

HJ011

J.R. Paine & Associates Ltd.

HJ011

**PHASE II
ENVIRONMENTAL SITE ASSESSMENT
HJ011-MARSHALL CREEK ROAD
HAINES JUNCTION, YUKON**

JRP-054-1997

J.R. Paine & Associates Ltd.

REPORT NO.: 8002-538

PROJECT: Phase II Environmental Site Assessment (ESA)

LOCATION: HJ011, km 5.2, Marshall Creek Road
Haines Junction, Yukon

CLIENT: Department of Indian Affairs and Northern Development
300-345 Main Street
Whitehorse, Yukon

ATTENTION: MR. DERRICK FRASER

August 29, 1997

J.R.PAINE & ASSOCIATES LTD.
14 BURNS ROAD
WHITEHORSE, YUKON
Y1A 4Y9

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1.0 INTRODUCTION

The following report details the results of the environmental site assessment which our firm conducted at a former garbage dump site known as HJ011 on August 7, 1997. The site where our investigation was performed is located approximately 5.2 km east of Haines Junction, Yukon, along the Marshall Creek Road (Old Alaska Highway).

J.R.Paine & Associates Ltd. was retained for this study with authorization to proceed granted by Derrick Fraser of DIAND on May 28, 1997.

Upon initiating this study, it was the intention of the Department of Indian Affairs and Northern Development (DIAND), Action On Waste Program, to delineate the extent of contamination associated with the activities that occurred at the site during its operation and to remediate the site to Level 'A' or aesthetic guidelines. Specifically, the objective was to assess the extent of geological and hydrological contamination that may be present at the site and to obtain recommendations for remediation of any contamination found.

Upon completion of a Preliminary Environmental Investigation conducted in December of 1996, by CCSG Associates, there were contaminant zones identified as surficial debris which necessitated further study. In order to satisfy this requirement a test-pit and hand sampling program was proposed and conducted by J.R.Paine & Associates Ltd., in order to identify the lateral and vertical extent of any contamination that may be present. Soil stratigraphy and groundwater conditions at greater depths also had to be identified so as to intimate possible migration patterns in the subsurface and to obtain recommendations for remediation.

This report contains a description of the methodology which our firm employed to satisfy the required objectives for contaminant characterization and delineation, as well as recommendations for future remediation efforts.

2.0 BACKGROUND INFORMATION

HJ011 is located approximately 5.2 km east of Haines Junction on the Marshall Creek Road on the north bank of the Dezadeash River as shown in figure 1. The site is located approximately 300 meters south of this road along a dirt trail. The site was initially used as a military garbage dump for road construction waste during the 1940's. Following this period the area has seen some use as a dumping area for local residents of Haines Junction until the 1960's.

Work conducted at the site to date includes:

*Preliminary Environmental Investigation, Site 44- Marshall Creek Road
prepared by CCSG Associates, December, 1996*

The site is currently designated as Crown Land.

3.0 METHODOLOGY

The methodology for the work program consisted of reviewing background information, performing a field work program, conducting a detailed laboratory program, and evaluating the data with engineering interpretations and recommendations for future remediation options. A detailed description of the work program performed is described below.

3.1 Field Work Program

A preliminary reconnaissance of the site was conducted on July 9, 1997 with Derrick Fraser, of D.I.A.N.D., to allow a preliminary check to be made based on the conclusions of the literature survey and to form a basis for planning and executing the site exploration.

The field reconnaissance involved walking over the site noting, where possible, the distribution of soil and rock types, important engineering geology features, important engineered structure features, terrain, relief, access, surficial debris, etc. The field reconnaissance also examined adjacent areas to see how they might effect the field investigative program.

Prior to initiating the field work program, test-pits and hand sample locations were situated in areas that would ensure representative soil sampling. Due to the localized areas of surficial debris identified at the site, a baseline was not established. Originally a baseline was thought to prove helpful in clean-up operations, however, given the density of the forested areas it was determined an inside-out remediation program would be sufficient in covering clean-up areas. Soil sampling methods consisted of subsurface test-pitting by use of a rubber tire backhoe and hand sample retrieval of soil and water samples.

The test-pit program involved excavating 6 test-pits in the locations depicted in the Site Sketch provided in Figure 2. The test-pit program was conducted using a John Deere 410C, Turbo 4x4 Rubber Tire Backhoe, operated by Ralph Hotte Contracting. This involved advancing test-pits, in areas of known surficial debris, and progressing downward until the groundwater table was encountered.

The principal objects of the investigation was:

1. To determine the sequence, thickness and lateral extent of the soil strata and level of bedrock (if present).
2. To obtain representative samples of the soils and rock for identification and classification for use in laboratory tests to determine relevant soil parameters and, where appropriate, contamination.
3. To identify the groundwater conditions and, where appropriate, contamination.

Field sampling consisted of obtaining disturbed soil samples from the teeth of the backhoe bucket at regular intervals, approximately one sample every half meter. During sampling, all samples were visually classified in the field with continuous field logs maintained. The specific soil conditions at each testhole location are described in detail on each individual test-pit soil log provided in Appendix A. Physical laboratory results for the grainsize analysis and plastic/liquid limits are provided in Appendix B. Each soil log contains the following information.

- i). Soil description for each stratum encountered
- ii). USC classification
- iii). Depths at which changes in soil stratigraphy occurs
- iv). Sample depths and types
- v). Physical laboratory analysis results

A total of 21 samples were retrieved during the test-pitting program. Another 14 samples were retrieved during the hand sampling program. This includes seven (7) water samples

as well as seven (7) soil samples. The water samples were obtained from the two existing ponds and the Dezadeash River. The soil samples were obtained from locations perceived to be related to environmental considerations at the site.

All soil samples that were to be chemically tested were kept in EPA approved air-tight glass jars and maintained at or below 4° C.

3.2 Laboratory Program

The primary objective of the laboratory program was to determine relative concentrations of any contaminants present and the physical properties of the soil and groundwater in the region. This information in turn will help in determining probable migration routes, concentrations of contaminants and like considerations, if necessary.

3.2.1 Physical Testing Program

All physical laboratory tests were conducted in our Whitehorse office and consisted of moisture content determination on all (21) test-pit samples retained. Furthermore, the following analysis was performed:

- grain size analyses -eight selected samples
- hydrometer analysis -two selected samples
- plastic & liquid limits -two selected samples

These results are presented in Appendix B.

3.2.2 Chemical Testing Program

Chemical testing conducted on-site during the field work test-pit program included a D-Tech PCB test kit/level meter as well as a Gas Tech Tracetector. The D-Tech PCB tests conducted indicated the presence of PCB's below 1 PPM, well below acceptable standards.

Hydrocarbon vapor testing was conducted on-site using a GasTech Tracetector vapor extraction unit to help determine the presence of hydrocarbon contamination. The Gas Tech Tracetector did not indicate any hydrocarbon concentrations above 60 PPM. These readings are also well below the acceptable standards and as such do not require remediation efforts.

Chemical laboratory analysis was conducted at Norwest Labs in Langley, B.C., and consisted of the following analysis.

Total Extractable / Polycyclic Aromatic Hydrocarbon		
TEH/PAH	(soil)	8 samples
TEH/PAH	(water)	2 samples
Polychlorinated Biphenyls		
PCB	(soil)	5 samples
PCB	(water)	2 samples
Total Metals		
Metals	(soil)	10 samples
Metals	(water)	3 samples
Organo-Chloride Pesticides		
Various	(soil)	1 sample

The methodology employed in the chemical analysis is provided in the Norwest Lab report submission located in Appendix C.

4.0 EVALUATION & INTERPRETATION

This section presents the information obtained from the field work and laboratory program described above. Briefly a description of the site will be provided along with details of the subsurface soil and groundwater conditions. Finally, all relevant data with respect to contamination encountered at the study area will be presented.

4.1 Site Conditions

The site is located approximately 5.2 km east of Haines Junction, Yukon, along the Marshall Creek Road (Old Alaska Highway) and is accessed by a dirt trail. This trail leads approximately 300 meters to the South and then turns to the east for approximately 100 meters, terminating near the Dezadeash River. The approximate size of the site is 100 meters by 250 meters. Two ponds are also located on the site as depicted in the site sketch presented in Figure 2. The approximate maximum depths of the ponds are 5 feet and 7 feet in the large & small ponds respectively. It should be noted that a small area of surficial debris, approximately 25 meters by 75 meters, was identified at the trailhead immediately adjacent to the Marshall Creek Road. The surficial debris in this area consisted of several barrels and rusted metal cans. Representative soil samples were likewise obtained in this area for further characterization and delineation.

4.2 Subsurface Soil and Groundwater Conditions

Subsurface soil conditions in the area surrounding the known contaminant area were determined from the 6 test-pits excavated at the site during our investigation as well as from pre-existing data. The test-pit data was collated and the following trends in soil stratigraphy were noted.

In general, soil conditions at the site consisted of a 0.05 meter thick organic matte overlying a surficial silt stratum. The surficial silt layer is composed primarily of silt with

varying amounts of clay, gravel and fine sand. This surficial silt layer extends to an average depth of 0.9 meters, below which lies a clean sandy gravel layer with cobbles in size to 15 cm.. The groundwater table was encountered in all 6 test-pits at an average depth of 1.65 meters terminating the test-pit excavation due to excessive sidewall sloughage. Test-pits were advanced to an average depth of 1.8 m. with the maximum depth of excavation 2.3 meters.

No presence of permafrost was noted.

4.3 Contamination Considerations

From screening tests and chemical laboratory analysis performed on our selected samples we can conclude that the contamination levels detected are below the Generic Numerical Soil & Water Standards as listed in the Contaminated Site Regulations (Yukon, 1996) for park and residential levels.

Results from the Preliminary Environmental Investigation carried out by CCSG Associates indicated a few samples exceeded certain CCME guidelines. After comparing these results to the ones obtained during our study of nearby samples, we believe that contaminated areas are relatively localized and as such are not considered a high environmental liability.

It should be noted that due to the high degrees of natural mineralization that may occur in the area, some samples may exceed certain CCME guidelines due to natural constituents alone.

Due to the high permeability of the subsurface granular material which is present throughout the site and the relatively shallow depth of groundwater encountered, it can be intimated that most mobile contaminants that may have been present have most likely been flushed clean by natural groundwater flow and incidents of flooding.

5.0 RECOMMENDED REMEDIATION APPROACH

The following chapter will outline the remediation approach which may be initiated according to the desired objectives of the client.

It may be the objective of the client to remove impurities which pose aesthetic/contaminant concerns such as the existing surficial debris. The remediation program would involve removing all submerged debris present in the ponds (which include rusted barrels, car bodies and batteries) as well as accessible surficial debris in areas shown in figure 2. By executing this clean-up effort, the source for any potential contaminants would be removed and through natural processes the site would eventually remediate itself.

The remediation program which we envision is provided below.

5.1 A. hand clean-up operation would collect accessible surficial debris (primarily metal cans, rusted barrels and old vehicle parts) and dispose of them at the municipal landfill at Haines Junction.

5.2 Removal of existing debris from the two ponds (primarily car bodies and metallic drums) would be undertaken by use of a claw equipped backhoe. It may be necessary for personnel to be in the ponds to aid in attaching any necessary slings to submerged debris. It should be noted that due to the silty nature of the pond sediments, activity within either pond may cause the visibility of submerged debris to become negligible. As such, provisions should be made to either alternate removal of debris from the two ponds to allow for settlement or else conduct other clean-up operations during this time.

5.3 Clearing of surficial debris within 20 meters of the Dezadeash River should be conducted by hand.

5.4 The removed debris would be placed in the Haines Junction municipal landfill facility in compliance with their requirements following removal from the site dependent upon contaminant concentrations and constituents.

5.5 An approved EPA containment bin would be located on-site to dispose of unidentified waste materials that may not be disposed of in the Haines Junction landfill. Following clean-up operations this containment bin would be disposed of according to recognized protocols.

5.6 Any soils bared within 20 meters of the river or along known drainage paths should be seeded with grass to provide a vegetative cover.

