Laberge
ENVIRONMENTAL SERVICES

P.O. BOX 5111
WHITEHORSE, YT
Y1A 4S3

OFFICE PHONE (403) 668-6838
CELL PHONE (403) 668-1043
FAX (403) 667-6956

PRELIMINARY ENVIRONMENTAL INVESTIGATIONS

AT SITES 1(WL066), 2(WL067), 27(HJ040), AND 29(HJ042)

FOR

A.E.S. ACTION ON WASTE

BY

LABERGE ENVIRONMENTAL SERVICES

JANUARY,1997

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1.0 EXECUTIVE SUMMARY

Laberge Environmental Services (L.E.S.) conducted preliminary environmental investigations at four Arctic Environmental Strategy (A.E.S.) waste sites along the Alaska Highway. All four sites originated during the World War II military construction era and range from complete abandonment with restoration to continued use.

These investigations took the form of a reconnaissance level site assessment combined with judgemental sampling to confirm the presence and/or extent of a contaminant profile. Archival research and interviews were used to determine the potential contaminant profile and to refine field screening and sampling protocols. The field program employed a high sensitivity metal detector, organic vapour analyzer, visual cues, hand dug pits, backhoe trenching and sampling of soil, sediment, ground and surface water and vegetation. The laboratory program used a highly respected Canadian Association of Environmental Laboratories (C.A.E.L.) approved lab, Norwest Labs, to carry out analyses recommended by Canadian Council of Ministers of the Environment (C.C.M.E.) for potentially contaminated sites.

The results of this investigation can be summarized as follows:

There was no evidence of presence or contamination by persistent organics in the form of organochlorine pesticides or polychlorinated biphenols (P.C.B.s) Samples were taken from potential sources along exposure pathways, and at local control sites. All samples were below the limit of detection in all matrices.

A limited amount of hydrocarbon contaminated soils were detected in the immediate area of buried or backfilled waste sites. In all cases the concentration of hydrocarbons was low to moderate and confined to a small area. Only total hydrocarbon was analyzed with split samples retained for profiling of the carbon unit if this proved necessary. It was decided that due to the low concentrations the extra analysis cost was not warranted.

Site No. 1 at Iron Creek, Waste Site Number WL066 in the A.E.S. Waste Site Inventory, has some solid waste that is regarded as a low priority housekeeping issue. Hydrocarbon in soil here is well below clean-up criteria.

Site No. 2 at Lower Rancheria, Waste Site Number WL067, has some moderate hydrocarbon concentration in the immediate backfilled dump site area which does not warrant further attention.

Site No. 27 at Burwash Landing, Waste Site Number HJ040, has low concentrations of hydrocarbon, below clean-up criteria.

Site No. 29 at old milepost 1120 near Swede Johnson Creek, Waste Site Number HJ042, has very low concentrations of hydrocarbon, below clean-up criteria. The old dump here was very poorly located on top of saturated sands very near a year round creek, but does not appear to be causing any detectable contamination.

It is recommended that all four sites either be deleted from the waste site inventory, or given the lowest of priorities for clean-up. It is important to note the precise locations of these sites so that future land users are aware of them.

Small amounts of reclamation may be considered for Iron Creek (housekeeping) and Burwash Landing (landscaping). Also, an interpretive walking trail may be a useful consideration at Lower Rancheria to compliment the existing rest stop. Otherwise no further action or assessment of these sites is recommended.

2.0 INTRODUCTION

L.E.S. submitted a Proposed Assessment Plan for Sites 1; Iron Creek camp, east of Watson Lake, 2; Lower Rancheria Construction camp Km 1106, 27; Old dump at Burwash Land and 29; Old dumps near Swede Johnson Creek at old milepost 1120, in August 1996, and subsequently performed preliminary environmental investigations according to the plan under a Call -up Against a Standing Offer 96-6133-1. This Report details the site assessments, sampling strategy, findings and conclusions drawn about each of the four waste sites. The report is organized according to S.W.10) of contract No. 96-6133. The methods used to plan and carry out the assessments are described in section 3, and results are presented in section 4 and interpreted in section 5. A preliminary environmental risk assessment for each site is presented in section 6, followed by site specific recommendations in section 7. A complete list of references is included, and archival documents, photos, air photographs, site plans, test pit logs, analysis reports,and site photographs are appended.

All four sites originated during the WWII military construction era and are located along the Alaska Highway Corridor. Prior research and investigations have shown that former military sites can contain a certain group of persistent contaminants(1), (2). The approach taken in this assignment was to research archival materials and interview people acquainted with these sites in order to design an effective field program to determine the presence and/or extent of this group of contaminants. Although this assignment was at the reconnaissance level of assessment, every effort was made to collect enough data to verify the presence and extent of the selected analyses so that these sites could either be "put to bed" or slated for further assessment and clean-up.

3.0 METHODOLOGY

A comprehensive desk top review of archival and recent information was carried out before going ahead with a modified field and lab program for each site. The desk top review included examination of available information on file with government agencies, review of materials and photographs at the Yukon Archives, and interviews with people directly acquainted with each site. During this review, a potential contaminant profile was identified as well as the most probable locations of buried waste. A field screening method was selected and a sampling and analysis protocol selected on the basis of the desk top review (3). A description of the methods used in the investigation follows:

3.1 Review of Existing Data

First, the A.E.S. Waste Site Inventory files were reviewed and the sites discussed with Action on Waste inspectors.. Next, reports and documents concerning waste sites with military origins were reviewed. Materials at the Archives were examined, in particular, a collection of documents that were assembled for the fiftieth anniversary of the Alaska Highway (4). Air photographs dating from the 1940's and 1960's were examined at the Archives as well (5). Topographic maps and stereo pairs of the most recent air photographs were obtained. The air photos proved quite useful, so enlargements of the waste site areas were ordered from the National Air Photo Library for use in field work and site plans.

Finally, people with direct experience at these sites were interviewed by phone and in person. The Kluane First Nation provided helpful assistance in regard to the Burwash Landing and Swede Johnson sites (6).

3.2 Field Work Program

During the desk top review potential contaminants that may be present at the sites were identified as well as probable locations of buried waste. Site conditions and likely

migration pathways were inferred from the air photos. From these, the field screening technique and overall assessments were finalized. The potential contaminant profile was narrowed down to persistent organochlorine pesticides, chlorinated biphenols, metals, and hydrocarbon products because they had been detected at other military waste sites. To detect these, it was decided that metal detector scanning, soil vapour surveys, test pitting, visual cues, crude topographic surveying, photo documentation, and verification sampling of various matrices would all be used at each site. To save on analysis costs, some duplicate samples were retained for further screening if certain analyses were detected in a given sample.

Local control samples were collected at each site to ensure the validity of soil sample results. Standard protocols were followed in sample collection, preservation, shipping, and handling to further ensure data quality.

The use of various geotechnical surveying methods was considered, especially ground penetrating radar, but it was decided that test pitting by backhoe at locations identified by screening methods would be more cost effective for the particular sites and conditions.

3.3 Laboratory Program

Norwest Laboratories was selected as the analytical lab, and sampling kits were obtained for the range of potential contaminants and matrices. Norwest is a C.A.E.L. approved lab with an excellent QA/QC program.The methods of analysis were selected on the basis of those recommended by the C.C.M.E. National Contaminated Sites Remediation Program (3).

4.0 RESULTS OF THE STUDY BY SITE

4.1 SITE NUMBER 1- IRON CREEK CAMP, OLD M.P. 596

This site originated in 1943 as a construction camp for the final alignment of the Alaska Highway administered by the U.S. Public Roads Administration. As such, it was used by the American Military as well as private road contractors. The American Military turned all of the Northwest Highway System over to the Department of National Defense (D.N.D) on April 1, 1946. The camp originally contained about 29 frame structures. After the road was completed, the camp was abandoned and scavenged for several years. Former D.N.D. and Public Works (D.P.W.) employee, Basil Dowd, recalled that the camp was overgrown and hardly noticeable by the early 1950's (7). After the Canadian military turned the camp over to Public Works, it eventually came back into use as a Grader station operated under contract first to D.P.W., and after 1972, to the Government of The Yukon. A stereo pair of air photos taken in 1947 shows that many of the structures were already gone (see Appendix Two - air photo enlargement 11347-438). A plan of the site made in 1953 shows only about a dozen buildings still standing at that time (see Appendix One Camp Mile 596).

4.1.1 Site Description and Inventory

The site is open to the Alaska Highway along the north and straddles the B.C./Yukon border to the south. A private property abuts the site to the west, which is currently occupied by the Iron Creek Highway Lodge and facilities. A pothole lake curves around the south and west sides of the site.(see Appendix Two - air photo enlargement 28106-70). The original military camp area is now occupied by the road maintenance contractor and contains a metal shop, several out buildings, and two residential trailer units. There are several areas of accumulated solid waste of varying vintage consisting of wrecked road maintenance equipment, old vehicles, a wrecked trailer and miscellaneous wood and metal waste. These are shown on Plan One, Appendix Three. It is likely that the common garbage dump used by the military was over an embankment along the lake shore, which

is now private property. Metal waste and scattered garbage was found in this area dating from the 1940's. The area directly to the south of the clearing was used for waste disposal when the site came back into use for road maintenance and now contains an unused sewage disposal pit, junked road maintenance equipment, a backfilled garbage dump, and a modest amount of metal and wood waste along the southernmost boundary parallel to the border.

About 25 percent of the original military camp clearing is revegetated by mature trees and understorey dominated by poplar. Areas apparently logged when the construction camp was built are similarly revegetated. Modest revegetation exists in the clearing to the south of the camp, composed of pioneer species and dominated by willow and aspen. This growth is about 20 years old and is progressing slowly due to poor soil matrix.

4.1.2 Site Conditions

The surface features in the site area are glacial in origin and the topography is gently sloped from north to south. The site itself is flat to gently sloped and drains to the south and west towards the pothole lake, which is approximately 20 meters below the average elevation of the site. The lake itself is about 11 hectares in size and 18 meters deep at its deepest point. The bottom material is accumulated organic sediments overlaying glacial till.

A topographic low traverses the southeast corner of the site from a northeasterly direction. The entire site is vegetated except for the clearing currently in use for road maintenance. The surface soil common throughout is a thin layer of organics and loam on top of sandy gravel or glacial till The site is well drained with no naturally standing water. The unused sewage disposal pit contains about 0.1 meters of standing water.

4.1.3 Subsurface Soil Conditions

Seven test pits were dug at the site using a small rubber tired backhoe. The resulting soil

profiles are indicated in Appendix Four, Test Pit Logs. Generally, the soil profile seems to be either sandy silts and till or sands and gravels underlain by dense glacial till. Buried waste has apparently been paced onto dense till and backfilled with local coarse grained soils.

4.1.4 Groundwater Conditions

Saturated soil was only encountered in one test pit, at a depth of 2.2 meters, otherwise only vadose water was encountered. The saturated soil in test pit #1 was likely a local perched aquifer resulting from local recharge through coarse backfill. It is expected that the underground drainage follows the surficial topography and trends towards the southwest towards the pothole lake.

4.1.5 Contaminant Considerations

An area of buried waste was noted with a metal detector and examined by test pitting and soil vapour testing.This turned out to be the only place where contaminants were detected, in the form of modest amounts of hydrocarbon in soil. The site was walked in a dense grid with a metal detector, and several pits dug by hand to the "B" horizon soil and checked with the organic vapour analyzer. This did not turn up any further indications of buried waste. A total of 12 soil samples were collected and analyzed for hydrocarbons, organochlorine pesticides, and PCB's. Two sediment samples were collected from the lake and analyzed for organochlorine pesticides and PCB's. One vegetation sample was collected from the border clearing and analyzed for pesticides. All of these samples were below the level of detection for all the parameters except for the hydrocarbons in soil detected at the buried waste site. Sample locations are indicated on the site plan. The results of analyses are presented in Table One.

Table One - IRON CREEK ANALYTICAL RESULTS

Sample I.D.	Matrix	Depth (m)	Organo chlorine pesticide scan (ppm)	PCBs (ppm)	Hydro-carbons (ug/g)
Local Control	soil	0.1	<0.05	<0.10	<10
P-1	soil	0.2	<0.05	<0.10	<10
P-2	soil	0.2	<0.05	<0.10	<10
T.P.I 1	soil	2.3	<0.05	<0.10	126
T.P.I 2	soil	0.6	NA	NA	<10
T.P.1 2	soil	1.5	<0.05	NA	96
T.P.I 3	soil	1.4	NA	NA	<10
T.P.I 4	soil	1.0	NA	NA	<10
T.P.I 4	soil	4.2	<0.05	<0.10	<10
T.P.I 5	soil	3.0	NA	NA	<10
T.P.I 6	soil	1.7	NA	<0.10	<10
T.P.I 7	soil	1.1	NA	NA	<10
S.I. 1	sed	12	<0.05	<0.10	NA
S.I. 2	sed	0.5	<0.05	<0.10	NA
B.C. 1	veg	-	<0.05	NA	NA

4.2 SITE NUMBER 2 - LOWER RANCHERIA CONSTRUCTION CAMP Km 1106

This site was also a military construction camp and was operated only from 1943 to 1946. The site was inventoried and declared surplus by D.N.D in 1955, and any useable materials were removed over the years leaving a few collapsed buildings noted by C.E. Edey during an assessment study in 1976 (8), and by Environment Canada during a survey of old waste sites in 1982 (9). The garbage dump used by the camp was apparently used by a service station that operated on the west side of the river until the late 1960's (7).

