

Mitigation: *Smoking is prohibited within 5 metres of the fuel storage facilities. Appropriate signs was posted. Fire-fighting equipment are available for immediate access near the tank farm and at all fuel storage locations.*

7.4 Heavy Machinery and Vehicle Management

Heavy equipment and vehicles such as excavators, bulldozers and trucks are required to conduct and support clean up activities. These vehicles will require routine maintenance and lubrication.

Impact: Wildlife Stress Wildlife can be affected by vehicle movements although it is expected that this will have a minimal impact.

Mitigation: *Mobile equipment and vehicle operators shall not operate vehicles in a manner to disturb any wildlife species.*

Impact: Habitat Alteration Some habitat alteration may occur if a spill of maintenance fluids occur.

Mitigation: *Vehicle and equipment maintenance and servicing shall be conducted only in designated areas on gravel pads, where special procedures can be implemented to manage fluids, waste, and contain potential spills. Maintenance, fuelling and lubrication of machinery shall be conducted in such a way as to avoid fluid spills. Used fluids (e.g., oils, antifreeze) and filters (e.g., oil, fuel) shall be containerized in separate and appropriately identified drums (or other appropriate containers) and shall be treated as hazardous materials. All storage containers shall be properly sealed after use. Waste fluids shall not be used for dust control.*

Impact: Health and Safety Because of the topography of the site, there is a concern for accidents involving vehicles on roads.

Mitigation: *A speed limit shall be established (tentatively 30 km/hour or less) and enforced by the site superintendent.*

7.5 Water Supply

Water from Lower Lake, located near Lower Lake borrow pit, shall be used as a water supply

source providing such use does not adversely affect fish habitats. It should be mentioned that no signs of aquatic life were recorded in Lower Lake. Therefore, minimal impacts are expected.

Impact: Fish Habitat Alteration There is a potential for fish habitat alteration from freshwater withdrawal activities.

Mitigation: *Water usage shall respect all conditions of the water permits delivered by the Nunavut Water Board.*

7.6 Asbestos Abatement

Asbestos pipe insulation and tiles were removed from all buildings located at the summit area. Remaining asbestos material shall be double-bagged and disposed in a separate cell of the non-hazardous landfill.

Impact: Health and Safety The removal of friable asbestos creates a health risk for personnel involved in the asbestos abatement activities.

Mitigation: *The removal of the asbestos from any locations is to be treated as an asbestos project and all of the related health and safety requirements adhered to. This will include the removal of all visible asbestos. The Safety Act and Occupational Health Regulations (Nunavut) require that workers handling asbestos material wear respiratory equipment approved by the Canada Standards Association, as well as other safety equipment including coveralls, gloves, eye protection and head gear. All personnel who work on the asbestos material must be trained for the use of protective equipment and safe handling and disposal of the asbestos. Warning signs should be posted at the site informing staff that asbestos removal is occurring and ensure that personnel not working with the asbestos should not be near the working site.*

7.7 Demolition Work

The Main PCB storage building will be demolished to make way for the construction of the Tier II landfill. Demolition work shall include the removal and disposal of structural steel, sheet metal cladding, fibreglass insulation, and concrete.

Impact: Health and Safety There is a safety concern for workers involved in demolition activities.

Mitigation: *A health and safety program that meets the standards and requirements of applicable regulatory agencies shall be implemented. The construction safety measures of the National Building Code shall be respected and enforced.*

7.8 Construction and Maintenance of Roads

Apart from the existing roads that will require routine maintenance, a temporary road will be constructed to gain access to the S1/S4 valley contaminated area. Another road will be constructed from the lower site to the S1/S4 beach area. In order to reach the S1/S4 beach area, a small stream will have to be crossed. This will be achieved either by installing culverts underneath the gravel road, or by installing a layer of small boulders through which water could continue to flow.

Impact: Permafrost Degradation Cut and fill operations required to provide the sub-granular base for the road access to the S1/S4 beach area may disrupt the permafrost.

