote the existing and future well-being of the residents and communities of Nunavut, and of Canada.

The Radio Island site is on federal lands that are regulated by INAC. As the Responsible Authority, INAC requires that an environmental screening be conducted in accordance with Section 18 of the *CEAA*. Where a proposed project in Nunavut involves a *CEAA* trigger, federal and territorial governments and the NIRB work together to harmonize the environmental screening process. This process is intended to provide information for the federal authorities to support the screening of the project pursuant to the requirements of *CEAA*. As such, the study has been conducted in a manner

that is consistent with the *NLCA* and *CEAA* and the guidance documentation of the NIRB, the Canadian Environmental Assessment Agency and INAC.

The initial step in obtaining approval for a project proposal within the Nunavut Settlement Area is the submission of an application for a permit, license, lease, or approval to an authorizing agency (*i.e.*, government department, Designated Inuit Organization, regulatory board). It is important to note that more than one authorization may be required for undertakings and activities on land or water.

The authorizing agency is responsible for initial processing of the application. Where regional land use plans are in place, the application is forwarded to the Nunavut Planning Commission (NPC) for review of conformity with the land use plan. Where a project proposal conforms to an approved land use plan, or if a variance has been approved, the NPC forwards the project proposal application to the NIRB for screening. If no approved land use plans exist, project proposal applications are referred directly by the authorizing agency to the NIRB for screening.

The initial steps of the screening involve notification of the proponent and authorizing agencies, establishment of a timeline for a screening determination (where not specified by regulation), and distribution of the project proposal application to appropriate stakeholders. Taking into account all comments received from stakeholders regarding the project proposal, existing scientific information, Inuit traditional knowledge, and the information provided by the proponent, the NIRB then reviews the potential effects of the project and the level of public concern about and/or support for the project proposal. Once the screening has been completed, the NIRB will produce a Screening Decision Report that documents its determination as to whether the project proposal should be approved without further review, abandoned or modified by the proponent, or subject to review under Part 5 or 6 of the NLCA.

If the NIRB determines that the project proposal should proceed without further review, the NIRB may include in its Screening Decision Report terms and conditions to be attached to the authorizations to be issued. The authorizing agency will include the NIRB terms and conditions in the final authorization. However, where the authorizing agency disagrees with the recommended terms and conditions, the agency must provide the NIRB with a rationale for omissions from the final authorization. Monitoring of adherence to terms and conditions is the responsibility of the authorizing agency. The NIRB will complete its screening and issue its Screening Decision Report to the authorizing agency (or agencies) within applicable legislated timelines to allow the agencies to meet their legislative requirements. However, should an agency have no legislated time limits regarding the issuance of permits, NIRB will provide its Screening Decision Report within “an acceptable time period”.

When the Screening Decision Report indicates that a review is required, the Minister may:

- refer the proposal to the Minister of Environment for review by a federal environmental assessment panel;
- refer the proposal back to the NIRB for a review of ecosystemic and socio-economic impacts; or
- inform the proponent that the proposal should be abandoned or modified and resubmitted to NIRB.

The scope of the project has been determined pursuant to Section 15.1 of the *CEAA*. Discussions with PWGSC were undertaken to establish the scope of the project, the scope of the environmental screening and the establishment of Valued Ecosystem Components (VECs). Factors considered in the environmental screening include those prescribed in Section 16.1 (a) to (e) of *CEAA*, listed below:

(a) the environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out;
(b) the significance of the effects referred to in paragraph (a);
(c) comments from the public that are received in accordance with this Act and the regulations;
(d) measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project; and
(e) any other matter relevant to the screening, comprehensive study, mediation or assessment by a review panel, such as the need for the project and alternatives to project, that the responsible authority or, in the case of a screening, the Minister after consulting with the responsible authority may require to be considered.

Cumulative environmental effects have been considered pursuant to Section 16.1(a) of *CEAA* for likely future projects. No additional factors have been prescribed under Section 16.1(e) by INAC for inclusion in the potential cumulative environmental effects assessment analysis.

The existing conditions of the project area environment, with respect to the identified VECs, are characterized in this report. Potential interactions of specific project activities with the environment are identified and the environmental effects are evaluated in consideration of appropriate mitigation measures.

3.0 ENVIRONMENTAL ASSESSMENT CONTACTS

Responsible Authority Contact: Lou Spagnuolo Contaminated Sites Project Officer Nunavut Regional Office Bldg. 969, P.O. Box 2200 Iqaluit, NU X0A 0H0 Phone: (867) 979-7936 Fax: (867) 979-7939	***CEAA Contact:*** Brian Torrie Project Assessment Group Canadian Environmental Assessment Agency 160 Elgin Street, 22nd Floor, Ottawa, ON K1A 0H3 Phone: (613) 957-0791
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4.0 PROJECT DESCRIPTION

INAC wishes to implement a remedial action plan at the former Navigational Aid and Weather Station located on Radio Island, Nunavut. This Project consists of the implementation of a remedial action plan for the site (scheduled to commence in 2006). The main tasks involved in the remedial action plan include the collection and disposal off-site of non-hazardous materials; the collection, containerization and disposal off-site at an approved facility of hazardous materials; and the excavation, containerization and disposal off-site at an approved facility of contaminated soils.

4.1 Project Location

Radio Island (Figure 4-1) is located south of Resolution Island, which is located at the southeastern tip of Baffin Island, Nunavut. It is situated at 61°18' N, 64°52' W, and approximately 340 km southeast of Iqaluit in Nunavut. The site is approximately 1 km long and 0.5 km wide, covering approximately 50 ha.

The former Navigational Aid and Weather Station at Radio Island was operated by the Canadian Department of Transport from 1929 to 1961. In 1996 the Royal Military College, Environmental Sciences Group (ESG) conducted an environmental investigation of the site (ESG 1997). Their investigations identified soil contaminated with inorganic elements exceeding Tier I and/or Tier II DCC criteria near the Main House and Winch Shed, Helipad, Generator Building Foundation and in the Beach Area. None of the samples collected by ESG contained PCBs in excess of the DCC criteria. One sample contained PAHs at concentrations in excess of the Criteria for Managing Contaminated Sites in British Columbia, and three samples exceeded both the Ontario Leachate Criteria and the British Columbia Leachate Criteria for lead. EarthTech (2001) conducted further studies of the site in order to develop clean-up and remediation plans. They quantified the volumes of hazardous and non-hazardous wastes, and the volumes of soils contaminated with metals and hydrocarbons.

4.2 Objectives of the Remedial Action Plan

The objectives of the Remedial Action Plan are to return the site to as near pre-disturbance conditions as possible while minimizing the potential for contaminants to enter the ecosystem.

4.3 Scope of Work

The scope of work to be carried out at Radio Island for the undertaking of the remedial action plan is described in this section.

4.3.1 Planning and Design

A detailed review of all previous site information was conducted in order to determine any information gaps and identify additional site information required for the preparation of a remediation specification. Applicable previous site information includes the assessment completed in 1996 by Royal Military College Environmental Sciences Group (ESG 1997), and an environmental site delineation and material inventory completed by EarthTech Canada Inc. (EarthTech 2001).

*ORIGINAL DRAWING BY PUBLIC WORKS AND GOVERNMENT SERVICES, ENVIRONMENTAL SERVICES WESTERN REGION.
PROJECT NO. 406853

Jacques Whitford	SCALE: N.T.S DATE: 24/10/05 DRAWN BY: JLB APPROVED BY:	CLIENT : TITLE : SITE LOCATION MAP RADIO ISLAND, NUNAVUT	FIGURE NO. 4-1

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Community consultation will be conducted prior to undertaking any remediation activities. As part of the community consultation, INAC and PWGSC project managers will meet with community members to gather their comments and concerns regarding the remediation of the site and to gain a better understanding of their current use of the facilities. The community consultation component of the project will continue for the duration of the project to ensure community members are kept informed about the activities, results, and plans regarding the site and are active participants in the remedial action plan (RAP) development.

Once the detailed scope of work has been finalized, permit applications will be prepared. The final component of the planning phase will be the preparation of a tender document for the supply of a camp, heavy machinery, and labourers for support services during all site activities.

The INAC Abandoned Military Site Remediation Protocol, based on an approach that addresses all legal requirements, heath and safety issues, INAC's Contaminated Sites Management Policy requirements and standard environmental management practices, was used to develop the remedial action plan for the Radio Island Site.

4.3.2 Field Program

4.3.2.1 Camp Construction

The remediation activities may involve the construction of a camp and or storage areas on-site or at a nearby location. There are no existing roads or airstrip on-site, although there is a beaching area on the north side of the island (Acadia Cove) in a natural bay. Mobilization to the site is anticipated to be thru sealift while site access will be accomplished thru helicopter flights from Iqaluit. A temporary camp will be constructed, at the location of the former burned-out camp, to hold a maximum of 20 people for one field season.

4.3.2.2 Remediation Activities

Landfills

Debris was found to be scattered throughout the site with no consolidated surface or covered landfill identified. Due to a lack of borrow source availability on the island, no engineered landfill will be developed on the island.

Physical Debris

There was approximately 200 m^3 of non-hazardous physical debris identified on the site. This will be collected, containerized and disposed of off-site at a facility that is licensed to accept the waste.

Contaminated Soils

Approximately 1290 m^3 of contaminated soils have been identified on site. These soils will be collected and shipped off-site for disposal. The contaminated soils are typically located in the bedrock gullies and as such, clean-up activities will ensure that all contaminated soils are collected from any bedrock crevices and fissures. Appropriate health and safety precautions will be undertaken to ensure that

workers are protected during handling activities. EarthTech (2001) identified soils contaminated with metals and hydrocarbons.

Metals Contaminated Soils

Soil with concentrations of arsenic, barium, cobalt, cadmium, copper, lead, molybdenum, mercury, nickel, selenium, tin, antimony and zinc which exceed the CCME Environmental Quality Guidelines for residential/parkland land use were found on site. This soil will be containerized and labelled, as necessary, in accordance with the Transportation of Dangerous Goods Act for transport to an off-site disposal facility licensed to accept metals contaminated soil.

Approximately 8 m^3 of soils were found to have an elevated leachable lead concentration greater than 5.0 mg/L. A contingency of 2 m^3 has been added to this for a total of 10 m^3. These soils are classified under the Transportation of Dangerous Goods Act as Class 9.3 Dangerous Waste. These will be containerized separately, labelled in accordance with the Transportation of Dangerous Goods Act and sent to a hazardous waste landfill for disposal.

Petroleum Hydrocarbon Contaminated Soil

Approximately 400 m^3 of soil contaminated by petroleum hydrocarbons was also identified on site. Any soils that were identified as being contaminated with petroleum hydrocarbons also had elevated metal concentrations. They are therefore considered to be metals contaminated soils and will be disposed of off-site at a disposal facility licensed to accept metals contaminated soils.

