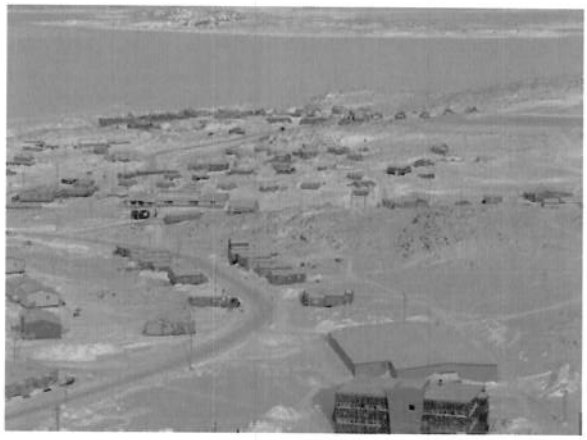
APPENDIX-K

FEASIBILITY STUDY ON METAL WASTE SITE, 2009

Hamlet of Cape Dorset Metals Disposal Site Study

Cape Dorset, Nunavut

Final Report
December 11, 2009



Prepared for:
The Hamlet of Cape Dorset

Project #: 09-2605

Submitted by:
Concentric Associates International Incorporated

Executive Summary

The community of Cape Dorset is currently operating a metals waste disposal site. The Hamlet of Cape Dorset has expressed concern over the appearance, environmental impacts and public safety and health risks this site may pose. Regulators have expressed concern over the volume of waste at the site, the lack of segregation of materials, the presence of improperly stored hazardous wastes and the flow of surface runoff through the site.

All suggested options for managing the waste require a preparatory phase involving sorting of the waste, removing and disposing of hazardous materials, cutting up large items and compaction of the remaining materials into manageable sized bales to decrease transport costs and storage requirements.

The options considered include disposal at sea, disposal at a landfill, on-site storage and sealift backhaul. Disposal at sea and disposal at a landfill were determined to be cost-prohibitive and unacceptable from a community perspective. Furthermore, no practical locations for landfilling of the material are currently available. On-site storage was also rejected as this option merely defers the problem to a later date and does not satisfy the community's immediate concerns regarding the aesthetics of the site.

The recommended option, therefore, is sealift backhaul. It is suggested that a single season approach to disposal via sealift is adopted. A single season approach would require all equipment and crew to arrive in Cape Dorset with the first supply ship in late June (estimated) and ideally return on the last ship in late October (estimated). It is estimated that the project could be completed in 13-16 weeks at a cost of roughly $2,700,000 (rounded). Once the material is removed from the site, it is recommended that a Phase I/II site assessment be completed to determine the nature and extent of any contamination which may have resulted from the long-term storage of wastes at the site. Once completed, the site may then be restructured to accept future metal waste. Preliminary recommendations for future site management are provided below. If adopted, these will assist in bringing the Cape Dorset metals disposal site into compliance with the hamlets water license.

Site security in the form of an earthen berm, a gate at the main entrance and a site supervisor would provide viable control measures both in terms of access to the dump as well as managing the storage of different types of materials. Weekly inspections by the site supervisor would ensure that proper operational procedures were being followed and that the integrity of the berm was maintained.

A waste segregation protocol should be established in which materials are segregated at the time of disposal. This would facilitate processing and ensure that the maximum possible revenue is gained from the sale of the scrap metal. A schedule for the removal of the metal should be established based upon the rate of re-generation. Hazardous wastes should be handled and stored according to Government regulations and should be removed on an annual basis via sealift. Movement of surface water through the site should be minimized. This may be accomplished with the construction of an earthen berm and drainage ditches which surround the outer perimeter of the disposal area. A groundwater monitoring program involving annual sampling of

wells located both upgradient and downgradient of the metals disposal site should be established. In addition, a closure plan which outlines how the metals disposal site will be abandoned and the means by which it will be restored to its pre-use conditions should be prepared. Finally, an operations and maintenance manual for the metals disposal site should be created. This manual would be a valuable reference to ensure future operation of the site in an efficient and environmentally sound manner.

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Introduction

The community of Cape Dorset is currently operating a metals waste disposal site. The Hamlet of Cape Dorset has expressed concern over the appearance, environmental impacts and public safety and health risks this site may pose. Regulators have expressed concern over the volume of waste at the site, the lack of segregation of materials, the presence of improperly stored hazardous wastes and the flow of surface runoff through the site.

A previous study conducted by Dillon Consulting Limited (2003) involved the analysis Cape Dorset's municipal landfill and the metals waste disposal site. Dillon's objectives were to assess these facilities and to determine the means by which these sites might be upgraded and/or expanded to accommodate future waste materials that would be generated in the following 20 years.

The current study was conducted to assess the present state of the metals disposal site and to provide management options to address the Hamlets concerns and to bring the site into compliance with applicable environmental legislation. To achieve this objective, Concentric carried out the following scope of work:

1. Traveled to Cape Dorset to meet with the Hamlet council and the Mayor to discuss the history, background and possible remedial techniques to bring the metals waste disposal site into compliance with applicable environmental legislation.

2. Reviewed all known relevant information regarding the metals waste disposal site.

3. Surveyed the site to ascertain the amounts and types of materials present.

4. Identified the process or processes required to ensure that the metals disposal site meets environmental standards and guidelines.

5. Prepared the following report for the Hamlet Council and Government of Nunavut that summarizes findings from the above-noted tasks and provides associated recommendations.

1. Background

The Hamlet of Cape Dorset is located on Dorset Island near Fox Peninsula at the southwest tip of Baffin Island (Appendix A, Attachment 1, Project Location Map). The community has a population of approximately 1,236, over 90% of which are Inuit. Employment is related to the provision of basic consumer services and the export of native art. The community is supplied with basic services such as electricity which is regionally generated and also utilizes propane and petroleum products for fuel and home heating. The Hamlet is challenged by the local geography and climate, both of which create natural barriers to transportation services. The community imports many of its basic needs through annual re-supply via sealift during the summer months.

1.1. Physical Geography

Located within the Canadian Shield, the regional landscape consists of undulating, exposed bedrock. The area is dotted with small lakes and vegetation is composed of dwarf shrubs, sedges, grasses, mosses and lichens. Surficial materials where present, consist of sands, silts, clays and gravel (till). Cape Dorset is also located within the continuous permafrost zone.

1.1.1. Geology

Regional geology is comprised of Early Holocene/Wisconsinan till and Quaternary/Pre-Quaternary bedrock and rock weathering products. The till is comprised of silty sand with cobble- and boulder-sized igneous and metamorphic clasts. The bedrock and rock weathering products include outcrops and/or a discontinuous cover of rubble, boulders, gravel, sand and minor silt. The bedrock geology is variable and comprises numerous sub-divided classifications.

1.1.2. Hydrogeology

Cape Dorset is situated within a peri-glacial environment in which permafrost-influenced subsurface conditions do not support significant local or regional-sized aquifers. Localized areas of near-surface groundwater can be expected on a seasonal basis.

1.2. Site Description

1.2.1. Location

The metals disposal site is located roughly 0.5 km west of the Hamlet of Cape Dorset. It is accessed from a gravel lane which branches off the main road leading to the sewage lagoons and the municipal landfill (Appendix A, Attachment 2, Site Location). The site is situated adjacent to Telik Inlet with its northern border located within approximately 40 meters of the waters edge. The nearest residence is located approximately 125 meters east of the disposal site.

1.2.2. Site Plan

The waste at the metals disposal site may be divided into two main areas (Appendix A, Attachment 2, Site Location and Attachment 3, Site Survey). The first area (upper site) is located on the southern part of the site adjacent to the main road leading to the sewage lagoons and municipal landfill. The materials found in upper site are distributed among several moderately sized piles. Some segregation of the material has taken place in this area, but the majority of the piles are of mixed composition (Appendix B, Photograph 1).

The second main area (lower site) is located on the northern half of the site adjacent to Telik Inlet. Two large piles are located on the west side of the main access road. The remaining waste is distributed among several smaller piles present on the east side of the main access road. An approximately 1.5 meter high berm surrounds the entire northern edge of the lower site (Appendix B, Photograph 2). Materials in this area have been roughly sorted.

The upper and lower piles of waste are roughly 100 meters apart and are connected by the gravel access lane. Surficial drainage at the site is generally to the northeast towards Telik Inlet.

1.2.3. Existing Facilities

Existing facilities at the metals disposal site are minimal. There are no structures nor are there any mechanisms in place such as bins or signs which would assist in segregating the waste for recycling or other forms of waste management. Further, there are no measures in place for the containment or proper handling of any hazardous materials.

1.2.4. Site Access

The metals disposal site is currently completely open to the public. No fencing or signs are present on-site to restrict when the site may be accessed. At this time, there are no administrative controls in place that limit either the quantity or type of materials being dumped. There are also no restrictions regarding where on the site these materials may be deposited.

1.2.5. Current Community Involvement

Members of the community currently do not follow any firm rules or maintain any order when depositing materials at the dump. The situation could be improved with appropriate on-site management as well as public education. As has been noted in previous reports, the dump is generally not managed and items are left randomly at the site by Hamlet workers, Contractors and the public.

1.3. Site History

1.3.1. Age of the site

It is estimated based on the types of materials present on-site that the metals waste disposal site has been in operation for at least 30 years. Anecdotal evidence provided by Cape Dorset council members suggests that this site may have formerly been occupied by a community landfill. Aerial photographs were reviewed from the National Air Photo Library for the years 1969, 1972, 1983, 1987, 1989, and 1992 (Appendix C, Aerial Photographs). Results of the aerial photograph review are presented in **Table 1** below. A summary of the overall observations follows Table 1

Table 1: Aerial Photograph Review – Observations

Year	Photo No.	Observations
1969	A21180-73	Site appears to be vacant.
1972	A24735-62	A road is visible leading to what is the current-day metals disposal site. Small debris piles are scattered throughout both the upper and lower portions of the site.
1983	A26393-18	A large clearly visible debris pile is present on the upper portion of the site immediately adjacent to where the road for the disposal site branches off from the main road. A large cleared area is visible on the lower portion of the site although debris piles are not evident in this photo.
1987	A27162-102	Site is generally similar to the 1983 aerial photograph.
1989	A27464-14	Site is generally similar to the 1987 aerial photograph.
1992	A27863-94	A large clearly visible debris pile is present on the upper portion of the site immediately adjacent to where the lane leading to the disposal site branches off from the main road. A large cleared area is visible on the lower portion of the site as are several debris piles.

