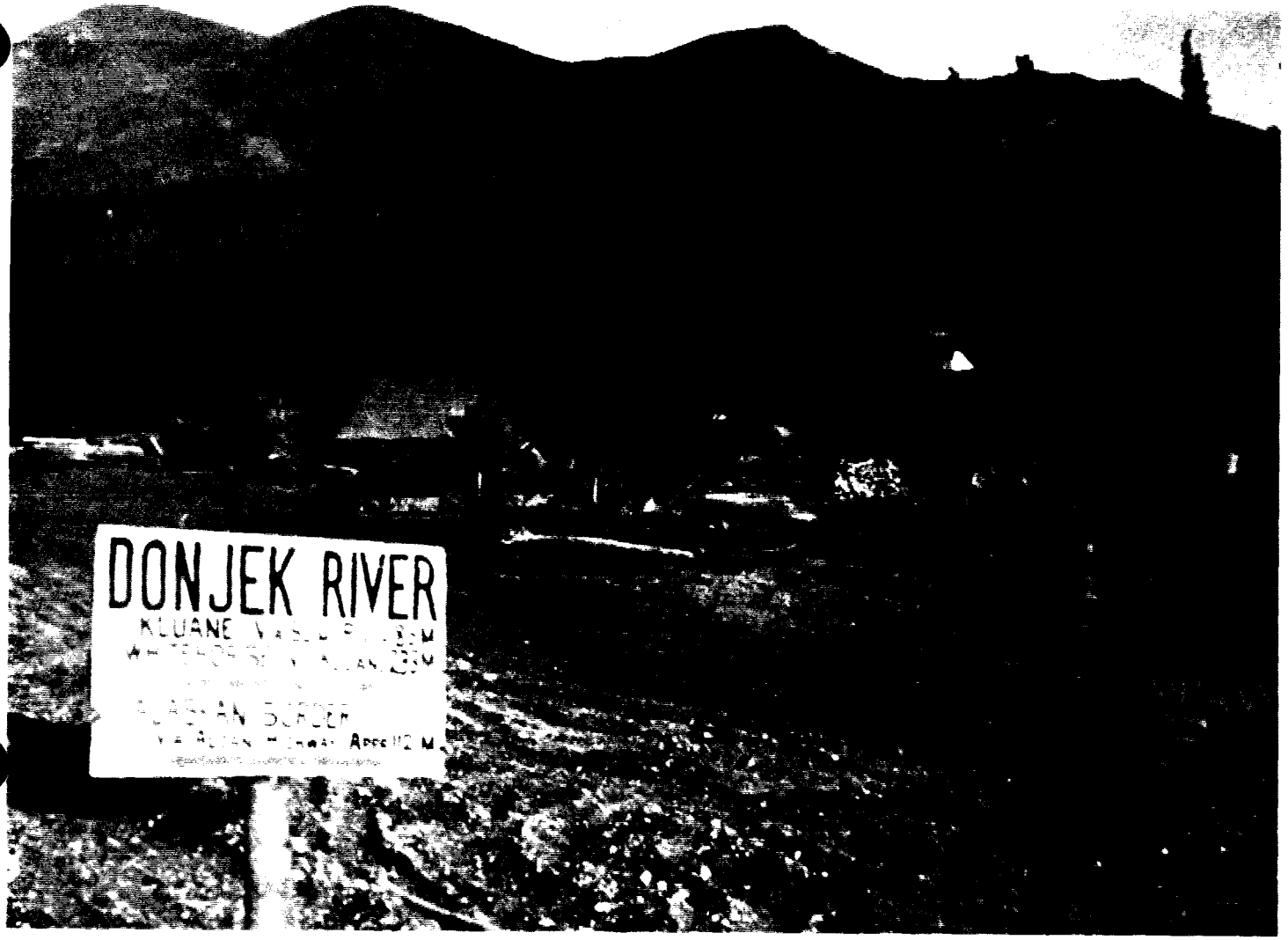
Phase I & II Environmental Site Assessment



Former Military Site
Donjek River
Mile Post 1130 Alaska Highway
(DIAND Site 31)

Prepared for:

Arctic Environmental Strategy - Action on Waste
Indian and Northern Affairs Canada
Whitehorse, Yukon

Prepared by:

Hycal
ENVIRONMENTAL SCIENCES LTD.

November 1996

EXECUTIVE SUMMARY

Hycal Environmental Sciences Ltd. was retained by Action on Waste, Arctic Environmental Strategy, Indian and Northern Development, Canada to carry out an environmental assessment of a former military site, known as Donjek River, at old Mile Post 1130 of the Alaska Highway, the western Yukon Territory.

The purpose of the investigation was to gather preliminary information on the site in order to determine whether further site assessment or remediation is required and to make recommendations on future assessments or remediation, where necessary. Previous reports indicated that debris was present on the site and there was the possibility of some environmental concerns related to the property.

The investigation consisted of six tasks:

1. Historical Site Assessment
   A history of the site was developed to provide an understanding of the past uses of the site and adjacent properties, to identify conditions or events which could have adversely affected the site, and to facilitate site location, inspection, and sampling.

2. Site Inspection
   The site was visually inspected to identify conditions of environmental concern including signs of surface contamination, evidence of the use or storage of hazardous materials, the presence of equipment or materials that might contain PCBs, indications of pits or sumps, indications of waste incineration, and conditions of concern on adjacent properties.

3. Site Sampling
   Soil sampling was carried out to confirm the presence or absence of contaminants. Geophysical investigation was carried out to determine whether buried metal debris was present on the site.

4. Sample Analysis
   Soil samples from the subject site was analyzed for the presence of contaminants which have been associated with military activities in the Yukon.

5. Risk Assessment

   A preliminary risk evaluation was carried out to determine the degree of risk to humans, or to the environment in general, that might be associated with conditions identified on the site.

6. Recommendations for Further Investigation / Remediation

   Methods and results of each of the tasks undertaken were documented. Recommendations for further investigation were then developed.

Investigation of the subject site was limited by the scope of the study, including the allocated budget and time. Further investigation would be required to more fully assess all of the areas within the site or to allow for more precise risk analysis. However, given the results of the investigation, the following conclusions and recommendations can be offered:

the investigation confirmed the presence of surficial and subsurface debris on the subject site. Given the history of the site and the visible materials, most of this material appears to have been related to military operations in the area during the construction of the Alaska Highway. Some postwar dumping of materials was, however, evident. The presence of a dump on the eastern edge of the Donjek River valley escarpment appeared to be confirmed by geophysical data.

- while historical searches yielded some useful information, the site appears to have been subject to activities which were poorly or never documented. Therefore, **further historical record searches are not indicated at this time.**

- some metal and wood debris was evident on the surface of the site. **This debris does not appear to pose any imminent risk to human health or the environment.** The surficial debris is not visible from any major road and does not result in any diminished aesthetic value, other than from within the site itself. **The debris could, therefore, be left on the site.**

- Geophysical surveying indicated the presence of significant quantities of buried metal on the site. Geophysical investigation indicated that subsurface metal is present at depth in the area east of an old oil change pit on the site. Anomalous magnetic response, evident at several isolated locations within the site, suggested that the occurrence of buried metal is widespread. It is not known whether this metal includes any drums or canisters, and whether any contaminants might be present within these areas. The climate and age of the site would suggest that any buried drums would have been subject to

deterioration. **Leachate monitoring would provide information on potential migration from areas of buried metal with less damage to the ground surface than excavation of the metal would entail. Further geophysical work, to identify all major areas of metal burial should be conducted prior to planning the location of any monitoring wells.**

- analysis of three soil samples indicated that while metals were present in the soil at levels above CCME Assessment Criteria, these levels did not exceed Remediation Criteria, except for zinc (which exceeded CCME Remediation Criteria for Parkland and Residential Use) Hydrocarbon levels inside the oil change pit exceeded Alberta Tier I criteria. A soil sample from a mound east of the oil pit was found to contain 4,4-DDD, 4,4-DDE, 2,4-DDT and 4,4-DDT at levels of concern due to the total amount of pesticides present. Fenuron and picloram were not detected in the two soil samples that were analyzed for these compounds. PCBs were not detected in the two samples analyzed. **Given the large aerial extent of the site, further soil sampling and analysis would be required to confirm the results of the initial soil analysis and more adequately assess soil conditions on the site.**

- records were not kept of what materials were deposited in the dump at the escarpment on the west side of the subject site were not kept and the dump was not monitored to ensure that unsuitable materials were not deposited. The dump's proximity to the river valley might allow contaminants within the dump to readily leach into the river valley. Therefore, **detailed subsurface sampling in the area of the dump, and the installation of a groundwater monitoring well is recommended to better assess risks associated with the dump.**

A preliminary risk evaluation suggests that the ecological risk associated with contaminants found on this site is moderate to low. This conclusion is based upon the observed health of the ecosystem, evidence of moderate but probably localized areas of contamination, relative concentration of contaminants, and relative toxicity of the compounds found. However, information about surface and subsurface conditions on the site is limited. **If a greater level of confidence as to risks associated with the subject site is required, further investigative work would be required and a Level 1 CCME Risk Assessment should be carried out**.

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1. INTRODUCTION

1.1 Project Background

This investigation was carried out as part of investigations of abandoned waste and disposal sites throughout the Yukon by Action on Waste, Arctic Environmental Strategy, Indian and Northern Development, Canada. These sites were associated with activities such as exploration, mining, industrial and military operations.

The purpose of the investigations was to gather preliminary information in order to determine whether further site assessment or remediation is required and to make recommendations on future assessments or remediation where necessary. A primary objective was to determine whether contaminants are present on the site, and if they are, whether they are migrating from the site. A secondary objective was to identify physical hazards. If contaminants were identified on the site, a preliminary risk assessment was to be carried out to determine the degree of risk to humans or the environment in general.

Hycal Environmental Sciences Ltd. was retained by Action on Waste, Arctic Environmental Strategy, Indian and Northern Development, Canada to carry out environmental assessment of four separate sites. This report outlines the investigation of one of these sites, known as "Site 31". Site 33 is located approximately 36 miles (58 kilometres) west of Burwash Landing, at Alaska Highway Mile Post 1130 (Figure 1).

Limitations of the investigation are presented in Appendix A.

1.2 Previous Investigations

Previous investigations which have discussed the subject site have included:

- the Operation Clean Up Inventory (1973), which identified sites of environmental concern;
- a study on the Alaska Highway - Haines Road Clean Up (Edey, 1976), carried out for the Department of Indian and Northern Development, which included a sketch of the subject site identifying some wastes on the subject site;

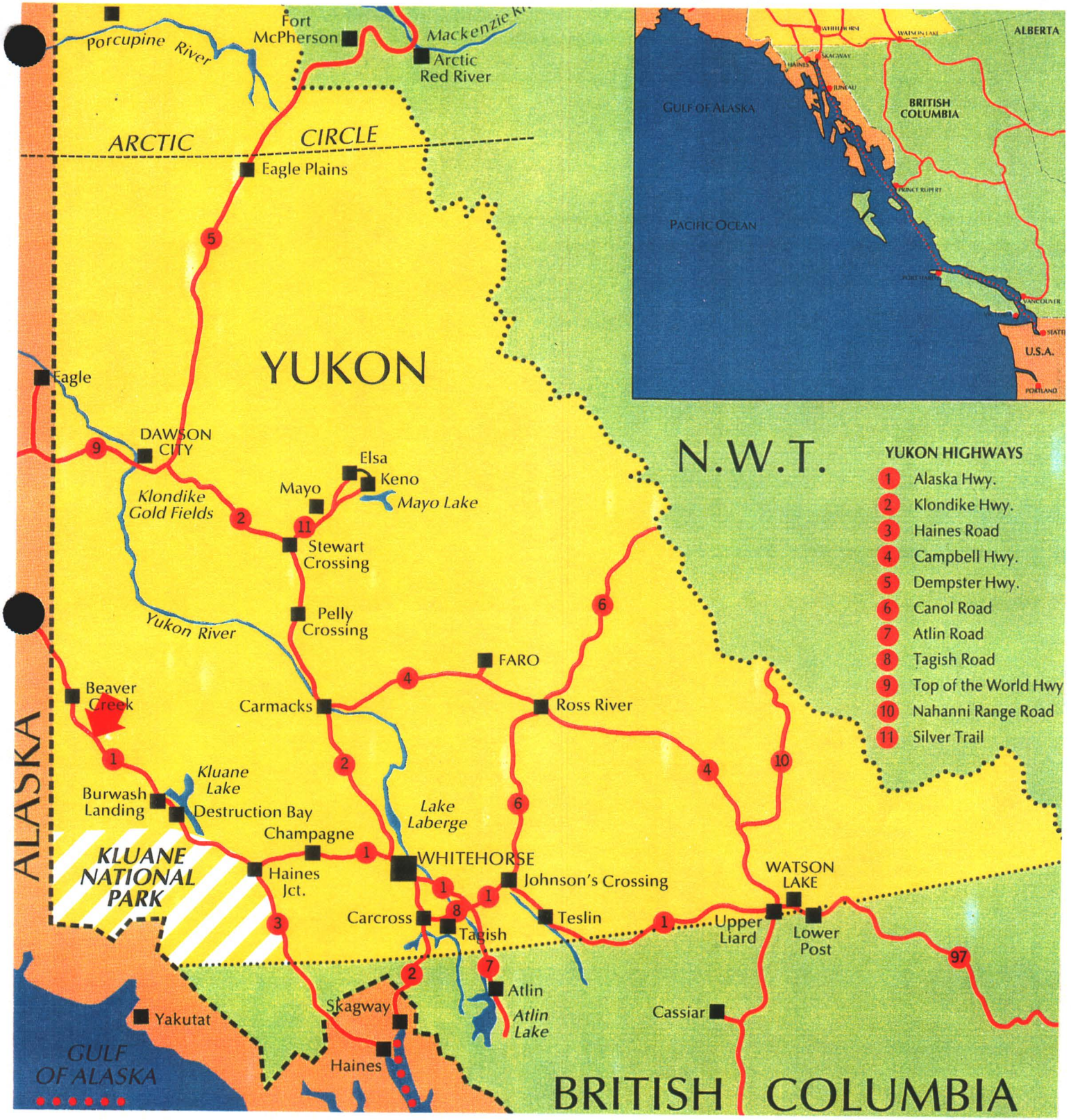


Figure 1. Site Location.

- a Summary of Waste Disposal Sites in the Yukon Territory (Reger, 1983), prepared for Environmental Protection Service, Environment Canada, which identified land disposal sites in the Yukon;

- Gray's Alaska Highway Camp and Refuse Locations Preliminary Inventory, and

- a summary of previous work, interviews and historical research by Bisset (1995).

Relevant portions from the above work have been compiled in Appendix B.

Most of the previous work was very general and often repeated the same information. While previous work offered a start to investigation of the subject site, it was necessary to augment previously gathered material in order to adequately assess the site.

2. SCOPE AND METHODOLOGY

2.1 Site Location and History

A review of records of previous investigations, aerial photographs, and historical material from the Yukon Archives, and interviews with area residents and the local government officials were used to determine the location of the subject site. An investigator from Hycal then proceeded to the approximate area of the site and carried out a reconnaissance of the area to pinpoint the exact location and access to the site.

2.2 Site Reconnaissance

Site reconnaissance was carried out by Hycal in September 1996 to determine:

- the precise location of the subject site;
- the aerial extent of the subject site;
- vegetative and topographic considerations in planning a sampling program and geophysical investigation;
- surficial evidence of site occupation; and
- a local wildlife and vegetation inventory.