PCB Contaminated Soils

No PCB contaminated soils were identified at the site.

Hazardous Materials

EarthTech identified 15 m^3 of hazardous materials on site. These materials will be packaged and shipped off-site for disposal in accordance with the Transportation of Dangerous Goods Act.

Barrels

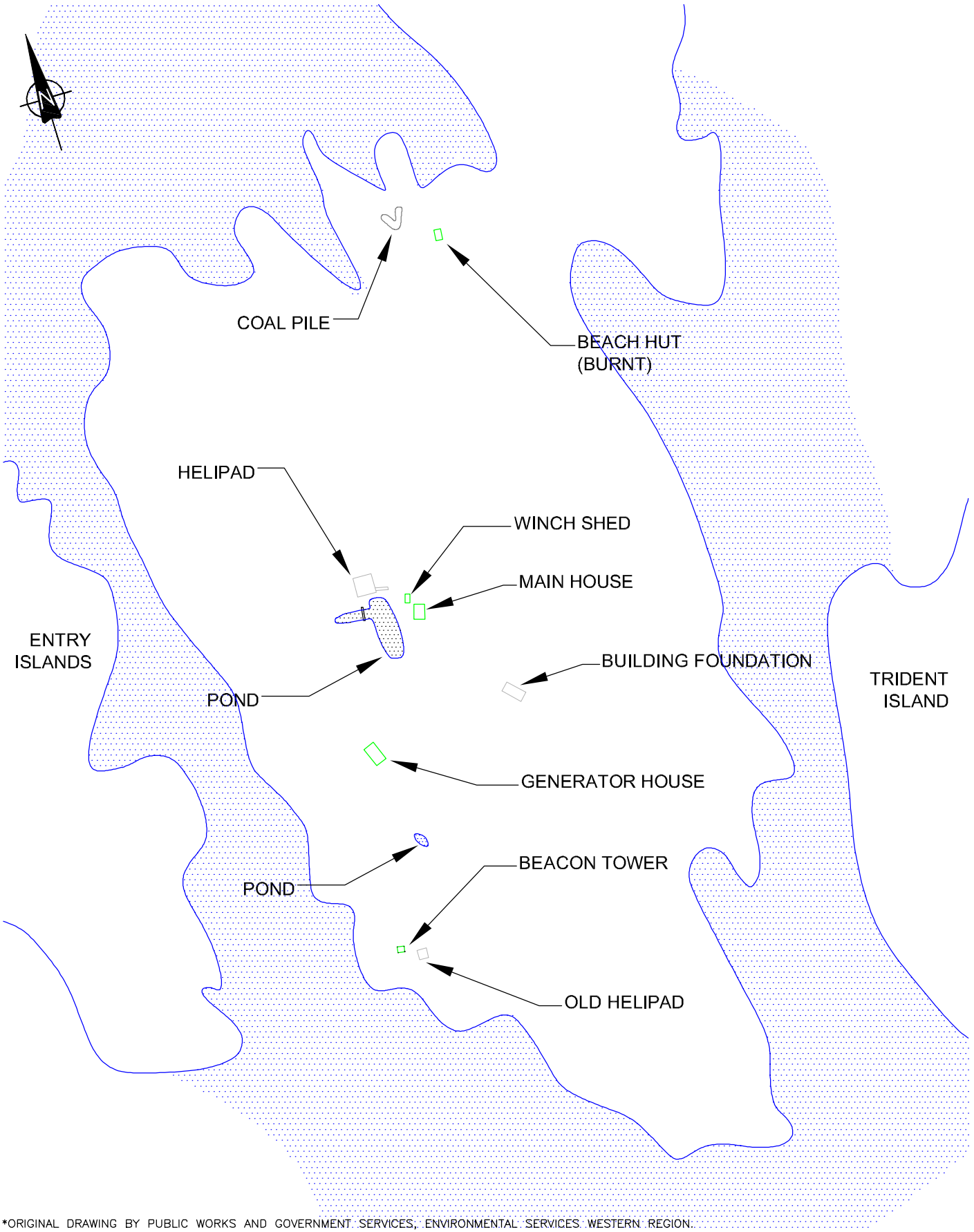
Empty barrels that are found on site will be crushed and disposed of off-site.

4.4 Existing Infrastructure

Figure 4-2 is a site layout of the Radio Island site. Site infrastructure consists of the following:

- 2 intact buildings;
- the remains of three buildings;
- 2 helipads; and
- 1 beacon tower.

All of the infrastructure and buildings will be demolished with the exception of the Main House which is to remain as an emergency shelter and the beacon tower which is operational.



*ORIGINAL DRAWING BY PUBLIC WORKS AND GOVERNMENT SERVICES, ENVIRONMENTAL SERVICES WESTERN REGION.
PROJECT NO. 406853

Jacques Whitford	SCALE: 1 : 3000 DATE: 24/10/05 DRAWN BY: JLB APPROVED BY:	CLIENT : TITLE : **SITE LAYOUT** **RADIO ISLAND SITE, NUNAVUT**	FIGURE NO. 4-2

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4.5 Waste Inventory

Wastes identified at the Radio Island site are identified in the following subsections.

4.5.1 Buildings and Infrastructure

The buildings and infrastructure still standing at the Radio Island site include the Main House, winch shed, former powerhouse, generator house, beacon tower, two old helipads, a burnt out beach hut and an old coal pile.

4.5.2 Hazardous Waste

During the materials survey, hazardous material such as lead paint, batteries, and asbestos were identified and inventoried. The following potentially hazardous wastes were identified:

- 8 lead acid batteries from tower beacon light;
- 16 batteries and some asbestos insulation in the power house;
- lead paint on buildings;
- 16 lead acid batteries (some submersed);
- asbestos heat insulation board; and
- 100 m of lead sheathed electrical wire.

4.5.3 Non-hazardous Waste

Non-hazardous waste and debris at the site includes (EarthTech 2001):

- Former Helipad and Beacon Tower:
  - cables;
  - metal structure;
  - wood debris; and
  - domestic debris.

- Vicinity of former powerhouse on east and west sides and north south along ravine:
  - concrete foundations;
  - steel frame columns;
  - trusses/beams;
  - wooden sill foundations;
  - concrete;
  - C channels;
  - Metal debris;
  - Cable from helipad to tower site; and
  - Crushed barrels (70).

- Vicinity of Main House on east and west sides and north south along ravines:
  - Concrete foundations;
  - Steel frame columns;
  - Trusses/beams;
  - Wooden foundation(s);
  - Concrete;
  - C channels;
  - Metal debris;
  - Crushed barrels;
  - Wire cable;
  - bricks / wooden structures (helipad, hut and winch shed);
  - Winch mechanism and motor; and
  - Submersed debris in pond and low areas.

- Beach Hut and coal stockpile:
  - metal from winch system;
  - scrap metal from hut;
  - wooden ladder/platform;
  - cables;
  - poles;
  - wires;
  - crushed barrels (30); and
  - 26 m^3 of coal.

4.6 Proposed Activities

The proposed activities at the Radio Island site include a review of previous information collected for the site, remediation activities, and report preparation. Information on all activities is summarized in Table 4-1.

Table 4-1: Task Description and Tentative Schedule – Radio Island Remediation Activities

Activity	Status	Comment
Obtain Contracts		
Obtain contract for site remediation	April 15, 2006	
Obtain all necessary permits for site remediation	April 15, 2006	
Remediation Activities		
Physical Debris	2006 field season	Debris will be collected, containerized and disposed of off-site at a licensed facility.
Contaminated soil	2006 field season	Soils will be collected and shipped off-site. Collected soils will include collection from crevices and fissures. Contaminated soils include those contaminated with metals and petroleum hydrocarbons.
Hazardous material	2006 field season	Hazardous materials will be packaged and shipped off-site for disposal in accordance with Transportation of Dangerous Goods Act.
Barrels	2006 field season	Empty barrels will be crushed and disposed of off-site.
Buildings and Infrastructure	2006 field season	All buildings and infrastructure will be demolished except for the main house and beacon tower. Before demolition, hazardous materials will be removed and disposed of as detailed above.

In general, cleanup requirements for the main site involve the excavation of approximately 230 m^3 of DCC Tier II soil, 10 m^3 of leachate toxic soil and the cleanup of debris, both hazardous and non-hazardous. Cleanup requirements for the generator building foundation involve the excavation of approximately 70 m^3 of DCC Tier II soil and 10 m^3 of leachate toxic soil, and the cleanup of debris both hazardous and non-hazardous. Cleanup at the beach will involve the excavation of approximately 10 m^3 of DCC II soils and the cleanup of debris both hazardous and non-hazardous.

4.7 Work Camp

If it is deemed feasible to erect a work camp at the Radio Island site, one will be established. The camp will be owned by the primary contractor who will be responsible for:

- food services;
- heating;
- lighting;
- fuel;
- potable and domestic water systems;
- sewage collection, treatment and disposal system;
- waste, refuse and garbage collection and disposal;
- camp fire prevention, alarm and fire fighting system;
- camp safety and security service;
- meals and catering service;
- sleeping and washroom facilities;
- bedding and bedding laundry service;
- janitorial service;
- personnel laundry facilities;
- recreational facilities; and
- snow removal.

The work camp, including its facilities, utilities, services, location and operation will be operated in accordance with applicable Federal, Territorial, and local codes, regulations, and requirements governing camps, including environmental regulatory requirements and Water Use Licenses.

Prior to the installation of camp facilities, all necessary work will be completed to ensure protection of the environment. Additionally, consideration will be given to possible wildlife encounters when determining the camp layout. Bear and other wildlife safety literature will be considered when selecting the location of the kitchen, food storage, washroom, and sleeping facilities. A working wildlife deterrent system will be put in place and a replacement will be made available within 24 hours, should the primary system fail.

Wastes will be disposed of in an environmentally responsible manner and in accordance with relevant regulations. For example, an incinerator will be used to destroy all combustible waste. As well, liquid waste in the form of wash water, meltwater collection, rinse water from the cleaning of fuel tanks and pipelines, water from dewatering contaminated soil areas, and/or any other liquid effluent stream will be

released onto the ground at a location that is a minimum of 30 m from natural drainage courses and 100 m from fish bearing waters. Wastewater will be discharged following appropriate testing to ensure it meets all applicable federal and territorial water quality legislation standards and guidelines, and any approvals or permits to operate.

Any liquid effluent not conforming to these guidelines will be disposed of as hazardous material in accordance with Section 02090 - Hazardous Waste Material. All hazardous material will be removed from the island and transported to a licensed facility.

Sewage from the temporary work camp will be collected for offsite disposal, and disposed of according to appropriate guidelines and regulations, such as the Water License, and the *Public Health Act* (Nunavut). Should construction of a lagoon be necessary, it will be sized accordingly to provide wastewater storage for the duration of the construction phase of the Project. Maximum fluid depth will not exceed 1 m.