Based on the historical photographs, it appears that the site has been occupied by a waste disposal site since the early 1970s. Given the small scale of the photographs, it was not possible to distinguish whether the debris piles noted in the earlier photographs were associated with a former municipal landfill or were the beginnings of the current metals disposal site. Municipal waste therefore may be present on the metals site. Based on this and the long-term storage of metal waste, some of which may contain hazardous materials, it is recommended that a Phase I/II environmental site assessment be conducted. A Phase I/II assessment would determine both the nature and extent of any contamination that may be present at the metals disposal site.

1.3.2. Site Use

Historically the site has been used for about thirty years. Its use, however, has accelerated during the past twenty years as more consumer goods such as vehicles, refrigerators and electronics have made their way to the north. As these goods have passed their useful life, they have been dumped at the site in a random fashion. Materials dumped have been of mixed composition and have included items such as, cars, trucks, heavy machinery, structural steel, appliances, oil tanks, drums and tires. The hazardous materials associated with some of these including fluids from vehicles and CFC's from appliances, were likely not removed prior to the items being dumped at the site. Other hazardous items such as cans of paint and batteries have been left exposed at the site.

2. Regulatory Background

The management of solid waste within communities such as Cape Dorset is multi-jurisdictional. The day to day management of existing solid waste sites is, to a large extent, controlled at the community level. Regulatory oversight, however, is provided by various departments within both the territorial and federal governments.

The statutes regarding the management of solid waste are designed to ensure the protection of environmental quality and human health. The relevant statutes associated with the Cape Dorset metals disposal site include the following:

- Nunavut Environmental Protection Act (R.S.N.W.T. 1988, c.E-7)
- Nunavut Public Health Act (R.S.N.W.T. 1988, c.P-12).
- Nunavut Waters & Nunavut Surface Rights Tribunal Act (S.C. 2002, C. 10)

Nunavut Environmental Protection Act

The Government of Nunavut, Department of the Environment is responsible for upholding the Nunavut Environmental Protection Act (EPA) and hence regulating the disposal and management of solid waste. Subsection 5 of the Act states:

"Discharge of contaminants
5. (1) subject to subsection (3), no person shall discharge or permit the discharge of a contaminant into the environment".

There are no exceptions pursuant to Subsection (3) that apply to the Cape Dorset site.

Subsection 12 of the EPA deals with offenses and punishment. As noted in this section, anyone who is in contravention of section 5 is guilty of an offense. Numerous hazardous materials including, paint, batteries, CFCs and vehicle fluids are present at the Cape Dorset metals disposal site. These materials are not contained and some items such as the batteries and vehicle fluids were observed to be leaking directly on to the ground surface. The site, therefore, may be subject to censure by the Chief Environmental Protection officer. Concentric is not aware, however, of any orders that have been issued pursuant to subsection 5 that apply to the Cape Dorset site.

To facilitate compliance with the Nunavut Environmental Protection Act, seven guides have been developed by the Department of the Environment for materials (principally hazardous) considered contaminants under the Act. The guides are as follows:

- Guideline for the General Management of Hazardous Wastes in the NWT
- Environmental Guideline for Waste Batteries
- Environmental Guideline for Waste Paint
- Environmental Guideline for Waste Solvents
- Environmental Guideline for Antifreeze
- Environmental Guideline for Ozone Depleting Substances

- Environmental Guideline for Asbestos

These documents provide direction on the correct management of these materials. As noted above, numerous hazardous materials are present at the Cape Dorset metals dump. Based on a review of the guides, it appears that the management practices at the site may fall outside the guidelines presented in the above-noted documents and hence may be subject to enforcement.

Nunavut Public Health Act

In order to protect human health and safety, the Government of Nunavut, Department of Health and Social Services also plays a role in regulating solid waste sites. Subsection 25 (1) of the act states:

"25. (1) On the recommendation of the Minister, the Commissioner may make regulations that the Commissioner considers necessary for the prevention and mitigation of disease and the promotion and preservation of health in the Territories...may for this purpose make regulations

(i) respecting the control of waste disposal grounds for the disposal of excreta and garbage;

(q) respecting the prevention of the pollution, defilement, discoloration or fouling of lakes, streams, rivers, ponds, pools, springs and watercourses, so as to ensure their sanitary condition;

(r) respecting the prevention, control and abatement of air pollution due to any cause;"

Based on the above, the Cape Dorset metals site could upon inspection, be subject to regulations constructed under the Nunavut Public Health Act.

Nunavut Waters & Nunavut Surface Rights Tribunal Act

Solid waste disposal may also come under the scrutiny of Indian and Northern Affairs Canada (INAC) who are responsible for enforcing water licences issued under the Nunavut Waters & Nunavut Surface Rights Tribunal Act (S.C. 2002, c. 10). A key component of any water licence is the analysis of solid waste disposal and its effects on the quality and quantity of inland waters. The Cape Dorset metals disposal site, therefore, may be subject to enforcement based on its water licence issued by INAC.

It is evident from the above discussion, that any strategies developed to deal with existing solid waste or its future management will necessarily involve input from various levels of government. The execution of such strategies, however, will likely rest at the community level.

2.1. Regulatory Reports

Two municipal water use inspection reports (January 15, 2001 and October 6, 2003) have been issued for Cape Dorset by Indian and Northern Affairs Canada. These reports, which were presented in a previous study issued by Dillon Consulting (2003), made note of several issues relating to the metals waste disposal site. Items of particular concern noted in the report included; lack of segregation of the materials, no containment of the hazardous materials, and no viable measures in place to contain runoff that flows into Telik Inlet from the dump site. Since these reports were issued, some segregation of materials has taken place and a berm has been constructed around the northern edge of the site to prevent surface runoff from entering Telik Inlet. Otherwise the site remains largely unchanged.

Indian and Northern Affairs Canada, Nunavut District Office was contacted for updated inspection reports. At the time this report was prepared, however, no response had been received. More recent inspection reports, therefore, may be available for future review and consideration.

3. Previous Studies

The Government of Nunavut previously commissioned studies to assess the environmental impact of solid waste management in the territory. A summary of two of these studies, one of which was specific to Cape Dorset, follow. It is noteworthy that the present report does not attempt to replicate either of these studies but rather makes reference to pertinent sections of them in order to provide relevant information.

3.1. Dillon Consulting – Cape Dorset Solid Waste Improvement Study

The Dillon Consulting Limited study was conducted in 2003 at the Cape Dorset site. This study involved the analysis of both the community municipal landfill and the metals waste disposal site. Dillon's objectives were to assess the disposal and storage facilities as well as to determine the means by which these sites might be upgraded and/or expanded to accommodate future waste materials that would be generated in the following 20 years.

With respect to the metals disposal site, Dillon suggested four potential options for managing the waste. These included storage of the material at its current location, removal of the waste to a landfill, disposing of the material at sea, or transport of the metal waste to the south where it could be sold for scrap. All of the proposed management options called for a reduction in the volume of scrap metal via shredding and/or compaction.

3.2. Environmental Protection Service - Management Options for End-of-Life Vehicles (ELVs) in Nunavut

A second study (2006) was prepared by the Environmental Protection Service of the Government of Nunavut. This study discussed both the current means of managing end of life vehicles (ELV's) as well as future management strategies for ELVs in several communities throughout Nunavut. Although the report focused solely on ELVs, the options presented could also be applied to other recyclable scrap metal such as that present in Cape Dorset. Disposal at sea and disposal in a landfill were presented in the report as potential options for managing the waste, but were discounted due either to high cost or lack of community support. The report focused, therefore, on the means by which the ELVs could be completely removed from the communities and shipped south for recycling.

In addition to the above, several other studies regarding scrap metal recycling in remote northern communities were reviewed. Relevant information from these was incorporated into the current report where applicable.

4. Site Characteristics

4.1. Geographic characteristics

The site is subject to extreme cold weather with sub-zero conditions typically lasting for between seven and eight months. These freezing temperatures have an impact on access to the dump for the purpose of compacting and removing materials as well as access to the region as a whole. The only viable way to import or export goods of any kind to or from the community is by way of the ocean. Accordingly, any attempts to remove materials would be restricted to a few summer months each year at best.

4.2. Waste Characteristics

Previously noted, the metals disposal site may be divided into two main areas, the upper site and the lower site (see Appendix A, Attachment 3, Site Survey and Appendix B, Photographs). Waste in the upper site represents approximately 25% of the total volume of materials in the metals dump. Items present in the upper site are largely unsorted and generally consist of mixed light metal. Heating oil tanks and drums, fiberglass tanks and metal pipes, however, have been segregated. Some miscellaneous vehicles, appliances, and general refuse are scattered about this area.

Waste contained in the lower site constitutes roughly 75% of the total volume. Over 40% of this in turn is found in two large piles situated on the west side of the lower site. The larger of the two is composed predominately of cars, trucks, and heavy commercial vehicles. The other consists of corrugated metal and mixed heavy and light steel. To the east of these two piles are several smaller waste piles the largest of which are composed of unsorted light metal, appliances, snowmobiles, tires and pipes. Other materials on-site in smaller quantities include steel ribbon, sheet metal shelves, electronics, mattresses, bicycles and general refuse.

In addition to the above, hazardous materials including partially full paint cans, vehicle batteries and vehicles fluids are present at the site. Chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HFCs) in refrigeration equipment present at the site may also be a concern. The majority of these types of wastes are located at the lower site although some are scattered throughout the upper site as well.

Some materials that are dumped on the site are affected by the freezing temperatures whilst others are not. Petroleum byproducts for example do not freeze they become a slow moving sludge in freezing conditions. Ethylene glycol, found in anti-freeze and windshield washer fluid also tend to thicken in sub-zero temperatures but do not entirely lose their liquid qualities, thereby presenting a year round environmental hazard.