The site reconnaissance was carried out during a period of "fall weather" prior to snow covering the subject site. Site visibility was good with only minor obscuring of some ground surface by deciduous leaves which had fallen from some trees.

2.3 Geophysical Investigation

Geophysical methods were used to supplement/augment other methods of site assessment. Geophysical investigation was indicated due to:

- the age of the sites and the possibility of vegetation and soil obscuring and covering materials on the site;
- the site history in which materials were reported buried or bulldozed over;
- the metallic nature of some of the materials which would have buried; and
- the extent of the sites and scope of the project precluding grid soil sampling and borehole investigations.

The time domain electromagnetic method is generally the preferred geophysical technique for the delineation of subsurface metals due to the speed of data acquisition, high sample density and relative insensitivity to adjacent surficial metals. However, relatively dense vegetation growth at many of the survey regions, precluded its use. At those sites where utilization of electromagnetic instrumentation was not feasible, the magnetic method was employed.

2.3.1 Electromagnetic Method

A time-varying electromagnetic (EM) field produced at surface results in currents flowing within subsurface conductors in configurations defined by the laws of magnetic induction. Resulting secondary EM fields distort the primary field. The resultant field, measurable at any point on the surface of the ground, differs from the primary field in intensity, phase and direction to an extent dependent on the magnitude and geometry of the subsurface conductor(s).

The Geonics Limited EM61 is a high-powered time domain EM metal detector. The decay of secondary currents produced by a pulsed primary field is measured a relatively long time after the primary pulse is terminated. This technique results in a method where results are essentially independent of ground conductivity.

Results of the EM61 surveys are presented as coloured contour maps illustrating lateral variations in electromagnetic response (millivolts [mV]0 at each site area. The use of two vertically displaced receiver coils enables a filtering, of sorts, of near-surface anomalies. The lower coil response (Channel 2) identifies all buried and surficial metal within the sphere of effect of that coil. The differential channel is the algebraic difference of the upper coil responses, resulting in partial filtering of near-surface sources. In general, upper coil response (Channel 1) is biased towards metallic objects occurring at shallow depth.

2.3.2 Total Magnetic Field Method

Magnetometers measure the intensity of the geomagnetic field. The geomagnetic field is comprise of two main parts:

- the earth's magnetic field; and
- local magnetic anomalies in the relatively near-surface. These consist of variations caused by geological features and by man-made magnetic objects.

Over relatively small areas, geological features contribute minimally to the geomagnetic field and local magnetic anomalies are generally entirely due to above surface magnetic/electromagnetic sources and to buried metal objects. Dependent upon instrument and source coupling geometry, both positive and negative magnetic anomalies are significant in the identification of subsurface metals, as illustrated in Figure 2.

The magnetic response at base stations, located adjacent to each survey grid, were repeatedly measured and recorded at small time intervals (less than 90 minutes) to compensate for diurnal variations in the earth's magnetic field.

Results of the corrected total field magnetometer surveys are presented as coloured contour maps illustrating lateral variations in magnetic intensity (nanoTeslas [nT]). Background magnetic intensity was subtracted from the field measurements, as indicated within each figure, to further clarify data presentation.

2.4 Soil and Vegetation Sampling

Soil and vegetation samples were taken so that chemical analyses for contaminants that might be associated with former site activities could be carried out. Soil and vegetation samples were taken in areas suspected to be sites of contamination as indicated by proximity to buildings or activities of concern (such as the oil change pit), areas of stressed vegetation, and in areas in which empty barrels or other metal containers were identified. Baseline soil and vegetation samples were taken at locations inferred to represent baseline conditions due to age of vegetation and location away from signs of past occupation.

Detailed grid soil sampling was precluded by the scope of the project (time and laboratory analysis budgets). The presence of permafrost at the time of the investigation precluded soil sampling at depths greater than approximately 0.5 metres. Use of a drilling rig or large equipment would have been required to advance sampling past this depth and such equipment was not included in the scope of work.

Soil samples were visually and olfactorily examined for indications of hydrocarbons and other contaminants, then promptly placed in clean, glass jars with teflon lids. The soil samples were packed with no headspace and retained in darkness at approximately 4°C.

Samples of vegetation were taken by using a trowel to extract the plants as intact as possible. Vegetation samples were placed in plastic bags with as little

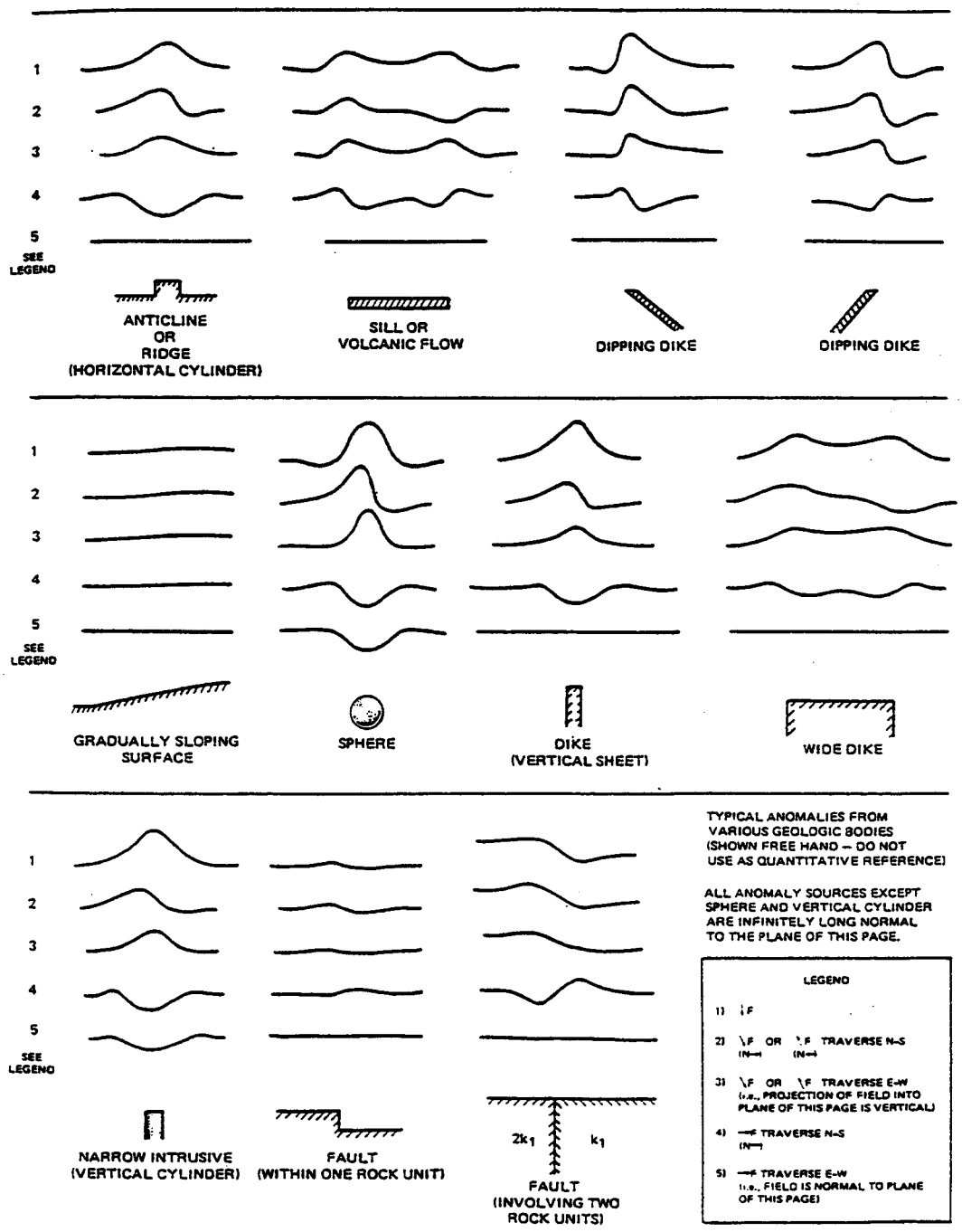


Figure 2. Anomalies for Geologic Bodies at Various Orientations and Different Inclinations of the Field (Breiner, 1973).

surrounding air as possible, then they were retained in darkness at approximately 4°C.

Three soil samples were analyzed for the presence of metals, pesticides (organo-chloride, organo-phosphate and fenuron, an organo-nitrogen pesticide), phenoxy/acid herbicides (2,4-D, picloram and 2,4,5-T), hydrocarbons, and PCBs. The analytical parameters were selected on the basis of site history and on contaminants which have been previously associated with military activities in the Yukon, as outlined by Bisset (1995). No duplicate samples were analyzed due to a limited analytical budget.

Vegetation samples were not analyzed due to limited budget for sample analyses.

2.5 Analytical Methods

Analyses of soil samples was carried out by Norwest Laboratories of Calgary, Alberta. The laboratory is accredited by the Standards Council of Canada and the Canadian Association of Environmental Analytical Laboratories.

Specific analytical methods used in the sample analyses are presented in Appendix C with the laboratory results.

2.6 Preliminary Risk Analysis

Due to time limitations and budget constraints associated with this project it was not possible to complete a full Level One Ecological Risk Assessment (ERA) as defined in the CCME Framework for Ecological Risk Assessment. However a preliminary evaluation of ecological risk was completed in which site specific data on habitat, species, land use, contaminants, environmental fate and toxicity were used to develop and overview of ecosystem components potentially at risk.

A site specific probabilistic model was not developed therefore, fate, effects, conclusions and recommendations are based solely on scientific literature and professional experience with these contaminants. It should, therefore, be recognized that conclusions pertaining to fate and effects will carry a high degree of uncertainty at the site specific level.

2.7 Personnel

Personnel who participated in the investigation are listed in Appendix D.

3. INVESTIGATION RESULTS

3.1 Site Location and Description

3.1.1 Location

Site #31 is located in the Donjek River area, southeast of the current Donjek River Bridge, at Mile Post (MP) 1130 (1818.5 km) (Figure 3). The site is at approximately 61°43'55" N latitude and 139°43'66" W longitude, within NTS 115 G/12.

The subject site encompasses approximately 1 hectare, from the area beside an outfitter's cabin west to the east banks of the Donjek River. A dirt road (an abandoned portion of the original Alaska Highway) leads from the current Alaska Highway west, down an escarpment, to the edge of the Donjek River (Photograph 2). Two unpaved side roads lead from this main road to the outfitter's cabin and to the remains of a wooden building beside a concrete oil change pit (Photographs 3 and 4).

Metal and wood debris, including pieces of barrels, pails, vehicle parts, and building foundations were scattered throughout the site (Photographs 5 and 6). Vegetation was observed growing through much of the debris (Photograph 7).

Mounds of one to two metres elevations were present throughout the site. Some of these mounds were attributed to human activities, due to the protrusion of metal and wooden debris from within them. Visual inspection could not determine whether other mounds on the site were related to human activities or were the result of frost heaving. In order to determine their possible origin, some of these mounds were investigated using geophysical methods.

Several concrete structures were present on the site. These included an oil change pit, of approximately 1 1/2 metres in depth (Photograph 8). The walls of the pit were largely intact, however, several large cracks were present in the concrete (Photograph 9). A concrete slab, which appeared to have been the foundations of a building, was located close to the outfitter's cabin on the site (Photograph 10).

3.1.2 Topography, Geology and Soils

The eastern portion of the site is located above the river valley of the Donjek River. This area consists of undulating morainal deposits comprised of silty/sandy till from the Late Wisconsin glaciation (Rampton, 1977)..The area includes a fairly steep north to south escarpment along the eastern banks of the

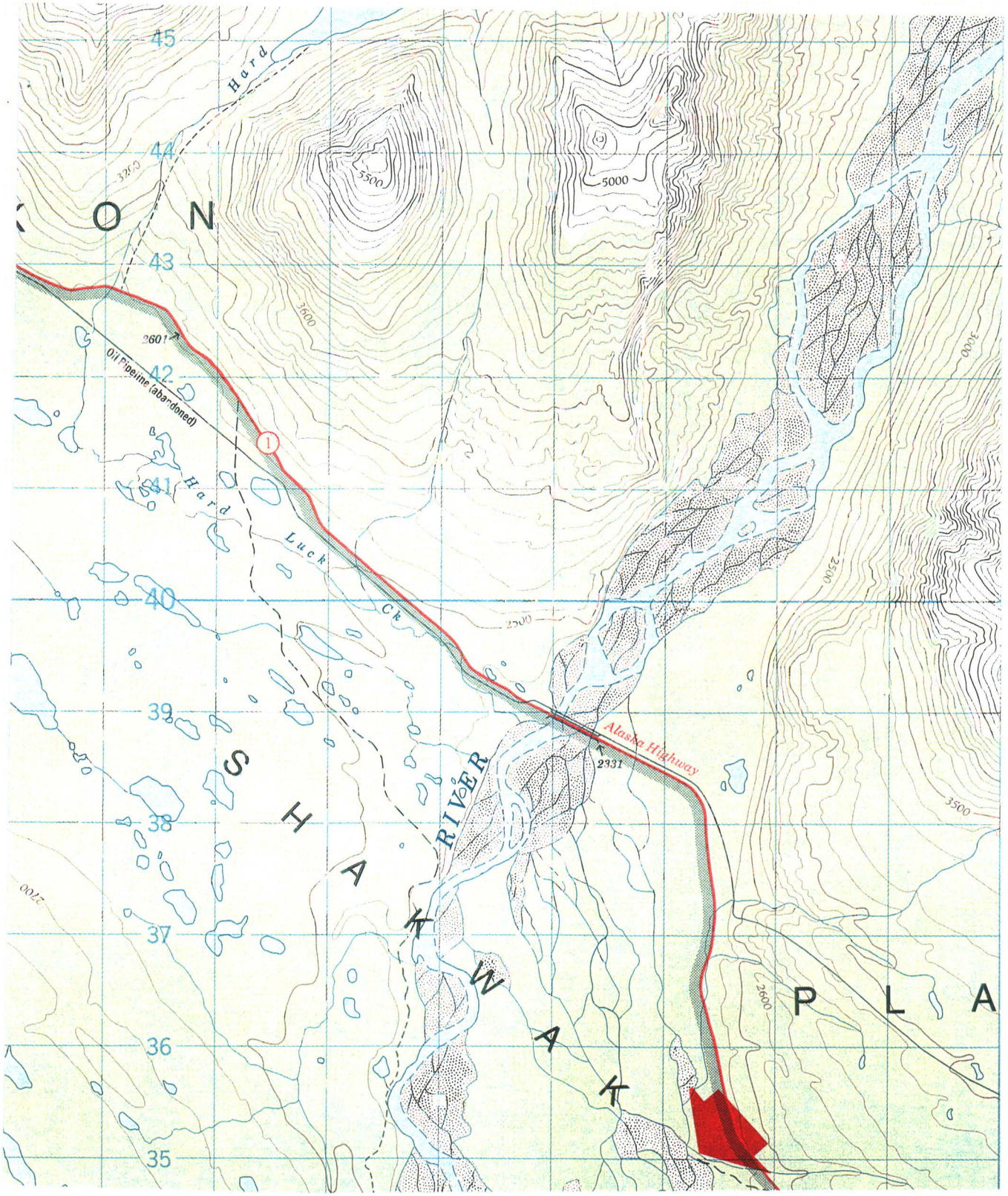


Figure 3. Detailed Site Location.

Photograph 2 Road from uplands portion of the subject site to the Donjek River valley, looking west. Former dump area was located immediately north of the road, in the right corner of the photograph. September 1996.

Photograph 3. Road and shed beside oil change pit on subject site. September 1996.