A fire extinguisher will be provided for each camp facility. A carbon monoxide detector will be provided for each facility that is equipped with an oil-burning heater. All flammable liquids will be handled and stored according to the current National Fire Code of Canada.

Basic camp rules will be established for the benefit of all occupants. The rules will cover subjects such as property damage, smoking, use of alcoholic beverages, drugs, firearms, security, nuisance, and any other matter related to the management of the camp operation. A copy of the camp rules will be provided to all occupants upon arrival to camp. Camp rules will prohibit the consumption of alcoholic beverages on site.

4.8 Personnel

The site restoration team will include the remediation contractor, a site project manager, an environmental expert, and PWGSC and INAC representatives periodically. The personnel compliment on site will consist of the following:

- 1 Site Engineer;
- 1 Environmental Inspector (part time); and
- Construction Contractor which includes:
  - Site Superintendent;
  - Hazardous Waste Specialist;
  - Backhoe operator;
  - 5 quad drivers;
  - 3 Wildlife Monitors;
  - Mechanic;
  - 2 Journeymen;
  - 4 labourers;
  - Cook and helper;
  - Health and Safety Coordinator; and
  - Medic.

4.9 Equipment

Equipment, materials and supplies required for the 2006 site restoration activities will include, but is not limited to:

- 1 307B tracked excavator or equivalent;
- 5 quads with trailers;
- 1 water pump;
- Water tank;
- Sewage treatment tank;
- Solid waste incinerator;
- 1 portable generator;
- 1 boat and motor;
- cutting torches;
- adequate fuel in drums, oil, grease, antifreeze, etc.;
- safety supplies (*e.g.,* tyvek suits, nitrile gloves, hard hats, respirators);
- portable radios, satellite phone, GPS;
- spill kit and absorbent material;
- over pack drums; and
- camp.

5.0 ENVIRONMENTAL ASSESSMENT METHODOLOGY

5.1 Overview and Approach

The assessment of the potential environmental effects of the proposed project has been carried out using a rigorous methodological framework developed on the basis of current, accepted practice and professional experience of the study team. The potential environmental effects of activities associated with the project on each Valued Ecosystem Component (VEC) selected for consideration has been evaluated. Mitigation measures to address and minimize any potential environmental effects are also identified and discussed. The potential environmental effects resulting from malfunctions and accidents associated with the work plan have been evaluated. As well, the cumulative environmental effects of past, present and planned future activities have been assessed.

The assessment of project impacts is determined through the following procedure:

- VEC definition;
- determination of boundaries;
- potential interactions, assessment of impacts and mitigation analysis;
- summary of residual environmental impacts; and
- summary of mitigation and monitoring.

Each of these steps is described in further detail below.

5.2 VEC Definition and Selection

Standard environmental assessment practice encourages scoping to focus assessments on those environmental issues of greatest importance, referred to as Valued Environmental Components or VECs. The identification of key issues through stakeholder consultation, document review process and site assessment process is critical to ensuring that the assessment focuses on those matters of primary concern to regulatory authorities, stakeholders and the assessor.

VECs are selected as components of the environment that are valued by society, and upon which the environmental assessment is focused. Potential environmental issues of concern that may be associated with the proposed project have been identified through consultation with INAC, the Government of Nunavut, and through the professional judgement of the study team.

Based on the existing environmental conditions, the scope of the screening includes environmental effects on physical, biological, social and environmental components of value. The scope excludes the effects of accidental events on worker safety and the effects of burning fossil fuels by machinery used during the site remediation on the atmospheric environment (including greenhouse gas levels and climate change). The scope of the socio-economic assessment is limited to the basic requirements of the *CEAA* Screening process whereby the assessment of socio-economic effects is limited to "*any change that the project may cause in the environment, including any such change on health and socio-economic conditions"*. The VECs identified for the project take in to consideration the nature, and temporal and spatial scope of the project and anticipated potential-environmental interactions. VECs selected and the rationale for their selection is provided in Table 5-1. Any environmental component that is identified as valued by the public stakeholders or the regulators, or is deemed so based on the professional judgement of the EIA Study Team becomes a VEC. Soil was not selected as a VEC for this project as there is minimal soil on site with the only soil being accumulated in crevices, valley and gullies formed by rock.

Table 5-1: VEC Selection Rational

VEC	Rationale For Selection		
	Public/Stakeholder Concerns (*)	**Regulatory Considerations(**)**	**Professional Judgement**
Air Quality	√	√	√
Marine Environment	√	√	√
Terrain		√	√
Terrestrial & Avian Animals and Habitat	√	√	√
Health and Safety	√	√	√
Archaeological and Heritage Resources	√	√	√
Land Use	√	√	√
Aesthetics	√	√	√
Socio-economic Issues	√	√	√

(*) Although there has been no direct Stakeholder feedback regarding Radio Island, all components checked in this column have been identified by Stakeholders for similar activities on Resolution Island.
(**) Includes federal and territorial regulations.

Although land use was identified as a VEC by the public, regulators and the professional judgement of the study team, investigation showed that Radio Island does not fall under the typical land use areas of Kimmirut or Iqaluit as defined by the Nunavut Atlas. Thus, the Project will not interact with traditional land use. Land use is not discussed further in this assessment.

5.3 Identification of Cumulative Environmental Affects

Cumulative effects have been defined as changes to the biophysical, social, cultural or economic environments caused by a project component in combination with any ongoing, past or future activities. Cumulative effects can occur as interactions between project components (either from the same or more than one site) and/or between environmental components. Effects can occur in one of four ways:

- physical or chemical transport mechanisms;
- "nibbling loss" (i.e., gradual disturbance);
- spatial or temporal crowding; and
- growth induction initiated by a project.

5.4 Analysis of Cumulative Environmental Effects

Four steps in the analysis of the cumulative environmental effects of this project include scoping, analysis of effects, mitigation measures, and significance.

Scoping: Scoping includes the identification of issues of potential concern, VECs that could be affected and boundary setting. The activities considered include the detailed site assessment. Temporal and spatial boundaries encompass those periods during, and areas within which, the VECs are likely to interact with, or be influenced by project activities. The spatial boundaries include impacts over a larger (regional) area including the crossing of jurisdictional boundaries. Other boundaries to be considered as appropriate include administrative and technical boundaries imposed by factors such as finite resources of data, time, cost, and labour, as well as technical, political, or administrative and jurisdictional considerations.

Analysis of Effects: This section identifies the specific nature and extent of the interactions between the project and the VECs. Where appropriate, the assessment includes a summary of major concerns or hypotheses of relevance regarding the effect of each activity on the VECs being considered. Where existing knowledge or the application of standard mitigation indicates that an interaction is not likely to result in an impact, certain issues may warrant only limited analysis.

Mitigation Measures: For each interaction, options available for mitigation are considered in the impact analysis.

Significance: The environmental assessment considers activities associated with project activities that could result in adverse environmental effects in consideration of their likelihood of occurring, and taking into account appropriate mitigation measures. In determining whether there are adverse environmental effects, the following factors are considered:

- negative effects on the health of biota;
- loss of rare or endangered species;
- reductions in biological diversity;
- loss of critical/productive habitat;
- fragmentation of habitat or interruption of movement corridors and migration routes;
- transformation of natural landscapes;
- discharge or presence of persistent and/or toxic chemicals;
- toxicity effects on human health; and
- effects on cultural issues.

5.5 Identification of Mitigation Measures, Residual Impacts and Monitoring

Mitigation measures are identified that will result in a reduction or elimination of likely environmental impacts associated with the clean up. Section 6 discusses each VEC, the associated potential adverse environmental effects, the mitigation, and residual environmental effects. Taking into account the mitigation measures, the significance or anticipated residual impacts are identified for all potential impacts. The significance of the residual environmental impacts of project activities on a VEC is evaluated based on review of relevant literature, consultation with experts, and professional judgement.

Monitoring will be required in the future for a number of reasons including compliance, agreement commitments and impact management. This methodology also allows INAC to be able to establish baseline conditions for the project at the time of initiation. The implementation of recommended mitigation and monitoring will allow future activities to be compared to the current conditions identified by this assessment.

6.0 ENVIRONMENTAL ASSESSMENT

This section describes the potential interactions of specific project activities with the existing environmental conditions. Planned appropriate mitigation activities are identified and an assessment of the potential residual environmental effects (after mitigation is applied), including cumulative environmental effects. Potential interactions between the project and the identified VECs are described in the sub-sections below.

6.1 Regional Setting

Radio Island is located south of Resolution Island, which is located at the southeastern tip of Baffin Island in Nunavut. The nearest community is the City of Iqaluit, which is located approximately 340 km northwest of the site.

The site is located within the Meta Incognita Peninsula Ecoregion. This ecoregion is characterized by mean annual temperatures of approximately -11.5°C with a summer mean of 1°C and a winter mean of -22.5°C. Mean annual precipitation ranges from 200 mm to 400 mm. Vegetation within the ecoregion is continuous shrub tundra, consisting of dwarf birch, willow, northern Labrador tea, Dryas spp., and Vaccinium spp. Rock outcroppings interspersed with sandy morainal veneers and frozen organic

deposits are the dominant surficial materials in the ecoregion, and Static Cryosols with Turbic and Organic Cryosols are the dominant soils. Characteristic wildlife include caribou, hare, arctic wolf, fox, polar bear, raptors, walrus, seal, whale, shorebirds and waterfowl. Communities in the region include Iqaluit, which is the largest community in the eastern arctic, as well as the community of Kimmirut.

Water in the vicinity of the Radio Island Site includes Hudson Strait to the south side of the island and the Labrador Sea to the east, both of which are part of the Atlantic Ocean. There are some smaller ponds of standing water on the island itself. The only soils identified at the site are located in the gullies and valleys formed by the bedrock and are most likely Crysolic Regosols. A few minor till deposits occur on the site. Vegetation at the site is limited to the areas of deposited soil in the valleys and gullies, although the entire site is covered in mosses (ESG 1997).

6.2 Public Consultation

Community consultation will be conducted prior to the commencement of any site restoration activities. Consultations took place in Kimmirut on December 12, 2005 and in Iqaluit on December 13, 2005. Additional consultations will take place at these locations in April or May, 2006. As part of the community consultation, INAC and PWGSC project managers will meet with members of the community to hear their comments and concerns associated with the remediation of the site and to gain a better understanding of their current use of the facilities. The community consultation component of this project will continue throughout the duration of the project to ensure that the community is informed about the activities, results, and plans regarding the site.

6.3 Air Quality

6.3.1 Existing Environment

Radio Island is classified as having a low arctic ecoclimate characteristic of other low arctic sites. The mean annual temperature is approximately -11.5°C with a summer mean of 1°C and a winter mean of -22.5°C. The mean annual precipitation ranges from 200 mm to 400 mm. The classification of the site as sub-Arctic means that there is considerable moisture in the form of rain, fog, ice and snow.

