AMEC Earth & Environmental
a division of AMEC Americas
2227 Douglas Road, Burnaby, BC
Canada V5C 5A9
Tel +1 (604) 294-3811
Fax +1 (604) 294-4664
www.amec.com

ENVIRONMENTAL ASSESSMENT OF THE PROPOSED REMEDIATION OF THE ROBERTS AND IDA BAY ABANDONED MINE SITES

Submitted to:

Public Works and Government Services Canada

Edmonton, AB

Submitted by:

AMEC Earth & Environmental,
a division of AMEC Americas Limited

Burnaby, BC

16 February 2007

AMEC File: VE51612

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF APPENDICES

IMPORTANT NOTICE

This report was prepared exclusively for Public Works and Government Services Canada (PWGSC) and Indian and Northern Affairs Canada (INAC), by AMEC Earth & Environmental, a division of AMEC Americas Limited (AMEC). The quality of information, conclusions and estimates contained herein is consistent with the level of effort involved in AMEC services and based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions and qualifications set forth in this report. This report is intended to be used by PWGSC and INAC, only, subject to the terms and conditions of its contract with AMEC. Any other use of, or reliance on, this report by any third party is at that party's sole risk.

EXECUTIVE SUMMARY

AMEC Earth & Environmental, a Division of AMEC Americas Limited (AMEC), was retained by Public Works and Government Services Canada (PWGSC) on behalf of the Department of Indian and Northern Affairs Canada (INAC) to prepare an environmental assessment for the proposed remediation of the abandoned Roberts Bay and Ida Bay silver mines in Nunavut. The site is situated approximately 115 kilometres southwest of Cambridge Bay, Nunavut.

The purpose of the project is to remove/consolidate the abandoned mine wastes, debris and contaminated soils while minimizing/mitigating disturbance to the receiving environment. The mine openings will be closed and the landscape left as natural as possible. Remediation of the Roberts Bay and Ida Bay mine sites is being proposed by INAC as the agent of the Crown. A screening-level environmental assessment report following the requirements of the *Canadian Environmental Assessment Act (CEAA)* is required for this project as the project will be funded by the Federal government.

The remediation program is proposed to commence in the summer of 2007 (Year 1) with the mobilization of equipment and supplies to both Ida Bay and Roberts Bay and the set up of a temporary work camp at Roberts Bay. Various remediation activities are scheduled up until the summer of Year 3 when the remaining material would be removed from the site.

A number of field assessments have been conducted for the site which have led to a significant amount of information being collected and compiled in various technical reports. In August 2006, INAC presented public consultation meetings in Cambridge Bay to inform community members about the proposed remediation of the Roberts Bay and Ida Bay mine sites. The presentation informed attendees about the site history, the existing conditions, and the remediation options.

This report addresses project activities, site specific baseline conditions that have been identified as being potentially affected by the project, potential environmental effects and general mitigative measures for the remediation of the Roberts Bay and Ida Bay mine sites.

Various activities associated with the proposed remediation of the Roberts Bay and Ida Bay mine sites have the potential to interact with the environment including exhaust and noise from vehicles and equipment involved in the remediation, disturbance of surface and subsurface features such as vegetation and permafrost, and disturbance of migratory birds and associated habitat. There is also a potential for the mobilization of contamination during the removal of contaminated soils and hazardous wastes identified on-site or from accidental spills of fuel. With the implementation of appropriate mitigation measures, spill prevention measures and contingency plans and project design strategies potential adverse effects of the proposed project will be adequately managed and residual effects are assessed as being not significant.

As all migratory birds are protected under the Migratory Birds Convention Act it is recommended that a qualified environmental professional conduct a field assessment of the area encompassing the proposed Ida Bay barge loading site and mine site prior to commencing the project in order to ensure proposed remediation activities can be completed as scheduled.

Positive affects associated with the proposed project include:

- improved soil quality with appropriate management or removal of contaminated soils from the site;
- improved aesthetics and drainage with the removal of abandoned site infrastructure and grading of the site;
- potential discovery and documentation of previously unidentified archaeological sites; and
- utilization of local businesses to provide economic benefits for the neighbouring communities.

After implementation of the remedial plan, long-term monitoring requirements are expected to be minimal, requiring only simple instrumentation installed at the Roberts Bay mine site, the details for which will be finalized following completion of the proposed remediation project. In addition, there are no cumulative effects expected with respect to current and foreseeable activities in the project area.

1 INTRODUCTION

AMEC Earth & Environmental, a division of AMEC Americas Limited (AMEC) was retained by Public Works and Government Services Canada (PWGSC) on behalf of Department of Indian and Northern Affairs Canada (INAC) to prepare an environmental assessment (EA) for the proposed remediation of the abandoned Roberts Bay and Ida Bay silver mines in Nunavut. Collectively known as the 'Roberts Lake property', the site is situated approximately 115 km southwest of Cambridge Bay, Nunavut.

This report addresses project activities, site specific baseline conditions that have been identified as being potentially affected by the project, potential environmental effects and general mitigative measures for the remediation of the Roberts Bay and Ida Bay mine sites (the site).

The following general provisions of the *Canadian Environmental Assessment Act* (CEAA) [Section 16(1)] were used as a guideline for this EA:

- the environmental effects of the project, including the environmental effects of potential 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;
- the significance of effects referred to above; and
- measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project.

Figures and photographs referenced in the report are attached in Appendix A and Appendix B, respectively.

1.1 PROJECT PURPOSE

The primary concern at both sites is the mine openings with respect to public safety. Abandoned mine wastes, debris, and contaminated soil are also concerns. A priority for the remedial activities will be the protection and restoration of the natural environment both during and following the remedial activities. The purpose of the project is to remove/consolidate the abandoned mine wastes, debris and contaminated soils while minimizing/mitigating disturbance to the receiving environment. The mine openings will be closed and the landscape left as natural as possible.

1.2 SCOPE OF WORK

The following activities were undertaken in preparation of this environmental assessment:

- literature review and collection of background information from previously prepared, relevant investigations;
- discussions with representatives from key regulatory agencies;
- identification of Valued Ecosystem Components (VECs) and Valued Socio-Economic Components (VSECs);
- identification of potential project related affects and potential accident scenarios;
- recommendation regarding mitigation measures during/after remediation activities;
- evaluation of residual impacts considering the implementation of mitigation strategies; and
- provision of a CEAA screening-level EA report that summarizes the above information.

The scope of the EA also includes potential off-site effects and cumulative effects associated with other current or foreseeable projects that may overlap with the proposed project.

1.3 FEDERAL INVOLVEMENT

CEAA is triggered by Federal involvement in a project. CEAA applies when a Federal department or agency is required to make a decision on a proposed project. In accordance with (Section 5(1)), of CEAA, the "triggering" provisions of an environmental assessment are required if a Federal authority exercises or performs one or more of the following powers, duties, or functions relating to a project:

- proposing the project (known as the "proponent trigger");
- granting money or any other form of financial assistance to the proponent (the "funding trigger");
- granting an interest in land to enable a project to be carried out (e.g., sell, lease, or otherwise transfer control of land) (the "land trigger"); and/or
- exercising a regulatory duty in relation to a project, such as issuing a permit or licence, that is included in the Law List prescribed in CEAA's regulations (the "Law List trigger"); this would include such items as permits under Section 5.1 of the *Navigable Waters Protection Act* (NWPA) and Section 35(2) of the *Fisheries Act*.

Remediation of the Roberts Bay and Ida Bay mine sites is being proposed by INAC. Funding for the project will be from the Federal government and as such, completion of a CEAA screening-level EA report is required for this project.

1.4 CONTACTS

Responsible Authority Contact:
Indian and Northern Affairs Canada
Dele Morakinyo
Project Manager, Contaminated Sites
Tel: (867) 975 4732

Federal Authority Contact:
Pubic Works and Government Services Canada
Jared Buchko
Manager, Environmental Services
Tel: (780) 497-3886
Cell: (780) 982-1887

Environmental Consultant Contact:
Sandra Baker
AMEC Earth & Environmental, a division of AMEC Americas Limited
Phone: 604-294-3811

1.5 REGULATORY REQUIRMENTS

The abandonment and reclamation of a mine is a physical work and is defined as a project under the Canadian Environmental Assessment Act (the Act). The Roberts Bay Mine Site is on Federal lands that are regulated by INAC. Where a proposed project in Nunavut involves a CEAA trigger, Federal and territorial governments and the Nunavut Impact Review Board (NIRB) work together to harmonize the environmental screening process.

1.5.1 Current Environmental Assessment and Review Process

The following summary of the current EA and review process, previously provided in the *Environmental Screening of the Proposed Site Remediation of the FOX-C DEW Line Site* (Jacques Whitford, 2005), was revised to reflect the updated NIRB Review Process (November, 2006).

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. All site activities will be carried out on Crown 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 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.

The initial step in obtaining approval for a project proposal within the Nunavut Settlement Area is the submission of an application for a permit, licence, 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 application for a permit, licence, 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.

During a screening, the Nunavut Impact Review Board evaluates a proposal to determine whether it may have significant adverse effects on the ecosystem, wildlife habitat or Inuit harvesting activities; or whether it may have significant socio-economic effects or cause significant public concern. Upon completing the screening, the NIRB issues its report to the Minister of INAC identifying the board's recommendation.

Article 12 of the NLCA, establishes two types of review processes for the environmental assessment of proposed projects: one under Part 5 and the other under Part 6 of the Article. A Part 5 review is conducted by NIRB, whereas a Part 6 review is conducted by a Federal Environmental Assessment Panel. NIRB's review process under Article 12, Part 5 of the NLCA is described below. NIRB's review process is designed to carry out the functions assigned to the Board by the NLCA, as they relate to environmental assessment. These functions are:

- to review the ecosystemic and socio-economic impacts of proposed projects;
- to gauge and define the extent the impacts will have on regions and communities; and
- to determine, on the basis of its review, whether project proposals should proceed, and if so, under what terms and conditions, and then report its determination to the Minister.

The NIRB can issue recommendations for monitoring of project effects, but the responsibility for enforcement of such provisions lies with the agency issuing a permit, licence, or authorization.

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 (2006a and 2006b), the Canadian Environmental Assessment Agency (1994 and 2003) and INAC (2005).

The proponent must contact all authorizing agencies responsible for issuing any authorization (i.e., letter, permit, license, lease, certificate, or other written or verbal communication that authorizes a project, or a component of a project to proceed). 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. As of August 2006 (the date referenced in the latest draft of the guidance document), the following two regions had

approved plans: North Baffin and Keewatin. The proposed remediation project is not located within either of these regions.

By issuing the project proposal a NIRB number, NIRB begins the screening process, and will issue its determination within 45 days unless:

- the Minister has approved an extension to the 45 days period; or
- there is a legal requirement for a licensing authority to make a decision within a certain time period; in that case, NIRB will complete the screening within a time period that allows the licensing authority to conform with that requirement.

Once NIRB has acknowledged receipt of a project proposal, the board conducts an internal screening to ensure that the required information is provided in the project proposal. NIRB staff will correspond with the proponent and the authorizing agencies regarding any deficiencies and attempt to resolve the deficiencies before proceeding with the screening process. Once the completeness of the project proposal has been determined, the project proposal is referred to a distribution list comprised of representatives from communities, co-management boards, Designated Inuit Organizations, hunters and trappers organizations, community councils, Federal and territorial government departments, relevant wildlife management boards as well as other agencies or individuals that the board feels are appropriate.

In screening a project proposal and making a determination, NIRB uses both traditional Inuit knowledge and recognized scientific methods. Accordingly, the Proponent must state where information was gathered through Inuit knowledge and by recognized scientific methods.

Once comments have been received from the distribution list and any additionally requested information has been received, In the screening assessment, NIRB gives consideration to the following:

- the completeness of the project proposal;
- further information requests from the distribution list;
- comments from the distribution list;
- ecosystemic impacts and specific environmental impacts;
- whether impacts can be mitigated with terms and conditions; and
- monitoring requirements.

Once NIRB has completed its screening assessment, it can make one of four determinations. A Screening Decision Report will be prepared, that documents the determination as to whether the project proposal should be approved without further review, returned to proponent for clarification, 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. It is understood that the authorizing agency will include the NIRB terms and conditions in the final authorization. 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. NIRB will generally determine that a review is not required when, in its judgment, the project is unlikely to cause significant public concern and, the adverse ecosystemic and socio-economic effects are not likely to be significant; or the project is of a type where the potential adverse effects are highly predictable and can be mitigated with known technology.

Although NIRB recommends an appropriate course of action, it is the Minister responsible for the project that makes the final decision. This will involve consultation with his/her colleagues that may also have decision-making responsibilities. In most cases, it is the Minister of Indian and Northern Affairs Canada (INAC).

Depending on the activity, environmental screening and assessment may also have to accommodate the requirements of the Federal Canadian Environmental Assessment Act (CEAA), in addition to the requirements of NIRB. The Roberts Bay and Ida Bay abandoned silver mines are located on Crown land that are regulated by INAC. As the Responsible Authority, INAC requires that an environmental screening be conducted in accordance with the CEAA.

The scope of the project has been determined pursuant to Section 15.1 of CEAA. Information provided by the PWGSC was reviewed 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.

1.5.2 Preliminary Review of Permits, Licenses and Authorizations

This assessment considers the potential effects of the proposed project within the spatial and temporal boundaries that encompass the periods and areas during and within which the proposed project may potentially interact with, and have an effect on, components of the environment.

Development of the Project will involve a number of distinct undertakings and activities, which may require authorizations from a variety of Federal, territorial, Inuit, and resource co-management agencies. Table 1-1 provides a preliminary listing of permits, licences, and authorizations that may be required to develop the Project. The specific permits, licences, 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.

Table 1-1: Summary of Potential Permitting Requirements

Activity	Permit/Licence/Authorization	Applicable Legislation	Responsible Agency
Water use and waste water disposal	Water licence	Nunavut Waters Act	Nunavut Water Board
Sewage disposal, food premises, sanitation at camps	Permit/criteria	Public Health Act	Nunavut Department of Social Services
Access to site and site clearing, laydown and staging areas, borrow sources	Land use permit/quarry permit/permit to access Inuit owned land	Nunavut Land Claims Settlement Act Territorial Lands Act and Regulations, Federal Real property Act & Regulations	Nunavut Tungavik Incorporated, Kivalliq Inuit Association Lands Division INAC
Transportation of dangerous goods	Certificate/Permit	Transportation of Dangerous Goods Act	Transport Canada, Nunavut Department of Sustainable Development

Activity	Permit/Licence/Authorization	Applicable Legislation	Responsible Agency
Required for transportation and the use of heavy equipment	Vehicle registration or permit	Nunavut Motor Vehicles Act	Nunavut Department of Community Government and Transportation
Remediation activities within the intertidal zone at Ida Bay (i.e. removal of marine sediment) would constitute disruption or destruction of fish habitat (HADD)	Authorization or letter of advice for activities affecting fish habitat	Federal Fisheries Act	Fisheries and Oceans Canada
Transportation of material on or off site by barge at Roberts Bay	Approval to construct a barge loading facility	Navigable Waters Protection Act	Transport Canada
Remediation activities that disturb/destroy habitat associated with species identified within the Species at Risk Act (SARA).	Permit or agreement authorizing a person to engage in an activity affecting a listed wildlife species, any part of its critical habitat or its residences	Species at Risk Act (SARA)	Environment Canada Canadian Wildlife Service
Remediation activities that disturb/destroy habitat/nests associated with migratory bird species.	Permit authorizing a person to remove nests where it is necessary	Migratory Birds Convention Act	Environment Canada Canadian Wildlife Service

At the time of report preparation various different remediation options had been proposed. Permitting requirements will depend on the final remediation option selected and the timing of the various proposed activities.

1.6 INFORMATION SOURCES

Information sources consulted during preparation of this report included telephone interviews with regulatory agencies, as well as project technical reports, internet references and databases.

1.6.1 Interviews

Table 1-2 summarizes the contact information for various government agencies which were contacted to ensure that local/regional concerns and potential issues were identified and adequately addressed.

Table 1-2: Information on Key Agency and Stakeholder Contacts

Agency	Name/Contact Information	Title	Interview Information
Department of Fisheries and Oceans Canada	Tania Gordanier gordaniert@dfo-mpo.gc.ca Phone: 867-979-8007	Habitat Management Biologist	Via e-mail (December 4, 2006).
Environment Canada – Canadian Wildlife Service	Mark Mallory Phone: 867-975-4637	Seabird Biologist	Via telephone and email (January 12, 2007).
Government of Nunavut – Wildlife Management Unit	George Hakongak	Wildlife Officer II	Via telephone, left voice mail (November, 21, 2006).
Government of Nunavut – Department of Environment	Mike Setterington Phone: 867-857-2828	Ecosystems Biologist	Via e-mail (November 27, 2006).
Indian and Northern Affairs Canada (INAC)	Julian Lim Phone: 867-975-4554	Environmental Scientist	Via e-mail (November 16, 2006).
Indian and Northern Affairs Canada (INAC)	Tracy Utting Phone: 867-975-4567	Environmental Assessment Coordinator	Via e-mail (November 20, 2006).
Nunavut Impact Review Board (NIRB)	General information request info@nirb.nunavut.ca	N/A	Via e-mail (December 5, 2006).
Government of Nunavut Department of Culture, Language, Elders & Youth	Julie Ross Phone: 867-934-2040	Chief Archaeologist (Igloolik)	Via telephone and email (January 2, 2007).
Health Canada (HC)	Carolyn Dunn Phone: 613-948-2875 Carolyn_dunn@hc.sc.gc.ca	Environmental Assessment Coordinator	Via telephone and email (January 8, 2006). HC was provided with copies of the two risk assessments conducted for the site (Senes Consultants, 2004; and UMA Engineering Ltd., 2005)

1.6.2 Technical Reports

A number of field assessments have been conducted for the site. The following reports have been collected and compiled in the following technical reports:

Field Survey and Inventory (Vista Engineering, 1996)

Vista Engineering produced an inventory of the abandoned waste materials and chemicals stored at the site as well as the remaining infrastructure. The inventory included drums of ore

processing chemicals, flotation chemicals, lime, nitric acid, carbonate, lead acid batteries, lube oil, and detonation cord.

Preliminary Assessment of Roberts Bay and Ida Bay Abandoned Mine Sites (Rescan, 2003)

The focus of this assessment was to determine the location of waste rock piles and tailings areas, determine the potential for acid rock drainage and metal leaching and to assess the stability of the mine workings. Rescan concluded that there was no evidence of acid rock drainage; however some of the waste rock tested indicated the potential for acid generation. The potential for arsenic leaching for the tailings pond was also identified. The recommendations presented included: a need to permanently secure all mine openings; a need to collect and secure all waste materials; and a need to conduct additional studies to determine whether there will be any future environmental impacts from the tailings impoundment and waste rock piles.

Rescan analyzed a single waste rock sample from the Ida Bay mine site which was found to have uncertain potential to generate net acidity. Water leachable arsenic was elevated above Canadian Council of Ministers of the Environment (CCME) freshwater aquatic life guideline. The recommendations included the permanent sealing of all mine openings, the collection, and segregation in a secure landfill of all non-hazardous waste materials and additional analysis on waste rock piles for metals leaching.

Phase I/II Environmental Site Assessment Roberts Bay Silver Mine and Ida Bay Silver Deposit, Nunavut (Rescan, 2004)

This report identified approximately 225 m^3 of hydrocarbon impacted soil in the vicinity of the mill, machine shop, and at the former fuel storage area at the Roberts Bay mine site. Elevated metal concentrations in soil were also identified at concentrations similar to the waste rock piles. An estimated 305 m^3 of non-hazardous waste materials were identified at the Roberts Bay mine site. Hazardous materials identified at the Roberts Bay mine site included barrels of fuel, oil, grease, compressed gas cylinders, lead acid batteries, a transformer, and unlabelled barrels of liquid.

Approximately 8 m^3 of non-hazardous waste was identified at the Ida Bay mine site however; contaminated soil and surface water were not found to be present at this site.

Draft Report on Human Health Screening level Risk Assessment for Roberts Bay Silver Mine and Ida Bay Silver Deposit (Senes Consultants, 2004)

The conclusions made by Senes were based on the Environmental Site Assessment (ESA) reports completed by Rescan (2003 and 2004). The risk assessment included receptor characterization, exposure assessment, hazard assessment and risk characterization. The report concluded that on the basis of conservative assumptions, ingestion of arsenic was a

concern at the Roberts Bay mine site. Physical hazards, such as the adits, waste rock piles, infrastructure, and debris also represented a potential risk.

The report concluded that the adit, exploration pit and the vent raise, presented physical hazards to people's safety at the Ida Bay mine site.

Roberts Bay Mine and Ida Bay Deposit Human Health and Ecological Risk Assessment (HHERA), Draft Report (UMA, 2005)

The assessment of human health risks concluded that there would be negligible risk associated with periodic exposure to the Roberts Bay mine site. This was based on an annual visit by a local family residing at the site for 30 days and subsisting off the aquatic and terrestrial environments. There were however, two sources of contaminants that represented the highest source of risk identified for the Roberts Bay mine site: standing bodies of water (flooded adits and tailing pond) and the fine fraction of waste rock/tailings (soil impacted with metals). The HHERA concluded that localized petroleum hydrocarbon impacts were a potential risk to small herbaceous mammals and could potential hamper re-growth of vegetation if allowed to remain on the surface. The concentrations of arsenic, silver, copper, vanadium and zinc identified in soil and vegetation at the Roberts Bay mine site are also a potential health concern to small herbaceous mammals. The impacted soil is mainly comprised of the fine fraction of the waste rock and the tailings material. The recommendation of the HHERA was to mitigate these two sources by either reducing or eliminating the potential for human exposure.

The assessment of human health risks concluded that there would be negligible risk associated with periodic exposure to the Ida Bay mine site.

Roberts Bay and Ida Bay Abandoned Mine Sites, Geochemical Assessment in Support of Site Remediation (AMEC, 2006)

The objectives of the geochemical investigation were to conduct detailed geochemical assessment of the tailings and waste rock and to assess mobility of arsenic and other metals from the tailings pond. Twenty-two waste rock samples, seven tailings samples, four mine water samples and a vegetation sample were collected from the Roberts Bay Site for analyses.

It was determined that the majority of the waste rock and tailings at the Roberts Bay mine site is net non-acid generating. Concentrations of several metals in most waste rock at the Roberts Bay mine site were elevated relative to average background concentrations and results from leach solutions indicate that generation of ARD or leaching of metals of interest does not appear to be of concern for these waste rock materials. It was also determined that the concentration of metals of concern in mine water at the Roberts Bay and Ida Bay mine sites are much lower than Metal Mine Effluent Regulations (MMER) regulatory values and consequently treatment is not required before discharge to the environment.

Roberts Bay and Ida Bay Abandoned Mine Sites, Remediation Plan (AMEC 2007a)

The purpose of the Remediation Plan was to collectively examine the information collected during all investigations, summarize the possible site remediation options for waste rock, tailings, impacted soil, mine openings, hazardous waste, non-hazardous waste and debris at the Roberts Lake property and to develop a remediation plan. A number of parameters were selected for the evaluation and ranking of the proposed remedial alternatives so that a preferential remedial option could be determined for each site issue. The parameters were selected based on the desired outcomes and in consideration of the environment in which the project area is located.

