PRELIMINARY ENVIRONMENTAL INVESTIGATIONS

DESTRUCTION BAY SITES 24, 25, & 26

HJ37 HJ38 HJ39

Conducted for the

Action on Waste Program,
Arctic Environmental Strategy
Whitehorse, Yukon

by:

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EXECUTIVE SUMMARY:

In September and October of 1996, three sites were investigated for possible contamination near Destruction Bay, Yukon, as part of the Action on Waste Program under the Arctic Environmental Strategy. These sites were identified by an inventory project which surveyed former military sites and activities in the Yukon. The purpose of the investigation discussed in this report was to determine if further assessments or remediation work would be required in any of the three sites examined.

Each site was related to one or more development project: the building of the Alaska Highway, the building, operation and decommissioning of the Canol Pipeline, and the building, operation and decommissioning of the Haines-Fairbanks pipeline.

Each site was investigated by a systematic methodology which included:

- historical and background research
- site reconnaissance
- sampling design and layout
- soil and water samplng
- site observations
- laboratory analysis
- reporting of results

SUMMARY OF FINDINGS:

We consider it unlikely that any of these sites are contaminated by CCME standards and guidelines and that no further investigation is needed. The results of laboratory analyses are presented in the text for each site; full lab results are contained in the appendices. Future land uses may suggest clean ups for aesthetic reasons or to protect the unwary from injury due to debris.

We recommend that a report of burial of drums filled with antifreeze and other unknown substances on the site of Pump Station E during its decommissioning be investigated. (See pages 7 and 9.)

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PRELIMINARY ENVIRONMENTAL INVESTIGATIONS DESTRUCTION BAY SITES

1.0 INTRODUCTION

1.1 Objectives

The Arctic Environmental Strategy (AES) Action on Waste Program has initiated a series of environmental investigations on abandoned waste disposal sites.

The objectives of the preliminary investigations are to determine if contaminants are present on the site and if so, are they present in concentrations that exceed guideline levels.

Information gathered would then be used to determine if further assessments or remediation work will be required.

During the preliminary investigation the site was characterised; to provide information on human health and environmental risks posed by any contaminants found at the site; and to identify the physical characteristics of the site which could impact on further studies or remediation.

A preliminary investigation proposal was submitted for three sites in the vicinity of Destruction Bay, Yukon. Permission to proceed was received from Brett Hartshore on September 10, 1996 based on revisions submitted on September 10, 1996.

2.0 METHODOLOGY

The site designations in the following discussions (Sites 24, 25 and 26) are the same as those used in the informational material provided by the Action on Waste program. The sites are located near Destruction Bay, Yukon as shown in Figure 1.

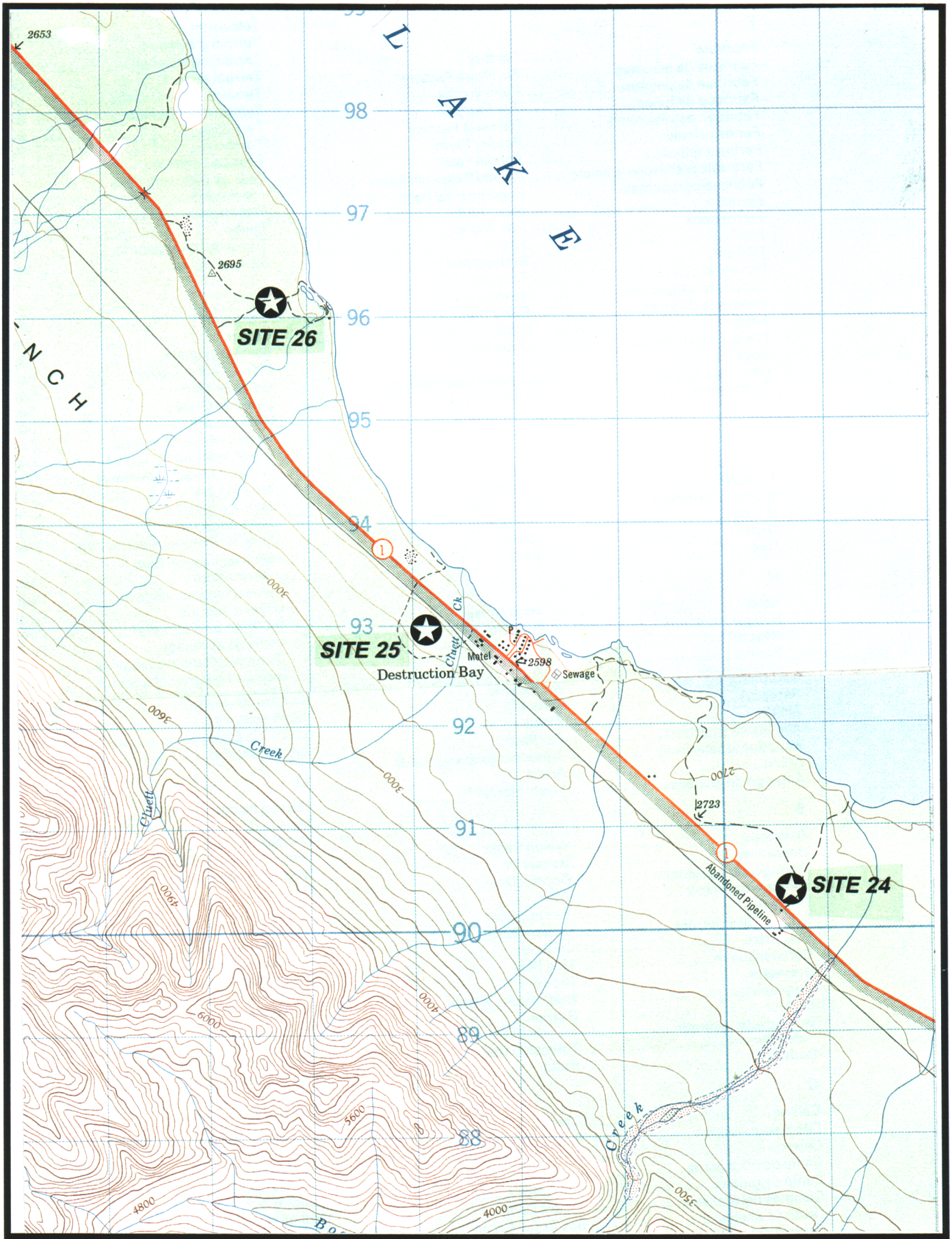

FIGURE #1 ACTION ON WASTE DESTRUCTION BAY GENERAL SITE MAP

2.1 Literature Search

Based on the background information provided by the Action on Waste Program, a literature search of archived material and reports was conducted. These sources of historical information were researched to provide further information on each site, including: area used, period of time which it was active, the type and amount of material that may have been deposited, and any activities which may have affected the site.

2.2 Interviews

Based on the literature search and initial contacts by the investigation team, personal and telephone interviews were conducted with individuals knowledgeable about the sites and the time period in which they were in use.

2.3 Site Reconnaissance

A site reconnaissance trip took place on August 21, 1996 to establish the location of each site (Figure 1) and to assess site characteristics which may influence the study design. The trip was successful in identifying the three main sites and two secondary sites based on the information provided. It also provided the necessary information to design the soil and water sampling programs.

2.4 Sampling Design and Layout

Sites targeted for investigation were former waste disposal sites. Wastes were deposited on the surface with minimal or no cover, therefore investigations concentrated on near surface soils. The design and layout of the soil sampling programs for each site were based on a modified British Columbia[1]. approach, to attain an approximate coverage of one sample per 10 metre grid at random depths of up to one metre. All water samples were discretionary samples, taken downstream of the sites, to detect possible contaminant migration.

Soil sample locations for Sites 24A &B were based on areas identified during the site reconnaissance (Photo 1 & 2), as having the greatest potential for contamination (discretionary samples). Water samples were taken from adjacent surface waters (Figure 4).

Soil sampling locations for Site 25 (Figure 4) were identified using a random sampling grid (Figure 5a) overlaying the area of visible disturbance and debris (Photos 3, 4 & 5). Non-random or discretionary soil samples were also taken to identify any downslope migration of possible contamination. Water samples for Site 25 were from two low-volume springs surfacing downslope of the site (Figure 4).

[1] Contaminated Sites, Site Characterization and Confirmation Testing, B.C. Environment draft document

Soil sampling locations for Site 26A were based on a systematic sampling grid because of the localized nature of the site and the terrain (Photo 6 & 7) where the visible waste was located. Site 26B utilized both a random sampling grid and a discretionary sample. Water samples were from an adjacent small inshore lake and standing water in an intermittent stream channel directly south of Site 26A and downslope of Site 26B (Figure 6)

2.5 Sampling and Analysis Parameters

After discussion with the Action on Waste Program staff, soil and water sample analysis parameters were decided upon. The broad spectrum approach during this preliminary investigation provided the greatest potential for identifying contaminants.

Soil Parameters	**Water Parameters**
BTEX[2]	Organochlorine Pesticides
PAHs[3]	PCBs[4]
PCBs	Total Metals
Organochlorine Pesticides	
Total Metals	

Individual soil samples were taken at each field site, as discussed in *Sampling Techniques* Section 3.1. Quanta Trace Laboratories was instructed to compose soil samples from each individual site in groups of five for total metals, organochlorines and PCB analysis. In determining which samples could utilize composite techniques, accepted lab protocols were considered as well as detection limits and guideline concentrations. Composite samples were not used for contaminants which had guideline concentrations that were less than five times the detection limit.

There was no composite sampling of soil for BTEX or PAH samples and no composite sampling of water.

3.0 SAMPLING TECHNIQUES

3.1 Soil Samples

All soil samples were taken by excavating a preliminary hole to the required depth using a power auger or shovel (Photo 8).

Sample containers for each site were identified and numbered prior to working in that excavation. Each soil site had the following samples taken:

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[2] Benzene, Toluene, Ethelbenzene and Xylenes.
[3] Polycyckuc Aromatic Hydrocarbons.
[4] Polychlorinated biphenals

BTEX	125 ml glass jar
PAHs, Organochlorines, PCBs	250 ml glass jar
Total Metals	500 gram Ziploc™ bag

Using latex gloves, all hole sloughing was removed and a stainless steel sampler was used to obtain the soil sample from the lower hole wall. BTEX was the first sample taken at each location, followed by PAHs. The soil was disturbed as little as possible while obtaining these samples and transferring to the glass jar. The glass jars were filled, compacted to reduce air space and then filled to the brim and lid attached. The sample for metal analysis was taken last.

Sample location, number and site notes were recorded on a field site diagram.

At a number of sample sites it was necessary to separate the pebble fraction from the soil fraction by hand prior to filling the sample containers. This occurred primarily at Site 25 with the shale creek bottom and at Site 26 with the glacial till.

All samples were then stored in a cooler and kept at 4 ° Celsius.

Replicate soil samples for QA/QC were taken at Site 25 (sample numbers 25-12 and 25-13).

3.2 Water Samples

Water samples were taken where possible in mid-channel at mid-depth. New protective latex gloves were worn at each site.

All sample bottles were identified and numbered on the lid and label prior to taking the water sample. Identification and numbers along with a site diagram and site notes were recorded in a field note book immediately after sampling.

Each water sample location had the following samples taken:

Organochlorine Pesticides	1 litre amber glass jar
PCBs	Sample bottle filled to brim and protective foil on lid.
Total Metals	250 ml poly bottle, preserved with nitric acid @ 0.5 ml/100 ml of sample

All samples were kept in a cooler at 4° Celsius prior to shipping to the laboratory.

Duplicate water samples at Site 25 (sample numbers 25-14 and 25-15) were taken simultaneously (1 litre with 1 litre duplicate, 250 ml with 250 ml duplicate) to ensure proper duplication.

A quality assurance water sample blank was prepared offsite to minimize contamination. The sample was prepared with deionized water supplied by the laboratory.

Water samples were collected and analyzed individually. As all water samples were of surface waters, no water samples were analyzed for BTEX or PAH compounds.

4.0 SITE OBSERVATIONS

Site cross sections and slope profiles were surveyed at Site 24A (Figure 3) and Site 25 (Figure 5). There was no cross section or profile survey of Site 26. A clinometer slope measurement of 40 to 41° was taken of the area with visible debris (Photo 9).

General site observations for each location are contained in the following results section.

5.0 LABORATORY ANALYSIS

Quanta Trace Laboratories of Burnaby B.C. performed all sample composites and analysis of inorganic parameters.

NorWest Laboratories of Vancouver B.C. performed all analysis for organic parameters.

Both labs are certified by the Canadian Association of Environmental Analytical Laboratories (CAEAL).

6.0 REPORTING OF RESULTS

Results of chemical analysis for all parameters listed are detailed in the results section. Where applicable, results are compared to CCME[5] guideline levels, if no CCME guidelines were established then guideline levels in the draft Contaminated Sites Regulations (Yukon) were used.

7.0 HISTORICAL INFORMATION

7.1 Historical review

Historical information was sought for each site to help guide sampling design, to aid in site interpretation, and to assist in drawing conclusions from the results. An exhaustive search of the DIAND library and the Yukon Archives revealed little other than general historical narrative. Most of the information relevant to these sites was obtained from Edey, C. E. (1976) "Alaska

[5] Canadian Council of Ministers of the Environment, Report CCME EPC-CS34 September 1991

Highway-Haines Road Clean-up", Bisset, K. (1995), by interviews, by examining PRA maps and aerial photographs, and by on-site interpretation.