By carrying out the above mentioned remediation approach, we believe that the site would effectively meet a Level 'A' criteria for remediation.

6.0 HAZARD LEVEL

To date, the site does not appear to have high quantities of impurities in the subsurface. As such, according to the Occupational Health and Safety Handbook provided by the Yukon Workers' Compensation Health and Safety Board the clean-up of the site is classified as a Class "A" Hazard Exposure. The use of standard safety equipment such as steel-toed boots, work gloves, shirts etc. as outlined in the Occupational Health and Safety Handbook will be adequate for personnel working at the site. In regards to the clean-up/remediation of the ponds, hip-waders will likely be required.

7.0 PROJECT REMEDIATION TEAM

At this time, it is envisioned that the project remediation team will be comprised of the following:

J.R.Paine & Associates Ltd.

Project Manager (Office):	Wilbur C. Kofoed, P.Eng.
Project Manager (Field):	Tares Dhara, E.I.T.
Senior Environmental Technician :	Robert Weldon
Soils Technician :	Rob Williamson

Aishihik First Nations

Aishihik First Nations Liaison:	Gordon Allison
Work Crew:	Aishihik First Nations personnel - 5 laborers

7.1 Safety Requirements

It should be noted that since the site is located on Crown Land, safety requirements regarding First Nations personnel on the site will fall under Human Resources Development Canada jurisdiction. Safety requirements for all other personnel will fall under the protection of the Yukon Workers' Compensation Health and Safety Board.

As mentioned in Section 4.0, this site is presently classified as a Class "A" Hazard Exposure.

7.2 Transportation/Heavy Equipment Requirements

Given the current site conditions, it is envisioned that the following transportation/heavy equipment will be required during clean-up operations:

1	Crew cab vehicle	Transport of personnel to and from the site.
1	Claw Equipped Backhoe	Retrieval of accessible car bodies and all barrels.
1	1 Ton Truck w/ enddump	Transportation of scrap metal and material to the Haines Junction landfill.

Note: Dependent upon ease of retrieval of the accessible vehicles and barrels, other equipment may be needed during the remediation program. This may include the need to utilize a HI-AB, full size dump-truck, and similar equipment.

8.0 CLOSURE

This report has been prepared for the exclusive and confidential use of the Department of Indian Affairs and Northern Development (DIAND). It applies only to the environmental assessment performed at the study area described above.

The recommendations provided herein are based on the subsurface soil conditions encountered during the field work programs, current investigative techniques, and generally accepted engineering practices. Due to the geological randomness of many soil formations, no interpolation of soil conditions between testholes has been made or implied. Soil conditions are known only at testhole locations. Furthermore, contaminant presence is known only in those testhole locations where qualitative observations have been made and where laboratory verification has been conducted. Recommendations are based, in part, on current environmental criteria which may change in time. Should other soils be encountered during anytime or other pertinent information become available, the recommendations may be altered or modified in writing by the undersigned.

Thank you for the opportunity to provide this service to your organization. We would be pleased to meet with you to discuss the contents of this report or to more thoroughly outline the recommended work program to follow. If you should have any questions or comments, please do not hesitate to contact the undersigned at your convenience.

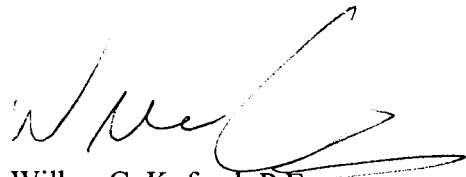
Yours truly,



Tares Dhara, E.I.T.
Junior Engineer

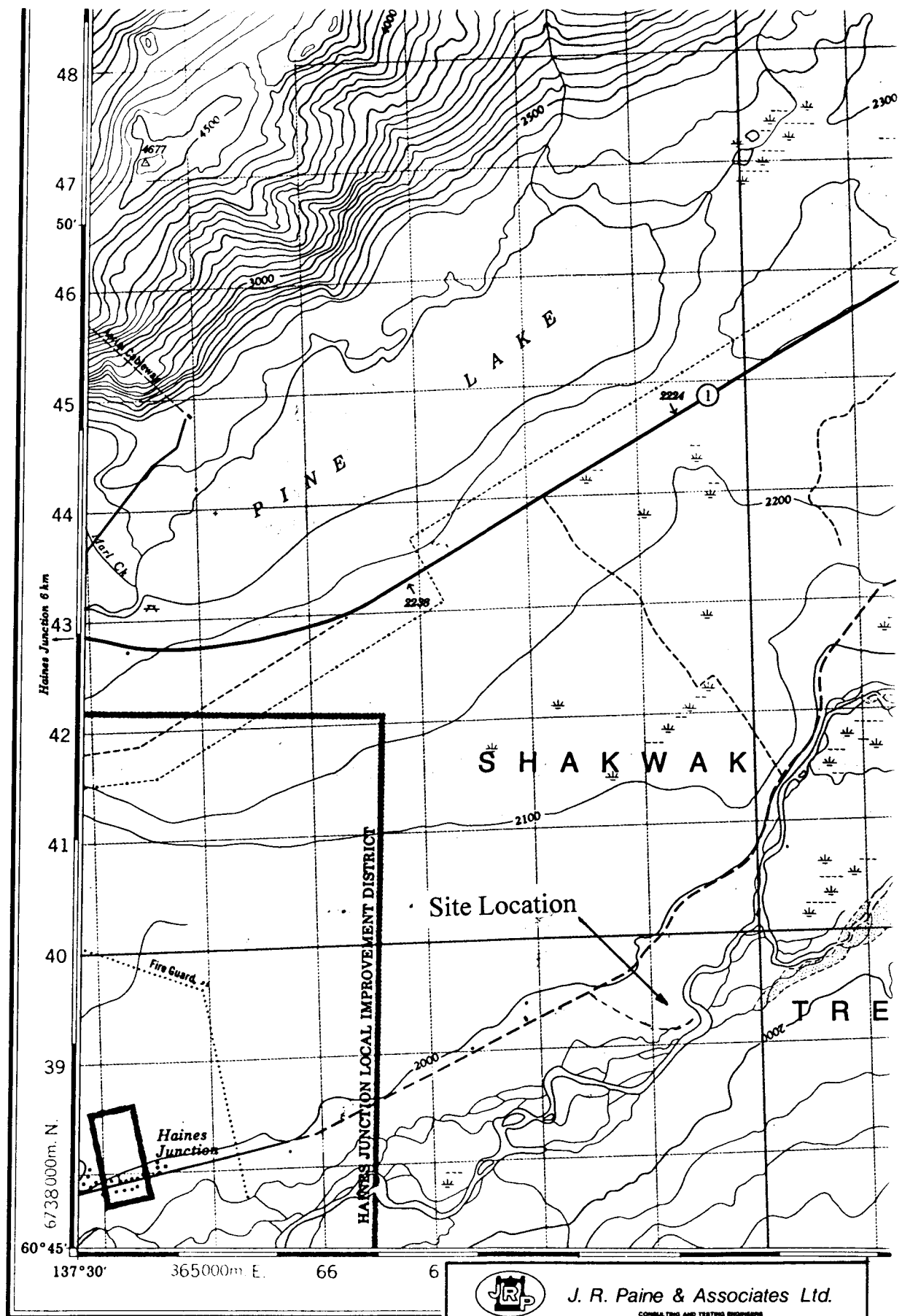
TD/td

c:\priv\8054-24\SiteAssessment



Wilbur C. Kofoed, P.Eng.
Office Manager

FIGURE 1
SITE LOCATION



Produced by the SURVEYS AND MAPPING BRANCH,
DEPARTMENT OF ENERGY, MINES AND RESOURCES.
Updated from aerial photographs taken in 1979. Culture check
1981. Published in 1985.

Copies may be obtained from the Canada Map Office,
Department of Energy, Mines and Resources, Ottawa,
or your nearest map dealer.

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Department of Energy, Mines and Resources.

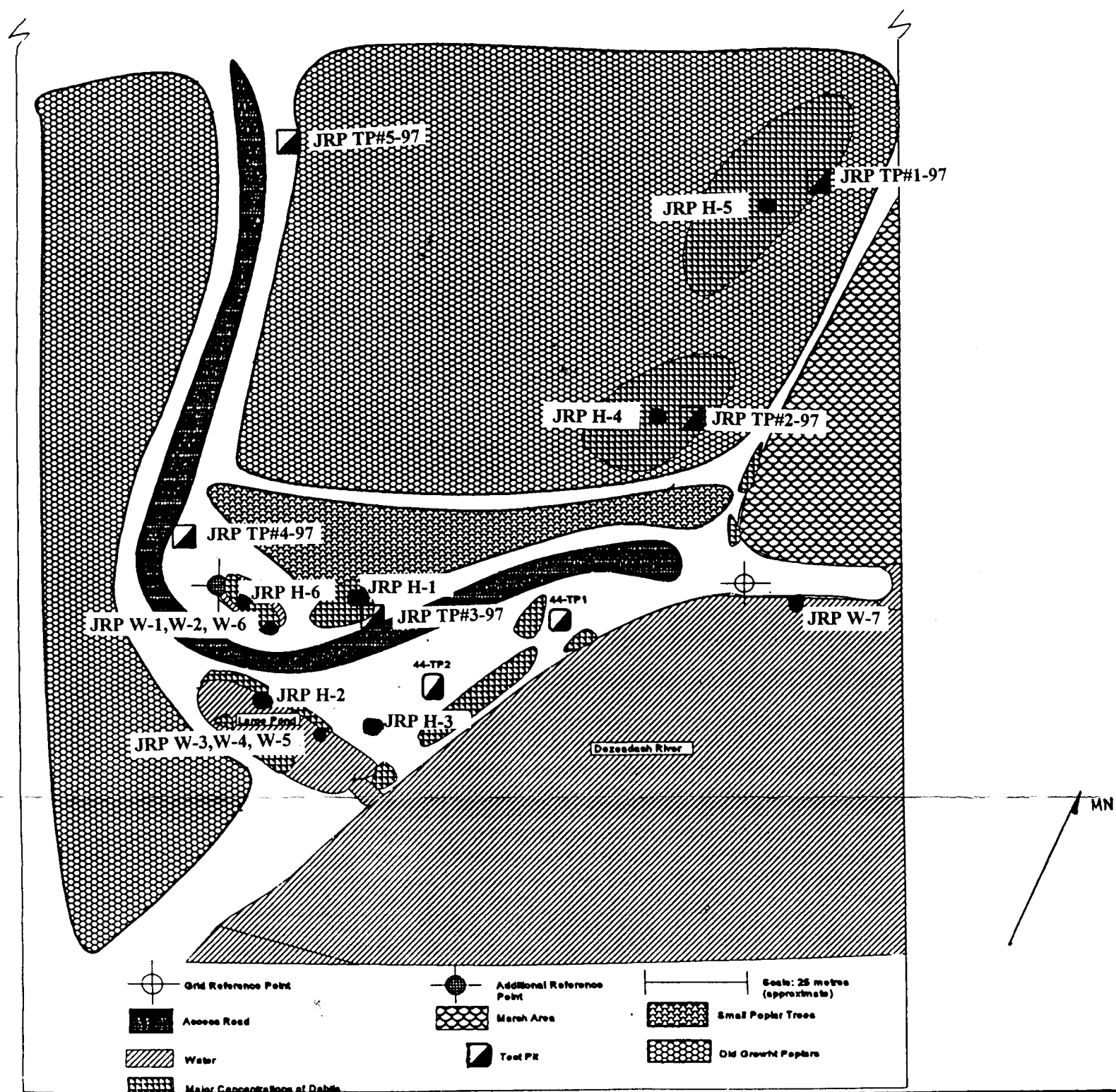
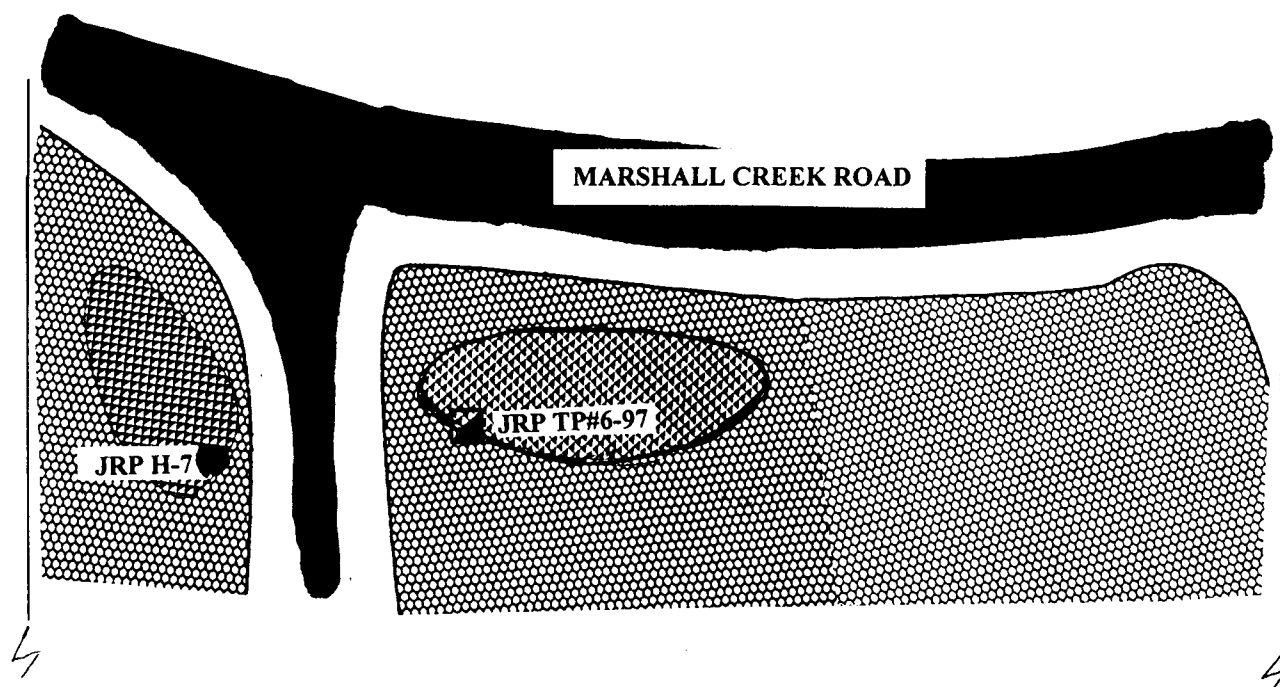