4.2.1 Site Description and Inventory

The site is bordered on the south by the Alaska Highway and on the west by the Lower Rancheria River. The old construction camp itself is located on a flat river terrace while the garbage dump is situated 1 Km east on a slightly higher bench.The old dump was backfilled about 20 years ago and has revegetated with pioneer species dominated by alder. The camp buildings were burned and buried at the same time and are only distinguished by revegetated mounds. The camp area is entirely revegetated by mature conifers with mature poplar, grasses and sedges in open areas. There is a negligible amount of old debris scattered around, composed mainly of metal waste. There is a small amount of recent garbage and litter at the old dump site and along a trail parallel to the river. There is a Government of Yukon rest stop situated at the entrance to the old camp. The buried waste on site consists of the burned and dozed camp buildings and a backfilled garbage dump. The majority of waste at the dump was likely put there during the post war period.The old dump site is revegetating slowly due to poor soil matrix.

4.2.2 Site Conditions

The site is flat to gently sloping in a northwesterly direction on a glaciofluvial lowland. The area is forested with conifer stands of lodgepole pine and black and white spruce. There is a carpet of mosses and lichens throughout the undisturbed area. Former roads,

clearings and building sites are revegetating with a mix of deciduous and conifers with shrubs and grasses underneath. Surface soils are medium to fine textured and well drained.

4.2.3 Subsurface Soil Conditions

Two test pits were dug at the old dump site, and several hand dug pits to the "B" horizon were made at the old camp site and below the toe of the old dump. The dump site is situated in coarse morainal soil on a bench above the old camp. The soil profile consisted of sandy gravels to a depth of 2.8m, while backfill material in two separate layers was mainly mixed sandy surface soils and organic debris. All of the hand dug pits revealed either sandy gravels or gravelly sand except for one of the backfilled building sites which was covered with sandy silt.

4.2.4 Groundwater Conditions

No saturated soils were encountered. The soils were coarse and rapidly drained throughout. It is expected that groundwater drains westward towards the river normal to the topographic relief.

4.2.5 Contaminant Considerations

The camp area and old dump site were screened with a metal detector and organic vapour analyzer, resulting in targets for test pitting and soil sampling. A total of five soil samples were collected. No organochlorine pesticides or PCB's were detected. Hydrocarbons in soil were found in at the old dump site and at the site of the old power house. Concentrations were all less than 500 ppm total hydrocarbons. Sample and test pit locations are shown in Appendix Three, Plan Two. Results of analyses are presented in Table Two.

Table Two - LOWER RANCHERIA ANALYTICAL RESULTS

Sample I.D.	Matrix	Depth (m)	Organo chlorine pesticide scan (ppm)	PCBs (ppm)	Hydro-carbons (ug/g)
Local Control	soil	0.1	<0.05	<0.10	<10
T.P.R-1	soil	2.5	<0.05	<0.10	453
T.P.R-2	soil	2.7	NA	NA	283
T.P.R-3	soil	2.3	NA	NA	361
P-1	soil	0.3	NA	NA	<10
P-2	soil	0.05	NA	NA	122

4.3 SITE NUMBER 27 - OLD DUMP SITES, BURWASH LANDING

This site is situated on both sides of the old access road to Burwash Landing just north of the Alaska Highway. A cleared area on the north side of the access road was the former location of a Pan American Construction building, with an old borrow pit across the road which eventually was used as a casual disposal place over the years (6). Pan American was the construction company that built the Burwash Landing airfield.

4.3.1 Site Description and Inventory

The site is composed of two clearings separated by the old access road, now upgraded as a residential street. The southern clearing is the location of an old dump that has been recently covered with end dumped soil and wood debris resulting from construction of a residential subdivision in the immediate area. The eastern edge of the old dump still has

some metal waste showing, otherwise there is no surface evidence of a dump having been located here. The dump site is revegetating rapidly with grasses and shrubs. The southern clearing contains a small casual borrow pit, and is otherwise empty and heavily revegetated with willow and grasses. There is no evidence of the old Pan American building remaining.

4.3.2 Site Conditions

The area is forested with white spruce and shrubs. There are open meadows in the area with willow, sedges, and grasses dominant. The site is now surrounded by a residential subdivision, but none of the lots are located on the waste site area investigated.

There is a thin layer of reddish brown organics and loess developing on glacio-lacustrine soils. The terrain is moderately sloping northward towards Kluane Lake.

4.3.3 Subsurface Soil Conditions

Four test pits and three hand dug pits to the "B" horizon soil were dug at the site. Generally, the soil profile consisted of a thin layer of reddish brown sandy topsoil and loess, underlain by light coloured sandy silt. The silt layer overlies either sandy gravel or dense grey silty till. No water table was encountered. Permafrost was encountered in one pit at 2.0m. Test pit locations are shown on the site plan and test pit logs for the Burwash site are attached in Appendix Four.

4.3.4 Groundwater Conditions

No water table was encountered at this site, and all soils were dry with no evidence of seasonal water table. It is expected that groundwater drainage generally follows the topographic relief and is affected by local zones of permafrost and buried peat layers.

4.3.5 Contaminant Considerations

A total of eight soil samples were collected at this site. No organochlorine pesticides or PCB's were detected . The only contaminant detected was hydrocarbons in soil, at very low concentrations at depth at the old dump site. Soil sample locations are shown in Appendix Three, Plan Three. Analytical results for the Burwash site are presented below in Table Three.

Table Three - BURWASH LANDING ANALYTICAL RESULTS

Sample I.D.	Matrix	Depth (m)	Organo chlorine pesticide scan (ppm)	PCBs (ppm)	Hydro-carbons (ug/g)
Local Control	soil	0.1	<0.05	<0.10	
T.P.B1	soil	1.0	NA	NA	56
T.P.B2	soil	3.7	<0.05	<0.10	12
T.P.B3	soil	1.8	NA	NA	<10
T.P.B4	soil	2.7	NA	<0.10	<10
P-B1	soil	0.2	NA	NA	23

4.4 SITE NUMBER 29 - OLD DUMP SITE NEAR SWEDE JOHNSON CREEK

This site is located 1.7 km west of the Swede Johnson creek crossing at old milepost 1120 on the south side of the Alaska Highway. The old dump sites originated with construction of the highway, and subsequent use by the Donjek pumping station on the Haines - Fairbanks pipeline situated 6 km west of the site. Garbage that could not be

burned in the incinerator at the pumping station was hauled to this dump (2). Sometime during the 1970's the main dump site was backfilled, and a pit dug 150 m west which is still in use as a household garbage dump by area residents (6).

4.4.1 Site Description and Inventory

An old casual garbage dump dating from construction of the road and pipeline is located down a steep embankment directly across from a gravel quarry. This area contains a negligible amount of scattered metal waste, cans and the like, and is barely visible. A main waste site is accessed by a 200m road from the highway and is located on a gravelly clearing next to a tributary stream of Swede Johnson creek. The old dump has been backfilled with gravelly sand and organics and is covered with revegetation in the form of willows and grasses. It appears as though the dump originated as a casual borrow pit excavated into steep south facing hillside.

4.4.2 Site Conditions

The area is located on moderately sloping morainal terrain on the height of land between the Kluane River and the Donjek River. The old military garbage dumps are very modest in size and are totally revegetated by conifers and shrubs.The main buried waste dump is situated in a cleared area and has been backfilled with a mixture of coarse soils and fine grained organic soils. Old roads and access dating from the 1940's has totally revegetated with white spruce and shrubs. The toe of the old dump is covered with willow and alder. The furthest extent of the dump is within 5m of the aforementioned creek. The undisturbed surface soils are rapidly drained silty sands.

4.4.3 Subsurface Soil Conditions

Two test pits and four hand dug pits to the "B" horizon were dug at the site. The test pits were located along the edge of the old waste dump. The generalized soil profile at the old dump site consists of one meter of silty sand fill underlain by a thin peat layer and a

zone of saturated white sand.The original ground in the surrounding area is made up of silty sands and gravel.

4.4.4 Groundwater Conditions

The old dump site is situated on top of a saturated sand layer at 2.0m. The elevation of the water table is 0.48m below the water surface elevation of the creek at test pit S-1, suggesting that the creek is exfluent towards the dump at this point. The general groundwater drainage in the area is expected to be from north to south following the moderately steep well drained topography.

4.4.5 Contaminant Considerations

Eight soil samples, two groundwater samples, two sediment samples and two surface water samples were collected at the site. The field of analyses was extended to dissolved metals and oil and grease in water, to determine if there was any affect on the creek cased by leachate from the old dump. No organochlorine pesticides or PCB's were detected in any matrix. None of the water samples had detectable oil and grease. Metals analyses indicate typical levels for both groundwater and surface water, and do not show any change in water quality in the reach of stream passing by the toe of the old dump site. Sample locations are shown in Appendix Three, Plan Four. The water analysis report is contained in Appendix Five, Analysis Reports. Results of analysis are presented below in Table Four.

Table Four - SWEDE JOHNSON ANALYTICAL RESULTS

Sample I.D.	Matrix	Depth (m)	Organo chlorine pesticide scan (ppm)	PCBs (ppm)	Oil & Grease (mg/L)	Hydro-carbons (ug/g)
Local Control	soil	0.2	<0.05	<0.10	NA	<10
TPS-1	soil	1.4	NA	NA	NA	<10
TPS-1	soil	2.0	NA	NA	NA	<10
TPS-1`	soil	2.5	<0.05	<0.10	NA	<10
TPS-2	soil	1.4	NA	NA	NA	44
PS-1	soil	0.1	<0.05	NA	NA	21
PS-2	soil	0.2	<0.05	NA	NA	<10
PS-3	soil	0.2	NA	NA	NA	<10
U/S sed	sed	0.3	<0.05	<0.10	NA	NA
D/S sed	sed	0.3	<0.05	<0.10	NA	NA
T.P.S-1	G.W.	2.3	NA	NA	<0.2	NA
T.P.S-2	G.W.	2.3	NA	NA	<0.2	NA

sed=sediment, G.W.=groundwater

For ICP scan refer to Appendix Five, Water Analysis Report

5.0 INTERPRETATION OF RESULTS

The desk top review suggested that a possible contaminant profile in the form of persistent chlorinated organics, hydrocarbon products, or landfill leachate may have been present at any of the four sites. Contamination at the four abandoned military sites could not be ruled out because experience has shown that poor disposal and handling practises has led to contamination of various matrices at similar sites. The information reviewed and data collected has confirmed with reasonable confidence that, apart from localized hydrocarbon contaminated soils, there are no significant contaminants present or migrating off site at any of the four sites studied. The following are interpretations of information and data by site:

Site Number One - Iron Creek Camp

Air photo interpretation and review of an old site plan indicated an extensive construction camp, which was replaced after a dormant period by the current highway maintenance facilities. Most likely waste disposal areas were examined and sampled after field screening. Samples were collected both at the potential sources and along the potential migration pathways. All surface and test pit soil samples were below the level of detection for PCB's and organochlorine pesticides both in the immediate area of abandoned waste and along the site boundaries. Sediment samples from the pothole lake were also free of these contaminants, as was the local control sample. Because of the location of sample sites it can be reasonably assumed that none of these contaminants are present in significant quantity or are migrating off the site.The small amount of hydrocarbons in soil were confined to the backfilled dump site and are not migrating to any significant degree. Solid waste in the form of junked equipment, scrap metal and litter is present in significant quantity. The fuel transfer area at the present maintenance garage shows soil staining and, and judging from soil vapour readings, there is a modest amount of locally contaminated soil in this area - typical of fuel transfer areas at industrial sites.

Site Number 2 - Lower Rancheria

Air photo interpretation and examination of old site plans indicated a fairly large construction camp on the river terrace probably associated with bridge and road construction. The camp garbage dump was used by a service station for some time during the post war period. Both the camp site and dump were cleaned up by burn and bury methods in the 1970's. Sampling of soils revealed hydrocarbon contaminated soils at the old backfilled dump and at the former site of the camp power plant. The concentration of hydrocarbons in soil was moderate and localized. There were no PCB's or organochlorine pesticides detected in any of the soil samples or in the local control sample. There was a negligible amount of scattered solid waste and some recently disposed wood and metal waste at the site.

Site Number 27 - Old Burwash Landing Dump

Interviews and review of air photos indicate that the site was used first by a construction company during the war years and later by local residents as a casual waste disposal site, and was recently backfilled with material stripped during development of a subdivision. Very low levels of hydrocarbons were detected below grade in the immediate area of the old dump. No PCB's or organochlorine pesticides were detected in any of the soil samples or in the local control sample.

Site Number 29 - Old Dumps Near Swede Johnson Creek

Interviews and air photo interpretation indicated that the site was used first as a casual garbage disposal site by road construction crews and as a dump site for the nearby Haines Fairbanks pipeline pumping station. The garbage dump was backfilled, and a new pit excavated about 10 to 15 years ago. The casual dumps along the roadway contain negligible amounts of litter and waste such as old cans and containers. The backfilled dump is situated on top of a saturated sand layer only a few meters from a creek, and appears to contain a typical mixture of metal waste, empty containers and other non

burnable garbage. All soil and sediment samples were free of PCB's or organochlorine pesticides. The creek water quality does not appear to be affected by leachate. The water surface elevation of the creek was higher than the water table during the site survey, suggesting that groundwater was flowing towards the dump at that time. A small amount of localized hydrocarbon contamination was noted below grade at the former crest of the buried dump.

6.0 PRELIMINARY ENVIRONMENTAL RISK ASSESSMENT

A sufficient number of samples was collected and site information compiled to state confidently that all four sites were found to present very low to negligible environmental risk. No persistent chlorinated organics were detected along any exposure pathways, and only modest amounts of hydrocarbons in soil were detected. Backfilled waste sites contained hydrocarbons in all cases but soil contamination was found to be very limited in extent. There were no cases of contaminants migrating off site.

The Iron Creek site contained the largest inventory of solid waste. This material does not present a significant physical hazard. The remaining three sites have negligible amounts of solid waste which present no physical hazard.

7.0 RECOMMENDATIONS

Although split samples were retained to profile any hydrocarbon contamination, the extra analyses were not considered worthwhile in light of the low levels present, absence of other contaminants, and very limited extent of soil contamination. No remediation or further site assessment is recommended unless the sites change in land use designation.

