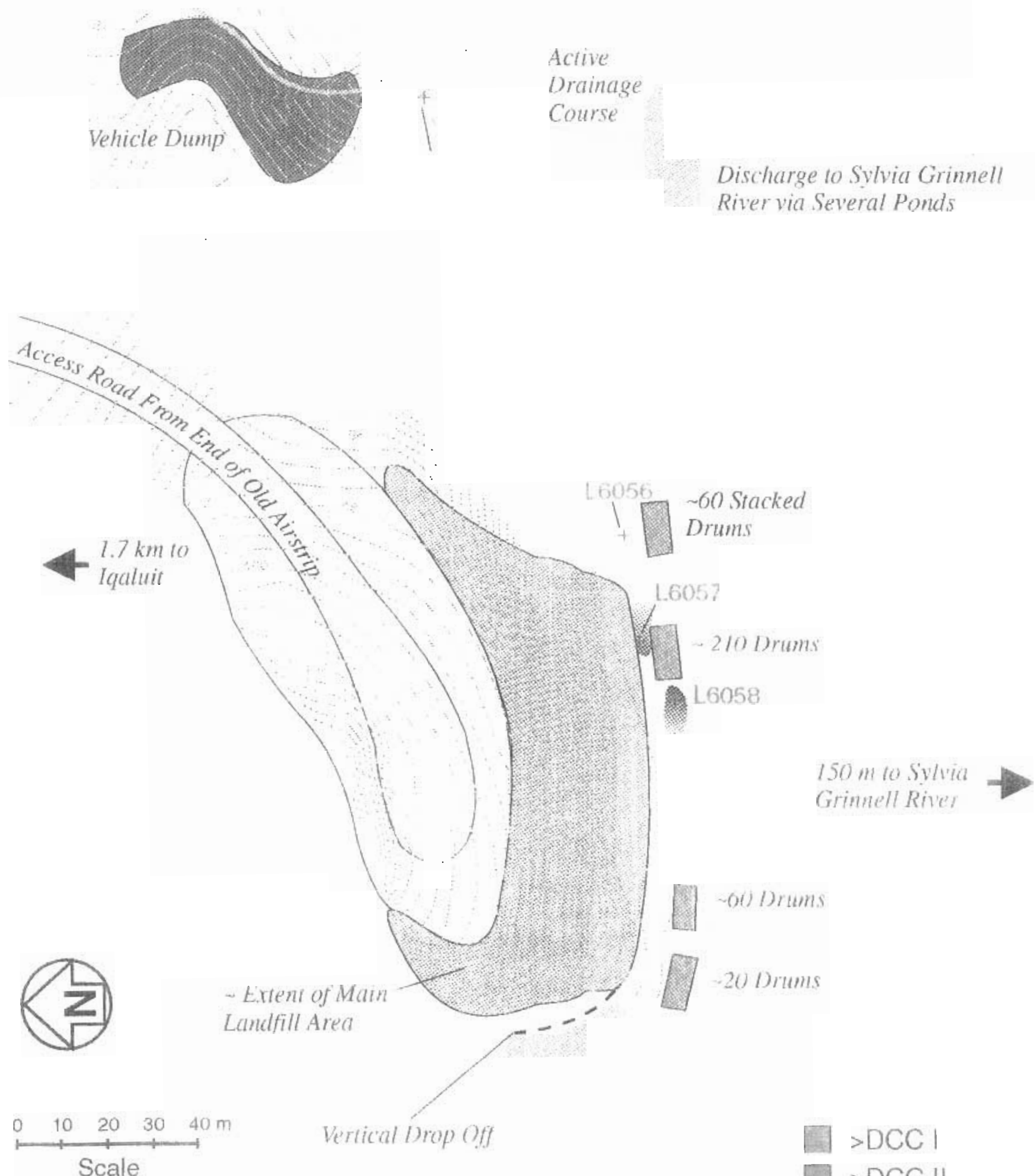
Map V-17: Samples Exceeding the Cleanup Criteria, Dump Site #1



Map adapted from the Preliminary Report on Cleanup of Waste Disposal Sites Near the Town of Iqaluit, NWT
Prepared by UMA Engineering Ltd., April 1994

ii. Polychlorinated Biphenyls (PCBs)

All eight soil samples collected in Dump Site #1 were analyzed for PCBs. Mean levels of PCBs (0.13 ppm) detected in soils were well below the DCC, but approximately 100 times background concentrations (Figure V-11). Maximum concentrations of PCBs in soils were also all below the DCC, although the concentration (0.71 ppm) in soil sample L6055, collected below the vehicle pile, was significantly elevated above background soil concentrations.

One of the three plant samples collected in Dump Site #1 was analyzed for PCBs. The concentration of PCBs in sample L6055P (*Salix glauca*) was 41 times the background concentration in plants.

Although PCBs were present in soils below the vehicle pile, no PCBs were detected in water sample WF6006 collected at the same location.

The three sediment samples were analyzed for PCBs (Bright et al. 1995). Although PCBs were detectable in all the samples (maximum = 0.99 ppb), concentrations were well below the Environment Canada Interim Freshwater Sediment Quality guideline of 34.1 ppb.