Mitigation: *Disturbed soil that disrupts natural drainage patterns or exposes permafrost in ice rich soils shall be repaired.*

Impact: Habitat Degradation Installation of culverts in the stream and subsequent covering by gravel might, or installation of a boulder layer cause stirring of bottom sediments and generate an increase in water turbidity downstream. This could cause impacts to the stream aquatic habitats as well as fish habitats in the ocean downstream.

Mitigation: *These impacts should be temporary (i.e., only during the construction and removal of the road and culverts), however, during these activities, a silt fence shall be installed to limit the spreading of sediments and turbidity downstream. The use of a bridge would eliminate the need for mitigation measures.*

7.9 Excavation of Contaminated Soil

Approximately 5,000 m³ of CEPA PCB soils will be excavated using heavy machinery or manually. Soil will be screened to remove large boulders and containerized. Other contaminated soils, such as Tier I and Tier II soils (lead, cobalt, mercury, or PCBs), as well as hydrocarbon contaminated

soils will also be excavated and managed according to their level of contamination. Hazardous material management areas will be set up for the processing of CEPA soils to prevent the contamination of "clean" areas.

Impact: Rutting and Erosion Unstable areas such as steep slopes and streams may be encountered during the excavation phase. These areas are more prone to rutting, erosion and environmental damage.

Mitigation: *Excavation work shall be minimized in the vicinity of watercourses. Heavy machinery, vehicles and equipment shall not be operated in waterways. Waste, excavated fill and/or debris shall not be disposed in waterways. Suitable barriers such as silt fences shall be installed if required to separate work areas from waterways. All unstable areas requiring excavation shall be identified and procedures shall be implemented to minimize surface rutting.*

Impact: Contamination of "Clean" Areas There is a risk that excavation activities contribute to the contamination of non-contaminated areas including fish habitat. Furthermore, equipment and machinery used during contaminated soil excavation and handling will require cleaning, and this will produce hazardous materials (solids and fluids) that can have a negative environmental impact if not managed properly.

Mitigation: *Hazardous material management areas shall be located at a minimum distance of 30 metres from the nearest water body. CEPA soils screening procedures shall be implemented in such a way as to prevent the spreading of contaminated dust. Movement of heavy machinery, vehicles and equipment within the hazardous material management areas shall be controlled to prevent the dispersion of potentially hazardous dust and materials into the environment. Wash water resulting from the cleaning (i.e., decontamination) of equipment and heavy machinery used in the hazardous waste management areas shall be recovered and treated as per regulations.*

Impact: Permafrost Degradation Material and equipment will have to be stored temporarily within each hazardous material management area for the duration of the excavation activities.

Mitigation: *Storage areas shall be sited in locations where the natural surface drainage will not*

be affected and where ponding can be avoided. Materials shall not be stored on unprotected ground. Gravel pads or other appropriate methods shall be constructed to protect ice-rich soil from damages.

7.10 Construction of Engineered Landfills

Engineered unlined landfills were constructed and operated on site for the disposal of non-hazardous waste materials. Engineered lined landfills were constructed and are operated on site for the disposal of Tier II contaminated soils and debris, creosote-treated timbers, and soils contaminated by heavy hydrocarbons such as lubricating oils and grease.

Impact: Rutting and Erosion Use of heavy equipment and machinery can damage soil integrity, especially in unstable areas.

Mitigation: *Heavy equipment operations shall be limited to pre-determined work areas. Activities outside these areas shall be minimized, and conducted only when the soil is sufficiently dry so that excessive rutting can be prevented.*

Impact: Surface Water Runoff/Sediment Movement Heavy equipment traffic and large movements of granular material may generate high sediment loads in surface water runoff.