6.3.2 Air Quality Impact Assessment

6.3.2.1 Study Area Boundaries

The spatial boundary for the assessment of project effects on air quality is the airshed on Radio Island. The temporal boundary is the remediation field work period.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA and NIRB for review by other federal and territorial departments following the CEAA process with additions to meet the NIRB requirements. Technical boundaries of the air quality assessment are the lack of site-specific meteorological data and the limited time frame associated with the environmental screening.

6.3.2.2 Identification of Issues, Interactions and Potential Effects

During the remediation activities, there will be minor emissions of greenhouse gases, nitrogen oxides (NO_x), sulphur dioxide (SO_2) particulate matter (PM) and carbon monoxide (CO) due to combustion of diesel fuel or gasoline in vehicles. There is also the potential for generation of dust during vehicle movement and remedial activities. These emissions will be of short-term duration and will be restricted to the local area around the site. Table 6-1 is an environmental assessment matrix for the Air Quality VEC.

Table 6-1: Environmental Effects Assessment Matrix: Air Quality

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Residual Environmental Effects				
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
General Remediation	Emissions of greenhouse gases, nitrous oxides, sulphur dioxide, particulate matter, and carbon monoxide from vehicles (A).	• None	1	2	2/5	R	1
	Vehicle movement will generate dust (A).	• Dust control measures will be implemented. Water will be used for dust suppression. Exposed soil piles will be covered.	1	2	2/5	R	1
Hazardous Materials Removal	The removal of the contaminated soil from the environment will reduce the risk of effects on air quality (P).	• N/A					

KEY:

Magnitude:

1 = Low: emissions predicted to be within the CCME National Ambient Air Quality Objectives
3 = High: Emissions predicted to exceed the CCME National Ambient Air Quality Objectives

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

1 = <1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse effects.

N/A = Not Applicable

6.3.2.3 Mitigation

Mitigative measures for controlling fugitive dust emissions during the project activities will be detailed in procedures that the contractors will be required to follow (i.e., watering down roads and exposed portions of the project site, covering exposed soil piles). Windblown dust during project activities is expected to be negligible.

6.3.2.4 Residual Environmental Effects

Definition of Significance

Significant Impacts to the atmospheric environment are defined to occur when ground-level concentrations associated with emissions from activities exceed ambient air quality standards that have been established by the government to protect human health and the environment. In this case, the National Ambient Air Quality Objectives from the Canadian Council of Ministers of the Environment (CCME 1999) are the standards used.

Residual Environmental Effects Summary

Table 6-2 summarizes the residual environmental effects of the project activities on air quality. The effects of vehicle and equipment emissions during the remediation activities are not expected to exceed CCME ambient air quality objectives, although no monitoring of emissions has been carried out. Emissions will be short term and intermittent and will not be unlike those from low traffic volumes in a city such as Iqaluit. Dust generation is expected to also be low in volume and infrequent.

Table 6-2: Residual Environmental Effects Summary Matrix: Air Quality

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
General Remediation	NS		
Hazardous Materials Removal	P		

KEY

Residual Environmental Effects Rating:

S = Significant Adverse Environmental Effect
NS = Not Significant Adverse Environmental Effect
P = Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a = effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.3.2.5 Summary of Environmental Effects on Air Quality

Remediation Activities at the Radio Island Site will not have a significant impact on the air quality. The Radio Island remediation will have a positive impact on air quality in terms of the removal of contaminated soil from the environment, thereby reducing the risk of dust from this soil affecting air quality.

6.4 Marine Environment

6.4.1 Existing Environment

Water in the vicinity of the Radio Island Site includes Hudson Strait to the west side of the island and the Labrador Sea to the east, both of which are part of the Atlantic Ocean. There are some smaller ponds of standing water on the island itself.

6.4.2 Marine Environment Impact Assessment

6.4.2.1 Study Area Boundaries

The spatial boundary for the assessment of the effects of project activities on the marine environment of the area is the marine environment surrounding Radio Island. The temporal boundary is the remediation field-work period.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA and NIRB for review by other federal and territorial departments following the CEAA process with additions to meet the NIRB requirements. Technical boundaries of the water quality assessment are the lack of site-specific water quality data and the limited time frame associated with the environmental screening.

6.4.2.2 Identification of Issues, Interactions and Potential Effects

Interactions between the remediation activities and the marine environment will be similar to those for the soil quality environment, i.e., the potential for leachates from exposed hazardous materials and contaminated soil, and the potential for spills of fuel and hazardous materials.

Table 6-3 is an environmental assessment matrix for the Marine Environment VEC.

Table 6-3: Environmental Effects Assessment Matrix: Marine Environment

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
General Remediation	Hazardous materials or contaminated soils may be exposed to leaching during investigations; the leachate may degrade marine environment (A).	• Activities near known areas of contamination will be carried out in a manner to minimize exposure of the contaminated materials.	1	1	2/1	R	1
	Accidental spills may result in marine environment degradation (A).	• Proper handling, storage and transportation procedures for hazardous materials will be implemented.					
		• All workers will be trained in proper handling procedures for all hazardous materials on site. • Hazardous materials or fuel will not be stored near any waterbody. • Spill contingency plans have been developed and will be implemented as necessary. • Contingency plans related to all materials and equipment will be available on site. • All fuel will be handled in accordance with the Contingency Plan.	1	1	2/1	R	1
	The operation of the construction camp will include treatment and disposal of waste, and could degrade water quality (A).	• Hazardous materials will be removed from the island and disposed of at appropriate, licensed facilities. • Combustible waste will be incinerated. • All sewage will be treated and disposed of in accordance with applicable regulations and guidelines.	1	1	2/1	R	1

Table 6-3: Environmental Effects Assessment Matrix: Marine Environment

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context

KEY:

Magnitude:

1 = Low: *e.g.,* Minor changes to water quality but not to the extent that aquatic life is affected or water that was previously potable is now non-potable.

2 = Medium: *e.g.,* Moderate changes to water quality, affecting aquatic life at a local level or decreasing the quality of potable water (*e.g.*, odour problem).

3 = High: *e.g.,* Major changes to water quality, affecting aquatic life at a regional level or rendering previously potable water non-potable.

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

1 = <1 month
2 = 1-7 months
3 = 8-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse effects.

N/A = Not Applicable

6.4.2.3 Mitigation

During the remediation activities, unnecessary disturbance to areas of hazardous waste will be minimized. Material handling and spill contingency plans will be in place and the disposal of camp wastes will meet all regulatory standards.

Proper handling procedures will be implemented for the storage and transportation of hazardous materials. All workers will be trained to properly handle all hazardous materials on site and no hazardous materials or fuel will be stored near water. Contingency plans for spills will be followed, and will be available on site, and all fuel will be handled in accordance with the contingency plan.

Hazardous materials will not be disposed of in the camp waste system. The disposal of all sewage will be in accordance with applicable regulations and guidelines.

6.4.2.4 Residual Environmental Effects

Definition of Significance

A significant impact to marine environment is defined as one of sufficient magnitude so as to alter the quality of the marine environment to a degree that will result in a significant impact on marine life as defined in the impact significance definitions for other related VECs.

Residual Environmental Effects Summary

Table 6-4 summarizes the residual environmental effects of the project activities on the marine environment. Activities during remediation are not expected to affect the marine environment significantly.

Table 6-4: Residual Environmental Effects Summary Matrix: Marine Environment

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
General Remediation	NS		

KEY

Residual Environmental Effects Rating:

S = Significant Adverse Environmental Effect
NS = Not Significant Adverse Environmental Effect
P = Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a = effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.4.2.5 Summary of Environmental Effects on Marine Environment

The effects of the Radio Island site remediation on marine environment are assessed as being not significant.

6.5 Terrain

The terrain VEC includes surficial geology, soils and vegetation. The soils component refers to the physical characteristics of the surficial material; soil quality is addressed as a separate VEC in Section 6.3.

6.5.1 Existing Environment

6.5.1.1 Geology and Soils

Radio Island is approximately 1 km long and 0.5 km wide and is comprised almost entirely of Canadian Shield Bedrock. The terrain consists of tilted bedrock with parallel rock ridges, knolls and gullies (PWGSC 2002). The only soils identified at the site are located in the gullies and valleys formed by the bedrock and are likely cryosolic regosols

6.5.1.2 Vegetation

Within the Meta Incognita Peninsula ecoregion, the landscape is covered by nearly continuous shrub tundra vegetation, consisting of dwarf birch, willow, northern Labrador Tea, *Dryas spp*., and *Vaccinium* spp. The flora on Radio Island was limited to the gullies and valleys where there is little soil present.

Mosses were found throughout the site where soils were present (PWGSC 2002). The results of analysis conducted on plant samples by the Royal Military College (ESG 1997) indicate that contamination in soil at Radio Island is entering the food chain and therefore having an impact on the local terrestrial ecosystem. Fortunately, the relatively low abundance of vegetation minimizes the overall potential for impact. (ESG 1997).

There are over 1000 species of vascular plants in Nunavut, of these only 18 species have been reviewed as to their general status in the territory. To date no rare or endangered vegetation species have been identified (Department of Sustainable Development 2001).

6.5.2 Terrain Impact Assessment

6.5.2.1 Study Area Boundaries

The spatial boundary for the assessment of the effects of project activities on the terrain of the area includes Radio Island. The temporal boundary is the remediation field-work period.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA and NIRB for review by other federal and territorial departments following the CEAA process with additions to meet the NIRB requirements. Technical boundaries of the terrain assessment are the lack of site-specific terrain data and the limited time frame associated with the environmental screening.

6.5.2.2 Identification of Issues, Interactions and Potential Effects

During the remediation activities, interactions with the terrain will be restricted to minor disruption by vehicle movement. Movement will be restricted to existing tracks and already-disturbed areas as much as possible.

Most of the waste appears to have been scattered directly on the ground with little or no waste having been buried.

Table 6-5 is an environmental assessment matrix for the Terrain VEC.

Table 6-5: Environmental Effects Assessment Matrix: Terrain

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
General Remediation	Vehicle movements could disturb the ground surface (A).	• Movement will be restricted to existing tracks and already-disturbed areas as much as possible.	1	1	2/1	R	2
Contractor Support	Movement of contractor's equipment and personnel around the site has the potential to disturb the tundra (A).	• Existing roads will be used for movement around the site.	1	1	2/1	R	2

KEY

Magnitude:

1 = Low: Erosion, permafrost degradation and destruction of vegetation is minor and limited in extent.

2 = Medium: Erosion, permafrost degradation and destruction of vegetation is more intense and widespread.

3 = High: Extensive erosion, permafrost degradation and destruction of vegetation.