PCB concentrations in soils below the pile of vehicles in the Sylvia Grinnell Park Dump approached the DCC, but concentrations in other areas of the dump were well below the DCC. PCBs were not detected in water collected from the drainage channel below the vehicle pile. Vegetation in the vicinity of the dump has been impacted, to some extent, by the presence of elevated PCB concentrations in local soils. Migration of PCBs from the dump into Sylvia Grinnell River is not evidenced by PCB concentrations in river sediments (Bright et al. 1995).

iii. Other Organic Contaminants

One soil sample (L6058) from Dump Site #1 was analyzed for pesticides. The total concentration of pesticides (0.027 ppm) in the sample did not exceed the BC (2 ppm), Québec (2 ppm) or Netherlands (3 ppm) Level B remediation criteria. Six of the 22 pesticide analytes were detected, but none were present at concentrations which exceeded the Netherlands B level criteria for individual chlorinated (0.5 ppm) or non-chlorinated (1 ppm) pesticides.

Two soil samples were analyzed for PAHs. Although most PAHs were detected, none of the analytes were present at concentrations exceeding the CCME R/P Remediation Criteria or the BCMOE Criteria.

Pesticide and PAHs were not detected at concentrations requiring remediation under the DLCU Protocol.

5. Cleanup Recommendations

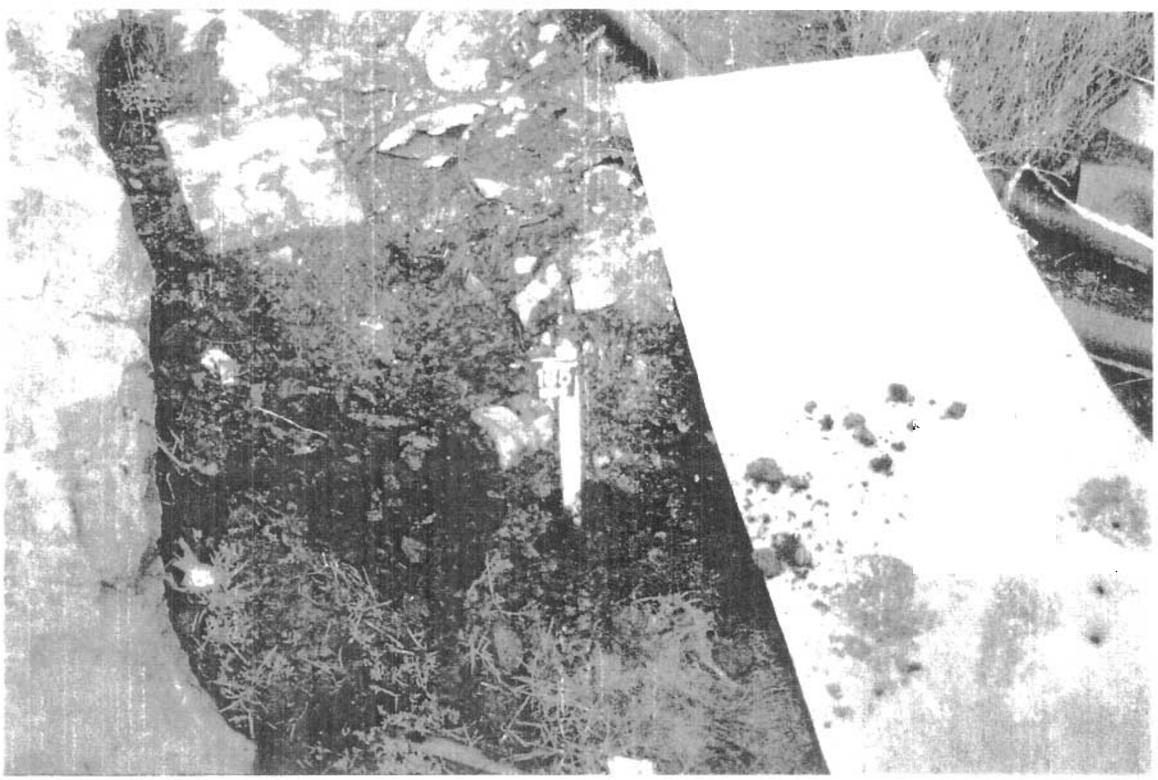
The results suggest that the area at the base of the dump is contaminated with metals from the debris present there. Soils around the areas where samples L6057 and L6058 were collected should be excavated and removed from contact with the Arctic ecosystem as outlined for Tier II soils in the DLCU Protocol. Soils near the L6055 and L6056 sampling locations, in which lead concentrations exceeded DCC Tier I, should be excavated and placed in an engineered landfill in accordance with the DLCU Protocol. The concentration of PCBs in sample L6055, though significantly elevated above background, does not warrant soil remediation under the DCC. Nevertheless, the area represented by this sample will be excavated because of the high levels of lead found in the same sample. It is suggested that after removal of the DCC II soils, any soil remaining between the base of the main area of the dump and the first boulder outcrop (see Haertling 1988) should be removed along with the Tier I soils because it contains some inorganic contamination at levels significantly elevated above background. The area to be excavated is defined by the base of the landfill slope and the first of a series of parallel bedrock outcrops.