J. R. Paine & Associates Ltd.
CONSULTING AND TESTING ENGINEERS

FIGURE 1
Site Location

Dwn. By	TD	Date	08/15/97
Scale	1:50,000	Plate No.	

FIGURE 2
TESTPIT & HAND SAMPLE
LOCATIONS



 J. R. Paine & Associates Ltd. <small>CONSULTING AND TESTING ENGINEERS</small>	
FIGURE 2- Test-pit & Hand Sample Locations	
Dwn. By TD/CCSG	Date 08/15/97
Scale As Shown	Plate No.

APPENDIX A
SOIL LOGS

Rolph Hotte Contracting		Haines Junction		TEST PIT NO: TP#1-97	
John Deere 410C		DIAND		PROJECT NO: 8054-24	
Turbo 4x4 Rubber Tire Backhoe		HJ011		ELEVATION:	
SAMPLE TYPE <input checked="" type="checkbox"/> TUBE <input type="checkbox"/> LOST <input checked="" type="checkbox"/> AUGER <input type="checkbox"/> BULK <input type="checkbox"/> SPT <input type="checkbox"/> CORE					

DEPTH(m)	SAMPLE NO	Soil Description	<div style="display: flex; justify-content: space-around; font-size: small;"> <div>PLASTIC</div> <div>M.C.</div> <div>LIQUID</div> </div> <div style="display: flex; justify-content: space-around; font-size: x-small;"> <div>8 16 24 32</div> </div>	<div style="display: flex; justify-content: space-between; font-size: x-small;"> <div>20 40 60 80</div> <div> <div>■ SILT ■</div> <div>◆ SAND ◆</div> <div>● GRAVEL ●</div> </div> <div>20 40 60 80</div> </div>				USC	SOIL SYMBOL	DEPTH(m)
0.0	1	ORGANICS- moss, lichen, roots, rootlets SILT -moist, soft, low plasticity, grey, trace oxidation					ORG		0.0	
	2	SANDY GRAVEL, TRACE OF SILT -damp, loose, poorly graded, fine grained, grey-brown, cobbles to 10 cm					GP-GM			
1.0										
	3	SANDY GRAVEL -moist, loose, poorly graded, med. to coarse grained, grey, gravels to 5 cm, cobbles to 10 cm.					GP			
2.0										
	4	Watertable Encountered								
		END OF HOLE @ 2.4 m.								
3.0									3.0	

J.R. Paine & Associates Ltd. Whitehorse, Yukon		LOGGED BY: TD	COMPLETION DEPTH: 2.4 m
		REVIEWED BY: WCK	COMPLETE:
		Fig. No:	Page 1 of 1

Ralph Hotte Contracting		Haines Junction		TEST PIT NO: TP#2-97	
John Deere 410C		DIAND		PROJECT NO: 8054-24	
Turbo 4x4 Rubber Tire Backhoe		HJ011		ELEVATION:	
SAMPLE TYPE <input checked="" type="checkbox"/> TUBE <input type="checkbox"/> LOST <input checked="" type="checkbox"/> AUGER <input type="checkbox"/> BULK <input type="checkbox"/> SPT <input type="checkbox"/> CORE					

DEPTH(m)	SAMPLE TYPE	SAMPLE NO	Soil Description	<div style="display: flex; justify-content: space-between; font-size: small;"> PLASTIC M.C. LIQUID </div> <div style="display: flex; justify-content: space-between; font-size: x-small;"> 8 16 24 32 </div>	<div style="display: flex; justify-content: space-between; font-size: x-small;"> 20 40 60 80 </div> <div style="display: flex; justify-content: space-between; font-size: x-small;"> 20 40 60 80 </div> <div style="display: flex; justify-content: space-between; font-size: x-small;"> 20 40 60 80 </div>				USC	SOIL SYMBOL	DEPTH(m)
					■ SILT ■	◆ SAND ◆	● GRAVEL ●				
0.0		5	ORGANICS - moss, lichen, roots, rootlets SILT -moist, soft, low plasticity, grey, trace oxidation SILTY SAND -moist, loose, poorly graded, fine grained, grey						ORG ML	0.0	
1.0		6							SM	1.0	
1.7		7	SANDY GRAVEL -wet, loose, poorly graded, med. to coarse grained, grey, gravels to 5 cm, odd rounded cobbles to 12.5 cm., clean						GP	1.7	
1.7		8	Watertable Encountered END OF HOLE @ 1.7 m.							1.7	
3.0										3.0	

J.R. Paine & Associates Ltd. Whitehorse, Yukon		LOGGED BY: TD	COMPLETION DEPTH: 1.7 m
		REVIEWED BY: WCK	COMPLETE:
		Flg. No:	Page 1 of 1

Ralph Hotte Contracting		Haines Junction		TEST PIT NO: TP#3-97	
John Deere 410C		DIAND		PROJECT NO: 8054-24	
Turbo 4x4 Rubber Tire Backhoe		HJ011		ELEVATION:	

SAMPLE TYPE	<input checked="" type="checkbox"/> TUBE	<input type="checkbox"/> LOST	<input checked="" type="checkbox"/> AUGER	<input type="checkbox"/> BULK	<input type="checkbox"/> SPT	<input type="checkbox"/> CORE
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DEPTH(m)	SAMPLE TYPE	SAMPLE NO	Soil Description	PLASTIC	M.C.	LIQUID	<div style="display: flex; justify-content: space-between;"> <div> ■ SILT ■ 20 40 60 80 </div> <div> ◆ SAND ◆ 20 40 60 80 </div> <div> ● GRAVEL ● 20 40 60 80 </div> </div>	USC	SOIL SYMBOL	DEPTH(m)
0.0			ORGANICS- moss, lichen, roots & rootlets					ORG		0.0
			SILT -trace of fine grained sand, wet, soft, low plasticity, beige, orange oxidized zones							
0.9								ML		
1.0			SANDY GRAVEL -moist, loose, poorly graded, dark grey, rounded gravel in size to 5 cm., medium to coarse grained sand, odd cobble to 15 cm.							
1.1								GP		
1.2			Watertable Encountered							
1.9			END OF HOLE @ 1.9 m.							
3.0										3.0

J.R. Paine & Associates Ltd. Whitehorse, Yukon		LOGGED BY: TD	COMPLETION DEPTH: 1.9 m
		REVIEWED BY: WCK	COMPLETE:
		Fig. No:	Page 1 of 1

Ralph Hotte Contracting		Haines Junction		TEST PIT NO: TP#4-97	
John Deere 410C		DIAND		PROJECT NO: 8054-24	
Turbo 4x4 Rubber Tire Backhoe		HJ011		ELEVATION:	
SAMPLE TYPE <input checked="" type="checkbox"/> TUBE <input type="checkbox"/> LOST <input checked="" type="checkbox"/> AUGER <input type="checkbox"/> BULK <input type="checkbox"/> SPT <input type="checkbox"/> CORE					

DEPTH(m)	SAMPLE TYPE	SAMPLE NO	Soil Description	<div style="display: flex; justify-content: space-between; width: 100%;"> PLASTIC M.C. LIQUID </div> <div style="display: flex; justify-content: space-between; width: 100%;"> 8 16 24 32 </div>	<div style="display: flex; justify-content: space-between; width: 100%;"> 20 40 60 80 </div> <div style="display: flex; justify-content: space-between; width: 100%;"> 20 40 60 80 </div> <div style="display: flex; justify-content: space-between; width: 100%;"> 20 40 60 80 </div>				USC	SOIL SYMBOL	DEPTH(m)
					■ SILT ■	◆ SAND ◆	● GRAVEL ●				
0.0			ORGANICS- moss, lichen, roots, rootlets							0.0	
		13	SILT -trace of fine grained sand, wet soft, low plasticity, dark grey/ beige, some orange oxidized zones								
1.0		14									
		15	SANDY GRAVEL -wet, loose, poorly graded, med. to coarse grained, grey, gravels to 8 cm								
			Watertable Encountered								
			END OF HOLE @ 1.2 m.								
2.0											
3.0											

J.R. Paine & Associates Ltd. Whitehorse, Yukon		LOGGED BY: TD	COMPLETION DEPTH: 1.2 m
		REVIEWED BY: WCK	COMPLETE:
		Fig. No:	Page 1 of 1

Ralph Hotte Contracting		Haines Junction		TEST PIT NO: TP#5-97	
John Deere 410C		DIAND		PROJECT NO: 8054-24	
Turbo 4x4 Rubber Tire Backhoe		HJ011		ELEVATION:	

SAMPLE TYPE	<input checked="" type="checkbox"/> TUBE	<input checked="" type="checkbox"/> LOST	<input checked="" type="checkbox"/> AUGER	<input type="checkbox"/> BULK	<input type="checkbox"/> SPT	<input type="checkbox"/> CORE
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DEPTH(m)	SAMPLE NO	Soil Description	<div style="display: flex; justify-content: space-between; font-size: small;"> PLASTIC M.C. LIQUID </div> <div style="text-align: center; margin-top: 5px;"> 8 16 24 32 </div>	<table border="1" style="width:100%; border-collapse: collapse; font-size: x-small;"> <tr> <td>20</td><td>40</td><td>60</td><td>80</td></tr> <tr> <td>20</td><td>40</td><td>60</td><td>80</td></tr> <tr> <td>20</td><td>40</td><td>60</td><td>80</td></tr> </table>	20	40	60	80	20	40	60	80	20	40	60	80	USC	SOIL SYMBOL	DEPTH(m)
20	40	60	80																
20	40	60	80																
20	40	60	80																
0.0		ORGANICS- moss, lichen, roots, rootlets			ORG		0.0												
16		SILT -trace of fine grained sand, damp, firm, low plasticity, grey, trace gravel	•		ML														
17		SANDY GRAVEL -wet, loose, poorly graded, grey, rounded gravel in size to 5 cm., odd cobble to 10 cm.	•		GP														
18		SANDY GRAVEL -wet, loose, poorly graded, some coarse sand, grey Watertable Encountered END OF HOLE @ 1.7 m.	•	■ ♦ •															
1.0							1.0												
2.0							2.0												
3.0							3.0												