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

1 = <1 month
2 = 1-7 months
3 = 8-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse effects.

N/A = Not Applicable

6.5.2.3 Mitigation

During the remediation activities, vehicles and workers will use existing tracks for travel, whenever possible. Intrusive remediation activities will be carried out in a manner that minimizes the extent of disturbance and the potential for erosion. The removal of site debris has the potential to disturb the existing terrain. Mitigation measures to reduce to levels of fugitive dust will also benefit local terrestrial vegetation. Removal of contaminated soil is not expected to affect terrain contours as contaminated soils exist in gullies and valleys only, therefore no re-contouring of the site is required.

6.5.2.4 Residual Environmental Effects

Definition of Significance

A significant environmental effect on the terrain VEC is one that results in permafrost degradation, surface erosion, sliding or slumping such that a significant effect results upon one of the water quality, biological, heritage resource, or socio-economic VECs or when the population of a vegetation species is sufficiently affected to cause a decline in abundance and/or change in distribution beyond which natural recruitment would not return the population to its former level within several growing seasons.

Residual Environmental Effects Summary

Table 6-6 summarizes the residual environmental effects of the project activities on terrain. Activities during remediation are not expected to affect terrain significantly. Some landforms will be disturbed during the contaminated soil removal but the disturbance is assessed as not significant.

Table 6-6: Residual Environmental Effects Summary Matrix: Terrain

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
General Remediation	NS		
Contractor Support	NS		

KEY

Residual Environmental Effects Rating:

S =Significant Adverse Environmental Effect
NS =Not Significant Adverse Environmental Effect
P = Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a = effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.5.2.5 Summary of Environmental Effects on Terrain

Remediation activities are assessed as not having significant effects on the terrain of Radio Island.

Contaminated soil removal will result in minor terrain disturbance. The removal of site debris has the potential to further disturb the existing terrain. Vehicles and workers will use existing tracks for movement around the site to minimize disturbance to the tundra.

6.6 Terrestrial and Avian Animals and Habitat

6.6.1 Existing Environment

Wildlife in the region is dependent on suitable habitat for survival and given the sparse presence of vegetation in the region low densities and diversity of wildlife in the area are expected. There are however several species that may utilize the area for certain life stages such as breeding or migrating. Based on existing information the keystone wildlife species expected in the area are highlighted below.

It should be noted that most data collected for the area was collected after the Radio Island facilities were already in place.

6.6.1.1 Mammals

Terrestrial mammals expected to be found in the area include caribou, hare, arctic wolf, fox, and polar bear (Ecological Stratification Working Group 1995).

Caribou

Caribou populations have been given a status of either 'endangered' or 'special concern' by COSEWIC, depending on the population. The Peary caribou (*Rangifer tarandus pearyi*) are considered endangered and Barren-ground caribou (*Rangifer tarandus groenlandicus*) are considered a species of special concern (COSEWIC 2004). Members of either population can be found in the study area at various times of the year.

Caribou have flexible and somewhat sporadic migration patterns that depend on weather and the availability of forage (COSEWIC 2004). They can deplete the food supply in an area, and change their migration routes to utilize new browsing areas.

Caribou were reported to have formerly been present on Resolution and Radio Islands; however, they no longer occur at these locations (Riewe 1992). Human activities besides hunting can affect caribou population success in an area. For example, industrial activity can represent a threat to caribou populations in the area of disturbance. Industrial activity can interrupt caribou migration and pose a threat because of the unpredictable nature of their food source and the need to change foraging areas often (COSEWIC 2004). Likewise, any activity that occurs near critical habitat areas (such as calving, rutting, or foraging areas) can represent a threat to population success (COSWEIC 2004).

Polar Bear

The polar bear (*Ursus maritimus*) is considered a sensitive species in Nunavut (Department of Sustainable Development, 2001) and in 2002 it was listed as a species of Special Concern (COSEWIC 2003). Canada has between 55 and 65 percent of the world's polar bear population which gives Canada a large amount of responsibility for managing the population and the resources on which they depend.

Movements of polar bears are normally dictated by sea ice characteristics, climate, and the presence of prey species, especially ringed seals (*Phoca hispida*) (Taylor *et al.* 2001). In Nunavut, polar bears are common in the coastal areas, especially in the summer. Pregnant females move inland to find denning sites, where they spend the winter with their new-born young.

The Radio Island Site is within the Davis Strait polar bear population that is estimated to be approximately 1400 bears (Government of Nunavut 2002). Population boundaries are based on the movement of tagged and female bears that have been outfitted with satellite collars (Taylor *et al.* 2001). Population data from this area are limited and estimates regarding population trends (increasing or decreasing) are inaccurate (COSEWIC 2002). This population is harvested by Inuit from Nunavut, Quebec, and Labrador.

Resolution Island and therefore Radio Island have been reported in previous studies to be suitable denning habitat areas for polar bears, and polar bears have been known to frequent the site (ESG 1997). Reiwe (1992) reported that polar bears are found on the ice east of Resolution Island. During the ESG site visit in 1997, at least 19 polar bears were spotted in the vicinity and two were seen on Radio Island.

Wolves

Little information exists on the status of wolves (*Canis lupus*) in Nunavut but they are expected to occur in low densities (COSEWIC 2003). Wolves are considered a sensitive species in Nunavut (Department of Sustainable Development 2001) and are usually hunted whenever they are detected (Borealis Exploration Limited 1981). They are usually found in association with caribou herds (Ferguson and Vincent 1992). One of the biggest threats to the long-term persistence of wolves are humans and their associated activities that cause habitat alteration and exploitation (Cluff *et al.*, 2002).

Wolverines

Historically wolverines (*Gulo gulo*) ranged throughout most of North America. By the 1900s they were virtually eliminated from the US and have disappeared from most of eastern and south central Canada. Today wolverines are only found in northern boreal forest and tundra habitats (NWT Government 2005).

The wolverine is listed as a species of Special Concern by COSEWIC and is considered sensitive in Nunavut (COSEWIC 2003; Department of Sustainable Development 2001). There are limited data available on the distribution, abundance, and ecology of wolverines in Nunavut (Mulders 2000); however, Anand-Wheeler (2002) reports distribution throughout Nunavut except on the High- Arctic Islands. Although the presence or absence of wolverines on Radio Island is unconfirmed, if they are present, they are expected to be at very low densities compared to other regions in Nunavut.

Wolverines are more scavengers than predators. They will travel long distances in search of carrion. They will also feed on small mammals, fish, ptarmigan, roots and berries (NWT Government 2005). Wolverines are often linked to large herds of ungulates as a source of carrion, including caribou. This makes the success of wolverine populations linked to the success of caribou populations (Environment Canada 2005).

Wolverine home ranges vary widely in size, but are generally more than several hundred square kilometres (NWT Government 2005). Home ranges are usually made up of vast areas of undisturbed habitat. Wolverines are non-migratory and do not hibernate. They do build dens however, and depend on them for hiding cover from predators and raising young (Environment Canada 2005).

Fox

Populations of red fox (*Vulpes vulpes*) and arctic fox (*Alopex lagopus*) are considered secure in Nunavut (Department of Sustainable Development 2001). Radio Island is within the range of arctic fox. Anand – Wheeler (2002) reports red fox present on Baffin Island and they have been spotted as far north as Resolute Bay. Red foxes have adapted well to arctic tundra habitats and compete with arctic foxes for prey and habitat.

In the arctic, foxes primarily prey upon lemmings. Other food sources include: birds, eggs, ground squirrels, and berries. The cyclic nature of lemming populations influences population success and

behaviour of foxes (Borealis Exploration Limited 1981). Lemming populations fluctuate at three to four year intervals and fox populations tend to respond to the changes in this food source. Arctic foxes that inhabit coastal regions also hunt for small marine animals, fish, and carrion along shorelines. During winter, these foxes venture onto the sea ice, where they frequently trail polar bears for the remains of seal kills and other food to scavenge.

Foxes prefer vegetated, soft ground for denning. There is no potential denning habitat at the Radio Island Site.

Arctic Hare

The arctic hare (*Lepus arcticus*) is the most northerly rabbit species. The arctic hares range extends north into the Arctic Archipelago. They are generally found in open and exposed areas above the treeline (Atlantic Canada Conservation Data Centre 2005). Local distributions are influenced by snow conditions, the availability of food, and predators. Arctic hare populations fluctuate cyclically, but the drivers for population change are not knows (Atlantic Canada Conservation Data Centre 2005).

Arctic hares are considered secure in Nunavut (Department of Sustainable Development 2001). They have small home ranges that allow them to build up a series of runways and escape routes from predators (Anand-Wheeler 2002). At the northern edge of their range, arctic hares can be found in groups of up to 300 animals (Atlantic Canada Conservation Data Centre 2005). They are a main prey species for carnivores and are important for maintaining predator-prey relationships in northern environments. The presence of arctic hare in a region can indicate the presence of predator species, such as foxes, in the region.

Arctic Hare feed on the twigs and roots of willows and birch, buds and berries of crowberry, and the foliage of northern plants such as grasses, sedges, saxifrages, cinquefoils, sorrels and campions (Atlantic Canada Conservation Data Centre 2005). Therefore they are not likely to occur on Radio Island as there is limited vegetation.

6.6.1.2 Birds

In the Arctic, the presence of birds is for the most part a seasonal phenomenon. Nunavut contains the northern limits of breeding ranges for numerous species of migratory birds, colonial seabirds, shorebirds and waterfowl. There have been no bird surveys conducted specifically at the site, however incidental observations have been documented and are discussed below. As well, bird surveys have been conducted by various agencies and researchers at sites close to the Project site. Information from those surveys is also incorporated below.

Nearby Frobisher Bay is the location of key marine sites, notably polynyas, that support migrating or overwintering marine birds. The Canadian Wildlife Service is conducting a survey program to determine the species of marine birds utilizing the Frobisher Bay area. The species of birds that may potentially exist in the vicinity of the Project are listed in Table 6-7.