Each remedial option was evaluated with respect to its potential risks, advantages and disadvantages. The remedial options were evaluated based on:

- long-term effectiveness;
- technical feasibility;
- protection of human health and safety;
- protection of ecological receptors such as caribou and fish through the effects on water quality and to vegetation (dust);
- overall time frame to implement;
- the need for long-term care and management of the site including post closure monitoring needs;
- capital costs; and
- operation and maintenance costs.

AMEC considered three different logistical “scenarios” for implementation of the proposed remediation plan. These “scenarios” are summarized as follows:

- Option 1: Mobilize equipment to site by sealift barge to the existing Doris North Project (now Hope Bay Limited) off-loading site (maintained by Miramar) on the west shore of Roberts Bay. Move heavy equipment across the ice in the following winter and complete the majority of the earthworks under winter conditions. Demobilize equipment in the following winter and ship equipment back off site by sealift barge. Total implementation time is in the order of 28 months resulting in significant equipment standby costs where the equipment is idle awaiting movement to and from the site.
- Option 2: Mobilize equipment to site by smaller sealift barge direct to the Ida Bay mine site. Complete earthworks at Ida Bay mine site during the summer and winter. Move heavy equipment across a winter road to the Roberts Bay mine site in the following winter and complete the majority of the earthworks under winter conditions. Demobilize equipment in the following winter and ship equipment back off site by sealift barge. Total implementation time is in the order of 28 months resulting in significant equipment standby costs where the equipment is idle awaiting movement to and from the site.

- Option 3: “Piggy back” remediation of the Roberts Bay and Ida Bay mine sites onto the back of the planned construction of the Doris North Project. A winter road would be constructed across Roberts Bay to connect the Doris North Project to the Roberts and Ida Bay mine sites. Remediation earthworks would be completed under winter conditions using the contractor personnel and equipment employed by Miramar to construct the Doris North Project, thus significantly reducing equipment mobilization and stand by costs. Under this option all non-hazardous demolition and site clean up debris would be trucked to the Doris North Project landfill site rather than create a non-hazardous landfill within the tailings pond at the Roberts Bay mine site as is proposed under options 1 and 2. Under Option 3, the approximately 390 m^3 of hydrocarbon and metal contaminated soils identified at the Roberts Bay mine site would be trucked to the Doris North Project to be placed underground in the permafrost as mine backfill thereby isolating it from the environment. Under Options 1 and 2 these soils will be removed from site to be disposed of at a licensed hazardous landfill site in Alberta.

The need to minimally disturb the natural environment was a paramount factor in the consideration of the potential remedial options. Potential effects/mitigation measures that were considered when selecting the remedial option included:

- wildlife habitat;
- minimizing construction of new roads, utilize winter and ice roads where possible; and
- minimizing disturbance beyond the existing footprint of the mine sites.

While there are some minor reductions in the mobilization/demobilization/standby costs for Option 2 as compared to Option 1, they are insignificant. Under Option 2, the earthworks at the Ida Bay mine site would be completed sooner than under Option 1 and most are done during the summer months. Option 2 has been described as having a slight advantage over Option 1 for the following reasons:

- quality of work and quality control is improved because most if the work in conducted during the summer at Ida Bay;
- there are no major structures above ground at Ida Bay that require removal and removing snow cover complicates the clean-up and removal of non-hazardous materials, small items etc.; and
- Ida Bay will be remediated and closed earlier with Option 2.

Should timing of the remediation work and other project requirements allow it, Option 3 would be the preferred alternative from a cost stand point. For Option 3, the mobilization/ demobilization/standby cost is reduced by “piggy backing” the remediation work onto the construction of the Doris North Project. Under this case, mobilization and demobilization of most of the heavy equipment is born by the Doris North Project and most of the standby costs are eliminated. Although “piggy backing" the remediation project with the Doris North project is

the most cost-effective, it may not be possible due to several unknowns such as permitting and construction status.

Roberts Bay and Ida Bay Abandoned Mine Sites, Geotechnical Assessment in Support of Site Remediation (AMEC, 2007b)

A detailed site plan and topographic survey was prepared for use as a base plan for the remediation program. Information regarding the logistics of mobilizing equipment and supplies to the site were discussed. Specific concerns relating to the mine openings at both the Roberts Bay and Ida Bay mine sites were described and management options provided.

Roberts Bay and Ida Bay Abandoned Mine Sites Environmental Site Assessment Report (Earth Tech, 2006a)

The objective of this assessment was to determine the extent and volumes of contaminated materials in order to support the development of a remedial plan for the site. Concerns related to Polychlorinated Biphenyls (PCBs), Polycyclic Aromatic Hydrocarbons (PAHs) and pesticides were not identified at the site. Impacted areas were limited to hydrocarbon and metal parameters in soil and waste rock fines. Concentrations of arsenic, barium, chromium, copper, lead, nickel, silver and zinc were typically an order of magnitude above measured background concentrations. The waste rock fines were located in all areas where waste rock had been stockpiled or used for construction. Concentrations of metals in the soil at the area of the mill were also elevated above background concentrations. The area of petroleum impacted soil was confined to the areas of the former fuel storage, the machine shop and the mill building. Earth Tech estimated 325 m^3 of petroleum impacted soil was present at the Roberts Bay mine site.

Roberts Bay and Ida Bay Abandoned Mine Sites - Geotechnical and Geophysical Report (Earth Tech, 2006b)

The objectives of the geotechnical assessment were to map surficial geology to provide locations and horizontal delineation of landforms, identify candidate locations for on-site landfill areas and determine the quantities of locally available borrow material. The objectives of the geophysical assessment were to identify and map any buried debris; and define the limits of any known landfills. Soil materials at the sites were typically composed of a surface organic layer (typically 15 to 30 cm deep) covering coarse textured mineral layers of sands and gravels with trace amounts of silt and clay-size materials. A frost layer was typically detected at about 0.6 m depth. Buried subsurface debris was generally not detected on the Roberts Bay mine site, with the exception of a medium sized buried ferrous object or shallow rock with high ferromagnetic properties in the area of the old camp (as determined by a geophysical survey). Four new locations and two previously developed areas were identified and evaluated as potential landfill sites and six borrow areas were identified at the Roberts Bay mine site.

No contaminated soil or water was identified at the Ida Bay mine site. About 9 m^3 of non-hazardous waste was identified at this site. A granular deposit for borrow material of about 1,200 m^3 of sand and gravel material with 1.1% fines to a thickness of 1 m is located about 250 m to the northeast of the site.

Roberts Bay and Ida Bay Abandoned Mine Sites - Waste Audit (Earth Tech, 2006c)

A detailed waste audit was conducted to determine the volumes of non-hazardous and hazardous waste. Approximately 355 m^3 of non-hazardous material was identified. As the nonhazardous waste was not located in close proximity to a water body, it was concluded that the material could be safely recovered without causing additional impacts to the surrounding environment. The recommendations with respect to the hazardous waste were that the material should be recovered and hauled to an approved off-site location for disposal. Due to the high lead content in the product used to paint the steel mill equipment, the recommendation was that the painted steel components are removed and hauled offsite for disposal or a lead abatement program be completed prior to recycling of the steel materials. The metal debris, such as the tent frame structures, has potential for re-use however the transportation costs may prohibit recycling. Earth Tech recommended the frames and trusses be cut and the material provided to the local community as stock.

Archaeological Impact Assessment – Ida Bay and Roberts Bay Mine Sites Remediation Program (FMA Heritage Resource Consultants Inc., 2006)

During the study, a total of eight archaeological sites were identified (NbNh-35 to NbNh-42). All sites identified consist of stone features; some sites also contain historic period artefacts. Of the eight sites identified, six are not within close proximity of the remediation activities, and no direct impact is anticipated from these activities. All six have been recommended for avoidance by remediation personnel, however, due to the moderate to high heritage value assigned to them. The remaining two sites (NbNh-39 and NbNh-42) are located within proximity of the Roberts Bay Mine site or the existing access to the site and avoidance of these areas by remediation personnel is recommended.

Roberts Bay/Ida Bay Mine Site Remediation – 99% Submission/Summary of Work (PWGSC, 2006)

PWGSC provided draft contract specifications which summarized the following details with respect to the proposed remediation activities:

- summary of work;
- work restrictions;
- project management and construction schedule;
- site-specific health and safety plan;
- environmental procedures;

- regulatory requirements;
- temporary facilities;
- mobilization and demobilization;
- camp facility;
- construction waste management and disposal;
- demolition and removal of hazardous waste;
- selective site demolition;
- mine opening seal;
- excavating, trenching and backfilling; and
- rough grading.

Specific project and mitigation details provided in this document have been incorporated into this assessment where possible.

Where applicable recommendations suggested in the previous reports have been incorporated into the proposed project activities.

1.6.3 Internet Resources

Various references/databases available on the Internet were also used for the preparation of this report including the following:

- Environment Canada - Species at Risk Act
  http://www.speciesatrisk.gc.ca/default_e.cfm;
  http://www.sis.ec.gc.ca/ec_species/ec_species_e.phtm
- Environment Canada, Canadian Wildlife Service – Migratory Birds Conservation
  http://www.cws-scf.ec.gc.ca/mbc-com/default.asp?lang=En&n=CF4732B8-1; and
  http://www.mb.ec.gc.ca/nature/ecb/da02s24.en.html#9
- Transport Canada - Navigable Waters Protection Program
  http://www.tc.gc.ca/marinesafety/Ships-and-operations-standards/nwp/menu.htm
  Environment Canada - Canadian Climate Normals 1970-2000.
  http://www.climat.meteo.ec.gc.ca/climate_normals/results_e.html?StnID=889&autofwd=1

1.7 PUBLIC CONSULTATION

In August 2006, INAC presented public consultation meetings in Cambridge Bay to inform community members about the proposed remediation of the Roberts Bay and Ida Bay mine sites. The presentation informed attendees about the site history, the existing conditions, and the remediation options. The remediation options were presented within the format of the Remediation Action Plan (AMEC, 2007a). The minutes from the community meetings have

been included in Appendix C for reference. A summary of the public consultation sessions is presented below in Table 1.3.

Table 1-3: Summary of Public Consultation Meetings in Cambridge Bay, Nunavut

Date	Summary of Consultation
August 30, 2006	Representatives of INAC and PWGSC hosted a Community Meeting at the Luke Novoligak Community Hall, Cambridge Bay. The Remediation Action Plan (RAP) was presented and questions from community members were answered. Community members asked questions concerning timing of remediation works, local employment in the remediation project, health hazards of the proposed works and cost of mine site remediation.
August 31, 2006	Representatives of INAC and PWGSC hosted a meeting with the Ekaluktutiak Hunters and Trappers Organization (HTO), Cambridge Bay. The HTO members asked questions regarding community benefit of the project, employment of local people, the timing of the project, bear monitoring, further consultation with elders, and other remediation projects in the north.
August 31, 2006	Representatives of INAC and PWGSC hosted a meeting with teachers and grade 11 and 12 students of Kiilinik High School, Cambridge Bay. The teachers and students asked questions regarding the role of INAC with the project, the project schedule, employment opportunities, and professional advice on how to become employed in the environmental remediation field.

Following the presentation of the proposed Remediation Action Plan during the three public consultation meetings representatives from INAC and PWGSC provided additional information as requested and answered questions. Some of the main questions raised related to the following aspects:

- it was explained that the tardiness in cleaning up Roberts Bay and Ida Bay mine sites was due to the fact that INAC has prioritized all contaminated sites that they are in charge of, and these two sites are of moderate priority; now they are next priority for clean-up;
- the potential removal of all materials from the site was described as not economically feasible (i.e., removal of non-hazardous materials from the site); in addition, discussions were carried out with local people and the town engineer in Cambridge Bay for the possibility of constructing a landfill that would receive the non-hazardous materials; this was not accepted by the town and the preference was given to be buried on site; and
- inquiries were made regarding creation of jobs during the clean-up project; it was confirmed by PWGSC that the remediation contractor will be hiring local people for most of the positions that will be available.

Feedback received during the public consultation sessions was incorporated into the development of the remediation plan.

2 PROJECT DESCRIPTION

This EA will consider the potential effects of the proposed remediation plan of the abandoned Roberts Bay and Ida Bay silver mines on the surrounding biophysical and social environments. The assessment will consider the spatial and temporal boundaries that encompass the periods and areas during and within which the proposed project may potentially interact with, and have an effect on, components of the environment.

Information regarding specific project details was summarized in the Remediation Plan (AMEC, 2007a) and the 99% Submission/Summary of Work (PWGSC, 2006). The remediation and abandonment of the mine sites includes the following and all related works:

- dismantling of infrastructure and segregation of wastes;
- drainage and cover of tailings pond;
- remediation of waste rock;
- remediation and disposal of non-hazardous waste;
- remediation and disposal of petroleum and metals impacted soil; and
- abandonment of mine openings.

The scope of the assessment includes the environmental effects of the remediation activities and subsequent closure/abandonment of the site. This would include the environmental effect of any malfunction or accident(s) that may occur in connection with the project and any cumulative effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out.

2.1 PROJECT LOCATION

The mines are located approximately 68^{o} 10’ 45” N by 106^{o} 33’ 29” W and about 115 km southwest of Cambridge Bay, Nunavut. An overview map showing the location of the project within Nunavut is provided in Figure 1, Appendix A. Figure 2 in Appendix A depicts the location of the two abandoned mine sites with respect to the Doris North Project.

2.1.1 Roberts Bay Mine Site

The Roberts Bay abandoned silver mine is located approximately 1 km north of Roberts Lake (Figures 3 and 4, Appendix A). The Roberts Bay mine site is located on and between two basaltic ridges, which run north-south. The site between the ridges occurs on a subtle crest primarily sloping southward and draining between the ridges into Roberts Lake (see Photographs 1, 2, and 3 in Appendix B). A restricted access trail (width 2.6 m) connects the floatplane and boat docking area located on Roberts Lake to the mine site.

2.1.2 Ida Bay Mine Site

The Ida Bay mine site is located on the north shore of Ida Bay on the Melville Peninsula adjacent to Melville Sound about 7 km north of the Roberts Bay mine site (Figure 2, Appendix A). The area of the Ida Bay mine site is located on a basaltic outcrop with north/south striking ridges. Adjacent to the outcrop are low-lying marshes underlain by coarse textured glacial till. The site slopes towards the southeast with surface drainage directly to the Arctic Ocean (Melville Sound). Figure 5 in Appendix A provides a description of the site plan for Ida Bay. Aerial photographs of the Ida Bay mine site are provided in Photographs 4 and 5, Appendix B.

2.2 SITE HISTORY

The Roberts Bay area was first staked by the Roberts Mining Company Ltd. in 1964. Silver was discovered at Roberts Bay in 1965. A silver showing was subsequently discovered and staked at Ida Bay in 1966. Exploration of the Ida Bay and Roberts Bay silver showings was conducted by the Hope Bay Silver Syndicate between 1967 and 1972 where exploration activities included trenching, drilling, mapping, and geophysical surveys. Mining equipment was mobilized to Ida Bay by Hope Bay Mines Ltd. (formerly Hope Bay Mining Co.) in 1973, and subsequent underground mining yielded over 10,000 ounces of high grade silver, shipped from site for metal recovery. The Roberts Bay deposit produced 10 tons of hand sorted ore with grades peaking at 4,863 oz/ton (approximately 15% silver).

In 1974 Hope Bay Mines Ltd. entered into a joint venture with Van Silver Explorations Ltd. And Reako Explorations to upgrade the Roberts Bay mine. A small 50 to 75 ton/day grinding flotation mill was constructed at the Roberts Bay mine site that yielded a total of 74,500 ounces of silver in the form of flotation concentrates until operations ceased in 1975. These concentrates were shipped off-site for metal recovery. Consequently, no leaching, smelting, or refining is believed to have occurred on site.

Further exploration continued at the leases throughout the 1980's and 1990's. In 1997, the Roberts Mining Lease was surrendered back to INAC and in 1998 the ground was re-staked as the ORO 5 claim.

In summary the history of the Roberts Bay and Ida Bay mine sites can be described as follows (Rescan, 2003):

Roberts Bay

- discover of silver deposit in 1964;
- exploration activities until 1972;
- commencement of mining activities in 1973 by Hope Bay which included the advancement of a 120 m long decline yielding 10 tons of hand sorted ore;
- 1974 expansion of the Roberts Bay Mine with the construction of a 50-70 ton/day mill;

- closure of mine in 1975 after yielding a total of 74 500 ounces of silver; and
- additional exploration activities occurred in the Roberts Bay area during the 1980's and 1990's.

Ida Bay

- discovery of the deposit at Ida Bay in 1965;
- exploration activities until 1972; and
- commencement of mining activities in 1973 which included the advancement of a 180 m long decline yielding 10 000 ounces of high grade silver.

In 2003, the site was identified, as a priority for cleanup under the Federal Contaminated Sites Accelerated Action Plan. Rescan Environmental Services Ltd. (Rescan, 2003) performed a preliminary assessment of the sites for PWGSC (acting on behalf of INAC) in 2003. In February 2004, Rescan conducted a combined Phase I/II Environmental Site Assessment for the sites on behalf of Indian and Northern Affairs Canada. In October 2004, Senes Consultants Limited completed Human Health Screening Level Risk Assessments for each of the two sites. AMEC, Earth Tech, EBA, and UMA, together with representatives of PWGSC and INAC, completed field studies for geotechnical, geochemical, ecological site assessment, and human health risk assessment in 2005, the results for which are summarized within this document.

In 2007, AMEC finalized a remediation plan for the mine sites from the information gathered during the 2004 and 2005 field assessments.

2.3 SITE ACCESS

The Roberts Bay and Ida Bay mine sites are located in an isolated area with no permanent road access. As part of this project, transportation options to move resources in and out of the area were investigated. The existing road between Roberts Bay and Ida Bay is restricted to ATVs and light equipment during the summer months. Heavy construction equipment can only travel between Roberts Bay and Ida Bay during winter months on ice roads.

The following discussion regarding potential access to the site was initially described in the Remediation Plan (AMEC, 2007a).

Winter Roads

Ice roads have been used in the past to connect the mine sites to Cambridge Bay (approximately 116 km long). Based on previous experience of local contractors, ice roads could be used in late winter and early spring, but not beyond mid-April. Ice roads are an effective alternative to the use of barges for the transport of equipment and materials. Ice roads are high maintenance, and close monitoring of ice roads is of paramount importance to ensure safety of workers and equipment.

Winter roads have the following advantages:

- they use limited or no fill material; minimal overburden material needs to be used and removed at the end of the project;
- provide good vehicle support; vehicles mounted on tracks are the preferred option;
- usually, their construction takes less time;
- they are less invasive for the environment, and leave a minimal print on a pristine environment; and
- a winter road connecting Roberts Bay and Ida Bay mine sites would allow movement of equipment and materials between the two sites along a suitable alignment, with minimal changes in elevation.

The Ida Bay mine site is located on the north shore of Ida Bay on the Melville Peninsula adjacent to Melville Sound about 6.2 km north of the Roberts Bay mine site (Figure 2). Given the amount of average annual snowfall in the area and the site conditions, winter roads are one of the preferred alternatives to access and connect the Roberts Bay and Ida Bay mine sites as well as provide access to the Doris North Project facilities if this alternative is selected.

Aerial Access

Currently, there are no air strips present at either of the two mine sites. It is not practical to build an air strip for remediation purposes. Access by air is therefore limited to float plane or helicopter. Supplies and personnel can be brought to the site by float plane during open water season (June 15 to September 15). Float plane landing points are envisaged at Roberts Lake approximately 1 km south of Roberts Bay mine site, and at the proposed docking location, on the north shore of Ida Bay mine site at Melville Sound. Float plane access from Roberts Lake could be fairly limited. The depth of water in Roberts Lake is sufficient for landing; however, the shoreline presents a morphology that is not suitable for docking boats or floatplanes requiring a large draft under full load. The shoreline at Roberts Lake is fairly shallow, sloping at a gentle angle to the water. Float plan landing on Melville Sound, along the shore east of the Ida Bay mine site is feasible provided float planes land at the preferred barge landing location, where a steep shore and deep waters were identified.

Helicopter pads could be easily prepared at both mine sites. There is limited or no vegetation at the sites, and low laying terrain morphology provides good opportunity and visibility for helicopter landing and take off. The pad would have to be built on a waste rock pad built on solid ground, or directly on a flat area adjacent to the mine site. This could be a very efficient way of accessing the site without any major disturbance to the environment. Helicopter access could be considered for emergency situations, for transport of supplies, personnel, and also removal of material form the site (debris, equipment, etc.).

Water Access

Open water is generally available in the region from 15 June to 15 September. Barge access is available in Roberts Bay during open water season approximately 1.5 km from the Roberts Bay mine site. However, careful consideration should be given to the barge draft requirements under a full load.

A single location for barge access from Melville Sound to Ida Bay mine site was located just 100 m or less to the northwest from the mine site. The shoreline at this location presents a steep drop in profile. The shore is mainly bare rock outcrops, so landing and transport on shore would be easier. The landing point is estimated to be around 7 or 8 m wide. The depth of water could not be measured, but is expected to be in excess of 2 m at 2 to 3 m from shoreline. NTCL subsequently confirmed from aerial photographic analysis that the area proximate to the Ida Bay mine site was suitable as a barge landinig. When selecting a barge, careful consideration should be given to the draft requirements under a full load. In addition, tidal water elevations should be monitored and coordinated with the requirements of maximum draft under full load. Barge landing should be avoided at a low tide level. Materials could be stockpiled at the shore during winter for removal by barge in the summer.

It should be noted that Miramar has been re-supplying their exploration camps at Windy Lake and Boston using NTCL supplied barges on an annual basis since the late 1990's. The barges are offloaded at a site on the west shore of Roberts Bay where equipment and material are stored pending winter conditions. In winter, the material and equipment are transported over ice roads across Roberts Bay and overland to these two exploration camps. The same routing could be used for remediation of the Roberts Bay and Ida Bay abandoned silver mine sites. The distance between the Miramar barge off-loading site and the Roberts Bay mine site is approximately 5 km with most of this across Roberts Bay.

2.4 EXISTING INFRASTRUCTURE

In 1996, Vista Engineering completed an inventory of the Roberts Bay mine site and its associated abandoned waste material, chemicals and the remaining infrastructure. The complete inventory is presented in Appendix D. The inventory included drums of ore processing chemicals, flotation chemicals, lime, nitric acid, carbonate, lead acid batteries, lube oil and detonation cord.

2.4.1 Roberts Bay Mine Site

At the Roberts bay mine site the prominent features remaining at the site are a variety of waste rock piles, two open and flooded adits, infrastructure remains of light framed "temporary" buildings, abandoned equipment, debris, an open surface landfill/dump with a waste rock berm, several surface ponds, drainage ditches and a small tailings pond (AMEC, 2007a). Waste rock was used at the mine site to level areas to support infrastructure and to construct berms for the landfill, fuel bladder and tailings pond. The waste rock pads vary in thickness from a thin

veneer, typically 0.2 to 0.5 m thick, spread over the surface to piles greater than 2 m high with some piles several meters high. The tailings pond was small (compared to many other facilities) measuring approximately 40 m in diameter and about 3 m deep at the thickest point (AMEC, 2007a). The estimated volume of tailings is 1,800 m^3 including the associated berm. The existing infrastructure of the Roberts Bay mine site is shown on Figures 3 and 4 in Appendix A.

