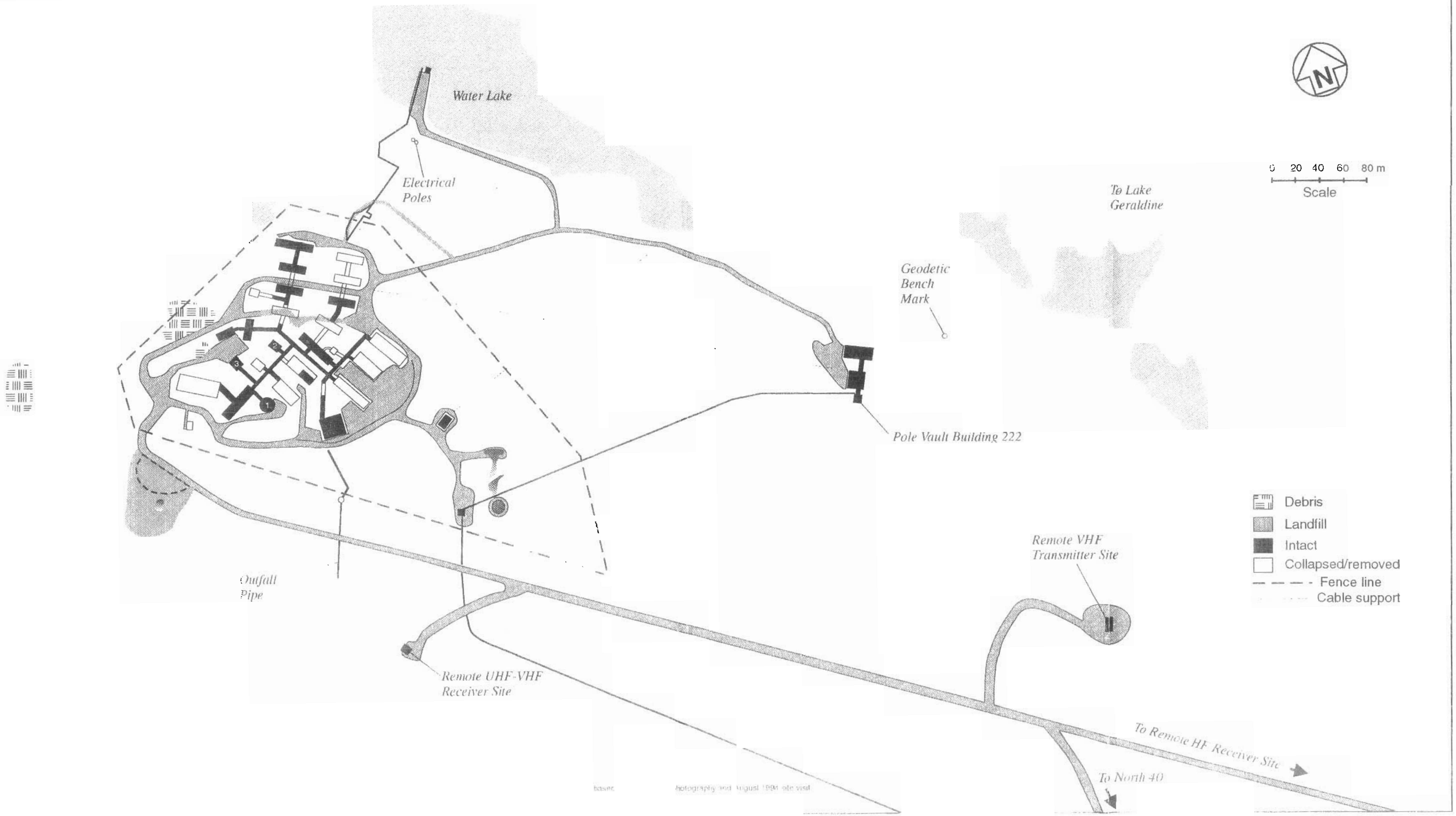
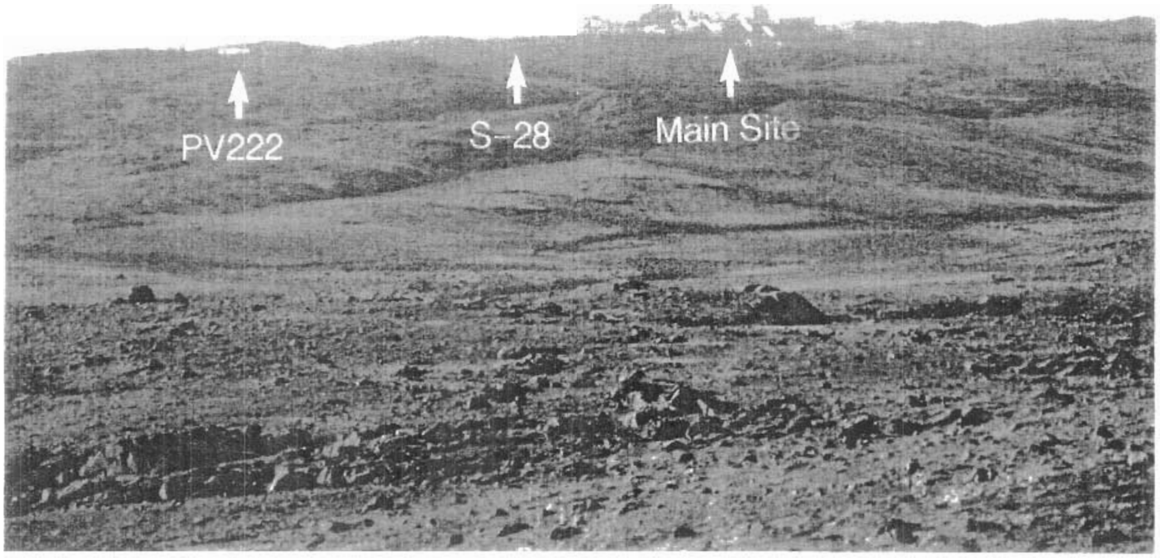
Map V-2: Upper Base