Table 6-7: Bird Species Potentially in the Study Area

Common Name	Scientific Name	Occurrence
Red throated loon	*Gavia stellata*	Common breeder
Pacific loon	*Gavia pacifica*	Rare breeder
Common loon	*Gavia immer*	Rare visitor
Yellow billed loon	*Gavia adamsii*	Rare visitor and possible breeder
Northern fulmar	*Fulmarus glacialis*	Common visitor and probable breeder
Tundra swan	*Cygnus columbianus*	Rare breeder
Greater white-fronted goose	*Anser albifrons*	Accidental visitor
Ross's goose	*Chen rossii*	Accidental visitor
Snow goose	*Chen caerulescens*	Common breeder
Brant	*Branta bernicla*	Rare visitor and accidental breeder
Barnacle goose	*Branta leucopsis*	Accidental visitor
Canada goose	*Branta Canadensis*	Rare breeder
Mallard	*Anas platyrhynchos*	Accidental visitor
Northern pintail	*Anas acuta*	Accidental visitor
American wigeon	*Anas Americana*	Accidental visitor
Common eider	*Somateria mollissima*	Common visitor and rare breeder
King eider	*Somateria spectabilis*	Common breeder
Oldsquaw	*Clangula hyemalis*	Common breeder
Red-breasted merganser	*Mergus serrator*	Rare breeder
Rough-legged hawk	*Buteo lagopus*	Rare breeder
Peregrine falcon	*Falco peregrinus*	Rare breeder
Gyrfalcon	*Falco rusticolus*	Rare breeder
Rock ptarmigan	*Lagopus mutus*	Uncommon breeder
Sandhill crane	*Grus Canadensis*	Uncommon breeder
Black-bellied plover	*Pluvialis squatarola*	Uncommon breeder
American golden plover	*Pluvialis dominica*	Common breeder
Common ringed plover	*Charadrius hiaticula*	Common breeder
Killdeer	*Charadrius vociferous*	Accidental visitor
Ruddy turnstone	*Arenaria interpres*	Rare breeder
Red knot	*Calidris canutus*	Rare breeder and uncommon visitor
Sanderling	*Calidris alba*	Rare breeder
Least sandpiper	*Calidris minutilla*	Accidental visitor
White rumped sandpiper	*Calidris fuscicollis*	Common breeder
Baird's sandpiper	*Calidris bairdii*	Common breeder
Pectoral sandpiper	*Calidris melanotos*	Rare breeder
Purple sandpiper	*Calidris maritime*	Rare breeder
Dunlin	*Calidris alpine*	Accidental visitor
Red phalarope	*Phalaropus fulicaria*	Uncommon breeder
Red-necked phalarope	*Phalaropus lobatus*	Accidental visitor
Pomarine jaeger	*Stercorarius pomarinus*	Uncommon visitor and probable breeder
Parasitic jaeger	*Stercorarius parasiticus*	Uncommon breeder
Long-tailed jaeger	*Stercorarius longicaudus*	Common breeder
Franklin's gull	*Larus pipixcan*	Accidental visitor
Black-headed gull	*Larus ridibundus*	Accidental visitor
Mew gull	*Larus canus*	Accidental visitor
Thayer's gull	*Larus thayeri*	Uncommon breeder
Iceland gull	*Larus glaucoides*	Accidental visitor
Glacaus gull	*Larus glaucescens*	Common breeder
Great black-backed gull	*Larus marinus*	Accidental visitor and possible

Table 6-7: Bird Species Potentially in the Study Area

Common Name	Scientific Name	Occurrence
		breeder
Black-legged kittiwake	*Rissa tridactyla*	Common breeder
Ross's gull	*Rhodostethia rosea*	Rare visitor
Sabine's gull	*Xema sabini*	Rare breeder
Ivory gull	*Pagophila eburnea*	Uncommon visitor
Arctic tern	*Sterna paradisaea*	Uncommon breeder
Dovekie	*Alle alle*	Common visitor
Thick-billed murre	*Uria lomvia*	Common breeder
Black guillemont	*Cepphus grylle*	Uncommon resident
Atlantic puffin	*Fratercula arctica*	Rare visitor
Snowy owl	*Nyctea scandiaca*	Uncommon breeder
Horned lark	*Eremophila alpestris*	Common breeder
Tree swallow	*Tachycineta bicolor*	Accidental visitor
Barn swallow	*Hirundo rustica*	Accidental visitor
Common raven	*Corvus corax*	Common resident
Northern wheatear	*Oenanthe oenanthe*	Rare breeder
American pipit	*Anthus rubescens*	Uncommon breeder
Yellow warbler	*Dendroica petechia*	Accidental visitor
Savannah sparrow	*Passerculus sandwichensis*	Accidental visitor
Lapland longspur	*Calcarius lapponicus*	Common breeder
Snow bunting	*Plectrophenax nivalis*	Common breeder
Hoary redpoll	*Carduelis hornemanni*	Rare breeder

(LePage et al. 1998)

The above list of species includes species that may be found in the vicinity of the Project, at various times of the year. Some species are temporary residents during migration or the breeding season, and others have been spotted as part of a survey when they were passing through the area as a result of unusual weather or some other temporary phenomenon.

6.6.1.3 Species at Risk

The federal *Species at Risk Act* (SARA) was passed by Parliament on December 12, 2002. As of June 5, 2003 most of the *Act* has come into force. SARA applies to all aquatic species and migratory birds wherever they are found and to all species listed as endangered, threatened or extirpated species on federal lands (which includes territorial lands) by COSEWIC. In addition, SARA amends the definition of "environmental assessment" in the *Canadian Environmental Assessment Act* to include any change that the project may cause to a listed species, its critical habitat or the residences of individuals of that species. Subsequently, any project requiring an environmental assessment under federal law that is likely to affect a listed species or its critical habitat needs to identify the adverse effects, and, if the project goes forward, steps must be taken to avoid or lessen those effects and to monitor them.

The polar bear, Perry caribou, wolverine and peregrine falcon are three wildlife species that are listed by COSEWIC (2003) as species at risk. The status of these species has been highlighted in the subsections above.

6.6.2 Terrestrial and Avian Animals and Habitat Impact Assessment

6.6.2.1 Study Area Boundaries

Given the wide ranging characteristics of most wildlife species, the spatial boundary for the assessment of the effects of project activities on the terrestrial animals includes the footprint of the Radio Island Site facilities plus the surrounding area. The temporal boundary is the remediation field-work period.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA and NIRB for review by other federal and territorial departments following the CEAA process with additions to meet the NIRB requirements. Technical boundaries of the terrestrial animals and habitat assessment are the limited time frame associated with the environmental screening.

6.6.2.2 Identification of Issues, Interactions and Potential Effects

Major threats to polar bears are occurring at the global scale. Bio-accumulation of pollutants and climate change are effecting the overall survival of this species. Hunting regulations and sustainable harvesting practices are being implemented to protect the bears. Radio Island is a potential denning site for polar bears and experiences high polar bear traffic. Consequently, the Project is expected to interact with polar bears.

Potential interactions with wildlife, such as polar bear, wolves, wolverine and foxes, and the Project exist if proper waste and odour management strategies for the facilities are not developed.

Most wildlife species are likely to exhibit some degree of sensitivity to human disturbance and from heavy equipment during remediation activities. This sensitivity varies based on aspects of their behaviour, including the degree to which they adapt and habituate to human disturbance. This disturbance could result in temporary displacement of certain species from preferred habitat, abandonment of nests, dens or breeding areas and stress-related reduction in reproductive success.

The soil remediation activities have the potential to disturb wildlife and destroy wildlife habitat.

Accidents, malfunctions and unplanned events such as collisions between wildlife and Project-related vehicles or hazardous materials spill may interact with wildlife in a manner that results in the alteration of habitat, changes in wildlife movement patterns and/or the loss of individual animals.

The remediation of the site will improve wildlife habitat by removing contaminated materials from the island.

Table 6-8 is an environmental assessment matrix for the terrestrial and avian animals VEC.

Table 6-8: Environmental Effects Assessment Matrix: Terrestrial & Avian Animals and Habitat

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
General Remediation Activities	The movement of humans and vehicles around the site has the potential to disturb wildlife (A).	• Workers will be instructed to avoid encounters with animals. • Vehicle movement will be restricted to existing tracks wherever possible. • Activity timelines will be kept as tight as possible to reduce the amount of time disturbance is occurring. • Nesting areas and SARA species habitat will be avoided or protected.	1	1	2/1	R	2
Soil Remediation	Soil removal could disturb wildlife and destroy habitat (A).	• Activities will be restricted to the contaminated site. • Care will be taken to ensure minimum disturbance. • Nesting areas and SARA species habitat will be avoided or protected.	1	1	2/2	R	2
	Removal of contaminated soil will improve wildlife habitat (P).						

KEY:

Magnitude:

1 = Low: *e.g.,* a few individuals. Species and or habitats affected occasionally.

2 = Medium: *e.g.,* a moderate percentage/number of individuals, species and or habitats affected within the LSA for a period of more than one month.

3 = High: *e.g.,* a large percentage/ number of individuals, species and or habitats within LSA affected for a period of more than one month.

4 = Very High *e.g.*, long-term regional effects on wildlife abundance distribution and biodiversity (*e.g.*, impact to an endangered species).

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

1 = <1 month
2 = 1-7 months
3 = 8-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse effects.

N/A = Not Applicable

6.6.2.3 Mitigation

Waste and odour management strategies for the facilities will identify and describe details of design features, operational measures, employee/contractor staff awareness and training, for handling of food, food waste and other wastes throughout the clean up site and specifically for the incinerator, landfill site, kitchens, camps and personnel quarters. This will minimize the attractiveness of the site for species that may be attracted by scent (e.g., wolves and polar bears), and therefore reduce the possibility of an encounter on-site.

In order to protect migratory birds that may make use of the project site or surrounding area in some capacity, and ensure compliance with the *Migratory Birds Convention Act (*MBCA*)*, a biologist will survey the site prior to initiating any on-site works. The biologist will be tasked with identifying nesting, staging, and foraging birds making use of the project area. Suitable mitigation will be put in place to ensure there are no *MBCA* contraventions. Mitigation plans include those described below.

- Nesting birds: Nests will be identified and flagged. Depending upon the situation and species, the area will either be protected and left undisturbed until the nest is abandoned following breeding season, or it will be moved in a manner that will ensure the viability of the eggs/nestlings.
- Foraging birds: Unless a species at risk is identified in the project area, no specific mitigation is proposed for birds using the project area for foraging purposes (there is no specific requirement for this under *MBCA*). The duration of disturbance will be short and all activity and disturbance will be restricted to the project site to minimize the amount of sensory and physical disturbance to surrounding areas and species.
- Species at Risk: If any SARA species are identified at the site (staging, nesting, or foraging), steps will be taken to avoid disturbance of all individuals of the species or their habitat throughout the project lifecycle. Steps to avoid disturbance of SARA-listed species include changing the timelines of Project activities, avoiding certain areas on or near the Project site, minimizing the area of disturbance, and leaving buffers between SARA species habitat and Project-related activity.
- Staging birds: The potential for this activity on-site will be assessed by the Project biologist during the site visit prior to commencement of Project activity, and suitable mitigation proposed for this type of situation if this potential is identified. Potential mitigation measures include avoiding certain areas, limiting Project activity timelines, and leaving buffers between staging areas and Project activity if necessary.

Prior to remediation activities, workers will receive wildlife awareness training and will be instructed to avoid wildlife encounters.

During the Project activities, efforts will be made to avoid known wildlife colonies or bird nesting areas. Where applicable, minimum distance and height restrictions will be employed for transportation activities. Also, the appropriate wildlife officer will be contacted for guidance to ensure that the disturbance of wildlife is minimized.