Mitigation: *Landfill sites shall be located at a minimum distance of 30 metres from the nearest water body. Silt fences shall be installed in drainage ditches in order to prevent migration of sediments to streams and water bodies.*

Impact: Habitat Loss/Alteration Habitat will be lost and altered through the excavation and removal of top soil, as well as by backfilling over vegetated areas.

Mitigation: *Upon landfill closure, the area shall be covered with granular material, graded and reshaped to match the surrounding topography and minimize erosion. Vegetation will eventually colonize this new surface area.*

7.11 On-site Treatment of Hydrocarbon Contaminated Soils

The soils contaminated by light hydrocarbons, such as gasoline and diesel fuel, will be excavated

and bio-treated on site, most likely by landfarming.

Impact: Contamination of "Clean" Areas Treatment activities may potentially contribute to the contamination of non-contaminated areas. Dry contaminated soil particles and dust may be spread by wind. Furthermore, runoff water draining from the soil may be contaminated.

Mitigation: *The landfarming treatment pad shall be located at a minimum distance of 30 meters from the nearest water body. The soil moisture level shall be kept at an optimal level to promote biodegradation, therefore this soil moisture will minimize loss of particles to wind. Drainage ditches located around the treatment pad will recover potentially contaminated water. The water will then be tested, and treated if required, before being discharged.*

7.12 Disposal of Hazardous Materials

PCB contaminated electrical equipment (e.g., transformers, capacitors, and ballasts) and old batteries have been found on site. Furthermore, hazardous materials may be encountered during the sorting of waste in landfills and the testing of drum contents. Sorting of waste was carried out at the furniture dump, is on-going at the beach dumps, and will be required at the cobalt dump and the airstrip dump, with partial sorting for the latter. Hazardous material management areas will be set up for the processing of hazardous waste to prevent the contamination of "clean" areas. Hazardous materials will be temporarily stored on site and shipped off site to an authorized hazardous waste disposal facility.

Impact: Health and Safety There is a safety concern for workers involved in the handling of hazardous waste.

Mitigation: *Every possible precaution shall be taken when hazardous materials and contaminated soils are handled, hauled or transported to ensure that such materials do not come into contact with site personnel. Protective clothing shall always be used by site workers when hazardous materials including contaminated soils are handled. All clean up personnel shall be informed and shall comply with requirements of the Workplace Hazardous Materials Information System (WHMIS) program and the Hazardous Waste Operations and Emergency Response (HAZWOPER) program.*

Impact: Habitat Degradation Spill of hazardous materials during off site shipping could cause severe impacts to terrestrial and/or fish habitats.

Mitigation: *Any unknown waste that may require off-site shipping shall be characterized to determine whether it must be considered as a transport hazard according to regulations. All provisions from the Transportation of Dangerous Goods Act (TDGA), the International Maritime Dangerous Goods (IMDG) Regulations, and the International Air Transport Association (IATA) Dangerous Goods Regulations shall be respected.*

7.13 Temporary Storage of CEPA Soils

CEPA soils will be containerized at the excavation and the bulk storage locations. Bulk soils and soil filled containers will be transported to the PCB storage facilities. The soil-filled steel containers meeting EIS specifications will be appropriately staged. Some soils may need to be stockpiled in bulk form inside a lined building, with access restricted to authorized and trained personnel.

Impact: Contamination of "Clean" Areas There is an environmental concern with the release of contaminated soils in non-contaminated areas during transportation to storage facilities.

Mitigation: *Spillage of material during transportation between the excavation site and the storage/stockpile location shall be minimized, if not avoided.*

7.14 Disposal of Non-hazardous Materials

Non-hazardous materials such as kitchen and camp rubbish, shredded drums and demolished building structures will be landfilled on site.

Impact: Aesthetic and Safety Non-hazardous waste may cause both an aesthetic and safety concern at the site if not managed properly. Non-hazardous waste can be scattered by wind or animals and thereby becoming a safety concern to personnel as well as wildlife.