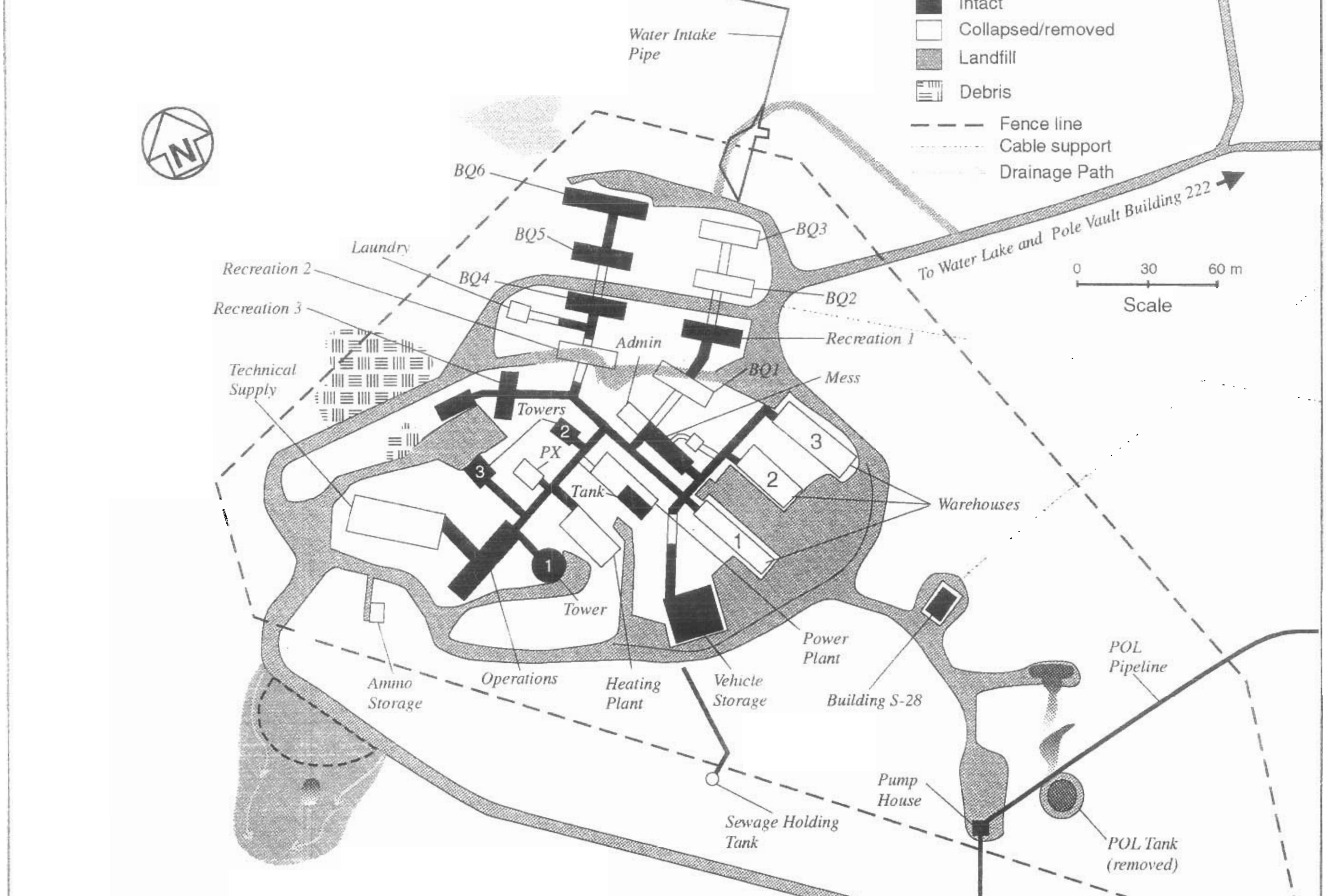




Photograph V-3: View from the east of the Upper Base including Pole Vault Building 222, Communications Building S-28 and the Main Site.

Photograph V-4: Aerial view of the Main Site at the Upper Base. Long-range radar were housed in goedesic domes formerly situated atop the rectangular towers.

Map V-3: Detail of the Main Site, Upper Base



Map based on 1986 aerial photography and August 1994 site visit

Photograph V-5: This residence is an example of the items scavenged from the Upper Base.