4.3. Regulatory Oversight

There has been minimal regulatory oversight with no local policing of the dumpsite being evident. Various levels of government and legislative authorities have provided reports and

commissioned studies both of which provided recommendations regarding the management of the site. As of this writing, however, only the most rudimentary recommendations have been implemented.

5. 2009 Site Visits

A visual inspection of the site was conducted by Concentric in July, 2009 followed by a second visit in August to conduct a detailed volumetric survey of the metals disposal site. The July inspection consisted of several site visits, the making of observational notes and meetings with community officials.

5.1. Meeting with Community Officials

Discussions were had with the Hamlet Environmental Committee and the Senior Administrative Officer, Mr. John Ivey. During our discussions, concern was expressed for the aesthetics of the site, the distance of the site from the tidal land bridge, the presence of improperly stored hazardous materials and the potential impacts of the site on aquatic life. The committee made it clear that their preference was for the complete removal of the metals from the dump site.

5.2. Site Inspection

During the July inspection of the metals disposal site, several issues of concern were noted. A section of the berm located directly north of the main pile of vehicles had been breached. Surface water was observed to be moving through the site towards Telik Inlet. Several vehicles were sitting in water and were leaking fluids into the water and on to the ground surface. Animal carcasses and potentially hazardous wastes including batteries, paint cans, and drums were scattered throughout the site (Appendix B, Photographs 13-16). During the three days that Concentric was in Cape Dorset, the berm was repaired and absorbent pads were placed beneath the leaking vehicles.

5.3. Earlier recommendations

Previous studies have made recommendations such as moving materials further from the high water line and building a berm. These two recommendations have been completed although the berm has since been breached (and subsequently repaired). Further recommendations have included segregating the waste into piles according to type and taking steps to facilitate recycling of certain types of material. While there have been some attempts at segregation, the task is far from complete and a recycling programme has yet to be implemented.

5.4. Site Survey

A survey of metals disposal site was conducted by Concentric in August of 2009 (see Appendix A, Attachment 3, Site Survey). The estimated total volume of waste at the site is 11,800 m^3. This is divided among the upper site which has a waste volume of roughly 3,000 m^3 and the lower site which has a volume of roughly 8,800 m^3.

Based on observations of the materials present on-site, the waste was classified into six categories with associated volumes. These are listed in Table 1 below.

Table 1: Estimated Volumes of Materials at the Cape Dorset Metals Disposal Site

Material Class	Estimated Volume (m^3)	Estimated Percentage of Total Volume
Vehicles (including snowmobiles)	2,900	25
Mixed Light Metal	6,300	54
Appliances	1,100	9
Oil Tanks and Barrels	600	5
Tires	400	3
Other	500	4
TOTAL	**11,800**	**100**

The total weight of the materials is estimated to be 2,100 metric tonnes. Estimates of the total tonnage at the site were calculated by cross referencing the current survey with data available from the Dillon report. The Dillon report estimated weight using a matrix that combined volume and estimates of content density. It is the adjustment of volume that provides a percentile basis for the estimation of weight. Concentric also independently calculated weight using data from its own volumetric survey and approximate material densities. An average of this value and the value determined by adjusting Dillon's data were used to obtain the estimate of total tonnage.

5.5. Current Waste Management Practices

At this time there are no viable or sustainable waste management practices or protocols in place nor are there any measures in place to inhibit random dumping at the site. Regulatory officials have already expressed concern over the volume of waste at the site, the lack of segregation and the presence of uncontained hazardous wastes. Community officials have expressed concern over the aesthetics of the site and its distance from the tidal land bridge. Although no orders are known to have been issued against the site, continuing with this modus operandi would likely be unacceptable from a regulatory perspective and merely defers the problem to a later date.

At the present time we are unaware of any concerns that have been expressed from regulators regarding the geographic location of the site. Storage of the waste at its current location, therefore, is a possibility. Certain immediate measures, however, would need to be implemented to satisfy the specific regulatory concerns noted above. These include:

- securing of the site by means of berms or fences (or a combination of the two)
- training of workers who may work at the site

- segregation of the waste so that like materials can be grouped together
- proper containment of the hazardous wastes
- disposal of non-metallic items at the local landfill
- a system of drainage installed to ensure that surface water is not moving through the disposal site and into Telik Inlet
- groundwater monitoring
- creation of an operations and maintenance manual
- creation of a closure plan

Even if the above measures are implemented, at some point, whether now or in the future, a plan will need to be introduced to reduce the volume of the existing waste as the dump surpasses its capacity. In addition, on-site storage of the waste in its current form, does not address the communities concerns of the aesthetics of the site and its distance from the tidal land bridge.

6. Waste Management Options

Options for managing the metal waste within Cape Dorset may involve removal, on-site storage, or a combination of the two. A discussion of potential options is discussed in the following sections.

6.1. Preparation of Material for Waste Removal

Prior to the removal of any of the metals material, whether to dump elsewhere or to backhaul, a major preparatory phase must be carried out. This would involve:

1. sorting the waste items;
2. removing and disposing of hazardous materials; and
3. compaction of materials into manageable sized bales.

Each of the waste removal options will require that the volume of waste is reduced in order to decrease transport costs and storage requirements. This reduction could best be achieved by using a portable baling machine. Rough estimates provided by an equipment recycling company have suggested that if the recyclable material is properly compacted and baled, the volume can be reduced by about 75%. Accordingly, it is estimated that the total volume can be reduced to approximately 3,000m^3 (rounded).

In general, sorting of the material would involve its separation in to three main groups, light metal that can be compacted; heavy metal items that must be sheared or torch-cut; and non-metallic items that may be disposed of in a landfill. Some management options such as disposal at sea (discussed in Section11.1.2) may involve an added level of segregation. Timing will be a critical issue due to the short season. Accordingly, sorting of the waste should take place when it can be most easily and economically accomplished. This may be prior to compacting the waste or in conjunction with the process. Hazardous wastes such as fluids in vehicles (fuel, lubricants, coolant, and windshield fluid) or drums, battery acid, paint, CFCs and possibly PCBs from items such as appliances and air-conditioning systems should be removed and dealt with according to government regulations. Removal of CFCs should be done by a licensed technician. In addition, tires should be removed from vehicles and fuel tanks properly decommissioned prior to compaction. These tasks are normally completed by recycling and salvage firms.

6.2. Disposal at Sea

Disposing of waste materials at sea is permitted in accordance with the Canadian Environmental Protection Act, 1999 (CEPA). The Act restricts what types of material may be disposed of and sets forth guidelines for its disposition. The disposal at sea program is administered by Environment Canada (EC) and is controlled by a system of permits obtained through EC and administered in accordance with the regulations provided under the CEPA. The application process is very complex and requires meticulous planning. A summary of the main requirements of the program as well as some of the most important considerations of this method of disposal are discussed below.

The disposal at sea program facilitates the dumping of a variety of "clean" material that is both environmentally and ecologically sound. The most common material being disposed of at sea is dredged sediment, making up roughly 90% of the material dumped in this way. However, bulky substances, including those "primarily composed of iron, steel, concrete or other similar matter", may also be disposed of providing that they will not have a significant adverse effect on the sea or seabed.

Assessment of the Proposed Disposal Site

A detailed description of the proposed disposal site must be undertaken. In general, less information will be required for pre-existing disposal sites if they have been used in the last 10 years. When this is not the case considerably more information must be provided. According to Mr. Mark Dahl, Ocean Disposal Specialist at Environment Canada (EC), no ocean disposal has taken place within Nunavut during the last 10 years. As such, an assessment of any proposed new site near Cape Dorset must include studies of the geological, chemical and biological characteristics of the ocean floor as well as the physical, chemical and biological characteristics of the water column. In addition, a description of the surrounding physical, biological and human environments must be included. To obtain the above information, long-term studies to acquire baseline data may be required.

Waste Characterization

According to the disposal at sea regulations, a detailed description and characterization of the waste must be provided. If the description and characterization is inadequate because its impact on human health and the environment cannot be assessed, then the application will be refused.

The waste characterization would include for example, the source, type, dimensions, previous uses, physical, chemical biochemical and biological properties of the material. In addition, it must be demonstrated that the materials to be disposed of are free of contaminants and floating debris.

According to EC official Mark Dahl, disposal of scrap metal has not been undertaken for some time. He added that typically this type of disposal is for large chunks of inert steel such as whole ships. He emphasized that the cleaning requirements are extremely stringent requiring for example, the removal of any fuels, lubricants, wiring, tires, batteries, fiberglass, engines and anything that may float or leach. Materials would then have to be steamed cleaned to remove any potential remaining contaminants. In Mr. Dahl's view, the cleaning costs would likely outweigh the cost of shipping the material off-site. He also felt that some of the waste at the Cape Dorset site (vehicles, appliances, heating oil tanks, drums etc.) would likely be rejected.

Environmental Assessment (EA)

The scope of the environmental assessment extends beyond the proposed dump site and gives consideration to other factors such as the impact or effects of the transportation process itself. The EA process would involve an assessment of the potential effects of the material at each stage

of its disposal and the subsequent presence of the material on "human health, living resources, amenities, and other legitimate uses of the sea". This process provides the basis for approval or rejection of the disposal and for determining monitoring requirements.

Alternatives to Disposal at Sea

A key aspect of the disposal at sea application process is a risk assessment of potential alternatives for managing the waste. According to CEPA, applications to dispose of waste at sea must demonstrate that other waste management options such as re-use or off-site recycling have been considered and discounted. The permit will be refused if any other opportunities exist to manage the waste without endangering human health or the environment or incurring excessive costs.

Community Support

According to Mark Dahl, communities in the north have traditionally been opposed to disposing of substances at sea. In 1994 for example, a permit to dispose of scrap metal at sea near Lougheed Island was issued to Panarctic Oils Ltd. Despite Panarctic being on the brink of starting the project, the permit was rescinded due to public concern and no disposal of scrap took place.

Because disposal at sea is very rare in the north, there is a lack of studies from which comparative cost information can be drawn. The complex application process involving lengthy and detailed site studies and assessments, the stringent sorting and cleaning requirements and the cost of dealing with any waste which cannot be disposed of at sea will make this option cost prohibitive. Furthermore, it is very unlikely that this option would receive community support.