7.2 Development Chronology:

Two transportation corridors traverse the Destruction Bay area. One, originating at Dawson Creek and passing through Whitehorse towards Fairbanks, is the route of the Alaska Highway and in the period 1943 - 1955, the Canol Military Pipeline. The second corridor, starting in Haines, carried military fuels via the Haines-Fairbanks Military Pipeline from 1955 to 1971. The construction, operation or decommissioning of these various projects are the most likely causes of environmental effects in the sites examined in this study, although local residential and commercial use may have contributed some impacts.

Highway construction and reconstruction occurred in several phases. The "Pioneer Road" was constructed by the U.S. Army between March and September, 1942. This phase saw the proliferation of camps, and the widespread and casual disposal of wastes. Almost immediately, military and civilian crews of the Public Roads Administration began the reconstruction and rerouting of the original track, with a continued spread of haphazard waste disposal. Although the construction camps are gone and the most contemporary waste disposal is now concentrated in known sites, highway construction and improvements remain a nearly constant activity.

The Canol Military Pipeline (Canol No.4) was completed in 1944 and operated until 1955. It was supplanted by the Haines-Fairbanks Pipeline (built 1953-1955) which used some of the same pumping station sites. This pipeline was abandoned in 1971, and a partial clean-up was done in 1976.

SITE 24A & B

1.0 SITE INFORMATION

1.1 Location

Two potential sites are located in this area: Site 24A is located approximately 3 km south of Destruction Bay on the east side of the Alaska Highway across from the former pump station "E". The second site, Site 24B is located in a gravel pit (Figure 2) approximately 2 km south of Destruction Bay, one kilometre east of the Alaska Highway.

Located just south of Destruction Bay, this was the site of living quarters and a maintenance/storage facility for Pump Station "E", Canol No.4 Pipeline. It was occupied until 1957, although some buildings were apparently used for storage and/or maintenance until the 1960's. Aerial photos taken in 1957 show a cluster of five buildings near the present-day remains of a septic tank, and three buildings to the right of the entrance road. Today no buildings remain, although Edey had noted a Quonset Hut in 1976. The remnants of the septic pit are obvious, and a sewer pipe leads to it from the site of former buildings. A buried waterline which supplied water from a source across the Highway crosses the creek near this point. Near the former vehicle service ramp, automotive debris (tires, oil filters ect.) can be seen along the creek bank.

A peculiar feature of this site are the many mounds of gravel deposited over the north-east part of this site, in the vicinity of a buried fuel tank. No information could be found about these mounds, which are covered with a growth of balsam poplar. The largest of these poplars date back to at least 1961. Since the first several years of a sapling's growth are generally not visible as rings, these would have rooted around the year 1959. We surmise that the gravel mounds would be associated with the demolition of Canol Pump Station "E" and the construction of Standard Oil Pump Station "E".

In the 60's and 70's a corral was located on the eastern portion of the site, and in the early 70's a racetrack ("Destruction Bay 1/4 mile Oval") was built several hundred meters to the northwest. Near the racetrack is a gravel pit noted by Edey. It contained several small piles of mostly burned construction debris, some of which was from demolished buildings with plumbing and wiring dating from the 1940's and 50's. Other than these small piles, the gravel pit does not appear to have been used for dumping.

In 1976, clean-up activities were done at Pump Station "E" across the road from Site 24. The heavy equipment operator (Peter Upton) recalls that they buried barrels of antifreeze and other [unknown] substances in a large pit immediately southeast of the pump building. This reported site of buried wastes was beyond the scope of this project and was not investigated. **We recommend that this site be investigated.**

SITE 24

1.2 Site Description

Site 24 A

- former camp site
- adjacent to Nines Creek
- road or berm along creek and curving to the east

Site 24 B

- gravel pit
- appears to be level and seasonally has standing water
- piles of soil and debris at south end of pit area
- ashes indicating some of the material was burnt

Reference Figure 3 for slope of site

2.0 FIELD WORK

2.1 Soil Sampling

A total of four soil samples were collected from Site 24A and two samples from 24B (Figure 2). Sampling logic for Site 24A is detailed as follows:

1. pit with wooden cribbing appearing to be a sewage or liquid waste disposal site
2. pit with wooden cribbing adjacent to stand pipe
3. loose piles of sandy gravel intermixed with wood and metallic debris
4. area of visible waste disposal alone drainage course

Sampling logic for Site 24B is detailed as follows:

1. soil and burnt waste piles
2. center of standing water mark indicating lowest elevation in gravel pit

2.2 Water Sampling

One water sample (# 24-7) was collected from an unnamed tributary flowing through Site 24A. The sample was collected midchannel 20 meters downstream of soil sample site #24-1 (Figure 2). The unnamed tributary has its headwaters to the west of the site in the Kluane Front Range Mountains. The tributary flows by Pipeline Pump Station "E", is culverted under the Alaska Highway and flows through Site 24A before discharging into Kluane Lake.

A sample blank (# 24-8) of deionized water was also submitted for analysis.

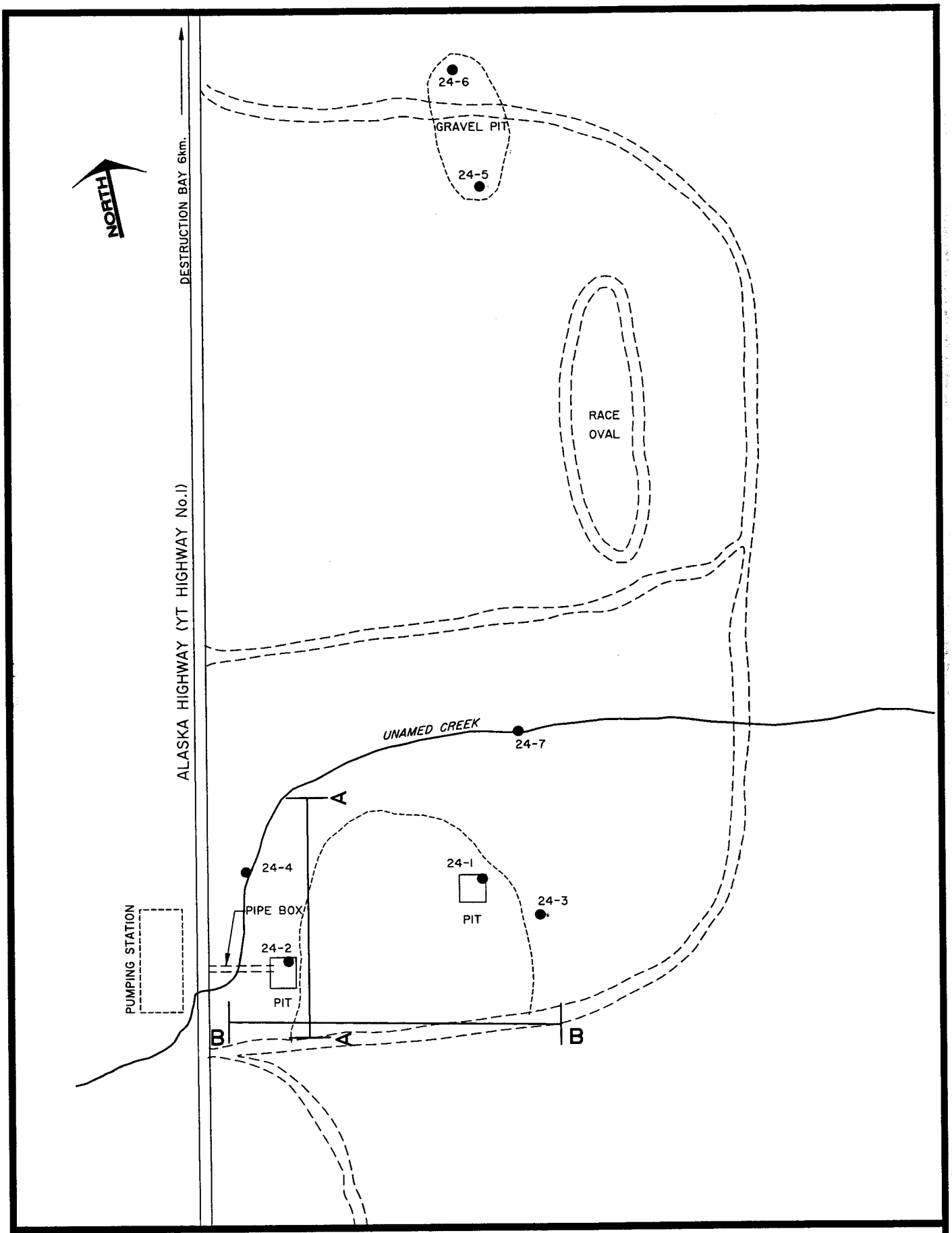
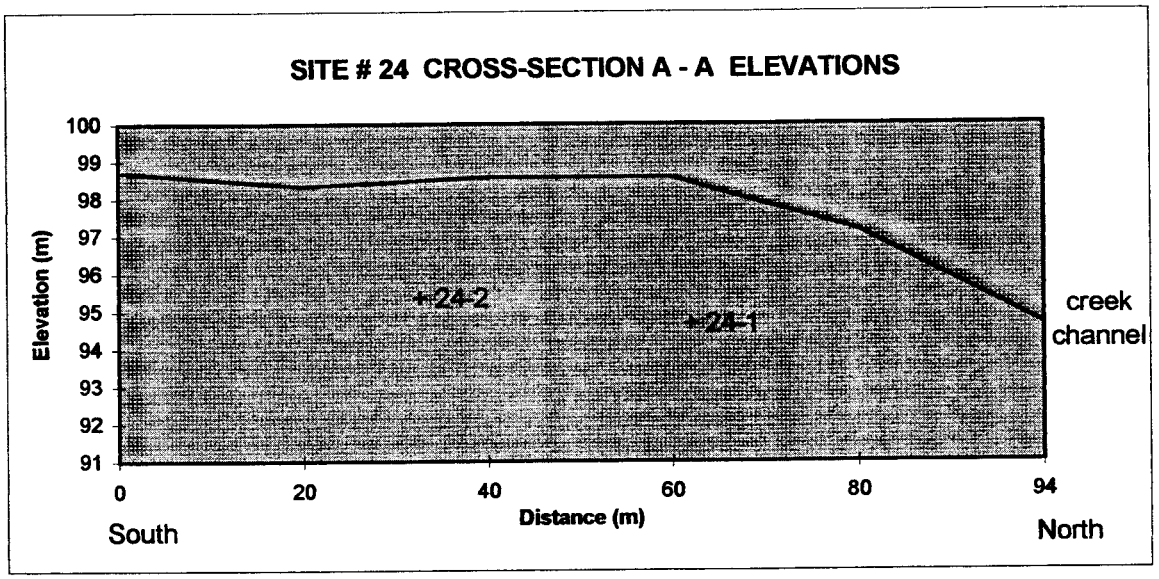
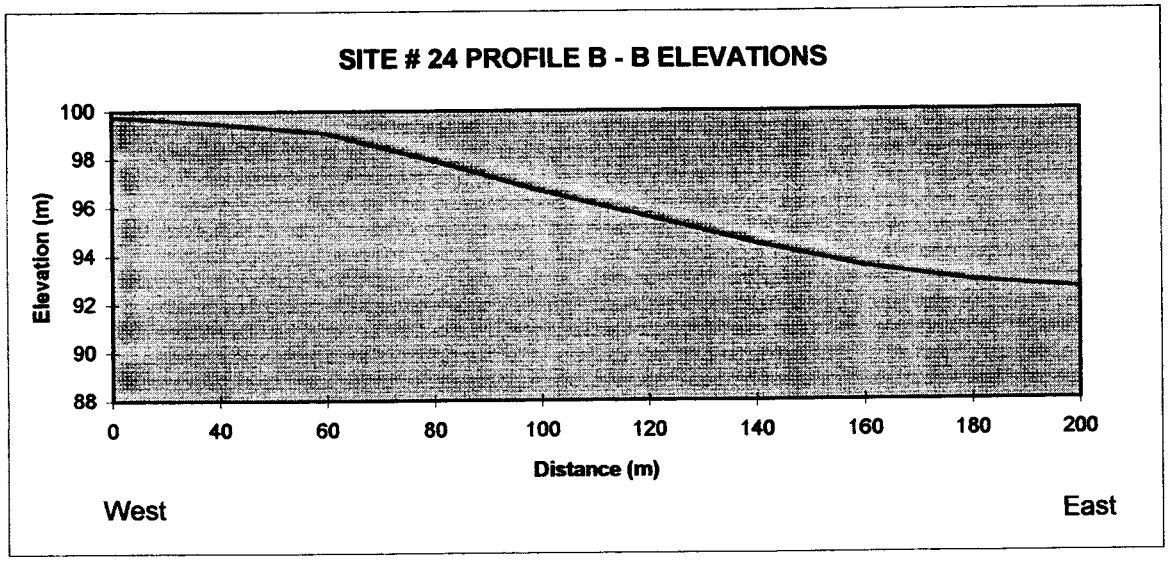