Various attempts have been made to remove hazardous wastes, including PCB-containing equipment, from the buildings at the Upper Base. Cleanup of Pole Vault Building 222 (PV222), the southernmost building in the immediate vicinity of the Upper Base, was contracted to Toxitec Lté. by Transport Canada in 1982 (DIAND File #B5565-2, May 22, 1985). PCB fluids which had leaked onto the floor of the building from five transformers were cleaned up and, where possible, affected parts of the floor were removed. During the cleanup 2-3 gallons of PCB Askarel were spilled over an area of approximately 2.5 m^2, on the snow outside the north side of the building (DIAND File #B5565-2, May 22, 1985). The spill occurred on October 13th, 1982 and was reported to the appropriate authorities the next day. Toxitec undertook to clean up the spill by removing contaminated snow from the area and containing the spill with absorbent material (DIAND File #B5565-2, May 22, 1985). A total of twenty-one 45 gallon drums of PCB-contaminated material including 13 transformers, 1114 L of PCB Askarel, and 13 barrels of wood, snow, tools and clothing were collected during the cleanup of the building and the spill.

An inventory of PCB materials remaining at buildings S-28 and PV222 at the Upper Base was made on August 14th, 1985 by the Environmental Protection Service (EPS File #4672-002). In October 1987, a total of 175 units including capacitors and transformers suspected of containing PCBs were removed from the Upper Base for proper containment and storage (PCB Inter-Agency Inventory).

In 1989 a cleanup and assessment of PCB and polychlorinated dibenzodioxins and dibenzofurans (referred to collectively herein as *dioxins*) contamination in and around Communications Building S-28 was undertaken by DIAND (DIAND File #N-5540-U1). Dioxin analyses were made to determine whether the combustion of PCBs had occurred during a fire inside Building S-28. The fire is suspected to have occurred when the base was still active; however, the actual date of the fire is unknown. Capacitors were removed from the electrical equipment in the building as well (Sanexen 1990).

The radio towers, POL tank and sewage tank were removed from the site in 1990. A large spill of Arctic diesel, presumably from the POL tank, was detected in a drainage catchment southwest of the site. It is unknown whether this occurred during or after active operation of the base.

2. Results of Previous Studies

In 1981 a watershed monitoring program was initiated by DIAND in conjunction with the GNWT Department of Public Health in recognition of the potential for contamination of Iqaluit's water supply lake (Lake Geraldine) by the migration of contaminants in drainage from the Upper Base (DIAND File #B5565-5-F15, Nov. 9, 1994). Under this program one water sample was collected in each of the Upper Base water supply lake and the town water supply lake in 1981. In 1985 a more intensive sampling program was undertaken and included five sampling locations between the Upper Base and the Water Treatment Plant. Finally six locations were designated in 1987, which were sampled again in 1988 and in 1990 through 1994. These water samples were collected at the inlet to the Upper Base water supply lake, in the Water Treatment Plant and at four points in between. To date, PCBs have been undetectable (below 20 ppt) in all but two of the samples collected as part of the watershed monitoring program. PCBs were detected in the 1985 (1.2 ppb) and 1987 (0.075 ppb) samples from the Water Treatment Plant but the levels did not exceed the Canadian Drinking Water Quality Criteria (3 ppb).

Nine soil samples have been collected as part of the watershed monitoring program (DIAND File #B5565-5-F15, Nov. 9, 1994). The only sample containing detectable levels of PCBs was collected at the site of the 1982 PCB fluid spill outside Pole Vault Building 222. PCB concentrations in this sample (174 ppm) were significantly elevated, violating the Canadian Environmental Protection Act (CEPA).

Under the direction of the Iqaluit PCB Inter-Agency Committee, soil and swab samples were collected at the Upper Base by EPS in October 1987 (File #4672-002, May 18, 1988). Results of analyses for three of the four soil samples collected from around Pole Vault Building 222 indicated the presence of PCBs at concentrations in violation of CEPA. One soil contained levels of PCBs (120,000 ppm) which were 2400 times the CEPA level. Three of the six swabs collected from the interior of Communications Building S-28 contained PCBs at levels exceeding the US EPA criteria for solid surface contamination of building interiors. It was recommended by EPS that additional cleanup of the Upper Base should be initiated by DIAND, based on the PCB data (EPS File 4672-002, May 18, 1988).

In 1990 Sanexen International Inc. conducted a study of PCB and dioxin contamination in and around the communications building (S-28) at the Upper Base. Its field sampling program included the collection of five soil, one water and 24 wall swab samples. In addition to field sampling, the investigation included the removal and proper containerization of electrical components suspected of containing PCBs. The results of dioxin analyses on three swab samples collected from the interior walls of Building S-28 indicated that the levels of dioxins on the interior surfaces of the building were not significantly elevated. The concentrations of PCBs in nine of the 16 swab samples analyzed were below the limits of detection, and the remaining seven swabs did not contain significantly elevated levels of PCBs. Since it is uncertain whether the proper methodology was used in obtaining the swab samples, interpretation of the reported results is tentative at best. The water sample collected from the floor of Building S-28 contained 710 ppb PCBs. PCBs were also detected in all five soil samples collected by Sanexen (1988). Recommendations included excavating and containerizing 4.5 m^3 of soil from outside both entrances of the building in the same manner as would be undertaken for soil containing PCBs in excess of the concentration regulated under CEPA. However, the maximum concentration of PCBs detected in soil from around Building S-28 (2.3 ppm) was well below that regulated under CEPA (50 ppm) and did not approach the CCME R/P Remediation Criteria (5 ppm). The rationale behind this recommendation is not provided. The report also contained the recommendation that the floor of the building be decontaminated and that the building be demolished (Sanexen 1988).