Photograph 4. Oil change pit and shed on subject site. September 1996.

Photograph 5. Metal debris on surface of subject site. October 1996.

Photograph 6. Discarded barrel on subject site. October 1996.

Photograph 7. Vegetation growing through postwar debris on river valley portion of the subject site. October 1996.

Photograph 8. Oil change pit on subject site. October 1996.

Photograph 9. Interior of oil change pit on subject site. October 1996.

Photograph 10. Concrete foundation near outfitter's cabin on subject site. October 1996.

Donjek River. Below this escarpment, relatively flat braided river deposits lie on the east side of the River. The river deposits consist of gravel with sand and silt. The area at the immediate base of the escarpment river has been mapped as 0.6 metres of silty sand overlying gravel (Rampton, 1977).

The subject site is located in the discontinuous permafrost zone (Geological Survey of Canada, 1967). Thermokarsting has been identified as a hazard in the area of the subject site, along the banks of the Donjek River (Indian and Northern Affairs Canada, 1994) Topography over the subject site is variable with 1 to 2 metre localized changes in elevation that appear to be the result of thermokarsting.

Soil is poorly developed in the area. Soil sampling indicated that the soil on the uplands area is generally black (Munsell colour 2.5/1) and organic, with minor silt to very fine sand. Permeability in this soil appeared to be moderate to low.

3.1.3 Surface and Subsurface Water

Regional groundwater flow direction would be anticipated to be towards the Donjek River, to the west. However, given the presence of permafrost and dense vegetative cover, shallow groundwater flow in the area above the Donjek River Valley may be limited. The vegetative cover may limit the amount of permafrost thawing during the summer and therefore, shallow groundwater flow may be minor to absent in vegetated areas.

No areas of surficial water ponding were observed on the subject site during the assessment. However, given the one to two metre localized changes in elevation over the site, some water ponding would be anticipated to occur during snow thaw and periods of heavy precipitation. The site displayed a general dip to the west.

No streams were noted on the subject site at the time of the site assessment. However, contiguous low areas on the site might act as ephemeral streams during snow melt or after significant rainfall.

3.1.4 Site Vegetation

The subject area was largely covered by dense vegetation which consisted predominantly of white spruce, some poplar, and some willow. Moss was present over much of the ground surface. Vegetation was sparse to absent in the area of the main dirt road running through the area, and along the two unpaved side roads. Vegetation was absent or appeared stressed in the area

immediately east of the oil pit and in two areas with old foundations, west of the outfitter's cabin.

3.1.5 Wildlife

Wildlife observed in the area (through tracks and scat, or through actual sightings) included bears, muskrats, moose, mice, rabbits, coyotes, bald eagles, ptarmigans, jays, and ducks. Trumpeter swans were noted in the area in September. Other wildlife reported in the area included muskrat, lynx, caribou and fox (Agriculture and Agri-Food Canada and Environment Canada, 1996). Local residents and wildlife officials reported that bears in the area include both black and grizzly varieties.

Local wildlife officials reported that the Donjek River carries high sediment loads and is not known to support fish. Clear creeks in the area of the Donjek River may contain grayling. (Lorne Laroque, pers. comm.)

3.1.6 Climate

Environment Canada (Agriculture and Agri-Food Canada and Environment Canada, 1996) described the climate in the area as follows:

> The climate is characterized by short, cool summers and long, cold winters. Winter temperature inversions are common, giving milder temperatures at higher elevation. Maritime air from the Gulf of Alaska periodically invades the ecoregion during the winter to produce mild spells with near-thawing temperatures. The mean annual temperature for the area is approximately -3°C with a summer mean of 10°C and a winter mean of -17°C. Mean annual precipitation ranges 250-300 mm.

3.1.7 Land Use

The site is located in an area of sparse human habitation. The site was not in use at the time of the assessment, however an outfitter uses the site for stabling of horses and other outfitting activities during the summer months.

Trapping and hunting is reported to occur in the general region of the site. Environment Canada has reported that "Land Use recollects high recreational, tourism and hunting values. (Agriculture and Agri-Food Canada and Environment Canada, 1996).

3.2 Site History

The first known occupation of the subject site was during World War II when it was occupied by United States military camps associated with the building of the Alaska Highway. A photograph of the subject site from September 1942 (Photograph 1, front cover of this report) showed an army camp consisting of a number of canvas tents and some wooden buildings. Equipment and materials, including a number of drums and a larger above ground storage tank were evident in this picture.

Photographs from 1944 (Yukon Archives, Photographs 1477, 1498, 3554, 45 and 339) indicated that the crossing at the Donjek River consisted of a pontoon bridge and a trestle bridge (Photograph 11).

The regimental historian of the 18th Engineers Regiment (U.S.) reported that the subject site was a camp for the following companies in 1942 to 1943 (Rust, 1944):

MP 231
- "H & S" Company — September 10 to December 7, 1942

MP 232
- "A" Company — August 17 to August 30, 1942
- "B" Company — August 30 to September 8, 1942
- "C" Company — August 17 to September 10, 1942
- "D" Company
  - 3rd Unit — December 8, 1942 to January 6, 1943
  - 2nd Unit — December 13, 1942 to January 6, 1943
  - 1st Unit — December 18, 1942 to January 6, 1943
- "E" Company
  - 2nd and 3rd Units, and HQ — August 31 to September 28, 1942
  - 1st Unit — August 31 to October 31, 1942
- "F" Company — August 24 to September 15, 1942

MP 234
- "D" Company
  - 2nd Unit — September 16 to September 30, 1942
  - 2nd Unit — Septembet 17 to September 30, 1942
  - 1st Unit — September 21 to September 30, 1942

It should be noted that at the time of Rust's report, MP 0 of the Alaska Highway was located at the Whitehorse airport. Mileages along the highway were reported with some variance by different sources and at different times. For example, Duesenberg reported that the Donjek River (Main Bridge) was at

Photograph 11. Alaska Highway Construction - Donjek River Bridges, 1942. Source: Yukon Archives, Photograph 1477.

1128.2 in 1945. A highway log (in the Yukon Archives) from the same year reported that the first bridge over the river was at 1130.4

A Utah Construction Company camp and a Dowell Construction camp were also located at the Donjek River in 1943 (Public Road Administration, 1943) (Figure 4). Utah and Dowell were independent contractors brought in to work on the section of the highway between Kluane Lake and the border (Duesenberg, 1994) Mapping from that time indicates that the Utah Construction Camp Two was located in the area which is currently occupied by a shed and the old oil change pit. The Dowell Construction Camp was located to the east, in the area currently occupied by the outfitter's cabin.

A 1945 Alaska Highway Log recorded the following information for the site:

1130.0	Old camp on left
1130.1	Old camp on left
1130.4	Donjek Trestle No.1
1130.6	Donjek Trestle No. 2
1130.8	Donjek Trestle No. 3
1131.2	Donjek Trestle No.4-5
1131.7	Donjek Trestle No. 6
1131.8	Donjek Trestle No. 7 (Main Channel Here)

Construction of the current Donjek River Bridge and realignment of the Alaska Highway was initiated in 1948. The bridge was completed by May 1952 (Royal Canadian Engineers). A report of the Royal Canadian Engineers at the time of the construction of the steel Donjek Bridge noted that:

> The Donjek, at Mile 1130 is typical, and here the army sappers are building a 1600 foot steel and concrete bridge to replace the wooden structures that are damaged every year. The bridging camp is now set up and as it will be a long job the camp is being made comfortable for the troops. The sappers sleep two to a room with good reading lamps over their beds. They will have a bowling alley, billiard and ping pong tables, a library and a canteen. (Royal Canadian Engineers, p.16)

Sources on the demobilization of the American army from the Alaska Highway and subsequent disposition of material associated with the highway construction vary on how much and what kinds of material were abandoned on site. The Vancouver Daily Province and the Edmonton Journal reported that one dump "was littered with cans, debris and decaying food" and that another contained barrel heaters, water heaters and hot-air chambers for furnaces (Remley, 1976, p.171). On the other hand, a study by the House Roads Committee of the United States Congress, whose investigations included flying the length of the road to ascertain the amount of debris left behind, concluded that "rumors of

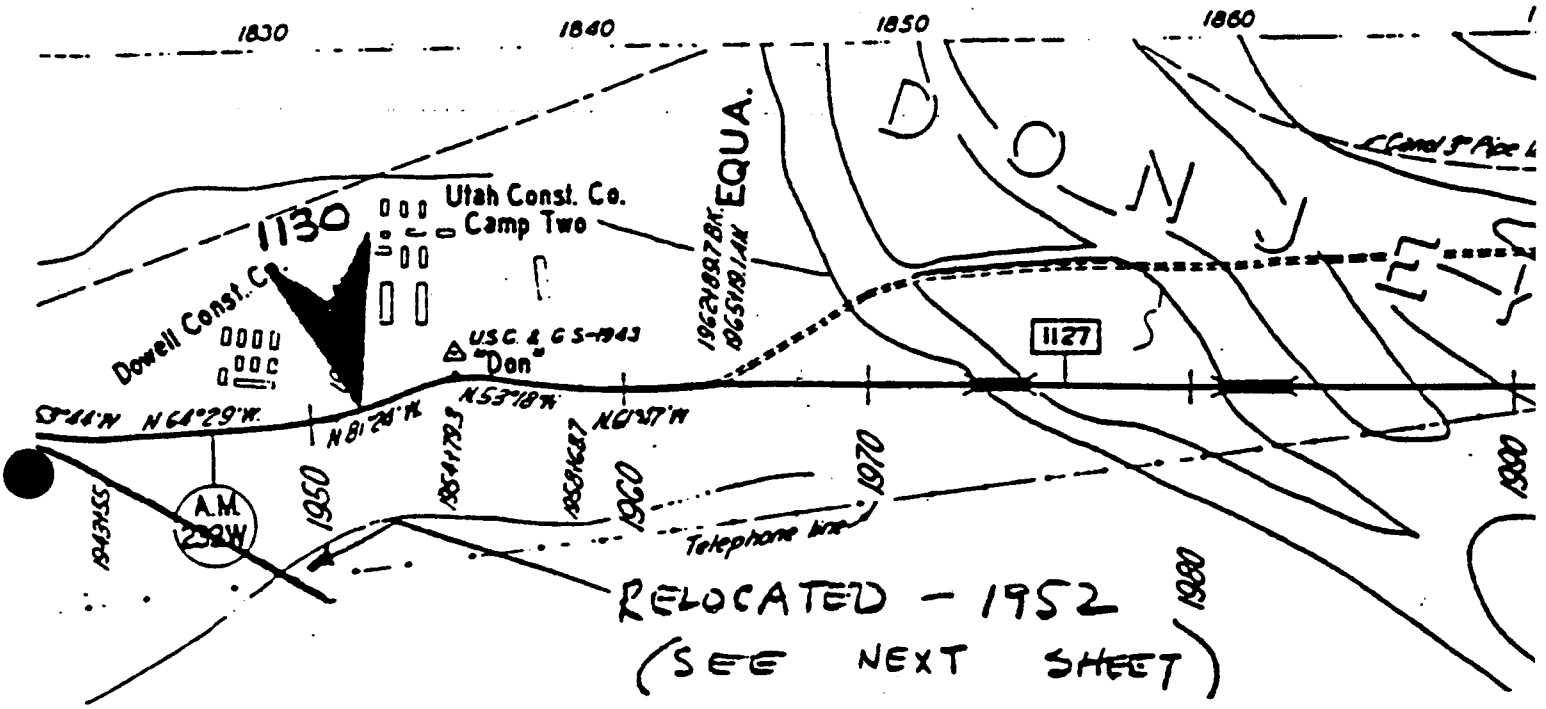


Figure 4. Public Roads Administration Map of the Subject Site, 1943 (with later amendments). Source: Yukon Archives.

abandoned equipment, wild extravagances, fraud and corruption" were vastly exaggerated and not borne out by investigation.

In a 1995 interview (Bisset, 1995, p.262), John Trout, of the Kluane Wilderness Village, reported that a dump was located on the north side of the road beside the camp and that "There are stories of equipment etc. being buried in the gravel bars in the Donjek River to the north of the old pioneer road bridge."

The Alaska Highway Camp and Refuse Locations Preliminary Inventory recorded a dump at this location as did the Operation Clean Up inventory in 1973 (Document 1, Appendix B). Edey (1976) reported that the site contained building debris, old truck bodies, tires, etc. (Figure 5)

Two pages of information on the site were assembled in 1983, as part of an Environment Canada program identifying land disposal sites in the Yukon Territory (Document 2, Appendix B). The disposal site was reported to have an aerial extent of 320 metres by 300 metres. The depth of the waste was said to be from 0 to 3 metres. Biodegradable and non degradable garbage was noted. The operation was described as an open dump with no burning. The reported period of operation of the site was 1942 to 1976.

An undated and unattributed set of notes found in the Yukon Archives (Document 3, Appendix B) appeared to be written after some cleanup had been attempted. The notes indicated that some areas of debris still remained. Aerial photographs accompanying the notes showed the site with little vegetation covering the area. As vegetation was present over much of the site at the time of the current investigation, this would suggest that the cleanup efforts recorded in the notes took place some time in the past, perhaps in association with the 1983 program.

Local residents who were interviewed during the course of the investigation included the DIAND officer at Beaver Creek, and Jim and Dorothy Cook at the Koidern River Lodge. Members of the area's First Nation were contacted through the investigation's field assistant, Rosemarie Vander Meer, of the White River Nation. It was reported that the dump along the road at the edge of the escarpment on site was in use by area residents until "a few years ago". Materials which were said to have been dumped in this area were unknown but were presumed to be mainly domestic waste. The dump was not monitored, therefore, there are no records of actual materials deposited at the site and no assurance that unsuitable materials were not disposed of in the dump.