FIGURE #2 ACTION ON WASTE DESTRUCTION BAY SITE #24
SITE MAP and SAMPLE LOCATIONS

Figure # 3 Action On Waste - Destruction Bay Site # 24





SITE 24

3.0 CHEMICAL ANALYSIS RESULTS

3.1 Soil Analysis

TABLE 1

Site 24 - Soil Samples Metal Analysis* µg/g							
Parameter	**24A-1**	**24A-2**	**24A-3****	**24A-4**	**24B-1**	**24B-2**	**CCME**
aluminum	12300	12100	17400	13500	13600	24800	---
antimony	<2.	<2.	<2.	<2.	<2.	<2.	40
arsenic	18	10	26	18	17	34	50
barium	132	121	147	112	151	228	2000
beryllium	0.3	0.3	0.3	0.4	0.3	0.3	8
bismuth	<6.	<5.	<5.	<5.	<5.	<.6	
cadmium	0.4	0.3	0.4	0.2	0.4	0.4	20
calcium	30200	26100	24600	13400	26900	30100	---
chromium	48.4	38.4	94.3	43.5	43.8	238.	800
cobalt	14.8	12.9	23.5	15.2	14.7	41.4	300
copper	61.1	52.0	73.9	51.1	52.4	141	500
iron	28000	26000	39000	31000	28000	61000	---
lead	6	10	7	8	7	8	1000
lithium	10	8.8	16.4	12.1	10.0	21.8	---
magnesium	14500	10400	30500	9240	11400	55700	---
manganese	611	460	693	368	523	1230	---
molybdenum	1	<1	2	<1	1	2	40
nickel	54.0	37.7	135	45.0	45.4	307	500
phosphorus	888	677	742	459	653	760	---
potassium	1340	1310	600	910	1000	850	---
selenium	6	<2	7	3	3	3	10
silicon	997	807	792	877	788	894	---
silver	<0.6	<0.5	<0.5	<0.5	<0.5	<0.6	
sodium	170	212	150	164	217	186	---
strontium	63	58	45	42	60	51	---
sulfur	240	300	410	220	240	610	---
thorium	17	14	25	23	17	36	---
tin	<1.	<1.	<1.	1.	<1.	<1.	
titanium	557	634	885	731	784	768	---
uranium	<6.	<5.	<5.	<5.	<5.	<6.	
vanadium	49	46	70	53	51	83	---
zinc	68.4	71.3	79.2	63.3	99.1	119	1500
zirconium	5.6	5.6	5.1	8.4	6.9	4.5	---

SITE 24

*Metal results at or below the detection limit do not appear in this table. See Appendix 4.
** Duplicate analysis, highest values are presented.

BETX and Light Hydrocarbons were less than detection limits. All PAHs, PCBs and organo-chloride pesticides were less than detection limits. Lab results are presented in Appendix 3.

3.2 Water Analysis

TABLE 2

Site 24 - Water Samples Analysis					
Parameter	**24-7**	**24A-8 QA Blank**	**Detection Limit**	**CCME Aquatic**	**CCME Drinking Water**
Total hardness as $CaCO_3$	290	0.2			500
calcium	77.4	0.05			
magnesium	23.4	0.02			
potassium	1.4	<0.2	0.2		
sodium	7.67	0.11			200
aluminum	<0.01	<0.01	0.01	0.1*	0.2
arsenic	<0.02	<0.02	0.02	0.05	0.025
barium	0.043	<0.0006	0.0006		1.0
cadmium	<0.0005	<0.0005	0.0005	0.0018*	0.005
chromium	<0.001	<0.001	0.001	0.002	0.05
copper	<0.002	<0.002	0.002	0.004*	1.0
iron	0.007	<0.003	0.003	0.3	0.3
lead	<0.005	<0.005	0.005	0.007*	0.01
manganese	0.002	<0.0006	0.0006		0.05
selenium	<0.01	<0.01	0.01	0.01	0.01
uranium	<0.06	<0.06	0.06		0.1
zinc	0.004	<0.001	0.001	0.03	5.0
antimony	<0.02	<0.02	0.02		
beryllium	<0.0002	<0.0002	0.0002		
bismuth	<0.02	<0.02	0.02		
cobalt	<0.001	<0.001	0.001		
lithium	0.002	<0.002	0.002		
molybdenum	<0.005	<0.005	0.005		
nickel	<0.002	<0.002	0.002	0.150	
phosphorus	<0.06	<0.06	0.06		
silicon	4.35	<0.06	0.06		

Site 24 - Water Samples Analysis					
Parameter	**24-7**	**24A-8 QA Blank**	**Detection Limit**	**CCME Aquatic**	**CCME Drinking Water**
silver	<0.001	<0.001	0.001	0.001	
strontium	0.344	<0.005	0.005		
sulfur	55.8	<0.1	0.1		
thorium	<0.005	<0.005	0.005		
tin	<0.005	<0.005	0.005		
titanium	<0.001	<0.001	0.001		
vanadium	0.012	<0.002	0.002		
zirconium	<0.001	<0.001	0.001		

* CCME Aquatic Life Water Standard for hardness > 180 mg/L as $CaCO_3$

PCBs and organochloride pesticides were all below detection.

SITE 24

3.3 Discussion

BTEX and light hydrocarbons are below detection limits; PCBs and organochloride pesticides are below detection, metals are within CCME guidelines. There is little reason to surmise that the metals present are not from natural sources.

4.0 Conclusions: Site 24

Sites 24a and 24b appear benign and do not warrant further testing. For purposes of public safety, the old septic pit and the pit adjacent to the buried fuel tanks might be filled in. As with many similar sites, these could benefit from cosmetic restoration, but this would not be essential for public purposes.

We strongly recommend that the report of buried drums on the site of Pump Station E be investigated.

SITE 25

1.0 SITE INFORMATION

1.1 Location

Site 25 is located approximately 500 metres west of the Alaska Highway on the south side of Cluett Creek (Figure 4).

This former dump is located in a dry channel immediately south of Cluett Creek approximately 400 meters upstream from the Highway just north of Destruction Bay. It was not in regular use after the early 1950's when it was supplanted by a dump closer to Kluane Lake and by a dump investigated in this report as Site 26. It appears to have been associated with the second wave of highway construction (1943 and later) since it occupies the site of a bridge across Cluett Creek built for the Army pioneer road. The site would have been used as a dump after this section of road had been re-routed. It contains mostly construction, automotive, and domestic debris along with a numbers of barrels.

1.2 Site Description

- the site is located in and along the banks of a seasonally active creek bed
- banks are silt and gravel
- stream bed is sandy shale

2.0 FIELD WORK

2.1 Soil Sampling

A random sampling grid (Fig. 5a) was employed over the areas of visible disturbance and debris. Discretionary samples were also taken in the dry water course immediately downslope of the site to identify any migration of possible contaminants.

2.2 Water Sampling

Water sample (# 25-14) was taken from Cluett Creek 200 metres downslope of sample site # 25-11. Sample location was 70 metres upslope of the pipeline right of way. The sample was taken of a combination of two oxidized spring flows that surface 20 metres upstream of water sample location. Combined spring flows are < 1 litre per second. Both spring flows are within the same creek channel perimeter and downstream of the soil sample grid for site 25.

The two oxidized spring flows are bracketed to the north and south by non-oxidized spring flows near the pipeline right of way to form Cluett Creek at the Alaska Highway (Figure 4)

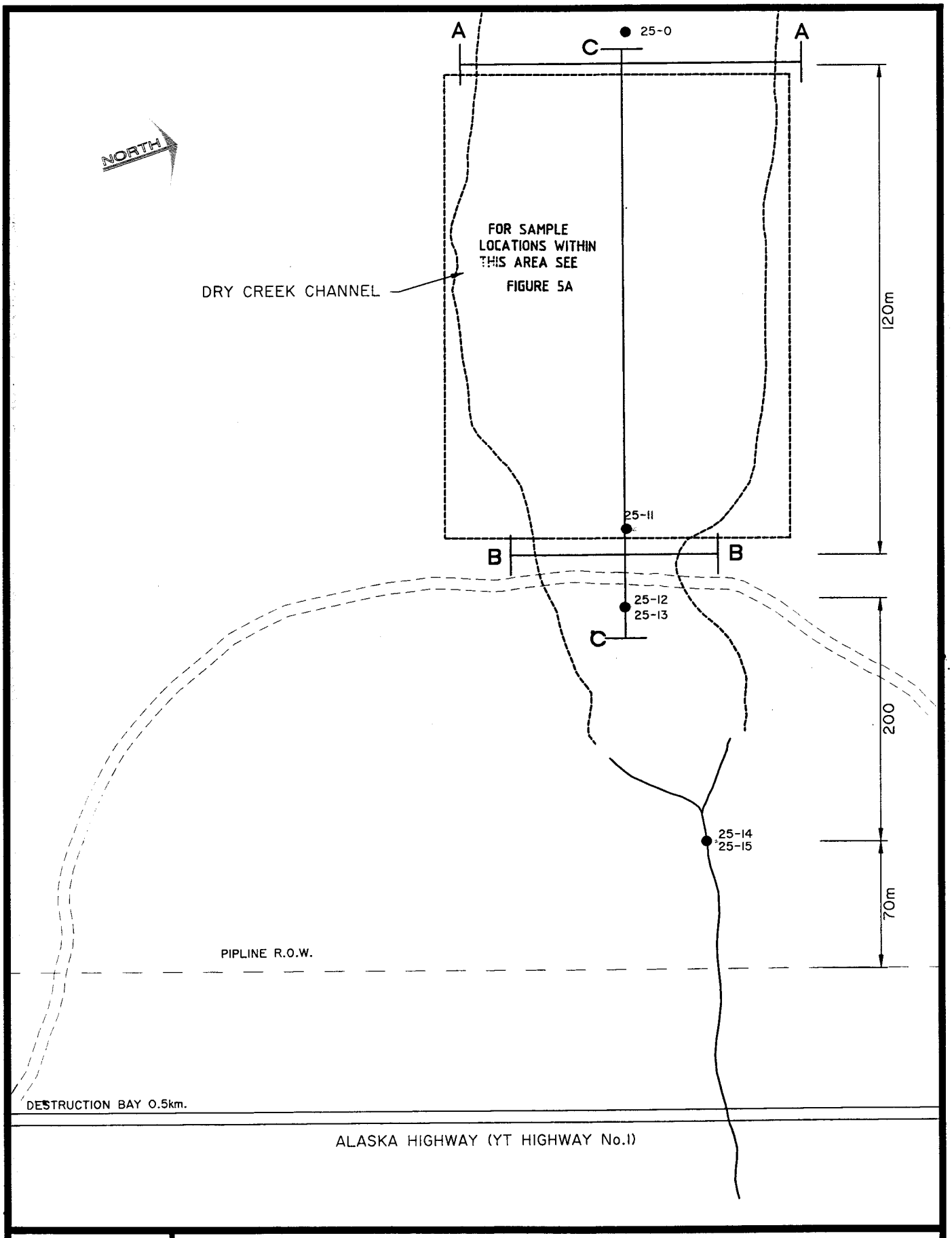
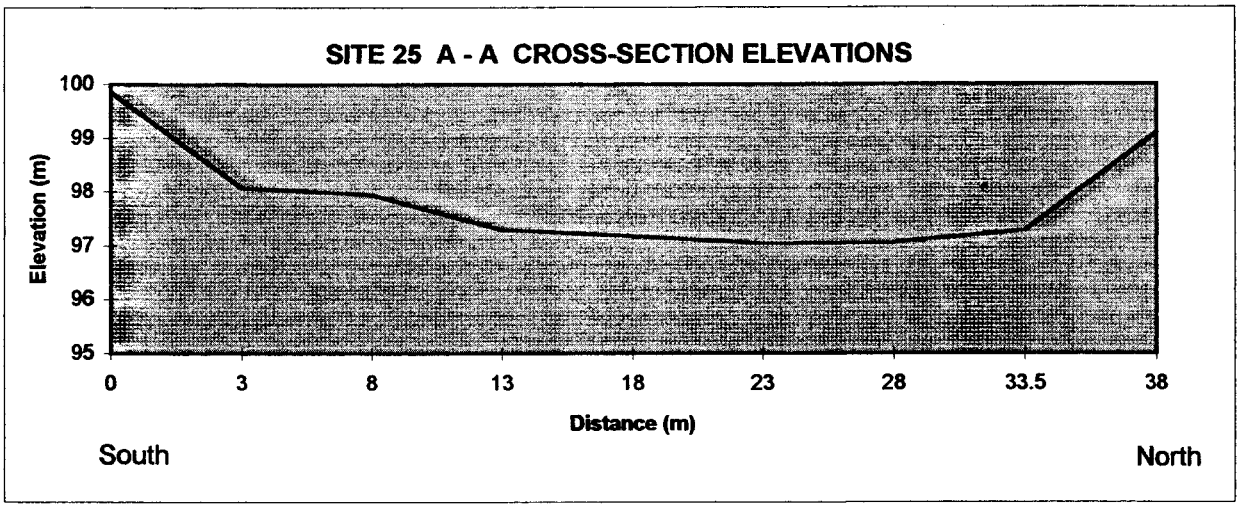
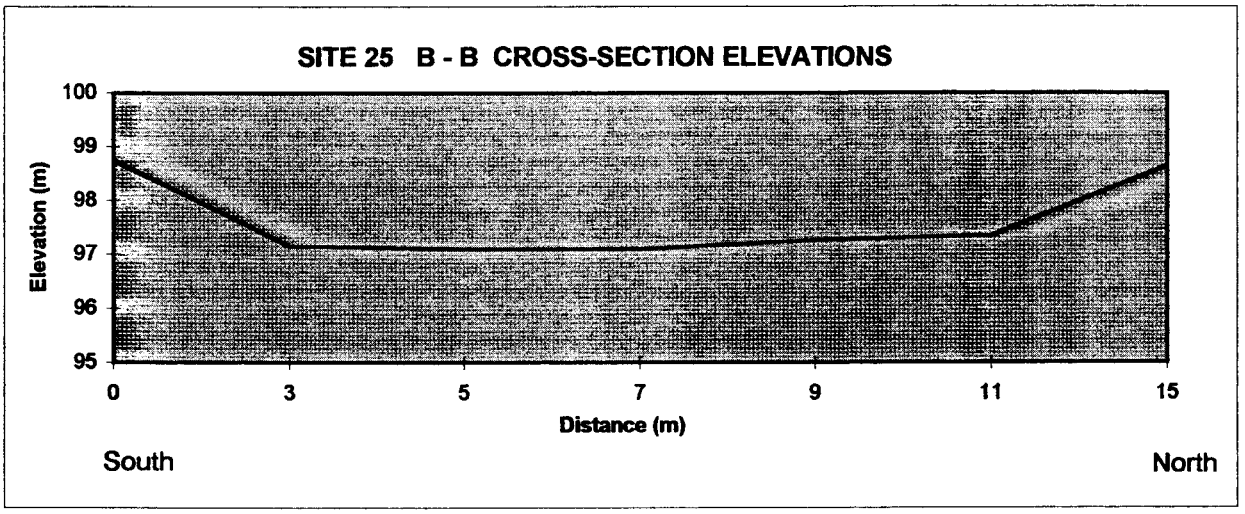
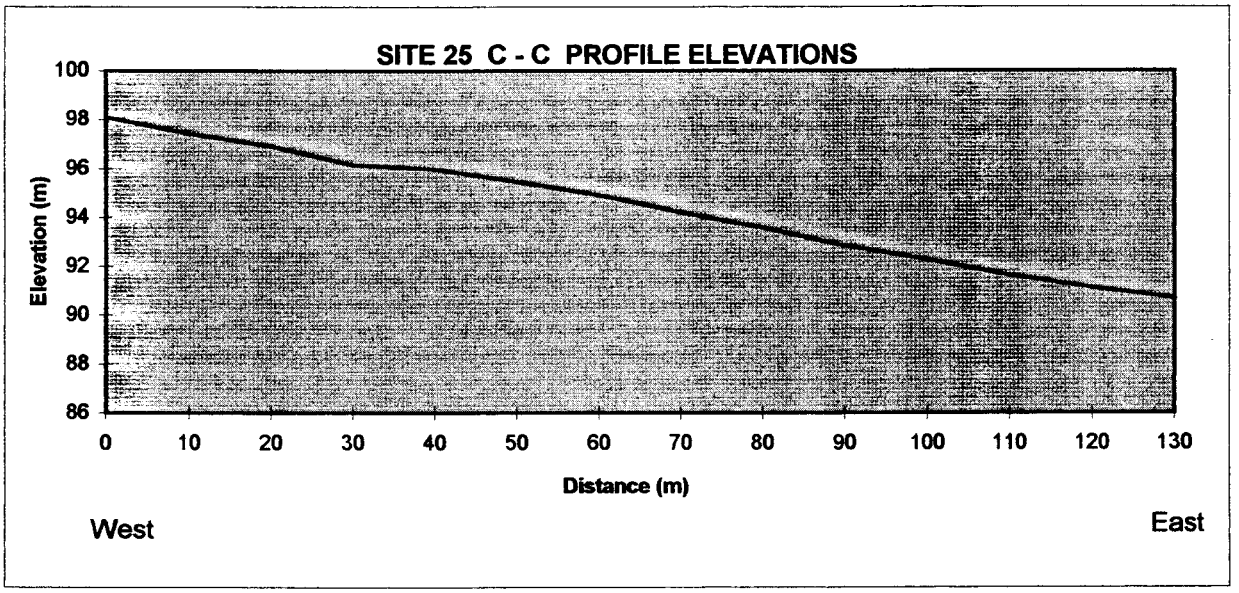