Mitigation: *Waste to be placed in non-hazardous landfills shall be compacted and rapidly covered with a layer of granular fill.*

7.15 Landfill Closure

Some existing dumps will be excavated and waste will be sorted to separate hazardous from non-hazardous material. These include the furniture dump, the maintenance dump and the beach dumps.

Impact: Safety and Health Because of the nature of work involved and potential hazardous material exposure, there is a concern for the health and safety of workers.

Mitigation: *The impact of these operations is similar to that of the section 7.12 and 7.14 and the mitigative measures identified in these sections apply.*

7.16 Development of Granular Borrow Areas

Granular material shall mainly be used for road construction, Tier II landfill construction and non-hazardous landfill covers. Resolution Island is very limited in granular material. Specific locations were identified as borrow areas. Blasting of bedrock may be required to increase the volume of granular material.

Impact: Wildlife Avoidance Blasting rock produces a high decibel noise which may alarm wildlife causing some avoidance and resident bird populations may be vulnerable to noise during their nesting period in May and June. This operation will only be required over short periods during the project. Therefore, avoidance by wildlife should not be permanent.

Mitigation: *Blasting shall be limited to the time of the season when nesting is mostly over (i.e., July and August).*

Impact: Safety Hazard The transportation and handling of explosives is a safety concern for workers.

Mitigation: *Handling, storage and transportation of explosives shall be conducted according to applicable laws and regulations. The handling of explosives shall be restricted to authorized and licensed personnel. Blasting shall be conducted in such a way as to minimize dispersal of material, and prevent dispersed materials from reaching fuel or hazardous material storage locations. A buffer zone of 300 metres shall be*

respected.

Impact: Habitat Loss/Alteration Habitat may be lost through the removal of vegetation from blasting operations. However, the bedrock areas to be blasted are relatively free of vegetation.

Mitigation: *No mitigative measures were considered necessary.*

Impact: Environmental Disturbances Quarrying activities may create environmental impacts to the immediate surroundings of the borrow pits.

Mitigation: *Quarry permits issued under the INAC Territorial Quarrying Regulations shall be obtained. The permits shall have site-specific provisions for environmental protection. These conditions are provided to minimize the extraction process impacts on water quality, drainage, erosion and ecosystems. All terms and conditions of the quarry permit shall be respected, including borrow area recontouring and clean up before abandonment.*

Impact: Disruption of Drainage Drainage may be impacted during excavation of the borrow areas. Sediments may be deposited into streams, thereby disrupting natural drainage of the area.

Mitigation: *Borrow pits shall be protected from erosion and ponding by proper grading.*

Impact: Permafrost Degradation Excavation of the borrow areas will remove the insulating ground cover and expose the sides and the bottom of the excavations to direct sunlight. This may result in erosion and slumping of the pit side walls. Damage to permafrost in the immediate vicinity of the pits is unavoidable. The areas are, however, surrounded by bedrock outcrops and it is likely underlain by bedrock as well. The excavations may therefore extend to surface bedrock in some areas, eliminating the concern for permafrost degradation.

Mitigation: *Final grading of any non-bedrock side walls will be required to address slumping and erosion of the pits the following summer.*

7.17 Migration Barriers

Migration barriers consisting of erosion control mats and trenches filled with containment booms will be installed at three (3) different locations to prevent the migration of contaminants (mainly fine particles transported with run-off) from reaching the ocean

Impact: Safety and Health Because of the nature of the work involved to remove existing containment booms, there is a concern that workers may be exposed to potentially hazardous materials.

Mitigation: *The impact of these operations is similar to that of the section 7.12 and 7.14 and the mitigative measures identified in these sections apply.*

Impact: Habitat Loss/Alteration Habitat will be lost through the removal of vegetation from excavation of trenches. However, the surface of land to be excavated to construct migration barrier is relatively small.

Mitigation: *No mitigative measures were considered necessary except that movement of heavy machinery required to excavate trenches shall be restricted to the close vicinity of excavation areas.*

7.18 Cumulative Effects

Cumulative effects are defined in the Canadian Environmental Assessment Act as "any cumulative environmental effects that are likely to result in combination with other projects or activities that have or will be carried out."