The 1993 Avati report contains data for 30 soil samples, to which the CCME R/P Remediation Criteria were applied, as well as data for five water, five paint and 13 insulation or floor tile samples collected from the Upper Base,. Total Petroleum Hydrocarbon (TPH) concentrations exceeded the Alberta criteria in 13 of the 16 samples analyzed; no TPH criteria are provided by CCME. Six soils collected from the vicinity of Pole Vault Building 222 (PV222) contained elevated concentrations of PCBs (1.6 - 2700 ppm). The levels of PCBs in three of the samples exceeded the level regulated by CEPA (50 ppm). Detection limits for the above analyses were very poor, however (e.g., 100, 500 and 1000 ppm). Inorganic element data for only one sample from the Upper Base is available in the Avati report (1993). None of the inorganic analytes were detected at levels exceeding the criteria. Levels of copper in a water sample were reported to exceed the CCME FAL Remediation Criteria. The report also includes asbestos data for pipe and boiler insulation, wall board and floor tiles, indicating that all contain significant quantities of chrysotile and amosite asbestos. Paint from the living quarters was reported to have a high content of lead, cadmium, chromium, antimony and zinc. In the concluding chapter of the Environmental Site Assessment volume of the Avati report (1993a) the Upper Base is designated a Class 1 high risk site using the National Contaminated Sites Classification System.

The Remediation Options volume of the Avati report (1993b) recommends various cleanup alternatives based on two ranking systems (the Kepner-Tregoe method and the EBA method) which score the applicability of each alternative to the site undergoing assessment. Alternative 6 received the highest scores under both ranking systems. This alternative for cleanup of the Upper Base involves the excavation of any landfills and contaminated media present on-site, separation of hazardous and non-hazardous salvageable materials and landfilling of the remaining non-hazardous material, and shipment of hazardous materials south to a regulated disposal facility. The report also contained specific recommendations concerning cleanup of the Upper Base. These included the removal, purging and cutting of the POL pipelines, building demolition, dismantling and cutting of communications facilities, collection and shredding of all surface debris and "asbestos abatement" which presumably was meant to be a recommendation for the proper and safe removal of asbestos-containing materials to a landfill.