FIGURE #4 ACTION ON WASTE DESTRUCTION BAY SITE #25
SITE MAP and SAMPLE LOCATIONS

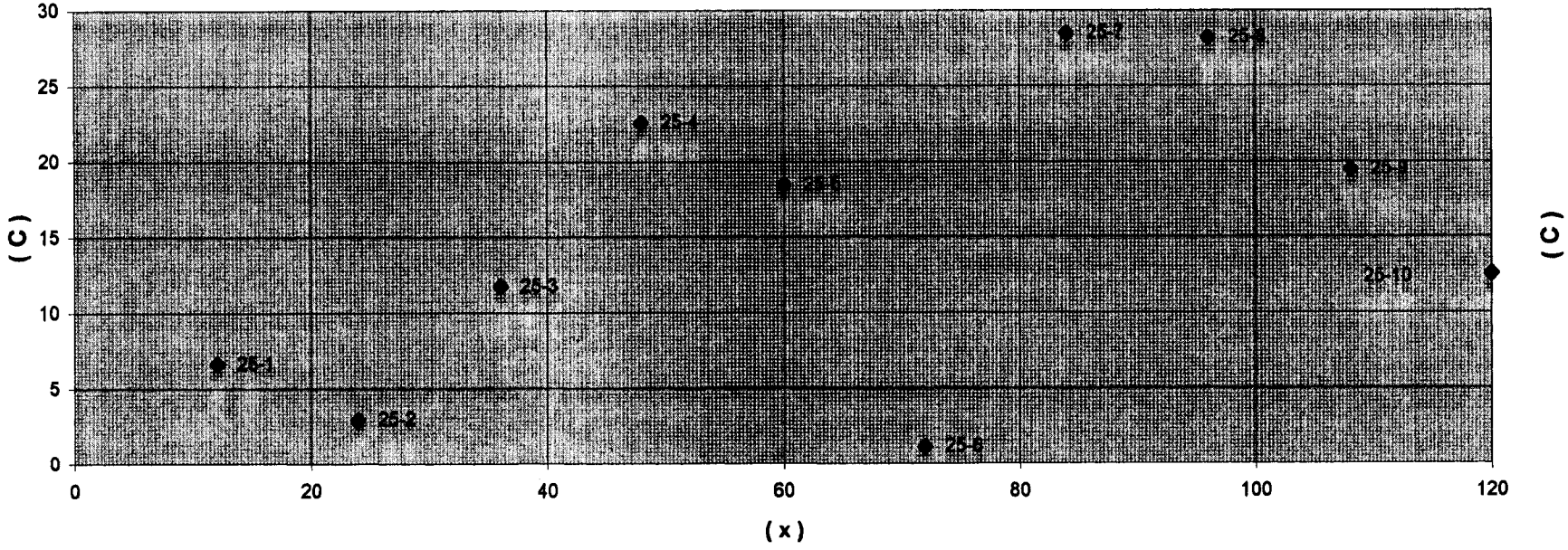
Figure # 5 Action On Waste - Destruction Bay Site # 25







SITE # 25 SAMPLE LOCATIONS 25-1 to 25-10



(Distances in Metres)

Figure # 5A Action On Waste - Destruction Bay Site # 25

SITE 25

3.0 Chemical Analysis Results

3.1 Soil Analysis

TABLE 3

Site 25 - Soil Samples Metal Analysis* µg/g							
Parameter	**25 1-5**	**25 6-10**	**25-11**	**25-12**	**25-13**	**25-0****	**CCME**
aluminum	16800	17700	16000	18600	17600	19100	---
antimony	<2.	<2.	<2.	<2.	<2.	<2.	40
arsenic	17.	16.	18.	17.	16.	27.	50
barium	156.	98.1	105.	146.	126.	154.	2000
beryllium	0.4	0.3	0.3	0.3	0.3	0.5	8
bismuth	<6.	<5.	<5.	<5.	<5.	<.6	
cadmium	4.7	0.5	0.5	0.5	0.5	0.6	20
calcium	29200	32100	30000	30600	30100	30700	---
chromium	45.1	45.2	43.7	43.3	45.9	47.7	800
cobalt	14.7	14.6	14.0	14.7	15.1	16.0	300
copper	65.6	61.2	58.7	59.8	60.7	62.1	500
iron	36000	39000	35000	40000	38000	40000	---
lead	7.	12.	7.	5.	7.	8.	1000
lithium	23.6	23.1	22.8	24.7	25.1	27.2	---
magnesium	17000	18200	16300	18200	17600	18600	---
manganese	709.	764.	655.	729.	715.	734.	---
molybdenum	2.	2.	2.	2.	2.	3.	40
nickel	37.1	35.4	34.6	35.4	37.4	38.4	500
phosphorus	919.	896.	892.	903.	966.	972.	---
potassium	870	650	880	890	870	1000	---
selenium	7.	2.	<2.	3.	3.	8	10
silicon	663.	623.	954.	720.	616.	581.	---
silver	<0.6	<0.5	<0.5	<0.5	<0.5	<0.6	
sodium	133.	118.	160.	131.	134.	154.	---
strontium	64.	59.	62.	58.	63.	65.	---
sulfur	480	460	360	380	430	440	---
thorium	22.	22.	22.	22.	23.	26.	---
tin	<1.	<1.	<1.	1.	<1.	<1.	
titanium	859.	754.	557.	872.	809.	936.	---
uranium	<6.	<5.	<5.	<5.	<5.	<6.	
vanadium	65	61.	61.	64.	65.	71	---
zinc	853.	115.	101.	109.	108.	110.	1500
zirconium	4.0	2.8	2.7	3.2	3.2	4.5	---

** Duplicate analysis, highest values are presented.

SITE 25

TABLE 4

Site 25 - Soil Samples															
Parameter	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**CCME***
Benzene	[illegible]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	5
Toluene	[illegible]	[illegible]	[illegible]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	30
Ethylbenzene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	50
m- & p-Xylene	[illegible]	<0.05	[illegible]	<0.05	[illegible]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	50**
o-Xylene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	50**
Light Hydrocarbons (C5-C10)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

* CCME Commercial/Industrial guidelines listed.
**Guideline level is for total xylenes.

All PAHs, PCBs and all organo-chloride pesticides were less than detection limits. Lab results are presented in Appendix 3.

3.2 Water Analysis

TABLE 5

Site 25 - Water Samples Analysis					
Parameter	**25-14**	**25-15**	**Detection Limit**	**CCME Aquatic**	**CCME Drinking Water**
Total hardness as $CaCO_3$	565	559			500
calcium	148	146			
magnesium	47.2	46.6			
potassium	1.3	1.4	0.2		
sodium	11.1	11.4			200
aluminum	<0.01	<0.01	0.01	0.1*	0.2
arsenic	<0.02	<0.02	0.02	0.05	0.025
barium	0.0251	0.0263	0.0006		1.0
cadmium	<0.0005	<0.0005	0.0005	0.0018*	0.005
chromium	<0.001	<0.001	0.001	0.002	0.05
copper	0.002	0.003	0.002	0.004*	1.0
iron	0.232	[illegible]	0.003	0.3	0.3
lead	<0.005	<0.005	0.005	0.007*	0.01
manganese	0.301†	0.373†	0.0006		0.05
selenium	<0.01	<0.01	0.01	0.01	0.01
uranium	<0.06	<0.06	0.06		0.1
zinc	0.003	0.004	0.001	0.03	5.0

Site 25 - Water Samples Analysis					
Parameter	**25-14**	**25-15**	**Detection Limit**	**CCME Aquatic**	**CCME Drinking Water**
antimony	<0.02	<0.02	0.02		
beryllium	<0.0002	<0.0002	0.0002		
bismuth	<0.02	<0.02	0.02		

SITE 25

TABLE 6

Site 25 - Water Samples Analysis					
Parameter	**25-14**	**25-15**	**Detection Limit**	**CCME Aquatic**	**CCME Drinking Water**
lithium	0.002	<0.002	0.002		
molybdenum	<0.005	<0.005	0.005		
nickel	<0.002	<0.002	0.002	0.150	
phosphorus	<0.06	<0.06	0.06		
silicon	4.16	4.2	0.06		
silver	<0.001	<0.001	0.001	0.001	
strontium	0.526	0.542	0.005		
sulfur	99	95	0.1		
thorium	<0.005	<0.005	0.005		
tin	<0.005	<0.005	0.005		
titanium	<0.001	<0.001	0.001		
vanadium	0.018	0.018	0.002		
zirconium	<0.001	<0.001	0.001		

* CME Aquatic Life Water Standard for hardness > 180 mg/L as $CaCO_3$

Exceeds CCME Aquatic Life Guidelines

† Exceeds CCME Drinking Water Guidelines

PCBs and organochloride pesticides were all below detection.