The Clean up of Resolution Island has been assessed for cumulative environmental effects. While past human occupation of the site must be considered in this assessment, the actual effects of past operations of the radar installation are not assessed in this report.

The project is to take place over a fixed period of time (summer seasons over three to five remaining years) in an area where no human occupation and development has occurred in the past apart from military operations. There is no reported human activity within 200 kilometres of the site.

Cumulative environmental effects of the project are expected to be negligible:

- no current traditional land usage, and no industrial or commercial activities have been reported in the immediate area and surroundings;
- the site has been previously occupied by the military and much of the project areas remain marginal for use by wildlife; and
- the project is to occur over a relatively short period of time.

8.0 MONITORING PROGRAM

8.1 Rationale

In order to monitor the efficiency and impact of clean-up activities, it will be necessary to establish a system of long-term monitoring stations in areas most likely affected by contamination from the site. By determining conditions at these sites both before and after remediation of the site, the success of the clean up effort can be assessed and, if required, further measures taken.

Numerous studies conducted prior to clean up of this abandoned military radar site have shown that contaminants were leaching from the site into the surrounding environment. Soil and plant samples have shown high levels of contamination.

8.2 Objectives

A long-term monitoring program shall be implemented at Resolution Island to verify the general conditions of PCB storage facilities (visual inspection) and to evaluate the performance of migration barriers (containment dams and erosion control devices) and landfills. The monitoring program shall have the following objectives:

- .1 Establish monitoring areas and determine the location of sampling points for the required media (*i.e.*, soil, water, sorbent material) likely impacted by contaminants;
- .2 Establish the baseline concentration data of known contaminant parameters in soil and groundwater; and
- .3 Implement a long-term monitoring schedule.

8.3 Methods

The long-term monitoring program shall combine visual inspection, sampling and analysis. The physical integrity of the PCB storage facilities and landfills should be inspected and reported using photographs (from the air as well as from ground level) and drawings. Documented observations should include signs of damage from settling, pounding, frost action, erosion, lateral movement and other potential causes.

The technique used for monitoring changes in the ecosystem shall be the "bottom up" method. In this method, soil and water samples are collected and analyzed to indicate potential for plant and animal intake. The advantages of using this method is that it is site specific, it is not damaging to

the environment, and it can detect problems before contaminants reach higher organisms in the food chain. As for the containment barriers, the monitoring program shall also include provisions for the collection and analysis of sorbent material within containment barriers to verify that they are not saturated.

In the monitoring program, considerations shall be given to contaminant movement in water and soil. Factors affecting the monitoring methodology include, sampled media, temporal and spatial considerations, and site selection.

8.3.1 Sampling Methods

Both soil and groundwater shall be sampled to provide data on the transport and presence of contaminants resulting from landfill leachate migration and movement of surficial contaminated soil particles through surface water run-off.

8.3.2 Temporal Considerations

The monitoring program will not only be used to characterize the surrounding environment in terms of contamination, but shall also measure how the level of contamination changes over time.

After establishing the baseline values, samples should be taken on a yearly basis for the first five (5) years after completion of the remediation work. Afterwards, sampling should be carried out at a less intense frequency until stable conditions are observed.

8.3.3 Spatial Considerations

Depending of the surface area of the site to be monitored, at least three (3) sampling locations shall be used. Typically, a monitoring well will be installed at each sampling location. Groundwater shall be sampled from each well and analyzed for all the required parameters. Results from groundwater samples will indicate the lateral distribution of contamination. Furthermore, both surface (0 - 10 cm) and subsurface (40 - 50 cm) soils shall be sampled in the vicinity of each sampling location (*i.e.*, near monitoring wells when present). Results from soil samples will indicate both the lateral and vertical distribution of contamination.