Clean up of the solid waste at the Iron Creek site is recommended at a low level of priority, and is regarded as a housekeeping issue. It may be necessary to delineate the extent of soil contamination at the present fuel transfer area sometime in the future,

especially if the land is transferred or changes use. The highest concentration of hydrocarbons was 126 ug/g, well below clean-up thresholds even if all of the hydrocarbon was volatile.

The Lower Rancheria site is already a rest stop, and consideration should be given to establishing an interpretive trail through the old camp site. Due to low readings on the organic vapour analyzer, the hydrocarbon present is likely well below clean-up threshold.

The Old Dump site at Burwash landing could benefit from additional fill and site grading, combined with burial of the remaining metal waste. This would restore the area to its former level of utility. No residential development should take place on top of the old dump because of obvious problems associated with underground utilities. Hydrocarbon concentrations were well below clean-up thresholds.

The old dump site near Swede Johnson Creek does not require remediation at this time. Further assessment should only be considered if the land is to be disposed or if the current garbage dump expands considerably. Hydrocarbon concentrations were well below clean-up thresholds.

All four waste sites should be removed from the A.E.S. Inventory of Waste Sites.

8.0 REFERENCES

1. Laberge Environmental Services, June 1993. *Use, Disposal and Transportation of Selected Contaminants in Yukon*. DIAND.

2. K. Bisset and Associates, April 1995. *Research of Former Military Sites and Activities in the Yukon*. For AES - Action on Waste, DIAND.

3. C.C.M.E. (Canadian Council of Ministers of the Environment), December 1993. *Guidance Manual on Sampling, Analysis, and Data Management for Contaminated Sites, Volumes I, II, and III.*

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5. Nation Air Photo Library, 1945 - 1964. Stereo pairs of four sites, located at Yukon Archives Reference room.

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7. Basil Dowd, 1996. Personal Communication, telephone interview.

8. Edey, C.E. 1976. *Alaska Highway - Haines Road Clean Up Assessment Study 1976*. Prepared for Land Use Section, DIAND.

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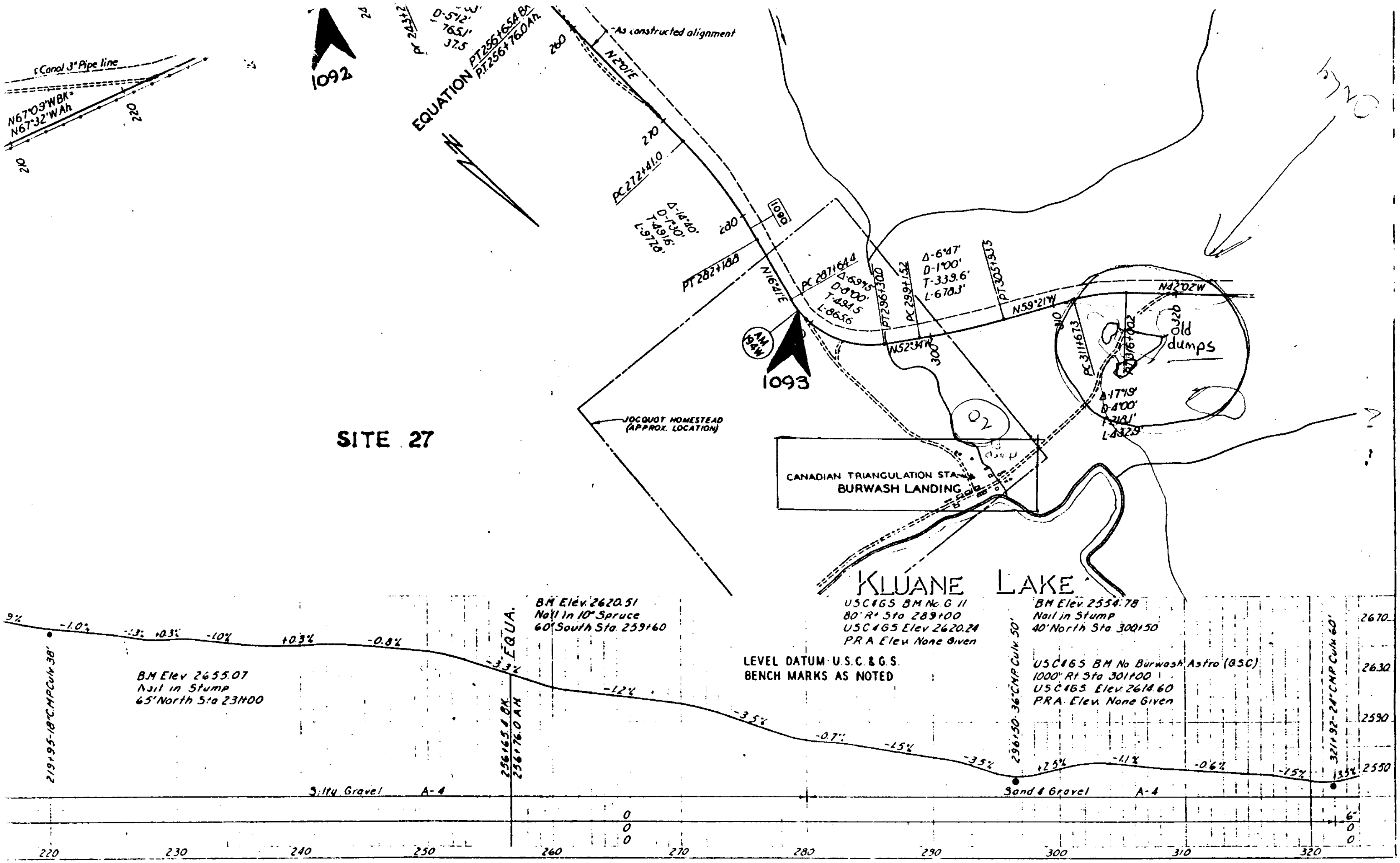
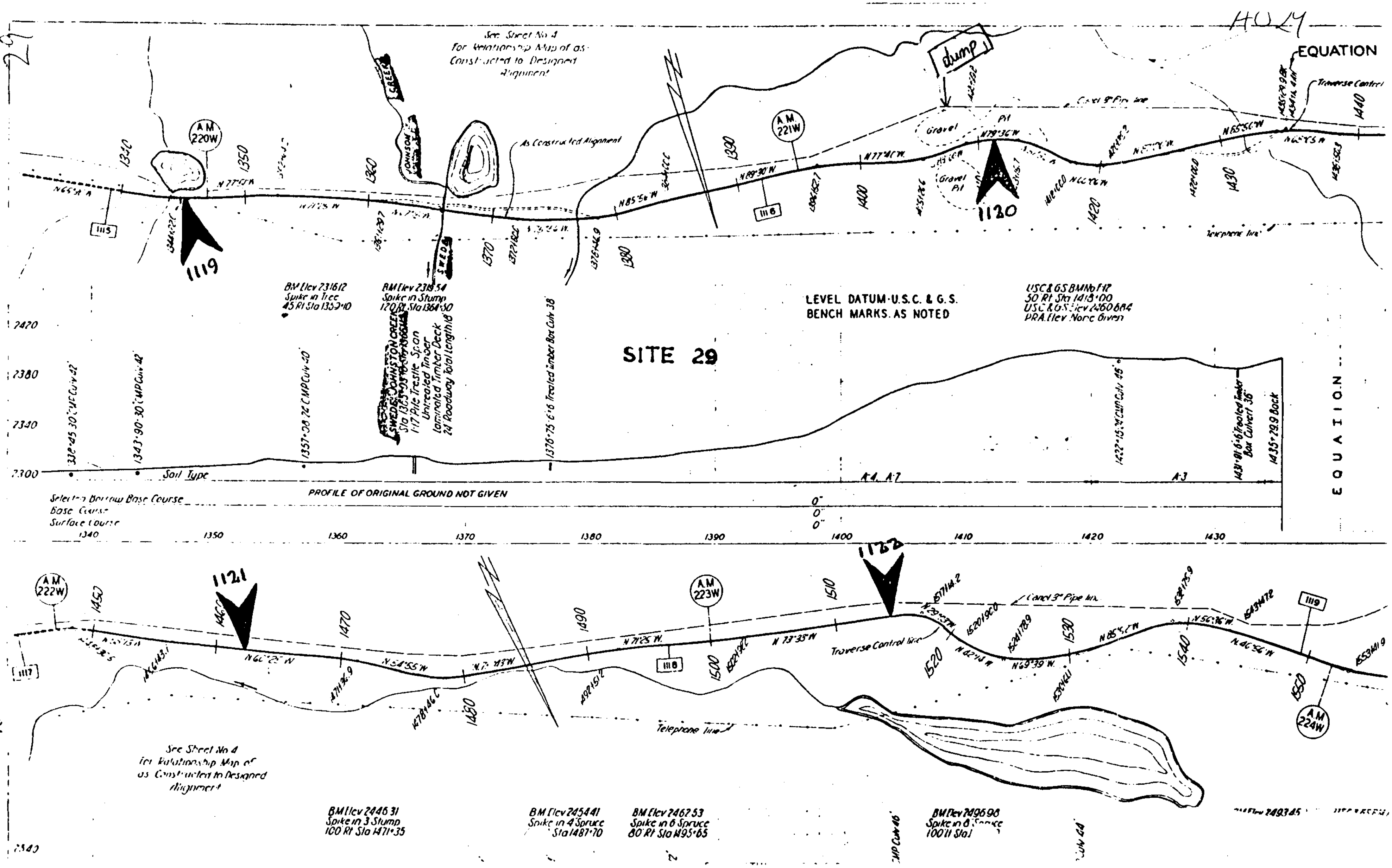
APPENDIX ONE

ARCHIVAL DOCUMENTS

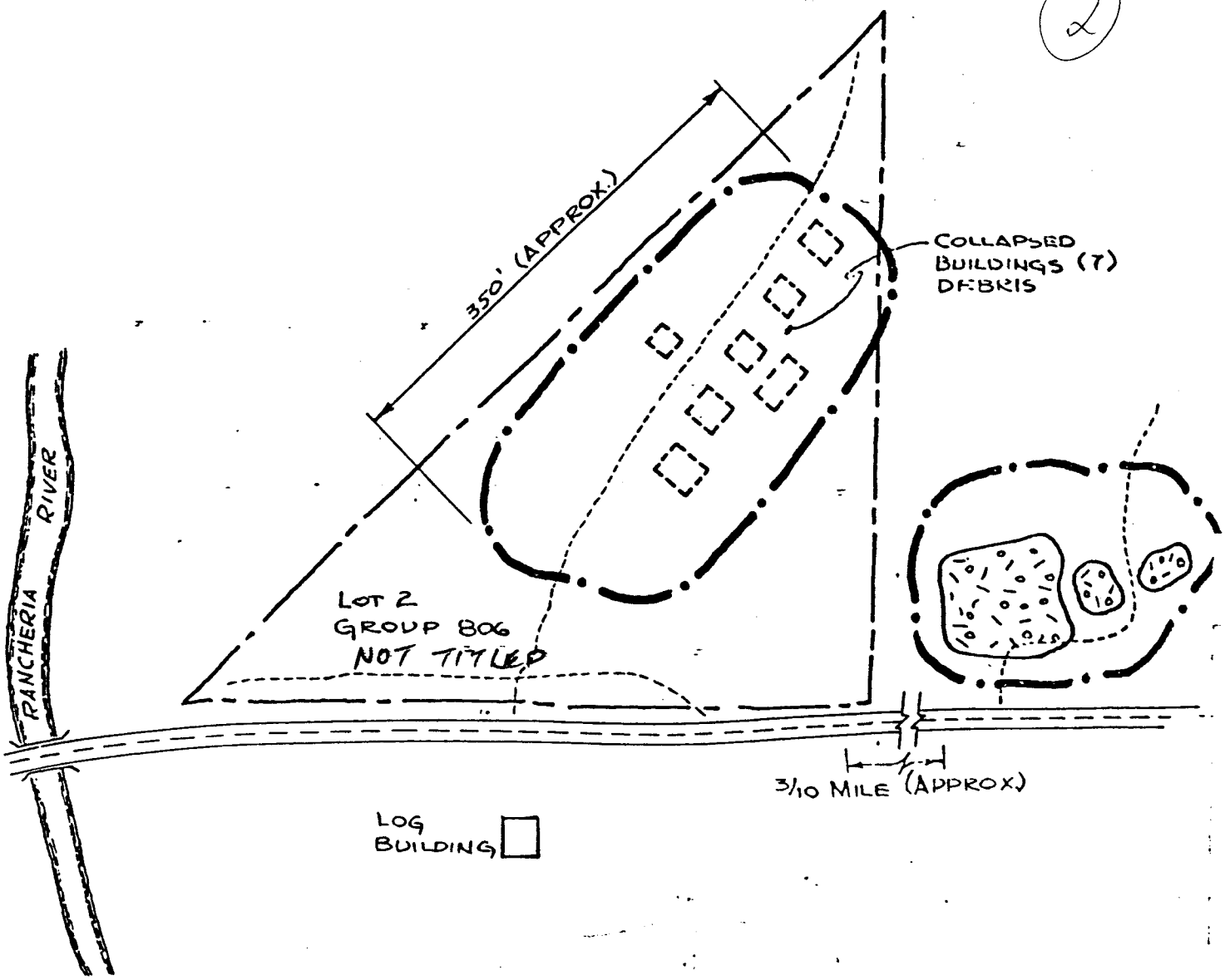


SITE 27
KLUANE LAKE
CANADIAN TRIANGULATION STA.
BURWASH LANDING
JOCQUOT HOMESTEAD (APPROX. LOCATION)
As constructed alignment
Canol 3" Pipe line
N67°09'W BK
N67°32'W Ah
EQUATION PT 256+65.4 Bk PT 256+76.0 Ah
1092
1093
PC 272+41.0
PT 282+18.8
PC 287+64.4
PT 296+30.0
PC 299+1.52
PT 305+13.3
PC 311+67.3
N20°11'E
N16°11'E
N52°34'W
N59°21'W
N42°02'W
Δ-6°47' D-1°00' T-339.6' L-678.3'
Δ-17°19' D-4°00' T-218.1' L-432.9'
old dumps
BM Elev 2620.51
Nail In 10" Spruce
60' South Sta. 259+60
USC&GS BM No. G 11
80' Rt Sta 289+00
USC&GS Elev 2620.24
PRA Elev None Given
BM Elev 2554.78
Nail in Stump
40' North Sta 300+50
LEVEL DATUM U.S.C.&G.S.
BENCH MARKS AS NOTED
USC&GS BM No Burwash Astro (GSC)
1000' Rt Sta 301+00
USC&GS Elev 2614.60
PRA Elev None Given
BM Elev 2655.07
Nail in Stump
65' North Sta 231+00
219+95-18" CMP Culv 38'
256+65.4 BK 256+76.0 AH
EQUA.
296+50-36" CMP Culv 50'
321+92-24" CMP Culv 60'
Silty Gravel A-4
Sand & Gravel A-4
2670
2630
2590
2550
220 230 240 250 260 270 280 290 300 310 320