3.3 Discussion

Detectable levels of BETX in Table 4 have been highlighted. The highest level of benzene encountered was in the first hole drilled, which was to represent the background levels found at the site. The presence of benzene and traces of ethylbenzene and xylene in the background sample is an anomaly. The most logical explanation is that traces of a hydrocarbon lubricant may have been used on the surface of the auger bit. As the auger bit was not disassembled any

such lubricant could have remained between the bit and the 4 auger flights. This might not have been removed by prior to drilling the background sample, and thus contaminated this sample.

Precautions were taken to separate the augers from fuel and the auger motor was not refuelled near the background sample location.

All levels of contaminants detected are below CCME guideline levels in the interim remediation criteria for residential/parkland land use categories.

4.0 CONCLUSIONS: Site 25

Site 25 appears to be benign so far as contaminants are concerned. Although it is hidden from view and well removed from present land-uses, it is an eyesore and could in the future be considered a public hazard because of the quantities of sharp and jagged debris.

SITE 26A & B

1.0 SITE INFORMATION

1.1 Location

Near milepost 1086 north of Destruction Bay, Site 26A is a dump accessed by a spur of the Army pioneer road which left the shore of Kluane Lake at this place and climbed a sandy-gravel bench towards the present-day road grade (Figure 6). From the mid 1950's to the mid 1970's domestic wastes and construction debris were discarded over the top edge of this 70-meter high bench. In 1984, the National Research Council (NRC) placed an atmospheric recording station on this hill. During the construction of this facility, the upper debris pile was partially covered by sand pushed over the edge of the embankment. Although some of these wastes are still visible, it is evident from revegetation and from the age of the materials that this site has not been used for two decades. Wastes were also deposited in a pit at the base of the hill immediately below the dump described. This pit was filled in the 1970's and is further covered by sloughing of glacial till from the bank above. In 1995, Yukon Energy Corp. placed an anemometer on the site of the earlier NRC station. This project did not affect either dump site.

No information could be found about a second site (Site 26B) indicated on the map as between 100 and 200 meters west of the small lake near the old telephone line right-of-way. The only evidence of waste disposal in the area indicated was a bed-frame and a barrel. Soil samples were taken at this site for the sake of completeness. It is possible that information about this site was confused with the lower portion of Site 26A described above. It is also possible that this site is a memory of a building visible in the 1957 airphotos which was standing nearby. No evidence of waste or surface disturbance could be seen on this building site which is now thickly revegetated with successional willow.

Two sites are located in this area

- Near the tower marked AM 186W - Site 26 A
- Near the junction of the Army Pioneer Road and the telephone line right-of-way - Site 26 B

1.2 Site Description

Site 26 A

The site is situated partially on top of the bluff and down the face of the slope. The bluff is composed of glacial till; inactive sand dunes are at the top near the anemometer tower

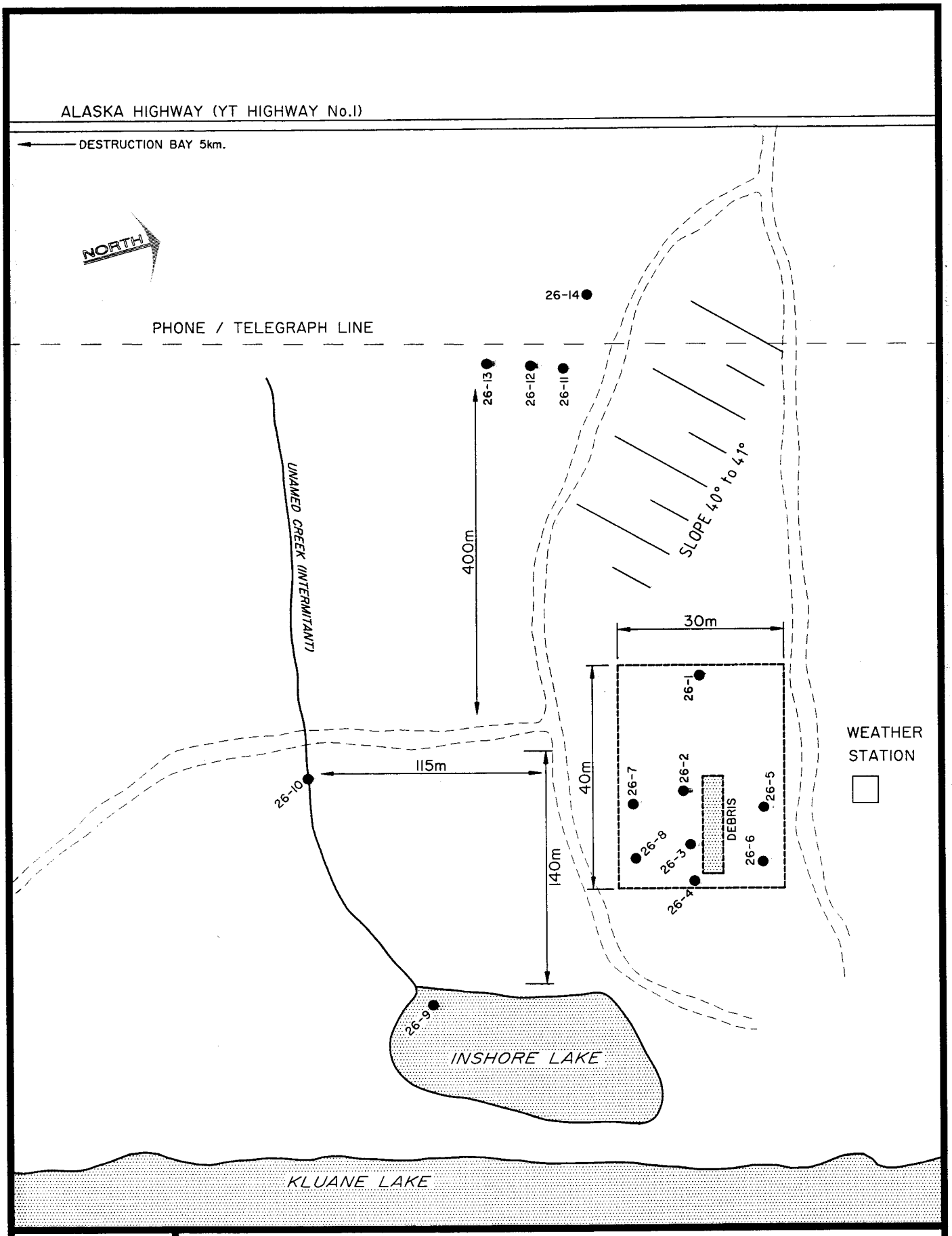


FIGURE #6 ACTION ON WASTE DESTRUCTION BAY SITE #26
SITE MAP and SAMPLE LOCATIONS

SITE 26

Site 26 B

Visible waste is scattered along the telephone right-of-way for approximately 30 m. This is a mature white spruce forest over sphagnum.

2.0 FIELD WORK

2.1 Soil Sampling

Two separate locations were investigated; Site 26A & B as shown on Figure 6.

Site 26A was the most obvious of the sites investigated. The site was located down the face of a steep slope, with the boundaries of the disposal site easily identified by the visible debris. The debris had been only partially covered with surface soil from the crest of the slope. Consequently, soil sampling could be concentrated within the area of suspected contamination. A non-random sampling grid was established using three grid lines transecting the site. The upper line was located 5 m down from the crest of the slope, the second line was located 15 m from the crest and the third line was located along the base of the slope.

Site 26B was located along a former telephone line right-of-way. A random sampling grid was established using the eastern edge of the line right-of-way as the baseline. One additional sample was taken adjacent to an abandoned drum on the opposite side of the line right-of-way.

All samples from Site 26A & B were collected by digging down to undisturbed mineral soils, about 30 cm.

2.2 Water Sampling

Two water samples were collected in the vicinity of Site 26A & B.

Water sample # 26-9 was taken from surface water in a small (<1 hectare) inshore lake adjacent to Kluane Lake. Inshore lake is located 140 meters downslope and to the south east of site 26A soil sample grid (Figure 6).

Water sample # 26-10 was taken from an intermittent creek channel standing water (non-flowing) under ice conditions. The channel is located 115 meters south of the Site 26A soil sample grid and is the only surface water course in the immediate area.

SITE 26

3.0 CHEMICAL ANALYSIS RESULTS

3.1 Soil Analysis

TABLE 7

Site 26 - Soil Samples Metal Analysis* µg/g						
Parameter	**26A 1 - 4**	**26A 5 - 8**	**26A 11 - 13**	**26A 14**	**OUT**	**CCME**
aluminum	15300	16200	12600	6900		---
antimony	< 2.	< 2.	< 2.	< 2.		40
arsenic	12	15.	16.	9.		50
barium	86.6	73.7	143.	126		2000
beryllium	0.3	0.3	0.3	0.2		8
bismuth	< 5.	< 6	< 5	< 6.		
cadmium	0.2	0.3	0.4	0.3		20
calcium	28800	27100	11600	15400		---
chromium	118.	71.8	56.0	24.9		800
cobalt	26.0	20.2	16.5	7.5		300
copper	74.9	67.4	71.3	40.4		500
iron	36000	36000	29000	12000		---
lead	5.	8.	7.	5.		1000
lithium	17.0	17.4	12.6	7.1		---
magnesium	32700	26000	12700	5130		---
manganese	698.	681.	641.	241.		---
molybdenum	< 1.	< 1.	< 1.	< 1.		40
nickel	188.	107.	59.9	24.2		500
phosphorus	719	687.	717.	698.		---
potassium	690	740	710	500		---
selenium	3.	3.	3.	5.		10
silicon	711	336.	493.	281.		---
silver	< 0.5	< 0.6	< 0.5	< 0.6		
sodium	264.	285.	214.	222.		---
strontium	57.	49.	32.	46		---
sulfur	350	320	490	1000		---
thorium	22.	22.	20.	8.		---
tin	< 1.	< 1.	< 1.	1.		
titanium	657.	678.	444.	286.		---
uranium	< 5.	< 6.	< 5.	< 6.		
vanadium	53.	57.	47.	23.		---
zinc	72.5	90.0	93.1	54.9		1500
zirconium	3.8	4.5	4.7	4.2		---

SITE 26

TABLE 8

Site 26A - Soil Samples									
Parameter	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**CCME***
Benzene	<0.05	<0.05	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	5
Toluene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	30
Ethylbenzene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	50
m- & p- Xylene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	50**
o-Xylene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	50**
Light Hydrocabons (C5-C10)	ND	ND	ND	ND	ND	ND	ND	ND	ND

* CCME Commercial/Industrial guidelines listed.
**Guideline level is for total xylenes.

TABLE 9

Site 26B - Soil Samples					
Parameter	**1**	**2**	**3**	**4**	**CCME***
Benzene	<0.05	<0.05	0.05	<0.05	5
Toluene	<0.05	<0.05	<0.05	<0.05	30
Ethylbenzene	<0.05	<0.05	<0.05	<0.05	50
m- & p- Xylene	<0.05	<0.05	<0.05	<0.05	50**
o-Xylene	<0.05	<0.05	<0.05	<0.05	50**
Light Hydrocarbons (C5-C10)	ND	ND	ND	ND	ND

* CCME Commercial/Industrial guidelines listed.
**Guideline level is for total xylenes.

All PAHs, PCBs and all organo-chloride pesticides were less than detection limits. Lab results are presented in Appendix 3.

SITE 26

3.2 Water Analysis

TABLE 10

Site 26 - Water Samples Analysis					
Parameter	**26-9**	**26-10**	**Detection Limit**	**CCME Aquatic**	**CCME Drinking Water**
Total hardness as $CaCO_3$	288	296			500
calcium	73.7	87.2			
magnesium	25.0	17.9			
potassium	1.0	1.9	0.2		
sodium	7.07	2.19			200
aluminum	0.05	[illegible]	0.01	0.1*	0.2
arsenic	<0.02	<0.02	0.02	0.05	0.025
barium	0.0435	0.0881	0.0006		1.0
cadmium	<0.0005	<0.0005	0.0005	0.0018*	0.005
chromium	[illegible]	0.002	0.001	0.002	0.05
copper	[illegible]	[illegible]	0.002	0.004*	1.0
iron	0.168	[illegible]	0.003	0.3	0.3
lead	<0.005	<0.005	0.005	0.007*	0.01
manganese	0.0218	0.853†	0.0006		0.05
selenium	<0.01	<0.01	0.01	0.01	0.01
uranium	<0.06	<0.06	0.06		0.1
zinc	0.008	0.009	0.001	0.03	5.0
antimony	<0.02	<0.02	0.02		
beryllium	<0.0002	<0.0002	0.0002		
bismuth	<0.02	<0.02	0.02		
cobalt	<0.001	0.002	0.001		
lithium	<0.002	0.002	0.002		
molybdenum	<0.005	<0.005	0.005		
nickel	0.002	0.008	0.002	0.150	
phosphorus	<0.06	<0.06	0.06		
silicon	5.04	6.76	0.06		
silver	<0.001	<0.001	0.001	0.001	
strontium	0.243	0.214	0.005		
sulfur	47.7	6.2	0.1		
thorium	<0.005	<0.005	0.005		
tin	<0.005	<0.005	0.005		

Site 26 - Water Samples Analysis					
Parameter	**26-9**	**26-10**	**Detection Limit**	**CCME Aquatic**	**CCME Drinking Water**
titanium	0.001	0.004	0.001		
vanadium	0.012	0.014	0.002		
zirconium	<0.001	<0.001	0.001		

* CCME Aquatic Life Water Standard for hardness > 180 mg/L as $CaCO_3$

▓ Exceeds CCME Aquatic Life Guidelines

† Exceeds CCME Drinking Water Guidelines

PCBs and organochloride pesticides were all below detection.