J.R. Paine & Associates Ltd. Whitehorse, Yukon		LOGGED BY: TD	COMPLETION DEPTH: 1.7 m
		REVIEWED BY: WCK	COMPLETE:
		Fig. No:	Page 1 of 1

Ralph Hotte Contracting		Haines Junction		TEST PIT NO: TP#6-97	
John Deere 410C		DIAND		PROJECT NO: 8054-24	
Turbo 4x4 Rubber Tire Backhoe		HJ011		ELEVATION:	

SAMPLE TYPE	<input checked="" type="checkbox"/> TUBE	<input checked="" type="checkbox"/> LOST	<input checked="" type="checkbox"/> AUGER	<input type="checkbox"/> BULK	<input type="checkbox"/> SPT	<input type="checkbox"/> CORE
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DEPTH(m)	SAMPLE TYPE	SAMPLE NO	Soil Description	PLASTIC	M.C.	LIQUID	<div style="display: flex; justify-content: space-between;"> <div> <div>■ SILT ■</div> <div>20 40 60 80</div> </div> <div> <div>◆ SAND ◆</div> <div>20 40 60 80</div> </div> <div> <div>● GRAVEL ●</div> <div>20 40 60 80</div> </div> </div>	USC	SOIL SYMBOL	DEPTH(m)
0.0			ORGANICS- moss, lichen, roots, rootlets					ORG		0.0
		19	SILT -trace of fine grained sand, moist, firm, odd rounded gravel to 5 cm., dark brown/grey, some med. plasticity clayey seams					ML		
		20	SANDY GRAVEL TO GRAVELY SAND -moist, loose, poorly graded, grey, rounded gravel to 8 cm., odd odd cobble to 13 cm.					GP-SP		
1.0										1.0
		21	Watertable Encountered							
2.0			END OF HOLE @ 2.0 m.							2.0
3.0										3.0

J.R. Paine & Associates Ltd. Whitehorse, Yukon		LOGGED BY: TD REVIEWED BY: WCK Fig. No:	COMPLETION DEPTH: 2.0 m COMPLETE:
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APPENDIX B

Laboratory Sieve Analysis



J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

SCREEN ANALYSIS

Sample: #2 Depth: 0.40m
Location: TP #1-97

Client: PUBLIC WORKS CANADA (DIAND)

Project: Haines Junction (HJ011)

Made by: RW Job No.: 8054-24

Ck'd by: J.C. Date: 1997/08/17

Sieve No.	Size of Opening MM	Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
50,000	50.0				100.0
40,000	40.0				76.4
25,000	25.0				65.0
20,000	20.0				46.6
12,500	12.5				42.0
10,000	10.0				31.6
5,000	5.0				24.3
2,500	2.5				
2,000	2.0				20.2
1,250	1.25				18.4
800	0.800				
630	0.630				
400	0.400				14.9
315	0.315				13.1
160	0.160				9.1
80	0.080				6.8

Description of Sample
Sandy gravel, trace of fines

GP-GM

Time of Sieving Min. 15

Method of Preparation Dry Washed X

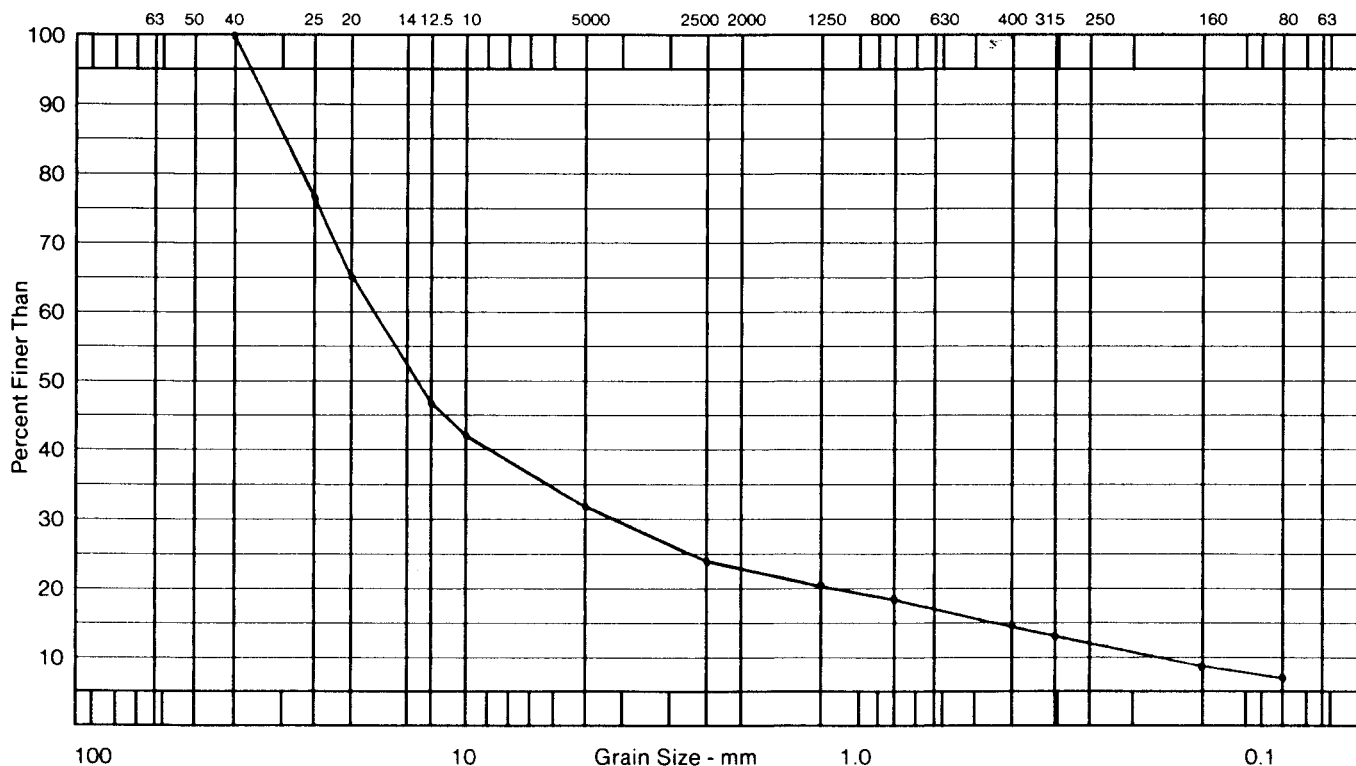
Remarks

Moisture: 2.9%

Gravel: 68.4%

Sand: 24.8%

Fines: 6.8%





J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

SCREEN ANALYSIS

Sample: **#4** Depth: **2.3m**
Location: **TP #1-97**

Client: **PUBLIC WORKS CANADA (DIAND)**

Project: **Haines Junction (HJ011)**

Made by: **RW** Job No.: **8054-24**

Ck'd by: **WCL** Date: **1997/08/17**

Sieve No.	Size of Opening MM	Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
50,000	50.0				
40,000	40.0				100.0
25,000	25.0				86.4
20,000	20.0				67.3
12,500	12.5				58.1
10,000	10.0				52.5
5,000	5.0				41.2
2,500	2.5				33.0
2,000	2.0				
1,250	1.25				
800	0.800				21.7
630	0.630				
400	0.400				8.3
315	0.315				
160	0.160				1.2
80	0.080				0.8

Description of Sample

Sandy gravel GP

Method of Preparation _____ Dry _____ Washed **X**

Remarks

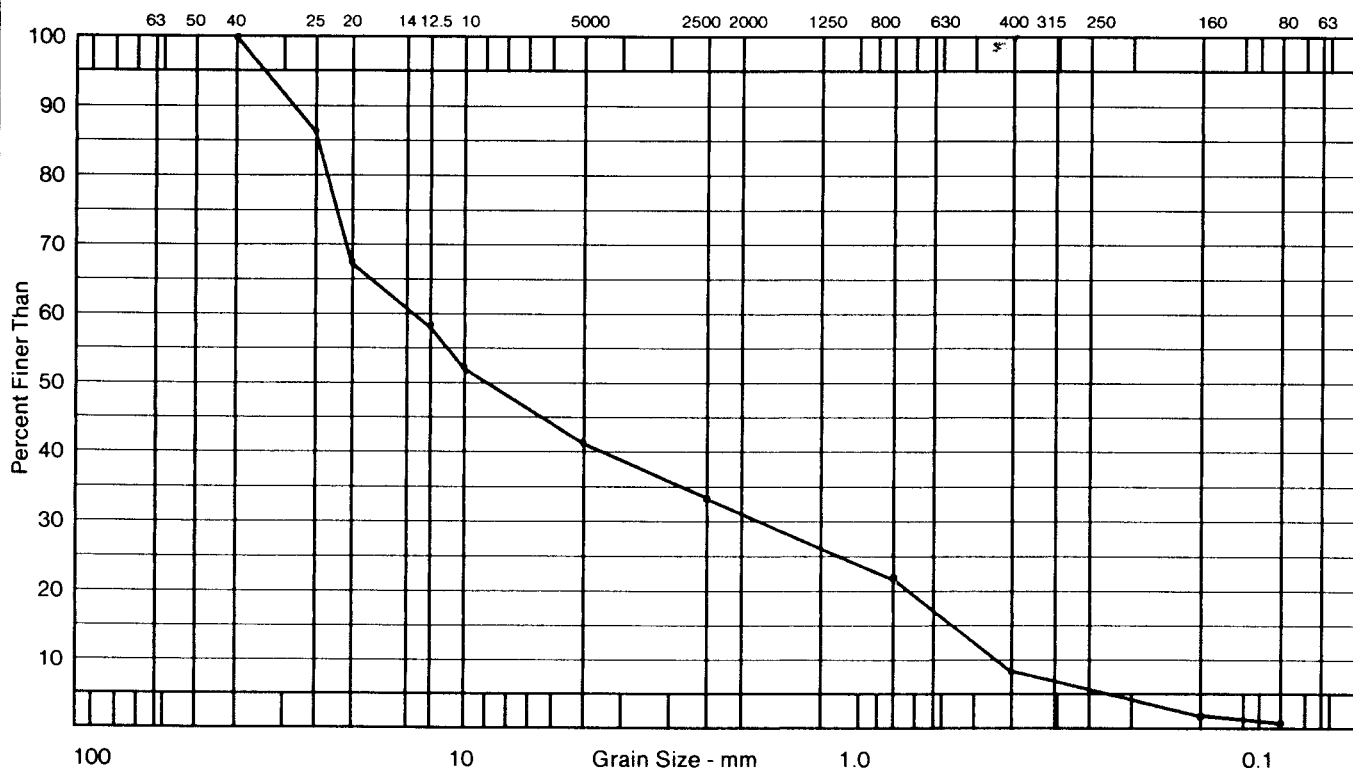
Moisture: 5.5%

Gravel: 58.8%

Sand: 40.4%

Fines: 0.8%

Time of Sieving _____ Min. **15**





J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

SCREEN ANALYSIS

Sample: #6 Depth: 0.6m
Location: TP #2-97

Client: PUBLIC WORKS CANADA (DIAND)

Project: Haines Junction (HJ011)

Made by: RW Job No.: 8054-24

Ck'd by: WCK Date: 1997/08/17

Sieve No.	Size of Opening MM	Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
50,000	50.0				
40,000	40.0				
25,000	25.0				
20,000	20.0				100.0
12,500	12.5				99.2
10,000	10.0				
5,000	5.0				
2,500	2.5				99.2
2,000	2.0				99.1
1,250	1.25				99.1
800	0.800				99.1
630	0.630				99.0
400	0.400				98.7
315	0.315				97.5
160	0.160				69.0
80	0.080				37.0