SITE 29
LEVEL DATUM-U.S.C. & G.S.
BENCH MARKS AS NOTED
See Sheet No 4
For Relationship Map of as-Constructed to Designed Alignment
As Constructed Alignment
EQUATION
Traverse Control
Canol 3" Pipe line
Telephone line
Gravel Pit
dump
Swede Johnston Creek
1119
1120
1121
1122
A.M. 220W
A.M. 221W
A.M. 222W
A.M. 223W
A.M. 224W
BM Elev 2316.12
Spike in Tree
45 Rt Sta 1352+10
BM Elev 2318.54
Spike in Stump
120 Rt Sta 1364+50
USC&GS BM No F17
50 Rt Sta 1418+00
USC&GS Elev 2460.664
PRA Elev None Given
Untreated Timber
Laminated Timber Deck
24' Roadway Total Length 18'
1376+75 6'x6' Treated Timber Box Culv 38'
1435+29.9 Back
Soil Type
PROFILE OF ORIGINAL GROUND NOT GIVEN
Selected Borrow Base Course
Base Course
Surface Course
2420
2380
2340
2300
1340
1350
1360
1370
1380
1390
1400
1410
1420
1430
Traverse Control line
BM Elev 2446.31
Spike in 3' Stump
100 Rt Sta 1471+35
BM Elev 2454.41
Spike in 4' Spruce
Sta 1487+70
BM Elev 2462.53
Spike in 6' Spruce
80 Rt Sta 1495+65
BM Elev 2496.98
Spike in 8' Spruce
BM Elev 2493.45

(2)



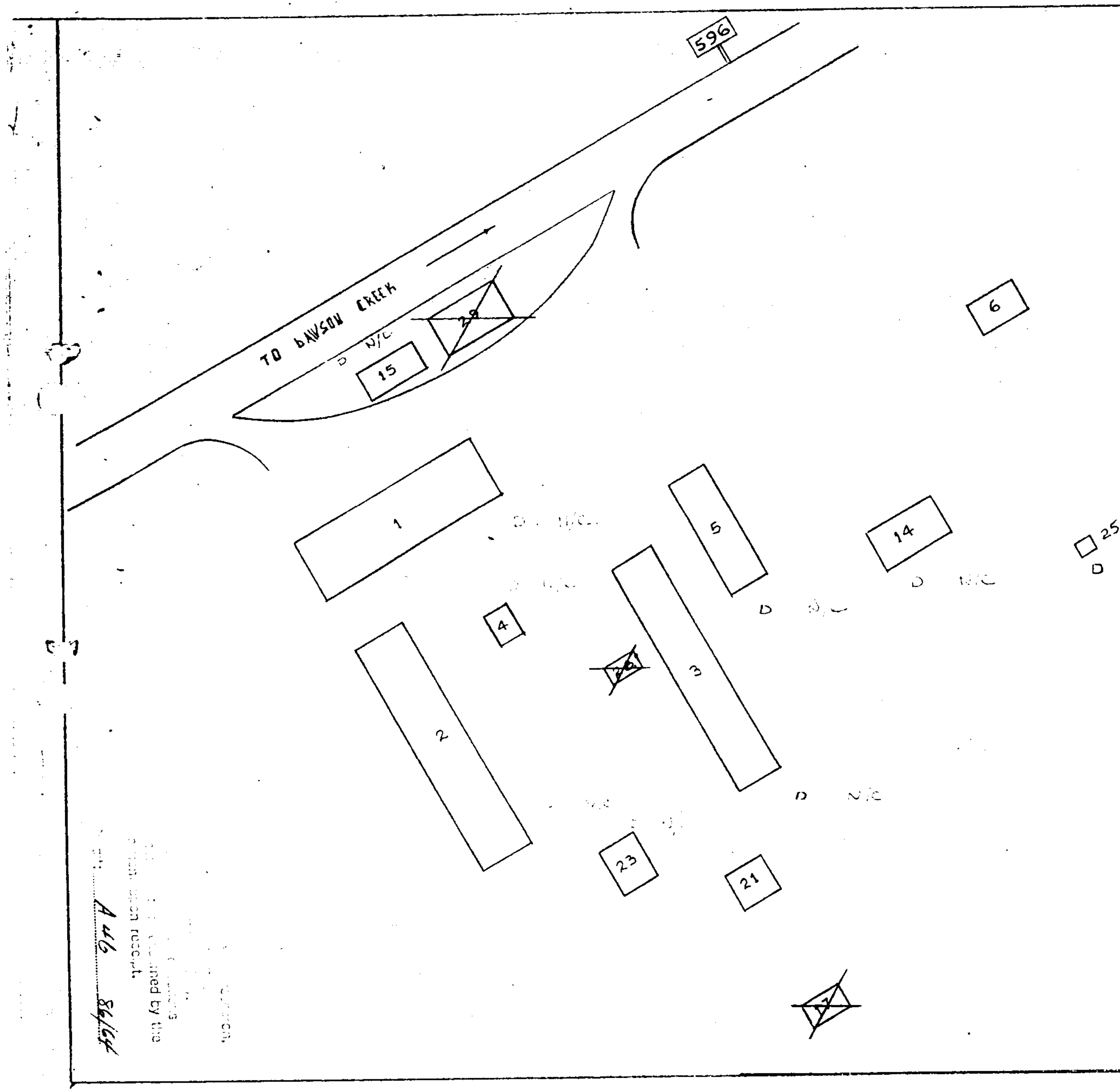
SITE 2

NORTH

ALASKA HIGHWAY
MILE - 687.0

FIGURE 4

KDK-1, C.6. 1976



SCHEDULE of BUILDINGS

Nº	SIZE	SQ. FT	TYPE	REMARKS
1	36'x96'	3.456	FRAME	LOG SIDING
2	30'x120'	3.600	"	PAPER "
3	30'x150'	4 500	"	" " MESS
4	12'x16'	192	"	" "
5	20'x60'	1.200	"	" "
6	15'x24'	360	"	" "
14	20'x36'	720	"	" "
15	15'x30'	450	"	LOG SIDING
16	20'x50'	1000	"	" "
~~17~~	~~12'x20'~~	~~240~~	~~"~~	~~" "~~
21	20'x20'	400	"	TENT FRAME
23	26'x26'	676	"	ICE HOUSE
25	8'x8'	64	"	LATRINE
~~28~~	~~9'x17'~~	~~153~~	~~"~~	~~PAPER SIDING~~
~~29~~	~~20'x30'~~	~~600~~	~~TIMBER~~	~~LOADING PLATFM~~

CHECKED [illegible] AUG 1957
CHECKED [illegible] JUNE [illegible]

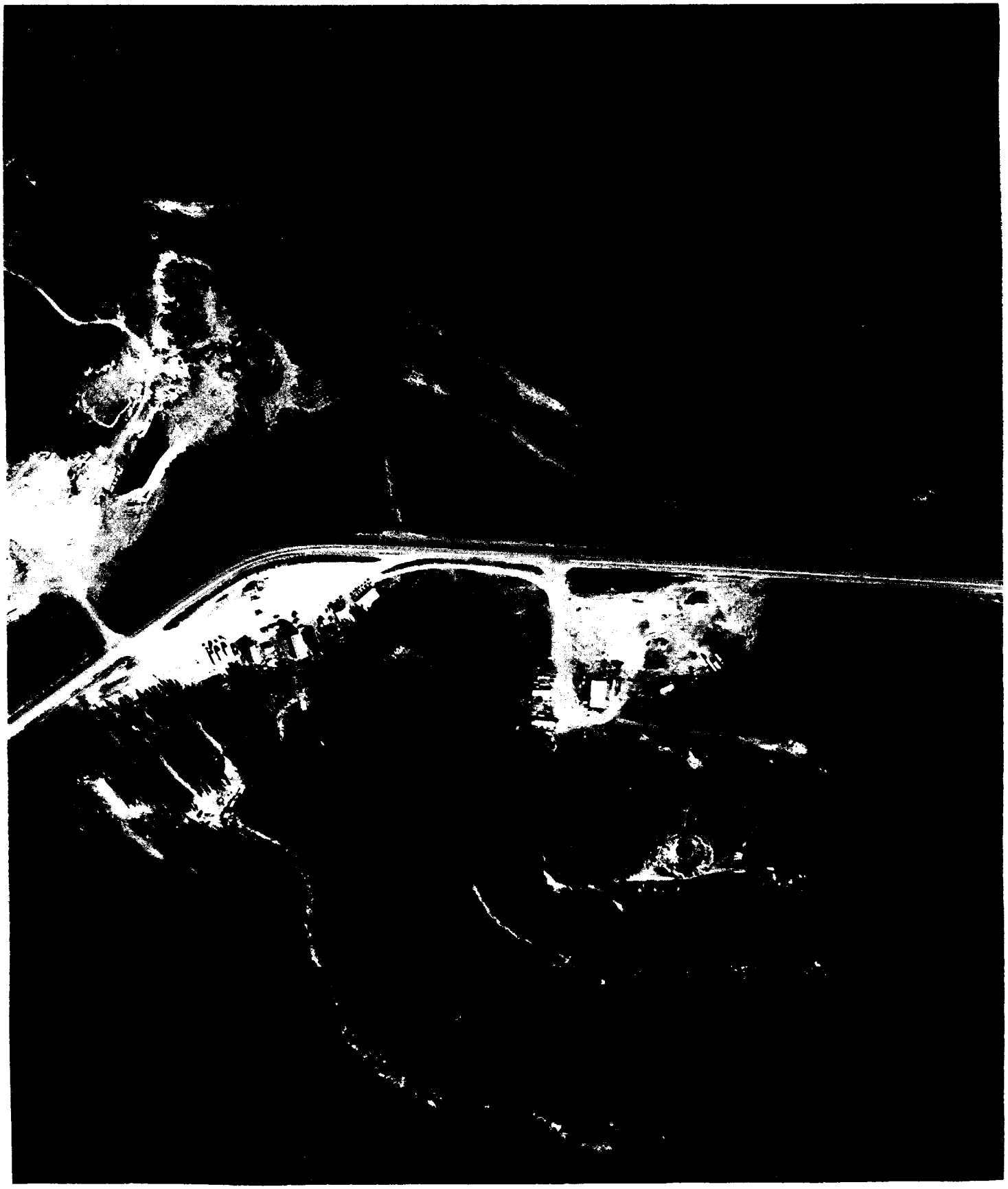
DEPARTMENT OF NATIONAL DEFENCE (ARMY)
NORTHWEST HIGHWAY SYSTEM
WHITEHORSE YUKON TERRITORY

CAMP MILE 596
SITE 1

DRAWN BY M.J.C.	APPROVED BY
CHECKED BY	
SCALE 1" = 50'0"	No. A.C. 596
DATE OCT. 1953	

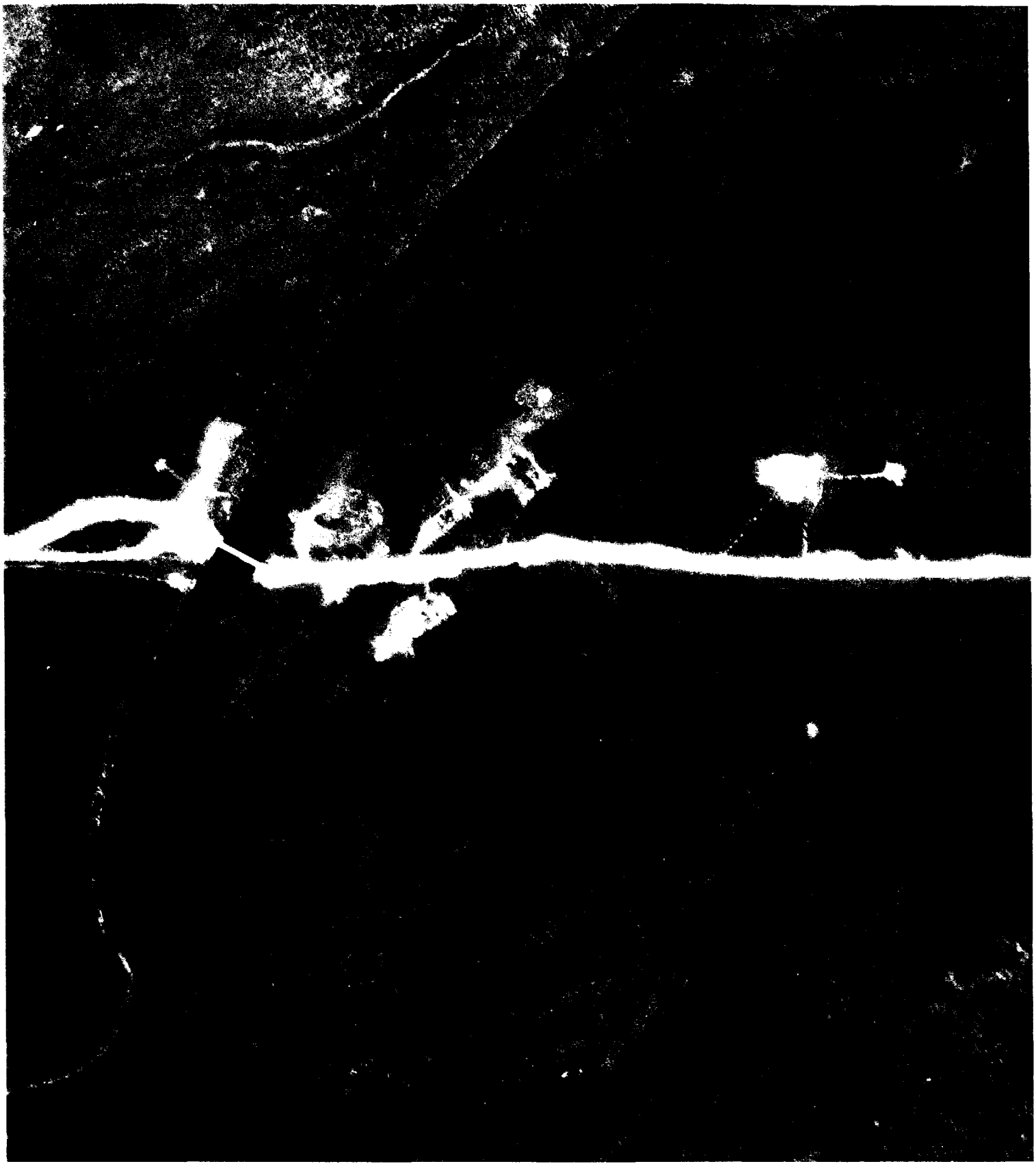
APPENDIX TWO

AIR PHOTOGRAPHS



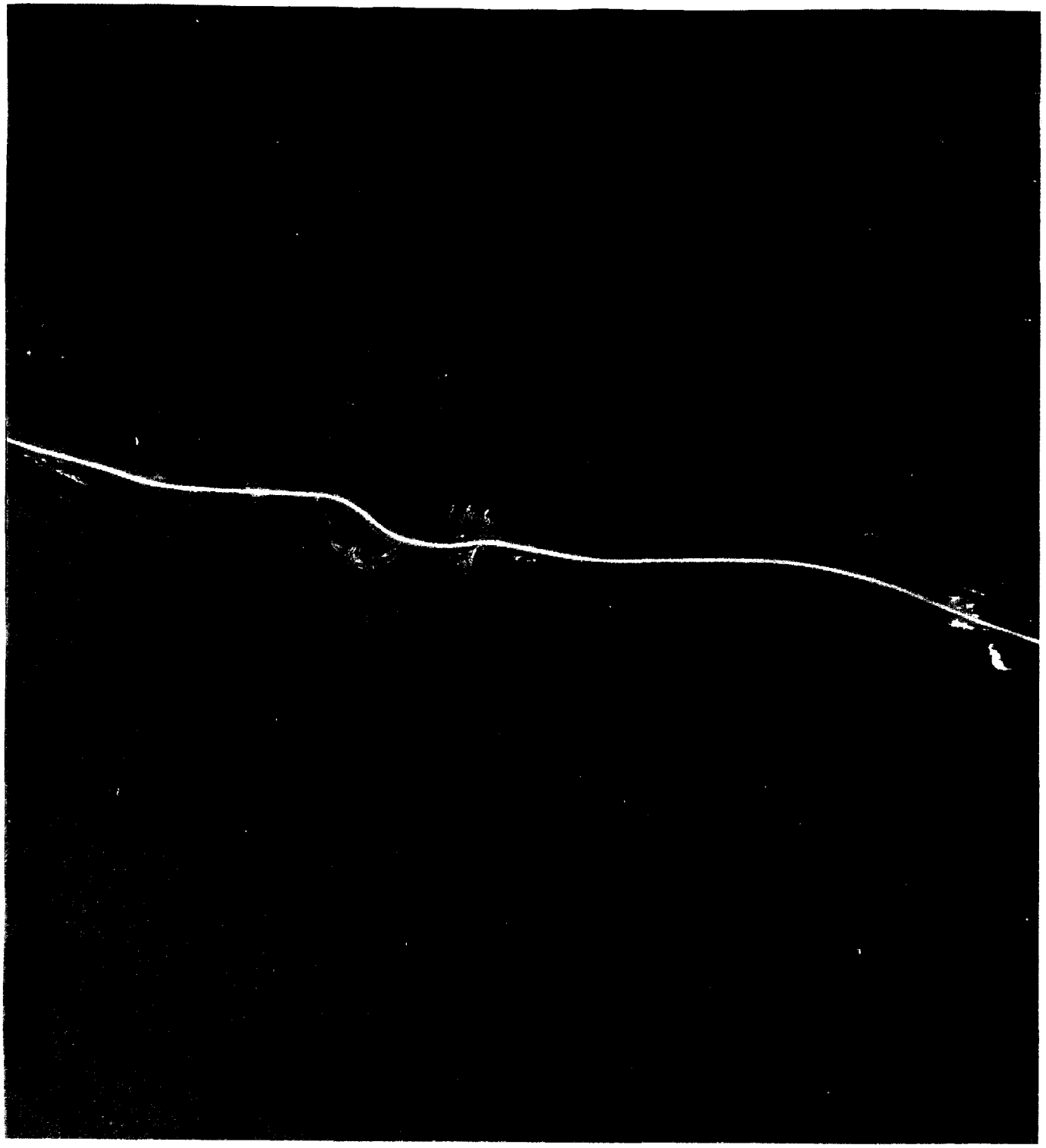
A28106-70 August 1994 Scale 1:2000

Site No. 1 - Iron Creek Camp, old Mile Post 596



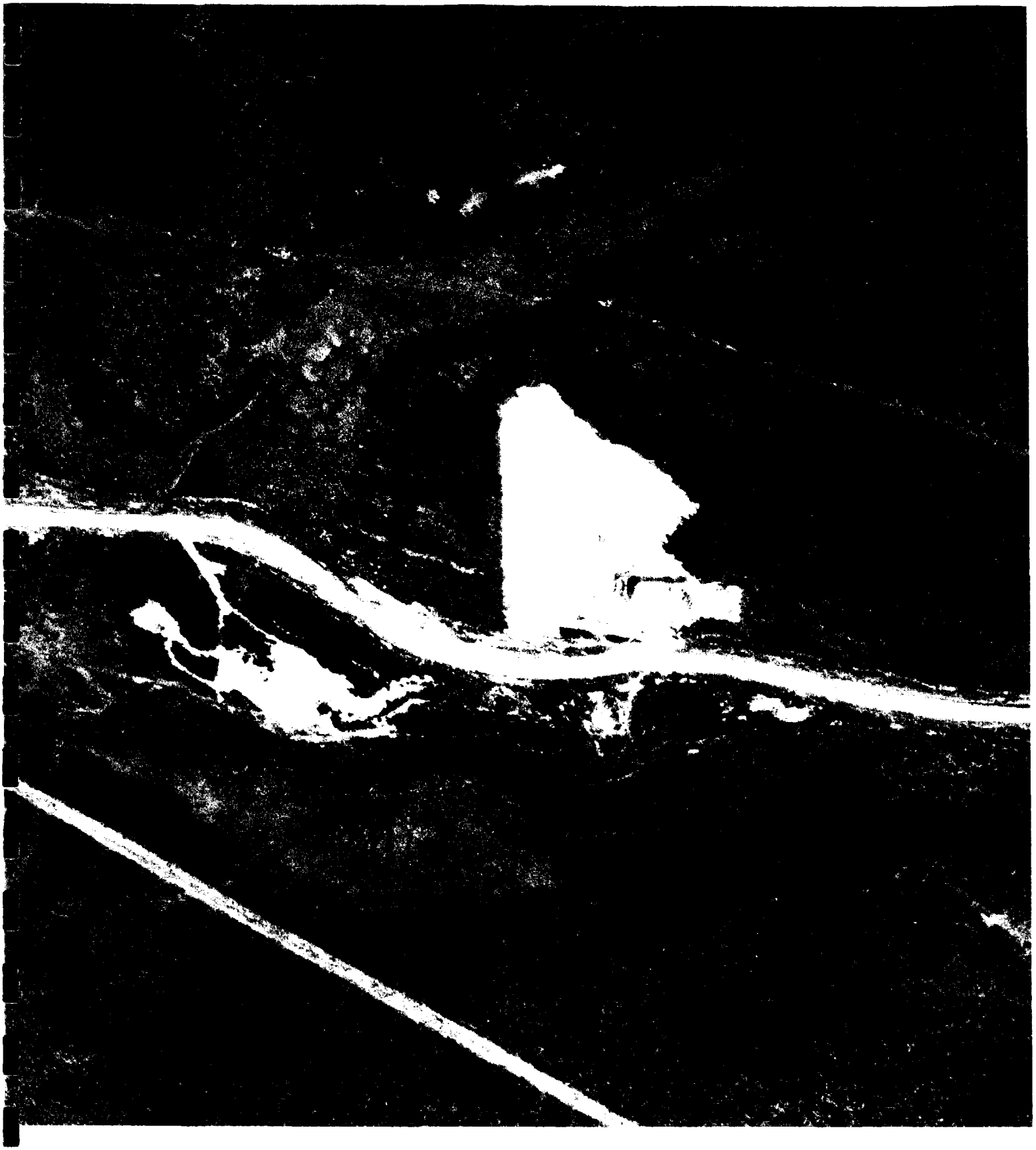
A11370-409 RCAF 1947 Scale 1:8000

Site No. 2 - Lower Rancheria Camp



A22997-62 1947 Scale 1:8000

Site No. 29 - Old dumps near Swede Johnson Creek, old Mile Post 1120

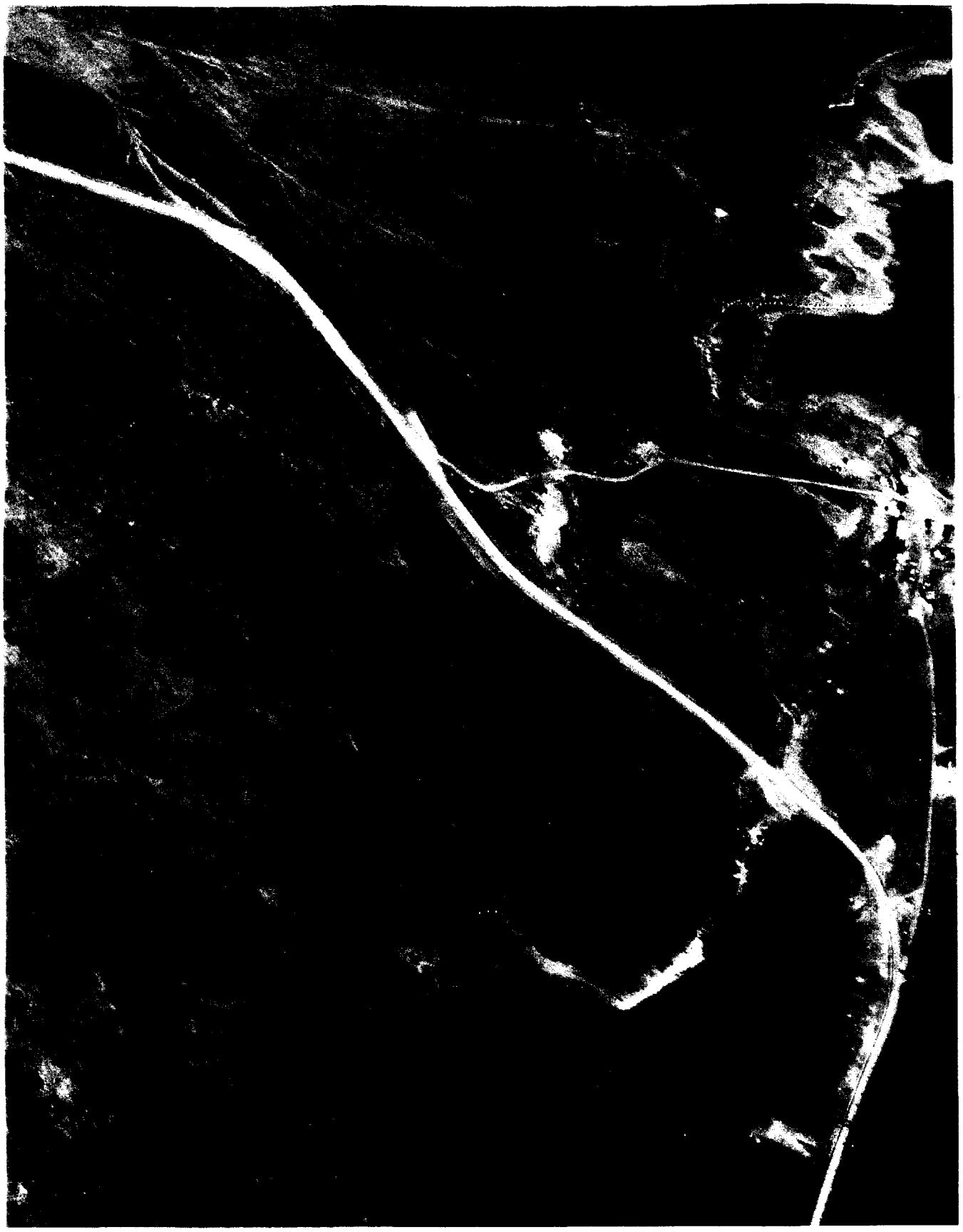


A27475-87 1989 Scale 1:4000

Site No. 29 - Old dump near Swede Johnson Creek, old Mile Post 1120

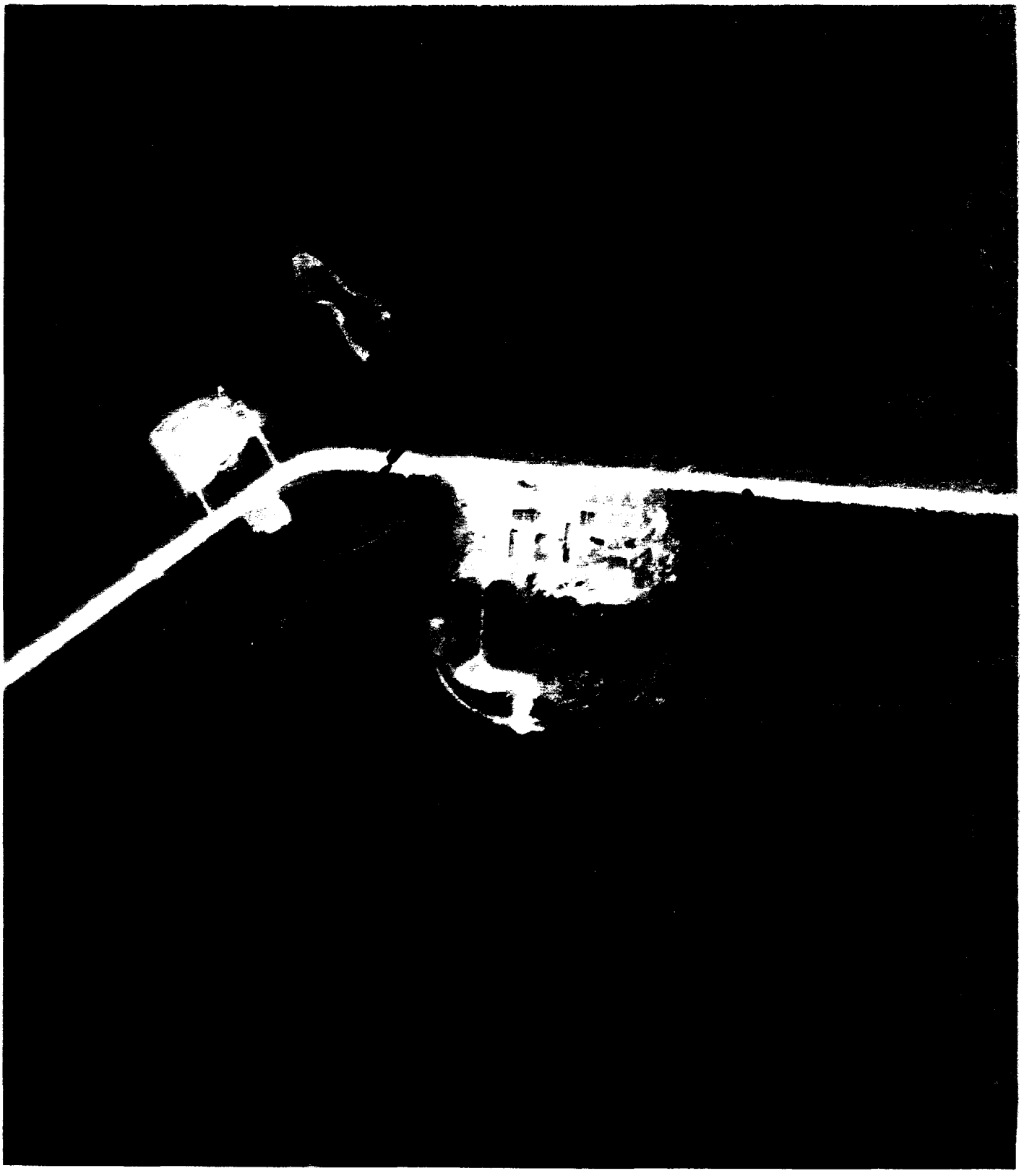
A27218-266 1987 Scale 1:4000

Site No. 27 - Old dumps near Burwash Landing



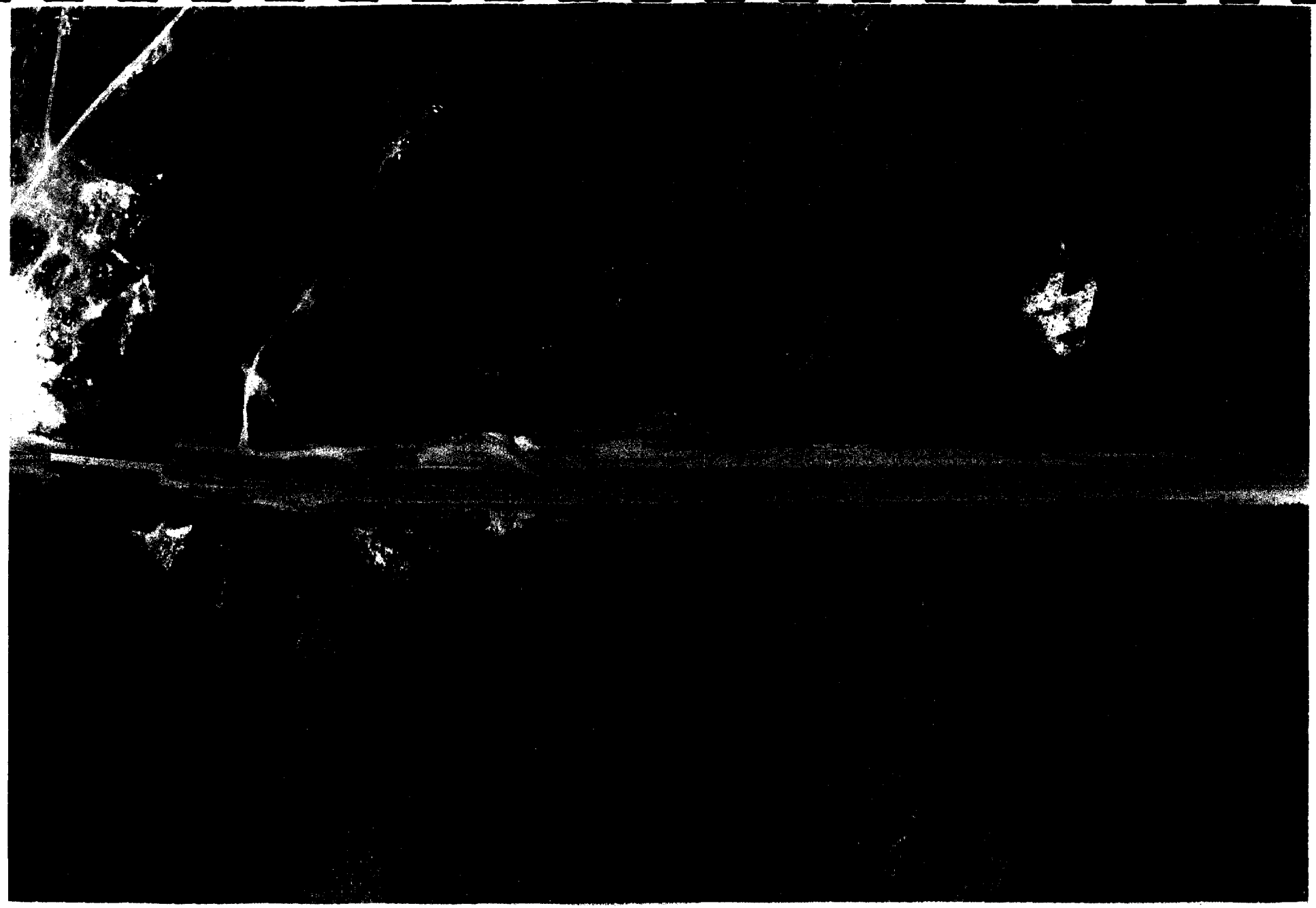
A13476-102 RCAF 1947 Scale 1:8000

Site No. 27 - Old dumps near Burwash Landing



A11347-438 RCAF 1947 Scale 1:8000

Site No. 1 - Iron Creek Camp, old Mile Post 596



A27829-110 June 1992 Scale 1:4000

Site No. 2 - Lower Rancheria Camp

APPENDIX THREE

SITE PLANS

APPENDIX FOUR

TEST PIT LOGS

TEST PIT LOG

VERTICAL SCALE: —
DATE: Sept. 9, 1996
EQUIPMENT TYPE: backhoe

DEPTH (m)	SYMBOL	DESCRIPTION OF MATERIAL	PIEZOMETER
0.1		organics, root zone, brown sandy SILT.	
1.1		silty sand, GRAVEL, dry.	
2.3		gravelly SAND fill, metal and plastic waste, water table at 2.2 m	
3.4		dense, silty, TILL. piezometer installed at 3.4m 1" Ø PVC hand slotted.	1" PVC
		END OF PIT 3.4 m sampled at 0.6, 2.3 m eastern limit of old back-filled garbage dump.	

Laberge Environmental Services
Box 5111, Whitehorse, YT Y1A 4S3
Tel: (403) 668-6838
Fax: (403) 667-6956

Job No. 96-11
Project: site Assessment, A.E.S.
Location: Iron Creek Camp
Pit No. T.P. I-1

TEST PIT LOG

VERTICAL SCALE: —
DATE: Sept. 9, 1996
EQUIPMENT TYPE: backhoe

DEPTH (m)	SYMBOL	DESCRIPTION OF MATERIAL	PIEZOMETER
0.2		silty SAND, brown, organics.	
0.5		dense sandy, silty, TILL.	
1.5		dense, sandy, TILL, grey. cold, dry.	
		END OF PIT 1.5 m pit located below old loading ramp, oily stain on surface sampled at 0.6, 1.5 m	

Laberge Environmental Services
Box 5111, Whitehorse, YT Y1A 4S3
Tel: (403) 668-6838
Fax: (403) 667-6956

Job No. 96-11
Project: Site Assessment, H.E.S.
Location: Iron Creek Camp
Pit No. TPI-2

TEST PIT LOG

VERTICAL SCALE: –
DATE: Sept. 9, 1996
EQUIPMENT TYPE: backhoe

DEPTH (m)	SYMBOL	DESCRIPTION OF MATERIAL	PIEZOMETER
0.10		sandy brown GRAVEL, organics, root zone.	
1.5		metal waste in sandy, GRAVEL	
		END OF PIT 1.5 m pit located in centre of old backfilled dump sampled at 1.4 m	

Laberge Environmental Services
Box 5111, Whitehorse, YT Y1A 4S3
Tel: (403) 668-6838
Fax: (403) 667-6956