SITE 26

3.3 Discussion

No BETX or hydrocarbon compounds were detected in any of the remaining samples. Benzene was detected in trace amounts in Sample 26 A3 only. Aluminum, chromium, copper and iron exceeded CCME Aquatic Life Guidelines although all substances were within the limits of CCME Drinking Water Guidelines. Due to the highly mineralized bedrocks of this region, we suggest that these readings are from natural sources, with the possible exception of chromium.

4.0 CONCLUSIONS: Site 26

From the standpoint of public safety, Site 26 appears benign and requires no further investigation. This is an attractive area overlooking Kluane Lake: future land-uses might suggest cosmetic restoration of the embankment - most likely by burying and revegetating.

Appendix 1
Soil Samples Locations

Site 24A & B

Sample	Description
24-1	Soil sample the base of an old hand dug pit, 2.7 m square. Upper half of the pit was cribbed with logs. Sample was taken from soil 30 cm below the base of the pit.
24-2	Soil sample from base of an old hand dug pit, 4 m square. Upper 1.2 m of pit was cribbed with squared timbers. Pit was roofed over with squared timbers and Domtar™ paper which is now collapsed. Pit has 12 cm diameter pipe entering the northwest corner at the 1.6 m level. The pit is 3.5 to 4 m deep and within 20 m of an unnamed creek.
24-3	Soil composite sample from fill piles located along the perimeter of the site.
24-4	Soil sample taken from the base of the creek bank 40 m north of the cribbed pit (sample 24-2).
24-5	Soil composite sample taken from fill piles along the south end of the gravel pit marked as Site 24B.
24-6	Soil sample taken from low elevation point of gravel pit. Area located at the north end of the pit, and subject to standing water.

Site 25

Sample	Description
25-0	Soil sample taken 2 m upstream of 0.00 m on sampling grid and center of creek bed. Serves as background soil sample. Depth 0.3 m.
25-1	Random soil grid sample. Depth 0.78 m.
25-2	Random soil grid sample. Depth 0.42 m.
25-3	Random soil grid sample. Depth 0.87 m.
25-4	Random soil grid sample. Depth 0.18 m.
25-5	Random soil grid sample. Depth 0.53 m.
25-6	Random soil grid sample. Depth 0.77 m.
25-7	Random soil grid sample. Depth 0.63 m.
25-8	Random soil grid sample. Depth 0.55 m.
25-9	Random soil grid sample. Depth 0.95m.
25-10	Random soil grid sample. Depth 0.66 m.
25-11	Non-random soil sample below soil sample grid upslope of access road crossing. Depth 0.30 m.

Site 25 cont'd

Sample	Description
25-12	Non-random duplicate soil sample taken 5 m downslope of access road crossing, identified on map as possible oil spill site. Depth 0.5 m.
25-13	Duplicate of sample 25-12.

Site 26A

Sample	Description
26-1	Non-random sample, second grid line (midslope) west end
26-2	Non-random sample, second grid line (midslope) midpoint on grid line.
26-3	Non-random sample, second grid line (midslope) 10 m east of 26-2
26-4	Non-random sample, second grid line (midslope) east end
26-5	Non-random sample, first grid line (near crest) near midpoint on grid line
26-6	Non-random sample, first grid line (near crest) 15 m east of 26-5
26-7	Non-random sample, third grid line (base of slope) midpoint on grid line
26-8	Non-random sample, third grid line (base of slope) 15 m east of 26-7

Site 26B

Sample	Description
26-11	Random sample
26-12	Random sample
26-13	Random sample
26-14	Non-random sample adjacent to 205 L drum west of telephone line right-of-way

APPENDIX 2
PHOTOS

Photo # 1
Site 24A

Pit with wooden cribbing, shown in lower right hand corner of photo, trees in background are along stream bank.

Photo # 2
Site 24A

Pit with wooden cribbing and stand pipe, no liquid found in pipe.

Photo # 3
Site 25

Looking down drainage course toward Kluane Lake, over area of random grid samples.

Photo # 4
Site 25 Wood debris, barrels and domestic wastes

Photo # 5
Site 25

Barrels with ends removed or cut in half scattered along creek bed.

Photo # 6
Site 26A Domestic wastes and burn debris.

Photo # 7
Site 26A Scrap metal and construction materials partially buried in slope

Photo # 8
Site 25 Power auger used at site to advance sampling holes.

Photo # 9
Site 26A Wastes had been tipped off the edge of the embankment and later partially buried.

APPENDIX 3
SOILS:
PAH's
PCB's
Organo-Chloride Pesticides

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.) : 21338
WO (Other) :
PO # : 29911
Date Samp. :
Date Rec'd. : 10-Oct-96
Date Comp. : 24-Oct-96

Client		Received From	
Name	: Quanta Trace Labs	Name	:
Address	: #401 - 3700 Gilmore Way Burnaby, B.C. CANADA V5G 4M1	Address	:
Phone	: (604) 438-5226	Phone	:
Fax	: (604) 436-0565	Fax	:
Attn.	: Janet Pel	Attn.	:
Project	:		

Polynuclear Aromatic Hydrocarbons in Soil

Parameter	21338-1 29911-1	21338-2 29911-2	21338-3 29911-3	21338-4 29911-4	Detection Limit
Naphthalene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Acenaphthylene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Acenaphthene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Fluorene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Phenanthrene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Anthracene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Fluoranthene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Pyrene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Benzo(a)anthracene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Chrysene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Benzo-fluoranthenes (b&k)	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Benzo(a)pyrene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Indeno(1,2,3-cd)pyrene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Dibenzo(a,h)anthracene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Benzo(g,h,i)perylene	<0.1	<0.1	<0.1	<0.1	0.1 ppm

Surrogate	% Recovery	Recovery Range
Nitrobenzene-d5	108.5	23-120
2-Fluorobiphenyl	98.5	30-115
4-Terphenyl-d14	100.5	18-137

Results are expressed in ppm (mg/kg), dry weight, without correction for recovery data.
na = not available due to hydrocarbon interferences.

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.) : 21338
WO (Other) :
PO # : 29911
Date Samp. :
Date Rec'd.: 10-Oct-96
Date Comp. : 24-Oct-96

Polynuclear Aromatic Hydrocarbons in Soil

Parameter	21338-5 21199-5	21338-6 29911-6	21338-7 29911-7	21338-8 29911-8	Detection Limit
Naphthalene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Acenaphthylene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Acenaphthene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Fluorene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Phenanthrene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Anthracene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Fluoranthene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Pyrene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Benzo(a)anthracene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Chrysene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Benzo-fluoranthenes (b&k)	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Benzo(a)pyrene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Indeno(1,2,3-cd)pyrene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Dibenzo(a,h)anthracene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Benzo(g,h,i)perylene	<0.1	<0.1	<0.1	<0.1	0.1 ppm

Surrogate	% Recovery	Recovery Range
Nitrobenzene-d5	103.2	23-120
2-Fluorobiphenyl	98.2	30-115
4-Terphenyl-d14	102.8	18-137

Results are expressed in ppm (mg/kg), dry weight, without correction for recovery data.
na = not available due to hydrocarbon interferences.

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.) : 21338
WO (Other) :
PO # : 29911
Date Samp. :
Date Rec'd. : 10-Oct-96
Date Comp. : 24-Oct-96

Polynuclear Aromatic Hydrocarbons in Soil

Parameter	21338-9 29911-9	21338-10 29911-10	21338-11 29911-11	21338-12 29911-12	Detection Limit
Naphthalene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Acenaphthylene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Acenaphthene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Fluorene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Phenanthrene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Anthracene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Fluoranthene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Pyrene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Benzo(a)anthracene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Chrysene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Benzo-fluoranthenes (b&k)	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Benzo(a)pyrene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Indeno(1,2,3-cd)pyrene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Dibenzo(a,h)anthracene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Benzo(g,h,i)perylene	<0.1	<0.1	<0.1	<0.1	0.1 ppm

Surrogate	% Recovery	Recovery Range
Nitrobenzene-d5	107.2	23-120
2-Fluorobiphenyl	100	30-115
4-Terphenyl-d14	105.5	18-137

Results are expressed in ppm (mg/kg), dry weight, without correction for recovery data.
na = not available due to hydrocarbon interferences.

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NORWEST LABS

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

WO (Lang.) : 21338
WO (Other) :
PO # : 29911
Date Samp. :
Date Rec'd. : 10-Oct-96
Date Comp. : 24-Oct-96

Polynuclear Aromatic Hydrocarbons in Soil

Parameter	21338-13 29911-13	21338-14 29911-14	21338-15 29911-15	21338-16 29911-16	Detection Limit
Naphthalene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Acenaphthylene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Acenaphthene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Fluorene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Phenanthrene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Anthracene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Fluoranthene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Pyrene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Benzo(a)anthracene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Chrysene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Benzo-fluoranthenes (b&k)	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Benzo(a)pyrene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Indeno(1,2,3-cd)pyrene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Dibenzo(a,h)anthracene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Benzo(g,h,i)perylene	<0.1	<0.1	<0.1	<0.1	0.1 ppm

Surrogate	% Recovery	Recovery Range
Nitrobenzene-d5	104.5	23-120
2-Fluorobiphenyl	94.8	30-115
4-Terphenyl-d14	86.8	18-137

Results are expressed in ppm (mg/kg), dry weight, without correction for recovery data.
na = not available due to hydrocarbon interferences.

Approved: Randy Neumann, B.Sc.
Laboratory Manager

Phone:
(604) 530-4344
1-800-889-1433
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NORWEST LABS

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

WO (Lang.) : 21338
WO (Other) :
PO # : 29911
Date Samp. :
Date Rec'd.: 10-Oct-96
Date Comp. : 31-Oct-96

Client		Received From	
Name	: Quanta Trace Labs	Name	:
Address	: #401 - 3700 Gilmore Way Burnaby, B.C. CANADA V5G 4M1	Address	:
Phone	: (604) 438-5226	Phone	:
Fax	: (604) 436-0565	Fax	:
Attn.	: Janet Pel	Attn.	:
Project	:		

Polychlorinated Biphenyls (PCBs) in Soil

Parameter	21338-1 29911-1	21338-2 29911-2	21338-3 29911-3	21338-4 29911-4	Detection Limit
Total PCBs	<0.1	<0.1	<0.1	<0.1	0.1 ppm

Parameter	21338-5 21199-5	21338-6 29911-6	21338-7 29911-7	21338-8 29911-8	Detection Limit
Total PCBs	<0.1	<0.1	<0.1	<0.1	0.1 ppm

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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NORWEST LABS

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

WO (Lang.) : 21338
WO (Other) :
PO # : 29911
Date Samp. :
Date Rec'd.: 10-Oct-96
Date Comp. : 31-Oct-96

Polychlorinated Biphenyls (PCBs) in Soil (cont.)

Parameter	21338-9 29911-9	21338-10 29911-10	21338-11 29911-11	21338-12 29911-12	Detection Limit
Total PCBs	<0.1	<0.1	<0.1	<0.1	0.1 ppm

Parameter	21338-13 29911-13	21338-14 29911-14	21338-15 29911-15	21338-16 29911-16	Detection Limit
Total PCBs	<0.1	<0.1	<0.1	<0.1	0.1 ppm

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

WO (Lang.) : 21338
WO (Other) :
PO # : 29911
Date Samp. :
Date Rec'd. : 10-Oct-96
Date Comp. : 31-Oct-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
PCB Aroclor-1260	116	PCBs	30-Oct-96	Ken M.
Surrogate	91			

Supervisor

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

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Fax:
(604) 534-9996

NORWEST LABS

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

WO (Lang.) : 21338
WO (Other) :
PO # : 29911
Date Samp. :
Date Rec'd. : 10-Oct-96
Date Comp. : 31-Oct-96

Client		Received From	
Name	: Quanta Trace Labs	Name	:
Address	: #401 - 3700 Gilmore Way Burnaby, B.C. CANADA V5G 4M1	Address	:
Phone	: (604) 438-5226	Phone	:
Fax	: (604) 436-0565	Fax	:
Attn.	: Janet Pel	Attn.	:
Project	:		

Organo-Chloride Pesticides in Soil

Parameter	21338-1 29911-1	21338-2 29911-2	21338-3 29911-3	21338-4 29911-4	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
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

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

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

WO (Lang.) : 21338
WO (Other) :
PO # : 29911
Date Samp. :
Date Rec'd. : 10-Oct-96
Date Comp. : 31-Oct-96

Organo-Chloride Pesticides in Soil (cont.)