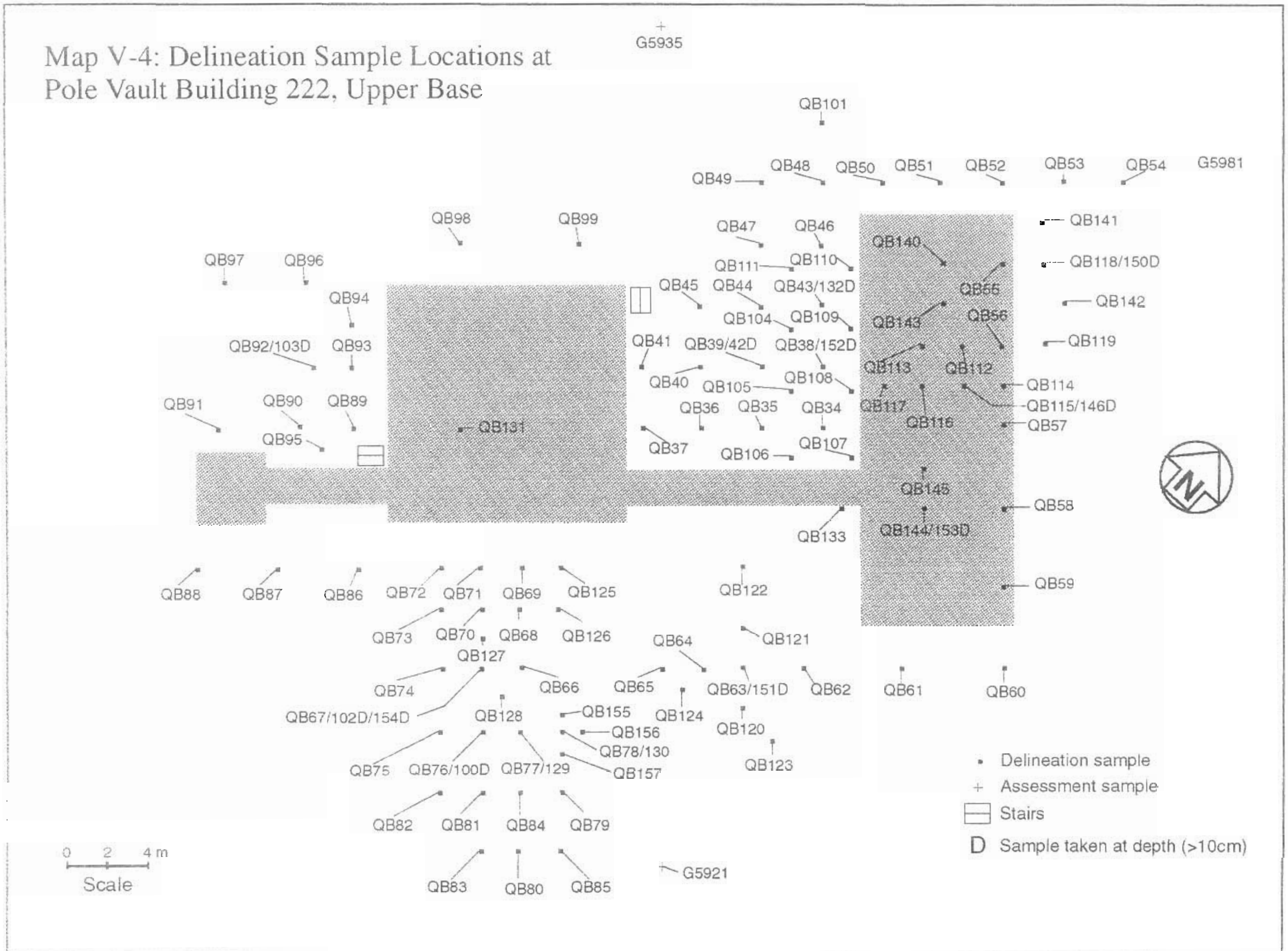
3. Current Sampling Program

As part of the current environmental assessment of sites in Iqaluit, two sampling programs were undertaken at the Upper Base by the ESG and Queen's University Analytical Services Unit (ASU). Each group adopted a specific approach, and these approaches are referred to as the delineation and assessment sampling programs, respectively. One sampling program focused on delineating areas of known PCB contamination around buildings PV222 and S-28 and was conducted from August 6th to 20th, 1994. The purpose of the delineation sampling program was to outline areas contaminated with PCBs at concentrations greater than 50 ppm and regulated under CEPA. A total of 115 delineation soil samples were collected from around Building PV222 (Map V-4). Another 31 were collected in and near Communications Building S-28 on the southeast side of the Main Site (Map V-5). Three samples of wood and two samples of insulation were collected from the inside of Building S-28 to be analyzed for PCB contamination. In addition, two samples composed of debris from the floor of Building S-28 were collected.

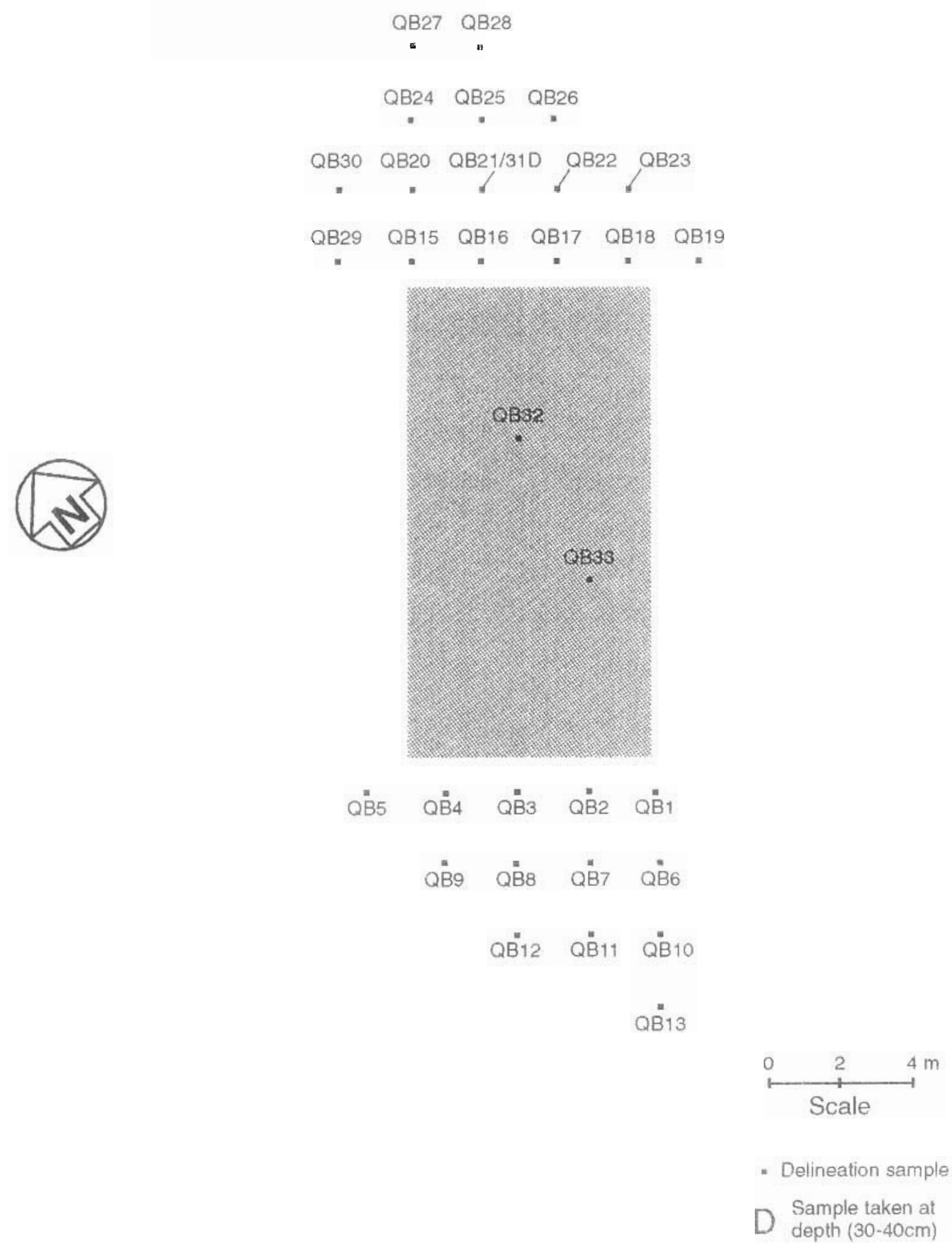
The methods employed by ASU in collecting the delineation samples are provided in greater detail in the Methods section of the Appendices. Delineation samples were analyzed on-site using Millipore EnviroGard™ PCB Test Kits. Confirmatory analyses were completed in southern laboratory facilities using standard Gas Chromatography/Electron Capture Detection (GC/ECD) methods.