Job No. 96-11
Project: Site Assessment, AES.
Location: Iron Creek Camp
Pit No. TP I-3

TEST PIT LOG

VERTICAL SCALE: —
DATE: Sept. 9, 1996
EQUIPMENT TYPE: backhoe

DEPTH (m)	SYMBOL	DESCRIPTION OF MATERIAL	PIEZOMETER
0.35		reddish brown, gravelly SAND, organics, root zone	
1.0		silty, gravelly, SAND. mottled at 0.8m	
3.0		sandy, gravelly, SILT. sandy GRAVEL. water table (seasonal, now dry)	
4.2		sandy, GRAVEL.	
		END OF PIT 4.2 m pit near old hopper 25m North of B.C. border sampled at 1.0m and 4.2m	

Laberge Environmental Services
Box 5111, Whitehorse, YT Y1A 4S3
Tel: (403) 668-6838
Fax: (403) 667-6956

Job No. 96-11
Project: Site Assessment A.E.S.
Location: Iron Creek Camp
Pit No. TP I-4

TEST PIT LOG

VERTICAL SCALE

DATE:

EQUIPMENT TYPE:

DEPTH	SYMBOL	DESCRIPTION OF MATERIAL	PIEZOMETER
0.2		gravelly, SAND. organics, rootzone.	
1.0		silty, sandy, GRAVEL. dry.	
3.0		gravelly, SAND. dry.	
		END OF PIT 3.0 m pit located beside old grader hulk. sampled at 3.0 m	

Laberge Environmental Services
Box 5111, Whitehorse, YT Y1A 4S3
Tel: (403) 668-6838
Fax: (403) 667-6956

Job No. 96-11

Project: Site Assessments, A.E.S.

Location: Iron Creek Camp

Pit No. TP I-5

TEST PIT LOG

VERTICAL SCALE ~

DATE: Sept. 10, 1996

EQUIPMENT TYPE: backhoe

DEPTH	SYMBOL	DESCRIPTION OF MATERIAL	PIEZOMETER
0.2		reddish brown silty, sand, organics. root zone.	
		sandy ~~silt~~, Stoney, GRAVEL dry.	
1.7		END OF PIT AT 1.7m pit located at south west corner of site boundary sampled at 1.7m	

Laberge Environmental Services

Box 5111, Whitehorse, YT Y1A 4S3

Tel: (403) 668-6838

Fax: (403) 667-6956

Job No. 96-11

Project: Site Assessments AES.

Location: Iron Creek Camp

Pit No. TP I-6

TEST PIT LOG

VERTICAL SCALE: —
DATE: Sept. 10, 1996
EQUIPMENT TYPE: backhoe

DEPTH	SYMBOL	DESCRIPTION OF MATERIAL	PIEZOMETER
0.2		peat, decomposed organics, trees.	
1.0		woody debris in gravelly, TILL.	
2.9		very dense sandy, silty, TILL, frozen at 2.8m	
		END OF PIT 2.9m pit located near old U.S. Army pit 50m. South of highway sampled at 1.1m, just above permafrost.	

Laberge Environmental Services
Box 5111, Whitehorse, YT Y1A 4S3
Tel: (403) 668-6838
Fax: (403) 667-6956

Job No. 96-11
Project: Site Assessments, AES.
Location: Iron Creek Camp
Pit No. TPI-7

TEST PIT LOG

VERTICAL SCALE

DATE:

EQUIPMENT TYPE:

DEPTH	SYMBOL	DESCRIPTION OF MATERIAL	PIEZOMETER
0.2		silty, sandy, ORGANICS. FILL. root zone	
1.0m		recent metal waste in sandy GRAVEL fill. dry.	
2.0		gravelly, sandy, SILT, fill. dry.	
3.2		old garbage (1940's beer cans), in organic silty, SAND, fill. original ground at 2.8m dry.	
		END OF PIT 3.2 m sampled at ~~2.8m~~ 2.5m pit located at crest of old garbage dump backfilled ~~at~~ about 1978.	