Description of Sample
Silty sand SM

Method of Preparation _____ Dry _____ Washed X

Remarks

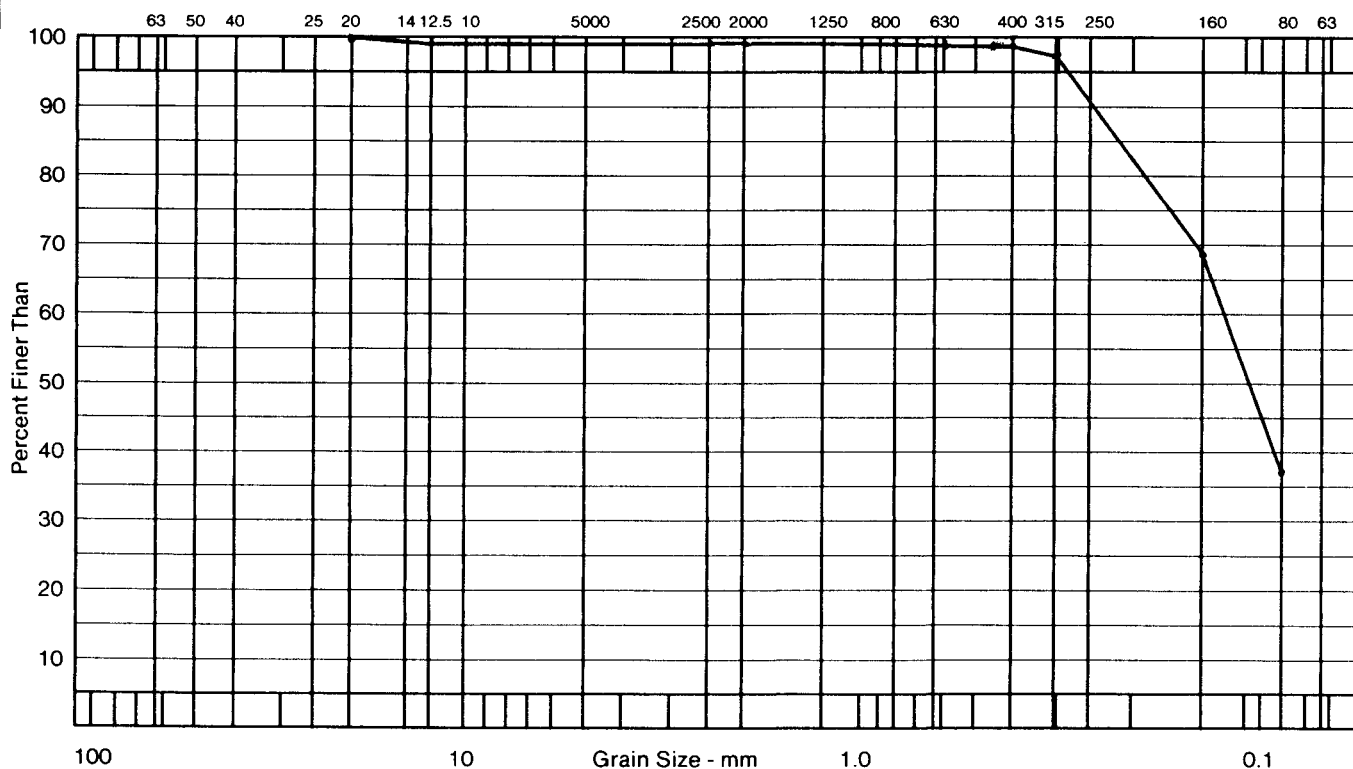
Moisture: 17.0%

Gravel: 0.8%

Sand: 62.2%

Fines: 37.0%

Time of Sieving _____ Min. 15





J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

SCREEN ANALYSIS

Client: **PUBLIC WORKS CANADA (DIAND)**
Sample: **#8** Depth: **1.6m** Project: **Haines Junction (HJ011)**
Location: **TP #2-97** Made by: **RW** Job No.: **8054-24**
Ck'd by: **WCK** Date: **1997/08/17**

Sieve No.	Size of Opening MM	Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
50,000	50.0				100.0
40,000	40.0				94.3
25,000	25.0				72.4
20,000	20.0				51.9
12,500	12.5				39.0
10,000	10.0				22.0
5,000	5.0				13.8
2,500	2.5				
2,000	2.0				
1,250	1.25				
800	0.800				8.5
630	0.630				
400	0.400				6.7
315	0.315				
160	0.160				2.6
80	0.080				1.0

Description of Sample _____
Sandy gravel **GP**

Method of Preparation _____ Dry _____ Washed **X**

Remarks _____

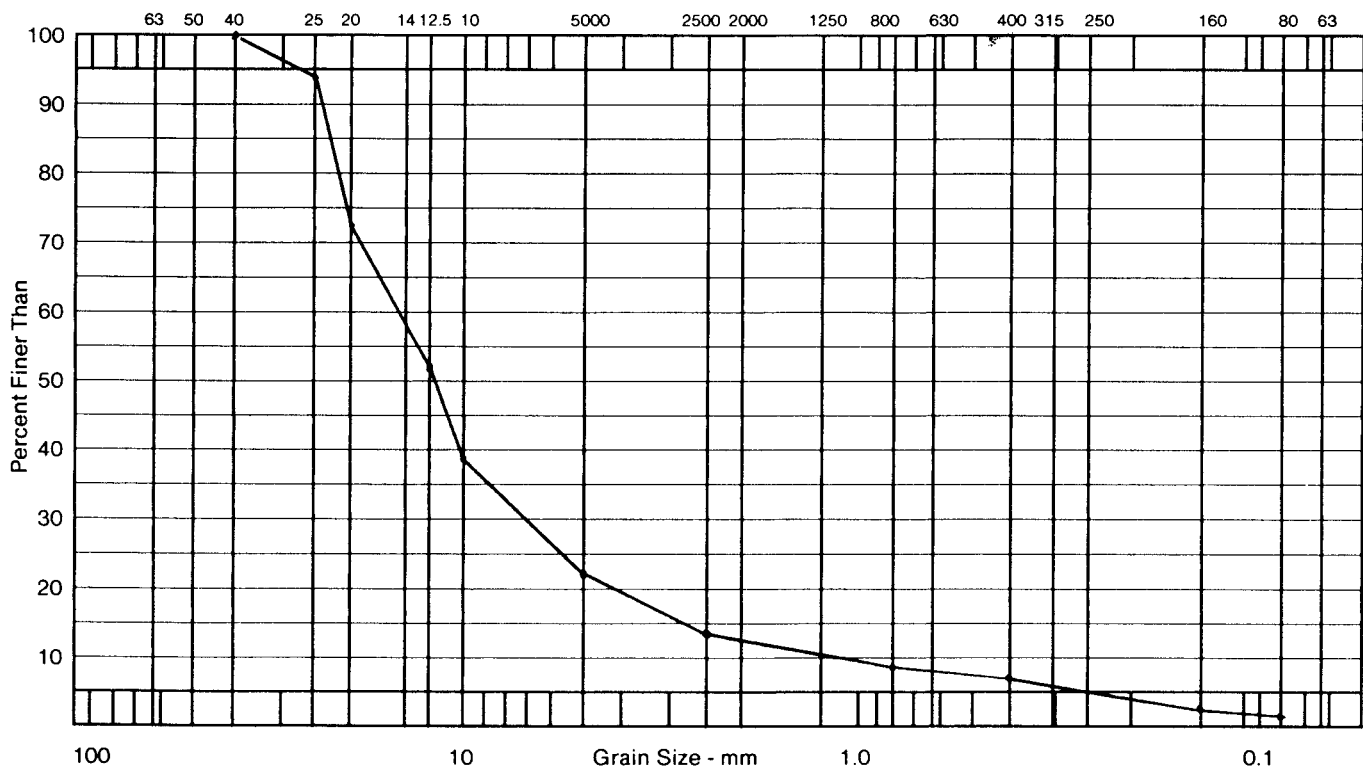
Moisture: 3.1%

Gravel: 78.0%

Sand: 21.0%

Fines: 1.0%

Time of Sieving _____ Min. **15**





J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

SCREEN ANALYSIS

Client: PUBLIC WORKS CANADA (DIAND)
Sample: #11 Depth: 0.8m Project: Haines Junction (HJ011)
Location: TP #3-97 Made by: RW Job No.: 8054-24
Ck'd by: WCL Date: 1997/08/17

Sieve No.	Size of Opening MM	Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
50,000	50.0				
40,000	40.0				100.0
25,000	25.0				94.7
20,000	20.0				83.2
12,500	12.5				67.2
10,000	10.0				56.3
5,000	5.0				32.6
2,500	2.5				19.4
2,000	2.0				
1,250	1.25				
800	0.800				12.1
630	0.630				
400	0.400				9.3
315	0.315				
160	0.160				3.7
80	0.080				2.5

Description of Sample

Sandy gravel

GP

Time of Sieving Min. 15

Method of Preparation Dry Washed X

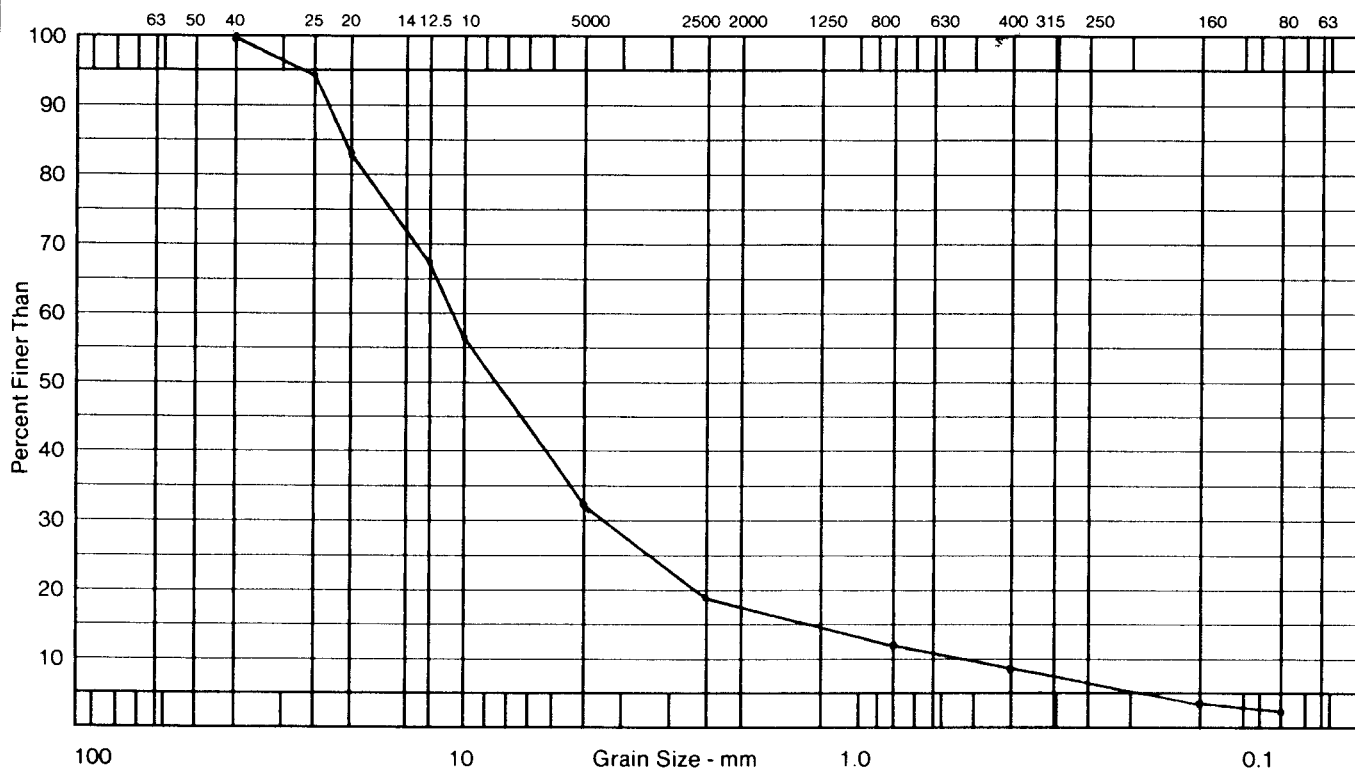
Remarks

Moisture: 2.4%

Gravel: 67.4%

Sand: 30.1%

Fines: 2.5%





J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

SCREEN ANALYSIS

Sample: **#15** Depth: **1.10m**
Location: **TP #4-97**

Client: **PUBLIC WORKS CANADA (DIAND)**

Project: **Haines Junction (HJ011)**

Made by: **RW** Job No.: **8054-24**

Ck'd by: **WCK** Date: **1997/08/17**

Sieve No.	Size of Opening MM	Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
50,000	50.0				
40,000	40.0				100.0
25,000	25.0				88.8
20,000	20.0				67.3
12,500	12.5				47.7
10,000	10.0				37.4
5,000	5.0				22.4
2,500	2.5				15.9
2,000	2.0				
1,250	1.25				
800	0.800				10.7
630	0.630				
400	0.400				7.5
315	0.315				
160	0.160				2.5
80	0.080				1.2