Soil remediation will be carried out in a manner that minimizes the extent of disturbance and the potential for erosion.

There is the potential for accidental events to adversely affect wildlife and wildlife habitat. To minimize the possibility of an accidental event, including collisions, spills, or fires, an environmental protection plan will be implemented that contains a number of sections that will minimize and mitigate potential effects of such an event on wildlife and wildlife habitat. These include Wildlife Protection Measures and Hazardous Materials and Spill Contingency Procedures.

6.6.2.4 Residual Environmental Effects

Definition of Significance

A significant environmental effect of the project activities on terrestrial or avian animals occurs when the population of a species is sufficiently affected by the Project to cause a decline in abundance and/or change in distribution beyond which natural recruitment (reproduction and immigration from unaffected areas) would not return the population to its former level within several generations.

Residual Environmental Effects Summary

Table 6-9 summarizes the residual environmental effects of the project activities on terrestrial and avian animals and habitat. Effects of the Project on terrestrial animals and habitat, for remediation activities are assessed as not significant. The removal and disposal of hazardous materials will have a positive effect on terrestrial animals.

Table 6-9: Residual Environmental Effects Summary Matrix: Terrestrial & Avian Animals and Habitat

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
General Remediation	NS		
Soil Removal	NS/P		

KEY

Residual Environmental Effects Rating:

S = Significant Adverse Environmental Effect
NS = Not Significant Adverse Environmental Effect
P = Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a =effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.6.2.5 Summary of Environmental Effects on Terrestrial and Avian Animals and Habitat

During the project activities, efforts will be made to avoid known wildlife colonies or bird nesting areas. Where applicable, minimum distance and height restrictions will be employed for transportation activities.

Wildlife protection measures that include provisions to reduce attractants through proper waste disposal, education and awareness of potential wildlife interactions and hazardous materials and spill contingency procedures will be adhered to.

The removal of contaminated soils will result in a positive effect on wildlife habitat.

The effects of the remediation activities on terrestrial animals and their habitat are assessed as not significant or as positive.

6.7 Health and Safety

6.7.1 Health and Safety Impact Assessment

6.7.1.1 Study Area Boundaries

The spatial boundary for the assessment of the effects of project activities on health and safety is the Radio Island Site vicinity (immediate area) and the homes of the workers performing the site remediation. The temporal boundary is the remediation field-work period.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA and NIRB for review by other federal and territorial departments following the CEAA process with additions to meet the NIRB requirements. Technical boundaries of the health and safety assessment are the lack of site-specific information and limited time frame associated with the environmental screening.

A full Human Health Risk Assessment is also being undertaken for this site by Jacques Whitford.

6.7.1.2 Identification of Issues, Interactions and Potential Effects

The exposure of potentially hazardous materials during remediation and the general handling of hazardous materials has the potential to impact health and the safety of workers. Ultimately, the removal of contaminated soil and other hazardous materials from the environment reduces the risk of exposure to people.

Polar bears, which are common in the area, are curious and will investigate unfamiliar items encountered in their environment. Objects such as parked snowmobiles, cabins, tents, or humans may attract the attention of polar bears. These characteristics of polar bears, combined with the location of proposed activity, result in the possibility of polar bear encounters between bears and individuals working on the Project.

Table 6-10 is an environmental assessment matrix for the Health and Safety VEC.

Table 6-10: Environmental Effects Assessment Matrix: Health and Safety

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
General Remediation	Disturbance to existing hazardous waste storage areas has the potential to expose workers to hazardous substances (A).	• Workers will be provided with safety training for the handling of the materials expected to be encountered. • Personal Protective Equipment will be provided to all workers. • A comprehensive health and safety plan will be developed and implemented.	1	N/A	1/1	R	N/A
	Removal of hazardous materials from the site (P)						
All Project Related Activity	Bear/human interactions have the potential to lead to injury of the person(s) involved (A).	• An appropriate waste management system will be installed and maintained. • Bear awareness training will be provided to all staff on-site. • Wildlife monitors will be present on site at all times.	1	N/A	1/1	R	N/A

KEY:

Magnitude:

1 = Low: No more than a few individuals are affected with minor, short-term health problems.

2 = Medium: A small portion of the local community are affected with minor, short-term health problems.

3 = High: An individual is affected with a chronic health problem or a large portion of the local community is affected with minor, short-term health problems.

Geographic Extent:

N/A

Duration:

1 = <1 month
2 = 1-7 months
3 = 8-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse effects.

N/A = Not Applicable

6.7.1.3 Mitigation

The transportation of any hazardous materials will be in accordance with the Transportation of Dangerous Goods Regulations. A comprehensive health and safety plan will be developed and

implemented with requirements for workers to wear and use appropriate personal protective equipment. Workers will also be trained in the use of personal protective equipment and proper handling procedures for hazardous materials.

The strategies suggested for avoiding polar bear encounters include avoiding locating the camp in areas that may be attractive to bears, such as long animal movement trails and ensuring that an appropriate waste management system is in place. Wildlife monitors will be onsite at all times.

If meeting a bear is unavoidable and there is an encounter, there are several strategies for dealing with the meeting. All staff will be fully trained in bear awareness, including ways to prevent injury during an encounter. For example, some of the fundamentals of bear training include suggestions such as:

- do not run;
- identify yourself to the bear and let it know that you are human and not a threat;
- talk to the bear in calm tones and wave your arms;
- if the bear approaches or attempts to get closer, become more animated in your movements and make your voice louder and more aggressive sounding; and
- if the bear continues to close in on you even after it has identified you as human, your best chance at survival is to play dead. Lay on your stomach on the ground with your hands behind your neck. Remain motionless for as long as possible until the bear is convinced you are no longer a threat and moves on.

6.7.1.4 Residual Environmental Effects

Definition of Significance

A significant environmental effect of the project activities on health and safety occurs if an individual develops a chronic health problem as a result of working on the Project.

Residual Environmental Effects Summary

Table 6-11 summarizes the residual environmental effects of the project activities on health and safety.

Table 6-11: Residual Environmental Effects Summary Matrix: Health and Safety

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
General Remediation	NS/P		

KEY

Residual Environmental Effects Rating:

S =Significant Adverse Environmental Effect
NS =Not Significant Adverse Environmental Effect
P =Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a =effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.7.1.5 Summary of Environmental Effects on Health and Safety

The collection and disposal of potentially hazardous debris and the general handling of hazardous materials has the potential to affect the health and the safety of workers. To help mitigate this risk, the transportation of any hazardous materials will be in accordance with Transportation of Dangerous Goods Regulations. Additionally, a comprehensive health and safety plan will be developed and implemented, which will require workers to wear and use appropriate personal protective equipment. Workers will also be trained in the use of personal protective equipment and proper handling procedures for hazardous materials. The removal of hazardous materials from the site will result in a positive effect on health and safety on the island. The effects of the remediation activities are assessed as not significant or as positive.

6.8 Archaeological and Heritage Resources

6.8.1 Existing Environment

The Government of Nunavut Department of Culture, Language, Elders and Youth conducted a search of the Nunavut Archaeological database. There are no recorded archaeological sites within a 15-km radius around the Radio Island Site. However, in a recent study of the east central coast of Baffin Island, of 58 recorded archaeological sites, 62% were located along island shorelines. These sites consist primarily of tent rings but house remains were also recorded, some of which are of Thule affiliation (Fedirchuk 2005). Given the strong association of island shores with archaeological sites further north along Baffin Island and the location of Radio Island relative to the archaeological Thule sites of Lake Harbour and Crystal II, there is good potential for archaeological sites on Radio Island. This perceived potential is supported by documented current use of the island for fishing, fowling, and trapping which indicate that similar activities may have been performed at the location in the precontact past. In addition, because the installation of the Navigational aid and Weather Station occurred in 1929, this site warrants documentation as a historic site.

6.8.2 Archaeological and Heritage Resources Impact Assessment

6.8.2.1 Study Area Boundaries

The spatial boundary for the assessment of the effects of project activities on archaeology and heritage resources is the facility and access route footprint. The temporal boundary is the detailed site assessment field-work period.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA and NIRB for review by other federal and territorial departments following the CEAA process with additions to meet the NIRB requirements. Technical boundaries of archaeological and heritage resources assessment are the lack of site-specific information and limited time frame associated with the environmental screening. The proposed archaeological impact assessment study would be conducted under archaeological permit and reviewed by the Department of Culture, Elders and Youth.

6.8.2.2 Identification of Issues, Interactions and Potential Effects

The presence and movement of people around the site has the potential to disturb archaeological resources identified around the site. Excavations during remediation activities have the potential to disturb or destroy archaeological and heritage resources but also offer the potential for the discovery of previously unknown sites. Table 6-12 is an environmental assessment matrix for the archaeology and heritage resources VEC. The establishment of the temporary camp and required associated facilities also have the potential to disturb archaeological remains.

Table 6-12: Environmental Effects Assessment Matrix: Archaeology and Heritage Resources

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
General Remediation	Any excavations associated with activities may disturb archaeological or heritage resources present (A).	• An archaeological impact assessment will be completed to identify archaeological sites and document the current condition of the station • Known archaeological and heritage resource sites will be marked prior to assessment and consolidation activities. • Authorities will be contacted if new artefacts or a site are discovered and work will be stopped until the site can be assessed. • Archival research will be undertaken to prepare a historical summary of the history and development of the station	1	1	1/1	I	N/A
	New archaeological or heritage resource sites may be discovered (P).	NA					

Table 6-12: Environmental Effects Assessment Matrix: Archaeology and Heritage Resources

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context

KEY:

Magnitude:

1 = Low: *e.g.*, loss of a minor proportion of data at site, local or regional level; after low impact, interpretative capacity of the remains is virtually intact, limited only by loss of minor items and/or features.

2 = Medium: *e.g.,* a proportion of the data at the site, local or regional level is lost but a significant proportion remains unimpaired; after medium impact, the interpretative capacity of the remains is hindered by loss of basic data about cultural descriptions and lifestyles.

3 = High: *e.g.*, a significant proportion of data at the site, local or regional level is lost; interpretative capacity of the remains following impact is minimal.

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

1 = <1 month
2 = 1-7 months
3 = 8-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse effects.

N/A = Not Applicable

6.8.2.3 Mitigation

In order to minimize impacts to archaeology and heritage resources, an archaeological impact assessment will be undertaken to determine whether use and maintenance activities in the past have disturbed archaeological materials and to identify archaeological sites and features for avoidance during program preparation and remediation activities. All identified archaeological and heritage resources will be clearly marked for avoidance during remediation. Additionally, in the event that a new resource is discovered within the remediation site, or a known resource is disturbed, the work will cease and the Nunavut Department of Culture, Language, Elders and Youth will be contacted. Work will not resume until permission to do so is obtained from the Department. Documentation of the Navigational aid and Weather Station would involve research resulting in a summary document, including early photographs and site plans, on the history and development of the station.