2.4.2 Ida Bay Mine Site

The Ida Bay Mine appears to have been operated as an annex to the Roberts Bay Mine with no milling operations performed on-site (AMEC, 2007a). Hand picked ore from the Ida Bay Mine was either transported overland to Roberts Bay or shipped off-site for processing. The prominent features remaining at the abandoned mine site are four main piles or areas of waste rock and the open flooded adit (AMEC, 2007a). Figure 5 in Appendix A, shows the existing infrastructure of the Ida Bay mine site.

2.5 PROJECT ACTIVITIES

The proposed remediation activities at the Roberts Bay and Ida Bay mine sites are described below. The remediation plan prepared by AMEC (2007a) provides a general description of the materials that require removal/remediation for each site.

Roberts Bay Mine Site

- remaining infrastructure;
- tailings pond;
- waste rock;
- non-hazardous waste;
- hazardous waste;
- petroleum and metals impacted soil; and
- mine openings.

Ida Bay Mine Site

- remaining infrastructure, hazardous and non-hazardous waste;
- waste rock;
- mine openings; and
- marine sediments.

For each of the concerns identified above for the Roberts Bay and Ida Bay mine sites, AMEC (2007a) ranked the potential remedial options based on long-term effectiveness, technical feasibility, impact on human health and safety, impact on ecological health and safety, time to implement, on-going monitoring requirements, and capital cost. The benefits to local communities were not incorporated in this evaluation, however it was understood that PWGSC

has already initiated a planned public consultation process on the proposed remediation options. The preferred remedial options for the Roberts Bay and Ida Bay mine sites are summarized below in Tables 2-1 and 2-2, respectively.

Table 2-1: Preferred Remedial Options for the Roberts Bay Mine Site

Issue	Preferred Remedial Option
Infrastructure	Dismantle and segregate wastes into hazardous and non-hazardous materials. Hazardous materials removed from site. Non-hazardous material disposed of within the tailings pond and then capped with non-acid generating waste rock.
Tailings	Drain tailings (treat water if necessary); remove any spilled tailings and place into the pond; expand the containment area by expanding and flattening the berms to a minimum of 3H:1V to accommodate and bury non-hazardous waste (as needed); cover with approximately 2 m of compacted waste rock in the winter to establish permafrost and isolate frozen waste from the environment; cover with overburden.
Waste rock (NAG)	Utilized where required for cover, erosion control, backfill with the remainder re-graded and left in place.
Non-hazardous waste	Bury within the tailings pond and covered with waste rock to isolate from the environment. Recycle and reduce volumes where possible. Existing domestic landfill will be covered and the berms reinforced to enhance long-term physical stability.
Hazardous waste	Neutralize acids and incinerate petroleum products where feasible to reduce volumes with the majority of the waste containerized and transported off-site for disposal at an appropriate disposal facility in the south.
Petroleum and metals impacted soil	Excavate hydrocarbon contaminated soil from fuel storage compound and garage area (~325 m^3) and excavate metal laden soil from mill building area (~65 m^3), place in 1 m^3 supersacs or containers and transport off-site to an appropriate facility for treatment or disposal.
Mine openings	Infill with waste rock where feasible, blast the roof and then backfill depression with waste rock. Replace cap on the Roberts Bay Mine vent raise with an engineered pre-cast / cast-in-place concrete cap, and then cover with waste rock.

Table 2-2: Preferred Remediation Options for the Ida Bay Mine Site

Issue	Preferred Remedial Option
Infrastructure/non-hazardous and hazardous debris	Dismantle and segregate. Containerize hazardous debris and transport to an appropriate off-site facility. Reduce and recycle volumes of non-hazardous waste where possible and bury remainder within the adit at the Ida Bay mine site, then cap with waste rock. Move remaining to Roberts Bay mine site.
Waste Rock (NAG)	Remove from above the high tide level, utilize for backfill. Transport remainder to Roberts Bay for use as cover, backfill, etc.
Mine openings	Infill with waste rock, blast the roof and then backfill depression with additional waste rock.
Marine sediments	Remove the waste rock from the shoreline above high tide and manage with the remaining waste rock.

The detailed project description pertaining to the proposed remediation of the Roberts Bay and Ida Bay mine sites is provided below.

2.5.1 Roberts Bay Site Remediation

2.5.1.1 Site Infrastructure

At the end of mining activities, the supporting infrastructure was abandoned in place. Infrastructure remaining at the Roberts Bay mine site at the time of the assessment in August 2005 was identified in four areas:

- former camp
  - platforms and remains of several tent-cabin frames, outhouse and shed; and
  - core racks.
- mill area
  - metal frames (tent frames) of mill and assay lab; and
  - hazardous material storage shed.
- machine shop/adit;
  - metal frame of the machine shop; and
  - metal tent frame covering the underground mine adit entrance that was then enclosed within a chain link fence.
- pump house
  - remains of a shed which enclosed the pump

Key Issues

Hazardous materials, associated with the infrastructure, such as PCB containing equipment, asbestos-containing materials, mill process chemicals, waste oil, fuel and batteries have all been identified at the site. Concentrations of lead-based paint, greater than 500 ppm, were identified on the steel mill equipment (cone crusher, ball mill tanks and flotation cells, tables, etc.). Therefore, this equipment must be treated as hazardous waste under the guideline of the NWT Government (applicable within Nunavut) or the lead must be removed prior to the steel being recycled or disposed of on-site. Removing the lead paint at this remote site without spreading it around will be difficult due to the lack of indoor facilities in which to contain any sandblasting activity. The main issues pertaining to the remaining infrastructure are:

- physical safety risks to humans and terrestrial wildlife;
- risk of exposure to hazardous materials within the remains of the former buildings; and
- aesthetics.

Proposed Remediation

The proposed remediation strategy is to dismantle and segregate the different types of wastes at both the Roberts Bay and Ida Bay mines sites. Demolition activities proposed for the Roberts Bay mine site include the following:

- demolish adit cover building;
- demolish mill building and fresh water pumphouse. (metal frames and remains of a shed, wood, concrete, tires, steel, plastic, cables, abandoned equipment);
- demolish coarse ore hopper structure;
- demolish assay building;
- demolish reagent storage building;
- clean-up old camp area (platforms and remains of several tent-cabin frames, core racks, outhouse and shed);
- clean-up adit, garage, fuel bladder areas;
- clean-up mill, assay lab areas; and
- remove fuel bladder.

The remediation for the infrastructure would entail:

- removal of hazardous materials from the building remains and equipment; hazardous materials would then be managed appropriately and areas would be cleaned of any chemicals and impacted soils;
- the unpainted metal framed structures and equipment can be cut into manageable sizes for on-site burial in a non-hazardous landfill site to be developed within the tailings pond; painted surfaces identified as containing lead will either be subjected to lead abatement or taken off-site for disposal at an appropriate facility (the preferred option);
- the wood from the sheds, outhouse, pumphouse, etc. will be collected and broken down such that it can be burned or buried on-site; the ash from burning will be moved to the non-hazardous landfill; and
- debris from around the site would be collected and segregated into stockpiles of nonhazardous waste (i.e., wood, steel, and other inert material) for disposal within the nonhazardous landfill area.

The majority of the demolition and segregation will be undertaken by hand, although small equipment will be utilized for hauling and stockpiling the material in an on-site burial location. Opportunities to allow some suitable recycle of non-hazardous material such as the cut up steel tent frames will be explored with local communities although the great distance between the site and the local communities will likely be a significant disincentive to interested parties coming to the site to pick up these materials. Once dismantled, the demolition waste will be classified as

hazardous and non-hazardous waste and handled according to the remedial plan developed for the respective type of waste material

2.5.1.2 Tailings Pond

The ore produced at Roberts Bay was shipped off site for processing. However, during the last year of operation some ore at the Roberts Bay mine was subjected to flotation processing with the concentrate shipped offsite for further processing. Tailings produced during the process were deposited in the small tailings pond. Reportedly, only flotation tailings were produced with no cyanide or mercury used during processing of the ore on-site.

Key Issues

The main issues pertaining to the tailing pond are as follows:

- the semicircular berm may be too steep to maintain physical stability of the contained tailings in the long term presenting a physical risk;
- possible ecological and human exposure to metals (arsenic and lead) through direct contact with the tailings; and
- the tailings in their current condition are a potential source of dust and therefore represent a risk to ecological health.

Proposed Remediation

Draining of the standing water and covering the tailings in the winter time with a minimum of 2 m of waste rock to provide an isolation barrier and reestablish permafrost was determined to be the preferred solution. The steps in implementing this remedial strategy include:

- The existing berms around the tailings pond will be beefed up and re-graded to 3H:1V slope to provide a stable long-term structure. The estimated volume of clean waste rock required to implement this alternative is approximately 665 m3. This waste rock will be obtained from the waste rock stockpiles, from the Ida Bay mine site, and from the rock filled berms around the fuel bladder, fine ore pad and machine shop.
- The water in the tailings pond would be drained prior to the emplacement of clean waste rock. To minimize the impact to the environment and eliminate the use of a sedimentation pond, the water would be pumped into the underground mine adit so that it discharges at least 2 m below the current flooded surface. This will allow more rapid drawdown of the water from the tailings pond without fear of sediment release to the receiving aquatic environment. The water in the tailings pond has been found to have metals concentrations above the freshwater aquatic life guidelines but less than the MMER guidelines.
- Non-hazardous demolition debris from both the Roberts and Ida Bay mine sites would be buried within the tailings pond and then capped with clean waste rock.

- Tailings and waste rock fines from other areas of the site would be excavated and emplaced above the existing tailings.
- The entire surface of the tailings pond would be covered with no less than 2 m of waste rock to isolate the tailings from contact with people, wildlife and to prevent future wind and water erosion of the currently exposed tailings. Side slopes will also be reinforced with waste rock and flattened to a 3H:1V slope minimum to ensure long term stability.

2.5.1.3 Waste Rock Dumps

Historically, the waste rock was abandoned around the Roberts Bay mine site without consideration of treatment requirements. Some waste rock was used for construction of roads and infrastructure, usually as a surface veneer less than 1.0 m thickness. Other waste rock was abandoned in small piles around the site. The waste rock areas and piles (excluding the tailings pond) identified at the sites are summarized in Table 2-3.

Table 2-3: Volumes of Waste Rock at the Roberts Bay Mine Site

Site	Location	Volumes (m^3)			
		Clean	ARD	In-Use	Total
		WR	WR	WR	WR
Roberts Bay	Ore Pad - West Half	31			
	Ore Pad - East Half	32			
	Explosives Area (including road)	20			
	Fuel Bladder Berm - South Half	76			
	Fuel Bladder Berm - North Half	72			
	Waste Rock Pile - South End	80			
	Waste Rock Pile - North East End	80			
	Waste Rock Pile - North West End	80			
	Waste Rock Plateau - East	488			
	Waste Rock Plateau - North	332			
	Waste Rock Pile 1 (East)	155			
	Waste Rock Pile #2 (North)	27			
	Waste Rock Berm #1 (W of Fine Ore Pad))	59			
	Access Road to Ida Bay	451			
	Fine Ore Pad	134			
	Mill Yard Area (North)	251			
	Waste Rock Berm #2 (N of Tailings Pond)	44			
	Waste Rock Berm #3 (S of Tailings Pond)	321		321	
	Waste Rock Berm around existing Dump	48		48	
	Ramp of Waste Rock (to Adit #2)	64			
Total Waste Rock		2473	0	369	2842

The estimated total volume of waste rock at the Roberts Bay mine site is 2,842 m^3 based on site survey information and best estimates for average depths of veneers. Based on the geochemical test results, the potential for the waste rock to generate acidity and to release metals in the long term is very limited.

Key Issues

The key issues related to waste rock are:

- aesthetics; and
- use to infill openings, cover low laying areas and minimize visual impact.

The waste rock was confirmed to be non-acid generating and therefore it constitutes a valuable resource for use as backfill, re-grading, capping and erosion protection, without a need for special disposal conditions.

Proposed Remediation

Placement of the waste rock within the flooded sections of the underground workings is the preferred remedial strategy however, based on the geometry of the adit, there is not enough capacity within the adits. There is also the added difficulty that the adits are flooded and potentially unstable. The waste rock material could therefore be emplaced either within the adits, or used as backfill following adit roof blasting. The remaining waste rock could be used for backfilling, berm reinforcement, cover, and reshaping of the various site features. The steps entailed in implementing this solution area as follows:

- The maximum quantity of waste rock (approximately 100 m^3) will be emplaced within the adits. (Note: Some of the waste rock will have been used to infill the adit at Ida Bay prior to the remainder being transferred to Roberts Bay mine site.) The adit backs will then be blasted and additional waste rock will be used to backfill the depressions and level of the area to blend with the surrounding environment.
- The stockpiled overburden will be used to cover the waste rock and contour the landscape, as deemed necessary.

2.5.1.4 Non-Hazardous Waste

The Roberts Bay mine site had a flotation mill and maintenance shop that were constructed as wood and steel tent frames that have decayed leaving significant debris (wood, concrete, tires, steel, plastic, cabling, abandoned equipment, etc.). Site infrastructure was generally abandoned and left to decay leaving significant debris across the two sites (estimated at 375 m^3 of non- hazardous debris).

As part of the waste audit conducted by Earth Tech (2006c) approximately 92 m^3 of wood, 84 m^3 steel/metal products and 178 m^3 miscellaneous inert wastes were identified; for a total

quantity of 354 m^3. During the demolition of the site infrastructure, additional non-hazardous wastes are expected to be generated.

An existing surface landfill, containing domestic waste, is present on-site but it has not been closed out. It did not appear that any waste had been buried below grade at this location.

Key Issues

The debris currently present at the site is unsightly and unsafe to visitors and terrestrial wildlife. The existing landfill which was used for the disposal of domestic waste generated at the camp has not been appropriately covered. As such, the landfill presents a physical hazard which will need to be addressed as part of the remedial plan.

Proposed Remediation

The preferred remedial option is to leave the waste materials in place and simply provide a waste rock cover to isolate the waste from humans and wildlife and improve the aesthetics (Option 2). This provides a stable, long-term solution, at a low cost, and utilizing available materials. This would be implemented by using approximately 350 m^3 of waste rock to stabilize and finish the berms plus cover the surface of the landfill to a depth of approximately 1 m. This remedial option would require the use of earth moving equipment.

2.5.1.5 Hazardous Waste

The waste audit conducted by Earth Tech (2005c) created an inventory of hazardous wastes at the Roberts Bay mine site. The following hazardous materials were identified:

- Possible PCB containing equipment (capacitors, light ballasts) – 0.25 m^3;
- fuel – gasoline and jet fuel - 3200 L;
- hydrocarbon impacted water from fuel bladders and in barrels - 800 L;
- waste oils and glycols - 675 L;
- compressed gas cylinders – 10;
- mill process chemicals (xanthanate, various acids, calcium, lime, lead shavings);
- acids;
- equipment painted with lead amended paints – 11,000 kg;
- lead acid batteries – 0.25 m^3; and
- detonation cord.

Asbestos materials on site were limited to a transite panel constructed heating cabinet located within the former mill. Although confirmatory asbestos samples were not submitted it is expected that the transite board would contain in the range of 2 to 10% chrysotile asbestos. A few brake pads were also observed at both the Roberts Bay and Ida Bay mine sites.

Hazardous and non-hazardous waste found at the Ida Bay mine site will be transported to the Roberts Bay mine site so that waste materials can be managed together under strict handling conditions, and disposed of as appropriate (on site landfill, or off site).

Steel components covered with paint that has a lead concentration greater than 500 ppm is considered a hazardous waste. It should be removed and transported off-site to a facility licensed to receive lead waste. Alternatively the lead-based paint could be removed from the metal prior to recycling or disposal of the steel materials. Steel coated with lead-based paint should not be considered for on-site burial or donation to the community.

Key Issues

The key issue with the presence of hazardous waste at the site is the threat to human and terrestrial wildlife health and safety. Aesthetically the drums and containers are unappealing. If the containers of liquid waste remain at the site, there is a risk of spillage through puncture, corrosion, and/or vandalism, which could impact soil, surface water and/or groundwater.

Proposed Remediation

The preferred remedial option is to collect and remove the hazardous waste to an appropriate off-site facility. Where feasible, acids would be neutralized on-site. Abandoned petroleum products could be appropriately mixed and incinerated on-site to reduce the volume of hazardous waste requiring transportation. If the incinerator option is selected, the incinerator would have to be mobilized to the site and appropriate permitting would be required.

Remediation of waste lead and lead paint should be consistent with the “Guideline for Waste Lead and Lead Paint” published by the Government of the Northwest Territories in April 2004.

Remediation of waste batteries should be consistent with the “Guideline for the Management of Waste Batteries” published by the Government of the Northwest Territories in September 1998.

Hazardous materials would be placed into drums or overpacks, sealed, and appropriately labeled and manifested. The drums and overpacks will then be transferred via winter road to the barge loading site on Roberts Bay where they will be stored inside seacan shipping containers at the loading dock until open water season. The containers will then be transferred by barge to Hay River and then trucked to an appropriate disposal facility in Alberta. The costs associated with the transportation of the hazardous materials could be significantly reduced were this aspect of the work combined with the resources being utilized at the nearby Doris North Project.

2.5.1.6 Petroleum and Metals Impacted Soil

Both metals and petroleum hydrocarbon impacted soils were identified during the environmental site assessment conducted by Earth Tech (2006a). Metals impacted soil, mainly comprised of waste rock fines, was identified in the vicinity of the mill building and other areas of the site

where waste rock had been stockpiled. There is approximately 325 m^3 of petroleum contaminated soils located around the fuel storage compound, mill and garage at Roberts Bay and an additional 65 m^3 of metal contaminated soil from around the mill site.

Key Issues

The two primary concerns with the presence of the metals and the petroleum hydrocarbon impacted soil are:

- impacted soil represents a safety and toxicity hazard to humans and wildlife through soil contact, ingestion and vapour inhalation; and
- the petroleum hydrocarbons and metals may contaminate local surface and shallow groundwater (above the permafrost).

Proposed Remediation

Option 2 is the preferred remedial option which includes containerizing the contaminated soils and removing off-site for appropriate disposal as follows:

- excavate the 390 m^3 (325 m^3 hydrocarbon impacted soil + 65 m^3 metals impacted soil) of impacted soil and place into 1 m^3 capacity super-sack containers;
- transport the containers to the barge loading dock at Roberts Bay via the winter road; and
- transfer the containers by barge to Hay River and then by truck to an appropriate disposal facility in Alberta

This remedial option limits human and wildlife exposure (via ingestion, inhalation, or physical contact) to petroleum hydrocarbons and metals impacted soil and will not require future monitoring. Placing the impacted soil in a landfarm does not address the metals impacted soil, requires operation and maintenance and will take an estimated five years to naturally attenuate the hydrocarbon impacted soils.

2.5.1.7 Mine Openings

There were two mine openings identified at the Roberts Bay mine site. One adit, referred to here as Adit #1, was located to the northeast of the tailings pond. At the time of the 2005 site visit Adit #1 had been covered with a wooden framework and plywood against which some waste rock had been emplaced. Standing water was observed at the entrance to the adit indicating the mine working has flooded. A chain-link fence surrounded the adit to provide some protection against access.

A second adit, referred to as Adit #2, was located to the east of Adit #1 on the side of the eastern basaltic ridge. The walls of Adit #2 appear to have partially collapsed and a chain link

fence only partially surrounds it. Caving and fractures are evident implying the structural integrity of the opening is not sound.

A vent raise, sealed with concrete, was also identified to the north of the opening of Adit #2. There was no evidence of subsidence around the vent raise however; no details regarding the manner in which the raise was capped are available.

Key Issues

Physical hazards to the safety and health of humans and terrestrial animals who visit the site are posed by access available into the mine workings through the adits. The deteriorating structures and fences surrounding the adits detract from the aesthetic value of the site.

Proposed Remediation

The preferred remedial alternative will be the one in which access to the mine workings are permanently sealed to prevent access and will be stable for the long-term. Ideally, the remedial method will restrict human and wildlife access to mine water with elevated concentrations of metals. The PWGSC (2006) indicates that the two adit roofs and one vent raise will be blasted down and in-fill with clean waste rock following the following process:

- clear away fence, debris, and timbers at the entrance to the adits;
- drill and blast the top of the adit to drop the top of the adit;
- cover the remaining depressions with waste rock;
- place the pre-cast concrete cap over top of the current concrete capped vent raise; and
- cover the concrete cap with a minimum 500 mm of waste rock, and blend in with the surrounding area.

An engineered pre-cast concrete cap will be placed over top of the current concrete capped vent raise to ensure that this opening is permanently secured in accordance with prevailing mine safety regulations dealing with minimum cap strengths. The new cap will span the full width and length of the existing concrete cap, and shall be anchored in the surrounding rock at least 0.5 m away from the edges of the existing cap, to ensure that it is well founded on competent bedrock. Should a cast in place reinforced concrete cap be a more economical approach, it would also be an acceptable solution provided the minimum required concrete quality and strength are ensured. The new concrete cap will then be covered with waste rock.

2.5.2 Ida Bay Site Remediation

Based on the findings of the previous assessments, the main issues at the Ida Bay mine site to be addressed as part of the remediation plan are:

- remaining infrastructure including hazardous and non-hazardous waste;

- waste rock;
- mine openings; and
- marine sediments.

2.5.2.1 Site Infrastructure, Hazardous and Non-Hazardous Waste

An exploration trench was identified in the basaltic ridge west of the adit. Reportedly, the trench was excavated using blast and muck techniques. The trench was approximately 1.2 m wide, 8 to 10 m long and 1.0 m deep. Additional smaller trenches are present in the vicinity. At the time of the 2005 site visit the trench was filled with water (AMEC, 2007a). Warning signs had not been posted and oxidation staining was not visible.

Mine-related waste materials scattered around the Ida Bay mine site include the following:

- non-hazardous (wood, lumber, steel, rubber hoses, tin cans, auto parts) – approximately 9 m^3; and
- hazardous (e.g. broken lead batteries) – approximately 100 kg and a few asbestos brake pads.

Key Issues

The key issues are:

- aesthetics; and
- human health safety and safety of terrestrial wildlife.

Proposed Remediation

The preferred remedial strategy is to transport the non-hazardous waste to the Roberts Bay mine site where they will be co-managed. The preferred remedial option for the management of nonhazardous waste at Roberts Bay is burial within the tailings pond. The remaining infrastructure and debris would be collected and segregated by hand. The non-hazardous waste from Ida Bay would have to be transported to Roberts Bay and then placed in a 0.5 m lift above the tailings. The waste would then be covered with a minimum thickness of 2 m of waste rock.

The preferred option for the remediation of the exploration trench is to infill the trench with waste rock and contour with the existing grade. Earth moving equipment would be required to implement this task. Approximately 10 m^3 of the clean waste rock material will be required to backfill the exploration trench.