The PCB results presented above suggest that previously reported levels of PCBs which exceeded the DCC Tier I level (DIAND File #B5565-2, May 22, 1985) have now fallen below that level. It is likely that the removal of electrical equipment in 1986 also removed the sources of the PCBs and hence PCB levels have dropped. The concentrations of PCBs (0.71 ppm) detected in soils downstream from the vehicle pile suggest that the currently inaccessible soil under the vehicle pile needs to be assessed for PCBs. **Following the removal of the vehicles as outlined below, soil from this area should be collected and analyzed for PCBs.**

As part of the concurrently run Historical Ocean Disposal Study, sediment samples were taken from the Sylvia Grinnell River in the vicinity of Dump Site #1. The sediment samples contained levels of PCBs which were slightly elevated above background (Bright et al. 1995). Levels of PCBs in the Sylvia Grinnell River sediment samples were, however, much lower than in sediments obtained from Koojesse Inlet which is closer to town. With the exception of one sediment sample, containing elevated chromium concentrations, levels of inorganic analytes in the sediment samples from the river were below the sediment guidelines. In particular, lead - which was found to be elevated in soils near the dump - was not detectable in any of the sediment samples, and zinc concentrations in sediment from the river were only slightly elevated above background levels. **The dump, located on the north bank of the river, does not appear to have had a significant impact on nearby river sediments.**

In addition to the remediation of contaminated soils at the dump site, its physical stability needs to be addressed. Loose metallic debris, including the large uncovered pile of vehicles on the eastern side of the site, should be removed and either placed in an engineered landfill or, should it prove economical, shipped South to be recycled. Much of this material could be shredded prior to landfilling or shipment. Barrels should be disposed of as outlined in the DLCU Barrel Protocol (Chapter IV). Although the 1994 UMA report suggests leaving the face of the slope intact, due to success of plant growth, visual inspection of the area during the current investigation indicated that the dump site represents a potential hazard to people frequenting the area. It is proposed that sufficient granular fill be added to cover exposed metallic debris and stabilize the face by decreasing its slope. The addition of sufficient fill would allow permafrost infiltration of the waste-containing section, and therefore the leaching of contaminants from within the dump would also be prevented. Erosion of the freshly regraded slope-face could be reduced by planting it with seed from endemic, early successional species. Erosion and leachate generation should be prevented, as suggested by UMA (1994), "by constructing a swale along the edge of the top of the site to redirect drainage which could run down the exposed face".

Photograph V-34: Sample L6055 was collected from the drainage channel running through the vehicle pile and contained elevated levels of lead and PCBs.



Photograph V-35: Sample L6057 was collected from the small stained area and contained elevated levels of lead and zinc.

Photograph V-36: Sample L6058, collected from the black stain, contained elevated levels of zinc.