Description of Sample

Sandy gravel

GP

Method of Preparation _____ Dry _____ Washed **X**

Remarks

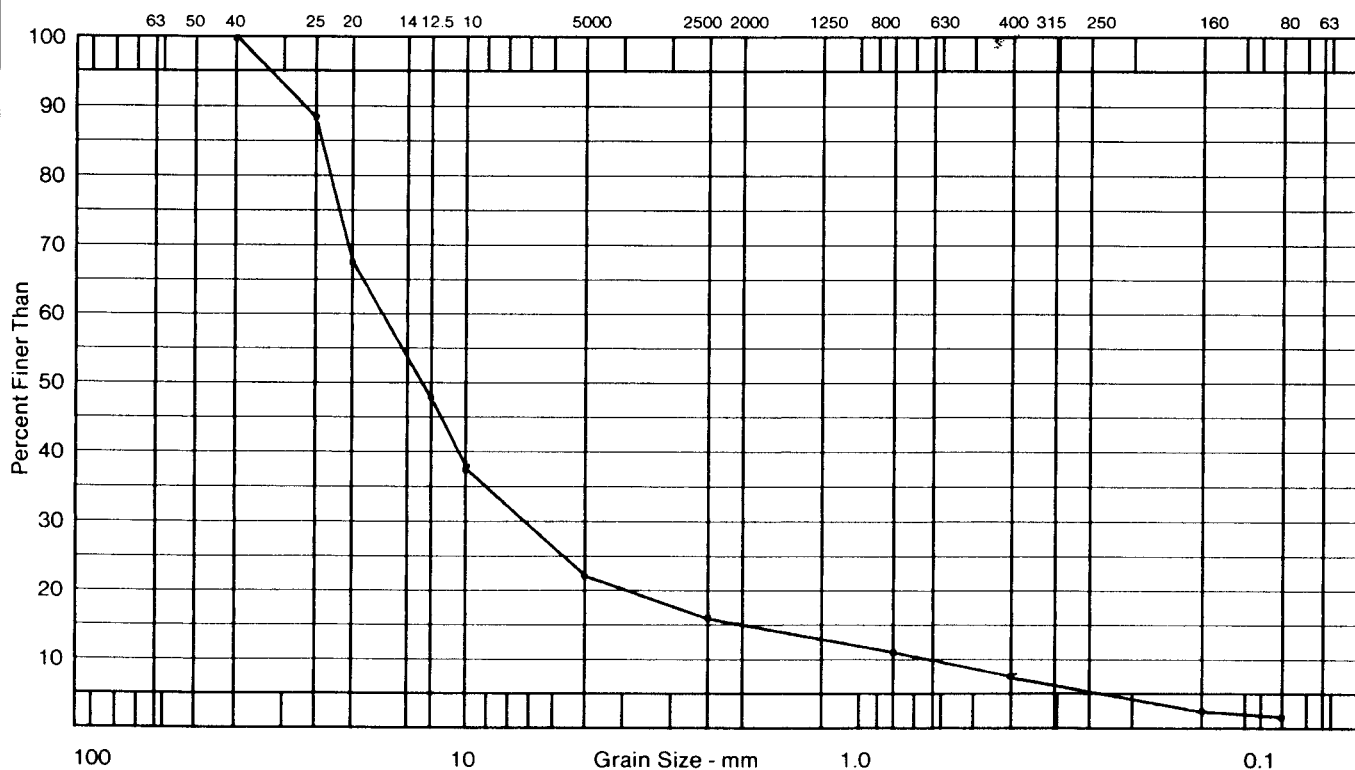
Moisture: 3.3%

Gravel: 77.6%

Sand: 21.2%

Fines: 1.2%

Time of Sieving _____ Min. **15**





J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

SCREEN ANALYSIS

Client: PUBLIC WORKS CANADA (DIAND)
Sample: #18 Depth: 1.5m Project: Haines Junction (HJ011)
Location: TP #5-97 Made by: RW Job No.: 8054-24
Ck'd by: WCI Date: 1997/08/17

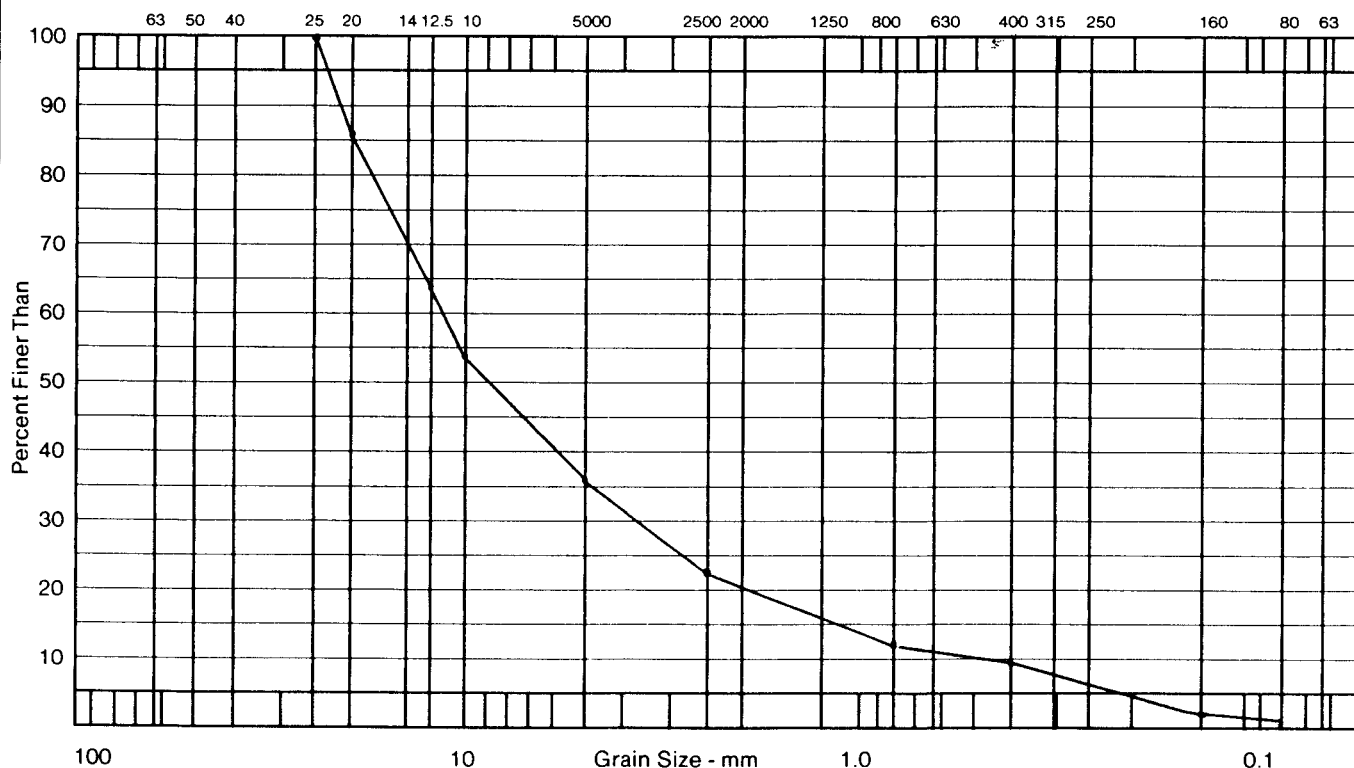
Sieve No.	Size of Opening MM	Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
50,000	50.0				
40,000	40.0				
25,000	25.0				100.0
20,000	20.0				85.5
12,500	12.5				64.2
10,000	10.0				54.2
5,000	5.0				35.5
2,500	2.5				22.5
2,000	2.0				
1,250	1.25				
800	0.800				12.1
630	0.630				
400	0.400				9.8
315	0.315				
160	0.160				1.9
80	0.080				0.7

Description of Sample _____
Sandy gravel GP

Method of Preparation _____ Dry _____ Washed X
Remarks _____

Time of Sieving _____ Min. 15

Moisture: 4.1%
Gravel: 64.5%
Sand: 34.8%
Fines: 0.7%





J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

SCREEN ANALYSIS

Sample: **#20** Depth: **1.0m**
Location: **TP #6-97**

Client: **PUBLIC WORKS CANADA (DIAND)**

Project: **Haines Junction (HJ011)**

Made by: **RW** Job No.: **8054-24**

Ck'd by: **W.C.** Date: **1997/08/17**

Sieve No.	Size of Opening MM	Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
50,000	50.0				
40,000	40.0				
25,000	25.0				100.0
20,000	20.0				84.1
12,500	12.5				74.6
10,000	10.0				66.5
5,000	5.0				50.2
2,500	2.5				38.0
2,000	2.0				
1,250	1.25				
800	0.800				20.7
630	0.630				
400	0.400				9.8
315	0.315				
160	0.160				3.2
80	0.080				1.9