The preferred option of the management of the hazardous waste is to place the lead batteries and asbestos into appropriate containers and store the containers over the winter months at the

barge loading dock. In summer, the packaged hazardous material will be shipped to Hay River by barge for subsequent transport by truck to a suitable recycling and/or disposal facility in Alberta.

2.5.2.2 Waste Rock

Four waste rock piles were identified in proximity to the adit at the Ida Bay mine site (see Figure 5, Appendix A). The waste rock piles identified at the Ida Bay mine site are summarized in Table 2-4.

Table 2-4: Volumes of Waste Rock at the Ida Bay Mine Site

Site	Location	Volumes (m^3)			
		Clean WR	ARD WR	In-Use WR	Total WR
Ida Bay	Waste Rock Pile # 1 (East)	1606			
	Waste Rock Pile # 2 (North)	602			
	Waste Rock Pile # 3 (South)	148			
	Waste Rock Pile #4 (West)	156			
Total Waste Rock		2512			2512

The total volume of waste rock at Ida Bay was determined to be 2,512 m^3. As per the AMEC Geochemical report (2006), the waste rock was determined, based on static and kinetic test results, to be non-acid generating (NAG). In addition, all waste rock samples had paste pH values greater than 7.0 indicating that none of the samples are currently generating net acidity even though they have been exposed to weathering for greater than thirty years. The concentration of cadmium and mercury were elevated in the Ida Bay waste rock relative to average background concentrations.

Key Issues

The waste rock at Ida Bay is not expected to generate net acidic drainage or release deleterious concentrations of metals into the aquatic environment. The key issues related to waste rock are aesthetics and visual impact.

The clean or non-acid generating waste rock constitutes a valuable resource for use as backfill, re-grading, capping and erosion protection.

Proposed Remediation

If the waste rock were not required for backfill, re-grading, capping and erosion protection at either of the mine sites, it would be left in place and re-contoured. It is expected that the bulk of the waste rock present at Ida Bay mine site will be required to implement the remedial plan at the Roberts Bay mine site. Also, the visual impact at Ida Bay mine site will be considerably

improved. The required quantity of waste rock would be transported by truck via a winter road from Ida Bay to Roberts Bay mine site, with minimal or no impact to the environment.

The preferred remedial strategy was required to be a long-term, no maintenance, solution that will eliminate potential for metal leaching. Although off-site disposal meets these objectives, this alternative has a relatively high cost associated with both the transportation and tipping fee. The preferred option would be to place the waste rock within the flooded sections of the underground workings at Ida Bay and Roberts Bay mine sites, filling in all the trenches and the adit at Ida Bay first. The steps in implementing this remedial option are:

- remove the waste rock from above high tide level first, then the remainder using earth moving equipment;
- emplace waste rock within the adit at Ida Bay. If additional material can be placed in the vent raise this should also be undertaken; after placing the waste rock the adit (and vent raise) the rock would be blasted to drop the roof down on the waste rock; additional waste rock would then be used to infill the depression created and regrade the area; and
- load the remaining quantities of waste rock (~600 m^3) into trucks and transported via winter road to the Roberts Bay mine site where it will be used to cover and reshape the local site features.

2.5.2.3 Mine Openings

The adit is a prominent feature at the Ida Bay mine site and is fully open with no physical barrier, or posted warning signs to prevent access. The adit is located approximately 15 m from the ocean shoreline and at the time of the 2005 site visit, was fully flooded with fresh water. The timbers bracing the back of the adit entrance appear deteriorated and their structural integrity is uncertain.

A vent raise located to the west of the adit that had been covered with loose plywood which has begun to deteriorate. Below the plywood, the vent raise is filled with water.

Key Issues

The open adit at Ida Bay is a prominent safety hazard to humans or wildlife. The adit should be permanently sealed to prohibit access by humans or wildlife. The open and partially covered vent raise is also a safety hazard to humans or wildlife. The structural integrity of the timbers supporting the adit and the plywood covering the vent raise are uncertain.

Proposed Remediation

Placement of the waste rock within the flooded section of the adit and vent raise is the preferred remedial strategy however, based on the geometry of the adit and the expected permafrost zone, there would not be enough capacity within the adit and vent raise for all the waste rock. There is also the added difficulty that the adit and vent raise are flooded and potentially

unstable. Provided the material could be placed safely this would be a preferred alternative. However, the majority of the waste rock would be transported to the Roberts Bay mine site. PWGSC (2006) suggests that the adit and vent raise be sealed using the following process:

- remove timbers at entrance to adit;
- drill and blast the top of the adit to drop the top of the adit;
- cover the remaining depressions with waste rock;
- place the pre-cast concrete cap over the vent raise; and
- drill and blast the vent shaft. Fill depression with waste rock.

2.5.2.4 Marine Sediments

The most southern waste rock pile was observed to extend from land into the ocean and is partially covered by seawater at high tide. The volume of waste rock material deposited within the ocean tidal zone is estimated to be less than 20 m^3.

Key Issues

Approximately 20 m^3 of sediment impacted with metals (copper and lead) were identified below the waste rock pile which extended into the tidal zone which may impact the aquatic environment.

Proposed Remediation

The preferred remedial option is to remove the waste rock from the shoreline above high tide while leaving the impacted sediment in place. Metals are not currently leaching into the marine environment and removal of sediment would only serve to increase disturbance in the near-shore marine environment. This will leave the aquatic environment undisturbed while eliminating a potential source of future impact. The steps in this remedial plan are:

- survey and mark the high tide elevation;
- excavate the waste rock above the high tide; and
- transport the remaining waste rock to Roberts Bay via a winter road where it will be used for backfilling and reshaping.

The implementation of this remedial option will require the construction of a winter road using earth moving equipment, excavation of waste rock using earth moving equipment and a truck to haul the waste rock over land to Roberts Bay.

2.5.3 Work Camp

A temporary work camp will be constructed at the Roberts Bay mine site for the remediation crew during the summer seasons of years 1 and 2. During the winter months the remediation

crew could be based out of the Doris North Project site. It is anticipated that the temporary camp, including its facilities, utilities, services, location and operation will follow applicable Federal, Territorial, and local codes, regulations and requirements governing camps, including environmental regulatory requirements, Land Use Permit and Water Licence (Jacques Whitford, 2005).

The provisions of the camp facilities services are described as follows (PWGSC, 2006):

- utilities and services required for camp such as heating, lighting, fuel, potable, and domestic water systems;
- sewage collection;
- treatment and disposal systems;
- waste, refuse and garbage collection and disposal system;
- camp fire prevention;
- alarm and fire fighting system;
- camp safety and security service;
- meals and catering service;
- shower/wash facilities;
- sleeping and washroom facilities;
- bedding and bedding laundry service;
- janitorial service;
- recreational facilities; and
- personnel laundry facilities.

Camp facilities services for the contractor's workforce, surveyors, engineer, specialist inspectors and for two (2) over night visitors will be provided. Separate space is to be provided for female staff. Water will be provided that meets Health Canada Guidelines for Canadian Drinking Water Quality.

After the remediation works are complete, the temporary camp will be decommissioned and demobilized from the site. All camp structures, facilities, garbage and equipment will be removed from the site, and the area will be left in a secured state for human health and ecological sustainability.

2.5.4 Proposed Schedule of Remediation Activities

A number of different project scenarios have been suggested by PWGSC. At the time of report preparation the specific remediation activities and project schedule had not been finalized.

The available information suggests that a winter road would be constructed and maintained between the south end of Roberts Bay and the Roberts Bay and Ida Bay mine sites to allow the

contractor's equipment to travel between the two sites during this winter period to complete the major earth moving components of the remediation plan.

The proposed activities of the remediation program at the Roberts Bay and Ida Bay mine sites, based primarily on Option 2 described in the Remediation Plan (AMEC, 2007a), are summarized in Table 2-5 below.

Table 2-5: Task Description and Tentative Schedule Based on Option 2 - Roberts Bay and Ida Bay Mine Site Remediation

Task	Tentative Schedule	Duration
Mobilization - Summer Year 1		
Mobilize equipment & supplies to Hay River	June 1 – August 22, 2007	11 weeks
Barge departs Hay River for Ida Bay		
Barge off loads at Ida Bay		
Place Equipment & Material in Storage	October 2007 – January, 2008	22 weeks
Construct Ice Road to Roberts Bay Minesite	January 2008	3 weeks
Move Equipment to Roberts Bay Minesite		
Summer Earthworks - Year 1		
Drill off and blast in adit roof opening at Ida Bay	August 15 – September 30, 2007	6 weeks
Fill in blasted depressions at Ida Bay adit (allow for settling)		
Drill off and blast in Ida Bay vent raise opening		
Fill in blasted depression over Ida Bay vent raise		
Backfill exploration trenches at Ida Bay mine site		
Re-grade Ida Bay waste site		
Set Up Camp in Summer of Year 1		
Fly camp, equipment & supplies to Cambridge Bay	June 2007	4 weeks
Fly camp, equipment & supplies to Roberts Bay Mine site		
Set up Construction Camp at Roberts Bay Mine		
Collect Hazardous Materials & Prepare for shipment offsite	July 2007	4 weeks
Demolish structures	July 1 – August 31, 2007	8 weeks
Collect and move non-hazardous debris into piles at Roberts & Ida Bay mine sites ready for transfer		
Dewater tailings pond	August 15 – August 30, 2007	1 week
Winter Earthworks - Year 2		
Drill off and blast in adit roof openings (2) at Ida Bay mine site	February 1 – March 30, 2008	8 weeks
Fill in blasted depressions at Roberts Bay adits (allow for settling)		
Move excess waste rock from Ida Bay to Roberts Bay		
Move hazardous and non-hazardous waste to Roberts Bay mine site		

Summer Earthworks - Year 2		
Re-open Camp	June 2008	4 weeks
Excavate hole and bury demolition debris in tailings pond		
Cover tailings pond with waste rock cap	July 2008	4 weeks
Construct tailings pond stabilizing berm		
Place pre-cast concrete cap on Roberts Bay Vent raise		
Cover pre-cast shaft cap with clean waste rock		
Excavate hydrocarbon & metal contaminated soils & place in sacks/containers for shipment	July 1 – August 30, 2008	8 weeks
Re-grade Roberts Bay mine site	August 2008	2 weeks
Decommission and remove camp		
Winter Works - Year 3		
Construct Winter Road to Ida Bay	January 15 – January 31, 2009	2 weeks
Move sacks of contaminated soil to barge loading site	February 1 – February 15, 2009	2 weeks
Move equipment to barge loading site		
Ship equipment to Hay River via barge	August 15 – September 30, 2009	6 weeks
Ship hazardous material by barge to Hay River		
Transport hazardous material from Hay River to disposal sites in Alberta	October 2009	4 weeks
Dispose of hazardous material at licensed sites		
Post Closure Water Quality Monitoring	July 2007, 2008 and 2009	Annually

The equipment and material for implementation of the remediation plan would be mobilized to the Ida Bay mine site via a smaller dedicated barge from Hay River in the summer open water season of Year 1 (2007). The equipment would arrive at the Ida Bay mine site in mid August and be off-loaded. T he major earthworks required at the Ida Bay mine site would be completed in the late summer of Year 1 (between mid August and mid September).

In preparation for this work, a tent camp would be flown to site and set up at the Roberts Bay mine site in the summer of Year 1 (June 2007). The camp would be used as a base of operation for a small crew who would be tasked with collecting and re-packaging hazardous materials, demolishing the structures and assembling the non-hazardous waste materials in piles at both the Roberts and Ida Bay mine sites (AMEC, 2007a). This crew would have no heavy equipment prior to the arrival of the barge in August, consequently their work would be hand work, labour intensive with movement between the two sites restricted to an all terrain vehicle and trailer brought to site by a floatplane or open boat from Cambridge Bay or by helicopter. In mid August, once the barge arrived, the heavy equipment would be used to essentially complete the required earthworks at the Ida Bay mine site. The camp would be closed down for the winter in late September.

The camp would be re-opened in mid January to support the winter earthworks program and operated through the end of March. All remaining waste rock required at Roberts Bay, heavy equipment, hazardous and non-hazardous material would be moved to the Roberts Bay mine

site by the end of March with remediation of the Ida Bay mine site essentially complete. The camp would again be closed until the summer of Year 2 (June 2008). The camp would be re-opened in June of Year 2 and the remainder of the site remediation work completed at the Roberts Bay Site. This work would primarily focus on placing all non-hazardous waste in the tailings pond and capping the tailings pond. The Roberts Bay mine site would be essentially remediated by the end of August at which time the camp would be decommissioned and dismantled.

The winter road between the Roberts Bay mine site and the Ida Bay barge loading site would be re-established in mid-January of Year 3 (2009) and all of the equipment, the hazardous material and sacks of contaminated soil would be transported to the barge loading site to be held pending arrival of the barge in mid August (AMEC, 2007a). All of this equipment and hazardous material would be shipped by barge to Hay River in the late summer of Year 3. Upon arrival in Hay River, the equipment would be shipped back to Edmonton and the hazardous materials transported to the appropriate disposal facilities in Alberta (such as Swan Hill). This remediation scenario requires that most of the equipment be assigned to this project for a total time period approaching 28 months (June of Year 1 through October of Year 3). The actual usage of the equipment (operating time) over this 28 month period would be in the order of 6 months.

2.6 SUMMARY OF KEY PROJECT ACTIVITIES AND POTENTIAL ACCIDENTS

The key project activities for the remediation of the Roberts Bay and Ida Bay mine sites can be divided into the following three tasks:

- the mobilization of equipment and personnel to/from the site;
- the remediation of the site; and
- the demobilization of the site.

The material outputs for this project are limited to building materials, consumables used for routine maintenance of equipment and fuel/oil brought onto the site in support of the remediation activities. General refuse including food wastes generated during routine operations of the temporary tent camp will require appropriate management. Typical activities associated with the remediation activities proposed for the Roberts Bay and Ida Bay mine sites, together with key material/resource inputs and outputs are summarized in Table 2-6.

Accidents and malfunctions can occur during both the mobilization/demobilization phase and the remediation phase of the proposed project. However, they will likely have a low probability and be short-term in nature. Spills of deleterious materials such as fuels that will be present on-site have the potential to adversely affect the receiving environment, or cause harm to human health. The presence of hazardous materials on-site, such as asbestos and contaminated soils, also poses an additional risk to human health and the receiving environment. Although site specific management plans will be implemented to address potential incidents, accidental spills of fuel, or the malfunction of equipment containing this material, could release the substance into the environment.

Table 2-6: ***Summary of Key Activities and Potential Accidents that May Occur During Remediation of the Roberts Bay and Ida Bay Mine Sites***

Major Tasks	Duration	Material and Resource Inputs	Material and Resource Outputs
Mobilization			
Transport equipment to Roberts Bay	3 months	Energy, water, and fuel for equipment	Emissions, noise and dust (during summer) Consumables used for routine maintenance of equipment
Construction/operation of winter road	4 months	Energy, water, and fuel for equipment	Emissions and noise Consumables used for routine maintenance of equipment
Transport equipment from the staging area to the sites	1 month	Energy, water, and fuel for equipment	Emissions, noise and dust (during summer) Consumables used for routine maintenance of equipment
Construction/routine operations of small tent camp at Roberts Bay mine site	3 months	Energy, water, fuel for equipment and building materials.	Emissions, noise and dust (during summer) Consumables used for routine maintenance of equipment Building wastes and general refuse (including food wastes)
Accidents			Oil and gas leaks from vehicles. Spills of materials associated with equipment being moved, used during remediation activities or stored at the camp. Accidental release of hazardous materials being moved/packaged for transport off-site on. Loss of equipment of materials into the marine environment at the barge loading.
Remediation Activities			
Collecting, repackaging hazardous materials, demolishing structures and assembling non-hazardous waste materials into piles at both mine sites	3 months	Energy, water, and fuel for equipment	Emissions, noise and dust (during summer) Appropriately packaged hazardous materials Stockpiled demolition waste and non-hazardous materials
Winter earth moving	3 months	Energy, water, and fuel for equipment	Emissions and noise

Major Tasks	Duration	Material and Resource Inputs	Material and Resource Outputs
Remediation of tailings area, waste rock dumps, mine openings and non-hazardous wastes	3 months	Energy, water, and fuel for equipment.	Organic and inorganic waste. Waste removed to approved dumping site; some dust, emissions and noise.
Excavation and transportation of hydrocarbon and metal contaminated soil from the Roberts Bay mine site	3 months	Energy, water, and fuel for equipment	Minor drainage water and waste created.
Hazardous material barged to Hay River	2 months	Energy, water, and fuel for equipment.	Minor waste materials; some dust, emissions and noise. Waste removed to an approved landfill site.
Accidents			Oil and gas leaks from construction equipment. Spills of materials associated with equipment being moved or used during remediation activities. Accidental release of hazardous materials being moved/packaged for transport off-site.
Demobilization			
Summer camp decommissioned and demobilization of personnel	1 month		Energy, water, fuel for equipment and vehicles to leave site. Wastes generated by routine camp operations will be managed appropriately. All materials and wastes associated with the camp will be removed from the site during demobilization.
Accidents			Oil and gas leaks from vehicles. Spills of materials associated with equipment being moved, used during remediation activities or stored at the camp. Accidental release of hazardous materials being moved/packaged for transport off-site. Loss of equipment of materials into the marine environment at the barge loading.

3 ENVIRONMENTAL ASSESSMENT METHODOLOGY

3.1 OVERVIEW AND APPROACH

This assessment is designed to identify the effects on physical, biological, social and environmental components that are found in the projects area. Various assessment phases are included in this report, the details for which are provided in the following sections:

- VEC definition and selection;
- description of existing environment;
- study area boundaries;
- identification of interactions and potential effects;
- mitigation;
- residual environmental effects; and
- cumulative effects assessment.

3.1.1 VEC Definition and Selection

The assessment of the impacts of the project on VECs is done in consideration of the spatial and temporal scope of the proposed project. Following the review of the baseline conditions for the study area, information provided by PWGSC, and similar projects recently completed in Nunavut (Jacques Whitford, 2005a; 2005b) and the neighbouring Doris North Project, eleven components potentially affected by the proposed project were identified as valued ecological/socio-economic components:

- air quality and noise;
- soil quality;
- terrain, geology, hydrogeology and vegetation;
- wildlife and wildlife habitat;
- water quality;
- aquatic resources;
- health and safety;
- archaeology and heritage resources;
- land use;
- aesthetics; and
- socio-economic conditions.

Due to the relatively small scale of the proposed remediation activities, burning of fossil fuels (associated with climate change) and accidental injury to workers was considered outside the scope of this assessment. The socio-economic assessment was limited to the basic

requirements outlined in the Canadian Environmental Assessment Act which limit the discussion to "*any change that the project may cause in the environment, including and such change on health and socio-economic conditions*." The screening-level EA involves the evaluation of remediation activities, proposed monitoring activities and accidents on the VECs/VSECs.

3.1.2 Description of the Existing Environment

The EA of the proposed remediation of the Roberts Bay and Ida Bay mine sites is based on available bio-physical, aquatic, and cultural attributes collected from past studies and assessments. Where site specific information was unavailable, regional data acquired from environmental assessments associated with the Doris North Project were reviewed and used if applicable. A brief description of baseline conditions is provided for each of the VECs/VSECs described above.

3.1.3 Study Boundaries

Following a review of the project description and associated schedule, the following general spatial and temporal boundaries have been selected for the effects assessment.

Spatial Boundaries

As this assessment is being conducted under CEAA, the local study area boundary for this assessment includes the area that may be directly and/or indirectly affected by the proposed remediation of the two mine sites. The study area boundaries will be in place during the remediation works and throughout the post-remediation monitoring phase of the project.

The area of the proposed works will only include the existing mine sites and the road connecting the Roberts Bay mine site to the Ida Bay mine site. The construction and use of winter roads has been included in the proposed remediation works as a method of moving heavy machinery to and from the mine sites. The winter roads are proposed to be located between the two mine sites and from the Roberts Bay mine site to the Doris North jetty at Roberts Bay.

The spatial boundary for the area of proposed works that have the potential to affect the local aquatic environment includes the two mine sites, as well as the drainage areas associated with the mine sites. For the Roberts Bay mine site this area includes the drainage area to the south of the mine site to Roberts Lake. The Ida Bay mine site assessment includes the marine shoreline of Ida Bay (Figure 5, Appendix A).

For the purpose of this project, the regional study area encompasses the Doris North Project which is the only other project in the area.

Temporal Boundaries

Following a review of the available information the following general timeline has been identified.

- Summer 2007 - mobilize equipment by barge to the Ida Bay mine site;
- June 2007 - construction of small camp at Roberts Bay;
- September 2007 - complete site works at Ida Bay;
- January 2008 - construction of winter road between Roberts Bay, Ida Bay and Doris North jetty;
- January to April 2008 - move equipment to Roberts Bay;
- January to April 2008 - move remaining waste rock that was left behind after backfilling the depressions/openings at Ida bay to Roberts Bay for use as fill material;
- June 2008 to September 2008 - remediation of Roberts Bay mine site;
- January 2009 to March 2009 – Re-establish winter road between Ida Bay and Roberts Bay. Demobilize equipment, wastes etc. back to Ida Bay; and
- August 2009 to September 2009 – ship equipment and hazardous materials off site by barge from Ida Bay.

At this time the duration of remediation activities, including mobilization and demobilization of equipment, appears to be approximately 28 months. Specific dates for the various remediation activities were not known at the time of report preparation. Although it is recognized that the severe winters in the area make working in the winter difficult, winter roads have to be constructed and used to move equipment between the Ida Bay and Roberts Bay mine sites to minimize adverse environmental affects. It was suggested that the majority of winter work be conducted between March and April when the temperatures may be warmer but there is still enough snow on the ground to provide the needed protection to the terrestrial environment.

The schedule does not include the additional environmental monitoring that may be required after the remediation activities are completed. At the time of report preparation, post remediation activities were limited to a simple long-term monitoring program, requiring only simple instrumentation installed at the Roberts Bay Site. Post-closure environmental monitoring, during the two year long implementation timeframe and for an additional 25 year period on a diminishing scale (every year for the first 5 years, followed by once every 5 years through 25 years, will also be required.

No instrumentation should be required at the Ida Bay mine site as no landfill or hazardous materials are expected to remain at the site after remediation. Installation of groundwater monitoring equipment should not be necessary because the small water shed and shallow active zone. The chemistry of the local surface water should closely represent the chemistry of the groundwater in the active zone.

3.1.4 Identification of Interactions and Potential Effects

Following a review of available baseline information the interactions and potential effects associated with the preferred remediation option on the environment, prior to mitigation, are described. In identifying potential environmental effects associated with the proposed project, interactions between the project VECs/VSECs and environment are characterized. Project-environment interactions are assessed by answering the following questions:

- how do interactions occur?
- where do interactions occur?
- when do interactions occur?

The following standardized codes and descriptors were used to perform the project-environment assessment, the details for which are summarized in Appendix E:

- mitigation success;
- magnitude of effect;
- geographic extent;
- duration;
- frequency;
- reversibility;
- residual effects rating;
- probability of occurrence; and
- level of confidence.

A summary of those biophysical and socio-economic components that may be adversely affected by the proposed project and for which there is proposed mitigation adequate to reduce those effects is presented in Appendix F.