A concurrent assessment sampling program was carried out by the ESG from August 8th to 12th, 1994 to assess areas of potential rather than known contamination. A total of 101 assessment soil samples were collected at the Upper Base. The focus of the sampling program was on stained soils and, in particular, the migration of contaminants away from areas of higher concentration. Vegetation was collected to assess the potential for contaminant uptake into the food chain. Fifty-five plant samples were collected at locations where sufficient material was available.

Map V-4: Delineation Sample Locations at Pole Vault Building 222, Upper Base



Map V-5: Delineation Sample Locations at Building S-28, Upper Base



In addition to the investigation of unknown contamination at the Upper Base, the assessment sampling program examined the potential for contaminant migration from Building PV222, where PCBs at levels exceeding the concentration regulated under CEPA (>50 ppm) were previously identified. In particular, soils and vegetation were collected in drainage paths in the spill area in the watershed for the town's water supply lake, Lake Geraldine. A total of 45 soil samples were collected in drainage pathways originating in the vicinity of Pole Vault Building 222 (Map V-6). Twenty-six plant samples were collected at 25 of the soil sampling locations near Building PV222. Vegetation in the vicinity of the building varied depending on the depth and moisture content of soils. In drier areas with thinner soils, mosses and lichen dominated, but were intermixed with willows (*Salix* spp.) and white heather (*Cassiope tetragona*). Wetter areas with thin soils were also vegetated with willows and heather, as well as low sedges (*Carex* spp.). In wet or ponded areas taller sedges (*Carex* spp. and *Eriophorum* spp.) and thick mats of moss were abundant.

An inspection was made of the interior of Building PV222 and nine swabs of the wall were taken to determine levels of surface contamination. A sample of pipe insulation was collected for asbestos analysis. The Pole Vault building had been heavily vandalized - floors were scattered with paper, insulation and electrical equipment (Photograph V-6). Throughout the building, walls were riddled with bullet holes. Many capacitors had not been removed from electrical units in the easternmost room of the building, and transformers and capacitors were observed on the floor of both rooms (Photograph V-7). An oily residue covered much of the floor of the westernmost room of PV222 (Photograph V-8). A sample of floor debris was collected for PCB analysis.