E. Dump Site #2: Summer Camp Dump

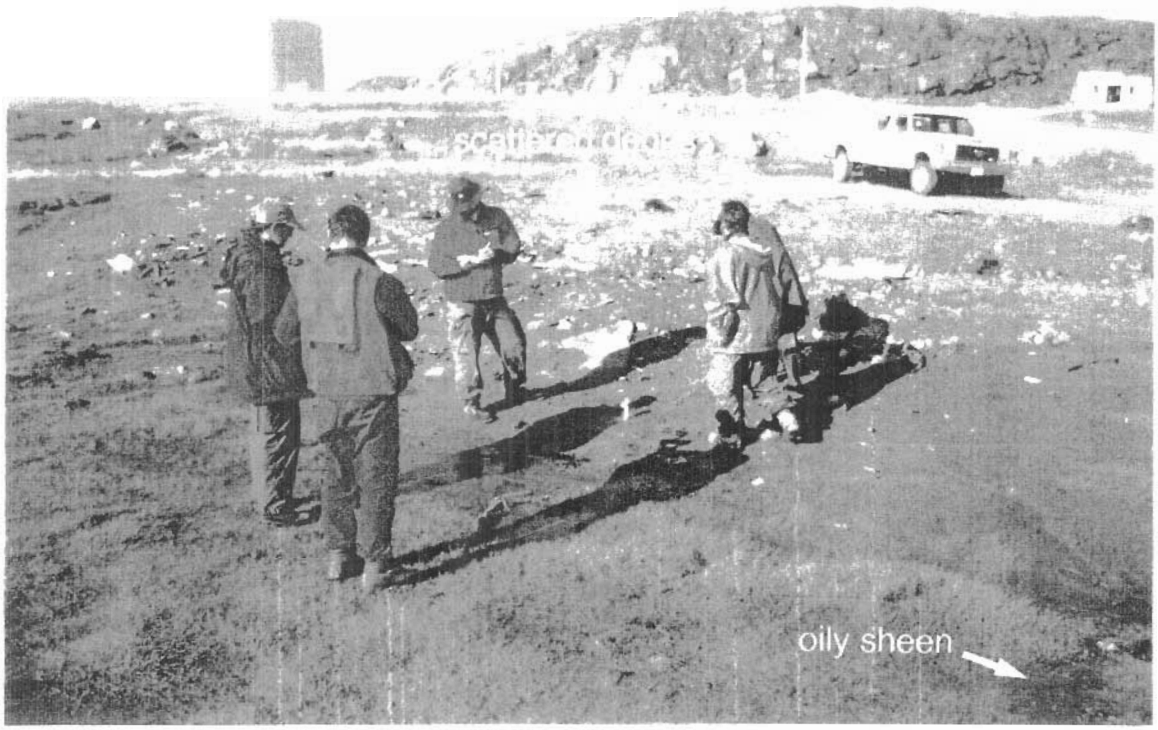
1. General

Dump Site #2, approximately 2 km south of Iqaluit in an area referred to locally as the West 40, is situated on the west side of the causeway access road immediately southwest of Dump Site #3, the site of the new municipal landfill, and opposite a Transport Canada POL tank farm (Map V-1). The site occupies approximately 1 ha of a low-lying area on the edge of the foreshore flats in an embayment, and comprises one small area of exposed domestic waste (Photograph V-37), buried metals including some barrels, and a few large pieces of scrap metal located on the beach. In the immediate vicinity of the site, there is a camping area used as a summer residence by local people. Vegetative cover in and around the site is medium to sparse in nature and composed almost entirely of grasses.

Dump Site #2 was used as a municipal waste dump for most of 1979 (PWC 1992). The operation of the site involved burning of waste in deep trenches. Now the only clue to the location of the trenches is from the presence of a small amount of domestic debris exposed on the surface of the soil. Granular material was added to the trenches on a regular basis to cover and stabilize the burned waste. Although the granular source is not known with any certainty, it resembles the coarse sand present in the surrounding area. Honey bags may have been disposed of at the site as well, although Dump Site #4 received most of this type of waste into the 1980s. Some larger metallic wastes including barrels were buried northeast of the trenches. Some of this material is partially exposed along the banks of a large drainage ditch running along the east side of the site.

A portion of the area occupied by wastes is situated within the limit of high tide. Erosion of the area by tidal action may have caused the debris at the south end of the site to become exposed. Additional erosion may be occurring as a result of water flowing over the area from a large drainage ditch on the eastern side of the site.

The large drainage ditch on the east side of the site making its way through the area and into a small embayment of Frobisher Bay is the only major drainage path through the site. This ditch currently receives runoff from Dump Site #3 to which it is connected by a road culvert.



Photograph V-37: The area littered with debris in Dump Site #2. Note that water in the vicinity has an oily sheen on its surface.

2. Results of Previous Studies

Oliver, Mangione, McCalla and Associates (1983) studied Dump Site #2 (which they referred to as Dump Site #3) as part of an investigation into waste disposal practices by the town of Iqaluit. Their report contains general information concerning the history of waste disposal at each site, and observations regarding their physical characteristics, but does not contain any information on the state of chemical contamination at these sites. Specific recommendations for cleanup of Dump Site #2 were based on the assumption that impact exerted by the site is aesthetic only. The recommendations included the removal of scrap waste from view by consolidating the affected area, covering the site with additional fill, and regrading the area.

The 1992 literature review by Public Works Canada summarizes general information concerning the Upper Base and six waste disposal sites located around Iqaluit, including Dump Site #2. Although it summarizes what is known of the historical use of this site for waste disposal, the review contains very little specific information regarding Dump Site #2.

Dump Site #2 was also included in the environmental site assessment conducted by Avati Ltd. (1993a). A total of ten soil, including a duplicate, and two water samples were collected for their assessment of this site. All ten soil samples were analyzed for inorganic elements. None of these were detected at concentrations in excess of the CCME R/P Remediation Criteria. Three soil samples from Dump Site #2 were analyzed for PCBs. Detection limits of 0.3 ppm for two of the analyses were insufficiently low to determine effectively the extent of PCB contamination at the site: PCBs were found at a concentration of 0.5 ppm in one sample, whereas they were undetectable in the second sample. The Avati report (1993a) presented TPH results for four of the soil samples collected at site #2. TPH levels were below detection in three soils and very low in the fourth (2.4 ppm).

The Avati Site Assessment volume (1993) reported inorganic element concentrations for both water samples collected at Dump Site #2. Eleven of the eighteen inorganic analytes were undetectable in either sample; copper was detected at levels exceeding the CCME FAL Remediation Criteria in both samples, while lead was detected at a concentration (4 ppb) within the range of the FAL criterion (1-7 ppb). A single water sample was analyzed for the ABN suite of priority pollutants. Two of the phthalate compounds were detected at concentrations exceeding the CCME FAL Remediation Criteria. However, the reported concentrations were comparable to those reported in the background water sample collected as part of the same study, and the analytical firm outlined in their laboratory report that these compounds were common contaminants present in laboratory plasticware. Both Avati water samples were analyzed for TPHs and none were detected in either sample. Neither water sample was analyzed for PCBs.

In the Remediation Options volume of its report, Avati (1993b) lists the type of waste materials, contamination and hazards present at each site. The list of waste present, which includes domestic waste, sewage and scrap metal, was gleaned from the Environmental Site Assessment volume (Avati 1993a) and the 1991 UMA report. PCBs, volatile metals and non-volatile metals were reported in the contamination section. Lead, PCBs, boron and vanadium in soils and di-n-butylphthalate and bis(2-ethylhexyl)phthalate in water were reported to be present in excess of CCME criteria and to represent "hazards" within Dump Site #2. But the contaminants in soils reported to constitute a hazard had been erroneously compared to the CCME Agricultural rather than the CCME R/P Remediation Criteria. In fact, none of the contaminants detected exceeded the CCME R/P Remediation Criteria, which is the set of criteria outlined in the Avati Site Assessment volume as being most appropriate for application to Dump Site #2. Copper and lead concentrations in water collected from the site which did exceed the FAL criteria were not included in the summary of contamination (Avati 1993b).