3.1.5 Mitigation Measures

Mitigation measures are suggested within each assessment section. A detailed explanation of the mitigation measures is found within the Remediation Plan (AMEC, 2007a) and 99% Project Specification provided by PWGSC (2006). At the time of report preparation the project description was still being finalized therefore the mitigation measures considered address various potential affects that may not be a concern following selection of the final remedial option. The suggested mitigation measures are designed to minimize the potential environmental impacts of the remediation activities. Where indicated, post-remediation monitoring has also been described in order to ensure potential long term affects are adequately addressed.

3.1.6 Residual Impacts

The expected residual impacts of the remediation works take into consideration the existing conditions, the proposed remediation and finally the proposed mitigation measures. Residual environmental effects after the implementation of appropriate mitigation measures are identified and importance of the effects rated. For the purpose of this assessment Table 3-1 below summarizes the definitions used for characterizing potential residual effects.

Table 3-1: Definitions for Characterising Residual Effects Identified for the Remediation of the Roberts Bay and Ida Bay Mine Sites

Level	Definition
High	Potential impact could threaten sustainability of the resource and should be considered a management concern. Research, monitoring and/or recovery initiatives should be considered.
Medium	Potential impact could result in a decline in resource to lower-than-baseline but stable levels in the study area after project closure and into the foreseeable future. Regional management actions such as research, monitoring and/or recovery initiatives may be required.
Low	Potential impact may result in a slight decline in resource in study area during the life of the project. Research, monitoring and/or recovery initiatives would not normally be required.
Minimal	Potential impact may result in a slight decline in resource in study area during remediation activities, but the resource should return to baseline levels.

3.2 CUMULATIVE ENVIRONMENTAL EFFECTS

Cumulative effects will occur when two or more concurrent project activities interact either additively or synergistically to further exacerbate the effect on a VEC. Other activities that have or are likely to take place in the foreseeable future (i.e., projects currently planned and scheduled) can also lead to cumulative effects on VECs.

The analysis of the cumulative effects of the proposed project includes the following steps:

- identification of other activities that may overlap cumulatively with the proposed project;
- analysis of residual effects of proposed project;
- mitigation measures; and
- determination of significance of cumulative effects.

4 ENVIRONMENTAL EFFECTS ASSESSMENT

The preferred remedial option, described in the Remediation Plan (AMEC, 2007a) was used for this effects assessment, with additional details from the 99% Project Specification (PWGSC, 2006) included where applicable.

4.1 AIR QUALITY AND NOISE

4.1.1 Description of Existing Environment

Air Quality

The closest permanent meteorological station to the mine sites is the Cambridge Bay Airport station, operated by Environment Canada. Precipitation and temperature records for the Cambridge Bay Airport are shown in Table 4-1, summarized from Canadian Climate Normal information published by Environment Canada.

Table 4-1: Average Monthly and Annual Precipitation, Cambridge Bay Airport

	Rainfall (mm)	Snowfall (cm)	Precipitation (mm)	Average Snow Depth (cm)
January	0	5.6	4.6	21
February	0	6.4	5.1	24
March	0	7.4	6	28
April	0.1	7.5	6.5	31
May	1.6	9.3	9.4	30
June	9.8	2.8	12.5	7
July	21.7	0	21.7	0
August	24.5	2.2	26.7	0
September	11.4	8.9	19.3	1
October	0.4	16.2	14.6	7
November	0	9.3	7.2	14
December	0	6.3	5.3	18
YEAR	69.6	82.1	138.8	15

Source: Environment Canada, Canadian Climate Normals, 1971–2000, Cambridge Bay Airport, Nunavut.

The average annual precipitation is 69.6 mm rainfall, 821 mm snowfall, and 138.8 cm total precipitation. The mean daily high for July is 12.3°C and low of 4.6°C. The January mean daily high is -29.3°C and low of -36.3°C. The fluctuation between highs and lows for daily temperature averages 7.0°C.

The air quality assessment for the Doris North Project included predictions of SO_2, NO_2, TSP, PM_{10} and $PM_{2.5}$ as well as dust deposition rates. The maximum predicted 1-hour and 24-hour NO_2 concentrations were also below the applicable Federal objectives. The annual NO_2 concentration was predicted to be above the desirable Federal objectives over a small area

(0.5 ha) but was predicted to be within the acceptable Federal objectives. All of the annual PM_{10} predictions were below the US EPA primary standard, which was developed to be protective of the entire population. It was determined that the predicted 24-hour $PM_{2.5}$ concentrations would not exceed Canada -Wide Standards. The maximum annual $PM_{2.5}$ concentration was below the applicable US EPA primary standard of 15 µg/m³. The maximum annual deposition rate was predicted to be below the applicable criteria. Given that the key indicators meet those criteria designed to protect the receiving environment, no effects on the receiving environment were expected as a consequence of emissions from the Doris North project.

Activities associated with the remediation of the Roberts Bay and Ida Bay mine sites are short term in nature and would be expected to be negligible when compared to the emissions generated from the Doris North Project.

Noise

It was determined that sounds emitted from the Doris North Project would result in changes to the ambient noise levels, and that the resulting noise would return to background levels within 3 to 4 km of the active area. Potential effects that change in noise levels could have on the receiving environment (e.g., wildlife behaviour), were evaluated and identified as being minimal. No additional environmental effects are expected as a result of sounds emitted from the Doris North Project. Activities associated with the remediation of the Roberts Bay and Ida Bay mine sites are short term in nature and would be expected to be negligible when compared to the noise generated from the Doris North Project.

4.1.2 Air Quality and Noise Impact Assessment

4.1.2.1 Identification of Interactions and Potential Effects

In order to complete the proposed project, heavy machinery and ATV's will be utilized. Consequently, there will be low 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 and burning of non-hazardous waste. There is also minimal potential for generation of dust from vehicle operation on areas of exposed soil, such as ATV use between the two mine sites. All emissions will be short-term and restricted to the mine sites and the road between the two sites.

The primary sources of sound from the remediation activities will be associated with the camp, vehicles (i.e. ATVs) and equipment/machinery. Noise associated with these sources will be short-term and restricted to the mine sites and the road between the two sites.

4.1.2.2 Mitigation

Due to the short duration of the proposed project and the small scale of earth works, the level of emissions and windblown dust is expected to be minimal. Where required land/road surfaces

will be wetted during earth moving activities. The amount of soil exposed and disturbed will be limited to the areas requiring remediation and the movement of soils will be minimized whenever possible. Exposed soil piles will be covered. The removal of hazardous materials from the site will minimize the risk of effects on air quality over the long term.

General mitigation measures for the short-term noise, intermittent noise that will be generated during remediation activities include: maintaining equipment in good working condition and turning equipment off when not in use where practicable. Wildlife and employees working on the remediation project are expected to be the only receptors exposed to the elevated noise levels. Wildlife, in most cases will instinctively move away from the intermittent noise. Employees will implement appropriate hearing protection measures.

4.1.2.3 Residual Environmental Effects

Definition of Significance

Significant impacts to air quality 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 and 2003) are the standards used.

Significant impacts to noise levels would be directly associated with the potential receptors in the local area. As previously indicated, wildlife and employees working on the remediation project are expected to be the only receptors exposed to the short term elevated noise levels.

Summary of Environmental Effects on Air Quality and Noise

The proposed remediation of the mine sites will not have a negative impact on the air quality or noise within the project area. Furthermore, the removal of contaminated soils and hazardous material will likely improve the local air quality, by eliminating a source of contaminated wind blown material.

Residual effects to air quality and noise associated with the proposed remediation project were determined to be not significant and are summarized below in Table 4-2.

Table 4-2: Summary of Residual Effects to Air Quality and Noise Associated with the Proposed Remediation of the Roberts Bay and Ida Bay Mine Sites

VEC	Project Phase	Potential Effects	Positive or Negative Effect	Mitigation Success	Residual Effects Rating
Air Quality and Noise	Mobilization	Dust/exhaust emissions and noise from traffic and construction equipment.	Negative	High	Not Significant
	Remediation	Dust/exhaust emissions and noise from traffic and construction equipment.	Negative	High	Not Significant
		Removal of the contaminated soil from the environment will reduce the risk of effects on air quality	Positive	-	Positive
	Demobilization	Dust/exhaust emissions and noise from traffic and construction equipment.	Negative	High	Not Significant

It is not expected that CCME ambient air quality objectives will be exceeded, although site specific monitoring of emissions has not been carried out. Emissions from vehicles, construction equipment and the temporary camp will be short term and intermittent and will not have a significant residual effect on air quality within the local study area or regionally. Dust generation is expected to also be low in volume and infrequent.

Significant adverse effects associated with noise generated during the remediation of the Roberts Bay and Ida Bay mine sites are not expected due to the short term, intermittent nature of the proposed project activities. In addition, wildlife potentially affected by noise will instinctively move away from the area and employees working on-site will wear appropriate hearing protection.

4.2 SOIL QUALITY

4.2.1 Description of Existing Environment

The dominant soils in the region are Turbic and Static Cyrosols developed on discontinuous, thin, sandy moraine and level alluvial deposits (Rescan Environmental Services, 2004; Earth Tech, 2006b). Low lying areas at the site are saturated and marshy and are underlain by clayey silt with permafrost at depths of 0.3 to 0.6 m. Elevated areas are typically underlain by a silty gravely sand till which may be saturated if poorly drained with permafrost at approximately 0.6 m below grade. Occasional granular deposits are found in the vicinity of the site at surface and are typically well graded sand and gravel with 1 to 2 % silt/clay.

Heavy metal and hydrocarbon contaminated soils were identified only at the Roberts Bay mine site by Earth Tech in the Phase III Environmental Assessment (2006a). Additionally, there were heavy metal contaminated sediments identified in the inter-tidal zone of the Ida Bay mine site. Hydrocarbon impacted soils were identified in the area of the fuel bladders, garage and mill buildings. The total volume of hydrocarbon impacted soils at these three sites was estimated at 325 m^2 (Earth Tech, 2006a). Based on the analysis of fines (i.e. less than 5mm in size) collected from the surface of the waste rock pads, there were exceedances above the CCME residential/parkland criteria for metal in all the areas where waste rock is located. Metal parameters that typically exceeded CCME criteria in these samples included arsenic, barium,

chromium, copper, lead, nickel, silver, and zinc. These metal concentrations were commonly an order of magnitude higher than the metal concentrations found in the background locations. Field observations indicated that fine grained soils existed in all areas where waste rock was located or within a few metres of areas dominated with large diameter rock materials on the surface. The area covered with waste rock is approximately 1.5 ha in size.

Elevated metal concentrations were identified in the general vicinity of the mill. The metal concentrations in this area were generally two or more orders of magnitude higher than the metals determined in the waste rock fines. It is assumed that the elevated metal concentrations in the area of the mill are related to the processing of the ore material in this location. The volume of soils contained within this area is estimated at 65 m^3. Approximately 40 m^3 of the metal impacted material is co-contaminated with hydrocarbons.

4.2.2 Soil Quality Impact Assessment

4.2.2.1 Identification of issues, Interactions, and Potential Effects

Disturbance of sensitive soils within the tundra environment can increase erosion and have long term effects on vegetation and aesthetic values. Due to the contaminated nature of the soil there is a risk of human and wildlife exposure via ingestion, inhalation, or physical contact. However, the removal of the contaminated soil and hazardous materials from contact with the environment will improve overall soil quality.

The operation of the construction camp will include treatment and disposal of waste, which could potentially degrade soil quality.

Hazardous materials or contaminated soils may be exposed to leaching during investigations. Accidental spills of hazardous materials, contaminated soil and/or fuels may result in soil degradation.

4.2.2.2 Mitigation

Due to the sensitive nature of the tundra environment mobilization and demobilization of equipment to/from the site will occur during the winter months where possible and ATV use during the spring/summer months will be strictly limited to existing access routes.

The risk of exposure to the contaminated soils can be mitigated by following the suggested mitigation options which include of excavating the soil and placing the hydrocarbon contaminated soil into the tailings pond and capping it with non-acid generating waste rock. Investigators will have reviewed previous site assessments and activities near known areas of contamination will be carried out in a manner to minimize disturbance to the contaminated materials. The metal contaminated soil will be packaged and shipped to an appropriate disposal facility in (e.g. Swan Hill in Alberta).

The existing landfill at Roberts Bay will being remediated to eliminate the risk of leachate production and migration, and graded to promote surface runoff. 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.

Specific erosion control measures will be developed and implemented by the selected contractor. Example erosion control measures include:

- excavation phasing (e.g., clearing and grading small sections at once);
- soil stabilization (e.g., application of water in dry conditions);
- physical erosion control materials (mats, netting, mulches, straw) can be used to reduce any soil surface exposure (i.e. soil stockpiles); and
- compaction to minimize erosion where necessary.

Spill prevention and spill contingency plans will be in effect during all activities. 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 adjacent to fresh water or marine surface water environments. 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.

4.2.2.3 Residual Environmental Effects

Definition of Significance

Significant Impacts are defined as those altering soil such that one or both of the following occurs:

- soil chemical composition is altered such that it will not support vegetation in areas where vegetation previously grew and the extent is greater than 1 km from the facility; and
- soil chemical composition is altered such that it is a threat to groundwater and surface water.

Summary of Environmental Effects on Soil Quality

Residual effects to soil quality associated with the proposed remediation project were determined to be not significant with the implementation of applicable mitigation measures (i.e., Spill Contingency Plan). The overall residual environmental effects from the remediation works are estimated to be positive in nature, due to the elimination of risk of exposure to contaminated soils.

The operation of the work camp will include the treatment and disposal of waste, and has the potential to degrade soil quality. However, hazardous materials will not be disposed of in the

camp waste system, and the disposal of all sewage will be in accordance with applicable regulations and guidelines.

Residual effects to soil quality associated with the proposed remediation project are summarized below in Table 4-3.

Table 4-3: Summary of Residual Effects to Soil Quality Associated with the Proposed Remediation of the Roberts Bay and Ida Bay Mine Sites

VEC	Project Phase	Potential Effects	Positive or Negative Effect	Mitigation Success	Residual Effects Rating
Soil Quality	Mobilization	Disturbance of sensitive soils in tundra enviornment	Negative	High	Not Significant
		Construction/routine operations of small tent camp at Roberts Bay mine site	Negative	High	Not Significant
		Accidents – fuel/chemical spills or leaks from ATVs or equipment being moved may contaminate soils	Negative	High	Not Significant
	Remediation	Disturbance of sensitive soils in tundra enviornment	Negative	High	Not Significant
		Removal of existing contaminated soils and hazardous wastes and placing in tailinigs pond or packaging and mobilizing off-site	Positive	-	Positive
		Accidents – fuel/chemical spills or leaks from ATVs or equipment may contaminate soil	Negative	High	Not Significant
		Accidents - spills of hazardous materials being removed from site may contaminate soils	Negative	High	Not Significant
	Demobilization	Disturbance of sensitive soils in tundra enviornment	Negative	High	Not Significant
		Accidents – fuel/chemical spills or leaks from ATVs or equipment being moved may contaminate soils	Negative	High	Not Significant
		Accidents - spills of hazardous materials being removed from site may contaminate soils	Negative	High	Not Significant

Overall, it is predicted that the soil quality at the Roberts Bay mine site will be improved due to the removal of the hydrocarbon and metal contaminated soils. The proposed remediation works include either shipping all contaminated soils off-site for disposal or to bury the hydrocarbon contaminated soils in the tailings pond.

4.3 TERRAIN, GEOLOGY, HYDROGEOLOGY AND VEGETATION

Due to their close association terrain, geology, hydrogeology and vegetation are discussed collectively within the section below. The impact assessment, mitigation measures, and residual effects associated with these terrestrial resources are summarised below.

4.3.1 Description of Existing Environment

Terrain

The Roberts Lake project area is coastal lowland with numerous lakes and ponds separated by glacial landforms and parallel running geological intrusions of diabase dykes and sills (AMEC, 2007a). The drainage basins are generally long and narrow and predominantly oriented along

the north- south axis. Low lying areas at the site are saturated and marshy and underlain by clayey silt with permafrost detected at depths of 0.3 to 0.6 m. Elevated areas are typically underlain by silty gravelly sand till, saturated if poorly drained with permafrost at approximately 0.6 m below grade. Occasional granular deposits are found in the vicinity of the site at surface and are typically well graded sands and gravels with 1 to 2% silt/clay.

The Ida Bay mine site (Figure 5, Appendix A) is located on a southeast-facing slope of Ida Bay along the shore of Melville Sound. Many erratic boulders on the order of 0.5 to 1.0 m diameter are scattered on the bedrock surface around the perimeter of the site. The adit opening at Ida Bay is about 20 m from the shoreline with elevation of 3.0 m above mean sea level (amsl). Elevation increases gradually to the north and west. An old camp site for the mine is located about 150 m from the shoreline has elevation of 11 m amsl.

Geology and Hydrogeology

Information provided for the Doris North Project (2005) indicated bedrock ridges, oriented north/south parallel with the dominant strike of bedrock units, show the erosive effects of the northward flowing Pleistocene (Keewatin Lobe) continental glacier ice over 10,000 years ago. The surficial active layer over continuous permafrost is approximately 2 m thick. Drill core results (collected and analyzed for the Doris North Project) indicate soils below the active layer contain interstitial and segregated ground ice. Most of the soils are marine in origin and include clay, silt and some sand. Drill core results along the proposed road corridor between Roberts Bay and Tail Lake (part of the Doris North Project) shows bedrock as deep as 20 m below surface. Surface materials include frost-churned mineral and organic soils mantled by a thin cover of tundra vegetation. Linear frost cracks occur in raised marine spit deposits. Ice wedge polygons are common. Continuous permafrost has been described as extending to a depth of 560 m (Doris North Project, 2005).

The permafrost underlying the Doris North Project area is generally impervious to groundwater movements. Groundwater movement will only occur in the shallow active layer (depths up to 1.5 to 2.6 m) during its seasonal thaw period. Hydrogeological conditions would be expected to be similar for the Roberts Bay and Ida Bay mine sites.

The Roberts Bay and Ida Bay abandoned silver mine lie within the Hope Bay Volcanic Belt, to the north of the Slave Geological Province (AMEC, 2007b). The rocks are Archean in age and are members of the Yellowknife Supergroup. The volcanic belt has a width of approximately 15 km and a length of approximately 80 to 100 km, extending from Ida Bay in a south direction. The belt is flanked on either side by pink and grey granite and granodiorite intrusives.

The rocks in this belt are dominantly mafic to felsic lavas and tuffs, primarily basalts and andesites that have undergone metamorphism to greenschist facies. Intrusives such as granite and granodiorite with quartz veins are common throughout the volcanic belt. Along the margins, at the contact of the volcanics with granite, there are both structural and metamorphic deformations such as faulting and folding.

Both the Roberts Bay and Ida Bay silver mineralization is primarily structurally controlled. The primary structural trend of the ore body is east-west, and dipping to the north with veins and faults containing the economic deposits of silver, copper, lead and zinc ore minerals.

Total production from the two mine sites was reported to be greater than 74,500 and 10,000 ounces of high grade silver from Roberts Bay and Ida Bay mines, respectively. Grades were as high as 4,863 oz/t.

The Project area occurs in the seismically "Stable" zone of Canada. This region has too few earthquakes to define reliable seismic source zones.

Vegetation

Vegetation described for the Doris North Project area (Doris North Project, 2005) was characteristic of sub-arctic tundra zone. Three ecosystem units dominate the area: the ocean shoreline association, lowland ecosystems, and the rock outcrop and upland ecosystems. Several plant communities make up each of these ecosystems. Plant species identified include 19 shrubs, 92 herbs, 18 grasses, 32 sedges and rushes, 21 mosses and 8 species and/or genera of lichen. Inuit traditionally use many local plant species and understand the relationship between plants and caribou habitat requirements including the early showing of plants in snow free areas and the importance of such areas to caribou calving locations in the region. None of the local plants identified during the course of baseline studies conducted for the Doris North project were designated as endangered or threatened under SARA (Doris North Project, 2005).

The human health and ecological risk assessment (UMA, 2005) characterized the area of the Roberts Bay mine site as falling within the course substrate, bedrock outcrop ecosystem unit of the Hope Bay Volcanic Belt. The Ida Bay mine is found within the ocean shoreline association which is characterized by salt tolerant vegetation such as alkali grass and Lyme grass. The Hope Bay Volcanic Belt is situated within the Southern Artic Ecozone, characterized by a vegetative transition from southern taiga forest to northern treeless artic tundra. Harsh climatic conditions contribute to slow, restricted plant growth (UMA, 2005).

It was also determined that vegetation (cottongrass, *Eriophorum sp*.) found in a mature growth stage actively growing on the north edge of the tailings pond did not accumulate higher than normal concentrations of various metals in plant dry matter (UMA, 2005).

4.3.2 Terrain, Geology, Hydrogeology and Vegetation Impact Assessment

4.3.2.1 Identification of Issues, Interactions and Potential Effects

The existing mine sites have already altered the local terrain as a result of the deposition of waste rock, contaminated soils, hazardous and non-hazardous waste, construction of adits and tailings ponds. The remediation activities that are proposed for the mine sites will further alter the local terrain; however the works will include reshaping areas of excavation to natural contours, promoting natural drainage and revegetation. The breakdown and segregation of the

hazardous and non-hazardous material is expected to have minimal affects on the local terrain as the materials are not buried and movement of most of the materials will stay within the footprint of each mine site as much as possible. The excavation and removal of contaminated soil has the potential to degrade the permafrost.

Removal of the contaminated soil and hazardous materials from the environment will reduce the risk of contamination of active layer water. Installation of groundwater monitoring equipment should not be necessary because the small water shed and shallow active zone. The chemistry of the local surface water should closely represent the chemistry of the groundwater in the active zone.

It is expected that the proposed works will have minimal interaction or effects on the vegetation of the area due to the localized nature of the project. The operation of heavy machinery and ATVs and the location of the temporary field camp will all be within the areas that have already been impacted by previous activities at the mine sites. Due to the slow growing nature of the vegetation community in the area, it is likely that the remediation works will hinder the vegetative recolonization of the mine sites in the short term. Local vegetation may be affected by fugitive dust during remediation activities. However, the removal of contaminated soils will likely aid in the overall natural revegetation of the mine sites.

The construction and use of the winter road is also not likely to have a negative impact on the vegetation. Also, during the winter months the snow cover will help to protect the vegetation from machinery movement outside of areas of excavation. Construction/routine operations of small tent camp at Roberts Bay mine site could adversely affect the terrain and vegetation in a small area.

4.3.2.2 Mitigation

When possible, remediation activities, including excavation, material transport, mine adit closure, and waste rock burial will be timed to occur during the winter months so the permafrost layer is least likely to be disturbed. Additionally, the remedial works will all occur within the footprints of the mine sites and existing paths to limit the impact on the existing vegetation.

The excavation of the contaminated soils at the Roberts Bay mine site has the potential to disturb the permafrost layer; however the work will be conducted to minimize the amount of exposed permafrost. The duration of permafrost exposure will be minimized and the surface area of exposed permafrost or active zone will be minimized. Unless required for drainage purposes, smoothing and contouring of the disturbed surfaces will be minimized in order to create microsites that will encourage vegetation growth.