6.3. Burial of the Waste

A second option for managing the materials at Cape Dorset site is burial at a landfill. This process is regulated by the Environmental Protection Act. According to the Guideline for the General Management of Hazardous Waste (February 1998) "it is not acceptable for hazardous waste to be abandoned, poured down sewers, dumped on land or discarded at a landfill". If the scrap metal is to be land-filled all of the hazardous waste materials must be removed first. These materials include but are not limited to, batteries, oil-based paint, waste oil, solvents, fuel, propane tanks, CFCs, PCBs and electronic equipment. In addition, the preparatory steps discussed in section 11.1.1 would have to be undertaken to minimize the volume of material to be disposed of.

The most likely landfill location for disposal of the waste would be at the existing community dump. However, this site does not have the capacity to accommodate the volume of waste present at the metals disposal site. The second alternative for burial would be the creation of a landfill in the existing sewage lagoons that are eventually scheduled to be decommissioned. The process of creating a new landfill is complex and cost prohibitive. Proper design, management and maintenance are critical to minimize the environmental impact. Further, the licensing

process itself is time-consuming and involved. Currently the sewage lagoons are in-use and although due to be decommissioned a date is yet unknown. Given the community's desire to expedite clean-up of the metals disposal site, the landfill option is not considered feasible at this time. In any case, cost estimates for landfill creation suggest that the cost/benefit would far outweigh those of the sealift backhaul protocol (discussed in section 11.1.4) making this option impractical from a cost perspective.

6.4. On-Site Storage

The potential management options noted above all involve removal or partial removal of the metal waste from its current location. Another consideration would be the storage of waste in its current location. If properly managed, this option would extend the life and the capacity of the dump. In order to satisfy the community's concern regarding the aesthetics of the dump site and as a means to control surface runoff from entering Telik Inlet, a containment berm could be constructed around the site. The material would have to undergo the same preparatory phase as discussed for the waste removal options. It may also be advisable to conduct a Phase I/II site assessment prior to restructuring the site to ensure that no on-site contamination requiring remediation is present. In addition, all items which cannot be compacted and baled such as mattresses, fiberglass tanks and general refuse would have to be transported to the local landfill. Although this is a potential option, it would not entirely resolve the community's concerns regarding the aesthetics of the site or the impaired access to the tidal land bridge. In addition, whether now or in the future, a plan will need to be implemented to ensure the abatement of materials as the dump surpasses its capacity. Over time the baled material stored on site would degenerate and the bales would fall apart creating the need for a second compaction process prior to ultimate removal.

6.5. Sealift Backhaul

Complete removal from the site is not only the method preferred by the Cape Dorset Environmental Committee but also the best all round resolution to the issue of the growing metals dump. If the metals waste is to be removed from the site, oceanic shipment is the only way to achieve that goal. No overland access is available and the landing strip is unable to accommodate large commercial aircraft.

Practical considerations include seasonal access to the site and labour to prepare materials for baling in addition to the actual baling process itself and the eventual shipping of the materials. Special consideration must be given to the hazardous wastes which must be prepared according to the Transport of Dangerous Goods ACT (TDG) prior to shipping. The whole project will be constrained by climactic conditions and could potentially take more than one season to fully implement.

6.5.1. Schedule

Single Season disposal:

To schedule a single season clean up would require an operation with precise timing. If something were to go wrong or cause a delay, the cost could rise quickly. This would involve having contractors ready to commence sorting and preparing materials as soon as the weather permits. It would also require having a baler and any other required equipment shipped as soon as conditions would allow thereby ensuring the longest possible time is available to deal with unforeseeable issues that may arise.

The material would need to be sorted, cleaned, baled, loaded and shipped between the time of the first sailing in late June and the final sailing in roughly early November.

Dual Season disposal:

In a dual season, phased, approach, the first season would be used to sort the materials, remove hazardous chemicals, and cut up large items in preparation for the second season of baling and shipping. Local labour could be trained to complete this phase or a contractor could be hired.

Although the dual season approach provides more flexibility in scheduling, discussions with recycling contractors have revealed that in salvage operations such as this, the scrap metal is typically sorted, processed (fluids drained etc.) and baled simultaneously. This is done to minimize time on-site and thereby cost.

Ontario based recycling firm Premier Recycling has estimated that with the appropriate equipment in place, the materials at the metals disposal site can be processed in three to four weeks. This timeline will be significantly extended once shipping, loading and unloading times are included.

Typically cargo being shipped to the north must arrive at the main terminal roughly two weeks prior to sailing. Average sail time from the main terminal to Cape Dorset is three weeks. According to Northern Sealink and Supply Inc. (NSSI) representative Maryam Faramarzi, each year three sailings roughly six weeks apart, are scheduled for Cape Dorset beginning in roughly late June. Given that the estimated time to complete the processing of the scrap metal is three to four weeks, it may be possible for the equipment to be sent to Cape Dorset on the first ship and it and the scrap metal returned on the second ship six weeks later. If this timeline cannot be met, the equipment and at least a partial crew may be required to wait until the third sailing in late October. In this situation, costs may be incurred for idle equipment and crew. Unloading time, time to transport the equipment back to its place of origin, and time to transport the metal to a recycling facility must also be considered.

Based on the above, it is estimated that the project could take anywhere from 13 to 22 weeks to complete. It is possible with appropriate planning and a favorable sealift schedule, that the project could be completed in 13-16 weeks.

6.5.2. Costs

The two major costs associated with this project are labor and shipping. Shipping costs are based on weight or volume, whichever produces higher revenue per cargo unit. Typically shipping costs for large items such as trucks or machinery are assessed on a volume basis. Based on 2009 rates provided by Northern Sealink and Supply Inc. (NSSI), the cost to ship non-containerized items from Ste-Catherines, Quebec to Cape Dorset is $350.80 per 1000 kg or 2.5 m^3. Backhaul (southbound) rates for 2009 are $228.02 per 1000 kg or 2.5 m^3. NSSI indicated that these rates are expected to increase by roughly 3% for 2010.

According to Premier Recycling, to complete the job efficiently, the following three main pieces of equipment would be required; excavator equipped with a shear for cutting up large items that cannot be baled, baler (Aljon model 580 CL) and mobile magnet. Based on 2009 pricing from NSSI, the approximate cost to ship these items to and from Cape Dorset is roughly $80,000 (based on volume). NSSI has suggested that the scrap metal once processed should be shipped on a pallet system rather than in containers. As noted in Section 6.4, the estimated quantity of recyclable material at the Cape Dorset metals site is roughly 2,100 metric tonnes. The cost to backhaul this material therefore, is roughly $479,000 (based on weight).

As noted above, the project is estimated to take 13 to 22 weeks complete. Premier has indicated that the daily rate for three crew members and the above-noted equipment is roughly $17,000/day. If an average completion time of 17.5 weeks is used, the approximate total cost for the project would be $2,082,500.

Some costs will be recovered from the sale of the scrap. The price of scrap metals was reported in some detail in the Government of Nunavut's report on ELVs discussed in Section 4.2. However, we have discovered that the price of scrap metal fluctuates considerably and for that reason we have decided to err on the conservative side. Although it may be higher, we believe that the average price of scrap metal would be approximately $.10 per pound or $200 per ton (this information was obtained from scrapmetalpricesandacutions.com). Using the estimated weight range of 2100 metric tonnes, a scrap value of approximately $420,000 was obtained.

Primary costs associated with sealift backhaul are summarized in Table 2 below.

Table 2: Cost Summary Estimates for Sealift Backhaul

Item	Estimated Cost
Shipping of equipment to Cape Dorset	$80,000
Labor and equipment fees	$2,082,500
Sealift backhaul of material	$479,000
Sale of scrap metal	-$420,000
Sub-Total	**$2,221,500**
Contingency @ 20%	$444,300
Total (excluding taxes)	**$2,665,800**

Note: the above table does not include; insurance for the equipment during shipment, accommodations costs for the crew, cost to transport the metal and hazardous wastes from the shipping terminal to a recycling/disposal facility, cost to dispose of the hazardous wastes and tires, or final site cleanup.

6.6. Recommendations

Once the material is removed from the site it would be worthwhile conducting a Phase II environmental assessment to determine nature and extent of any contamination which may have resulted from the long-term storage of wastes at this site. A Phase II assessment is also recommended given that there is anecdotal evidence of this site being the former location of the municipal landfill.

7. Recommendations for Future Site Management

Once the existing material has been removed from the metal disposal site and a cleanup completed, the site may be restructured to accept future metal waste. Short or long term on site storage necessitates a proper management and control strategy. The following represents some of the considerations for adequately managing the on-site storage and recycling process. These recommendations if carried out will assist in bringing the metals disposal site in to compliance with the Hamlet of Cape Dorset's water license (3BM-CAP0810).

7.1. Site Security

An earthen berm surrounding the site and a gate at the main entrance that restricts access would provide a viable control measure both in terms of access to the dump as well as managing the storage of different types of materials. To ensure no materials are dumped in or near Telik Inlet the berm should be should be constructed a minimum of 30 meters from the high water line. Signs indicating materials allowed or not allowed should be posted at the entrance and access to the site should be limited to certain times. When open, a site supervisor should be on hand to ensure the items get deposited in the correct locations and any hazardous components are dealt with immediately and in the correct manner.

7.2. Collection and Segregation

It is essential that future disposal at the site is conducted in a controlled manner. Waste should be segregated at the time of disposal to facilitate processing. According to the Guide for Recycling Scrap Metal from Nunavut and Northern Manitoba, one way to increase revenue from the sale of the scrap is to sort the material into ferrous and non-ferrous piles as non-ferrous metal is worth up to eight times more. The waste should be further sorted into like materials as items require different levels of processing and some are not acceptable for recycling. Covered bins could be used to segregate certain waste types and/or signs could be used to direct users to the appropriate disposal areas.

7.3. Hazardous Wastes

It is critical that all hazardous materials are dealt with correctly and efficiently. Whenever possible, hazardous materials should be stored in their original containers. When this not possible as for example with batteries and fluids drained from vehicles, containers that are sealable and leak proof such as drums provide a viable alternative. Containers must also be appropriately labeled. Typically in the north, batteries, paint cans and drums containing liquid waste are stored in secured sea cans. Attention must be given, however, to the storage of incompatible wastes. Information on storage and labeling requirements for specific wastes is available in seven guides developed by the Nunavut Environmental Protection Services (see Section 3). It should be noted that the removal of CFC's must be done by a licensed technician. Finally, hazardous wastes should be removed on an annual basis via sealift backhaul.