Laberge Environmental Services

Box 5111, Whitehorse, YT Y1A 4S3

Tel: (403) 668-6838

Fax: (403) 667-6956

Job No. 96-11

Project: Site Assessment AES.

Location: Lower Rancheria

Pit No. TPR-1

TEST PIT LOG

VERTICAL SCALE: —

DATE: Sept. 10 1996

EQUIPMENT TYPE: backhoe

DEPTH	SYMBOL	DESCRIPTION OF MATERIAL	PIEZOMETER
0.1		silty, sandy, GRAVEL. organics, root zone.	
2.7		sandy, GRAVEL, fill. recent waste near surface. old stuff at bottom, mixed mostly metal waste. more beer cans circa 1940.	
		END OF PIT 2.7 pit located at crest of old dump site, northern limit. Sampled at 2.7 m	

Laberge Environmental Services
Box 5111, Whitehorse, YT Y1A 4S3
Tel: (403) 668-6838
Fax: (403) 667-6956

Job No. 96-11

Project: Site Assessments A.E.S.

Location: Lower Rancheria

Pit No. TP R-2

TEST PIT LOG

VERTICAL SCALE —

DATE:

EQUIPMENT TYPE:

DEPTH (m)	SYMBOL	DESCRIPTION OF MATERIAL	PIEZOMETER
0.25		reddish brown sandy GRAVEL. organics, root zone. dry	
2.3		sandy, GRAVEL. dry	
		END OF PIT 2.3m pit dug at toe of old dump site to sample for hydrocarbon at 2.3m.	

Laberge Environmental Services

Box 5111, Whitehorse, YT Y1A 4S3

Tel: (403) 668-6838

Fax: (403) 667-6956

Job No. 96-11

Project: & Site Assessments A.E.S.

Location: Lower Rancheria

Pit No. TP R-3

TEST PIT LOG

VERTICAL SCALE: —
DATE: Sept. 11, 1996
EQUIPMENT TYPE: backhoe

DEPTH (m)	SYMBOL	DESCRIPTION OF MATERIAL	PIEZOMETER
0.5		sandy, LOAM · organics. root zone reddish brown.	
1.5		crumbly, sandy, silty, TILL. gray. very dry.	
1.7		blue grey fairly dense, silty, TILL. dry.	
		END OF PIT 1.7m pit located at southern limit of old dump site sampled at 1.0m	

Laberge Environmental Services
Box 5111, Whitehorse, YT Y1A 4S3
Tel: (403) 668-6838
Fax: (403) 667-6956

Job No. 96-11
Project: Site Assessments, AES.
Location: Burwash Landing
Pit No. TP B-1

TEST PIT LOG

VERTICAL SCALE: ~

DATE: Sept. 11, 1996

EQUIPMENT TYPE: backhoe

DEPTH (m)	SYMBOL	DESCRIPTION OF MATERIAL	PIEZOMETER
0.3		metal waste in silty, organics, SAND, fill.	
1.0		sandy GRAVEL. dry.	
3.5		blue grey, silty, dense, TILL. water table encountered 3.5m	
3.7		saturated blue grey till	
		END OF PIT 3.7m pit located midway along easternmost crest of old dump. Sampled at 3.7 m	

Laberge Environmental Services
Box 5111, Whitehorse, YT Y1A 4S3
Tel: (403) 668-6838
Fax: (403) 667-6956

Job No. 96-11

Project: Site Assessments AES.

Location: Burwash Landing

Pit No. TP B-2

TEST PIT LOG

VERTICAL SCALE —

DATE: Sept. 11, 1996

EQUIPMENT TYPE: backhoe

DEPTH (m)	SYMBOL	DESCRIPTION OF MATERIAL	PIEZOMETER
0.1		reddish brown organics, loess.	
.5		very fine, SILT, LOESS.	
2.5		dense, sandy, TILL. Permafrost encountered at 2.0m	
		END OF PIT 2.5 m	
		pit located midway between old dump and meadow.	
		sampled at 1.8m	

Laberge Environmental Services
Box 5111, Whitehorse, YT Y1A 4S3
Tel: (403) 668-6838
Fax: (403) 667-6956

Job No. 96-11

Project: Site Assessments, AES

Location: Burwash Landing

Pit No. TP B-3

TEST PIT LOG

VERTICAL SCALE —

DATE: Sept. 11, 1996

EQUIPMENT TYPE: backhoe

DEPTH (m)	SYMBOL	DESCRIPTION OF MATERIAL	PIEZOMETER
0.6		reddish brown, organics, LOESS.	
0.7		very fine SAND. dry	
1.7		sandy, stoney GRAVEL dry	
2.0		stoney, dense, sandy, TILL. wet	
2.7		permafrost, sandy TILL.	
2.8		dense, frozen, gravelly, TILL.	
		END OF PIT 2.8m pit located in northwest corner of site. sampled at 2.7m just above permafrost layer.	

Laberge Environmental Services
Box 5111, Whitehorse, YT Y1A 4S3
Tel: (403) 668-6838
Fax: (403) 667-6956

Job No. 96-11

Project: Site Assessments AES

Location: Burwash Landing

Pit No. TP B-4

TEST PIT LOG

VERTICAL SCALE: —
DATE: Sept. 12, 1996
EQUIPMENT TYPE: backhoe

DEPTH (m)	SYMBOL	DESCRIPTION OF MATERIAL	PIEZOMETER
0.15		organics, dark grey silty, SAND. backfill.	
1.5		silty, SAND. fill. old metal and wood waste.	
1.7		peat layer	
1.9		white uniform fine SAND.	
3.0		sitly peat layer, saturated sand underneath to 3.0 water table at 2.8m	
		END OF PIT 3.0m pit located at western end of old backfilled dump sampled at 2.3m	

Laberge Environmental Services
Box 5111, Whitehorse, YT Y1A 4S3
Tel: (403) 668-6838
Fax: (403) 667-6956

Job No. 96-11
Project: Site Assessments AES
Location: Old dump near Swede Johnson
Pit No. TPS-1

TEST PIT LOG

VERTICAL SCALE: —
DATE: Sept. 12, 1996
EQUIPMENT TYPE: backhoe

DEPTH (m)	SYMBOL	DESCRIPTION OF MATERIAL	PIEZOMETER
0.5		silty, SAND. fill. organics.	
1.3		old metal waste, glycol cans etc. in sandy fill.	
2.0 2.2		peat layer	
2.8		white fine uniform SAND water table at 2.5m	
		END OF PIT 2.8 m pit located at easternmost end of old backfilled dump. sampled at 2.3 m	

Laberge Environmental Services
Box 5111, Whitehorse, YT Y1A 4S3
Tel: (403) 668-6838
Fax: (403) 667-6956

Job No. 96-11
Project: Site Assessments AES.
Location: old dump near Swede Johnson
Pit No. TP S-2

APPENDIX FIVE

ANALYSIS REPORTS - NORWEST LABS

NORWEST LABS

EDMONTON PH. (403) 438-5522 FAX (403) 438-0396
CALGARY PH. (403) 291-2022 FAX (403) 291-2021
LANGLEY PH. (604) 530-4344 FAX (604) 534-9996
LETHBRIDGE PH. (403) 329-9266 FAX (403) 327-8527
WINNIPEG PH. (204) 982-8630 FAX (204) 275-6019

DATE 20 SEP 96 08:30
P.O. NO. 96-09-2139
W.O. NO. 2 119049
PAGE 1

NORWEST LABS-CALGARY
BAY 6, 2712-37 AVE NE
CALGARY, AB
T1Y 5L3

LABERGE ENVIRON.

WATER ANALYSIS REPORT

SAMPLE		1 W1991 T.P.S-1	2 W1992 T.P.S-2	3 W1993 SWEDE JOHNSON TRIB U/S CREEK	4 W1994 SWEDE JOHNSON TRIB D/S CREEK
ORGANICS					
OIL AND GREASE	mg/L	<0.2	<0.2	<0.2	<0.2
TRACE ICP,DISS					
ALUMINUM	mg/L	0.076	0.019		
ANTIMONY	mg/L	<0.005	<0.005		
ARSENIC	mg/L	<0.01	<0.01		
BARIUM	mg/L	0.106	0.0752		
BERYLLIUM	mg/L	<0.0005	<0.0005		
BISMUTH	mg/L	<0.007	<0.007		
BORON	mg/L	0.005	0.021		
CADMIUM	mg/L	<0.0005	<0.0005		
CALCIUM	mg/L	40.7	62.6		
CHROMIUM	mg/L	0.0014	0.0009		
COBALT	mg/L	0.0029	0.0024		
COPPER	mg/L	0.003	0.006		
IRON	mg/L	2.10	0.082		
LEAD	mg/L	0.003	<0.002		
LITHIUM	mg/L	0.00123	0.00247		
MANGANESE	mg/L	1.63	1.09		
MAGNESIUM	mg/L	7.25	11.6		
MOLYBDENUM	mg/L	0.002	0.002		
NICKEL	mg/L	0.005	0.004		
PHOSPHORUS	mg/L	<0.006	<0.006		
POTASSIUM	mg/L	1.75	4.52		
SELENIUM	mg/L	<0.003	<0.003		
SILICON	mg/L	8.06	8.00		
SILVER	mg/L	<0.001	0.001		
SODIUM	mg/L	3.05	4.13		
STRONTIUM	mg/L	0.113	0.204		
SULPHUR	mg/L	2.46	3.86		
THALLIUM	mg/L	<0.004	<0.004		
TIN	mg/L	0.005	0.009		
TITANIUM	mg/L	0.0010	0.0007		
VANADIUM	mg/L	<0.001	<0.001		
ZINC	mg/L	0.0191	0.0073		

Lab Manager:

NORWEST LABS

EDMONTON PH. (403) 438-5522 FAX (403) 438-0396
CALGARY PH. (403) 291-2022 FAX (403) 291-2021
LANGLEY PH. (604) 530-4344 FAX (604) 534-9996
LETHBRIDGE PH. (403) 329-9266 FAX (403) 327-8527
WINNIPEG PH. (204) 982-8630 FAX (204) 275-6019

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P.O. NO. 96-09-2139
W.O. NO. 2 119049
PAGE 2

NORWEST LABS-CALGARY
BAY 6, 2712-37 AVE NE
CALGARY, AB
T1Y 5L3

LABERGE ENVIRON.

WATER ANALYSIS REPORT

SAMPLE		1 W1991 T.P.S-1	2 W1992 T.P.S-2	3 W1993 SWEDE JOHNSON TRIB U/S CREEK	4 W1994 SWEDE JOHNSON TRIB D/S CREEK
TRACE ICP,TOTAL					
ALUMINUM	mg/L			0.033	0.097
ANTIMONY	mg/L			0.007	<0.005
ARSENIC	mg/L			<0.01	0.01
BARIUM	mg/L			0.0225	0.0304
BERYLLIUM	mg/L			<0.0005	<0.0005
BISMUTH	mg/L			<0.007	<0.007
BORON	mg/L			0.005	0.003
CADMIUM	mg/L			<0.0005	<0.0005
CALCIUM	mg/L			27.8	28.7
CHROMIUM	mg/L			<0.0008	<0.0008
COBALT	mg/L			<0.0007	<0.0007
COPPER	mg/L			0.001	0.002
IRON	mg/L			0.390	0.743
LEAD	mg/L			0.003	0.002
LITHIUM	mg/L			0.00064	0.00038
MANGANESE	mg/L			0.221	0.418
MAGNESIUM	mg/L			4.54	4.73
MOLYBDENUM	mg/L			<0.001	<0.001
NICKEL	mg/L			<0.001	0.003
PHOSPHORUS	mg/L			<0.006	<0.006
POTASSIUM	mg/L			3.43	4.35
SELENIUM	mg/L			<0.003	<0.003
SILICON	mg/L			5.73	6.02
SILVER	mg/L			<0.001	<0.001
SODIUM	mg/L			2.18	2.20
STRONTIUM	mg/L			0.0711	0.0753
SULPHUR	mg/L			1.51	1.62
THALLIUM	mg/L			<0.004	<0.004
TIN	mg/L			<0.003	<0.003
TITANIUM	mg/L			0.0005	0.0041
VANADIUM	mg/L			<0.001	<0.001
ZINC	mg/L			<0.0005	<0.0005

Lab Manager: D. MacPhee

Phone:
(604) 530-4344
1-800-889-1433
Fax:
(604) 534-9996

NORWEST LABS

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

WO (Lang.) : 20791
WO (Other) :
PO # :
Date Samp. :
Date Rec'd. : 17-Sep-96
Date Comp. : 23-Sep-96

Client		Received From	
Name	: Laberge Environmental	Name	:
Address	: Box 5111 Whitehorse, Yukon CANADA Y1A 4S3	Address	:
Phone	: (403) 668-6838	Phone	:
Fax	: (403) 667-6956	Fax	:
Attn.	: Ken Nordin	Attn.	:
Project	:		

Organo-Chloride Pesticides in Tissue

Parameter	20791-33 BC.1 Veg. Silex SP	Detection Limit
Pesticide		
Aldrin	< 0.05	0.05 ppm
BHC (alpha isomer)	< 0.05	0.05 ppm
Chlordane	< 0.05	0.05 ppm
4,4'-DDD	< 0.05	0.05 ppm
4,4'-DDE	< 0.05	0.05 ppm
2,4'-DDT	< 0.05	0.05 ppm
4,4'-DDT	< 0.05	0.05 ppm
Dieldrin	< 0.05	0.05 ppm
Endosulfan I	< 0.05	0.05 ppm
Endosulfan II	< 0.05	0.05 ppm
Endrin	< 0.05	0.05 ppm
Heptachlor	< 0.05	0.05 ppm
Heptachlor epoxide	< 0.05	0.05 ppm
Hexachlorobenzene	< 0.05	0.05 ppm
Lindane	< 0.05	0.05 ppm
Methoxychlor	< 0.05	0.05 ppm
Mirex	< 0.05	0.05 ppm

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

Approved:

Randy Neumann, B.Sc.
Laboratory Manager

Phone:
(604) 530-4344
1-800-889-1433
Fax:
(604) 534-9996

NORWEST LABS

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

WO (Lang.) : 20791
WO (Other) :
PO # :
Date Samp. :
Date Rec'd. : 17-Sep-96
Date Comp. : 30-Sep-96

Client		Received From	
Name	: Laberge Environmental	Name	:
Address	: Box 5111 Whitehorse, Yukon CANADA Y1A 4S3	Address	:
Phone	: (403) 668-6838	Phone	:
Fax	: (403) 667-6956	Fax	:
Attn.	: Ken Nordin	Attn.	:
Project	:		

Organo-Chloride Pesticides in Soil

Parameter	20791-1 LC Ranchera	20791-2 TP R1, 2.5m	20791-6 TP B2, 3.7m	20791-9 LC Burwash	Detection Limit
Pesticide					
Aldrin	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
BHC (alpha isomer)	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Chlordane	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
4,4'-DDD	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
4,4'-DDE	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
2,4'-DDT	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
4,4'-DDT	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Dieldrin	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Endosulfan I	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Endosulfan II	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Endrin	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Heptachlor	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Heptachlor epoxide	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Hexachlorobenzene	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Lindane	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Methoxychlor	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Mirex	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Percent Moisture	8.47	2.86	10.42	10.01	

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

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Langley, B.C. V3A 5E8

WO (Lang.) : 20791
WO (Other) :
PO # :
Date Samp. :
Date Rec'd. : 17-Sep-96
Date Comp. : 30-Sep-96

Organo-Chloride Pesticides in Soil (cont.)