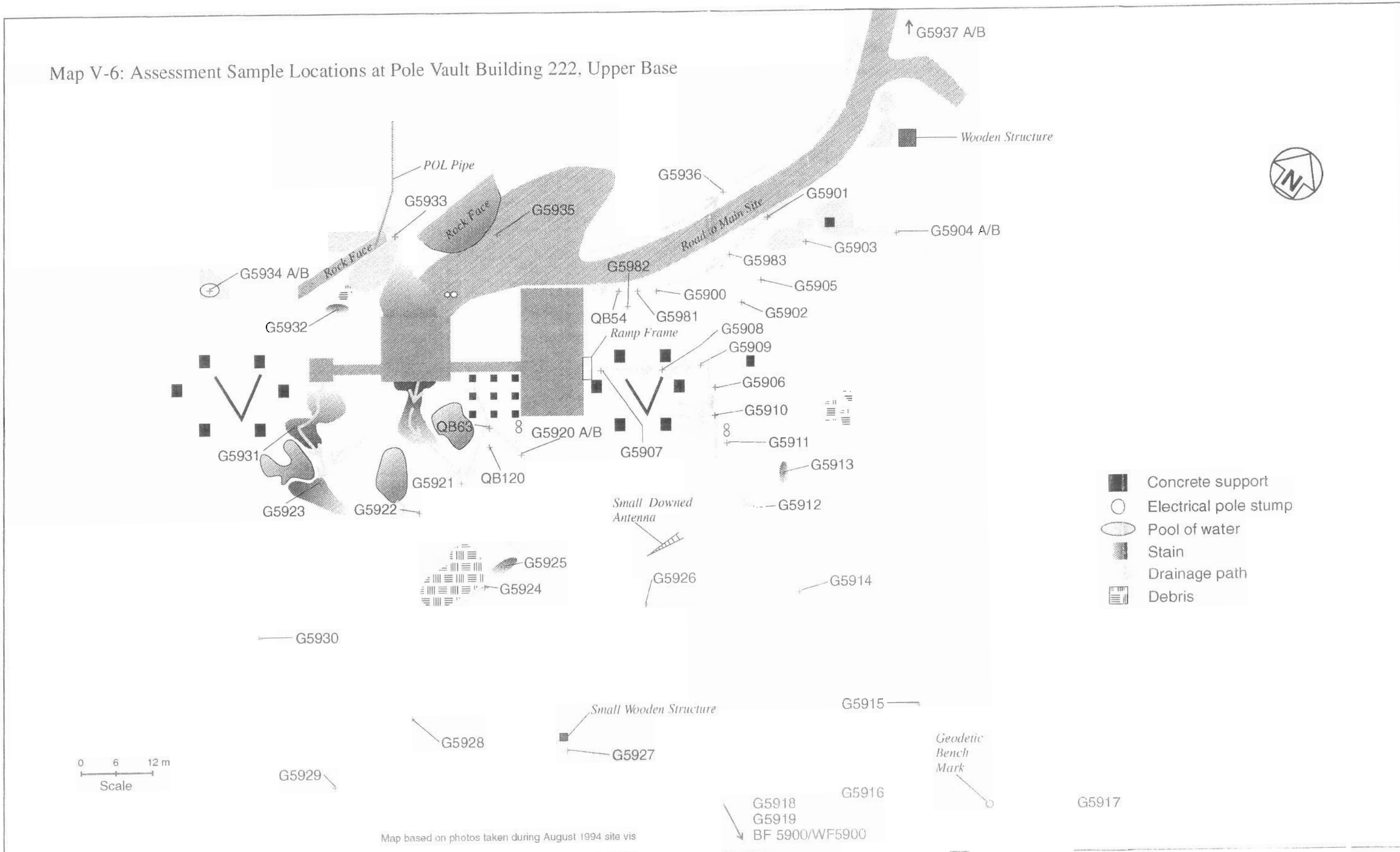
Eight soil and six plant samples were collected from locations near Communications Building S-28, the other site of known PCB contamination. Very little staining was present in the vicinity of the building. Vegetation was sparse in its immediate vicinity and consisted of early successional species including willows (*Salix arctica*), milk-vetch (*Astragalus alpinus*) and broad-leaved willow herb (*Epilobium latifolium*). The interior of the building was also assessed by means of six wall swabs. Much of the inside of the building is blackened due to the fire which occurred there, likely at some time during its operation (Photograph V-9). Dismantled electrical equipment is strewn about the room.

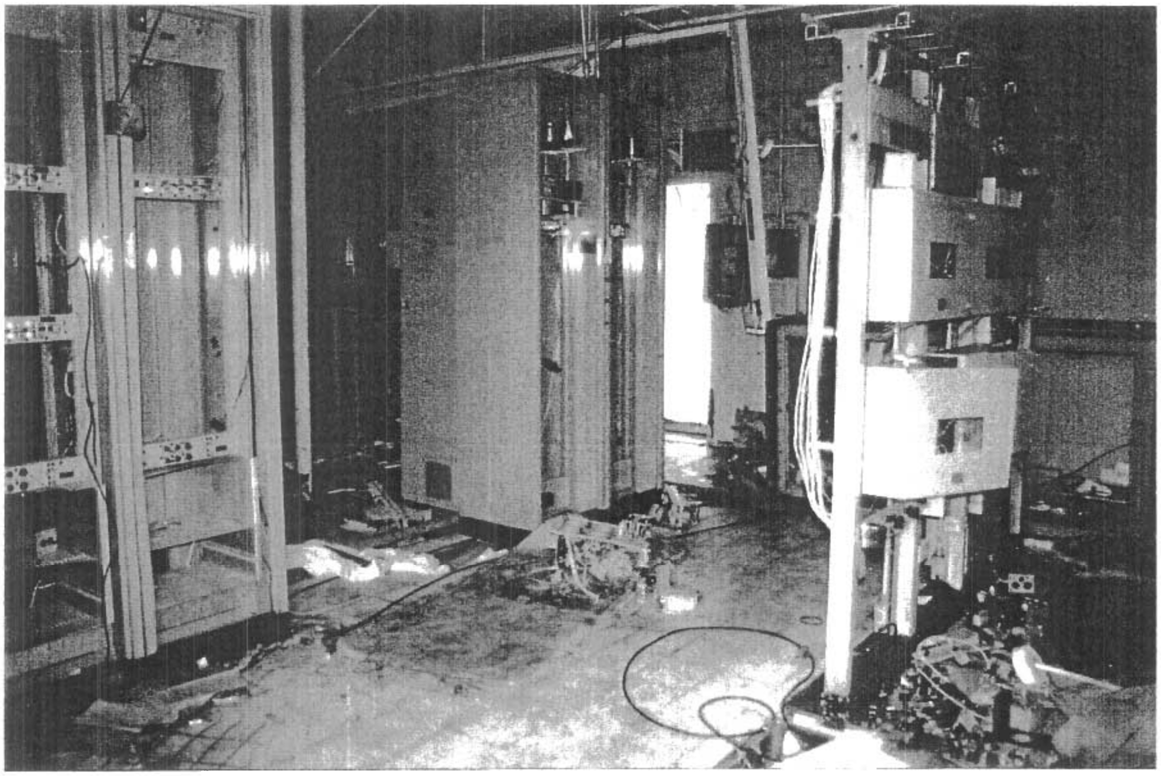
The approach to sampling at the Main Site was based on the types of activity that may have occurred in specific areas (e.g., disposal of waste liquid out doors or down drains, use of hazardous materials in the power plant) and on visible evidence of potential contamination (e.g., staining of soil). Drainage from areas of potential contamination was also sampled. A total of 39 soil samples, including two field duplicates, were collected at the Main Site (Map V-7), which was littered with debris and the remains of partially removed buildings (Photograph V-10). As noted above, buildings have been removed and used for storage or, in at least one case, as a residence. The interiors of the buildings were similarly scattered with materials as a result of scavenging and vandalism (Photograph V-11). Six wall swabs were collected inside one of the towers.