7.4. Surface Water Diversion

The movement of surface water through the site must be minimized to prevent potential contaminants from entering Telik Inlet. This can partially be accomplished with the construction of an earthen berm. The berm would play a dual role of providing site security and inhibiting the flow of surface water in to and out of the site. Additional diversion control measures such as drainage ditches will also be required to re-direct the flow of surface water around the site.

7.5. Groundwater Monitoring

Groundwater monitoring wells should be installed upgradient and down gradient of the metals disposal site. The upgradient monitoring wells will enable the collection of background data which may be used to assess levels of contaminants (if present) in groundwater collected downgradient of the site. Both well locations should be sampled annually for the water quality parameters outlined in Part H, Item 4 of Cape Dorset's water license.

7.6. Site Inspections

The metals disposal site should be inspected weekly to guarantee that proper operational conditions (as discussed above) exist at the site. Weekly inspections would also ensure that the integrity of the berm and drainage ditches had not been breached.

7.7. Waste Removal

A schedule for the removal of scrap metal could be established that is based upon the rate of material regeneration. A cooperative regional approach to recyclable waste management may provide a more cost effective alternative to a go it alone approach. If a cost sharing program were developed certain costs may be reduced. Another alternative approach that we have considered would be that of the Hamlet of Cape Dorset purchasing its own, smaller, compactor to process some of the scrap metal as part of an ongoing waste management protocol. The cost of a small auto/scrap metal baler would be in the range of $300,000 to $400,000.

7.8. Closure Plan

A closure plan should be prepared which outlines how the metals disposal site will be abandoned and the means by which it will be restored to its pre-use condition. This is required for the metals disposal site to be in compliance with the hamlets water license. This plan should describe the characteristics of the site, outline an implementation and completion schedule and provide a proposal identifying how the restoration costs will be financed.

7.9. Appointment and Training of Staff

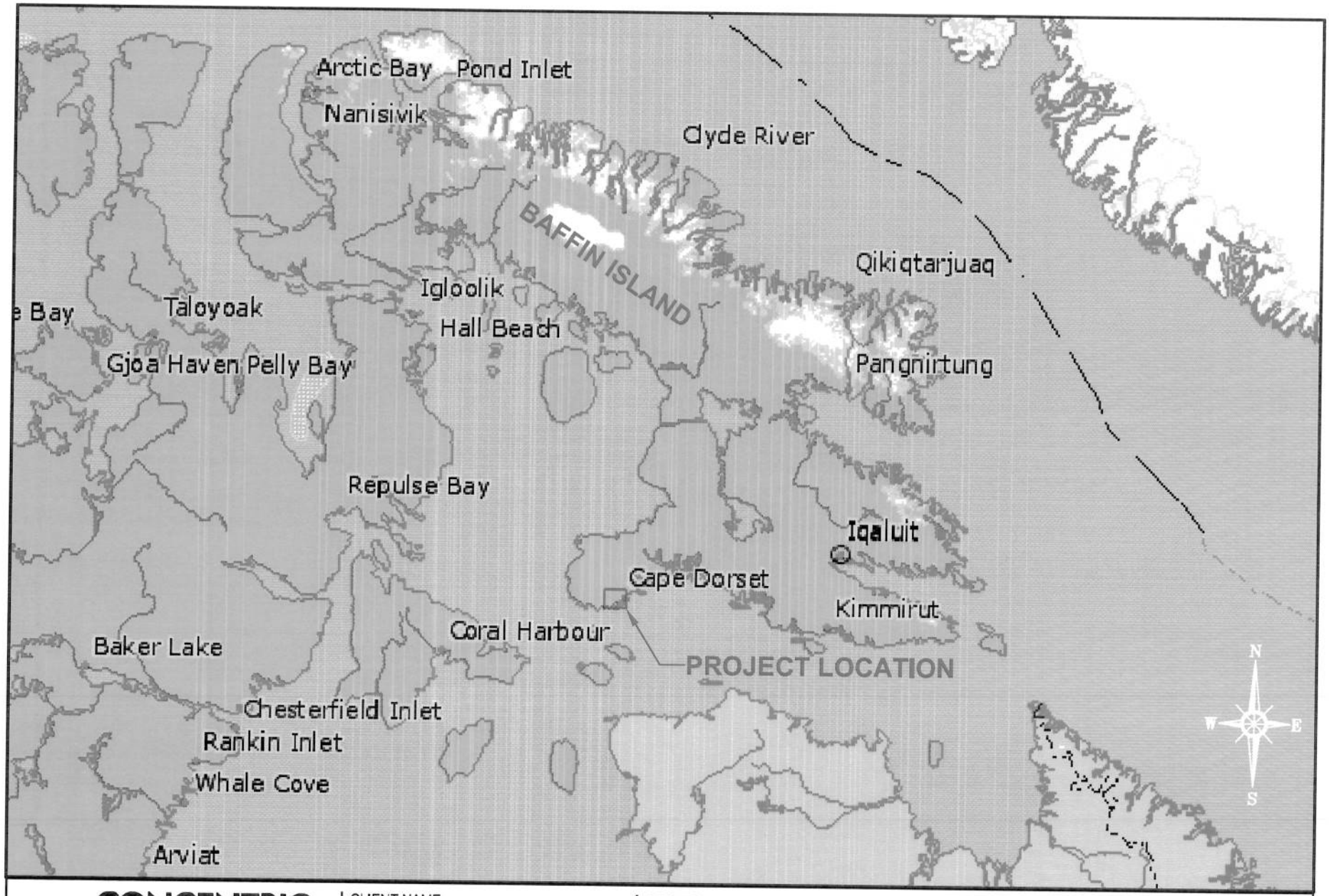
Future management and administration of scrap metal recycling could offer training and employment opportunities for local members. Training could be provided in for example, hazardous waste management (including certification for CFC removal) and the proper techniques of preparing scrap metal for baling. In addition, personnel will be required to supervise the site when materials are being deposited and to conduct regular inspections.

7.10. Operations and Maintenance Manual

A requirement of the Hamlet of Cape Dorset's water license is the preparation of an operation and maintenance manual for the metals disposal site. This manual would outline operational procedures including but not limited to hours of operation, proper waste segregation techniques, hazardous waste management (including contaminated soil), emergency response procedures, groundwater sampling techniques and timetables and schedules and methods for the annual removal of scrap metal and stored hazardous wastes. The manual, therefore, would be a valuable reference to ensure that the future operation of the site is conducted in an efficient and environmentally sound manner.

APPENDIX A

Figures



CONCENTRIC ASSOCIATES INTERNATIONAL INCORPORATED

OTTAWA 1-866-919-4530 | LONDON 1-866-919-4531 | IQALUIT 1-866-919-4533

CLIENT NAME: HAMLET OF CAPE DORSET

PROJECT ADDRESS: CAPE DORSET, NUNAVUT

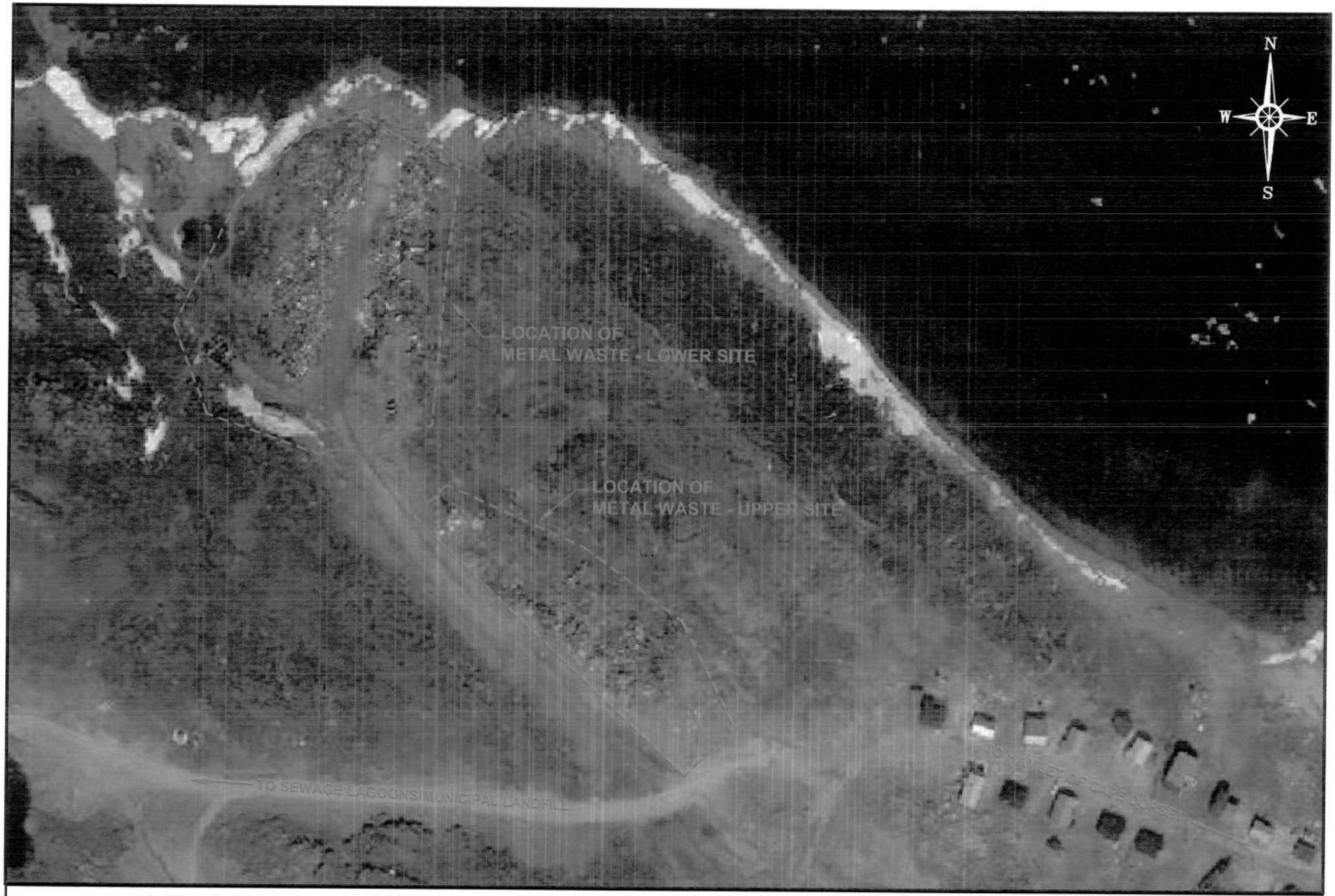
PROJECT NAME: CAPE DORSET METALS DISPOSAL SITE STUDY

DRAWING TITLE: PROJECT LOCATION MAP

DESIGN: ES
DRAWN: CY
DATE: NOV/09
FILE No: 09-2605

SHEET No.