8.3.4 Site Selection

Reproducibility is considered an important factor in the monitoring program. This is primarily due to temporal and spatial variations. The following rationale shall be used in selecting monitoring sites:

- The site should represent a probable contaminant distribution route;
- Sampling plots should be relatively uniform but large enough that sufficient unaffected areas are available for future sampling;
- Sites should be easily identifiable;
- Sites should be typical of the surrounding area in terms of soil (sediment) and vegetation type.

8.4 Recommendations

The areas where PCB soils are containerized shall be inspected as required by regulations arising from CEPA. Furthermore, it is recommended that soil and water samples be taken for the analysis of PCBs up and down gradient of migration barriers at the S1/S4 valley, the S1/S4 beach area, the furniture dump, and around the PCB storage areas. In addition, sorbent materials shall be collected from booms in containment barriers and shall be replaced before they become saturated. Soil samples shall also be taken in the pathways leaching from the summit (North Slope, PCL dump, etc.) and analyzed for PCBs although less frequently than for other locations.

It is also recommended that soil samples be taken for the analysis of heavy metals in the leachate pathway of the lead dump (beach landfill) and the cobalt dump (maintenance area), and that remote soil and water background samples be collected and analyzed for targeted contaminants as references.

9.0 Screening Recommendation

Subject to review and public consultations, the findings of this screening report are that the proposed clean up project at Resolution Island is not likely to cause adverse effects. The project may continue/proceed with the assurance that the mitigating measures identified in this report will be implemented.

10.0 REFERENCES

- 1-Dew Line Cleanup, Environmental Workshop**, Royal Roads Military College Environmental Sciences Group, October 1991.
- 2-Dew Line Cleanup, 2nd Environmental Workshop**, Royal Roads Military College Environmental Sciences Group, April 1993.
- 3-Dew Line Cleanup: Scientific and Engineering Summary Report**, prepared by Royal Roads Military College Environmental Sciences Group and UMA Engineering Ltd. for the Department of National Defence, 1995.
- 4-Environmental Study of a Military Installation at Resolution Island, BAF-5**, prepared by Royal Roads Military College Environmental Sciences Group for the Department Indian Affairs and Northern Development, March 1994.
- 5-Environmental Study of a Military Installation at Resolution Island, BAF-5-Volume Two**, prepared by Queen's University Analytical Services Unit for the Department of Indian Affairs and Northern Development, March 1995.
- 6-Environmental Study of a Military Installation at Resolution Island, BAF-5-Volume Three**, prepared by Royal Military College Environmental Sciences Group for the Department of Indian Affairs and Northern Development, RMC-CCE-ES-96-10, March 1996.
- 7-Environmental Study of a Military Installation at Resolution Island, BAF-5-Volume Four**, prepared by Queen's University Analytical Services Unit for the Department of Indian Affairs and Northern Development, March 1997.
- 8-Environmental Risk Assessment for Resolution Island, Northwest Territories**, prepared by Golder Associates Ltd and Royal Roads University for the Department of Indian Affairs and Northern Development, May 1997.
- 9-PCB Testing Program: BAF-5 - Resolution Island**, prepared by Bond Architects & Engineers Ltd. for the Department of National Defence, September 1988.
- 10-Clean up Options for Resolution Island**, prepared by Qikiqtaaluk Corporation and Legault, Desjardins, Simon Consultants Inc. for the Department of Indian Affairs and Northern Development, December 1997.
- 11- Soils in Canada**, Clayton, J.S. W.A Ehrlich, D.B. Cann, J.H. Day and I.B. Marshall., Research Branch, Department of Agriculture, Ottawa (In 2 Volumes), 1977.
- 12-Canadian Climate Data, Resolution Island, NWT, User Calculated Means for (1962-1993)**, Environment Canada, 1994.

**13-Canadian Climate Data, Resolution Island, NWT, User Calculated Means for (1929-1961),
Environment Canada, 1994.**