Description of Sample **Sandy gravel to gravelly sand**

GP-SP

Time of Sieving Min. **15**

Method of Preparation **Dry** **Washed**

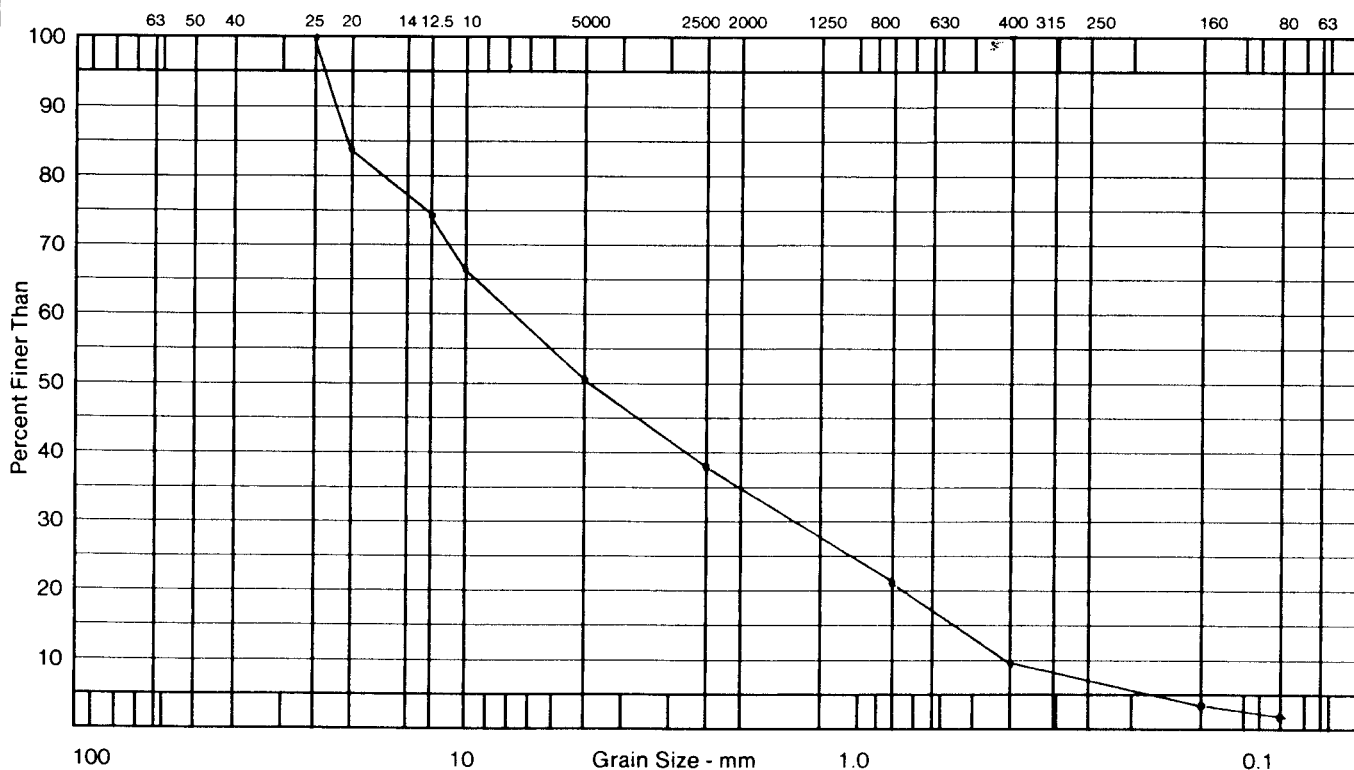
Remarks

Moisture: **2.8%**

Gravel: **49.8%**

Sand: **48.3%**

Fines: **1.9%**



APPENDIX C

Chemical Laboratory Analysis

To: J.R. PAINE & ASSOCIATES LTD.
14 Burns Road
Whitehorse, Yukon
Y1A 4Y9

Workorder: 28443
Received : 14-Aug-97
Completed: 26-Aug-97

Attn: Tares Dhara

Re: Soil & Water Samples

ANALYSIS
OF
ENVIRONMENTAL SAMPLES

METHODOLOGY - SOILS

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).
Mercury was determined by cold vapour-UV (EPA Method 245.1).

The numbers next to the parameter names refer to the Soil Numerical Criteria in B.C. Ministry of Environment "Criteria for Managing Contaminated Sites (CHCS) in British Columbia, April, 1997" and are provided for information only.

METHODOLOGY - WATER

Total metals were determined in a sample aliquot which was acid digested in a closed teflon vessel in a microwave oven (EPA Method 3015). The digest was analyzed by UNICP-AES (EPA Method 200.15).

Mercury was determined by cold vapour - UV (EPA Method 245.1).
Thallium was determined by GF-AAS (EPA Method 7000A).

The numbers next to the parameter names refer to B.C. Ministry of the Environment "Criteria for Managing Contaminated Sites (CHCS) in British Columbia, April, 1997, Water Numerical Criteria", and are provided for information only.

ACCREDITATION

Norwest Labs 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. Norwest Labs is also registered in the B.C. Ministry of Environment Laboratory Registration Program.

NORWEST LABS

To: J.R. PAINE & ASSOCIATES LTD.

W/O: 28443 Page 1

Sample type		soil	soil	soil	soil	soil
Identification		H-1	H-2	H-2	H-3	H-4
Fraction				duplicate		
Lab Reference #		28443-002	28443-003A	28443-003B	28443-004	28443-005
ICP - ULTRASONIC NEBULIZATION						
Method used		uwave	uwave	uwave	uwave	uwave
		HNO3/H2O2	HNO3/H2O2	HNO3/H2O2	HNO3/H2O2	HNO3/H2O2
		soluble	soluble	soluble	soluble	soluble
Amount analysed		0.506 g	0.512 g	0.510 g	0.511 g	0.500 g
SOIL NUMERICAL CRITERIA-PL&RL						
aluminum		32000	23500	23400	33400	38200
antimony	20	< 2.	< 2.	< 2.	< 2.	< 2.
arsenic	30	< 2.	11.	10.	2.	14.
barium	500	245.	127.	131.	275.	304.
beryllium	4	0.3	0.4	0.4	0.4	0.6
bismuth		< 5.	< 5.	< 5.	< 5.	< 5.
cadmium	5	0.6	0.5	0.4	0.9	0.7
calcium		24700	11800	11800	17700	15600
chromium	250	42.0	37.8	38.8	47.0	58.6
cobalt	50	12.5	12.0	11.9	13.7	17.1
copper	100	35.4	35.9	32.9	46.6	46.2
iron		37000	34000	33000	37000	45000
lead	500	7.	9.	7.	21.	11.
lithium		19.3	20.4	20.2	20.8	27.3
magnesium		15800	13700	13700	15400	18200
manganese		582.	497.	484.	630.	641.
mercury	2	0.03	0.02	0.02	0.02	0.02
molybdenum	10	< 1.	< 1.	< 1.	< 1.	< 1.
nickel	100	24.7	22.8	23.2	28.5	33.9
phosphorus		905.	856.	833.	852.	1060
potassium		4280	2890	3070	6100	7300
selenium	3	< 2.	< 2.	< 2.	< 2.	< 2.
silicon		409.	565.	663.	416.	952.
silver	20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
sodium		3000	1280	1380	3240	2990
strontium		84.	46.	48.	81.	84.
sulfur		80	90	90	60	330
thorium		< 1.	< 1.	< 1.	< 1.	< 1.
tin	50	1.	2.	3.	< 1.	3.
titanium		2620	2240	2220	2410	2890
uranium		< 5.	< 5.	< 5.	< 5.	< 5.
vanadium	200	73.	77.	77.	79.	120
zinc	500	81.9	88.0	90.6	136.	94.3
zirconium		11.9	14.1	14.0	12.8	16.8
Results in		ug/dry g	ug/dry g	ug/dry g	ug/dry g	ug/dry g

NORWEST LABS

To: J.R. PAINE & ASSOCIATES LTD.

W/O: 28443 Page 2

Sample type Identification Lab Reference #		soil H-5 28443-006	soil H-6 28443-007	soil H-7 28443-008	soil S-5 28443-009	soil S-8 28443-010
ICP - ULTRASONIC NEBULIZATION- Method used		uwave HNO3/H2O2 soluble 0.501 g	uwave HNO3/H2O2 soluble 0.520 g	uwave HNO3/H2O2 soluble 0.507 g	uwave HNO3/H2O2 soluble 0.508 g	uwave HNO3/H2O2 soluble 0.518 g
Amount analysed						
SOIL NUMERICAL CRITERIA-PL&RL						
aluminum		31600	25700	33800	23500	20300
antimony	20	< 2.	< 2.	< 2.	< 2.	< 2.
arsenic	30	< 2.	10.	7.	5.	< 2.
barium	500	233.	175.	256.	162.	89.1
beryllium	4	0.3	0.3	0.5	0.3	0.4
bismuth		< 5.	< 5.	< 5.	< 5.	< 5.
cadmium	5	0.5	0.6	0.3	0.2	0.1
calcium		16800	14000	16100	16800	16600
chromium	250	50.6	40.6	52.7	40.9	36.4
cobalt	50	15.7	12.3	16.3	12.2	11.2
copper	100	47.4	52.9	43.5	31.4	29.2
iron		44000	32000	40000	29000	29000
lead	500	14.	22.	9.	6.	4.
lithium		24.5	18.9	23.2	16.9	17.4
magnesium		16800	13600	16700	12400	12800
manganese		641.	399.	622.	438.	530.
mercury	2	0.03	0.05	0.03	< 0.02	< 0.02
molybdenum	10	< 1.	1.	< 1.	< 1.	< 1.
nickel	100	31.8	25.2	32.1	23.4	21.7
phosphorus		943.	863.	961.	760.	721.
potassium		5400	3760	5700	2780	2110
selenium	3	< 2.	< 2.	< 2.	< 2.	< 2.
silicon		985.	790.	971.	824.	823.
silver	20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
sodium		1570	1830	2610	1260	929.
strontium		63.	61.	81.	61.	51.
sulfur		190	640	210	80	80
thorium		< 1.	< 1.	< 1.	< 1.	< 1.
tin	50	19.	4.	1.	2.	2.
titanium		2640	2180	2480	2070	2110
uranium		< 5.	< 5.	< 5.	< 5.	< 5.
vanadium	200	91.	75.	91.	70.	71.
zinc	500	109.	91.5	86.8	63.5	55.4
zirconium		13.8	13.1	14.9	11.5	13.0
Results in		ug/dry g	ug/dry g	ug/dry g	ug/dry g	ug/dry g

NORWEST LABS

To: J.R. PAINE & ASSOCIATES LTD.

W/O: 28443 Page 3

Sample type		soil
Identification		S-12
Lab Reference #		28443-011
ICP - ULTRASONIC NEBULIZATION--+		
Method used		uwave HNO3/H2O2 soluble
Amount analysed		0.501 g
SOIL NUMERICAL CRITERIA-PL&RL--+		
aluminum		22700
antimony	20	< 2.
arsenic	30	10.
barium	500	115.
beryllium	4	0.4
bismuth		< 5.
cadmium	5	0.2
calcium		18900
chromium	250	36.6
cobalt	50	11.6
copper	100	29.2
iron		30000
lead	500	8.
lithium		18.1
magnesium		12900
manganese		494.
mercury	2	< 0.02
molybdenum	10	2.
nickel	100	21.0
phosphorus		770.
potassium		2670
selenium	3	< 2.
silicon		943.
silver	20	< 0.5
sodium		1500
strontium		63.
sulfur		70
thorium		< 1.
tin	50	3.
titanium		2210
uranium		< 5.
vanadium	200	77.
zinc	500	56.4
zirconium		14.6
Results in		ug/dry g

NORWEST LABS

To: J.R. PAINE & ASSOCIATES LTD.

W/O: 28443 Page 4

Sample type		water		water		water
Identification		W-4		W-4		W-7
Lab Reference #		28443-012		28443-013		28443-014
ICP - ULTRASONIC NEBULIZATION						
Method used		uwave HNO3		uwave HNO3		uwave HNO3
		TOTAL		TOTAL		TOTAL
WATER NUMERICAL CRITERIA-AW						
aluminum .05-.5		0.02		0.13		0.45
antimony 0.3	<	0.02	<	0.02	<	0.02
arsenic 0.5	<	0.02	<	0.02	<	0.02
barium 10		0.010		0.0220		0.0237
beryllium 0.053	<	0.0002	<	0.0002	<	0.0002
bismuth	<	0.02	<	0.02	<	0.02
cadmium.002-.018	<	0.0005	<	0.0005	<	0.0005
calcium		32.3		26.5		25.6
chromium 0.02	<	0.001	<	0.001	<	0.001
cobalt 0.5	<	0.001	<	0.001	<	0.001
copper 0.02-0.09		0.007		0.010		0.012
iron 3		0.374		0.196		0.635
lead 0.04-0.16	<	0.005	<	0.005	<	0.005
lithium	<	0.002		0.003	<	0.002
magnesium		6.14		4.36		4.34
manganese 1		0.0140		0.0093		0.0214
mercury 0.001	<	0.0001	<	0.0001	<	0.0001
molybdenum 10	<	0.005	<	0.005	<	0.005
nickel 0.25-1.5	<	0.002	<	0.002	<	0.002
phosphorus		0.09	<	0.06	<	0.06
potassium		1.7		1.1		0.9
selenium 0.01	<	0.01	<	0.01	<	0.01
silicon		1.31		3.48		3.86
silver 0.001	<	0.001	<	0.001	<	0.001
sodium		4.58		2.72		2.65
strontium		0.164		0.153		0.150
sulfur		4.7		5.2		5.2
thallium 0.003	<	0.003	<	0.003	<	0.003
thorium	<	0.005	<	0.005	<	0.005
tin		0.006	<	0.005	<	0.005
titanium		0.001		0.007		0.036
uranium 3	<	0.06	<	0.06	<	0.06
vanadium	<	0.002		0.003		0.004
zinc 0.3		0.012		0.008		0.007
zirconium	<	0.001	<	0.001	<	0.001
Results in		mg/L		mg/L		mg/L

Test results are for internal use only. Norwest liability is limited to the testing fee paid.