The excavation of contaminated soils and movement of waste rock is likely to alter the existing terrain. However, the existing terrain is currently not in its natural form. As such the effects of further excavation would be minimal.

The waste rock stockpiles will be recontoured, and all disturbed areas will be rough graded following excavation or disturbance. Details pertaining to grading requirements for the proposed remediation project include the following (PWGSC, 2006):

- recontour all waste rock piles at Ida Bay. Remove waste rock on encroaching water;
- rough grade covers placed over imploded vents and adits;
- rough grade landfill site at the tailings pond;
- rough grade cover material placed on existing landfill site;
- rough grade all areas disturbed at Roberts Bay;
- recontour any remaining waste rock piles; and
- compact filled and disturbed areas using a dozer; undertake five (5) passes with a dozer.

Overall, the removal of abandoned site infrastructure will improve the visual aesthetics of the local terrain. Drainage will be improved with grading of the site and historically disturbed areas will be blended into the landscape.

Mitigation measures used to reduce the levels of fugitive dust will reduce potential effects to local vegetation. The camp will be located on previously disturbed lands where possible and existing roads will be used for all movement within and between sites.

4.3.2.3 Residual Environmental Effects

Definition of Significance

A significant environmental effect on terrain, geology or hydrogeology 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 component. For vegetation an environmental effect would be considered significant 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.

Summary of Environmental Effects on Terrain, Geology, Hydrogeology and Vegetation

There will be considerable affects on terrain and vegetation within the area directly affected by remediation activities, but the area affected will be small. Impacts to local terrestrial resources at the mine sites will be limited due to the timing and limited footprint of the proposed works. Direct affects on vegetation, associated with the remediation project, prior to mitigation, will have localized, medium term, moderate effects on terrain and vegetation.

The affected areas should be capable of being successfully naturally recolonized and are expected to reach their pre-remediation level of productivity. Activities during the remediation phase are expected to benefit vegetation through the creation of microsites, during grading,

which will assist the establishment of vegetation. Land disturbance will be minimized and disturbed areas will be reclaimed as soon as possible. Erosion will be minimized by ensuring no steep, easily erodable slopes are left at the end of remediation.

Residual effects to terrain, geology, hydrogeology and vegetation associated with the proposed remediation project are summarized below in Table 4-4.

Table 4-4: Summary of Residual Effects to Terrain, Geology, Hydrogeology, and Vegetation Associated with the Proposed Remediation of the Roberts Bay and Ida Bay Mine Sites

VEC	Project Phase	Potential Effects	Positive or Negative Effect	Mitigation Success	Residual Effects Rating
Terrain, Geology, Hydrogeology and Vegetation	Mobilization	Disurbance of sensitive terrain features or vegetation during mobilization	Negative	High	Not Significant
		Construction/routine operations of small tent camp at Roberts Bay mine site	Negative	High	Not Significant
		Accidents – fuel/chemical spills or leaks from ATVs or equipment being moved	Negative	High	Not Significant
	Remediation	Disurbance of sensitive terrain features and vegetation during remediation activities by equipment	Negative	High	Not Significant
		Removal of abondoned site infrastructure may disturb existing terrain/vegetation conditions	Negative	High	Not Significant
		Removal of existing contaminated soils will alter terrain and may degrade permafrost layer	Negative	High	Not Significant
		Removal of the contaminated soil and hazardous materials from the environment will reduce the risk of contamination of active layer water	Positive	-	Positive
		Regrading of site will improve drainage	Positive	-	Positive
		Accidents – fuel/chemical spills or leaks from ATVs or equipment	Negative	High	Not Significant
	Demobilization	Disurbance of sensitive terrain features or vegetation during demobilization	Negative	High	Not Significant
		Accidents – fuel/chemical spills or leaks from ATVs or equipment being moved	Negative	High	Not Significant
		Accidents - spills of hazardous materials being removed from site	Negative	High	Not Significant

Based on the information provided in this report and taking into account the proposed mitigation measures, the effects of the project on terrain, geology and hydrogeology is not likely to cause significant adverse effects. Remediation activities will have short term, minor residual effects on vegetation while natural revegetation occurs. However, the removal of contaminated soils and hazardous material will likely improve the soil conditions and revegetation success by reducing the amount of area with elevated levels of contamination.

4.4 WILDLIFE AND WILDLIFE HABITAT

4.4.1 Description of Existing Environment

The wildlife resources of the Hope Bay Volcanic Belt have been characterized as part of the comprehensive environmental impact assessment of the neighbouring Doris North Project (Miramar Hope Bay Ltd.). Baseline wildlife information, intended to support the mineral

extraction within this area of Nunavut, has been collected by various consultants since 1994. Prior to this, peer reviewed papers and government supported research had been published on the subject. Hurbert and Associates (2002) provide a detailed synopsis of available wildlife data. The wildlife information in this section was taken from a summary of the Hurbert and Associates Ltd. (2002) report prepared by UMA (2005).

Species in nine different families of mammals have been observed. These include shrews (*Scoricidae*), hares (*Leporidae*), squirrels (*Sciuridae*), voles and lemmings (*Arvicolidae*), weasels (*Mustelidae*), wolves and foxes (*Canidae*), deer/caribou (*Cervidae*), muskox (*Bovidae*) and bears (*Ursidae*). Many of these mammals have much larger home territories relative to the study area (e.g. bears, foxes, wolverines, wolves, muskox) or are migratory over very wide areas (e.g., caribou). The caribou of the Hope Bay area are considered a VEC by the local Inuit population. The 2003 Hope Bay Wildlife Studies Report (Calef and Hurbert, 2003) states that based on regional flights and location data provided by the NWT Government from satellite collared caribou, the Hope Bay Study Area cannot be considered even a peripheral part of the calving grounds of either the Bathurst or the Queen Maud Gulf (now Ahaiak) caribou herds in 2003.

The more prolific smaller mammals, such as red-backed or tundra vole, brown or collared lemming play an important role in the northern ecosystem and were the most abundant in field trapping programs conducted in support of the Doris North Project. They are reportedly an important prey item for falcons, hawks, eagles, owls, pomarine jaegers, foxes, weasels and infrequently wolves and grizzly bears. The populations of the species belonging to the family Arvicolidae, known as microtine rodents, cycle over a 3-4 year period with population shifts of 10 - 100 fold differences. Predator abundance will also vary with the cycles of these microtine rodents.

The bird inventories summarized by Hurbert and Associates (2002) tabulated 65 different avian species including waterfowl, raptors, ptarmigan, shorebirds, gulls and jaegers, owls, sparrows, longspurs and a finch. Most of the avians tabulated are migratory breeding species, but a few are resident (ptarmigan, gyrfalcons, ravens, redpoll finch and snowy owl). None of the species tabulated are categorized as “endangered” or are identified as special status. Based on ground census of breeding birds, the Lapland longspurs, savannah sparrows, redpoll finch, treed sparrow and horned larks are the most abundant species found. The density of scrub cover accounted for more than 70% of the spatial distribution of these breeding songbirds. The aerial surveys of nesting waterfowl conducted between 1996 and 1998 determined that the geese, both Canada and white-fronted species, represented 75% to 99% of all waterfowl observed. The loon and merganser were infrequently observed on the lakes in the Hope Bay area. An aerial survey in 1998 produced low density estimates (0.35 birds/ km^2) for ground dwelling ptarmigan. These surveys were not repeated in following years. Ptarmigan are well camouflaged on the tundra and may be present at higher densities than estimated by this technique.

Current research being conducted by the Canadian Wildlife Service in the Arctic proximate to the Roberts Bay and Ida Bay mine sites includes the following:

- Survival and Reproduction of King Eiders at Karrak Lake;
- Nutritional Ecology and Population Biology of Ross' Geese at Karrak Lake;
- Monitoring Survival and Recovery Rates in Mid-continent White-fronted Geese and dispersal in Arctic Geese at Karrak Lake;
- Monitoring Survival and Recovery Rates in Mid-continent White-fronted Geese at Perry River; and
- Pacific Common Eider Reproductive Ecology and Survival in the Central Arctic (Bathurst Inlet).

Information provided by the CWS (Pers. comm. Mark Mallory, Seabird Biologist, January 12, 2007) indicated that Pacific Common Eiders (*Somateria mollissima v-nigrum*) nest, molt and rear their young in the coastal areas of Melville Sound and Elu Inlet. Those areas plus Bathurst Inlet are considered to be core breeding area for eiders based on surveys conducted throughout the central arctic in 1995 and 1996. The CWS did not have specific data for Ida Bay; however, the general area is known to be valuable to eiders from mid June to late October. The CWS suggested that a field investigation should be conducted prior to remedial activities to determine whether eiders use the coastal area proximate to the Ida Bay mine site.

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). In addition, SARA amends the definition of “environmental assessment” in CEAA 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. Although the majority of the published reports focus on the higher profile avian and mammalian species (e.g., raptors and caribou), the Hope Bay area is known to support a full complement of arctic and subarctic mammalian and avian species. Most importantly, none of the species observed or reported to be present in the area are listed as “endangered” in Nunavut under SARA.

Due to the topographic elevation provided by the volcanic ridges in the Hope Bay Volcanic Belt, the area has long been known to be important habitat for nesting raptors (Hurbert and Associates, 2002). The most abundant raptors are the peregrine falcons, roughlegged hawks and golden eagles. The *tundrius* subspecies of peregrine falcon, which is considered “threatened” under SARA, has been documented at the site. All raptors and their nests and eggs, are protected by legislation.

A summary of the wildlife species identified within the Doris North project area, which is considered representative of the wildlife species that may be found at the Roberts Bay and Ida Bay mine sites is presented in Table 4-5 below.

Table 4-5: Summary of Wildlife Species Documented Within and Around the Doris North Project Area Considered Representative of the Roberts Bay and Ida Bay Mine Sites

Common Name	Latin Name
Waterfowl	
Canada goose	*Branta canadensis*
common eider	*Somateria mollissima*
pacific loon	*Gavia pacifica*
tundra swan	*Cygnus columbianus*
king eider	*Somateria spectabilis*
Raptors	
peregrine falcon	*Falco peregrinus*
gyrfalcon	*Falco rusticolus*
golden eagle	*Aquila chrysaetos*
rough-legged hawk	*Buteo lagopus*
Upland Birds	
lapland longspur	*Calcarius lapponicus*
common redpoll	*Carduelis flammea*
American tree sparrow	*Spizella arborea*
semipalmated plover	*Charadrius semipalmatus*
golden plover	*Pluvialis dominica*
Mammals	
Arctic hare	*Lepus arcticus*
Arctic ground squirrel (siksik)	*Spermophilus parryii*
muskox	*Ovibos moschatus*
barren ground caribou	*Rangifer tarandus groenlandicus*
wolverine	*Gulo gulo*
Arctic fox	*Alopex lagopus*
wolf	*Canis lupus*
barren ground grizzly bear	*Ursus arctos*

4.4.2 Wildlife and Wildlife Habitat Impact Assessment

4.4.2.1 Identification of issues, Interactions, and Potential Effects

Impact on the terrestrial wildlife community has already occurred due to historical mining activities and associated site contamination, and it is expected that the remediation of the mine sites will improve wildlife habitat. There is the potential for direct mortalities to wildlife caused by traffic and heavy equipment. Migratory birds commonly pass through the area and remediation

activities may occur in areas frequented by various migratory bird species. The proposed project is being designed so that nests are not disturbed or destroyed. In the event that remediation activities can not be completed without disturbing/destroying habitat/nests associated with migratory bird species, a permit authorizing the removal of nests or disruption of habitat will be required as outlined in the Migratory Birds Convention Act.

There is potential for human and wildlife interaction during the life of the project, however, it is expected that such encounters will be insignificant and minimal. It is likely that most species will avoid the area where people are working and machinery is operating. It is possible that the temporary camp may attract wildlife if food waste is not managed properly. The operation of machinery and ATVs may increase the risk of collisions wildlife as well as altering wildlife migration patterns. Hunting at the site will be strictly prohibited. Wildlife may be using the infrastructure remaining on the site as habitat (i.e., nests in structures). The demolition of these facilities has the potential to impact availability of habitat.

The Human Health and Ecological Risk Assessment (UMA, 2005) indicated that the degree of exposure and inherent toxicity of the hydrocarbons and trace elements identified at the Roberts Bay and Ida Bay mine sites would be sufficient to cause adverse population effects on any small mammal species or guild. The caribou, with their large home ranges, are not anticipated to be adversely affected from the periodic exposure to these sites. Similarly, the secondary avian consumers are unlikely to be exposed to potentially harmful concentrations of contaminants of concern.

4.4.2.2 Mitigation

Implementation of a Wildlife Management Plan would ensure wildlife awareness training of the remediation work crew which would decrease the risk of disturbing local wildlife migration behaviour. Example mitigation measures that will be included in the Wildlife Management Plan prepared by the project contractor are provided below for reference:

Traffic/equipment Management

- minimizing the amount of disturbed area;
- reduce noise by use of muffled exhaust systems;
- all diesel powered equipment will meet emission guidelines;
- minimum flying altitude of 300 m above ground level for any project aircraft outside of the Project area;
- vehicles restricted to designated roads and prepared work areas (i.e., recreational use of off-road vehicles is prohibited);
- establishing and enforcing speed limits;
- giving wildlife the right-of-way (i.e. caribou);
- implement dust suppression methods (i.e., spraying with water) on roads during the snow/ice free period (chemical dust suppressants will not be used);

- apply water to roadways to reduce dust from vehicles and minimizing grading;
- conducting pre-project surveys to identify wildlife sensitive locations (i.e. birds nests) and developing plan to ensure avoidance;
- promoting natural vegetation regeneration following remedial activities; and
- wildlife awareness and sensitivity training for on-site personnel;

Waste Management

- education and reinforcement of proper waste management practices to all workers and visitors to the site;
- implementing appropriate waste management protocols, which may include burning all food wastes in an oil-fired incinerator;
- eliminating attractants (e.g. food waste, oil products) at the landfill site;
- separation of food waste and non-food waste at source;
- appropriate fencing around the landfill area;
- burning waste oil in waste-oil furnaces or taken off-site for recycling;
- designating appropriate areas for worker lunch and coffee breaks;
- educating people on the risk associated with feeding wildlife and careless disposal of food garbage; and
- ongoing review of the efficacy of the waste management program and adaptive improvement.

Infrastructure remaining on site will be inspected for use by wildlife prior to demolition. Facilities will not be demolished in the immediate vicinity of nests while birds are nesting and the responsible wildlife officer will be contacted for additional guidance to ensure disturbance of wildlife is minimized. Physical works/activities will be scheduled around breeding times or situated to avoid effects on wildlife receptors including breeding birds. All site personnel will be briefed on the sensitivity of raptors to disturbance especially during nesting (described as approximately June 1 to August 1). In the event that remediation activities occur during the breeding bird season site personnel will be required specifically to avoid direct disturbance (i.e., close approach) to known nests.

The CWS has suggested that a field investigation should be conducted prior to remedial activities to determine whether eiders use the coastal area proximate to the Ida Bay mine site. As all migratory birds are protected under the Migratory Birds Convention Act it is recommended that a qualified environmental professional conduct a field assessment of the area encompassing the proposed Ida Bay barge loading site and mine site prior to commencing the project in order to ensure proposed remediation activities can be completed as scheduled. The Environmental Management Plan will specifically include mitigation measures that protect all migratory birds and their habitat. In the event that remediation activities can not be completed without disturbing/destroying habitat/nests associated with migratory bird species, a permit

authorizing the removal of nests or disruption of habitat will be required as outlined in the Migratory Birds Convention Act.

Specific protection measures will have to be implemented to ensure the protection of migratory birds and associated habitat, especially during the months between June and October. During the remediation activities, efforts will be made to avoid known wildlife colonies (i.e., dens) or bird nesting areas. Where applicable, minimum distance and height restrictions will be employed for transportation activities. Should any active nests be discovered, demolition activities will be postponed until the nesting is complete or a permit authorizing the removal of nests or disruption of habitat will applied for as outlined in the Migratory Birds Convention Act. Also, the appropriate wildlife officer will be contacted for guidance to ensure that the disturbance of wildlife is minimized.

General caribou protection measures, which are usually attached to land use permits, state that project activities shall be prohibited within all caribou calving areas during calving season or block or cause substantial diversion to caribou migration. These protection measures should not affect the project schedule since available information indicates that the proposed project is located outside of these areas.

All disturbed areas will be re-graded and reshaped to match the existing terrain to facilitate the recovery of the ecosystem components. A contingency plan will be prepared that address spills of hazardous materials as well as other potential accident scenarios that may adversely affect wildlife and wildlife habitat.

4.4.2.3 Residual Environmental Effects

Definition of Significance

A significant environmental effect of the project activities on terrestrial 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.

Summary of Environmental Effects on Wildlife and Wildlife Habitat

Based on the information provided in this report and taking into account the proposed mitigation measures, the effects of the project on wildlife and wildlife habitat are not likely to cause significant adverse effects. The removal of the contaminated soil and hazardous waste will have a positive effect on the local area.

Due to the limited scope and size of disturbed area that is proposed to be remediated, it is expected that there will not be any significant impacts on terrestrial wildlife or habitat from the proposed remediation works with the implementation of applicable mitigation measures.

Residual effects to wildlife and wildlife habitat associated with the proposed remediation project are summarized below in Table 4-6.

Table 4-6: Summary of Residual Effects to Wildlife and Wildlife Habitat Associated with the Proposed Remediation of the Roberts Bay and Ida Bay Mine Sites

VEC	Project Phase	Potential Effects	Positive or Negative Effect	Mitigation Success	Residual Effects Rating
Wildlife and Wildlife Habitat	Mobilization	Disruption of migratory bird habitat during the mobilization of equpment to the site	Negative	High	Not Significant
		Disruption to habitat - general noise from routine camp operations	Negative	High	Not Significant
		Disruption to habitat - attraction of wildlife to food wastes related to camp	Negative	High	Not Significant
		Wildlife mortalities by traffic	Negative	High	Not Significant
		Accidents – fuel/chemical spills or leaks from ATVs or equipment may contaminate habitat	Negative	High	Not Significant
	Remediation	Disruption of wildlife and migratory bird habitat during remediation activities	Negative	High	Not Significant
		Wildlife mortalities during remediation activities by heavy equipment	Negative	High	Not Significant
		Accidents – fuel/chemical spills or leaks from ATVs or equipment may contaminate habitat	Negative	High	Not Significant
	Demobilization	Disruption of migratory bird habitat during the mobilization of equpment to the site	Negative	High	Not Significant
		Wildlife mortalities by traffic	Negative	High	Not Significant
		Accidents – fuel/chemical spills or leaks from ATVs or equipment may contaminate habitat	Negative	High	Not Significant
		Accidents - spills of hazardous materials being removed from site may contaminate habitat	Negative	High	Not Significant

4.5 HYDROLOGY AND WATER QUALITY

4.5.1 Description of Existing Environment

Peak surface water flows typically occur in June during snowmelt. A second smaller peak may occur from rainfall in late August or early September. The streams in the study area are usually frozen with negligible flow from November until May. The mean outflow from June to October for Little Roberts Lake is approximately 1.73 m^3/s (Doris North Project, 2005).

Surface runoff that is generated at the Roberts Bay mine site drains off-site to the south and eventually discharges into Roberts Lake (UMA, 2006). There is a small unnamed lake to the north east of the Roberts Bay mine site that was used as a water source for mine operations as well as drinking water. A low-lying muskeg drainage area is located to the south east of the mine site. Surface runoff draining off the west flank of the main volcanic ridge, including the tailing pond, infiltrates into the shallow soils in the low lying area west of the mine, or forms small isolated pools.

The Ida Bay mine site is situated on the shore of Ida Bay, and there are no adjacent freshwater water bodies adjacent to the mine site. The Ida Bay adit and associated waste rock lie

immediately adjacent to the ocean (Melville Sound). The marine habitat in the vicinity of Ida Bay is too shallow for float plane, or any type of marine vessel access. There is also a small creek approximately 300 m southwest of the open adit at the Ida Bay mine site that empties into Melville Sound.

Elevated levels of silver and copper concentrations were identified in bodies of water on the site and in the local stream at the point of discharge into Roberts Lake (UMA, 2006). Copper levels discharging into Roberts Lake were also elevated in comparison to other regional data.

The geochemical assessment of the Roberts Bay mine site (AMEC, 2006) reported the following conditions that may impact water quality:

- the tailings at the Roberts Bay mine site are net non-acid generating;
- the concentration of metals of concern (arsenic, copper, lead, nickel, and zinc) in mine water at the Roberts Bay mine site are much lower that Metal Mining Effluent Regulations (MMER) regulatory values and consequently treatment is not required before discharge to the environment;
- the concentrations of most elements measured in the mine water samples were very low and similar to guideline values protective for fresh water aquatic life (CCME, 2003);
- the concentration of arsenic in the Roberts Bay tailings pond and a large pond near the north road leading to Ida Bay was much lower than MMER discharge guidelines but slightly elevated compared to CCME guidelines for both fresh water and marine water;
- the water in the tailings pond has been found to have metals concentrations above the freshwater aquatic life guidelines but less than the MMER guidelines; it is proposed that this water is pumped into an underground mine adit to eliminate the risk of sediment release to an aquatic receiving environment;
- the concentration of selenium in the north pond at Roberts Bay exceeded CCME guideline values for fresh water; and
- the concentration of zinc in the tailings sump sample at the Roberts Bay mine site was below MMER guidelines for discharge but exceeded CCME guideline values for fresh water.

The Geochemical Assessment of the Ida Bay mine (AMEC, 2006) site reported the following conditions that may impact water quality:

- all waste rock and tailing samples at the Roberts Bays and Ida Bay mine sites had paste pH values greater than 7.0 indicating that none of the samples are currently generating net acidity even though they have been exposed to weathering for greater than 30 years;
- the concentration of cadmium and mercury were elevated in the Ida Bay waste rock;
- the concentration of metals of concern (arsenic, copper, lead, nickel, and zinc) in mine water in the adit at the Ida Bay mine sites are much lower than MMER regulatory values and consequently it was determined that treatment was not required before discharge to the environment;

- the concentration of most elements measured in the mine water samples were very low and similar to guideline values protective for fresh water aquatic life (CCME, 2003); and
- although the Ida Bay waste rock contained elevated concentrations of cadmium relative to background, it likely occurs as insoluble suspended particulates and is not expected to result in elevated concentrations in the receiving waters adjacent to the site.

4.5.2 Hydrology and Water Quality Impact Assessment

4.5.2.1 Identification of issues, Interactions, and Potential Effects

The proposed remediation of the mine sites will be completed outside of any water bodies at both Roberts Bay and Ida Bay. There is a small quantity of waste rock proximate to and within the high tide area of Melville Sound at Ida Bay, however, information available at the time of report preparation indicated that this area was not included in the proposed remediation project. It is not anticipated that there will be any significant runoff containing sediment during the spring when the snow cover melts.

There is the potential that accidental spills of fuels/oils associated with the vehicles/equipment may be released into the environment as well as runoff from concrete from mixing on-site. In the unlikely event that there were to be any spills of fuels from equipment of hazardous materials during removal from the site, the contaminated soil, rock, or snow would be immediately contained and managed appropriately.

It was presumed that the operation of the temporary work camp will include treatment and disposal of waste, which has the potential to impact water quality.