Additional confusion concerning the state of contamination at Dump Site #2 has been created by the contaminant summary map (Figure 5.4) contained in Appendix C of the Remediation Options volume of the Avati report (1993b). Many contaminants which were detected in analyses, but did not exceed either the CCME R/P Remediation Criteria for soils or the CCME FAL Remediation Criteria for water, were included. Consequently, it appears that a total of ten samples contain contaminants in excess of the criteria, rather than the actual two.

Based on scores obtained by each of seven alternatives under two different ranking analyses, the Remediation Options volume of the Avati report (1993b) suggests Alternatives 2, 3, 6 or 7 (as outlined in Chapter 6 of their report) for consideration for cleanup of Dump Site #2. The institution of Alternatives 6 or 7, both of which include landfill excavation, could potentially create an environmental hazard where none currently exists. The DLCU Protocol specifically advises against the excavation of landfills which are not undergoing undue erosion or instability. The reader is left to decide which of these four alternatives is most appropriate for the cleanup of Dump Site #2. The Avati report (1993b) also contains the site-specific recommendation that the water from Dump Site #3 be treated prior to reaching site #2 or be diverted away from it.

UMA (1994a) studied Dump Sites 1 through 5 and reported on their aesthetic, physical and geotechnical characteristics. Contaminant assessment did not form part of the study. The potential impact of Dump Site #2 on the marine ecosystem was commented upon. Recommendations for cleanup and remediation of the site suggested the following: (1) the removal of loose metal debris to an appropriate landfill, leaving in place any materials whose removal might jeopardize the stability of the site; (2) rerouting of the drainage which runs through the landfilled area to reduce erosion; and (3) the removal of any large pieces of metal present on the beach.

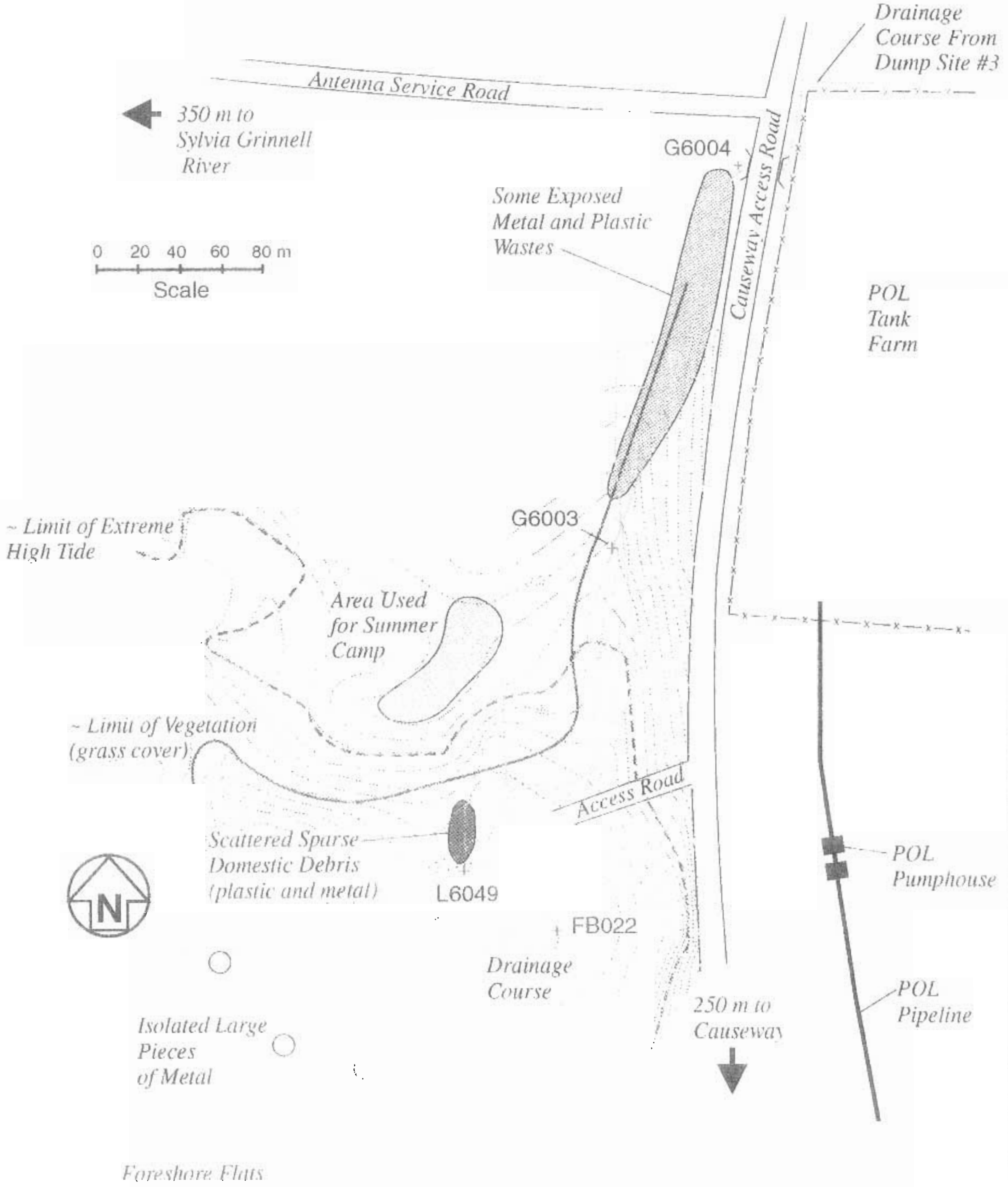
The 1994 (a) UMA document contains a subdocument produced in 1992 by the engineering firm Hardy BBT. The following recommendations were made in this document: (1) the drainage course running along and eroding the eastern edge of Dump Site #2 should be regraded and reconstructed with suitable erosion protection to avoid jeopardizing the stability of the covered landfill area; (2) the open area of garbage within the site could be covered and seeded; and (3) the large pieces of metal on the foreshore should also be removed.