Vegetation in the main area of the site, like that near the Pole Vault building, varied according to soil depth, moisture content and degree of disturbance. Vegetative cover in the immediate are of the buildings at the Main Site was very sparse and consisted in great part of early successional species like the grass *Trisetum spicatum*, broad-leaved willow-herb (*Epilobium latifolium*), poppies (*Papaver radicatum*) and, in wetter areas, sedges (*Carex* spp.). Areas experiencing less disturbance were more lushly vegetated and willows (*Salix* spp.) made up a greater proportion of the species distribution. Plants were sampled in 14 locations where soil was collected.

The Upper Base landfill is located just outside the entrance to the site on the edge of a steep hill (Map V-7). It is essentially a dump to which some fill has been added, and consists primarily of scrap metal and wood (Photograph V-12). Additional waste in the landfill includes some domestic debris (tin cans, camera film, furniture) and a couple of small drums. One of the drums contained a black tar-like substance which had spilled onto the ground. The nine soil and four plant samples collected in the landfill were taken from major drainage paths and from the tar-like stain.

Map V-6: Assessment Sample Locations at Pole Vault Building 222, Upper Base





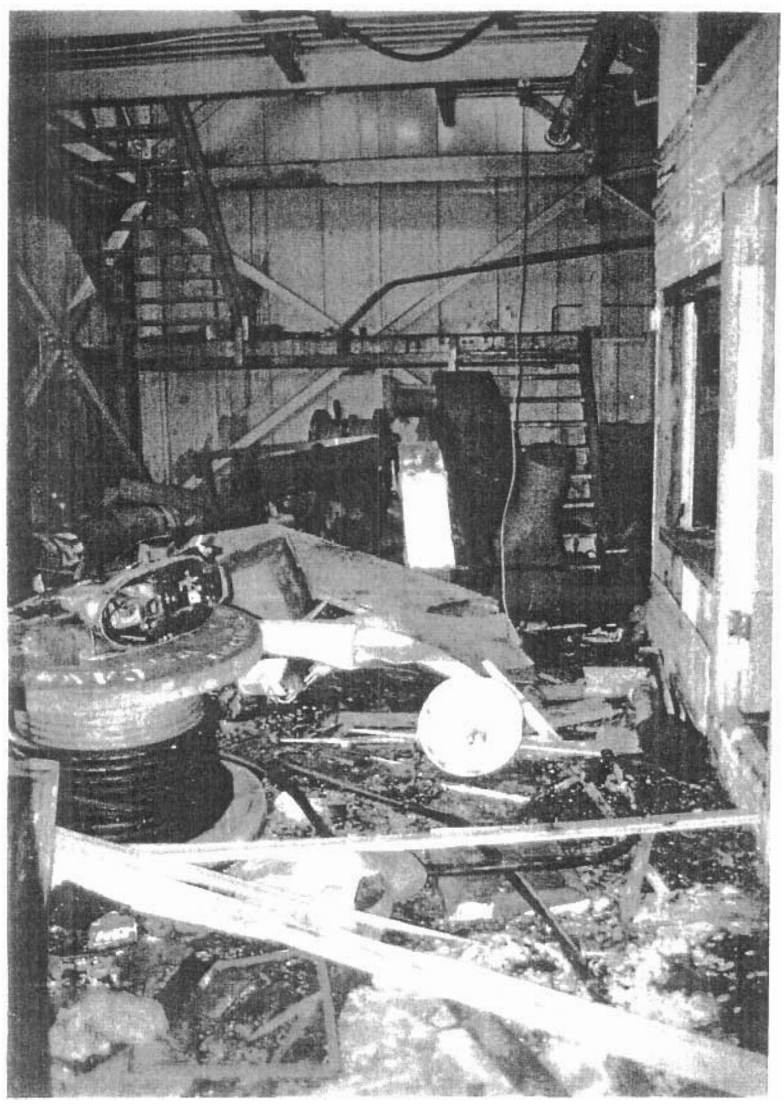
Photograph V-6: The easternmost room of Pole Vault Building 222 where electrical equipment containing capacitors was observed.

Photograph V-7: View of the westernmost room of Pole Vault Building 222, where transformers and capacitors were found.

Photograph V-8: The floor of the westernmost room in Pole Vault Building 222, littered with debris and covered with an oily coating.

Photograph V-9: The burnt interior of Communications Building S-28 where the remains of electrical equipment were found.

Photograph V-10: Building remains scattered around the Main Site.



Photograph V-11: The interiors of a typical building at the Main Site, littered with debris and equipment.