Aerial photographs of the site housed at the Yukon Archives and at the University of Calgary were reviewed. Aerial photographs from 1972 (Figure 6) were at a scale to at which it was difficult to discern site details (1:60,000). However, the site was visible on the photographs as a two juxtaposed clearings on the uplands above the Donjek River. A small disturbed area was visible at

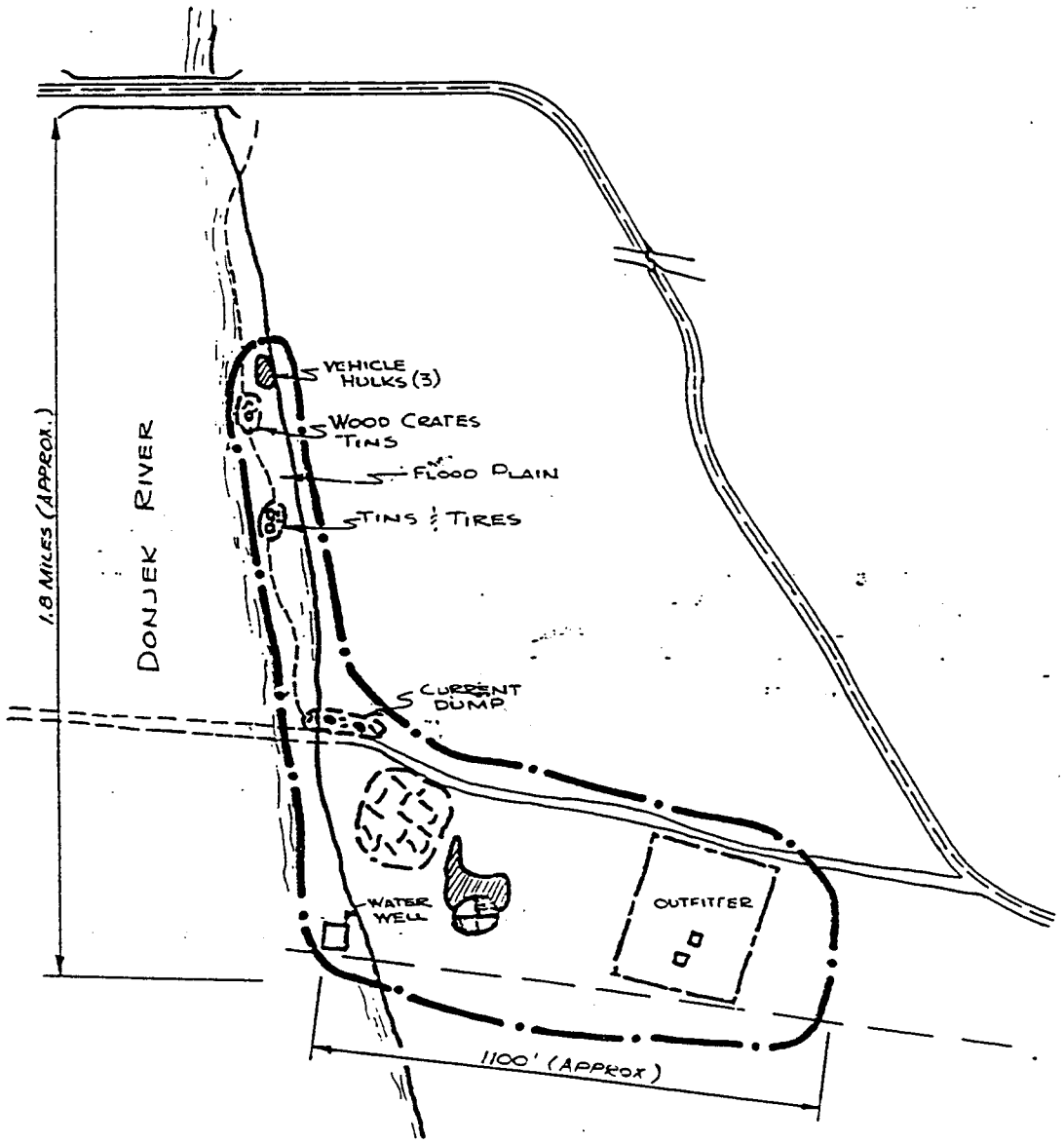


Figure 5. 1976 Mapping of the Subject Site by Edey.

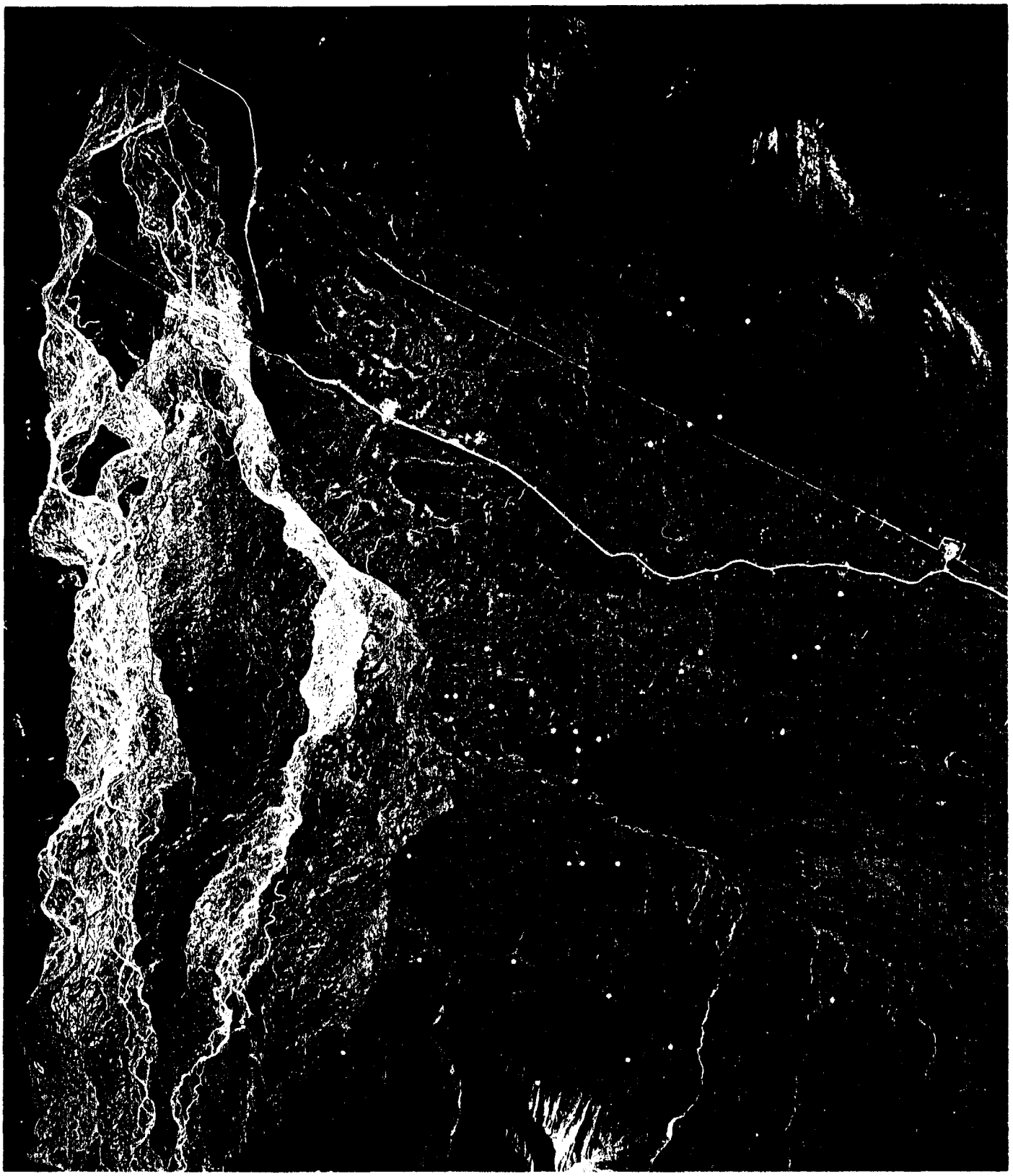


Figure 6. Aerial Photograph of Subject Site (1:60,000), 1972.

the edge of the escarpment, in the area said to have been used for postwar dumping.

3.3 Geophysical Results

The scope of the project prevented the undertaking of a detailed geophysical study over the full extent of the site. Instead, areas were prioritized for geophysical evaluation based upon site inspection. Areas that were geophysically surveyed are outlined in Figure 7.

Area "A" comprised a partially open area adjacent to an existing building. EM61 survey data were collected at 0.2 metre intervals along survey lines spaced 2 metres apart within the open portion of the area. As in-field monitoring of EM61 survey measurements indicated the presence of metal throughout the initial survey area, the survey area was extended to define the lateral limits of the buried metal. Relatively dense vegetation within the extended area necessitated the use of the more portable magnetometer instrumentation. Magnetometer survey data were collected at the nodes of a 5 metre by 5 metre survey grid.

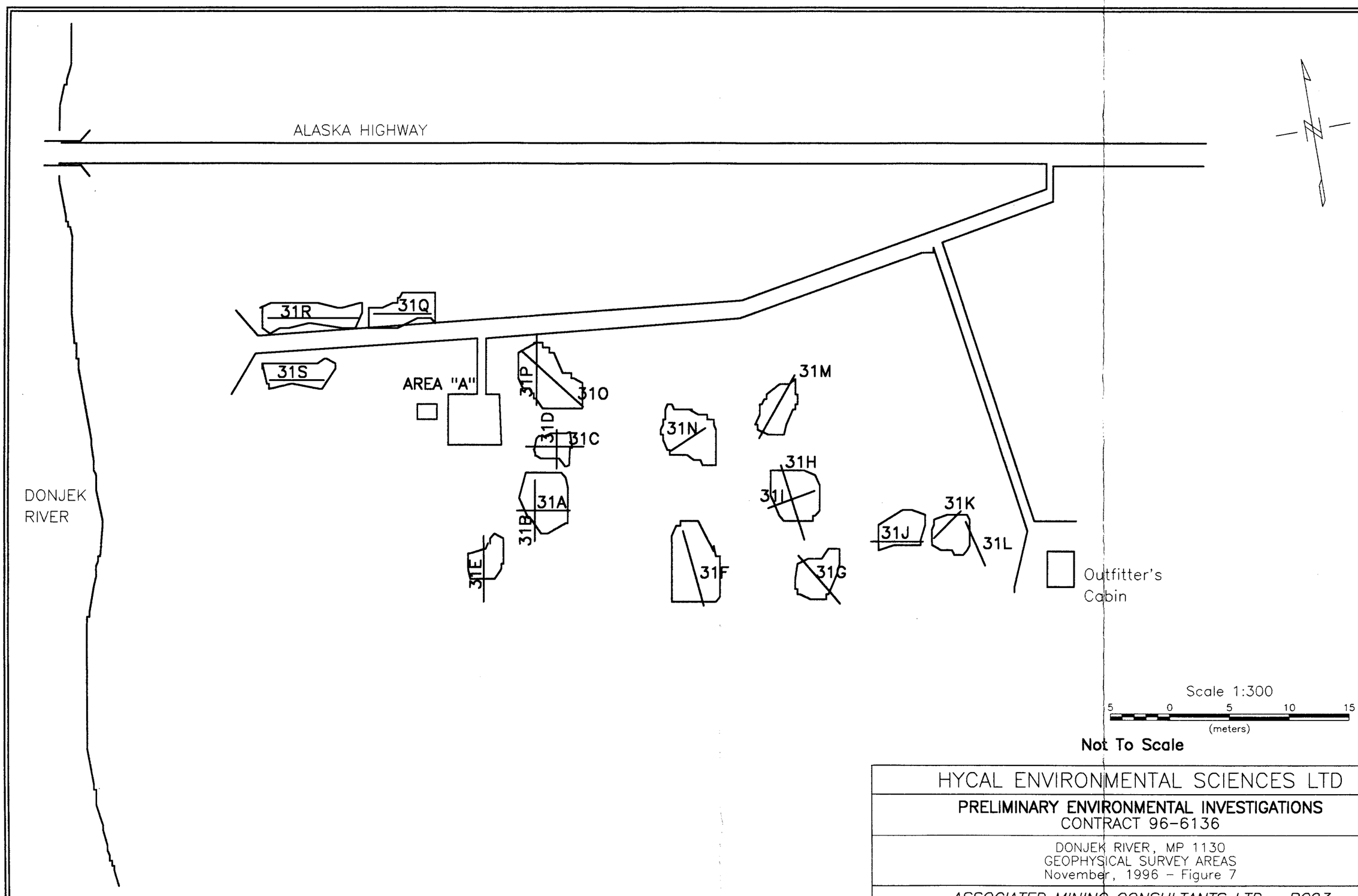
As is apparent in the illustrated results (Figure 8), the EM61 Channel 2 survey indicated regions of anomalous electromagnetic response indicative of buried metal positioned predominantly along the perimeter of the surveyed area. Review of the EM61 Differential Channel survey data (Figure 9) revealed corresponding anomalous response in both position and magnitude, suggesting that the source of the anomalies may extend to a depth of greater than one metre below the surface.

As the survey progressed, anomalous EM61 response of greatest magnitude was apparent along the southern perimeter of the initial survey area. Thus, the area of investigation was extended to the south. Magnetometer surveys identified three areas of anomalous response attributed to buried metal (Figure 10) - anomalies 31a, 31b and 31c.

Magnetic Anomaly 31a - extending from station 15W to 3W along line 30W, this anomaly is likely the magnetic response to buried metal identified along the southern extent of the area "A" EM61 survey.

Magnetic Anomaly 31b - of relatively small lateral extent and of low to moderate magnitude

Magnetic Anomaly 31c - of relatively small lateral extent and of low to moderate magnitude



Scale 1:300

5 0 5 10 15

(meters)

Not To Scale

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CONTRACT 96-6136

DONJEK RIVER, MP 1130
GEOPHYSICAL SURVEY AREAS
November, 1996 – Figure 7

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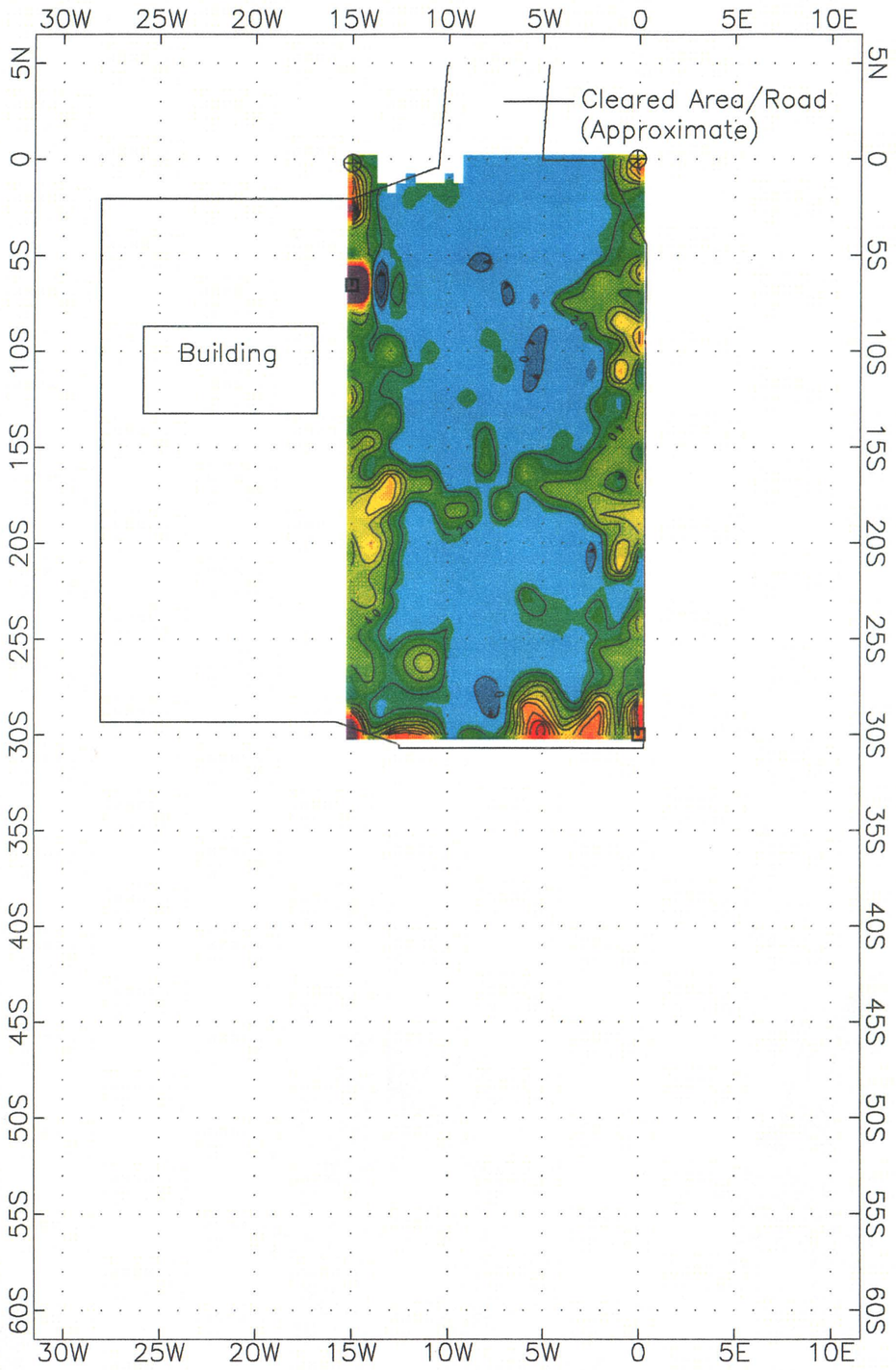