3. Current Sampling Program

Sampling of Dump Site #2, as part of the current investigation by the ESG, took place on August 14th, 1995. A single channel draining from Dump Site #3, through a culvert into Dump Site #2, and ultimately into the foreshore flats, was the focus of the sampling program (Photograph V-38). A total of three soil samples were collected in the area; one each at the top and in the middle of the drainage channel running through the area, and one from an area with exposed debris in it through which the drainage channel passes (Map V-18). No vegetation was collected at the site due to its sparseness. Detailed descriptions of individual sampling locations and vegetation surveyed are provided in Section E, Chapter IV of the Appendices.

As part of the concurrently conducted Historical Ocean Disposal study, one sample of marine sediment was collected in the high intertidal zone of the embayed area, adjacent to the dump (FB022, Bright et al. 1995).

Map V-18: Sample Locations at Dump Site #2, West 40 Summer Camp Area



Map adapted from the Preliminary Report on Cleanup of Waste Disposal Sites Near the Town of Iqaluit, NWT
Prepared by UMA Engineering Ltd., April 1994

4. Analytical Results

The analytical results for this and all other sites can be found in Chapter V of the Appendices. None of the soils collected in Dump Site #2 contained contaminants in excess of the DCC or other applicable criteria.

i. <u>Inorganic Elements</u>

Two of the three soil samples collected at Dump Site #2 were analyzed for inorganic elements. Mean and maximum levels of all elements investigated were well below the DCC (Figure V-12). Concentrations of all inorganic analytes, except lead and arsenic in one of the sample, were comparable to concentrations in background soils. Lead and arsenic concentrations were four and three times the background soil concentration, respectively, in L6049.

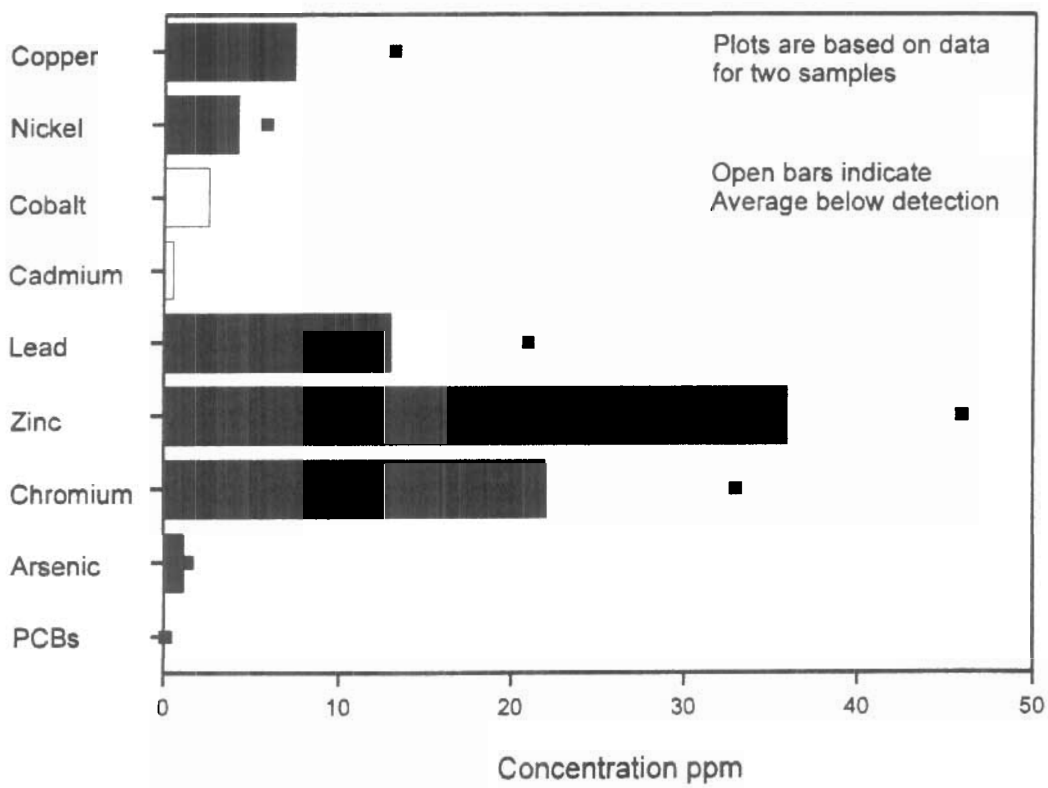


Figure V-12: Mean and Maximum Inorganic Element and PCB Concentrations in Soils Collected at Dump Site #2.