ATT-1



CONCENTRIC
ASSOCIATES INTERNATIONAL INCORPORATED

OTTAWA 1-866-919-4530
LONDON 1-866-919-4531
IQALUIT 1-866-919-4533

CLIENT NAME:
HAMLET OF CAPE DORSET

PROJECT ADDRESS:
CAPE DORSET, NUNAVUT

PROJECT NAME:
CAPE DORSET METALS DISPOSAL SITE STUDY

DRAWING TITLE:
SITE LOCATION

DESIGN: ES
DRAWN: CY
DATE: NOV/09
FILE No: 09-2605

SHEET No.
ATT-2

OVERVIEW - LOWER SITE

OVERVIEW - UPPER SITE

BERM (1.0 m TALL)

ASPHALT RIBBON
90m²

MISCELLANEOUS
1375m²

SHEET METAL SHELVER
458m²

MATTRESSES
66m²

WHEELS & CABLES
~31m²

ELECTRONICS
133m²

BICYCLES
612m²

APPLIANCES
1033m²

ENGINES
462m²

TIRES
443m²

PIPES
597m²

BATTERIES
154m²

VEHICLES
1540m²

CORRUGATED METAL / MISCELLANEOUS
1332m²

VEHICLES
2174m²

VEHICLES
7.2m²

HUDSON STRAIGHT

NOTE:
ALL VOLUMES ARE ESTIMATIONS

HIGH TIDE LINE

FIBREGLASS/PLASTIC HOLDING TANKS
160m²

PIPES
20.2m²

OIL TANKS/BARRELS
5.2m²

UNSORTED
~44m²

UNSORTED
209m²

OIL TANKS/ BARRELS
9.7m²

INSULATED CANISTERS
14m²

UNSORTED
327m²

PIPES
95.6m²

UNSORTED
~44m²

UNSORTED
88.1m²

UNSORTED
831m²

UNSORTED
180m²

OIL TANKS/BARRELS
59m²

UNSORTED
143.7m²

SCRAP WOOD
663.2m²

TO SEWAGE LAGOON

TO CAPE DORSET

TO QUARRY

NO.	REVISION	DATE
1		
2		
3		
4		
5		
6		
7		

NOTES:

CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR REPORTING ALL DISCREPANCIES TO OWNER AND/OR CONSULTANT PRIOR TO TENDER CLOSING.

LATEST APPROVED DRAWINGS ONLY TO BE USED FOR CONSTRUCTION.

PRINTS ARE NOT TO BE SCALED.

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CLIENT DRIVEN RESULTS ORIENTED
EXPERIENCE THE DIFFERENCE

CLIENT NAME:
HAMLET OF CAPE DORSET

PROJECT ADDRESS:
CAPE DORSET, NUNAVUT

PROJECT NAME:
HAMLET OF CAPE DORSET METALS WASTE DISPOSAL SITE - FINAL REPORT

DRAWING TITLE:
ATTACHMENT 3 - SITE SURVEY

DESIGN:	RH	SCALE:	NTS
DRAWN:	JAK	DATE:	AUG/08
APPV'D:	RH	FILE No:	084806

SHEET No.

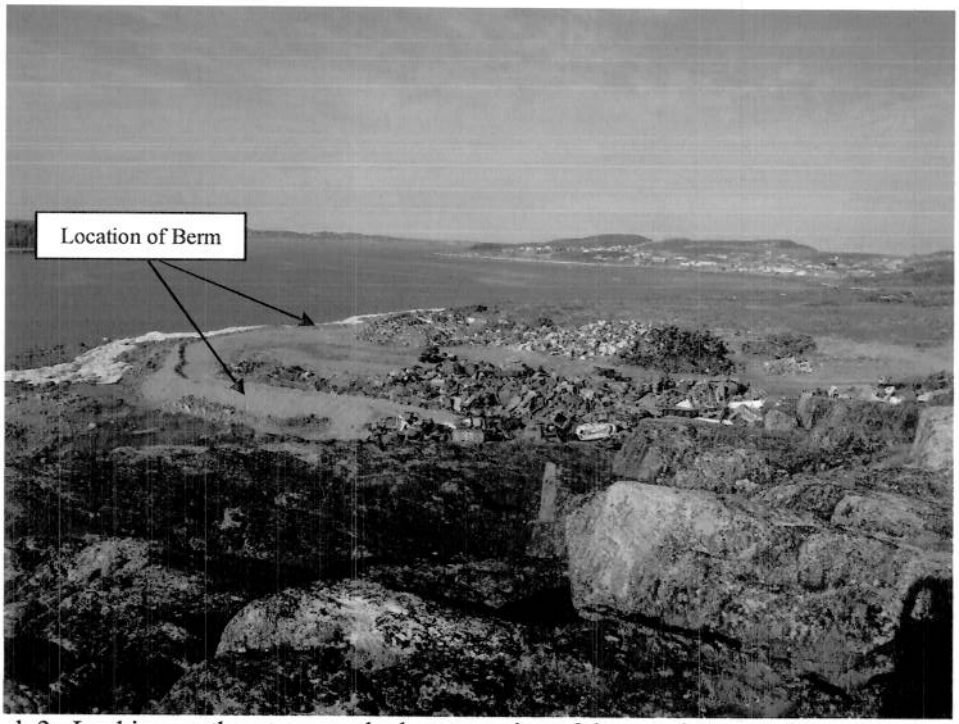
S1

1 OF 1

APPENDIX B

Site Photographs

Photograph 1: Looking southeast across the upper portion of the metals waste disposal site.



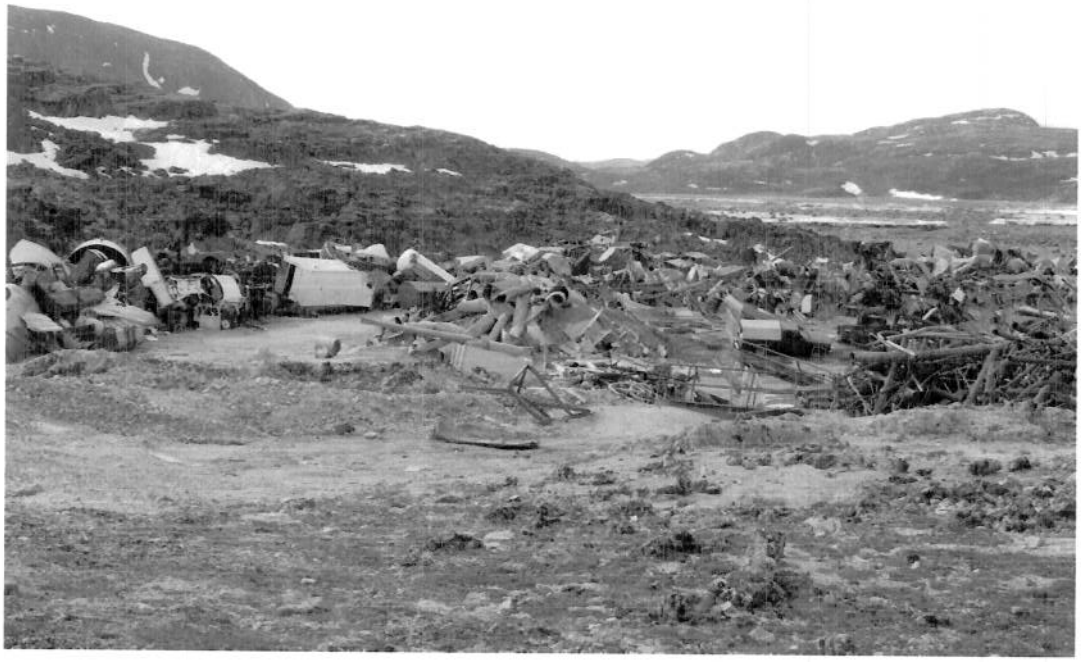
Photograph 2: Looking northeast across the lower portion of the metals waste disposal site towards the Hamlet of Cape Dorset. Note the berm surrounding the portion of the site adjacent to Telik Inlet.

Photograph 3: Looking southwest across the upper portion of the metals disposal site.

Photograph 4: Heating oil tanks and drums located in the upper site.

Photograph 5: Fiberglass tanks located in the upper site.

Photograph 6: Looking northeast across the lower portion of the metals waste disposal site.



Photograph 7: Looking southwest across the lower portion of the metals waste disposal site towards Telik Inlet.

Photograph 8: Large pile of assorted vehicles at the lower site. View is to the southwest.

Photograph 9: Large pile of mixed metal located directly opposite photograph 8 above. View is to the southeast.

Photograph 10: Mixed metal including white goods located in the lower site. View is to the southeast.

Photograph 11: Snowmobiles present at the lower site. View is to the east.

Photograph 12: Pipe present at the lower site. View is to the east.

Photograph 13: Uncontained and leaking batteries at the lower site. View is to the south.