Approved: 



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WO (Lang.) : 28443
 WO (Other) :
 PO # : 8002-538
 Date Samp. :
 Date Rec'd. : 14-Aug-97
 Date Comp : 21-Aug-97

Client

Received From

Name : J.R. Paine & Associates Ltd
 Address : 14 Burns Road
 Whotehorse, Yukon
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 Fax : 403-668-2400
 Attn. : Tares Dhara
 Project : Haines Junction 8002-538

Name :
 Address :
 Phone :
 Fax :
 Attn. :

Polychlorinated Biphenyls (PCBs) in Water

Parameter	28443-20 W-5	28443-21 W-6	Detection Limit
Total PCBs	<0.5	<0.5	0.5 ppb

Results are expressed in ppb (ug/L), 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 0.5 ppb, but no match was found.

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WO (Lang.) : 28443

WO (Other) :

PO # : 8002-538

Date Samp. :

Date Rec'd. : 14-Aug-97

Date Comp : 21-Aug-97

Polychlorinated Biphenyls (PCBs) in Water (cont.)

Definitions / Methods

Total PCBs:

This analysis is carried out in accordance with U.S. Environmental Protection Agency Methods 3510/8080 (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.

Comments

Quality Control Results

Compound	% Recovery	Analysis	Date	Analyst
PCB Aroclor-1268	56	PCBs	20-Aug-97	Stephen H.
Surrogate - TCMX	74			
Surrogate - DCBP	45			

Ralph Smith
Supervisor

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


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WO (Lang.) : 28443
 WO (Other) :
 PO # : 8002-538
 Date Samp. :
 Date Rec'd. : 14-Aug-97
 Date Comp. : 25-Aug-97

Client
Received From

Name : J.R. Paine & Associates Ltd.
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 Attn. : Tares Dhara
 Project : Haines Junction 8002-538

Name :
 Address :
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Polynuclear Aromatic Hydrocarbons in Soil

Parameter	28443-22	28443-23	28443-24	28443-25	Detection
	H-1	H-2	H-3	H-4	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	92	94	110	110	23-120
2-Fluorobiphenyl	94	104	89	87	30-115
4-Terphenyl-d14	102	106	103	82	18-137

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

na = not available due to high hydrocarbon contamination.



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WO (Lang.) : 28443

WO (Other) :

PO # : 8002-538

Date Samp. :

Date Rec'd. : 14-Aug-97

Date Comp. : 25-Aug-97

Polynuclear Aromatic Hydrocarbons in Soil (cont.)

Parameter	28443-26 H-5	28443-27 H-6	28443-28 H-7	28443-29 S-5	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	112	81	87	97	23-120
2-Fluorobiphenyl	86	85	86	92	30-115
4-Terphenyl-d14	98	97	106	99	18-137

Results are expressed in ppm (ug/g) dry weight, without correction for recovery data.
 na = not available due to high hydrocarbon contamination.

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WO (Lang.) : 28443
WO (Other) :
PO # : 8002-538
Date Samp. :
Date Rec'd. : 14-Aug-97
Date Comp. : 25-Aug-97

Polynuclear Aromatic Hydrocarbons in Soil (cont.)

Definitions / Methods

Polynuclear Aromatic Hydrocarbons:

This analysis is carried out in accordance with U. S. Environmental Protection Agency Method 3540/8270 (#SW 846, 3rd Edition, Washington DC) which involves extraction of the components with an organic solvent followed by analysis by capillary gas chromatography using a mass selective detector.

Percent Moisture:

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

Comments

Quality Control Results

Compound	QA/QC		Analysis	Analyst	
		% Recovery		Date	Analyst
fluoranthene			PAHs	30-Aug-97	
benzo(a)pyrene				30-Aug-97	

Ralph H. Smith
Supervisor

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


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WO (Lang.) : 28443
 WO (Other) :
 PO # : 8002-538
 Date Samp. :
 Date Rec'd. : 14-Aug-97
 Date Comp. : 26-Aug-97

Client**Received From**

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Attn. : Tares Dhara
Project : Haines Junction 8002-538

Name :
Address :

Phone :
Fax :
Attn. :

Petroleum Hydrocarbons in Soil

Parameter	28443-22 H-1	28443-23 H-2	28443-24 H-3	28443-25 H-4	Detection Limit
<u>LEPH (C10-C18)</u>	<10	<10	<10	<10	10 ppm
<u>HEPH (C19-C32)</u>	<10	<10	<u>62</u>	<u>53</u>	10 ppm

Parameter	28443-26 H-5	28443-27 H-6	28443-28 H-7	28443-29 S-5	Detection Limit
<u>LEPH (C10-C18)</u>	<10	<10	<10	<10	10 ppm
<u>HEPH (C19-C32)</u>	170	<u>390</u>	<u>19</u>	<10	10 ppm

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



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WO (Lang.) : 28443
WO (Other) :
PO # : 8002-538
Date Samp. :
Date Rec'd. : 14-Aug-97
Date Comp. : 26-Aug-97

Petroleum Hydrocarbons in Soil (cont.)

Definitions / Methods

LEPH + HEPH:

LEPH (Light Extractable Pet. Hydro.), HEPH (Heavy Extractable Pet. Hydro.)
Summation of the C10 - C18 or C19 - C32 carbon range respectively, determined using a calibrated standard. Alberta Environmental Centre Method G108.0 which involves extraction of the sample with dichloromethane followed by analysis with capillary gas chromatography using a flame ionization detector.

Comments

Quality Control Results

Compound	QA/QC		Analyst		
	% Recovery		Analysis	Date	Analyst
diesel fuel	118		LEPH/HEPH	25-Aug-97	G. January


Supervisor

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

PAGE 2 of 2

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WO (Lang.) : 28443
WO (Other) :
PO # : 8002-538
Date Samp. :
Date Rec'd. : 14-Aug-97
Date Comp. : 26-Aug-97

Client

Received From

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Fax : 403-668-2400
Attn. : Tares Dhara
Project : Haines Junction 8002-538

Name :
Address :
Phone :
Fax :
Attn. :

Polynuclear Aromatic Hydrocarbons in Water

Parameter	28443-1	28443-30	Detection Limit
	W-3	W-1	
Naphthalene	<0.1	<0.1	0.1 ppb
Acenaphthylene	<0.1	<0.1	0.1 ppb
Acenaphthene	<0.1	<0.1	0.1 ppb
Fluorene	<0.1	<0.1	0.1 ppb
Phenanthrene	<0.1	<0.1	0.1 ppb
Acridine	<0.05	<0.05	0.05 ppb
Anthracene	<0.1	<0.1	0.1 ppb
Fluoranthene	<0.1	<0.1	0.1 ppb
Pyrene	<0.1	<0.1	0.1 ppb
Benzo(a)anthracene	<0.01	<0.01	0.01 ppb
Chrysene	<0.1	<0.1	0.1 ppb
Benzo(f)fluoranthene	<0.01	<0.01	0.01 ppb
Benzo(a)pyrene	<0.01	<0.01	0.01 ppb
Indeno(1,2,3-cd)pyrene	<0.1	<0.1	0.1 ppb
Dibenzo(a,h)anthracene	<0.01	<0.01	0.01 ppb
Benzo(g,h,i)perylene	<0.1	<0.1	0.1 ppb

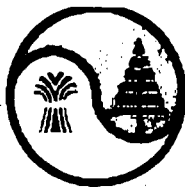
Surrogates

% Recovery

Recovery Range

Nitrobenzene-d5	96	88	23-120
2-Fluorobiphenyl	96	73	43-116
4-Terphenyl-d14	46	34	33-141

Results are expressed in ppb (ug/L), without correction for recovery data.


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WO (Lang.) : 28443

WO (Other) :

PO # : 8002-538

Date Samp. :

Date Rec'd. : 14-Aug-97

Date Comp. : 26-Aug-97

Polynuclear Aromatic Hydrocarbons in Water (cont.)

Definitions / Methods

Polynuclear Aromatic Hydrocarbons:

This analysis is carried out in accordance with U. S. Environmental Protection Agency Method 3540/8270 (#SW 846, 3rd Edition, Washington DC) which involves extraction of the components with an organic solvent followed by analysis by capillary gas chromatography using a mass selective detector.

Comments

Quality Control Results

Results					
Compound	QA/QC	% Recovery	Analysis	Analyst	
			Date		
naphthalene		122	PAHs	20-Aug-97	Cathy C.
fluoranthene		86			
benzo(a)pyrene		66			

Ralph Hill
Supervisor

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


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WO (Lang.) : 28443
WO (Other) :
PO # : 8002-538
Date Samp. :
Date Rec'd. : 14-Aug-97
Date Comp. : 26-Aug-97
Client
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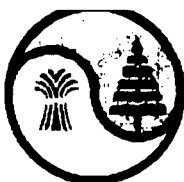
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Petroleum Hydrocarbons in Water

Parameter	28443-1 W-3	28443-30 W-1	Detection Limit
<u>LEPH (C10-C18)</u>	380	< 50	50 ppb
<u>HEPH (C19-C32)</u>	< 50	< 50	50 ppb

Results are expressed in ppb ($\mu\text{g/L}$) without correction for recovery data.

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WO (Lang.) : 28443

WO (Other) :

PO # : 8002-538

Date Samp. :

Date Rec'd. : 14-Aug-97

Date Comp. : 26-Aug-97

Petroleum Hydrocarbons in Water (cont.)

Definitions / Methods

LEPH + HEPH:

LEPH (Light Extractable Pet. Hydro.), HEPH (Heavy Extractable Pet. Hydro.)
Summation of the C10 - C18 or C19 - C32 carbon range respectively, determined using a calibrated standard. Alberta Environmental Centre Method G108.0 which involves extraction of the sample with dichloromethane followed by analysis with capillary gas chromatography using a flame ionization detector.

Comments

Quality Control Results

Compound	QA/QC % Recovery	Analysis	Analyst Date	Analyst
diesel fuel	79	LEPH/HEPH	20-Aug-97	David D.

R. J. Smith
Supervisor

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



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WO (Lang.) : 28443

WO (Other) :

PO # : 8002-538

Date Samp. :

Date Rec'd. : 14-Aug-97

Date Comp. : 26-Aug-97

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 Project : Haines Junction 8002-538

Name :
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Organo-Chloride Pesticides in Soil

Parameter	28443-15 S8	Detection Limit
Pesticide		
Aldrin	<0.05	0.05 ppm
BHC (alpha isomer)	<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
Percent Moisture	6.0	

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


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WO (Lang.) : 28443
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PO # : 8002-538
Date Samp. :
Date Rec'd. : 14-Aug-97
Date Comp. : 26-Aug-97

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

Compound	QA/QC	% Recovery	Analyst		
			Analysis	Date	Analyst
Lindane		93	O-C Scan	22-Aug-97	Stephen H.
Endosulfan I		108			
4,4-DDT		132			

Ralph Hunt
Supervisor

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


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WO (Lang.) : 28443
WO (Other) :
PO # : 8002-538
Date Samp. :
Date Rec'd. : 14-Aug-97
Date Comp. : 27-Aug-97
Client
Received From

Name : J.R. Paine & Associates Ltd	Name :
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Whitehorse, Yukon	
Y1A 4Y9	
Phone : 403-668-4648	Phone :
Fax : 403-668-2400	Fax :
Attn. : Tares Dhara	Attn. :
Project : Haines Junction 8002-538	

Polychlorinated Biphenyls (PCBs) in Soil

Parameter	28443-18 H-1	28443-17 H-2	28443-18 H-3	28443-19 H-4	Detection Limit
Total PCBs	<0.1*	<0.1*	<0.1*	<0.1*	0.1 ppm
Percent Moisture	26	18	11	25	

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(204) 275-6019

WO (Lang.) : 28443
WO (Other) :
PO # : 8002-538
Date Samp. :
Date Rec'd. : 14-Aug-97
Date Comp. : 27-Aug-97

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-1268	116	PCBs	28-Aug-97	Erik C.

Ralph Hirsch
Supervisor

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