Parameter	20791-11 TP S1, 2.5m	20791-12 SJ S1	20791-13 1-1	20791-14 TP1 2.3m	Detection Limit
Pesticide					
Aldrin	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
BHC (alpha isomer)	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Chlordane	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
4,4'-DDD	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
4,4'-DDE	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
2,4'-DDT	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
4,4'-DDT	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Dieldrin	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Endosulfan I	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Endosulfan II	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Endrin	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Heptachlor	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Heptachlor epoxide	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Hexachlorobenzene	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Lindane	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Methoxychlor	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Mirex	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Percent Moisture	32.61	2.59	96.53	5.64	

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

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Fax:
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WO (Lang.) : 20791
WO (Other) :
PO # :
Date Samp. :
Date Rec'd.: 17-Sep-96
Date Comp. : 30-Sep-96

Organo-Chloride Pesticides in Soil (cont.)

Parameter	20791-18 TP4 4.2m	20791-22 LC Iron Creek	20791-23 S2 Sediment	20791-25 P-8B	20791-27 R.S 2	Detection Limit
Pesticide						
Aldrin	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
BHC (alpha isomer)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Chlordane	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
4,4'-DDD	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
4,4'-DDE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
2,4'-DDT	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
4,4'-DDT	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Dieldrin	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Endosulfan I	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Endosulfan II	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Endrin	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Heptachlor	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Heptachlor epoxide	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Hexachlorobenzene	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Lindane	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Methoxychlor	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Mirex	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Percent Moisture	4.18	6.93	62.05	ND	23.74	

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

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1-800-889-1433
Fax:
(604) 534-9996

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WO (Other) :
PO # :
Date Samp. :
Date Rec'd.: 17-Sep-96
Date Comp. : 30-Sep-96

Organo-Chloride Pesticides in Soil (cont.)

Parameter	20791-28 SJ.S-2	20791-29 LC Swede Johnson	20791-30 S.J. Trib U/S Sed.	20791-31 S.J. Trib D/S Sed.	20791-34 BC.1	Detection Limit
Pesticide						
Aldrin	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
BHC (alpha isomer)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Chlordane	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
4,4'-DDD	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
4,4'-DDE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
2,4'-DDT	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
4,4'-DDT	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Dieldrin	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Endosulfan I	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Endosulfan II	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Endrin	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Heptachlor	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Heptachlor epoxide	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Hexachlorobenzene	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Lindane	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Methoxychlor	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Mirex	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05 ppm
Percent Moisture	33.88	26.38	53.67	36.15	8.56	

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

Phone:
(604) 530-4344
1-800-889-1433
Fax:
(604) 534-9996

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

WO (Lang.) : 20791
WO (Other) :
PO # :
Date Samp. :
Date Rec'd. : 17-Sep-96
Date Comp. : 30-Sep-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	82	O-C Scan	29-Sep-96	Ken M.
DDT	81			
Endosulfan I	86			

R.L. Veltman
Supervisor

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

Phone:
(604) 530-4344
1-800-889-1433
Fax:
(604) 534-9996

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

WO (Lang.) : 20791
WO (Other) :
PO # :
Date Samp. :
Date Rec'd. : 17-Sep-96
Date Comp. : 30-Sep-96

Client		Received From	
Name	: Laberge Environmental	Name	:
Address	: Box 5111 Whitehorse, Yukon CANADA Y1A 4S3	Address	:
Phone	: (403) 668-6838	Phone	:
Fax	: (403) 667-6956	Fax	:
Attn.	: Ken Nordin	Attn.	:
Project	:		

Polychlorinated Biphenyls (PCBs) in Soil

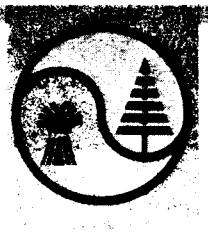
Parameter	20791-1 LC Ranchera	20791-2 TP R1, 2.5m	20791-4 TP 2, 1.5m	20791-6 TP B2, 3.7m	Detection Limit
Total PCBs	< 0.1 * (Aroclor)	< 0.1 * (Aroclor)	< 0.1 * (Aroclor)	< 0.1 * (Aroclor)	0.1 ppm
Percent Moisture	8.47	2.86	8.66	10.42	

Parameter	20791-8 TP B4, 2.7m	20791-9 LC Burwash	20791-11 TP S1, 2.5m	20791-13 1-1	Detection Limit
Total PCBs	< 0.1 * (Aroclor)	< 0.1 * (Aroclor)	< 0.1 * (Aroclor)	< 0.1 * (Aroclor)	0.1 ppm
Percent Moisture	5.49	10.01	32.61	96.53	

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

* The chromatogram from this sample was compared to the chromatograms of Aroclors 1248, 1254, 1260 and 1268 at a level comparable to 0.1 ppm, but no match was found.

Phone:
(604) 530-4344
1-800-889-1433
Fax:
(604) 534-9996



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

WO (Lang.) : 20791
WO (Other) :
PO # :
Date Samp. :
Date Rec'd. : 17-Sep-96
Date Comp. : 30-Sep-96

Polychlorinated Biphenyls (PCBs) in Soil (cont.)

Parameter	20791-14 TP1 2.3m	20791-18 TP4 4.2m	20791-20 TP6 1.7m	20791-22 LC Iron Creek	Detection Limit
Total PCBs	< 0.1 * (Aroclor)	< 0.1 * (Aroclor)	< 0.1 * (Aroclor)	< 0.1 * (Aroclor)	0.1 ppm
Percent Moisture	5.64	4.18	2.70	6.93	

Parameter	20791-23 S2 Sediment	20791-29 LC Swede	20791-30 Swede U/S sed	20791-32 Swede D/S sed	Detection Limit
Total PCBs	< 0.1 * (Aroclor)	< 0.1 * (Aroclor)	< 0.1 * (Aroclor)	< 0.1 * (Aroclor)	0.1 ppm
Percent Moisture	62.05	26.38	53.67	13.74	

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

* The chromatogram from this sample was compared to the chromatograms of Aroclors 1248, 1254, 1260 and 1268 at a level comparable to 0.1 ppm, but no match was found.

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Fax:
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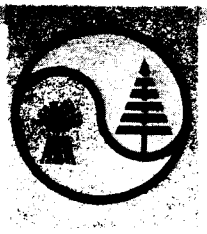

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203-20771 Langley Bypass
Langley, B.C. V3A 5E8

WO (Lang.) : 20791
WO (Other) :
PO # :
Date Samp. :
Date Rec'd. : 17-Sep-96
Date Comp. : 30-Sep-96

Polychlorinated Biphenyls (PCBs) in Soil (cont.)

Definitions / Methods

Total PCBs: This analysis is carried out in accordance with U.S. Environmental Protection Agency Methods 3540/8080 (SW 846, 3rd Edition, Washington DC) which involves extraction of the sample with methylene chloride then cleanup of the sample using a silica gel column 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

Compound	% Recovery	Analysis	Date	Analyst
PCBs	97	PCBs	29-Sep-96	Ken M.

R.H. Neumann
Supervisor

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

APPENDIX SIX

SITE PHOTOGRAPHS

SITE NO. 1 (WL066) - IRON CREEK: PLATES I1 TO I7

SITE NO. 2 (WL067) - LOWER RANCHERIA: PLATES R1 TO R6

SITE NO. 3 (HJ040) - BURWASH LANDING: PLATES B1 TO B6

SITE NO. 4 (HJ042) - SWEDE JOHNSON CREEK: PLATES S1 TO S6

PLATE I1- WWII garbage dump, over embankment along east side of pond.

PLATE I2 - One of only two remaining collapsed army construction site buildings.

PLATE I3 - Tar tank disposed in clearing south of camp. Typical of junked equipment in the cleared area.

PLATE I4 - Unused sewage disposal pit in clearing south of camp. According to local residents, the pit was never used.

PLATE I5 - Test Pit TPI-7 at north east corner of site between collapsed army buildings.

PLATE I6 - Test Pit TPI-1, edge of back filled dump site in clearing south of the camp.

PLATE I7 - Existing clearing at Iron Creek site, currently used for road maintenance under contract to Public Works Canada. The original army road construction camp was located here.

PLATE R1 - Typical of former camp building restoration work.

PLATE R2 - Power house site. Hydrocarbons detected in backfill material.

PLATE R3 - Looking east at edge of old army dump.

PLATE R4 - End of access to old army dump, edge of dump on right.

PLATE R5 - Toe of old army dump. Test pit R - 2 on crest above.

PLATE R6 - Test Pit R - 2, crest of old army dump.

PLATE B1 - Looking south across buried dump from access road.

PLATE B2 - Looking south along edge of old dump at remaining metal waste.

PLATE B3 - Exposed cut bank at south end of old dump.

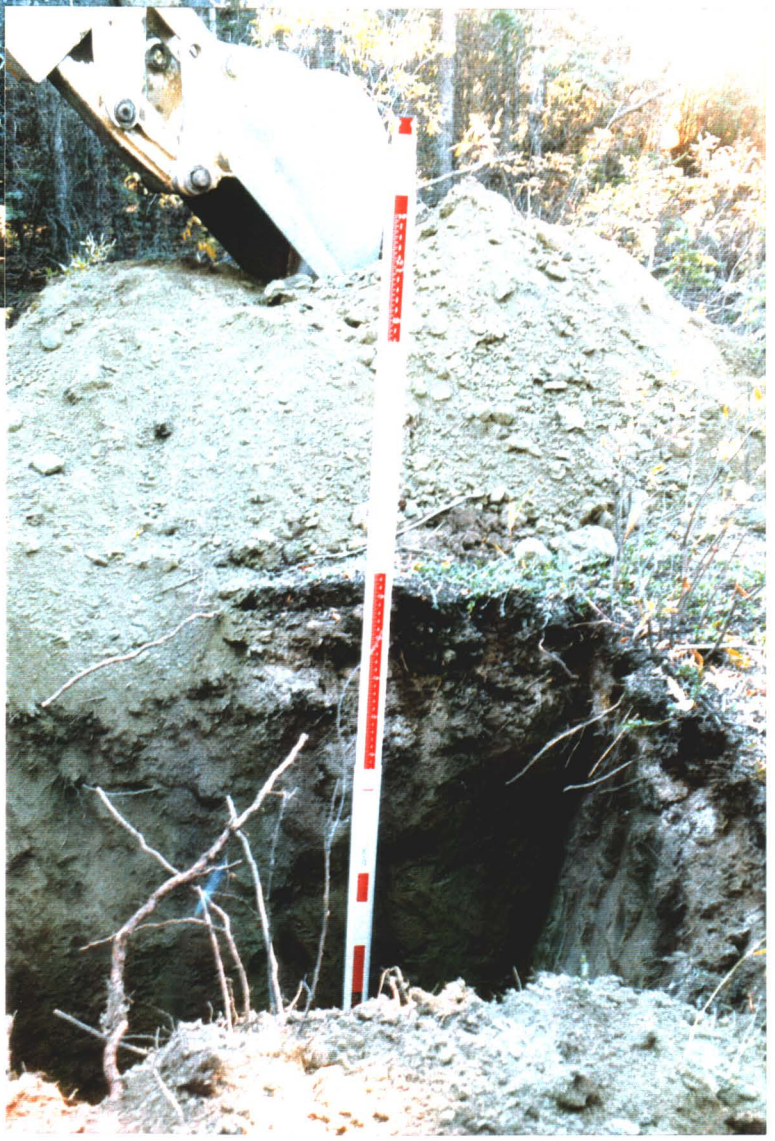

PLATE B4 - Test Pit B - 1 at the southern edge of the old dump.

PLATE B5 - Test pit B-5 in cleared area across the access road directly north of the old dump.

PLATE B6 - Casual borrow pit, former location of old Pan American Construction building, across the access road directly north of the old dump.

PLATE S1 - Looking down on casual garbage dating to road construction.

PLATE S2 - Typical of old construction era dumps along road embankment.

PLATE S3 - Looking south across clearing, old buried dump is at edge of clearing, creek just beyond.

PLATE S4 - Test pit S-2 at southeast extent of buried dump.

PLATE S5- Garbage dump currently in use.

PLATE S6 - U.S. Military container dated 1957, near surface in TPS-2.