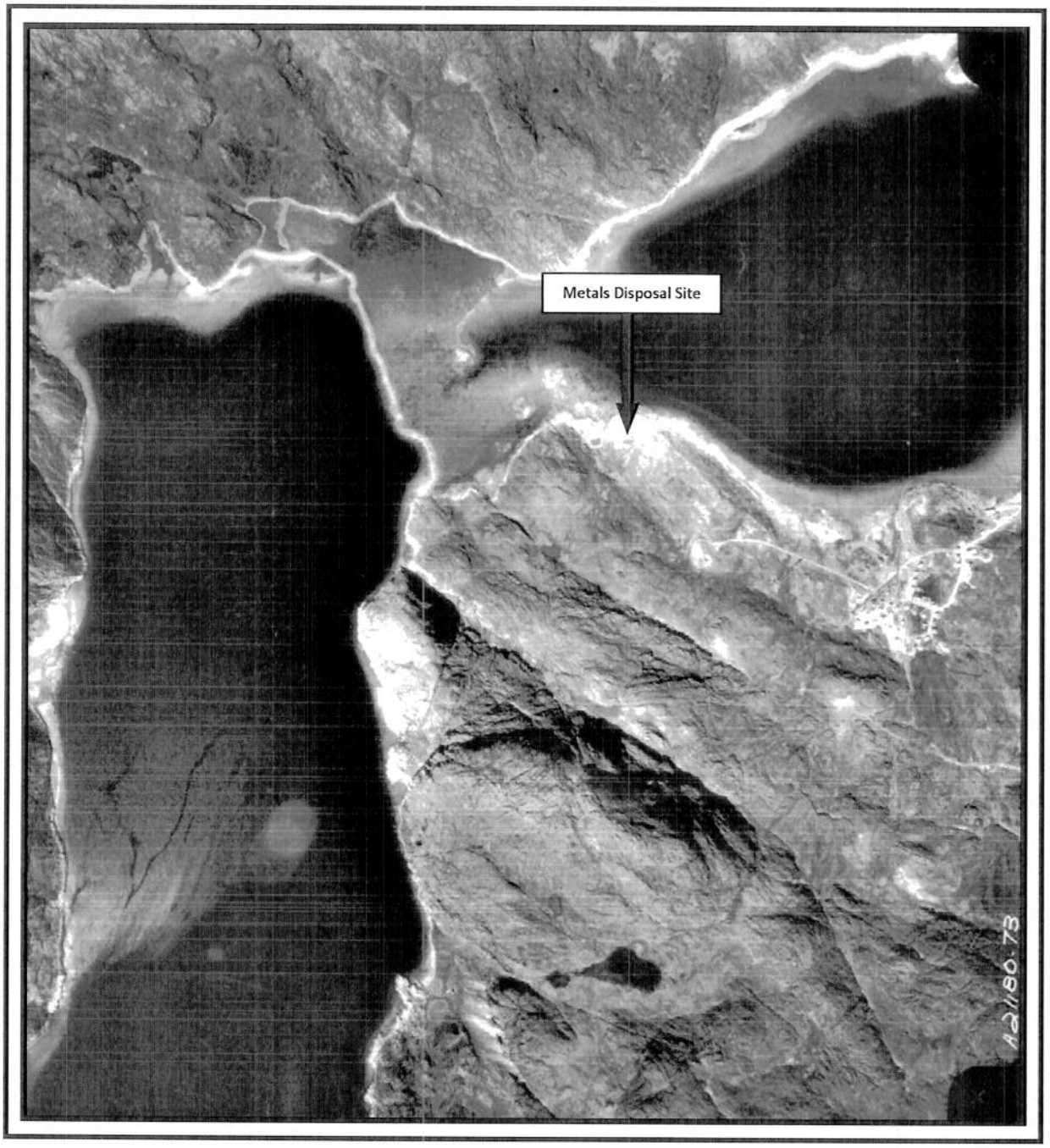
Photograph 14: Partially full paint cans present in the lower site.

Photograph 15: Possible transmission fluid leaking from vehicle.

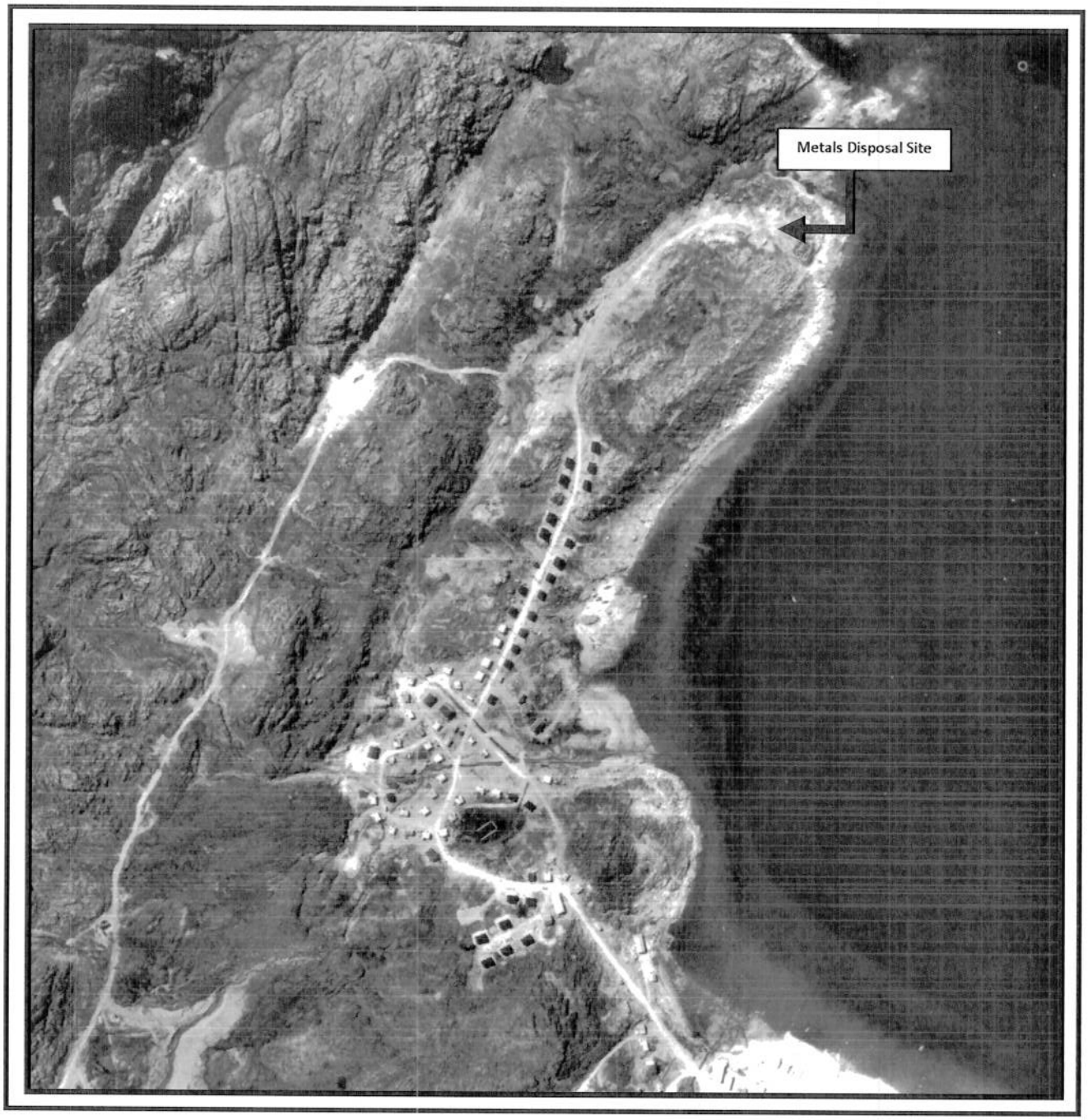
Photograph 16: Possible transmission fluid leaking from vehicle.