Closure and remediation of the landfill at Roberts Bay and the removal of the contaminated soil and hazardous materials from the environment will reduce the risk of contamination of surface water.

4.5.2.2 Mitigation

Specific sediment control measures will be selected and implemented by the selected contractor. Example sediment control measures include the following:

- short-term siltation control in construction areas (i.e., sediment fences and/or berms);
- application of sediment barriers, flow control and the use of settling ponds/check structures for flow reduction may be required at different locations across the excavation areas;
- equipment will not be operated within the wetted areas;
- disturbed areas adjacent to water will be stabilized as soon as possible, if required;
- grading activities will be sited away from natural drainages; and

- areas will be graded to blend with the natural terrain, and where appropriate, to promote surface runoff.

A site specific Emergency Response Plan will be developed by the selected contractor that includes a Spill Contingency Plan and specific protection measures will be implemented in the event that concrete is mixed close to a water body.

The selected contractor will have reviewed the previous site assessments and activities near known areas of contamination will be carried out in a manner to minimize disturbance to the contaminated materials.

Material handling and spill contingency procedures will be implemented during all remediation works. All excavated areas will be graded to natural conditions following the completion of works to promote natural infiltration.

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

4.5.2.3 Residual Environmental Effects

Definition of Significance

A significant impact to hydrology or water quality is defined as one of sufficient magnitude so as to alter the quantity or quality of water to a degree that will result in a significant impact on the aquatic receiving environment. A significant environmental effect of the project activities on the aquatic receiving environment occurs if a population or portion thereof is affected in such a way as to cause a decline or change in abundance or distribution of the population over one or more generations; natural recruitment may not re-establish the population to its original level. A significant effect on aquatic habitat may alter the valued habitat, physically, chemically or biologically, in quality or extent, to such a degree that there is a decline in the diversity of the habitat.

Summary of Environmental Effects on Water Quality

It is not expected that the proposed remediation works will have a significant impact on the existing water quality of the mine sites. The removal of the contaminated soils and hazardous materials will eliminate the risk of exposure of groundwater and surface water to sources of contamination.

Residual effects to hydrology and water quality associated with the proposed remediation project are summarized below in Table 4-7.

Table 4-7: Summary of Residual Effects to Hydrology and Water Quality Associated with the Proposed Remediation of the Roberts Bay and Ida Bay Mine Sites

VEC	Project Phase	Potential Effects	Positive or Negative Effect	Mitigation Success	Residual Effects Rating
Hydrology and Water Quality	Mobilization	Sediment in runoff from moving traffic/equipment through watercourses	Negative	High	Not Significant
		Accidents – fuel/chemical spills or leaks from ATVs or equipment being moved may contaminate receiving waters	Negative	High	Not Significant
	Remediation	Increased erosion and sediment in runoff from removing vegetation and disturbing soils near receiving waters	Negative	High	Not Significant
		Release of contaminated materials (soils/hazoardous wastes) into aquatic enviornment during remediation activities	Negative	High	Not Significant
		Concrete-affected wastewater.	Negative	High	Not Significant
		Regrading of site will improve drainage	Positive	-	Positive
		Accidents – fuel/chemical spills or leaks from ATVs or equipment may contaminate receiving waters	Negative	High	Not Significant
	Demobilization	Sediment in runoff from moving traffic/equipment through watercourses	Negative	High	Not Significant
		Accidents - spills of hazardous materials being removed from site	Negative	High	Not Significant
		Accidents – fuel/chemical spills or leaks from ATVs or equipment	Negative	High	Not Significant

Based on the information provided in this report and taking into account the proposed mitigation measures, the effects of the project on hydrology and water quality are not likely to cause significant adverse effects. It is predicted that the proposed remediation program will have an overall positive impact on water quality in terms of closing the existing landfill and removing contaminated soils and hazardous materials from the environment.

4.6 AQUATIC RESOURCES

4.6.1 Description of Existing Environment

Aquatic resources of Melville Sound and Roberts Lake were inferred from the baseline information collected by RL&L Environmental Services and Golder between 1995 and 2000, 2002 and 2003 for the Doris North Project (RL&L /Golder, 2002, 2003a, 2003b). Figure 6 in Appendix A provides a summary of the waterbodies that were assessed during the various field studies in support of the Doris North Project.

4.6.1.1 Marine Mammals

The marine mammal survey data was compiled in the terrestrial wildlife review prepared by Hurbert & Associates (2002), which indicated that ringed seals are the dominant marine mammal within the coastal inlets surrounding Kent Peninsula. Other marine mammals, including the primary predator of the ringed seals, the polar bear, are rare in this region.

4.6.1.2 Marine Benthos

The RL&L/Golder (2002) aquatic baseline studies included 3 marine benthos samples in the summer of 1997 and 1998 within Roberts Bay. The sample program included a shallow (<1.5 m), moderate (7 - 9 m) and deep (>15 m) habitat. Polychaeta (marine worms) were a dominate factor in all but the shallowest habitat. The shallow habitat was dominated, in terms of total numbers, by Nematoda (up to 80%) and Bivalvia (*Macoma inquinata*). In the moderate depth habitat, the marine scud *Pontoporeiu femorata* accounted for 33% of total numbers of organisms. There was a trend toward increasing overall benthic abundance with increasing depth. The deepest habitat was dominated by Polycheata, Nematoda and Cumacea.

4.6.1.3 Limnology

Limnology information was not available for the aquatic environments potentially directly affected by the proposed remediation activities. The aquatic resource potential of Roberts Lake was inferred from that described in neighbouring lakes, which include Little Roberts Lake and the outflow stream draining into Roberts Bay. Lakes in the region fall into a mesotrophic to oligotrophic category with low concentrations of available nutrients. The limnological data collected in support of the Doris North Project are typical of other lakes in the Slave Province RL&L/Golder (2002). The primary producers (peripyton and phytoplankton) in Little Roberts Lake and the outflow are dominated by the blue green cyanophyta *Oscillatoria spp*. Primary producers are dominated by the cyanophyta algae throughout all the lakes in the region. The secondary producers include the zooplankton in pelagic habitat and the benthic invertebrates in the lake substrate and stream beds. The numbers of zooplankton in the lakes of the Hope Bay region are dominated by Rotifera, Cladocera and Cyclopodia with little variation among the various lakes. The benthic communities in these lakes, including Little Roberts Lake, are dominated by Chironomidae (midges), Nematoda (roundworm), Bivalvia (clams), Oligochaeta (brittle worm) and Malacostraca (fairy shrimp, tadpole shrimp, isopods).

The numbers of drift organisms are dominated by Chironomidae (midges), Simuliidae (black flies), Ostracoda (seed shrimp) and Cladocera (water fleas). Differences in relative abundance in the various outflows can largely be ascribed to differences in physical characteristics of the streams. In July of 1996 the drift from Little Roberts Lake was dominated by the midges, while in August 1997 the cladoceran *Holopedium gibberum* dominated the total numbers. Stream benthic macro invertebrates are important components of the aquatic food chain. Little Roberts Lake outflow was on of the least productive streams (based on total abundance) perhaps because of marine influences. Other than the midge and black flies, the Little Roberts Lake outflow showed relatively high numbers of the Plecoptera (stoneflies) and Coelenterata (freshwater Cnidaria – hydra).

4.6.1.4 Fisheries Resources

The aquatic assessment conducted between 1995 and 2000 (RL&L /Golder, 2002) for the Doris North Project, resulted in over 1500 fish captured in gill nets and beach seines. In order of abundance, the captured species include cisco (36%), lake whitefish (34%), lake trout (28%), Arctic char (2%), least cisco (<1%) and broad whitefish (<1%). Ninespine stickleback were also present in most lakes and appeared to be favoured prey for lake trout. Fish populations in Little Roberts Lake were different from all other lakes because of the direct passage to Roberts Bay. Capelin, saffron cod and Arctic flounder were the predominant species caught during a two month study period (RL&L /Golder, 2002).

Diadromous species (Arctic char and broad whitefish) are found in Little Roberts Lake. The arctic char use Little Roberts Lake and the outflow of Roberts Lake during their migration and over wintering in Roberts Lake. Younger char aged between 1-4 years (smolts) use Roberts Lake and Little Roberts Lake as rearing grounds. The average fork length of these smolts is roughly 330 mm which translates into approximately 220 grams. The older char that migrate into Roberts Bay and Melville Sound for summer feeding gain significant weight. Lesser numbers of these older aged char were captured in Little Roberts Lake. The maximum fork length was 900 mm with a weight of > 9,000 grams. These larger char would be harvested by Inuit and other recreational fishermen. Based on the analysis of stomach contents, the char in Little Roberts Lake appear to be feeding on tadpole shrimp.

Lake trout are also present in Little Roberts Lake, and presumably Roberts Lake. The mean weight for lake trout ranges between 500 and 2000 grams. The lake trout captured in Little Roberts Lake fall into the smaller range. Nevertheless, recreational fishermen are likely to encounter more lake trout then char. The lake whitefish and cisco are both much too small to be considered as a recreational source. These smaller species may be prey items for piscevorois avians (heron) and mammals (mink). The grizzly bear will also hunt for fish, especially larger char migrating up the Little Roberts and Roberts Lake outflows.

4.6.2 Aquatic Resource Impact Assessment

4.6.2.1 Identification of Issues, Interactions, and Potential Effects

The remediation activities should take into consideration the drainage pattern of the Roberts Bay mine site that may transport contaminants or heavy metals into the drainage that empties into Roberts Lake. It is expected that with the removal of contaminated soils the potential of future transport of contaminants downstream will be reduced or eliminated.

There is the potential for the accidental release of fuels from vehicles or equipment. There is also the potential for the release of contaminated soils/materials into aquatic habitat during remediation activities and mobilization of hazardous material off-site. The only proposed work that is near fish bearing waters is the removal of waste rock above the high tide line at the Ida Bay mine site. At the time of report preparation, available information indicated that the waste

material below the high tide mark at Ida Bay would not be excavated as this may cause more of a habitat disturbance than restoration for the nearshore habitat.

The removal of contaminated soil and other hazardous materials from areas close to water bodies reduces the risk of exposure to aquatic animals.

4.6.2.2 Mitigation

Appropriate sediment control measures will be implemented as needed to protect the aquatic environment. An Emergency Response Plan will be developed that includes a Spill Contingency Plan and specific protection measures will be implemented in the event that concrete is mixed close to a water body. The impact of accidental spills will be minimized by these plans. The areas of excavation will be re-graded to mimic natural drainage patterns to ensure natural surface flow and infiltration. Mitigative measures such as berms, silt fences and/or silt curtains will be implemented to prevent deleterious substances from entering the aquatic environment.

4.6.2.3 Residual Environmental Effects

Definition of Significance

A significant environmental effect of the project activities on aquatic resources occurs if a population or portion thereof is affected in such a way as to cause a decline or change in abundance or distribution of the population over one or more generations; natural recruitment may not re-establish the population to its original level. A significant effect on aquatic habitat may alter the valued habitat, physically, chemically or biologically, in quality or extent, to such a degree that there is a decline in the diversity of the habitat.

Summary of Environmental Effects on Aquatic Resources

It is anticipated that there will not be any negative residual environmental effects on aquatic resources as a result of the remediation of the Roberts and Ida Bay mine sites. This is assumed because of the isolation of the Roberts Bay mine site from fish bearing waters and the minimal work excavation work required proximate to the marine environment at the Ida Bay mine site. The removal of the waste rock that is presently above the high tide mark at Ida Bay may improve the aquatic habitat as it will be eliminated as a source of contaminated sediment and/or runoff.

Residual effects to aquatic resources associated with the proposed remediation project were determined to be not significant and are summarized below in Table 4-8.

Table 4-8: Summary of Residual Effects to Aquatic Resources Associated with the Proposed Remediation of the Roberts Bay and Ida Bay Mine Sites

VEC	Project Phase	Potential Effects	Positive or Negative Effect	Mitigation Success	Residual Effects Rating
Aquatic Resources	Mobilization	Sediment in runoff from moving traffic/equipment through watercourses	Negative	High	Not Significant
		Accidents – fuel/chemical spills or leaks from ATVs or equipment being moved may contaminate receiving waters	Negative	High	Not Significant
	Remediation	Increased erosion and sediment in runoff from removing vegetation and disturbing soils near receiving waters	Negative	High	Not Significant
		Release of contaminated materials (soils/hazoardous wastes) into aquatic enviornment during remediation activities and mobilization off-site	Negative	High	Not Significant
		Concrete-affected wastewater	Negative	High	Not Significant
		Removal of contaminated soil and other hazardous materials from areas close to water bodies reduces the risk of exposure to aquatic receptors	Positive	-	Positive
		Accidents – fuel/chemical spills or leaks from ATVs or equipment may contaminate receiving waters	Negative	High	Not Significant
	Demobilization	Sediment in runoff from moving traffic/equipment through watercourses	Negative	High	Not Significant
		Accidents - spills of hazardous materials being removed from site	Negative	High	Not Significant
		Accidents – fuel/chemical spills or leaks from ATVs or equipment	Negative	High	Not Significant

The remediation of the near shore area will reduce the potential for further impact. The overall effect of the proposed remediation on aquatic receptors and habitat is assessed as not significant or as positive.

4.7 HEALTH AND SAFETY

4.7.1 Description of Existing Environment

A Screening Level Human Heath Assessment was conducted by Senes Consultants (2004) for the Roberts Bay and Ida Bay mines sites. The human health risk assessment was conducted using conservative assumptions that lead to an overestimation of potential exposure (Senes, 2004). The risk assessment for Roberts Bay mine site showed that none of the existing contaminants of potential concern exceeded the hazard quotient for carcinogenic effects, although the carcinogenic risk from arsenic exposure exceeded the risk level of 1×10^{-5}; the ingestion pathway was the main source of arsenic, particularly the consumption of water. The assessment of the Ida Bay site showed that the hazard quotient was not exceeded by contaminants. The Roberts Bay mine site was identified as having physical hazards including the adit, waste rock piles, and mine equipment and facilities. The Ida Bay mine site had physical hazards that included an adit, exploration pits and a vent raise.

Additionally, a human health and ecological risk assessment of the mine sites was conducted by UMA (2005). It was concluded that the petroleum hydrocarbon and trace metals at Roberts Bay

mine and Ida Bay deposit do not represent a chemical hazard to periodic visitors to the site. The report recommended that remedial strategies should consider mitigating the human exposure to fine waste rock/tailings and isolated standing water (UMA, 2005).

4.7.2 Health and Safety Impact Assessment

4.7.2.1 Identification of issues, Interactions, and Potential Effects

There is the potential for injury to employees during mobilization to/from the site from vehicles and equipment. Specific provisions need to be made to ensure employees are properly prepared for working in northern climate conditions.

The environmental assessments produced by Rescan (2003, 2004), Senes (2004), Earth Tech (2006a), UMA (2005) and AMEC (2006, 2007a) have identified areas of contamination on both the Roberts Bay and Ida Bay mine sites. The existing environmental impacts include contaminated soils, exposed waste rock, hazardous and non-hazardous materials, mine openings and contaminated marine sediments.

It was concluded that there would be negligible human health risks associated with periodic exposure to the mine sites (UMA, 2005). Although there were no excessive risks predicted, two sources of contaminants stand out as the highest sources of risk; (1) standing bodies of water, including flooded adits and tailing pond; and (2) the fine fraction of waste rock/tailings with elevated arsenic and or lead (UMA, 2005).

4.7.2.2 Mitigation

Prior to the start of work, course material for a Worker Orientation Seminar will be developed. This seminar will describe the work at the site, and provide instruction for the applicable health, safety, and environmental policies and regulations as related to the site work activities to all employees.

A comprehensive Site Specific Health and Safety Plan will be developed for the remediation activities, which will require workers to wear appropriate personal protection equipment as well as describe procedures for handling hazardous material and spill contingencies. An Emergency Response Plan will also be developed that includes a Spill Contingency Plan and Fire Safety Plan. The transport of contaminated and hazardous material will be done in accordance to Transportation of Dangerous Goods Regulations.

4.7.2.3 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.

Summary of Environmental Effects on Health and Safety

The remediation of the mine sites will eliminate human health risk of exposure to contaminated soils and water and to the physical risks of abandoned mine equipment and facilities as well as adits and waste rock piles. Residual effects to human health associated with the proposed remediation project are summarized below in Table 4-9.

Table 4-9: Summary of Residual Effects to Human Health Associated with the Proposed Remediation of the Roberts Bay and Ida Bay Mine Sites

VEC	Project Phase	Potential Effects	Positive or Negative Effect	Mitigation Success	Residual Effects Rating
Health and Safety	Mobilization	Vehicle accidents during mobilization	Negative	High	Not Significant
		Injuries associated with working in a northern climate	Negative	High	Not Significant
		Exposure to contaminates idenfied on-site.	Negative	High	Not Significant
	Remediation	Vehicle/equipment accidents during remediation	Negative	High	Not Significant
		Injuries associated with working in a northern climate	Negative	High	Not Significant
		Exposure to contaminates idenfied on-site.	Negative	High	Not Significant
	Demobilization	Vehicle accidents during demobilization	Negative	High	Not Significant

Based on the information provided in this report and taking into account the proposed mitigation measures, the effects of the project on health and safety are not likely to cause significant adverse effects.

4.8 ARCHAEOLOGY AND HERITAGE RESOURCES

4.8.1 Description of Existing Environment

The archaeological impact assessment", prepared by FMA Heritage Resource Consultants Inc. (FMA, 2006), identified eight archaeological sites within the study area (Figure 7). All sites identified consist of stone features. Several of the sites also contain historic period artefacts. Of the eight sites identified (NbNh-35 to NbNh-42), six are outside the area identified as being directly affected by the remediation activities (FMA, 2006). These six sites have been recommended for avoidance by remediation personnel, due to the moderate to high heritage value assigned to them (FMA, 2006).

There are two sites, NbNh-39 and NbNh-42, which are located within the proximity of the Roberts Bay mine site including the existing access to the site. Site NbNh-39 is a recent stone circle located immediately south of the Roberts Bay mine camp location and has been given low to moderate heritage value due to the recent nature of the site (FMA, 2006). Avoidance of this site is recommended.

Site NbNh-42 is located in close proximity to the shoreline of Roberts Lake; additionally the ATV trail that accesses the Roberts Bay mine site runs directly through the site. Above the beach is a complex and large site consisting of numerous features including five stone circles of varying age, historic metal and wood debris, four blinds, one box hearth and a hide drying location (FMA, 2006). Avoidance of this site is recommended due to the high heritage value of the site and access to the mine site is recommended from the east in order to avoid potential impacts (FMA, 2006).

4.8.2 Archaeological and Heritage Resources Impact Assessment

4.8.2.1 Identification of issues, Interactions, and Potential Effects

The proposed remediation works have the potential to affect two known archaeological sites (NbNh-39 and NbNh-41) located within the project area. Six other archaeological sites are located proximate to the proposed project area.

The presence and movement of people around the site has the potential to disturb unrecorded archaeological resources that may be present. Remediation activities also have the potential to expose new sites. Environmental effects on archaeological sites are considered negative, permanent, and irreversible. Once a site is disturbed or destroyed, cultural information is lost. However, because archaeological sites are of limited spatial extent, they can often be readily avoided, once the locations are known. It should be noted that positive effects do occur prior to the actual disturbance. Many sites are being recorded and investigated largely because of potential development. This provides the opportunity to add to the scientific and cultural knowledge of the region.

4.8.2.2 Mitigation

The area of the archaeological sites should be well marked in order for the remediation crew to determine the best site access and work area option that will eliminate impacts to the sites. Archaeological sites NbNh-39 and NbNh-41 will be avoided during the remediation works.

It is recommended that the existing ATV trail be closed and an alternative route to the Roberts Bay mine site be accessed from the low lying area located east of the site (FMA, 2006).

An Archaeology Protection Plan will be developed that clearly outlines specific procedures to be followed in the event an artefact is discovered on the surface or during subsurface site works. Specific policies regarding the collection and preservation of findings will include the following:

- the discovery of any additional archaeological artefacts will trigger a stoppage of work at that location and a notification to the Nunavut Department of Culture, Language, Elders, and Youth;
- work will not proceed until the site has been assessed, mitigated and permission to proceed is given;

- significance of the finding will be reviewed at the time the artefact is discovered;
- The Nunavut Department of Culture, Language, Elders, and Youth will be involved in the removal of any and all artefacts found on site; and
- Nunavut Department of Culture, Language, Elders, and Youth will take ownership of/responsibility for these artefacts.

4.8.2.3 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.

Summary of Environmental Effects on Archaeological and Heritage Resources

Staff working on the remediation will be made aware of the historical significance of the area and will be briefed on the types of the artefacts commonly found in the area. There is the potential for additional archaeological resources. Work will be stopped in the event that an artefact is discovered during remediation activities. Residual effects to archaeological and heritage resources associated with the proposed remediation project are summarized below in Table 4-10.

Table 4-10: Summary of Residual Effects to Archaeological and Heritage Resources Associated with the Proposed Remediation of the Roberts Bay and Ida Bay Mine Sites

VEC	Project Phase	Potential Effects	Positive or Negative Effect	Mitigation Success	Residual Effects Rating
Archaeology and Heritage Resources	Mobilization	Disturbance or destruction of previously identified archaeological sites	Negative	High	Not Significant
		Disturbance or destruction of new/unanticipated archaeological sites	Negative	High	Not Significant
		Discovery and documentation of unanticipated archaeological sites	Positive	-	Positive
	Remediation	Disturbance or destruction of previously identified archaeological sites	Negative	High	Not Significant
		Disturbance or destruction of new/unanticipated archaeological sites	Negative	High	Not Significant
		Discovery and documentation of unanticipated archaeological sites	Positive	-	Positive
	Demobilization	Disturbance or destruction of previously identified archaeological sites	Negative	High	Not Significant
		Disturbance or destruction of new/unanticipated archaeological sites	Negative	High	Not Significant
		Discovery and documentation of unanticipated archaeological sites	Positive	-	Positive

There are no expected adverse residual affects on archaeological and heritage resources as a result of the proposed remediation works with the implementation of applicable mitigation measures. Based on the information provided in this report, the effects of the project on archaeological and heritage resources are not likely to cause significant adverse effects.

4.9 LAND USE

4.9.1 Description of Existing Environment

A summary of the existing land use conditions of the area of the Roberts Bay and Ida Bay was provided by UMA (2005).

In the summer months, access to the Roberts Bay mine is only possible by float equipped fixed wing air craft, helicopter, or via boat into Melville Sound/Roberts Bay and over land travel. In the winter, access is possible via snow mobile and sled. The closest community is located along the eastern coast of Bathurst Inlet and is known as Umingmaktok. Cambridge Bay, a larger centre, is located approximately 115 km northeast.

In 1997 the Roberts Mining Lease was surrendered back to INAC and in 1998 the ground was re-staked as the ORO 5 claim. Available information suggests that mineral exploration has not occurred in the immediate area for several years.

The majority of activity during the past couple of years at the Roberts Bay and Ida Bay mine sites has been directly associated with determining the extent of contamination at the site and developing an appropriate remediation plan.