The marine sediment sample collected as part of the Historical Ocean Disposal study (FB022) contained levels of inorganic elements which were comparable to those present in background sediments.

Inorganic element concentrations in soils and marine sediments collected in the vicinity of Dump Site #2 were not elevated above the DCC.

ii. Polychlorinated Biphenyls (PCBs)

Two of the three soil samples collected were analyzed for PCBs. PCBs were undetectable in one sample and were present at levels well below the DCC in the other (Figure V-12). The concentration of PCBs (0.077 ppm) in the sample in which they were detected (L6049) were 77 times mean background soil levels (0.001 ppm).

The marine sediment sample (FB022) contained levels of PCBs which were comparable to those present in background sediments.

Concentrations of PCBs in soils and sediments collected in Dump Site #2 were not elevated above the DCC.

iii. Other Organic Contaminants

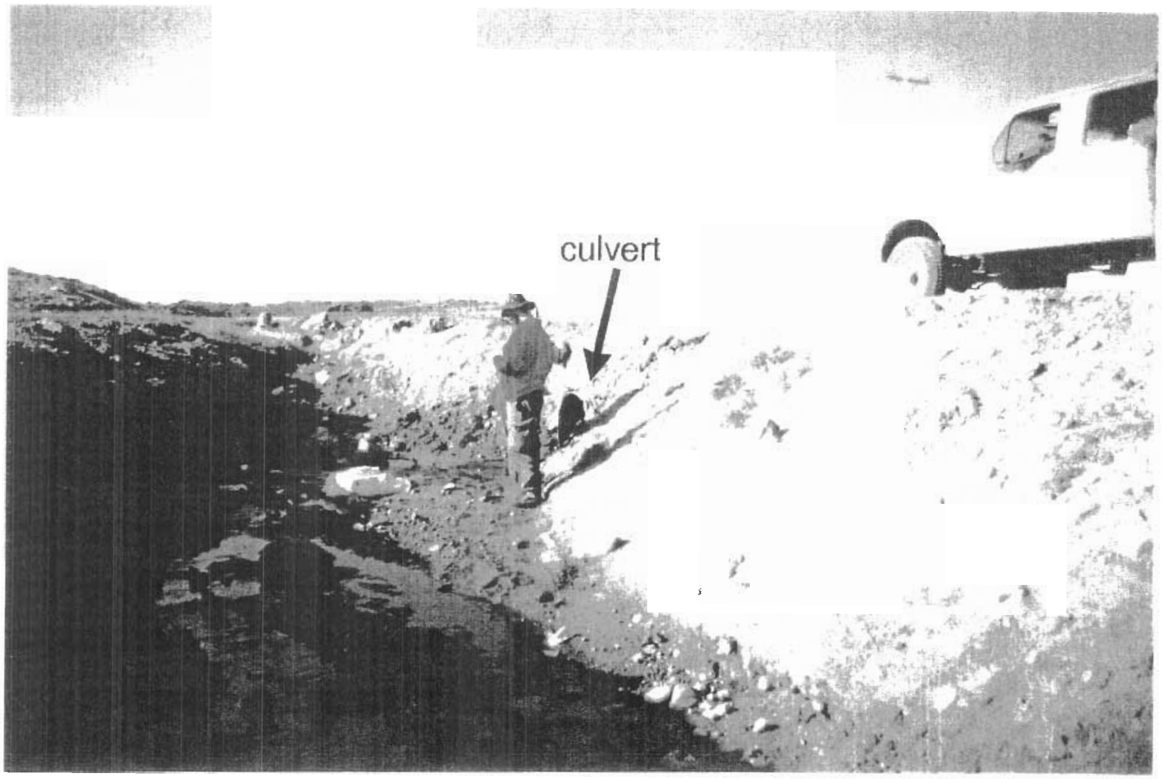
One soil sample (L6049) from Dump Site #2 was analyzed for pesticides. Results from analytical duplicates for this sample are averaged. The average total concentration of pesticides (0.0012 ppm) detected did not exceed the BC (2 ppm), Québec (2 ppm) or Netherlands (3 ppm) Level B remediation criteria, nor did the average total concentration of pesticides exceed the Netherlands criteria for individual chlorinated pesticides (0.5 ppm). Seven of the 22 pesticide analytes were detected at very low levels in at least one of the duplicates.

Pesticides, although detected in soils collected in Dump Site #2, were not elevated above the applicable criteria.