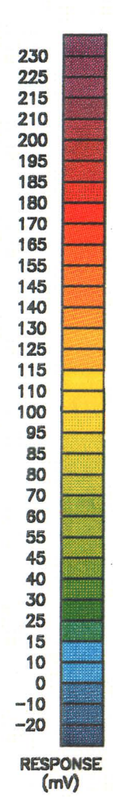

Surface Metal

Survey Grid Markers

Scale 1:300

5 0 5 10 15

(meters)

HYCAL ENVIRONMENTAL SCIENCES LTD

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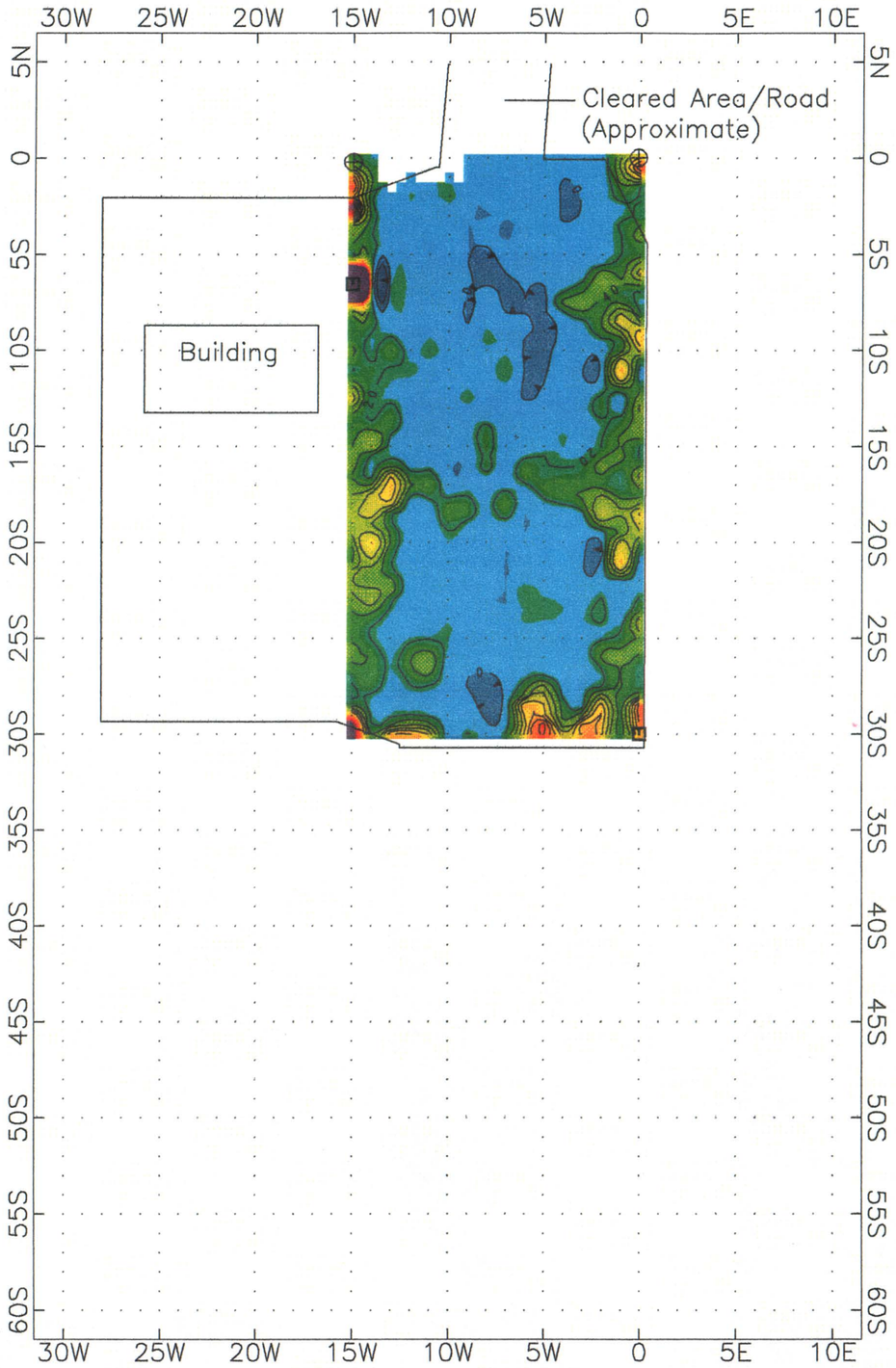
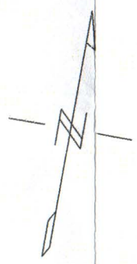
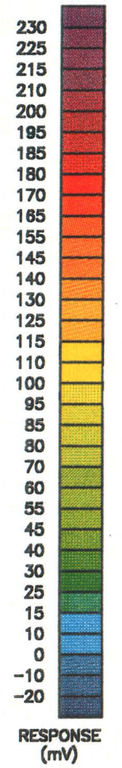
DONJEK RIVER, MP 1130
EM61 SURVEY - Channel 2 - AREA 'A'
November, 1996 - Figure 8

ASSOCIATED MINING CONSULTANTS LTD - PG93







⊡ Surface Metal

⊕ Survey Grid Markers

Scale 1:300

5 0 5 10 15

(meters)

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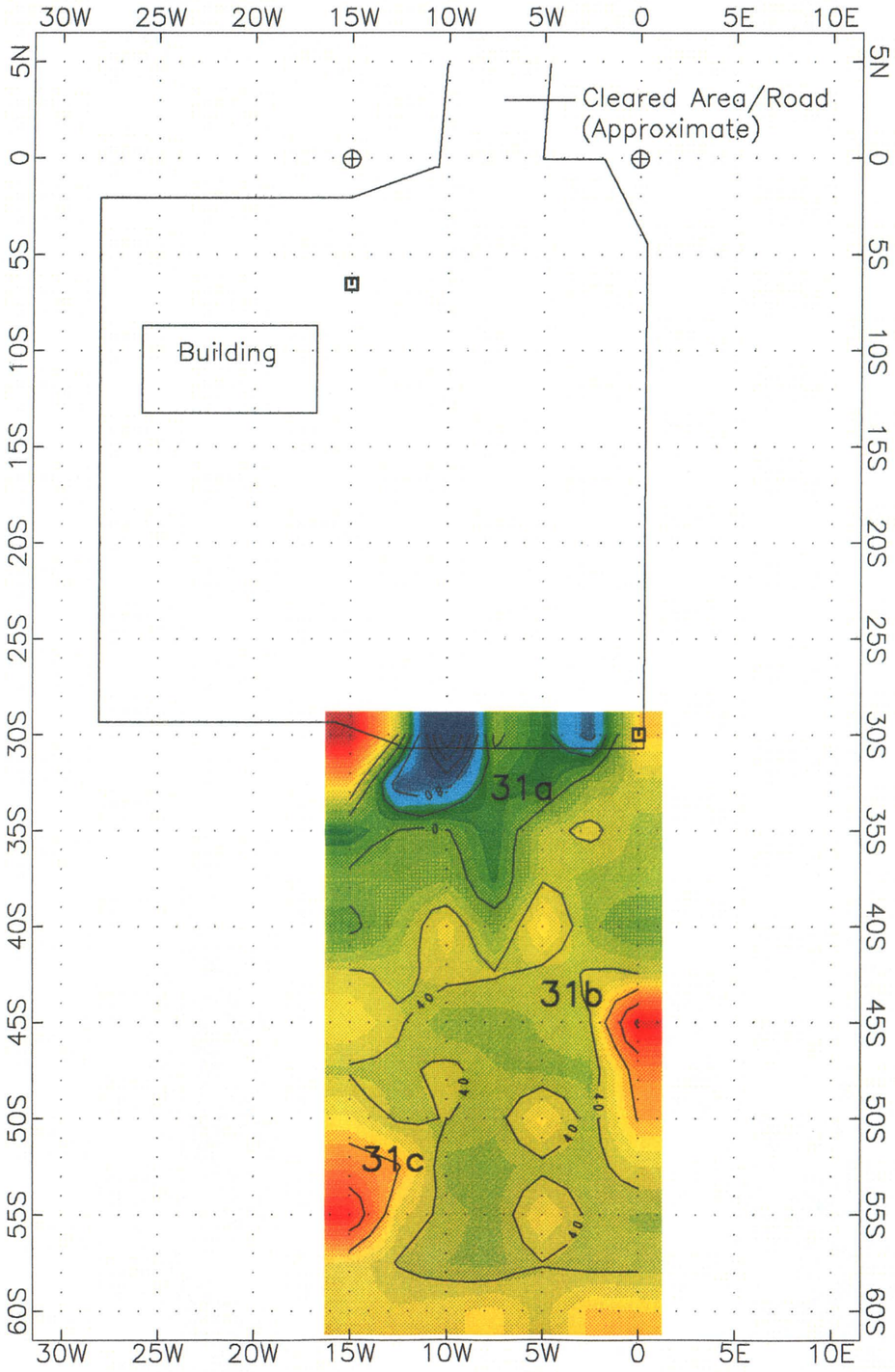
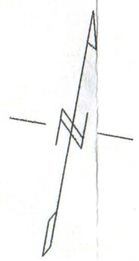
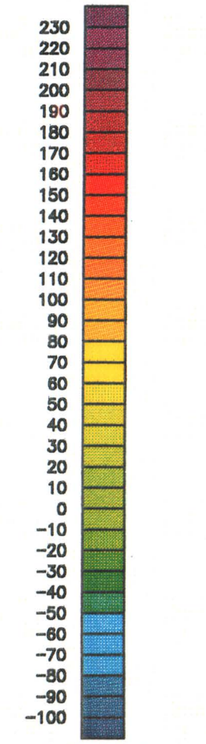
PRELIMINARY ENVIRONMENTAL INVESTIGATIONS
CONTRACT 96-6136

DONJEK RIVER, MP 1130
EM61 SURVEY - Differential Channel - AREA 'A'
November, 1996 - Figure 9

ASSOCIATED MINING CONSULTANTS LTD - PG93







31a Magnetic Anomaly

⊡ Surface Metal

⊕ Survey Grid Markers

Scale 1:300

5 0 5 10 15

(meters)

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PRELIMINARY ENVIRONMENTAL INVESTIGATIONS
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DONJEK RIVER, MP 1130
TOTAL FIELD MAGNETOMETER SURVEY - AREA 'A'
November, 1996 - Figure 10

ASSOCIATED MINING CONSULTANTS LTD - PG93

As stated previously, the scope of the project precluded a detailed geophysical study of the entire site. Instead, specific areas were targeted based upon site observations. Those areas identified for further geophysical study included obvious earth mounds and infrastructure remnants. Within those areas, magnetometer measurements were obtained at 2 metre intervals along either a single line, or a pair of perpendicular survey lines. Although not conclusive in the identification of all buried metal within the individual areas, this method was employed to identify large concentrations of buried metal within the areas. A brief discussion of the results of this survey follows:

Lines 31 A and 31B	A mound located approximately 20 metres southeast of the southeast corner of area "A". Evidence of some metal at Stations 6E and 20 E on Line 31A and Station 22N on Line 31B.
Lines 31 C and 31D	Positioned over a topographic high. Evidence of metal on both survey lines.
Line 31 E	Metal (wire coil) evident at surface. Magnetic measurements indicated buried metal (Stations 4S to 10S).
Line 31F	Magnetic results gave no indication of buried metal in the immediate vicinity of the survey
Line 31G	Evidence of metal at Stations 6N and 8N.
Lines 31H and 31I	Two lines within the perimeter of a wooden building foundation. Anomalous results evidence of buried metal.
Lines 31K and 31L	Line 31L located over a concrete pad. Indications of buried metal on both lines.
Line 31M	Small clearing with directional lumber. Some metal indicated.
Line 31N	Magnetic response did not indicate the presence of metals in the immediate vicinity of the survey line.
Lines 31O and 31P	Large clearing with two mounds. Magnetic intensity variations indicated some metal.

Lines 31 Q	Single survey line adjacent to access road. No indication of buried metal.
Lines 31R and 31S	Survey lines within fill material on the east and west side of the access road, in the area of reported dumpsite. Anomalous magnetic response indicated the presence of buried metals. Magnitude of the response was greater on the east side of the road.

3.4 Adjacent Properties

Lands immediately to the north, east and south of the subject property were undeveloped and consisted of northern boreal forest, with black spruce, scrub willow, birch and moss. The Alaska Highway was located north/northeast of the subject property. The Donjek River was present to the west of the property. No conditions were identified on adjacent properties that would suggest that the subject property has been adversely affected by activities on neighbouring land.

3.5 Soil Analyses

A background sample, from an area which appeared to have not been in use and soil samples from two 'active' areas within the site were analyzed for indications of contaminants which would be anticipated to have been associated with former activities on the site. Two soil samples were analyzed for a metal and hydrocarbon content. Soil from inside the oil pit (Sample B8) was analyzed for common organo-chloride pesticides, organo-phosphate pesticides, and PCBs. Another sample (B3) was analyzed for the organo-nitrogen pesticide, picloram, and for phenoxy/acid herbicides (2,4-D , fenuron, and 2,4,5-T). Results of the soil sample analyses are summarized in Figure 11.

Both of the soil samples from active areas of the site were found to contain contaminants at a level for concern:

> A sample of material from inside the oil pit (Sample B8) contained arsenic, beryllium, cadmium, cobalt, copper, molybdenum, nickel, selenium, tin and vanadium in excess of CCME Assessment Criteria (CCME, 1991). The hydrocarbon level exceed Alberta Tier I Criteria (Alberta Environmental Protection, 1994). Zinc was determined to be present in levels exceeding CCME Remediation Criteria for Parkland and Residential Usage. No PCBs were detected in the sample.