Although site specific information regarding use of the area by the local communities was not available, general information regarding traditional use of the area has been compiled for the neighbouring Doris North Project (Points West, June 2002). In the early to mid 1900's the local Inuit would have followed a much more nomadic life style. Northern communities are much more concentrated today; nevertheless, up to 58% of the population in major centres, and over 75% of the population in smaller northern communities participate in traditional hunting and fishing activities (Hornal and Associates Ltd., 2003). The natural food resource cycles dictated the hunting and fishing habits of the Inuit. These natural cycles are likely still followed today. During the winter (December until May) the focus would be on seal hunting on the ice. During early spring and before ice break-up on the lakes, the focus would shift to ice fishing on inland freshwater lakes (Points West, 2002). Caribou hunting would stretch from spring through until fall, but hunters preferred to hunt caribou between August and November. This was because these animals would contain more fat deposits and thicker coats. Incidental hunting for small terrestrial game, including ptarmigan and arctic hare would also occur through the summer. In late summer the focus would be on netting the migrating char as they return from the ocean toward their over wintering habitats in the inland lakes.

4.9.2 Land Use Impact Assessment

4.9.2.1 Identification of issues, Interactions, and Potential Effects

The proposed remediation activities of the Roberts Bay and Ida mine sites have the potential to temporarily disrupt seasonal hunting in the area due to the operation of the ATV between the mine sites and the presence of project workers. Adverse affects to land use associated with the accidental release of fuels or hazardous materials is possible.

4.9.2.2 Mitigation

Local communities and Inuit Associations will be notified of the proposed remediation works, in order to mitigate any disturbance to seasonal hunting trips. An Emergency Response Plan will also be developed that includes a Spill Contingency Plan and Fire Safety Plan to prevent or limit impacts from accidents and emergencies.

4.9.2.3 Residual Environmental Effects

Definition of Significance

A significant environmental effect of the project activities on land use occurs if the potential for traditional land use activities are permanently lost.

Summary of Environmental Effects on Land Use

The remediation works have the potential to disturb seasonal land use activities such as hunting; however the local communities will be notified of the proposed works in order to mitigate such disturbances. The area directly affected by the proposed remediation activities is minimal relative to that available for traditional use. Residual effects to land use associated with the proposed remediation project are summarized below in Table 4-11.

Based on the information provided in this report and taking into account the proposed mitigation measures, the effects of the project on land use are not likely to cause significant adverse effects.

Table 4-11: Summary of Residual Effects to Land Use Associated with the Proposed Remediation of the Roberts Bay and Ida Bay Mine Sites

VEC	Project Phase	Potential Effects	Positive or Negative Effect	Mitigation Success	Residual Effects Rating
Land Use	Mobilization	Disruption to seasonal hunting in the area due to the operation of ATV between the mine sites and the presence of project workers	Negative	High	Not Significant
		Accidents – fuel/chemical spills or leaks from ATVs or equipment being moved	Negative	High	Not Significant
	Remediation	Disruption to seasonal hunting in the area due to the operation of ATV between the mine sites and the presence of project workers	Negative	High	Not Significant
		Accidents – fuel/chemical spills or leaks from ATVs, equipment or hazardous wastes.	Negative	High	Not Significant
	Demobilization	Disruption to seasonal hunting in the area due to the operation of ATV between the mine sites and the presence of project workers	Negative	High	Not Significant
		Accidents – fuel/chemical spills or leaks from ATVs or equipment being moved	Negative	High	Not Significant

4.10 AESTHETICS

4.10.1 Description of Existing Environment

The Roberts Bay and Ida Bay mine sites have anthropogenic features that clearly stand out from the surrounding natural environment. The remaining mine facilities structures, waste rock piles, tailings pond, mine openings, hazardous and non-hazardous waste all contribute to a decreased aesthetic value.

4.10.2 Aesthetics Impact Assessment

4.10.2.1 Identification of issues, Interactions, and Potential Effects

It is not expected that the proposed remediation works will have an adverse effect on the aesthetic values of the area. It is expected that as a result of the remediation activities, overall aesthetic value of the area will be improved. Accidental spills of fuels or hazardous materials are possible during mobilization and remediation activities.

4.10.2.2 Mitigation

The remediated areas of the mine sites will be recontoured to blend into the natural landscape. No additional mitigation measures are required in relation to the aesthetic values of the mine sites. It is predicted that the overall aesthetics of the site will be improved by the proposed remediation.

4.10.2.3 Residual Environmental Effects

Definition of Significance

A significant environmental effect of the project activities on visual aesthetics occurs when the appearance of the area is decreased to a level that adversely affects the current and potential future use of the area.

Summary of Environmental Effects on Aesthetics

The proposed remediation works are expected to have an overall positive effect on the aesthetic values associated with the mine sites. Residual effects to aesthetics associated with the proposed remediation project are summarized below in Table 4-12.

Table 4-12: Summary of Residual Effects to Aesthetics Associated with the Proposed Remediation of the Roberts Bay and Ida Bay Mine Sites

VEC	Project Phase	Potential Effects	Positive or Negative Effect	Mitigation Success	Residual Effects Rating
Aesthetics	Mobilization	Construction of temporary camp	Negative	High	Not Significant
		Presence of ATVs and equipment	Negative	High	Not Significant
	Remediation	Presence of ATVs and equipment	Negative	High	Not Significant
		Removal of historic anthropogenic features and recontouring of remediated areas to blend into the natural landscape.	Positive	-	Positive
	Demobilization	Presence of ATVs and equipment	Negative	High	Not Significant

Based on the information provided in this report and taking into account the proposed mitigation measures, the effects of the project on visual aesthetics are predicted to be positive.

4.11 SOCIO-ECONOMICS

4.11.1 Description of Existing Environment

The project area is located in the Kitikmeot Region of Nunavut. The 2001 Census reported a population of 1,309 and the majority of the population participate in hunting and fishing activities. The results of the 2003 Socio-Economic Impact Assessment of the Proposed Doris North Project were used in the socio-economic assessment of the proposed remediation of the Roberts Bay and Ida Bay mines to infer potential effects.

4.11.2 Socio-Economic Impact Assessment

4.11.2.1 Identification of Issues, Interactions, and Potential Effects

The Socio-Economic Impact Assessment of the Proposed Doris North Project (Hornal and Associates Ltd., 2003), estimated the project impact on the following six Valued Socio-Economic Components:

- employment opportunities;
- education and training;
- contract and business opportunities;
- community health;
- crime; and
- demographics.

The Socio-Economic Impact Assessment conducted for the Doris North project suggested that the impact on employment opportunities, education and training and contract and business opportunities to be moderately positive. The impact on community health was expected to be moderate and could be either positive or negative depending on mitigative measures. The impact on crime was expected to be moderately negative and the impact on demographics was expected to be minor (Hornal and Associates, 2003).

The effects of the remediation of the mine sites are expected to be negligible compared to those identified for the Doris North Project due to the limited scope of the proposed remediation project.

4.11.2.2 Mitigation

Similar socio-economic impact mitigation measures will be employed as listed in the Doris North socio-economic impact assessment. Mitigation measures include the promotion of employment opportunities and business opportunities.

It should be noted that during the 2005 field program, use of the community facilities and services, and employment opportunities provided some benefit to the community. INAC will continue providing opportunities for local communities through the contractors' selection process.

4.11.2.3 Residual Environmental Effects

Definition of Significance

A significant environmental effect of the project activities on socio-economics are clearly distinguishable and result in strong concern among stakeholders or result in substantive

changes in the well-being of defined populations/communities. They are usually long-term in duration, or if short-term are not easily managed.

Summary of Environmental Effects on Socio-Economics

The remediation of the Roberts Bay and Ida Bay mine sites would be a benefit to the people that may utilize the natural resources of the area of the mine sites. With the successful remediation of the areas of concern the sources of potential risks will be eliminated. With the contaminated areas remediated, people would be able to continue hunting and consuming wildlife that inhabit the local area without a risk to their health. Residual effects to socio-economics associated with the proposed remediation project are summarized below in Table 4-13.

Table 4-13: Summary of Residual Effects to Socio-economics Associated with the Proposed Remediation of the Roberts Bay and Ida Bay Mine Sites

VEC	Project Phase	Potential Effects	Positive or Negative Effect	Mitigation Success	Residual Effects Rating
Socio-economic Conditions	Mobilization	Utilzation of local companies for mobilization of equipment to/from site	Positive	-	Positive
	Remediation	Utilzation of local companies for remediation activities	Positive		Positive
	Demobilization	Utilzation of local companies for demobilization of equipment from site	Positive	-	Positive

Overall, the impact of the remediation activities would have a small positive effect on the socio-economic situation of the region.

4.12 GENERAL CONTINGENCY, EMERGENCY RESPONSE AND SPILL PLAN

The selected contractor will develop and implement appropriate contingency, emergency response and spill plans which prevent spills and accidents and include:

- hazard identification and risk assessment;
- details of a response plan and a reporting procedure;
- provides a list of emergency contacts and external resources;
- provides mapping of the previously described hazardous materials identified on-site as well as areas where potential emergencies may arise (i.e. temporary housing);
- detail procedures to be followed for emergencies and spills that could occur; and
- provides outlines of appropriate clean up procedures for likely spills.

4.13 PROPOSED MONITORING REQUIREMENTS

After implementation of the remediation plan the long-term monitoring program should be very simple, requiring only simple instrumentation installed at the Roberts Bay mine site. No instrumentation should be required at the Ida Bay mine site as no landfill or hazardous materials are expected to remain at the site after remediation.

Installation of groundwater monitoring equipment should not be necessary because of the relatively small watershed and shallow active zone. The chemistry of the local surface water should closely represent the chemistry of the groundwater in the active zone. Monitoring sites at the Roberts Bay mine site should include the following (AMEC 2007a):

- the stream flowing south to Roberts Lake (main watershed);
- the stream or streams flowing north and west around the bedrock high (northern site drainage);
- any stream flowing west to Roberts Bay located below the tailings and dump sites to detect possible leachate from these features; and
- Roberts Lake (for background and quality control).

The monitoring program should minimally follow the INAC protocols for remediated sites. During the first five years after remediation, monitoring, and sample collection should be conducted at least once a year, preferably immediately after the spring melt (June). Monitoring frequency should be reduced to once every five years (for the next 5 years with re-evaluation after 25 years).

Thermistors strings should be installed (in pairs) within the tailings pond location at the Roberts Bay mine site to confirm permafrost re-establishment after capping of the structure. The collection of data from these thermistors should occur on the same schedule as water sample collection to save on travel and labour costs.

4.14 SUMMARY OF RESIDUAL ENVIRONMENTAL EFFECTS

Residual environmental effects are those that remain after mitigation measures have been factored into the analysis. A significant residual effect is defined as any permanent, non-mitigable change in an identified VEC or VESC. The standardized codes and descriptors used to perform the project-environment assessment are summarized in Appendix E.

The environmental effects assessment for those biophysical and socio-economic components that may be adversely affected by the proposed project and for which there is proposed mitigation adequate to reduce those effects is provided in Appendix F.

With the implementation of mitigation measures and project design strategies described in Section 2.0, potential adverse effects of the proposed project will be adequately managed and adverse residual effects are not expected to occur.

After implementation of the remedial plan, long-term monitoring requirements are expected to be minimal, requiring only simple instrumentation installed at the Roberts Bay mine site, the details for which will be finalized following completion of the proposed remediation project.

4.15 CUMULATIVE EFFECTS

The cumulative effects assessment, required under CEAA, considers the interaction between residual effects of the project under consideration (i.e., those effects that remain during construction and/or operations after implementation of mitigation measures) and those associated with other identified project and/or activities. Residual effects may interact potentially resulting in cumulative impacts.

Potential cumulative effects are assessed only for those environmental components likely to sustain an adverse residual effect as a result of the proposed project. Based on the results of the environmental assessment, residual effects are not anticipated with respect to those biophysical or socio-economic components analyzed.

As part of the Cumulative Effects Assessment the following information sources were searched for projects that may to the cumulative effects of the project area:

- information compiled for the Doris North Project;
- Nunavut Impact Review Board (NIRB);
- Canadian Environment Assessment Registry (CEAR); and
- Mackenzie Valley Land and Water Board (MVLWB) - no projects were found on the MVLWB website that may contribute to cumulative effects of the project area.

The only other major project that would interact with the Roberts Bay and Ida Bay is the Doris North Project (Figure 8, Appendix A). If possible, remediation of the mine sites will be coordinated with the Doris North Project for the use of equipment and transfer of contaminated material. Baseline data gathered for the Doris North Project has been used in the assessment of potential impacts of VECs found at the Roberts bay and Ida Bay mine sites, due to the close proximity of the projects.

4.15.1 Project Scope

The proposed remediation of the Roberts Bay and Ida Bay mines includes the remaining infrastructure, the tailings pond, waste rock, non-hazardous waste, hazardous waste, contaminated soils, mine openings, and marine sediments. Apart from the mine site issues, a proposed winter road is to be constructed between Roberts Bay to the mine sites, which will be

used to transport hazardous waste and metals contaminated soil off site. A temporary camp will be also established at the Roberts Bay mine site to facilitate the breakdown and segregation non-hazardous waste.

At the time of report preparation, the remediation option suggested for the mine sites was estimated to take approximately 28 months, which includes mobilization, remediation, demobilization as well as the disposal of hazardous materials off-site. Although there is the potential for the remedial activities to be "piggy backed" on to the Doris North Project, the feasibility of this option was not known and therefore possible effects from this option were not considered in this assessment.

4.15.2 Analysis of Effects

The remediation of the mine sites will initially disturb the existing terrain and environmental conditions of both sites. However, given the limited environmental footprint of the sites and the removal and disposal of contaminated soil and hazardous waste, it is expected that the overall impact of the remediation works will be positive. In the long term the remediation project facilitates the return of soil, water and vegetation and wildlife habitat to natural conditions.

Due to the limited time frame of the project it is not expected that it will contribute significantly to the cumulative environmental effects of other land use activities in the local area. It is also not expected to significantly impact the traditional land use activities such as hunting and fishing by local Inuit peoples.

Remediation of the Roberts Bay and Ida Bay mine sites will have an overall positive affect on the environment and mitigation strategies will be implemented to avoid and/or reduce potential project-related impacts.

4.15.3 Mitigation Measures

The remediation works will be implemented by following an Environmental Management Plan (EMP) that will identify areas of environmental sensitivity. The EMP will provide Best Management Practices (BMPs) that, when implemented, will effectively mitigate potential impacts on the environment.

Due to the remoteness of the mine sites and the sensitivity of the surrounding environment, care is to be taken to ensure that the project does not impact or alter the landscape outside the mine sites.

4.15.4 Significance

There are no negative residual or cumulative effects expected with respect to the current and foreseeable activities in the project area.

Based on the information provided in this report and taking into account the proposed mitigation measures, the effects of the project are not likely to cause significant adverse effects.

4.16 IMPACT OF THE ENVIRONMENT ON THE PROJECT

The seasonal work conditions limit the time allowed for winter and summer remediation activities. 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. Although adverse weather conditions are relatively common in this northern environment, it is understood that the contractor chosen for completing the project will be familiar with the site specific conditions and adequately prepared to perform the required measures to ensure the proposed project proceeds. Due to the relatively short duration of the project there is minimal potential for the adverse environmental conditions to affect the proposed remediation activities.

5 CONCLUSIONS

The remediation of the abandoned Roberts Bay and Ida Bay mines sites will ultimately allow the sites to be restored to pre-disturbance conditions. The project will require the removal of contaminated soil and hazardous waste, the demolition and removal of mine site infrastructure, and non-hazardous waste, and the closure of mine openings. The effects of the proposed project on the Valued Environmental Components associated with the remediation of the Roberts Bay and Ida Bay mine sites have been assessed as not significant or as positive.

6 REFERENCES

AMEC, 2006. Roberts Bay and Ida Bay Abandoned Mine Sites, Geochemical Assessment in Support of Site Remediation. Prepared for Public Works and Government Services Canada.

AMEC, 2007a. Roberts Bay and Ida Bay Abandoned Mine Sites, Remediation Plan. Prepared for Public Works and Government Services Canada, January 2007

AMEC, 2007b. Roberts Bay and Ida Bay Abandoned Mine Sites, Geotechnical Assessment in Support of Site Remediation. Prepared for Public Works and Government Services Canada.

Canadian Council of Ministers of the Environment (CCME). 1999. Canadian Environmental Quality Guidelines. Chapter 1: Canadian National Ambient Air Quality Objectives: Process and Status.

Guidelines. Chapter 1: Canadian National Ambient Air Quality Objectives: Process and Status.

Canadian Council of Ministers of the Environment (CCME), 2001. Canada-Wide Standards for Petroleum Hydrocarbons.

Canadian Council of Ministers of the Environment (CCME), 2003. Canadian Environmental Quality Guidelines. Summary Table, December, 2003.

Canadian Council of Ministers of the Environment (CCME), 2005. (updated from 1999) Environmental Quality Guidelines.

Canadian Environmental Assessment Agency, 1994. Determining Whether a project is Likely to Cause Significant Adverse Environmental Effects.

Canadian Environmental Assessment Agency, 2003. Canadian Environmental Assessment Act – An Overview.

Calef and Hubert, 2003. 2003 Hope Bay Wildlife Studies Report.

COSEWIC. 2004. Committee on the Status of Endangered Wildlife in Canada website: www.cosewic.gc.ca

Doris North Project, 2005. Technical Report

Earth Tech (Canada) Inc. 2006a. Roberts Bay and Ida Bay Abandoned Mine Sites Environmental Site Assessment Report. Report prepared for Public Works and Government Services Canada (April 2006).

Earth Tech (Canada) Inc., 2006b. Roberts Bay and Ida Bay Abandoned Mine Sites - Geotechnical and Geophysical Report. Prepared for Public Works and Government Services Canada (April 2006).

Earth Tech (Canada) Inc., 2006c. Roberts Bay and Ida Bay Abandoned Mine Sites Waste Audit. Prepared for Public Works and Government Services Canada (April 2006).

Environment Canada, Canadian Climate Normals, 1971- 2000, Cambridge Bay Airport, Nunavut.

FMA Heritage Resource Consultants Inc., 2006. Archaeological Impact Assessment – Ida Bay and Roberts Bay Mine Sites Remediation Program. Report prepared for Public Works and Government Services Canada.

Hornal and Associates Ltd., 2003. A Social-Economic Impact Assessment of the Proposed Doris North Project in the Kitikmeot Region Nunavut. Report Prepared for Miramar Hope Bay Ltd.

Hurbert and Associates, 2002. Terrestrial Wildlife of Hope Bay, Nunavut: An Integration and Overview of Data Collected from 1994-2002. Prepared by G. Calef and B. Hubert for Miramar Hope Bay Limited.

Hurbert and Associates, 2003. Data Report – Wildlife Studies: June – July 2003 of Hope Bay, Nunavut. Prepared by G. Calef and B. Hubert for Miramar Hope Bay Limited.

Jacques Whitford Limited, 2005a. Environment Screening of the Proposed Site Remediation at the Former FOX-C DEW Line Site at Ekalugad Fjord, Nunavut. Report prepared for Public Works and Government Services Canada.

Jacques Whitford Limited, 2005b. Environment Screening of the Proposed Site Remediation at the Former CAM-F DEW Line Site at Sarcpa Lake, Nunavut. Report prepared for Public Works and Government Services Canada.

Indian and Northern Affairs Canada (INAC), 1993. Guidelines for Acid Rock Drainage Prediction in the North. Indian and Northern Affairs Canada QS-8480-000-EF-A1.

Indian and Northern Affairs Canada (INAC), 2005. General Terms of Reference for Environmental Assessments. INAC BC Region. 21-June-05 revision.

Indian and Northern Affairs Canada (INAC), 2006. Nunavut Regional Office of Indian and Northern Affairs Canada website. http://www.ainc-inac.gc.ca/nu/nuv/zxcd_e.html. Viewed November 16, 2006.

Northwest Territories Government, 1998. Guideline for the Management of Waste Batteries.

Northwest Territories Government, 2003. Environmental Guideline for Contaminated Site Remediation.

Northwest Territories Government, 2004. Environmental Guideline for Waste Lead and Lead Paint.

Nunavut Impact Review Board (NIRB), 2006a. Guide to Filing Project Proposals and the Screening Process. August 2006.

Nunavut Impact Review Board (NIRB), 2006b. Guide to the NIRB Review Process. Updated November 2006.

Points West Heritage Consulting Ltd. (Points West), June 2002. Doris North (Hope Bay) Project, Nunavut. Archaeological Investigations in 2003 – Final Report.

Price, W.A. 1997. DRAFT Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Minesites in British Columbia. British Columbia Ministry of Employment and Investment, Energy and Minerals Division.

Rescan Environmental Services Ltd. (Rescan), 2003. Preliminary Assessment of Roberts Bay and Ida Bay Abandoned Mine Sites, Nunavut, Canada. Report prepared for Public Works and Government Services Canada.

Rescan Environmental Services Ltd. (Rescan) 2004. Phase I/II Environmental Site Assessment Roberts Bay Silver Mine and Ida Bay Silver Deposit, Nunavut.

RL&L Environmental Services Ltd. and Golder Associates Ltd., 2002. Aquatic Baseline Studies Doris Hinge Project Data Compilation Report 1995-2000. Submitted to Miramar Hope Bay Limited November 2002.

RL&L Environmental Services Ltd. and Golder Associates Ltd, 2003a. Doris North Project Aquatic Studies 2002 Submitted to Miramar Hope Bay Limited March 2003.

RL&L Environmental Services Ltd. and Golder Associates Ltd, 2003b. Doris North Project Aquatic Studies 2003. Submitted to Miramar Hope Bay Limited November 2003

Senes Consultants, 2004. Draft Report on Human Health Screening level Risk Assessment for Roberts Bay Silver Mine and Ida Bay Silver Deposit. Prepared for Indian and Northern Affairs Canada.

UMA Engineering Ltd., 2005. Roberts Bay Mine and Ida Bay Deposit Human Health and Ecological Risk Assessment, Draft Report prepared for Public Works and Government Services Canada.

Vista Engineering, 1996. Field Survey and Inventory. Private Report.

7 LIMITATIONS AND CLOSURE

This screening report has been prepared for Public Works and Government Services Canada (PWGSC) and Indian and Northern Affairs Canada (INAC). Any use that a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. AMEC will not assume any responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The findings, conclusions, and recommendations in this screening report are based on the expertise and experience of AMEC staff in conducting similar reviews. AMEC staff have also relied, in part, upon information provided by others. Accordingly, AMEC accepts no responsibility for any deficiency, misstatements, or inaccuracy contained in this report as a result of misstatements, omissions, misrepresentations, or fraudulent information provided in written reports or through personal interviews. The possibility remains that unexpected environmental conditions may be encountered at the site. Should such an event occur, AMEC must be notified so we may determine if any modifications to our conclusions are necessary.

Thank you very much for selecting AMEC for this assignment. Please call either of the undersigned if you require any further information.

Respectfully submitted,

AMEC Earth & Environmental
a division of AMEC Americas Limited

Reviewed by:

Sandra Baker, M.Sc., R.P.Bio.
Environmental Biologist

Tim Bekhuys, P.Biol., R.P.Bio.
Senior Environmental Scientist

Bruce Ott, Ph.D., R.P.Bio.
Senior Mining Scientist