APPENDIX C

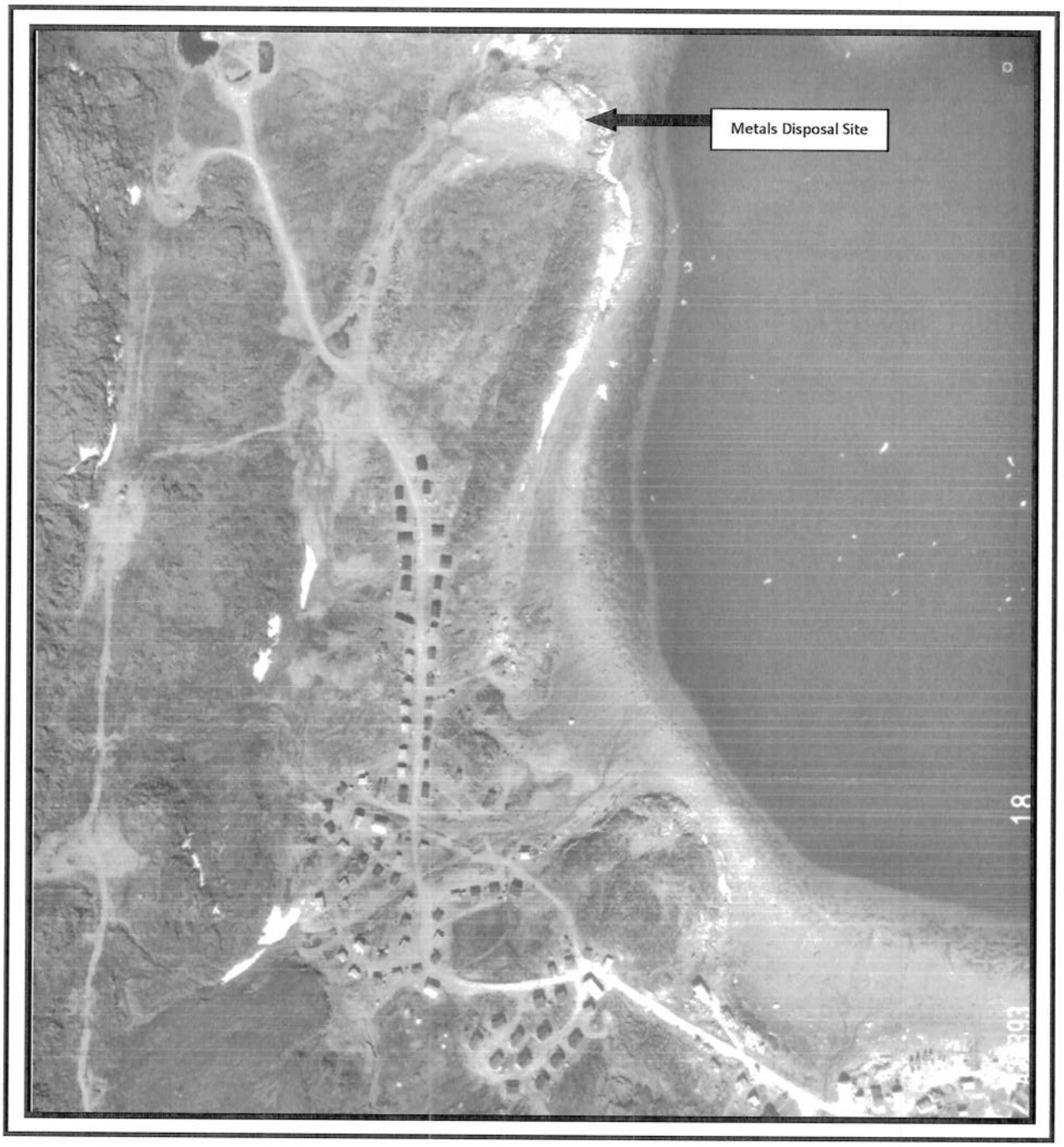
Aerial Photographs



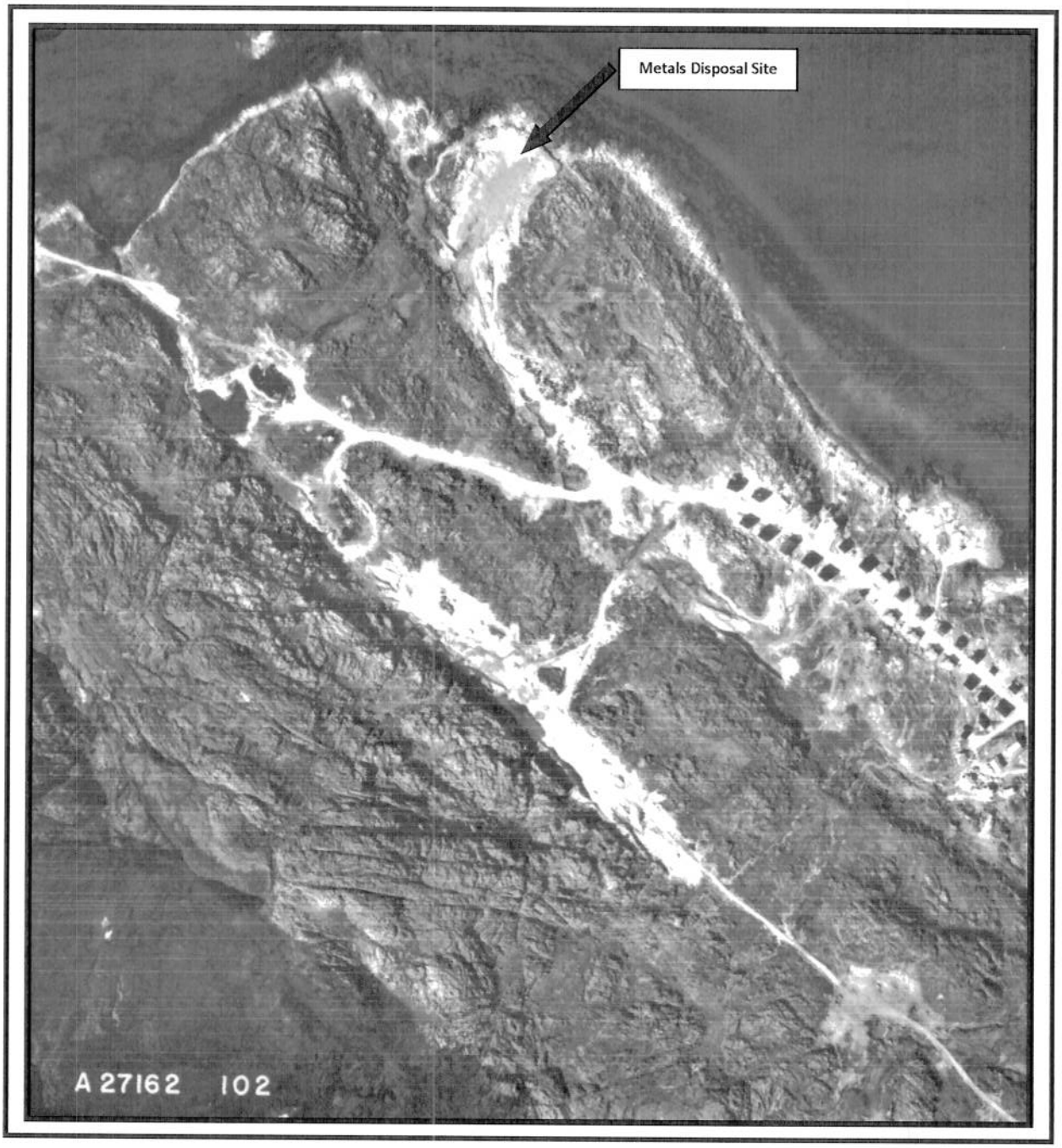
Photograph 1: 1969 Aerial Photograph – Cape Dorset Metals Disposal Site.



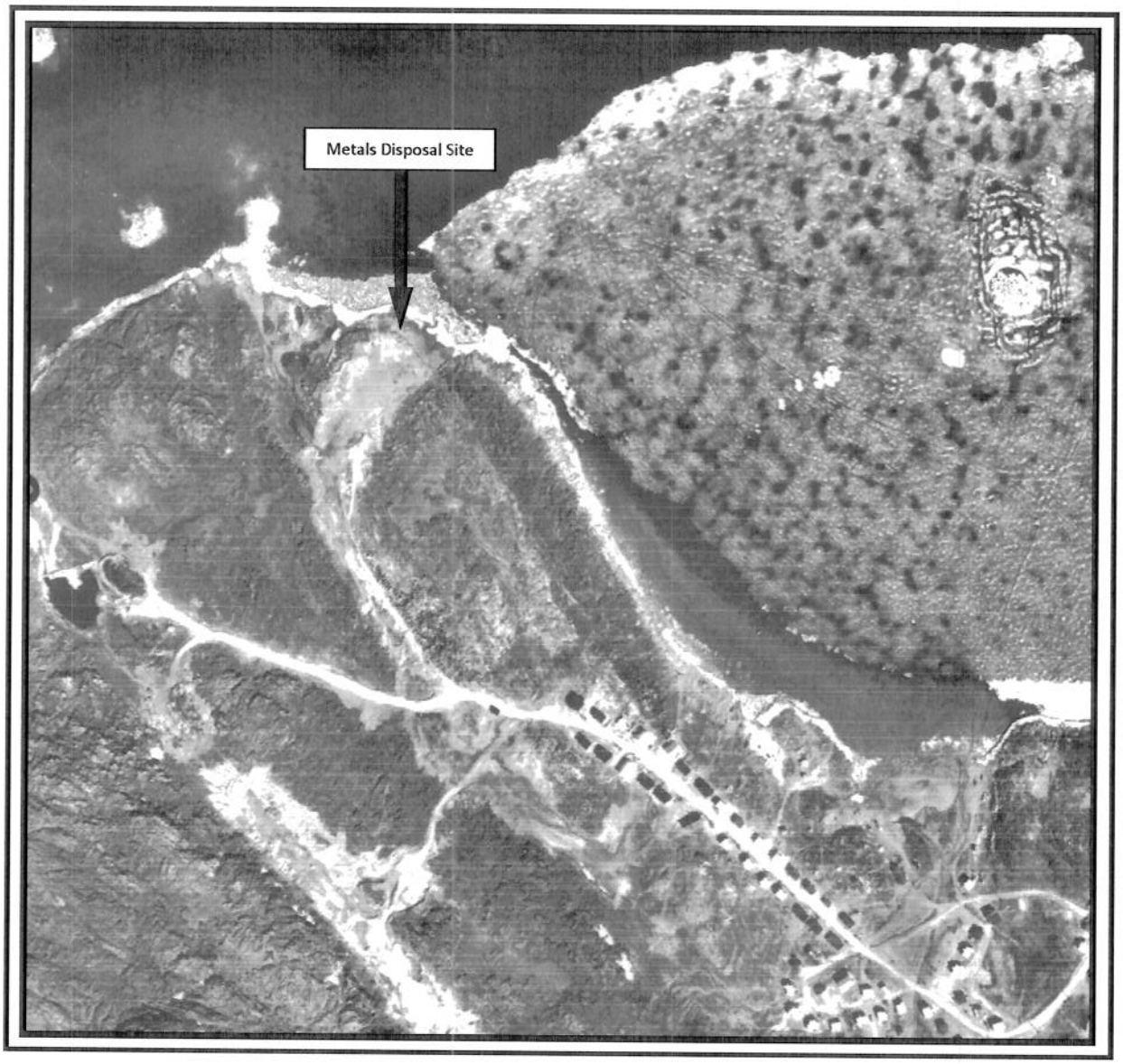
Photograph 2: 1972 Aerial Photograph – Cape Dorset Metals Disposal Site.



Photograph 3: 1983 Aerial Photograph – Cape Dorset Metals Disposal Site.



Photograph 4: 1987 Aerial Photograph – Cape Dorset Metals Disposal Site.



Photograph 5: 1989 Aerial Photograph – Cape Dorset Metals Disposal Site.

Photograph 6: 1992 Aerial Photograph – Cape Dorset Metals Disposal Site.

APPENDIX D

Reference Publications and Emails

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1. "Cape Dorset Solid Waste Improvement Study – Draft Report", Dillon Consulting Limited (October 2003) for Government of Nunavut, Community Government & Transportation.

2. Environment Canada's Disposal at Sea Program website (October 2009), http://www.ec.gc.ca/seadisposal/main/index_e.htm

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11. Personal Communication, Mark Dahl, Ocean Disposal Specialist, Environmental Protection Operations, Environmental Stewardship Branch, Environment Canada (October, 2009).

12. Personal Communication, Morris Lindenbaum, Premier Recycling Timmins Ltd. (November 2009).

13. "Scrap Metal Recycling in Nunavut & Northern Manitoba", North Central Development (March 30, 2007) for Government of Canada Climate Change Mitigation Program Enhanced Recycling.