Figure 11: Summary of Soil Analyses - Donjek River, MP 1130

	CCME Assessment Criteria	CCME Remediation-Parkland/ Residential Criteria	Donjek Background	Donjek Pit	Donjek B3
METALS					
Arsenic	5	30	4.3	**14**	**6.7**
Antimony	20	20	<0.50	1.51	1.01
Barium	200	500	67.9	197	111
Beryllium	4	4	0.103	0.172	0.152
Cadmium	0.5	5	0.168	**2.43**	**1.18**
Chromium	20	250	11.4	**43.9**	**39.9**
Cobalt	10	50	4.9	8.79	7.28
Copper	30	100	18.7	**95.2**	**32.6**
Lead	25	500	6	**335**	**269**
Mercury	0.1	2	0.03	0.06	0.09
Molybdenum	2	10	0.42	**2.82**	0.93
Nickel	20	100	13.2	**68.2**	**26.3**
Selenium	1	3	0.63	**1.14**	0.91
Silver	2	20	<0.001	0.265	<0.001
Thallium	0.5	-	<0.20	<0.20	<0.20
Tin	5	50	0.74	**8.27**	1.03
Vanadium	25	200	16.6	**123**	**27.4**
Zinc	60	500	39.7	**2490**	**143**
PESTICIDES					
Organo-Chloride Pesticides	-	-	BDL	BDL	***
Organo-Phosphate Pesticides	-	-	BDL	BDL	
Organonitrogen Pesticides	-	-	BDL		BDL
HERBICIDES					
2,4-D	-	-	<0.1		
Picloram	-	-	<0.1		<0.1
2,4,5-T	-	-	<0.1		
OTHER					
Hydrocarbons	*	-	118	**10300**	836
Moisture (wt%)	-	-	32.6	54.8	37.8
PCB's	0.1	5	<0.1	<0.1	

***

Organo-Chloride Pesticides	Donjek B3
4,4'-DDD	**0.24**
4,4'-DDE	**0.08**
2,4'-DDT	**0.15**
4,4'-DDT	**0.58**
all other constituent compounds	BDL

All soil values are in mg/kg dry weight (ppm) unless otherwise stated
BDL = Below Detection Limits for all constituent compounds

Exceeds Level of Concern

Exceeds Assessment Criteria

Exceeds Remediation-Parkland/ Residential Criteria

Exceeds Alberta Tier I for Hydrocarbons (1000 mg/kg)
** No CCME Criteria for Hydrocarbons*

- A soil sample from a mound east of the oil pit (Sample B3) was found to contain levels of arsenic, cadmium, chromium, copper, lead, nickel, vanadium and zinc in excess of CCME Assessment Criteria (CCME, 1991). This sample was also analyzed for organo-chloride pesticides and was found to contain 4,4-DDD, 4,4-DDE, 2,4-DDT, 4,4-DDT at levels which might be interpreted to be of concern due to the total amount of pesticides.

A background sample (Sample B4) did not identify metals, pesticides, herbicides, hydrocarbons or PCBs at a level of concern.

3.6 Preliminary Risk Analysis

Based on available information (such as site location, characterization of soils, inferred site drainage, proximity to water bodies and land use, referred to in Section 3.1), it is likely that the following factors will act to increase the ecological risk at this site:

1) Contaminants

The presence of contaminants in exceedence of CCME assessment and remediation criteria increases the risk of an ecological impact. In addition it is likely these contaminants will be taken up and concentrated within vegetation of the site due to the chemical characteristics of the contaminants found

2) Proximity To Surface Water

The Donjek river is less than 100 ft from much of the site, in fact a small portion of the site is at the banks of the river.

3) Soils

Surface and subsurface soils silty sand of moderate water permeability, which increase the risk of contaminant migration and exposure to additional receptors.

4) Land Use

The use of adjacent land for hunting increases the risk of humans consuming animals exposed to contaminants through foraging or habitation on site.

5) Wildlife

The following site characteristics will act to decrease ecological risk:

1) Permafrost

The ubiquitous presence of permafrost beneath surface soils will act as a natural barrier preventing deep migration of contaminants.

2) Containment

Concrete containment of some of the contamination may decrease potential exposure.

Plant and animal species in the area were noted during the site investigation, however, the scope of this investigation precluded determination of Valued Ecosystem Components (VEC) as this would have required a detailed examination of interrelationships within the ecosystem of this site. If this site's ecosystem was better understood through further ecological work, keystone species, as well as hypersensitive species, could be identified and used in statistical models to predict impacts to the ecosystem.

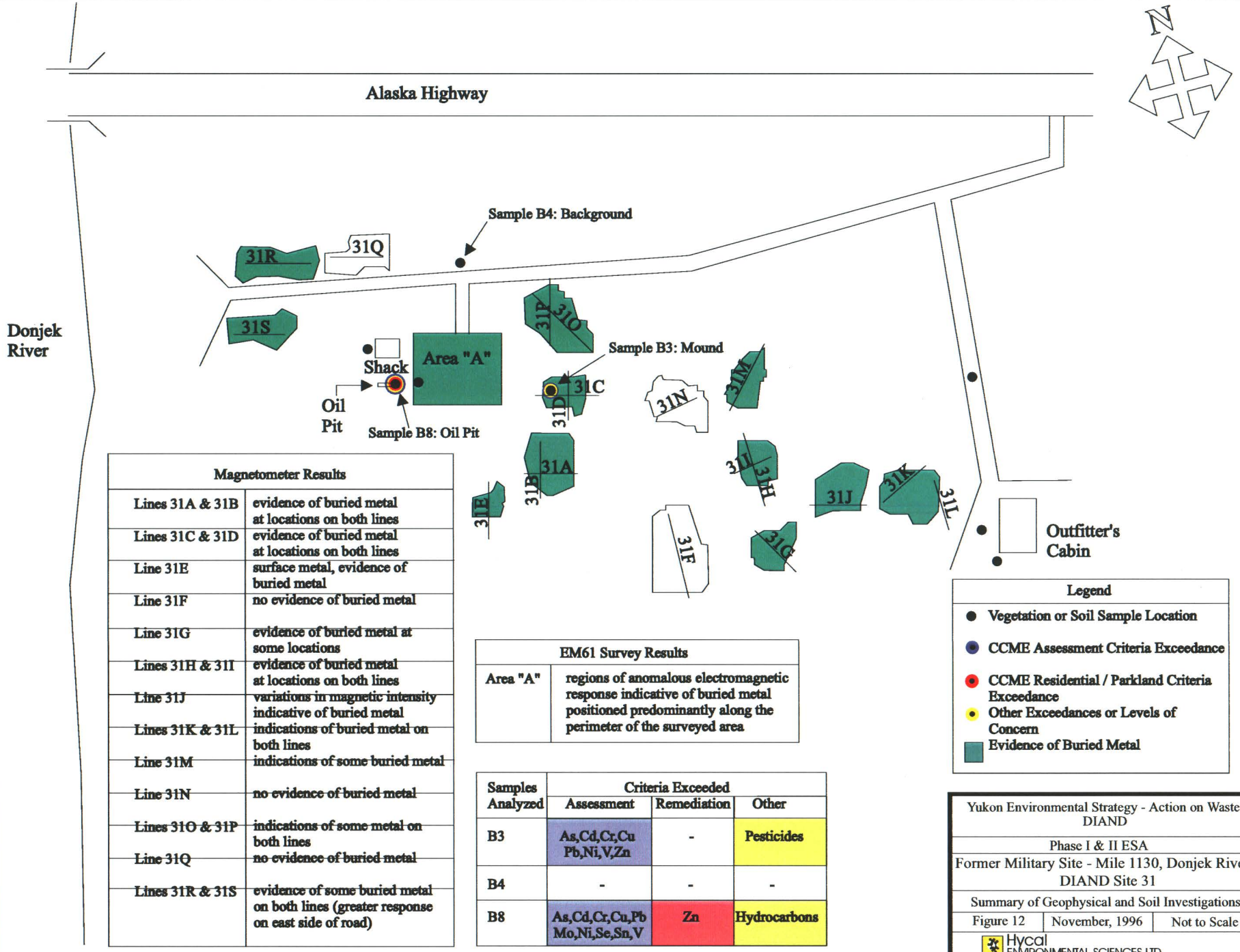
Based on the limited species information readily available, no species listed as being "endangered" by the World Wildlife Foundation of Canada (WWF) were identified on the site. The only site species identified on the site which is listed as "vulnerable" was the grizzly bear.

Contaminants of Concern and Properties

As was detailed in Section 3.4, ten metal contaminants (Arsenic, Cadmium, Chromium, Copper, Lead, Molybdenum, Nickle, Selenium, Tin and Vanadium) in excess of CCME Assessment Criteria were found in soils on the site Only Zinc was found to exceed CCME Remediation Criteria for residential/parkland areas. While most of these compounds exceeded CCME Assessment Criteria, it should be noted that the concentrations were fairly close to background concentrations for this area (with the exceptions of chromium, copper lead and zinc). The primary concern for these types of contaminants is that they are readily taken up in vegetation as micronutrients where they are bioconcentrated. Animal species then consume this vegetation while foraging on site and receive a concentrated dose of metals.

Other contaminants of concern found at this site included hydrocarbons within the former oil change pit and the organo-chloride pesticides DDD, DDE and DDT. The hydrocarbons represent a moderate to low risk since concentrations were fairly low, and they were believed to be localized within the concrete pit, where there is limited vegetative growth However, the organo-chlorides may represent a significantly higher risk due to their classification as persistent

pesticides. DDT, and its metabolites DDE and DDD, have an exceptionally long half-life in the environment and are known to be extremely toxic to an ecosystem due to their high bioconcentration factors. Typically these compounds will significantly concentrate as they partition into organic matter of soil and plants. Once sorbed to organic matter these compounds are even more persistent as they cannot be water leached due to their high lipid solubility.



Magnetometer Results	
Lines 31A & 31B	evidence of buried metal at locations on both lines
Lines 31C & 31D	evidence of buried metal at locations on both lines
Line 31E	surface metal, evidence of buried metal
Line 31F	no evidence of buried metal
Line 31G	evidence of buried metal at some locations
Lines 31H & 31I	evidence of buried metal at locations on both lines
Line 31J	variations in magnetic intensity indicative of buried metal
Lines 31K & 31L	indications of buried metal on both lines
Line 31M	indications of some buried metal
Line 31N	no evidence of buried metal
Lines 31O & 31P	indications of some metal on both lines
Line 31Q	no evidence of buried metal
Lines 31R & 31S	evidence of some buried metal on both lines (greater response on east side of road)

EM61 Survey Results	
Area "A"	regions of anomalous electromagnetic response indicative of buried metal positioned predominantly along the perimeter of the surveyed area

Samples Analyzed	Criteria Exceeded		
	Assessment	Remediation	Other
B3	As,Cd,Cr,Cu Pb,Ni,V,Zn	-	Pesticides
B4	-	-	-
B8	As,Cd,Cr,Cu,Pb Mo,Ni,Se,Sn,V	Zn	Hydrocarbons

Legend

- Vegetation or Soil Sample Location
- CCME Assessment Criteria Exceedance
- CCME Residential / Parkland Criteria Exceedance
- Other Exceedances or Levels of Concern
- Evidence of Buried Metal

Yukon Environmental Strategy - Action on Waste
DIAND

Phase I & II ESA

Former Military Site - Mile 1130, Donjek River
DIAND Site 31

Summary of Geophysical and Soil Investigations

Figure 12 | November, 1996 | Not to Scale

Hycal ENVIRONMENTAL SCIENCES LTD.

4. CONCLUSIONS AND RECOMMENDATIONS

Investigation of the subject site was limited by the scope of the study. Investigation was prioritized to fit with allotted time and budget. **Further investigation would be required to more fully assess all of the areas within the site or to allow for more precise risk analysis.**

A summary of geophysical and soil sample analyses results is presented in Figure 12. The investigation confirmed the presence of surficial and subsurface debris on the subject site. Given the history of the site and the visible materials, most of this material appears to have been related to military operations in the area during the construction of the Alaska Highway. Some postwar dumping of materials was, however, evident. The presence of a dump on the eastern edge of the Donjek River valley escarpment appeared to be confirmed by geophysical data.

4.1 Historical Data

While historical searches yielded some useful information, the site appears to have been subject to activities which were poorly or never documented. Therefore, **further historical record searches are not indicated at this time.**

4.2 Surficial Debris

Some metal and wood debris was evident on the surface of the site. **This debris does not appear to pose any imminent risk to human health or the environment.** The surficial debris is not visible from any major road and does not result in any diminished aesthetic value, other than from within the site itself. The debris may, in fact, add some sense of history to the area, and may be considered to have a positive value.

4.3 Subsurface Metals

Geophysical surveying indicated the presence of significant quantities of buried metal on the site. Geophysical investigation indicated that subsurface metal is present within the northern portion of survey Area "A", apparently occurring at depth. Anomalous magnetic response, evident at several isolated locations within the site, suggested that the occurrence of buried metal is widespread. **Further detailed geophysical investigations would be required to more fully map subsurface metal on the site. Excavation would be**

required to determine whether this debris includes any canisters or barrels containing any contaminants.

Given the fragile nature of the environment in this area, and the severe damage to the permafrost and the ecosystem related to it that might result from disturbance of the ground surface, **the risk related to not determining the nature of subsurface metal debris must be weighed against the risk of disturbing the area's ecosystem**.

The climate and age of the site would suggest that any buried drums would have been subject to deterioration. **Leachate monitoring would provide information on potential migration from areas of buried metal with less damage to the ground surface than excavation of the metal would entail**. Further geophysical work, to identify all major areas of metal burial should be conducted prior to planning the location of any monitoring wells.

4.4 Soil Sample Analysis

While a number of soil samples were taken during the investigation of the subject site, the project budget allowed for the analysis of only three soil samples. Analysis indicated that while metals were present in the soil at levels above CCME Assessment Criteria, these levels did not exceed Remediation Criteria, except for zinc (which exceeded CCME Remediation Criteria for Parkland and Residential Use) Hydrocarbon levels inside the oil change pit exceeded Alberta Tier I criteria. A soil sample from a mound east of the oil pit was found to contain 4,4-DDD, 4,4-DDE, 2,4-DDT and 4,4-DDT at levels of concern due to the total amount of pesticides present. Fenuron and picloram were not detected in the two soil samples that were analyzed for these compounds. PCBs were not detected in the two samples analyzed.

Given the large aerial extent of the site, further soil sampling and analysis would be required to confirm the results of the initial soil analysis and more adequately assess soil conditions on the site.

Further soil analysis would be recommended for samples from:

- areas of stressed vegetation;
- topographic lows (where water ponding may occur and where runoff may be concentrated);
- the area along the upper edge of the Donjek River Valley, particularly in the vicinity of the dump on the northern side of the road; and
- in the vicinity of the oil change pit.

Analysis of duplicate samples would be recommended to verify analytical results.

4.5 Risk Associated With the Site

A preliminary risk evaluation suggests that the ecological risk associated with contaminants found on this site is moderate to low. This conclusion is based upon the observed health of the ecosystem, evidence of moderate but probably localized areas of contamination, relative concentration of contaminants, and relative toxicity of the compounds found. **If a greater level of confidence as to risks associated with the subject site is required**, further investigative work would be required and **a Level 1 CCME Risk Assessment should be carried out**.

As noted previously, the risk evaluation associated with this investigation was limited in scope. It is not possible to predict ecological fate and effect without completing a more detailed environmental risk assessment where a probabalistic model is developed. No groundwater wells were present in the vicinity of the subject site and the permanence of the permafrost in the area could only be inferred. Installation of groundwater monitoring wells and an assessment of permafrost conditions in the area over time (including the summer months) would be required to assess possible contaminant migration pathways with more confidence. Further soil sample analysis would be required to assess possible soil contamination more fully. Animal and vegetation studies would be required to assess whether there has been uptake of contaminants from the site.

The makeup of material in the dump located at the escarpment on the west side of the subject site is of concern. Records of what materials were deposited in this area were not kept and the dump was not monitored to ensure that unsuitable materials were not deposited. The dump's proximity to the river valley might allow contaminants within the dump to readily leach into the river valley. Therefore, **detailed subsurface sampling in the area of the dump, and the installation of a groundwater monitoring well is recommended to better assess risks associated with the dump.**

4.6 Project Implications for Assessments at Other Sites

Results of this investigation suggest that:

- vegetative growth may appear quite healthy in some areas where building materials and debris is present. Therefore, **vegetative cover is not necessarily an indicator of non-activity in an area. Ground reconnaissance of potential sites would be required to assess whether they have indeed been occupied and whether materials from the occupation remain onsite.**

- **geophysical methods were invaluable in identifying dumping areas** which were either not obvious at surface or which were dubious due to the presence of frost heaving in the area.

- activities that occurred on the site, such as burial of materials, were not documented in historical background materials. While historical information may be valuable in locating sites and identifying some issues of concern, **on-site investigation is required to assess whether a site has been subject to activities of concern**.