6.8.2.4 Residual Environmental Effects

Definition of Significance

A significant environmental effect of the project activities on archaeology and heritage resources would involve the destruction or disturbance of all or part of an archaeological, historic or palaeontological site considered to be of local, regional territorial, national, or international value. This effect, if not controlled through mitigative investigation and documentation would result in the permanent loss of part of the non-renewable heritage resource base.

Residual Environmental Effects Summary

Table 6-13 summarizes the residual environmental effects of the project activities on archaeology and heritage resources. Residual effects are assessed as not significant or positive for the detailed site assessment.

Table 6-13: Residual Environmental Effects Summary Matrix: Archaeology and Heritage Resources

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
General Remediation	NS/P		

KEY

Residual Environmental Effects Rating:

S =Significant Adverse Environmental Effect
NS =Not Significant Adverse Environmental Effect
P =Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a= effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.8.2.5 Summary of Environmental Effects on Archaeology and Heritage Resources

The presence and movement of people at the site has had and will have the potential to disturb the archaeological and heritage resources in the area of the station facilities. Proposed activities also have the potential to facilitate the discovery of new archaeological and heritage resource sites. In order to minimize impacts to archaeology and heritage resources, an archaeological impact assessment will be undertaken and all known archaeological and heritage resources will be clearly marked so that they can be avoided. Additionally, in the event that a new resource is discovered within the remediation site, or a known resource is disturbed, the relevant authorities will be contacted. Archival research will be undertaken to document the history of the station. The effects of the Project on archaeology and heritage resources are assessed as not significant or positive.

6.9 Aesthetics

6.9.1 Existing Environment

The Radio Island site is located on a barren island. The facilities interrupt a natural arctic landscape view with one of a former military operation.

6.9.2 Aesthetics Impact Assessment

6.9.2.1 Study Area Boundaries

The spatial boundary for the assessment of the effects of project activities on aesthetics is the Radio Island Site facilities. The temporal boundary is the remediation field-work period.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA and NIRB for review by other federal and territorial departments following the CEAA process with additions to meet the NIRB requirements. No technical boundaries have been recognized for the assessment of the project on aesthetics.

6.9.2.2 Identification of Issues, Interactions and Potential Effects

Ultimately, the clean up activities will improve the aesthetics of the site by removing unsightly debris and restoring the site to a more natural state. Table 6-14 is an environmental assessment matrix for the aesthetics VEC.

Table 6-14: Environmental Effects Assessment Matrix: Aesthetics

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
General Clean Up Activities	The clean up will improve the aesthetics of the site by removing unsightly debris and restoring the site to a more natural state (P).	• N/A					

KEY:

Magnitude:

1 = Low: Little change to the visual landscapes

2 = Medium: Viewsheds are partially obscured or degraded.

3 = High: Most viewsheds are obscured or degraded.

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:
1 = <1 month
2 = 1-7 months
3 = 8-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse effects.

N/A = Not Applicable

6.9.2.3 Mitigation

No mitigation is required since project activities are expected to improve the aesthetics of the area.

6.9.2.4 Residual Environmental Effects

Definition of Significance
A definition of significance for residual effects on aesthetics is not required since effects are positive.

Residual Environmental Effects Summary
Table 6-15 summarizes the residual environmental effects of the project activities on aesthetics.

Table 6-15: Residual Environmental Effects Summary Matrix: Aesthetics

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
Remediation	P		

KEY

Residual Environmental Effects Rating:

S =Significant Adverse Environmental Effect
NS =Not Significant Adverse Environmental Effect
P =Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a = effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.9.2.5 Summary of Environmental Effects on Land Use

The remediation activities are expected to have a positive effect on the aesthetic environment.

6.10 Socio-Economics

6.10.1 Existing Environment

Radio Island is located off Resolution Island, Nunavut. The closest community is Iqaluit with a population, according to the 2001 census, of 5236. The economy of the region is based on hunting and fishing and on the tourist industry.

6.10.2 Socio-Economic Impact Assessment

6.10.2.1 Study Area Boundaries

The spatial boundary for the assessment of the effects of project activities on socio-economics is Nunavut as labour and equipment may be required from Iqaluit where most of the effects of the Project will be felt. The temporal boundary is the remediation field-work period.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA and NIRB for review by other federal and territorial departments following the CEAA process with additions to meet the NIRB requirements. No technical boundaries have been recognized for the assessment of the project on socio-economics.

6.10.2.2 Identification of Issues, Interactions and Potential Effects

The successful Contractor will ensure a minimum Inuit Employment and Contracting level is maintained. Inuit involvement in the remediation activities will include both employment and business (contracting) opportunities, and local purchases.

Table 6-16 is an environmental assessment matrix for the socio-economic VEC.

Table 6-16: Environmental Effects Assessment Matrix: Socio-Economics

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
General Remediation	Nunavut residents will have employment opportunities during the field work (P).	• N/A					

KEY:

Magnitude:

1 = Low: *e.g.,* Few individuals affected.

2 = Medium: *e.g.,* A moderate number of individuals affected.

3 = High: *e.g.,* A large number of individuals affected.

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

1 = <1 month
2 = 1-7 months
3 = 8-36 months
4 = 37-72 months
5 = >72 months

Frequency:

1 = <11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = >200 events/year
6 = continuous

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse effects.

N/A = Not Applicable

6.10.2.3 Mitigation

During any remediation project, whenever possible, INAC strives to support and enhance the development of healthy, sustainable communities by leveraging local skills and knowledge into their approach to addressing environmental issues associated with contaminated sites. By these means core competencies are maximized and deployed. Whenever possible, the project will also adopt solutions tailored to the northern environment and its inhabitants. This includes leveraging local knowledge and the incorporation of provisions accounting for the unique needs of northerners and the needs of the environment in which they live into the development and implementation of policies and procedures.

6.10.2.4 Residual Environmental Effects

Definition of Significance

A definition of significance for residual effects on socio-economics is not required since effects are positive.

Residual Environmental Effects Summary

Table 6-17 summarizes the residual environmental effects of the project activities on socio-economics.

Table 6-17: Residual Environmental Effects Summary Matrix: Socio-Economics

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
General Remediation	P		

KEY

Residual Environmental Effects Rating:

S =Significant Adverse Environmental Effect
NS =Not Significant Adverse Environmental Effect
P =Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a = effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.10.2.5 Summary of Environmental Effects on Socio-Economics

The contractor will be required to have a minimum Inuit content in the workforce for the remediation work. This will provide employment benefits and related economic benefits.

6.11 Summary of Environmental Effects

Table 6-18 is an interaction matrix between the Project and several environmental parameters, showing the effects of the Project on the environment. The parameters listed are those required by the NIRB and those that were not identified as specific VECs in the preceding sections, were included as part of the VECs discussed.

6.12 Cumulative Effects

The effects of the remediation of the former Radio Island Site will be cumulative with the effects of other activities in the area. The purpose of the remediation is to return the site to as near pre-disturbance conditions as possible while minimizing the potential for contaminants to enter the ecosystem. There are no other activities occurring at the site to interact with the Project. The only potential cumulative effect identified is the potential pressure placed on the local labour pool if workers are also being hired for other construction or remediation projects in the area. Given the short term of this Project, the effects are not expected to be significant.

6.13 Impact of the Environment on the Project

The implementation of a clean up project in an Arctic environment has unique logistical issues. The potential exists for delays in the clean up associated with bad weather. These delays may include work stoppage on-site or delays in the transportation to and from the site of personnel and supplies. Conditions related to the Arctic climate, such as ice and frozen ground may also delay clean up activities. Ice may delay marine transport to and from the site. Clean up activities which are best completed at maximum thaw may be delayed depending on seasonal climate changes.

7.0 ASSESSMENT SUMMARY

The remediation activities at the Radio Island Site will interact with the environment through vehicle and machinery emissions, waste disposal, surface disturbance and the provision of employment to local inhabitants. There is also the potential for spills of fuel or hazardous materials. The activities will be carried out following standard good operating practices for northern Canada, with spill prevention practices and contingency plans in place. The environmental effects of the activities are assessed as being of low magnitude and not significant. The activities will benefit the area through the short-term employment of local individuals and through the completion of clean up of the site.

TABLE 6-18:

NUNAVUT IMPACT REVIEW BOARD
ENVIRONMENTAL INTERACTION MATRIX
RADIO ISLAND REMEDIATION

		ENVIRONMENTAL COMPONENTS	PHYSICAL	climate/ weather	ground stability	noise	sediment quality	soil quality	air quality	water quality	hydrology/ limnology	permafrost	eskers and other unique landscapes	BIOLOGICAL	vegetation	wildlife including habitat	birds including habitat	freshwater Biota and Habitat	marine Biota and Habitat	protected areas	land use	archaeology & heritage resources	aesthetics	socio-economics
INTERACTION MATRIX																									
PROJECT ACTIVITIES																									
SITE PREPARATION	Mobilization to the site				M				M																P
	Camp construction				M							M			M	M	M		M						P
REMEDIATION	Remediation of Landfills				M			P	M			M			M	M	M					P/M	P		
	Removal of Physical Debris							P		P					M	M						P/M	P	P	
	Remediation of Contaminated Soils							P	P	P		M			M	M	M		M					P	
	Removal of Hazardous Materials							P		P					P	P	P							P	
	Removal of Empty Barrels																						P	P	
CLOSURE	Site closure and demobilization				M																		P	P	

Notes: Please indicate in the matrix cells whether the interaction causes an impact and whether the impact is:

P *Postitive*
N *Negative and non-mitigatable*
M *Negative and mitigatable*
U *Unknown*
If no impact is expected then please leave the cell blank

TABLE 6-18: **NUNAVUT IMPACT REVIEW BOARD ENVIRONMENTAL INTERACTION MATRIX**
RADIO ISLAND REMEDIATION

	PROPOSED MITIGATION MEASURE	IMPLEMENTATION SCHEDULE	PROPOSED MONITORING SCHEDULE	REPORTING SCHEDULE
IMPACTS (IDENTIFIED IN TABLE 1)				
Ground stability and permafrost	See Table 6-5	During remediation activities	None proposed	None proposed
Air quality	See Table 6-1	During remediation activities	None proposed	None proposed
Vegetation	See Table 6-5	During remediation activities	None proposed	None proposed
Wildlife & birds, including habitat	See Table 6-8	During remediation activities	Prior to remediation	As required depending on monitoring finds
Marine biota and habitat	See Table 6-3	During remediation activities	None proposed	None proposed
Archaeology and Heritage Resources	See Table 6-12	During remediation activities	During remediation	As required depending on monitoring finds

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