Parameter	21338-5 21199-5	21338-6 29911-6	21338-7 29911-7	21338-8 29911-8	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
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

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

Phone:
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NORWEST LABS

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

WO (Lang.) : 21338
WO (Other) :
PO # : 29911
Date Samp. :
Date Rec'd. : 10-Oct-96
Date Comp. : 31-Oct-96

Organo-Chloride Pesticides in Soil (cont.)

Parameter	21338-9 29911-9	21338-10 29911-10	21338-11 29911-11	21338-12 29911-12	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
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

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.) : 21338
WO (Other) :
PO # : 29911
Date Samp. :
Date Rec'd. : 10-Oct-96
Date Comp. : 31-Oct-96

Organo-Chloride Pesticides in Soil (cont.)

Parameter	21338-13 29911-13	21338-14 29911-14	21338-15 29911-15	21338-16 29911-16	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
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

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.) : 21338
WO (Other) :
PO # : 29911
Date Samp. :
Date Rec'd.: 10-Oct-96
Date Comp. : 31-Oct-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	84	O-C Scan	30-Oct-96	Ken M.
Endosulfan I	87			
DDT	85			
Surrogate	112			

R. H. Neumann
Supervisor

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

quanta trace laboratories inc.

401 - 3700 Gilmore Way, Burnaby, British Columbia, Canada V5G 4M1
Telephone: (604) 438-5226 Fax: (604) 436-0565

To: TRANS-NORTHERN CONSULTING
Box 4850
Whitehorse, Yukon
Y1A 4N6

Attn: DAVE LOEKS

Workorder: 29907
Received : 07-Oct-96
Completed: 29-Oct-96

Re: Determination of BTEX in Soils

ANALYSIS

OF

SOIL SAMPLES

METHODOLOGY

ANALYSIS
BTEX determined by Norwest Labs. Their report is attached.

Lab #	Site
29907-1	24-1
29907-2	24-2
29907-3	24-3
29907-4	24-4
29907-5	24-5
29907-6	24-6
29907-7	25-0
29907-8	25-1
29907-9	25-2
29907-10	25-3
29907-11	25-4
29907-12	25-5
29907-13	25-6
29907-14	25-7
29907-15	25-8
29907-16	25-9
29907-17	25-10
29907-18	25-11
29907-19	25-12
29907-20	25-13
29907-21	26-1
29907-22	26-2
29907-23	26-3
29907-24	26-4
29907-25	26-5
29907-26	26-6
29907-27	26-7
29907-28	26-8
29907-29	26-11
29907-30	26-12
29907-31	26-13
29907-32	26-14

ACCREDITATION

Quanta Trace is accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL), by the Standards Council of Canada (SCC), and by Washington State Department of Ecology for specific tests. Quanta Trace is also registered in the B.C. Ministry of Environment Laboratory Registration Program.

1-800-[illegible]-1433
Fax:
(604) 214-9956

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

WO (Lang.) : 21283
WO (Other) :
PO # : 29907
Date Samp. :
Date Rec'd. : 8-Oct-96
Date Comp. : 28-Oct-96

Client		Received From	
Name	: Quanta Trace Labs	Name	:
Address	: #401 - 3700 Gilmore Way Burnaby, B.C. CANADA V5G 4M1	Address	:
Phone	: (604) 438-5226	Phone	:
Fax	: (604) 436-0565	Fax	:
Attn.	: Janet Pel	Attn.	:
Project	:		

Petroleum Hydrocarbons in Soil

Parameter	21283-1 29907-1	21283-2 29907-2	21283-3 29907-3	21283-4 29907-4	21283-5 29907-5	Detection Limit
BTEX						
Benzene	<0.05	<0.05	<0.05	<0.05	<0.05	0.05 ppm
Toluene	0.05	<0.05	<0.05	0.05	<0.05	0.05 ppm
Ethylbenzene	<0.05	<0.05	<0.05	<0.05	<0.05	0.05 ppm
m- & p- Xylene	<0.05	<0.05	<0.05	<0.05	<0.05	0.05 ppm
o- Xylene	<0.05	<0.05	<0.05	<0.05	<0.05	0.05 ppm
Light Hydrocarbons (C5-C10	ND	ND	ND	ND	ND	0.10 ppm
Percent Moisture	12.78	20	6.05	21.05	8.98	

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

Phone:
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NORWEST LABS
203-20771 Langley Bypass
Langley, B.C. V3A 5E8

WO (Lang.) : 21283
WO (Other) :
PO # : 29907
Date Samp. :
Date Rec'd. : 8-Oct-96
Date Comp. : 28-Oct-96

Petroleum Hydrocarbons in Soil (cont.)

Parameter	24-6 21283-6 29907-6	25-0 21283-7 29907-7	25-1 21283-8 29907-8	25-2 21283-9 29907-9	25-3 21283-10 29907-10	Detection Limit
BTEX						
Benzene	<0.05	0.27	<0.05	<0.05	<0.05	0.05 ppm
Toluene	0.05	0.05	0.05	0.05	<0.05	0.05 ppm
Ethylbenzene	<0.05	<0.05	<0.05	<0.05	<0.05	0.05 ppm
m- & p- Xylene	<0.05	0.06	<0.05	0.06	<0.05	0.05 ppm
o- Xylene	<0.05	<0.05	<0.05	<0.05	<0.05	0.05 ppm
Light Hydrocarbons (C5-C10	ND	ND	ND	ND	ND	0.10 ppm
Percent Moisture	9.13	5.22	5.56	5.5	9.37	

Parameter	25-4 21283-11 29907-11	25-5 21283-12 29907-12	25-6 21283-13 29907-13	25-7 21283-14 29907-14	25-8 21283-15 29907-15	Detection Limit
BTEX						
Benzene	<0.05	<0.05	<0.05	<0.05	<0.05	0.05 ppm
Toluene	<0.05	<0.05	<0.05	<0.05	<0.05	0.05 ppm
Ethylbenzene	<0.05	<0.05	<0.05	<0.05	<0.05	0.05 ppm
m- & p- Xylene	0.08	<0.05	<0.05	<0.05	<0.05	0.05 ppm
o- Xylene	<0.05	<0.05	<0.05	<0.05	<0.05	0.05 ppm
Light Hydrocarbons (C5-C10	ND	ND	ND	ND	ND	0.10 ppm
Percent Moisture	15.92	5.84	4.77	4.86	4.21	

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

Phone:
(604) 530-4344
1-800-989-1433
Fax:
(604) 534-9986

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

WO (Lang.) : 21283
WO (Other) :
PO # : 29907
Date Samp. :
Date Rec'd. : 8-Oct-96
Date Comp. : 28-Oct-96

Petroleum Hydrocarbons in Soil (cont.)

Parameter	25-9 21283-16 29907-16	25-10 21283-17 29907-17	25-11 21283-18 29907-18	25-12 21283-19 29907-19	25-13 21283-20 29907-20	Detection Limit
BTEX						
Benzene	<0.05	<0.05	<0.05	<0.05	<0.05	0.05 ppm
Toluene	<0.05	<0.05	<0.05	<0.05	<0.05	0.05 ppm
Ethylbenzene	<0.05	<0.05	<0.05	<0.05	<0.05	0.05 ppm
m- & p- Xylene	<0.05	<0.05	<0.05	<0.05	<0.05	0.05 ppm
o- Xylene	<0.05	<0.05	<0.05	<0.05	<0.05	0.05 ppm
Light Hydrocarbons (C5-C10	ND	ND	ND	ND	ND	0.10 ppm
Percent Moisture	5.89	5.67	2.75	3.86	3.4	

Parameter	26-1 21283-21 29907-21	26-2 21283-22 29907-22	26-3 21283-23 29907-23	26-4 21283-24 29907-24	26-5 21283-25 29907-25	Detection Limit
BTEX						
Benzene	<0.05	<0.05	0.09	<0.05	<0.05	0.05 ppm
Toluene	<0.05	<0.05	<0.05	<0.05	<0.05	0.05 ppm
Ethylbenzene	<0.05	<0.05	<0.05	<0.05	<0.05	0.05 ppm
m- & p- Xylene	<0.05	<0.05	<0.05	<0.05	<0.05	0.05 ppm
o- Xylene	<0.05	<0.05	<0.05	<0.05	<0.05	0.05 ppm
Light Hydrocarbons (C5-C10	ND	ND	ND	ND	ND	0.10 ppm
Percent Moisture	2.85	4.52	4.52	4.26	6.17	

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

Phone:
(604) 530-4314
1-800-889-1433
Fax:
(604) 534-9986

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

WO (Lang.) : 21283
WO (Other) :
PO # : 29907
Date Samp. :
Date Rec'd. : 8-Oct-96
Date Comp. : 28-Oct-96

Petroleum Hydrocarbons in Soil (cont.)

Parameter	26-6 21283-26 29907-26	26-7 21283-27 29907-27	26-8 21283-28 29907-28	26-11 21283-29 29907-29	Detection Limit
BTEX					
Benzene	<0.05	<0.05	<0.05	<0.05	0.05 ppm
Toluene	<0.05	<0.05	<0.05	<0.05	0.05 ppm
Ethylbenzene	<0.05	<0.05	<0.05	<0.05	0.05 ppm
m- & p- Xylene	<0.05	<0.05	<0.05	<0.05	0.05 ppm
o- Xylene	<0.05	<0.05	<0.05	<0.05	0.05 ppm
Light Hydrocarbons (C5-C10)	ND	ND	ND	ND	0.10 ppm
Percent Moisture	3.06	3.07	2.75	11.9	

Parameter	26-12 21283-30 29907-30	26-13 21283-31 29907-31	26-14 21283-32 29907-32	Detection Limit
BTEX				
Benzene	<0.05	<0.05	<0.05	0.05 ppm
Toluene	<0.05	<0.05	<0.05	0.05 ppm
Ethylbenzene	<0.05	<0.05	<0.05	0.05 ppm
m- & p- Xylene	<0.05	<0.05	<0.05	0.05 ppm
o- Xylene	<0.05	<0.05	<0.05	0.05 ppm
Light Hydrocarbons (C5-C10)	ND	ND	ND	0.10 ppm
Percent Moisture	17.6	10.71	34.71	

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

Phone:
(604) 530-4344
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NORWEST LABS
203-20771 Langley Bypass
Langley, B.C. V3A 5E8

WO (Lang.) : 21283
WO (Other) :
PO # : 29907
Date Samp. :
Date Rec'd. : 8-Oct-96
Date Comp. : 28-Oct-96

Petroleum Hydrocarbons in Soil (cont.)

Definitions / Methods

BTEX Analysis: US EPA 8020 which involves purge & trap extraction of the volatile components followed by analysis by capillary gas chromatography using a photo ionization detector.

Light Hydrocarbons: Summation of the C5 to C10 carbon range determined using a calibrated standard. This method involves purge & trap extraction of the volatile petroleum compounds 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 Compound	% Recovery	Analyst Analysis	Analyst Date	Analyst
BTEX	101	BTEX, LH	17-Oct-96	Carol N/Ken M.

Supervisor

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

APPENDIX 4
SOIL SAMPLES:
METALS

quanta trace laboratories inc.

401 - 3700 Gilmore Way, Burnaby, British Columbia, Canada V5G 4M1
Telephone: (604) 438-5226 Fax: (604) 436-0565

To: TRANS NORTHERN CONSULTING
Box 4850
Whitehorse, Yukon
Y1A 4N6

Workorder: 29911
Received : 07-Oct-96
Completed: 04-Nov-96

Attn: DAVE LOEKS

Re: Soil Samples

ANALYSIS OF SOIL SAMPLES

METHODOLOGY

PREPARATION
A portion of each sample was dried at 55 degrees Celsius, screened using a 10 mesh sieve and the -10 mesh fraction was pulverized in a non-contaminating ceramic grinder to pass a 100 mesh screen. Another portion of the original sample was used to determine the organics.

DIGESTION
A portion (0.5 grams) of the prepared sample was acid digested in a closed teflon vessel in a microwave oven (modified EPA Method 3051).

ANALYSIS
Metals were determined on the resulting solution by UNICP-AES (EPA Method 200.15). PCB's, Organo-chloride Pesticides and PAH's were determined by Norwest Labs. Their report is attached.

RESULTS
Results are reported as micrograms of soluble element per gram of dry sample (ug/dry g).

QA/QC
A Certified Reference Material (Canadian Centre for Mineral & Energy Technology, Energy Mines & Resources Canada, Lake Sediment LKSD-1) was digested and analysed concurrently to monitor the accuracy of the analysis. One in ten samples was also digested and analyzed in duplicate.

ACCREDITATION

Quanta Trace is accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL), by the Standards Council of Canada (SCC), and by Washington State Department of Ecology for specific tests. Quanta Trace is also registered in the B.C. Ministry of Environment Laboratory Registration Program.