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PHOTOGRAPHS

Yukon Archives:

Cat 1477	Alaska Highway Construction - Donjek River Bridges, 1942
Cat 1498	Alaska Highway - Donjek River Bridges, 1942
Cat. 3554	Alaska Highway - Donjek River Bridge, 1942
Cat. 5675	Alaska Highway Camp - Donjek River, September 1942
Photo 45	Donjek River - Pontoon Bridge, 1942-1943 Lawrence Pedee
Photo 339	Alaska Highway - Donjek River Bridge, 1942. Yukon Economic Development

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Beaver Creek, Yukon

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Whitehorse, Yukon

APPENDIX A
LIMITATIONS

LIMITATIONS

The information and data contained in this report, including without limitation the results of any sampling and analyses conducted by or for Hycal Environmental Sciences Ltd. (Hycal) pursuant to Hycal's engagement, have been set forth to the best of Hycal's knowledge, information and belief.

Although every effort has been made to confirm that all such information and data is factual, complete and accurate, Hycal makes no guarantees or warranties whatsoever, whether expressed or implied, with respect to such information or data and accept no responsibility for any loss or damage arising therefrom or related thereto.

Any use which a third party makes of this report, any reliance on or decisions to be made based on it, are the responsibility of such third parties. Hycal accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The conclusions and recommendations provided in this report are derived from information gathered from the sites identified in the report. They include Hycal's best judgments based on experience and in compliance with accepted investigative techniques. Hycal shall not by the act of issuing this report be deemed to have represented thereby that any sampling and analyses conducted by them have been exhaustive, and persons relying on the results thereof do so at their own risk.

APPENDIX B
PREVIOUS WORK

LIST OF DOCUMENTS

Document 1. Operation Clean Up file (1973) on the subject site.

Document 2 Environment Canada (1983) information sheets on the subject site.

Document 3. Undated and unattributed set of notes on the subject site from Yukon Archives Government Records Volumes 1168-69.

Document 1. Operation Clean Up (1973) file on the subject site.

OPERATION CLEAN UP

Beaver Creek R.M.O. Area

- U.S. Army Dump m.p. 1130 Alaska Hwy.
- U.S. Army Dump m.p. 1154.6 Alaska Hwy.
- U.S. Army Dump m.p. 1155.6 Alaska Hwy.
- U.S. Army Dump m.p. 1165.8 Alaska Hwy.
- U.S. Army Dump m.p. 1174.5 Alaska Hwy. - YFS. cleaned this up this fall (1974)

.115 Army

Fed. Gov't.

Site No. 6 Alaska Hwy.

GARBAGE SITES

Location

Location - Latitude ~~[illegible]~~ Longitude ~~[illegible]~~
Highway ~~[illegible]~~ Mile ~~[illegible]~~ Distance off Road ¼
Access ~~By Road~~
Size of Clearing _____ Acres _____ Dimensions _____
Garbage occupies 10 Acres Site in use - ___ Yes ~~X~~ No
Distance from Improvements _____ Type of Improvements _____

Originator

___ Town or Village
___ Lodge, Motel
X Camp (Industrial)
___ Camp (Tourist, Roadside stop)
___ Official Campground

Type of Garbage

___ Vehicle Bodies - Amount _____
X Building Debris
___ Kitchen Refuse
X Abandonned Site, Tires, etc.
___ Debris from Clearing
Age of Garbage _____
This debris the U.S.Army.

Fire Hazard Involved

___ High X Medium ___ Low
____ Paper, Debris, etc. scattered in adjacent area
Fire Guard - X Nil ___ Satisfactory ___ Unsatisfactory

Site

___ Natural Depression ___ Dug out, Hole X Piled on ground
Vegetation cover around site Willow, Aspen And Black Spruce.
Pollution Potential - X Nil ___ Existing ___ Future
Pollution would effect ___ Stream ___ Lake,
Remarks: Site should be cleaned up.
Aesthetic Value Medium
Visible from Road ___ Yes X No
Recommendations for Site ____ Cleanup and abandon ____ Development
Remarks on Cleanup/Improvement Costs Approx. 56 man hrs. will be required
General Remarks on Site ~~to clean up this site. It would require a dozer~~ for 6 hrs. to excavate and bunch old truck bodies, and the other unburnables.

July 25/73 — Date
[signature] — Inspecting Officer
_____ — Supervisor

Document 2. Environment Canada (1983) information sheets on the subject site.

31

Environment Canada
Environmental Protection Service

Site Code 102
NTS Sheet 115 G/12
Donjek

IDENTIFICATION AND VERIFICATION OF ACTIVE AND INACTIVE LAND DISPOSAL SITES IN THE YUKON TERRITORY

Community Landfill — Presently in use no

Community Name Donjek — Region Southwestern Yukon

(Along abandoned Alaska Highway right of way

1.0 LOCATION Mile 1130.0 to 1130.1 Alaska Highway

1.1 Latitude N 61°38'20" Longitude W 139°43'20" Elevation 795 M.

1.2 Distance from disposal area to townsite N.A. km.

1.3 Distance from disposal area to town water source N.A km.
Is there any chance of contamination? minimal 10

1.4 What type of water source N.A

1.5 Population served by water source N.A. 10

1.6 Distance from disposal area to major surface water 250 m 5

1.7 Uses of major surface water trapping recreation Donjek River 7

1.8 Distance to nearest house 100 m

1.9 Surrounding land use:

	1/4 km radius	1/4 - 1 km radius	Beyond 1 km radius	
new	Alaska Highway bush	Donjek River	Residential –	20
old	Alaska Highway Donjek River	bush	Commercial –	

2.0 DISPOSAL SITE CHARACTERISTICS

2.1 Dimensions: Length 320 meters Width 300 meters 8
Approximate depth of waste 0-3 meters

2.2 Present condition: Open unknown
Covered _____ details _____ 5
Other _____ specify _____

2.3 Source of waste U.S. Army, public, commercial

2.4 Types of waste:
Liquid sewage no Garbage biodegradable yes
Non degradable (appliances, car/truck bodies, metal scrap) yes 5
Industrial waste (specify) (oils, chemicals etc) no
Inventory of other likely wastes —

2.5 Operation:
Open Dump yes
Open Dump with Burning no

31

Dump with Occasional Cover perhaps
Sanitary Land Fill There is (or was) a dumping area on
Other (specify) this site which appears to be less than 100 m from the Donjek River

2.6 Who had access to the site during operation? Public yes
Community Services _____ Specify U.S. Army

2.7 Methods of containment for high concern wastes unknown

2.8 Evidence of leachate (liquids produced by garbage) YES unknown NO _____

2.9 Leachate containment (liquids escaping from dump) YES unknown NO _____

2.10 Evidence of methane gas or odours YES _____ NO ✓
Comments no

2.11 Period of operation 1942 to 1976

2.12 Mean high temperature for July 18.5 °C

2.13 General soil type gravel glacial, silt

2.14 Vegetation willow, aspen

2.15 Depth to permafrost during the summer discontinuous - possibly present here

2.16 Are there any sensitive environments or critical habitats such as endangered species breeding grounds in the area? NO _____ YES ✓
Specify grizzley bears, beaver, muskrat, ducks are to be found throughout the Donjek valley area

2.17 How far from the landfill are they? 0.1 km

3.0 GENERAL NOTES: ANNUAL RAINFALL - 300 mm.

3.1 Property owner: Present private lease, crown
Past (during operation) U.S. Army (crown)

3.2 Past or present problems with site there was too much refuse in this area

3.3 Reason for closing or abandoning site U.S. Army moved from area;

3.4 Closure procedures unknown

3.5 Information source and/or references Colin Eddy's report Yukon Archives; booklet Alaska Highway Clean-up 1976

4.0 COMMENTS
During World War II there were at least 15 bldg at this site; At mile 1130.1 there was a military and commercial dump

I did not visually inspect this site

M.R. Initials

Date Aug 27, 1983

Document 3. Undated and unattributed set of notes on the subject site from Yukon Archives Government Records Volume 1168-69.

PHOTOS #5A & 5B

SITE #5 MILE 1130 (KM 1817) Donjek River EU-6-8.0-3-4.4

PHOTO# 5A The garbage on the right of the side of the road was buried in the same locations, covered with gravel scrapped off the road itself.

This area is a large one and majority of the wood debris was ignited and burnt a considerable amount of green trees ~~[illegible]~~

PHOTO# 5B ~~[illegible]~~ on right side of road shows the garbage on the embankment covered fully with gravel.

~~[illegible]~~

~~[illegible] was buried on site. Left photo~~

~~Many scraps cans [illegible] of~~

This was the only fire out of many within this area that should have been cleaned up due to the contractors carelessness. There remains many ends of wood debris within the area and I would estimate that 1/3 of the cleanup was completed but certainly 2/3 remains within this area. And that would include the areas which where allowed to burn all winter underground see photo #7 Note large fire area between Dickson cabin "Green roof and red roof building on cement pad. It can be noticed from the air that many areas have not been cleaned up. The contract stated that all wood debris was to be burnt or buried. This has not been completed as far as I am concerned.

EU-6-8.0-3-4.4

#5-A Photo #8 To left of photo road where gravel was taken to bury Russian [illegible] box on creek bed.

Note fire area which was ignited last fall by contractor while burning lumber. ~~[illegible]~~

One of many within this area caused by contractors negligence.

~~Map~~ # 5-B Photos

Note large flat scattered debris left on site

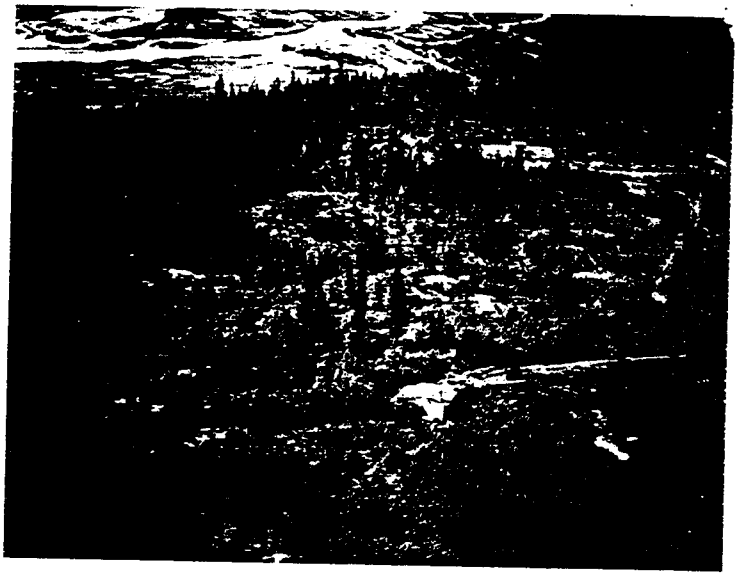
Note red roofed building on far Note road to left

where Rubbish was burnt.

All of these roads that follow ~~[illegible]~~ where

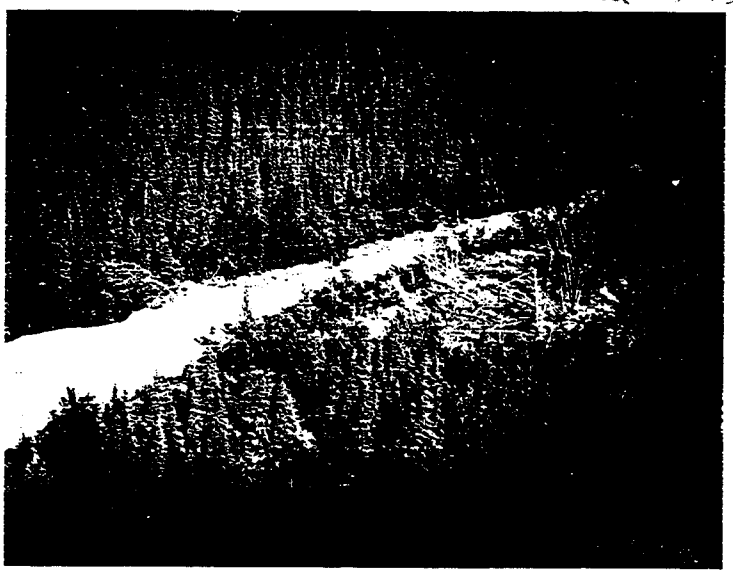
the fire burnt this rubbish out should be included

in this ~~area~~ Contaminated Clean up.



5A

Mile 1130



5B

Mile 1130

APPENDIX C
LABORATORY ANALYSES

Pr
(bc ., 530-4344
1-800-889-1433
Fax:
(604) 534-9996

NORWEST LABS

203-20771 Langley Bypass
Langley, B.C. V3A 5E8

WO (Lang.) : 22033
WO (Other) : 96-10-2834
PO # :
Date Samp. :
Date Rec'd. : 14-Nov-96
Date Comp. : 27-Nov-96

Client		Received From	
Name	: Hycal Environmental	Name	: Norwest Labs
Address	: 1338A - 36th Ave. NE Calgary, Alberta CANADA T2E 6T6	Address	: Bay 6, 2712-37 Ave. NE Calgary, Alberta CANADA T1Y 5L3
Phone	: (403) 735-6454	Phone	: (403) 291-2022
Fax	: (403) 291-2795	Fax	: (403) 291-2021
Attn.	:	Attn.	:
Project	:		

Herbicide Analysis in Soil

Parameter	22033-1 #1 R8864 1130 Donjeck Backgr	22033-2 #3 R8866 ite 33 Background	Detection Limit
Phenoxy/Acid Herbicides			
2,4-D	<0.1	<0.1	0.1 ppm
Picloram	<0.1	<0.1	0.1 ppm
2,4,5-T	<0.1	<0.1	0.1 ppm
Organonitrogen Pesticides			
Fenuron	<0.5	<0.5	0.5 ppm
Percent Moisture	34.52	21.12	

Parameter	22033-3 #4 R8867 Pump Station G Sample	22033-4 #6 R8869 Site 33 Koidern Sample	Detection Limit
Phenoxy/Acid Herbicides			
2,4-D	<0.1	<0.1	0.1 ppm
Picloram	<0.1	<0.1	0.1 ppm
2,4,5-T	<0.1	<0.1	0.1 ppm
Organonitrogen Pesticides			
Fenuron	<0.5	<0.5	0.5 ppm
Percent Moisture	6.04	56.6	

Results are expressed in ppm (mg/kg), dry weight, without correction for recovery data.

Ph:
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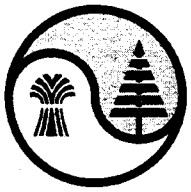

NORWEST LABS

203-20771 Langley Bypass
Langley, B.C. V3A 5E8

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WO (Other) : 96-10-2834
PO # :
Date Samp. :
Date Rec'd. : 14-Nov-96
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Herbicide Analysis in Soil (cont.)

Definitions / Methods

Phenoxy/Acid Herbicides: This analysis is carried out in accordance with U. S. Environmental Protection Agency Method 8151 (SW 846, 3rd Edition, Washington DC) which involves extraction of the components with an organic solvent followed by hydrolysis, derivatization and then analysis by gas chromatography using a mass selective detector.

Percent Moisture: Percentage of the total wet weight of the sample as received. This analysis is carried out gravimetrically by drying the sample to constant weight at 105 C.

Comments

Quality Control Results

QA/QC		Analyst		
Compound	% Recovery	Analysis	Date	Analyst
2,4-D	52	herbicides	26-Nov-96	Ken M.
2,4,5-T	47			
Picloram	73			

Supervisor

Note: All samples will be disposed of after 30 days following analysis unless other arrangements are made.

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Phone	: (403) 735-6454	Phone	: (403) 291-2022
Fax	: (403) 291-2795	Fax	: (403) 291-2021
Attn.	:	Attn.	:
Project	:		

Organo-Chloride Pesticides in Soil

Parameter	22032-1 #10 V3-R9371 Site 32 Koidern	22032-2 #11 B3-R9372 Site 31 Donjek	Detection Limit
Pesticide			
Aldrin	<0.05	<0.05	0.05 ppm
BHC (alpha isomer)	<0.05	<0.05	0.05 ppm
4,4'-DDD	<0.05	**0.24**	0.05 ppm
4,4'-DDE	<0.05	**0.08**	0.05 ppm
2,4'-DDT	<0.05	**0.15**	0.05 ppm
4,4'-DDT	<0.05	**0.58**	0.05 ppm
Dieldrin	<0.05	<0.05	0.05 ppm
Endosulfan I	<0.05	<0.05	0.05 ppm
Endosulfan II	<0.05	<0.05	0.05 ppm
Endrin	<0.05	<0.05	0.05 ppm
Heptachlor	<0.05	<0.05	0.05 ppm
Heptachlor epoxide	<0.05	<0.05	0.05 ppm
Hexachlorobenzene	<0.05	<0.05	0.05 ppm
Lindane	<0.05	<0.05	0.05 ppm
Methoxychlor	<0.05	<0.05	0.05 ppm
Mirex	<0.05	<0.05	0.05 ppm
Percent Moisture	53.8	43.97	

1.05 sum DDT

Results are expressed in ppm (mg/kg), dry weight, without correction for recovery data.
ND = Not Determined.

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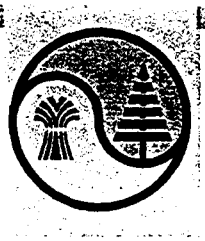

NORWEST LABS

203-20771 Langley Bypass
Langley, B.C. V3A 5E8

WO (Lang.) : 22032
WO (Other) : 96-10-2834
PO # :
Date Samp. :
Date Rec'd. : 14-Nov-96
Date Comp. : 27-Nov-96

Organo-Chloride Pesticides in Soil (cont.)

Definitions / Methods

Organo-Chloride Pesticides: This analysis is carried out in accordance with U. S. Environmental Protection Agency Method 8080 (#SW 846, 3rd Edition, Washington DC 20460) which involves extraction of the components with an organic solvent (EPA 3540) followed by analysis by capillary gas chromatography using an electron capture detector.

Percent Moisture: Percentage of the total wet weight of the sample as received. This analysis is carried out gravimetrically by drying the sample to constant weight at 105 C.

Comments

Quality Control Results

QA/QC		Analyst		
Compound	% Recovery	Analysis	Date	Analyst
Lindane	79	O-C Scan	26-Nov-96	Ken M.
Surrogate	101			

Supervisor

Note: All samples will be disposed of after 30 days following analysis unless other arrangements are made.

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Fax	: (403) 291-2795	Fax	: (403) 291-2021
Attn.	:	Attn.	:
Project	:		

Organo-Phosphate Pesticides in Soil

Parameter	22032-1 #10 V3-R9371 Site 32 Koidern	22032-2 #11 B3-R9372 Site 31 Donjek	Detection Limit
Pesticide			
Azinphos-Methyl (Guthion)	<0.25 ppm	<0.25 ppm	0.25 ppm
Chlorpyrifos	<0.25 ppm	<0.25 ppm	0.25 ppm
Coumaphos	<0.35 ppm	<0.35 ppm	0.35 ppm
Diazinon	<0.05 ppm	<0.05 ppm	0.05 ppm
Dichlorvos (DDVP, Vapona)	<0.15 ppm	<0.15 ppm	0.15 ppm
Dimethoate (Cygon)	<0.35 ppm	<0.35 ppm	0.35 ppm
Disulfoton (Disyston)	<0.15 ppm	<0.15 ppm	0.15 ppm
Ethion	<0.15 ppm	<0.15 ppm	0.15 ppm
Fonofos (Dyfonate)	<0.15 ppm	<0.15 ppm	0.15 ppm
Malathion	<0.15 ppm	<0.15 ppm	0.15 ppm
Methamidophos	<0.15 ppm	<0.15 ppm	0.15 ppm
Methyl Parathion	<0.15 ppm	<0.15 ppm	0.15 ppm
Mevinphos (Phosdrin)	<0.15 ppm	<0.15 ppm	0.15 ppm
Naled	<0.25 ppm	<0.25 ppm	0.25 ppm
Phorate (Thimet)	<0.10 ppm	<0.10 ppm	0.10 ppm
Phosalone	<0.35 ppm	<0.35 ppm	0.35 ppm
Terbufos	<0.15 ppm	<0.15 ppm	0.15 ppm
Percent Moisture	53.80	43.97	

Results are expressed in ppm (mg/kg), dry weight, without correction for recovery data.
ND = Not Determined.

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NORWEST LABS

203-20771 Langley Bypass
Langley, B.C. V3A 5E8

WO (Lang.) : 22032
WO (Other) : 96-10-2834
PO # :
Date Samp. :
Date Rec'd. : 14-Nov-96
Date Comp. : 27-Nov-96

Organo-Phosphate Pesticides in Soil (cont.)

Definitions / Methods

Organo-Phosphate Pesticides: This analysis is carried out in accordance with U. S. Environmental Protection Agency Method 8140 (#SW 846, 3rd Edition, Washington DC 20460) which involves extraction of the components with an organic solvent followed by analysis by capillary gas chromatography using a flame ionization detector.

Percent Moisture: Percentage of the total wet weight of the sample as received. This analysis is carried out gravimetrically by drying the sample to constant weight at 105 C.

Comments

Quality Control Results

QA/QC		Analyst		
Compound	% Recovery	Analysis	Date	Analyst
OPs	132	O-P Scan	26-Nov-96	Ken M.

Supervisor

Note: All samples will be disposed of after 30 days following analysis unless other arrangements are made.

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NORWEST LABS

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Langley, B.C. V3A 5E8

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WO (Other) : 96-10-2834
PO # :
Date Samp. :
Date Rec'd. : 14-Nov-96
Date Comp. : 28-Nov-96

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Name	: Hycal Environmental	Name	: Norwest Labs
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Phone	: (403) 735-6454	Phone	: (403) 291-2022
Fax	: (403) 291-2795	Fax	: (403) 291-2021
Attn.	:	Attn.	:
Project	:		

Herbicide Analysis in Soil

Parameter	22032-1 #10 V3-R9371 Site 32 Koidern	22032-2 #11 B3-R9372 Site 31 Donjek	Detection Limit
Phenoxy/Acid Herbicides			
Picloram	<0.1	<0.1	0.1 ppm
Organonitrogen Pesticides			
Fenuron	<0.5	<0.5	0.5 ppm
Percent Moisture	53.8	43.97	

Results are expressed in ppm (mg/kg), dry weight, without correction for recovery data.

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NORWEST LABS

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WO (Other) : 96-10-2834
PO # :
Date Samp. :
Date Rec'd. : 14-Nov-96
Date Comp. : 28-Nov-96

Herbicide Analysis in Soil (cont.)

Definitions / Methods

Phenoxy/Acid Herbicides: This analysis is carried out in accordance with U. S. Environmental Protection Agency Method 8151 (SW 846, 3rd Edition, Washington DC) which involves extraction of the components with an organic solvent followed by hydrolysis, derivatization and then analysis by gas chromatography using a mass selective detector.

Neutral Herbicides: This analysis is carried out in accordance with U.S. Environmental Protection Agency Method 8081 (SW-846, 3rd Edition, Washington DC) which involves extraction of the components with an organic solvent followed by derivatization and analysis by gas chromatography using an electron capture detector.

Percent Moisture: Percentage of the total wet weight of the sample as received. This analysis is carried out gravimetrically by drying the sample to constant weight at 105 C.

Comments

Quality Control Results

QA/QC		Analyst		
Compound	% Recovery	Analysis	Date	Analyst
2,4-D	52	herbicides	26-Nov-96	Ken M.
2,4,5-T	47			
Picloram	73			

R L Williamson
Supervisor

Note: All samples will be disposed of after 30 days following analysis unless other arrangements are made.

NORWEST LABS

INFORMATION SHEET - SOILS

WORK ORDER NO.

SHEET [ ] OF [ ]

DATE STAMP

COMPANY: HYCAL Environmental
ADDRESS:

PHONE: 735-6463
FAX:
RESULTS TO: Lisa-Henri Kirkland

CITY/TOWN: Calgary
PROVINCE:
POSTAL CODE:
ATTENTION:
PROJECT:

P.O. NO.	REPORTING SELECTIONS
E6-243	Q.A. REPORT ☐
REF./QUOTE NO.	

REPORT RESULTS: MAIL ☐ FAX ☑ COURIER ☐

RUSH DATE REQUIRED: D M Y

SURCHARGE WILL APPLY ON RUSHES

SAMPLE CUSTODY	SAMPLED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY
	LH Kirkland			
	COMPANY: Hycal	COMPANY: NWL	COMPANY	COMPANY
	DATE: 23 Oct 96	DATE: 3:00 23/10/96	DATE	DATE

DATE SAMPLED: D M Y

NUMBER OF SAMPLES: SOIL [9] WASTE [ ] WATER [ ] PLANT [ ] OTHER SPECIFY:

SPECIAL INSTRUCTIONS (SEE OVER FOR IMPORTANT SAMPLE INFORMATION INSTRUCTIONS AND ANALYSIS CODES)

hold all remaining samples for possible future analysis
future analysis may include: dicking furans
esterone
tordon
fenuron

CLIENT NO.

INVOICE NO.

COMPLETION DATE: D M Y

	SITE I.D.	SAMPLE DESCRIPTION	DEPTH (CM)	ANALYSIS PACKAGE CODES (USE CODES LISTED ON THE REVERSE OF THIS SHEET)	LAB CODING
1	①	1130 Donjek Background	-	PCB 2, PP1, P01, H4, TM44	
2	②	Site 33 ~~Sample~~ Oil Pit #1	-	as above	
3	③	Site 33 Background	-	as above	
4	④	Pump Stn. G Sample 5	-	as above	
5	⑤	1130 Donjek Pit	-	as above	
6	⑥	Site 33 Koidern Sample#1	-	as above	
7	⑦	Pump Stn G Sample 6	-	as above	
8	⑧	Pump Stn G Sample 5	-	no analysis at this point	
9	⑨	Site 33 North Pit	-	no analysis at this point	
10			-		
11			-		
12			-		
13			-		
14			-		
15			-		
16			-		
17			-		
18			-		
19			-		
20			-		

NORWEST LABS

Calgary, AB	Phone (403) 291-2022	Fax (403) 291-2021
Edmonton, AB	Phone (403) 438-5522	Fax (403) 434-8586
Lethbridge, AB	Phone (403) 328-9266	Fax (403) 327-8527
Langley, B.C.	Phone (604) 530-4344	Fax (604) 534-9896
Winnipeg, MB	Phone (204) 982-8630	Fax (204) 275-6019

TO:	Hycal Environmental	**DATE SAMPLED:**	23-Oct-96
		DATE RECEIVED:	24-Oct-96
ATTN:	Lisa	**DATE REPORTED:**	01-Nov-96
	Henri Kirkland	**LAB FILE#:**	96-10-2834
		Project: E6-243	

POLYCHLORINATED BIPHENYLS IN SOIL

LAB #	**R8864**	**R8865**	**R8866**	**R8867**	**R8868**	**Detection**
CLIENT #	**#1**	**#2**	**#3**	**#4**	**#5**	**Limit**
	1130 Donjek Background	**Site 33 Oil Pit #1**	**Site 33 Background**	**Pump Stn G Sample 5**	**1130 Donjek Pit**	
PCB Content	<0.1	<0.1	<0.1	<0.1	<0.1	0.1
Aroclor Type	----	----	----	----	----	

QUALITY ASSURANCE DATA

(This QA/QC data is representative of the lab based quality assurance program and is not to be utilized as field data.)

Surrogate Recovery % **Decachlorobiphenyl**	75	83	83	74	73

Results expressed in mg/kg dry wt. (ppm)

NORWEST LABS

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Winnipeg, MB	Phone (204) 982-8830	Fax (204) 275-6019

TO:	Hycal Environmental	**DATE SAMPLED:**	23-Oct-96
		DATE RECEIVED:	24-Oct-96
ATTN:	Lisa	**DATE REPORTED:**	01-Nov-96
	Henri Kirkland	**LAB FILE#:**	96-10-2834
		Project: E6-243	

POLYCHLORINATED BIPHENYLS IN SOIL

LAB # / CLIENT #	R8869 #8 Site 33 Koldern Sample 1	R8870 #7 Pump Stn G Sample 6	Method Blank Oct-31	Detection Limit
PCB Content	<0.1	<0.1	<0.1	0.1
Aroclor Type	---	---	---	

QUALITY ASSURANCE DATA

(This QA/QC data is representative of the lab based quality assurance program and is not to be utilized as field data.)

Surrogate Recovery % Decachlorobiphenyl	93	NA	82

NA - not available due to matrix interferences

R. Corbet, M.Sc., P.Ag.
Manager - Organics

Results expressed in mg/kg dry wt. (ppm)

NORWEST LABS

Calgary, AB	Phone (403) 291-2022	Fax (403) 291-2021
Edmonton, AB	Phone (403) 438-5522	Fax (403) 434-8586
Lethbridge, AB	Phone (403) 329-9266	Fax (403) 327-8527
Langley, B.C.	Phone (604) 530-4344	Fax (604) 534-9996
Winnipeg, MB	Phone (204) 982-8630	Fax (204) 275-8019

TO:	Hycal Environmental	DATE SAMPLED:	23-Oct-96
		DATE RECEIVED:	24-Oct-96
ATTN:	Lisa	DATE REPORTED:	01-Nov-96
		LAB FILE#:	96-10-2834
		Project: E6-243	

POLYCHLORINATED BIPHENYLS
QUALITY ASSURANCE DATA

(This QA/QC data is representative of the lab based quality assurance program and is not to be utilized as field data.)

Calibration Check (CC)

	Actual Amt. (ng)	Detected Amt. (ng)	% Rec.
Aroclor 1254	5.0	5.47	109

QA/QC Sample

	Actual Amt. (ug/g)	Recovered	% Rec.
Aroclor	50	51.9	104

$$\text{Accuracy} = \frac{\text{Ave \% Rec. MS + Ave \% Rec. MSD}}{2} = 101.3 \text{ \% Accuracy}$$

$$\text{\% RSD} = \frac{\text{Ave \% Rec. MS - Ave \% Rec. MSD}}{\text{\% Accuracy}} = 5.3 \text{ \% RSD}$$

The calculated values are based on matrix spike and duplicate recovery data performed on your samples at the time of analysis.

Date Acquired: Oct 31/96 Analyst: Trevor Ahlstrom

APPENDIX D
PROJECT PERSONNEL

PROJECT PERSONNEL

Personnel who participated in the investigation included:

Lisa-Henri Kirkland, B.A., B.Sc., P.Geol.	historical investigation, field sampling, data analysis, and report preparation
Rod Ewacha, B.Sc., E.I.T.	field sampling, data analysis
Mark Bowman, B.Sc., P. Geoph.	geophysical investigation
Rosemarie Vander Meer, White River Nation	assistance in field sampling and historical investigation
Douglas Lee, M.Sc., P.Biol.	preliminary risk evaluation
Alan MacDonald, M.E.Des.	report review