5. Cleanup Recommendations

The levels of contamination present in soils at Dump Site #2 are generally comparable to background concentrations. The low concentrations of PCBs and pesticides present in soils at this site could have been transported to the site in leachate from Dump Site #3. All but one of the pesticides detected at Dump Site #2 were detected at higher concentrations in soil from Dump Site #3. The one compound detected in Dump Site #2 soil which was not found in site #3 soils was present at the limits of detection (0.00004 ppb). In previous studies (Avati 1993a), copper and lead have been detected in water collected from the site at levels exceeding the CCME FAL Remediation Criteria, suggesting that contaminants may be leaching from the area of buried waste. The fact that these contaminants were not found to be elevated in soils from the area does not support the idea that they originate from within the dump, however. **Therefore, chemical contamination in the area occupied by Dump Site #2 does not represent a threat to the surrounding environment.**

Erosion of the areas where wastes are buried does pose a risk, however, as exposed wastes could be transported into the ocean by tidal action should it continue. The practice of burning materials before burial while the site was active indicates that a significant portion of the buried materials may be ash which is considered hazardous under the DLCU Protocol. Permitting any hazardous materials to enter fish bearing waters constitutes a potential violation of the Fisheries Act (Section 36). Any debris present on top of the substrate should therefore be removed, and erosion reduced with the addition of an appropriate amount of fill over the area most affected by the drainage channel which runs through the site. Exposed materials not readily removed from the substrate should be left undisturbed to avoid decreasing the stability of the filled areas. Rerouting the drainage channel under the access road by installing a culvert, as suggested by UMA (1994), is a possible further measure for the reduction of erosion.



Photograph V-38: View to the north of the large drainage ditch on the east side of Dump Site #2.

F. Dump Site #3: Site of the New Municipal Landfill

1. General

Dump Site #3 occupies 1.5 hectares in a large drainage catchment area 1.7 km south of the town of Iqaluit, immediately below and southwest of the current municipal dump, referred to in this report as Dump Site #4 (Map V-1). Due to its proximity to the airstrip (1.1 km to aircraft flight path) the site falls under the jurisdiction of Transport Canada. Also nearby are a POL tank farm operated by Transport Canada 125 m south of the site, and the summer camp area used by local residents approximately 500 m to the southwest. The approach to the site is via the causeway access road. The precise origins of the waste in this dump are unknown, but visual inspection suggests that it likely arose from military operations and may have been augmented by municipal activities. The site remained relatively undisturbed until 1991 when the search began for a site for the much-needed new municipal landfill. Since then the area has been studied extensively to assess the nature of any contaminants present in the waste already located there, and to predict the environmental impact should at least part of the area be excavated (UMA 1991, 1994a, 1994b). It was determined in a study by UMA (1991) that contaminant concentrations were sufficiently elevated in the northern half of the site to warrant its exclusion from the overall design. Hence in the fall of 1994 a new interim landfill was constructed in the southern half of the area occupied by Dump Site #3 following the UMA design (1994b, Photograph V-39). Because of its limited capacity, the new site will be used only for interim municipal waste disposal until a new site is available. The temporary solution will allow time for investigation into a longer term solution while permitting closure of the present waste disposal area. The current environmental assessment was conducted in August of 1994, before construction began. In the following discussion an attempt will be made to incorporate these changes into the current assessment of the site.

Dump Site #3 is surrounded to the northeast, east and west by large granite outcrops and was open to the north and south (Map V-19). The site is hidden on approach by road from the north by its low aspect and the large granitic outcrop which borders its northeastern corner, but is visible from the road to the southwest of the site. The topography of the area prior to construction suggested that it had been worked, and granular material added periodically. Revegetation of most of the affected area was extensive, however, but was restricted almost entirely to sedges, due to poor drainage from much of the area. Two built-up areas in the northern half of the site contained the greatest concentration of visible debris. The northernmost of these contained mostly barrels and building materials and, on the area's southern edge, a depression in which drainage had collected. The pooled water had an oily sheen on its surface. The southernmost and larger concentration of debris contained, in addition to barrels and building materials, more domestic wastes, including many tin cans. Water pooled on the northwestern edge of this pile, and an active drainage channel ran from it to a marshy area to the south. From here the drainage proceeded southwest into the roadside ditch, through a culvert and through Dump Site #2. Another drainage channel ran to the northeast along the base of the granitic rock face in the northeastern corner of the site to ultimately drain into Koojesse Inlet. Two piles of crushed barrels were located at the extreme north end and the southwestern corner of the site, respectively.

Dump Site #3 has undergone considerable alteration following the construction of the new municipal landfill (Photograph V-39). The landfill occupies the southern half of the dump and incorporates both a cellular design with central and western access roads and a culvert which can be opened and closed to control leachate discharge (Map V-20). The area outside that used for the new landfill has undergone some alteration as a result of construction activities as well. Berms have been constructed to the north and northeast of the area in accordance with UMA recommendations, in order to prevent migration of leachate from the contaminated areas. Drainage has been channeled to flow through the middle of the north half of the site and to pool just outside the northeastern corner of the new landfill where it can join a ditch which travels along the eastern side. At the southeastern corner the ditch makes a 90 degree turn and continues to follow the fenceline of the new landfill until it empties into the roadway ditch in the same manner it had before construction began. In addition to altering the drainage pattern, construction activities have resulted in the extraction of some wastes which were buried within the area for the new landfill. These wastes were deposited just outside and north of the area currently occupied by the new landfill.