To: TRANS NORTHERN CONSULTING W/O: 29911 Page 1

Sample type		soil	soil	soil	soil	soil
Identification		SITE 24-1	SITE 24-2	SITE 24-3	SITE 24-3	SITE 24-4
Lab Reference #		29911-001	29911-002	29911-003A	29911-003B	29911-004
ICP - ULTRASONIC NEBULIZATION						
Method used		uwave HNO3/H2O2 soluble	uwave HNO3/H2O2 soluble	uwave HNO3/H2O2 soluble	uwave HNO3/H2O2 soluble	uwave HNO3/H2O2 soluble
Amount analysed		0.505 g	0.502 g	0.488 g	0.502 g	0.505 g
aluminum	Al	12300	12100	17400	17000	13500
antimony	Sb	< 2.	< 2.	< 2.	< 2.	< 2.
arsenic	As	18.	10	20.	26.	18.
barium	Ba	132.	121.	141.	147.	112.
beryllium	Be	0.3	0.3	0.3	0.3	0.4
bismuth	Bi	< 5.	< 5.	< 6.	< 5.	< 5.
cadmium	Cd	0.4	0.3	0.3	0.4	0.2
calcium	Ca	30200	26100	24600	23500	13400
chromium	Cr	48.4	38.4	94.3	92.0	43.5
cobalt	Co	14.8	12.9	23.3	23.5	15.2
copper	Cu	61.1	52.0	66.2	73.9	51.1
iron	Fe	28000	26000	39000	39000	31000
lead	Pb	6.	10	6.	7.	8.
lithium	Li	10.	8.8	15.8	16.4	12.1
magnesium	Mg	14500	10400	30500	29800	9240
manganese	Mn	611.	460.	681.	693.	368.
molybdenum	Mo	1.	< 1.	2.	2.	< 1.
nickel	Ni	54.0	37.7	135.	133.	45.0
phosphorus	P	888.	677.	718.	742.	459.
potassium	K	1340	1310	600	580	910
selenium	Se	6.	< 2.	7.	4.	3.
silicon	Si	997.	807.	792.	776.	877.
silver	Ag	< 0.5	< 0.5	< 0.6	< 0.5	< 0.5
sodium	Na	170.	212.	150.	144.	164.
strontium	Sr	63.	58.	45.	43.	42.
sulfur	S	240	300	400	410	220
thorium	Th	17.	14.	24.	25.	23.
tin	Sn	1.	< 1.	< 1.	< 1.	< 1.
titanium	Ti	557.	634.	885.	702.	731.
uranium	U	< 5.	< 5.	< 6.	< 5.	< 5.
vanadium	V	49.	46.	70.	69.	53.
zinc	Zn	68.4	71.3	75.2	79.2	63.3
zirconium	Zr	5.6	5.6	5.1	4.6	8.4
Results in		ug/g	ug/g	ug/g	ug/g	ug/g

/2...

To: TRANS NORTHERN CONSULTING W/O: 29911 Page 2

Sample type		soil	soil	soil	soil	soil
Identification		SITE 24-5	SITE 24-6	SITE 25 1 TO 5 COMPOSITE	SITE 25 6 TO 10 COMPOSITE	SITE 25-11
Lab Reference #		29911-005	29911-006	29911-007	29911-008	29911-009
ICP - ULTRASONIC NEBULIZATION						
Method used		uwave HNO3/H2O2 soluble	uwave HNO3/H2O2 soluble	uwave HNO3/H2O2 soluble	uwave HNO3/H2O2 soluble	uwave HNO3/H2O2 soluble
Amount analysed		0.523 g	0.509 g	0.498 g	0.517 g	0.510 g
aluminum	Al	13600	24800	16800	17700	16000
antimony	Sb	< 2.	< 2.	< 2.	< 2.	< 2.
arsenic	As	17.	34.	17.	16.	18.
barium	Ba	151.	228.	156.	98.1	105.
beryllium	Be	0.3	0.3	0.4	0.3	0.3
bismuth	Bi	< 5.	< 5.	< 6.	< 5.	< 5.
cadmium	Cd	0.4	0.4	4.7	0.5	0.5
calcium	Ca	26900	30100	29200	32100	30000
chromium	Cr	43.8	238.	45.1	45.2	43.7
cobalt	Co	14.7	41.4	14.7	14.6	14.0
copper	Cu	52.4	141.	65.6	61.2	58.7
iron	Fe	28000	61000	36000	39000	35000
lead	Pb	7.	8.	7.	12.	7.
lithium	Li	10.0	21.8	23.6	23.1	22.8
magnesium	Mg	11400	55700	17000	18200	16300
manganese	Mn	523.	1230	709.	764.	655.
molybdenum	Mo	1.	2.	2.	2.	2.
nickel	Ni	45.4	307.	37.1	35.4	34.6
phosphorus	P	653.	760.	919.	896.	892.
potassium	K	1000	850	870	650	880
selenium	Se	3.	3.	7.	2.	< 2.
silicon	Si	788.	894.	663.	623.	954.
silver	Ag	< 0.5	< 0.5	< 0.6	< 0.5	< 0.5
sodium	Na	217.	186.	133.	118.	160.
strontium	Sr	60.	51.	64.	59.	62.
sulfur	S	240	610	480	460	360
thorium	Th	17.	36.	22.	22.	22.
tin	Sn	2.	< 1.	< 1.	< 1.	< 1.
titanium	Ti	784.	768.	859.	754.	557.
uranium	U	< 5.	< 5.	< 6.	< 5.	< 5.
vanadium	V	51.	83.	65.	61.	61.
zinc	Zn	99.1	119.	853.	115.	101.
zirconium	Zr	6.9	4.5	4.0	2.8	2.7
Results in		ug/g	ug/g	ug/g	ug/g	ug/g

/3...

To: TRANS NORTHERN CONSULTING W/O: 29911 Page 3

Sample type		soil	soil	soil	soil	soil
Identification		SITE 25-12	SITE 25-13	SITE 25-0	SITE 25-0	SITE 26 1 TO 4 COMPOSITE
Lab Reference #		29911-010	29911-011	29911-012A	29911-012B	29911-013
ICP - ULTRASONIC NEBULIZATION						
Method used		uwave HNO3/H2O2 soluble	uwave HNO3/H2O2 soluble	uwave HNO3/H2O2 soluble	uwave HNO3/H2O2 soluble	uwave HNO3/H2O2 soluble
Amount analysed		0.501 g	0.501 g	0.494 g	0.499 g	0.527 g
aluminum	Al	18600	17600	19100	18500	15300
antimony	Sb	< 2.	< 2.	< 2.	< 2.	< 2.
arsenic	As	17.	16.	27.	14.	12.
barium	Ba	146.	126.	154.	152.	86.6
beryllium	Be	0.3	0.3	0.5	0.2	0.3
bismuth	Bi	< 5.	< 5.	< 6.	< 6.	< 5.
cadmium	Cd	0.5	0.5	0.6	0.3	0.2
calcium	Ca	30600	30100	30700	29600	28800
chromium	Cr	43.3	45.9	47.7	43.1	118.
cobalt	Co	14.7	15.1	16.0	14.2	26.0
copper	Cu	59.8	60.7	62.1	56.7	74.9
iron	Fe	40000	38000	40000	39000	36000
lead	Pb	5.	7.	8.	4.	5.
lithium	Li	24.7	25.1	27.2	24.8	17.0
magnesium	Mg	18200	17600	18600	17900	32700
manganese	Mn	729.	715.	734.	716.	698.
molybdenum	Mo	2.	2.	3.	2.	< 1.
nickel	Ni	35.4	37.4	38.4	34.3	188.
phosphorus	P	903.	966.	972.	858.	719.
potassium	K	890	870	1000	900	690
selenium	Se	3.	3.	8.	5.	3.
silicon	Si	720.	616.	581.	553.	711.
silver	Ag	< 0.5	< 0.5	< 0.6	< 0.6	< 0.5
sodium	Na	131.	134.	154.	139.	264.
strontium	Sr	58.	63.	65.	58.	57.
sulfur	S	380	430	440	390	350
thorium	Th	22.	23.	26.	21.	22.
tin	Sn	1.	< 1.	< 1.	< 1.	< 1.
titanium	Ti	872.	809.	936.	816.	657.
uranium	U	< 5.	< 5.	< 6.	< 6.	< 5.
vanadium	V	64.	65.	71.	64.	53.
zinc	Zn	109.	108.	110.	100.	72.5
zirconium	Zr	3.2	3.2	4.5	2.9	3.8
Results in		ug/g	ug/g	ug/g	ug/g	ug/g

/4...

To: TRANS NORTHERN CONSULTING W/O: 29911 Page 4

Sample type		soil	soil	soil	lake sed	lake sed
Identification		SITE 26 5 TO 8 COMPOSITE	SITE 26 11 TO 13 COMPOSITE	SITE 26-14	CCGMR LKSD-1	CCGMR LKSD-1
Lab Reference #		29911-014	29911-015	29911-016	29911-017	29911-017A
ICP - ULTRASONIC NEBULIZATION						
Method used		uwave HNO3/H2O2 soluble	uwave HNO3/H2O2 soluble	uwave HNO3/H2O2 soluble	uwave HNO3/H2O2 soluble	total
Amount analysed		0.500 g	0.503 g	0.495 g	0.534 g	CCGMR MEAN
aluminum	Al	16200	12600	6900	3500	41300
antimony	Sb	< 2.	< 2.	< 2.	< 2.	1.2
arsenic	As	15.	16.	9.	33.	40.
barium	Ba	73.7	143.	126.	84.2	430.
beryllium	Be	0.3	0.3	0.2	0.1	1.6
bismuth	Bi	< 6.	< 5.	< 6.	< 5.	-
cadmium	Cd	0.3	0.4	0.3	1.	-
calcium	Ca	27100	11600	15400	59800	77200
chromium	Cr	71.8	56.0	24.9	9.2	31.
cobalt	Co	20.2	16.5	7.5	6.5	11.
copper	Cu	67.4	71.3	40.4	46.5	44.
iron	Fe	36000	29000	12000	17000	28700
lead	Pb	8.	7.	5.	73.	82.
lithium	Li	17.4	12.6	7.1	3.3	7.
magnesium	Mg	26600	12700	5130	4910	10400
manganese	Mn	681.	641.	241.	394.	700.
molybdenum	Mo	< 1.	< 1.	< 1.	9.	10.
nickel	Ni	107.	59.9	24.2	10.	16.
phosphorus	P	687.	717.	698.	630.	700.
potassium	K	740	710	500	410	9440
selenium	Se	3.	3.	5.	< 2.	-
silicon	Si	336.	493.	281.	208.	187000
silver	Ag	< 0.6	< 0.5	< 0.6	0.6	0.6
sodium	Na	285.	214.	222.	189.	14800
strontium	Sr	49.	32.	46.	50.	250.
sulfur	S	320	490	1000	14400	15700
thorium	Th	22.	20.	8.	2.	2.2
tin	Sn	< 1.	< 1.	1.	2.	16.
titanium	Ti	678.	444.	286.	291.	3010
uranium	U	< 6.	< 5.	< 6.	< 5.	9.7
vanadium	V	57.	47.	23.	23.	50.
zinc	Zn	90.0	93.1	54.9	304.	331.
zirconium	Zr	4.5	4.7	4.2	2.0	134.
Results in		ug/g	ug/g	ug/g	ug/g	ug/g

/5...

To: TRANS NORTHERN CONSULTING W/O: 29911 Page 5

Sample type		lake sed	lake sed	blank
Identification		CCGMR LKSD-1	CCGMR LKSD-1	PROCEDURAL
Lab Reference #		29911-017B	29911-017C	29911-018
ICP - ULTRASONIC NEBULIZATION				
Method used		conc. aqua regia soluble	dil. aqua regia soluble	uwave HNO3/H2O2 soluble
Amount analysed		CCGMR MEAN	CCGMR MEAN	-
aluminum	Al	-	-	< 0.05
antimony	Sb	1.2	-	< 0.02
arsenic	As	30.	-	< 0.02
barium	Ba	-	-	< 0.0005
beryllium	Be	-	-	< 0.001
bismuth	Bi	-	-	< 0.05
cadmium	Cd	1.2	1.2	< 0.001
calcium	Ca	-	-	< 0.05
chromium	Cr	12.	-	< 0.005
cobalt	Co	9.	8.	< 0.001
copper	Cu	44.	44.	< 0.005
iron	Fe	18000	18000	< 0.01
lead	Pb	84.	83.	< 0.01
lithium	Li	-	-	< 0.005
magnesium	Mg	-	-	0.03
manganese	Mn	460.	410.	< 0.005
molybdenum	Mo	12.	-	< 0.01
nickel	Ni	11.	12.	< 0.002
phosphorus	P	-	-	< 0.05
potassium	K	-	-	< 0.2
selenium	Se	-	-	< 0.02
silicon	Si	-	-	< 0.05
silver	Ag	-	-	< 0.005
sodium	Na	-	-	< 0.05
strontium	Sr	-	-	< 0.01
sulfur	S	-	-	< 0.1
thorium	Th	-	-	< 0.01
tin	Sn	-	-	< 0.01
titanium	Ti	-	-	< 0.002
uranium	U	-	-	< 0.05
vanadium	V	27.	-	< 0.01
zinc	Zn	337.	335.	< 0.005
zirconium	Zr	-	-	< 0.001
Results in		ug/g	ug/g	mg/L

 Approved: