# DETAILED ENVIRONMENTAL INVESTIGATIONS OF THREE FORMER U.S. MILITARY CAMP SITES - YUKON TERRITORY

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Prepared for:

**Indian and Northern Affairs Canada - Yukon**

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Indian and Northern Affairs Canada
345-300 Main Street
Whitehorse, Yukon

**Attention:** **Mr. Brett Hartshorne**
**Manager, Action on Waste**
**Arctic Environmental Strategy**

Dear Sir:

**RE: DETAILED ENVIRONMENTAL INVESTIGATIONS AT THREE FORMER U.S. MILITARY CAMP SITES**
**CONTRACT NO: 96-6127-2**

Enclosed are ten copies of the final report for the Detailed Environmental Investigations of three former U.S. Military Maintenance Camp Sites along the Alaska Highway, Yukon Territory. The follow-up investigations were conducted at Takhini River, Stony Creek and Mendenhall River. The report summarizes the field investigation activities and analytical results, recommends cleanup requirements at each site and outlines specifications for demolition, asbestos abatement, contaminated soil and debris removal.

Thank you for the opportunity to complete the detailed environmental investigations at these three sites. We trust that this report is consistent with your expectations, and we look forward to being of further service to Indian and Northern Affairs Canada.

Yours truly,

UMA Engineering Ltd.

A.S. Washuta, P.Eng.
Project Principal

ASW/klm
Enclosure

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# EXECUTIVE SUMMARY

Detailed environmental investigations were completed at three former United States Government military maintenance camp sites in the Yukon Territory. The requirement for additional work at these sites was identified in the report prepared by UMA (1996). These sites included:

- Takhini River - Mile 946.4 - LA041 (Site 16)
- Stony Creek - Mile 956 and Mile 956.8 - LA010 (Site 17)
- Mendenhall River - Mile 968 - LA042 (Site 18).

The primary objectives of the detailed environmental investigations were to:

- delineate and quantify the extent of previously identified areas of contamination, where applicable;
- re-evaluate public safety and environmental risks based on the additional site information;
- quantify the volumes and types of debris, and identify disposal options for these materials;
- provide recommendations for remediation as applicable; and
- prepare outline specifications for the recommended cleanup requirements.

As related to these objectives, a soil sampling program was carried out to delineate contaminated areas of concern at two of the three sites. A sub-surface investigation program was conducted to further characterize contaminants and identify potential migration pathways. Groundwater monitoring wells were installed at the Mendenhall River site to allow for continued monitoring of the apparent hydrocarbon contamination. The laboratory component of the investigation consisted of the analyses for specific parameters of concern. Physical surveys and inventories of debris areas were also carried out at all three sites. Samples of asbestos materials and paint were obtained.

The three sites were visited in September 1997. Analytical data were interpreted relative to site conditions and soil and water remediation criteria (primarily CCME (1991) criteria). A summary of the results of the detailed environmental investigation and recommended actions is provided in Table 1.

| TABLE 1 - PROJECT SUMMARY -DETAILED ENVIRONMENTAL INVESTIGATIONS<br>THREE SITES - YUKON TERRITORY | | |
|---|---|---|
| **Site Description** | **Summary of Environmental Investigation Results** | **Recommended Actions** |
| **Site 16: Takhini River - Mile 946.4**<br>• Former military maintenance camp; one building remains standing.<br>• Site is resting area along Takhini - Mendenhall River canoe route. | • Exposed debris in Takhini River bank, estimated volume of soil and debris 1000 $m^3$. | • Excavate and dispose of debris adjacent to and within the riverbank and from the river bed. Sort debris, carry out confirmatory testing following excavation. |
| | • Remaining building; poor structural condition, estimated volumes:<br>- 20 $m^3$ non-hazardous building components<br>- 3 $m^3$ PCB contaminated painted building components<br>- 50 $m^2$ of asbestos exterior siding tile<br>- 60 $m^2$ of asbestos wallboard | • Demolish the remaining camp building, dispose of PCB contaminated painted materials at southern landfill; asbestos at landfill licensed to accept asbestos wastes; non-hazardous debris in an appropriate landfill facility. |
| | • Scattered debris at site, estimated volume = 90 $m^3$ | • Collect and dispose/recycle scattered debris in an appropriate landfill facility. |
| **Site 17: Stony Creek - Mile 956 & 956.8**<br>• Former military maintenance camp and Canol Pump Station.<br>• No buildings remain. | • Scattered debris present, asbestos containing materials identified.<br>Estimated volumes:<br>- 3.5 $m^3$ asbestos containing materials<br>- 100 $m^3$ non-hazardous materials | • Collect and dispose of asbestos at landfill licensed to accept asbestos wastes; non-hazardous debris in an appropriate landfill facility. |
| | • localized hydrocarbon contamination in soil.<br>Estimated volume:<br>- 30 $m^3$ | • Excavate, containerize and ship hydrocarbon contaminated soil to a southern landfill facility licensed to accept contaminated wastes. contamination. |

| TABLE 1 - PROJECT SUMMARY -DETAILED ENVIRONMENTAL INVESTIGATIONS<br>THREE SITES - YUKON TERRITORY | | |
|---|---|---|
| **Site Description** | **Summary of Environmental Investigation Results** | **Recommended Actions** |
| **Site 18: Mendenhall River - Mile 968**<br>• Former military maintenance camp encompassing approx. 5 hectares.<br>• Former site of private retail fuel outlet (currently titled land).<br>• No facilities remain. | • Scattered debris throughout the campground and along the river valley.<br>Estimated volume:<br>- 250 $m^3$ of non-hazardous debris<br>• Hydrocarbon contamination identified in soil and groundwater suspected to be the result of operations at the former retail fuel outlet area.<br>• Migration of hydrocarbons in groundwater towards the Mendenhall River is likely on-going. | • Collect and dispose/recycle scattered debris in an appropriate landfill facility..<br>• Continued monitoring of groundwater levels and sampling for chemical analyses to establish increasing or decreasing trends. |

ESTIMATED VOLUMES ARE CONSIDERED TO BE ACCURATE TO WITHIN 25%.

# 1.0 INTRODUCTION

## 1.1 BACKGROUND

UMA Engineering Ltd. (UMA) was retained by the Department of Indian and Northern Affairs Canada (DIAND) to conduct detailed environmental investigations at three sites in the Yukon Territory as part of the Arctic Environmental Strategy (AES) - Action on Waste Program. These sites were former U.S. military maintenance camps. The requirement for additional work at these sites was identified in the report prepared by UMA (1996) following a preliminary environmental assessment. The three sites included in the 1997 project are:

- Takhini River - Mile 946.4 - LA041 (Site 16)
- Stony Creek - Mile 956 and Mile 956.8 - LA010 (Site 17 and Site 17C)
- Mendenhall River - Mile 968 - LA042 (Site 18).

## 1.2 OBJECTIVES AND SCOPE OF WORK

In general, the objectives of this project may be described as follows:

- delineate and quantify the extent of previously identified areas of contamination, where applicable;
- re-evaluate public safety and human/environmental health risks based on the additional information;
- quantify the volumes and type of debris;
- identify disposal options for these materials;
- provide recommendations for remediation, as applicable; and
- prepare outline specifications for recommended cleanup requirements.

Site specific objectives are described in subsequent sections of the report.

## 1.3 SCOPE OF REPORT

The report has been structured to allow for ease of extraction of all the information pertaining to a specific site. Sections 1 and 2 present information which is common to the investigation and reporting of all three sites.

Section 1 presents an outline of the study objectives and an overview of the program.

Section 2 describes the general project methodology, and includes a discussion of the sampling and analytical programs. A review and selection of clean up criteria is also presented.

Sections 3 to 5 provide the site specific information for the Takhini River, Stony Creek, and Mendenhall River sites, respectively. This site specific information generally includes:

- an outline of the recommendations made in 1996;
- a summary of the 1997 site investigation and results;
- interpretation of the analytical results where applicable; and
- recommendations for remediation and an outline specification for cleanup.

# 2.0 METHODOLOGY

This section describes the project methodology and provides a summary of the field investigation activities, and a discussion of laboratory requirements and procedures and cleanup criteria.

## 2.1 FIELD INVESTIGATION

The environmental investigation consisted of a field component and a laboratory component. The field component involved:

- a sampling program to delineate areas of concern identified in the preliminary environmental investigation;
- a subsurface investigation to identify potential contaminant migration pathways;
- physical survey of debris and work areas; and
- survey of all sampling and test hole locations.

The following outlines the general principles and rationale for the field program, and provides an overall schedule of activities carried out during the site investigation.

### 2.1.1 Sampling Program

The sampling program consisted of the collection of paint, suspected asbestos material, water, soil and sediment samples. Sampling locations were selected based on suspected areas of concern as identified by the preliminary environmental investigations at these sites conducted in 1996.

A summary of the 1997 field sampling program is provided in Table 2.1.

The paint sample was collected by scraping paint from the surface using a metal spatula, and then placing in a plastic ziplock bag. Two samples of potential asbestos materials were collected; one sample of exterior siding tile and one of fibrous material were placed in ziplock bags. In total, two surface water samples and five subsurface groundwater samples were obtained. Samples were collected in appropriate bottles and stored at 4°C until they were submitted to the laboratory for analyses. Thirty-five soil samples and

three sediment samples were retrieved. The samples were collected using sterile plastic scoops and stored in either glass jars or soil bags, depending on the analysis required. Soil samples were stored at 4°C until submitted for analyses. All sample analyses were carried out at EnviroTest Laboratories of Edmonton, Alberta.

**TABLE 2.1**
**SUMMARY OF THE 1997 FIELD SAMPLING PROGRAM**

| Mile No. | Site No. and Name | No. of Samples Collected | No. of Samples Analysed | Analysis Requested |
|---|---|---|---|---|
| 946.4 | LA-041<br>Site 16 - Takhini River | 1 paint<br>1 tile | 1 paint<br>1 tile | PCBs, lead<br>asbestos |
| 956.0 | LA-010<br>Site No. 17M and 17E<br>- Stony Creek | 2 water<br>13 soil<br>3 sediment | 1 water<br>8 soil<br>3 sediment | metals<br>metals, LEPH, HEPH<br>metals |
| 956.8 | LA-010<br>Site No. 17C- Canol<br>Pump Station No. 4 | 9 soil<br>1 fibrous material | 6 soil<br>1 fibrous material | PAH<br>asbestos |
| 968.1 | LA-042<br>Site No. 18 -<br>Mendenhall River | 5 water<br><br>13 soil | 5 water<br><br>7 soil | BTEX, VPH, LEPH, HEPH<br>BTEX, VPH, LEPH, HEPH |

LEPH = Light Extractable Petroleum Hydrocarbons
HEPH = Heavy Extractable Petroleum Hydrocarbons
PAH = Polyaromatic Hydrocarbons
BTEX = Benzene, Toluene, Ethylbenzene, Xylenes
VPH = Volatile Petroleum Hydrocarbon

### 2.1.2 Subsurface Investigation

**Soil Sampling**

The subsurface investigation program included the drilling of eight test holes at the Mendenhall River Site, four at the Stony Creek Site and six at the former Canol Pump Station. The test hole locations were selected based on areas of concern identified by UMA during the 1996 investigations. The test holes were advanced using a truck mounted CME drill rig equipped with a solid stem auger contracted from Midnight Sun Drilling Ltd of Whitehorse, Yukon.

The soil stratigraphy at the test hole locations was described based on examination of auger cuttings and logged. Test hole logs are provided in the site specific Appendices. Soil samples were collected as grab samples from the auger flights and screened with a Microtip™ photoionization detector (PID). These detectors measure concentrations of volatile organic compounds (VOCs) in air released from the soil. The PID was placed in the head space of the sample container to measure the concentration of organic vapours released from the sample after 10 minutes. Measured organic vapour concentrations are profiled on the test hole logs in site specific Appendices.

**Groundwater**

At Mendenhall River, three 50 mm diameter PVC monitoring wells were installed in the test holes. The location of the wells was selected to monitor groundwater quality downgradient from the former retail fuel outlet. Two 25 mm diameter PVC monitoring wells were installed in locations not accessible by the drill rig. A 50 mm diameter hand auger was used to install the 25 mm diameter wells.

All other test holes were backfilled upon completion and a one metre section of bentonite pieces (Enviroplug) placed at the top of the backfilled hole.

### 2.1.3 Field Schedule

The field investigation was carried out over a seven day period by a two person field team, consisting of Rudy Schmidtke and Natalie Plato, of UMA. Two DIAND employees assisted for the duration of the field investigations. The following provides a brief outline of the activities carried out.

**September 15, 1997**

Natalie Plato and Rudy Schmidtke met briefly with DIAND personnel in Whitehorse. The team then travelled to each site for a brief initial reconnaissance to identify primary areas of concern, review truck mounted drill accessibility and to estimate the time required for the field investigation.

**September 16, 1997**

The field investigation of the Takhini River Site was carried out. The following activities were performed:

- volumes and types of site debris were confirmed;
- dimensions and construction materials of the building were catalogued;
- two samples of building materials were collected;
- four test holes were hand-augered to investigate the extent of buried debris; and
- a detailed elevation and grid survey of the buried debris area adjacent to the river was conducted;

**September 17 to 21, 1997**

The site investigations at the Stony Creek and Mendenhall River sites were carried out over the five day period. At Stony Creek, including the former Canol Pump Station site, the following activities were completed.

- three holes were drilled to a depth of 7.6 m, and field screening was performed using the PID in each of the test holes;

- ten augered test holes were advanced at select locations to allow collection of soil samples, and field screening, using the PID, was performed in each of the test holes;
- two water samples, three sediment samples and one soil sample were collected from the slough area;
- volumes and types of site debris were confirmed; and
- twelve soil samples were collected to delineate stained areas.

At the Mendenhall River site, the following activities were carried out:

- eight holes were drilled to a depth ranging from 7.6 m to 15. 2 metres; and field screening, using the PID, was performed on samples collected from each of the test holes;
- monitoring wells were installed in three of the drill holes;
- two small diameter monitoring wells were installed in hand augered test holes in areas not accessible by the drill rig;
- all drill hole locations were surveyed to an arbitrary reference point;
- groundwater samples were collected from the five wells;
- water levels were recorded at all five wells; and
- the volumes and types of site debris were confirmed.

Water levels in the five wells were recorded daily until September 21. Subsequent monitoring of water levels was completed by DIAND personnel.

## 2.2 ENVIRONMENTAL CRITERIA

The selection of environmental criteria for the assessment of the contaminants at the sites incorporates two principles:

- Absolute or Criteria Based: where numerical values or limits are compared with measured concentrations from field samples.
- Risk Management: where the focus is on identifying the potential for the direct or indirect movement of a contaminant, and the impact that this movement may produce.

Within most regulatory jurisdictions, existing standards and guidelines are subject to interpretation, and remediation criteria are primarily used as a screening tool. Cleanup requirements, are therefore, based on site-specific conditions.

For the purposes of this project, the assessment of risk is based initially on the confirmation of the presence of contaminated media, using the CCME Residential/ Parkland (R/P) Remediation Criteria. The Residential/Parkland (R/P) criteria were selected based on the current land use at the sites under investigation. Parkland encompasses all uses of land in which the primary activity is recreation. The risks associated with concentrations below these criteria would be assumed to be minimal, unless a highly sensitive biotic element is present.

CCME Remediation Criteria for Water are divided into four usage categories - freshwater aquatic life, irrigation, livestock watering, and drinking water. For surface waters at these sites, remediation criteria for drinking water standards may be considered relevant where there is some reasonable expectation that the water may be used for drinking. Aquatic life criteria would be relevant if groundwater surfaced and organisms were exposed in a manner such that contaminant concentrations were not significantly reduced. The mobility of many organic and inorganic compounds is attenuated by soils during percolation to the groundwater table.

The CCME criteria do not address all chemicals, particularly some of the polycyclic aromatic hydrocarbons and organic contaminants that are analyzed as part of the Volatile Organic Compounds (VOC) suite. Appropriate criteria equivalent to CCME R/P have been adopted by various provinces, including B.C., Ontario and Alberta. There are also no CCME criteria for Total Petroleum Hydrocarbons (TPH) or Total Extractable Hydrocarbons (TEH) in soil. Yukon Territorial Guidelines have been used to evaluate any hydrocarbon contamination. TPH criteria have been developed to avoid contamination of groundwater resources, and are used as a guideline for evaluating the potential for the more toxic components of TPH - VOC and PAH.

Table 2.2 outlines the parameters and the applicable remediation criteria. Following in Tables 2.3 and 2.4, specific criteria are presented.

## 2.3 LABORATORY ANALYSES

Analytical reports for the submitted samples are provided in Appendix A. Laboratory analyses were conducted by EnviroTest Laboratories in Edmonton, Alberta. The parameters analyzed in soil and water included inorganic elements, volatile organic compounds, total purgeable hydrocarbons, total extractable hydrocarbons and polycyclic aromatic hydrocarbons.

**Volatile Organic Compounds (VOC)**

These compounds include, benzene, toluene, ethylbenzene and xylene (BTEX). These parameters are typically found in gasoline and industrial solvents, and are targeted due to their known carcinogenic properties.

**Total Purgeable Hydrocarbons (TPH)**

TPH is usually represented by $C_5$ to $C_{10}$ carbon atoms.

**Total Extractable Hydrocarbons (TEH)**

TEH concentrations correspond to hydrocarbon compounds composed of $C_{10}$ to $C_{30}$ carbon atoms. Fuel oils, including diesel, are represented by TEH concentrations.

**Polycyclic Aromatic Hydrocarbons (PAHs)**

The following compounds were included in the PAH analysis: naphthalene, acenapthylene, acenapthene, fluorene, phenanthrene/anthracene, benzo(a)pyrene fluoranthene, pyrene, B(a)A/chrysene/B(a)anthracene, benzo(b,j,k)fluoranthene, indeno(1,2,3-cd)pyrene 3-methylcholanthrene, 7,12-dimethylbenz(a)anthracene, dibenzo(ah)anthracene, benzo(ghi)perylene and dibenz(ah,ai,aj)pyrene.

## Polychlorinated Biphenyls (PCBs)

PCBs consist of a class of 209 compounds which were commonly used in transformer fluids, such as lubricants, or as paint additives until the late 1970s. The method of analysis used reported results in terms of Aroclor equivalence. Aroclors were commercially available PCB formulations in North America.

## Inorganic Elements

Waste disposal sites commonly contain metal debris, paint and other domestic and industrial wastes. Metals can be leached from the parent material and introduced into the environment. The analysis of metals in soils included the following inorganic elements: silver, barium, beryllium, cadmium, cobalt, chromium, copper, molybdenum, nickel, lead, tin, strontium, thallium, vanadium and zinc. The inorganic analysis for water included the aforementioned elements as well as some aluminum, boron, calcium, iron, potassium, manganese, magnesium, sodium, phosphorus, silicon and titanium.

**TABLE 2.2**
**SUMMARY OF REMEDIATION/ASSESSMENT CRITERIA**
**PRELIMINARY ENVIRONMENTAL ASSESSMENT - DIAND YUKON**

| Constituents | Criteria |
|---|---|
| SOIL | |
| • Inorganic Elements | CCME Residential/Parkland Remediation |
| • Total Extractable Hydrocarbons (TEH) | Yukon - Residential/Parkland Remediation |
| • Total Volatile Hydrocarbons (TVH) | Yukon - All Sites |
| • BTEX[1] | CCME Residential/Parkland Remediation |
| • Polycyclic Aromatic Hydrocarbons (PAH) | CCME Residential/Parkland Remediation<br>BC Ministry of Environment - Level B Remediation |
| WATER | |
| • Inorganic Elements | CCME Freshwater Aquatic Life<br>CCME Drinking Water |
| • TEH | Ontario Ministry of Environment and Energy |
| • TVH | N/A |
| • BTEX | CCME Freshwater Aquatic Life<br>CCME Drinking Water |
| • PAH | BC Ministry of Environment |

[1] Benzene, Toluene, Ethylbenzene, Xylene.

**TABLE 2.3**
**SOIL REMEDIATION CRITERIA**
**COMPARATIVE ENVIRONMENTAL CRITERIA**

| Parameters | CCME R/P[1] | BCMOE[2] | YUKON[3] |
|---|---|---|---|
| **Inorganic Elements** | | | |
| Silver | 20 | | |
| Barium | 4 | | |
| Beryllium | | | |
| Cadmium | 5 | | |
| Cobalt | 50 | | |
| Chromium | 250 | | |
| Copper | 100 | | |
| Molybdenum | 10 | | |
| Nickel | 150 | | |
| Lead | 500 | | |
| Tin | 50 | | |
| Strontium | | | |
| Thallium | | | |
| Vanadium | 200 | | |
| Zinc | 500 | | |
| **PAHs** | | | |
| Naphthalene | 5 | | |
| Acenapthene | | 10 | |
| Acenaphthylene | | 10 | |
| Fluorene | | 10 | |
| Phenanthrene | 5 | | |
| Anthracene | 5 | | |
| Fluoranthene | | 10 | |
| Pyrene | 10 | | |
| B(a)A/Chrysene/B(c)P | | | |
| 7,12-Dimethylbenz(a)anthracene | | | |

All concentrations in mg/kg.

1 CCME R/P - Canadian Council of Ministers of Environment Residential/Parkland (Remediation).

2 BC MOE - BC Ministry of Environment - Level B (Remediation).

3 Yukon - Yukon Territorial Guidelines.

**TABLE 2.3**
**SOIL REMEDIATION CRITERIA**
**COMPARATIVE ENVIRONMENTAL CRITERIA**

| Parameters | CCME R/P[1] | BCMOE[2] | YUKON[3] |
|---|---|---|---|
| PAH's (Continued) | | | |
| Benzo(b,j,k)fluoranthene | 1 | | |
| Benzo(a)pyrene | 1 | | |
| 3-Methylcholanthrene | | 1 | |
| Indeno(1,2,3-cd)pyrene | 1 | | |
| Dibenzo(a,h)anthracene | 1 | | |
| Benzo(ghi)perylene | | 1 | |
| Dibenz(ah,al,aj)pyrene | | 1 | |
| **PCBs (all Aroclors)** | 5 | | |
| **Organo-chlorine Pesticides** | | 2* | |
| **Hydrocarbons** | | | |
| BTEX | | | |
| Benzene | 0.5 | 0.24 | |
| Toluene | 3 | 2.1 | |
| Ethylbenzene | 5 | 0.28 | |
| Xylenes | 5 | 25 | |
| Total Volatiles | | | 200 |
| TEH | | | 1,000 |

All concentrations in mg/kg.
[1] CCME R/P - Canadian Council of Ministers of Environment Residential/Parkland (Remediation).
[2] BC MOE - BC Ministry of Environment - Level B (Remediation).
[3] Yukon - Yukon Territorial Guidelines.

**TABLE 2.4**
**WATER REMEDIATION CRITERIA**
**COMPARATIVE ENVIRONMENTAL CRITERIA**

| Parameters | CCME F/A[1] | CCME DW[2] | BCMOE[3] | MOEE[4] |
|---|---|---|---|---|
| **Inorganic Elements** | | | | |
| Silver | 0.1 | -- | | 1.2 |
| Aluminum | 5-100 | -- | | |
| Barium | -- | 1,000 | 1,000 | 1,000 |
| Beryllium | -- | -- | 5.3 | 4 |
| Boron | -- | 5,000 | 5,000 | 5,000 |
| Calcium | | | | |
| Cadmium | 0.2-1.8 | 5 | | 5 |
| Cobalt | -- | -- | 50 | 100 |
| Chromium | 2-20 | 50 | 2 | 50 |
| Copper | 2-4 | ≤1,000 | 2-8 | 23 |
| Iron | 300 | ≤300 | | |
| Potassium | | | | |
| Magnesium | | | | |
| Manganese | -- | ≤50 | 100 | |
| Molybdenum | -- | -- | 1,000 | 7,300 |
| Sodium | | | | 200,000 |
| Nickel | 25-150 | -- | | 100 |
| Lead | 1-7 | 10 | 3-11 | 10 |
| Phosphorous | | | | |
| Silicon | | | | |
| Tin | -- | -- | | |
| Strontium | | | | |
| Titanium | | | | |
| Thallium | -- | -- | | 2 |
| Vanadium | -- | -- | | 200 |
| Zinc | 30 | ≤5,000 | | 1,100 |

All concentrations in ug/L, unless otherwise noted.

1 CCME F/A = Canadian Council of Ministers of Environment - Fresh Water Aquatic Life.
2 CCME DW = CCME Drinking Water Guidelines.
3 BCMOE = BC Ministry of Environment Aquatic Life.
4 MOEE = Ontario Ministry of Environment and Energy - Groundwater Criteria for Residential/Parkland Land Use for a Potable Groundwater Condition.

**TABLE 2.4**
**WATER REMEDIATION CRITERIA**
**COMPARATIVE ENVIRONMENTAL CRITERIA**

| Parameters | CCME F/A[1] | CCME DW[2] | BCMOE[3] | MOEE[4] |
|---|---|---|---|---|
| **PAHs** | | | | |
| Naphthalene | | | 1 | 21 |
| Acenapthene | | | 6 | 20 |
| Acenaphthylene | | | | 310 |
| Fluorene | | | 12 | 280 |
| Phenanthrene | | | 0.3 | 63 |
| Anthracene | | | 0.1 | 12 |
| Fluoranthene | | | 0.2 | 130 |
| Pyrene | | | 0.02 | 0.2 |
| B(a)A/Chrysene/B(c)P | | | | |
| 7,12-Dimethylbenz(a)anthracene | | | | |
| Benzo(b,j,k)fluoranthene | | | | 0.2 |
| Benzo(a)pyrene | | 0.01 | 0.01 | 0.01 |
| 3-Methylcholanthrene | | | | |
| Indeno(1,2,3-cd)pyrene | | | | 0.2 |
| Dibenzo(a,h)anthracene | | | | 0.2 |
| Benzo(ghi)perylene | | | | 0.2 |
| Dibenz(ah,al,aj)pyrene | | | | |
| **PCBs (all Aroclors)** | 1 ng/L | | 0.0001 | 0.2 |
| **Hydrocarbons** | | | | |
| Benzene | 300 | 5 | | 5 |
| Toluene | 300 | ≤24 | | 24 |
| Ethylbenzene | 700 | ≤2.4 | | 2.4 |
| Xylenes | | ≤300 | | 300 |
| Petroleum Hydrocarbons (gas/diesel) | | | | 1,000 |
| Petroleum Hydrocarbons (heavy oils) | | | | 1,000 |

All concentrations in ug/L, unless otherwise noted.

1 CCME F/A = Canadian Council of Ministers of Environment - Fresh Water Aquatic Life.
2 CCME DW = CCME Drinking Water Guidelines.
3 BCMOE = BC Ministry of Environment Aquatic Life.
4 MOEE = Ontario Ministry of Environment and Energy - Groundwater Criteria for Residential/Parkland Land Use for a Potable Groundwater Condition.

# 3.0 TAKHINI RIVER

In 1996, UMA carried out a preliminary environmental investigation of the Takhini River Site. This site is a former military maintenance camp and is located at Mile 946.4 of the Alaska Highway, approximately 45 km west of Whitehorse, at an elevation of 670 metres above sea level. The former camp was situated south of the Alaska Highway and west of Takhini River. An overall site plan is provided in Drawing 3-1. At the time of the 1996 investigation, one building remained in the main camp area.

Based on the analytical results of the soil and water samples collected at this site in 1996, the Takhini River site at Mile 946.4 is considered to pose insignificant environmental risk. Given the use of this site as a campground, moderate public safety risk is associated with the presence of debris in and around the river. The debris in the riverbank will continue to be eroded during periods of high water flow, exposing additional debris.

The presence of the partially damaged building on site also poses a moderate public safety risk. The building paint was found to contain low concentrations of PCBs as well as high concentrations of several metals. Although no specific human health risks are associated with the paint (metals and PCBs in their current state are relatively immobile), improper disposal or burning of these materials could pose some health risks.

As related to the above, the following recommendations were made with respect to the cleanup of this site:

- remove and dispose of the building;
- excavate and dispose of debris adjacent to the river; and
- collect and dispose of site debris in the area.

In 1997, DIAND retained UMA to carry out additional work related to developing specific cleanup requirements for this site. This section of the report summarizes the results of the 1997 site investigation activities, and provides recommendations for remediation.

## 3.1 SUMMARY OF THE 1997 SITE INVESTIGATION ACTIVITIES

### 3.1.1 Field Investigation

Table 3.1 outlines the activities carried out during the 1997 investigation at Takhini River.

**TABLE 3.1**

| Objective | Site Investigation Activities |
|---|---|
| Recommendations for the disposal of building materials, including those identified with PCB contaminated paint, and associated costs. | • Detailed dimensions and construction materials of building.<br>• Collected two samples of building materials:<br>- one exterior siding tile sample was analysed for asbestos; and<br>- one paint sample from the ceiling was analyzed for PCBs. |
| Preparation of outline specifications for the proposed sitework. | • Carried out an elevation and grid survey. Estimated volume of material to be removed from the riverbank.<br>• Confirmed volumes and types of debris to be removed. |

Specific site information, including test hole logs and photographs, is in Appendix B.

### 3.1.2 Results

**Abandoned Building**

The building that remains on the Takhini River site is a 2 X 4 wood frame building with two rooms. It appears that the building was mainly used as a washroom/shower facility. Drawing 3-1 shows the location of the building at the time of the 1997 investigation. It is 6 m high at the roof peak. The building is in very poor structural condition primarily due to suspected scavenging of building components. A list of major building components that remain follows:

1. The exterior siding consists of 0.3 X 0.6 m green/brown speckled tile (Photograph 01, site specific Appendix). The siding tile has a 25 mm overlap. A sample was collected and submitted for asbestos analysis. The siding tile is attached to 0.25 m wide wood planks. Photographs 02 and 03 show the damage that has occurred on the south and west walls.
2. Two layers of 12 mm thick drywall are on the interior walls to a height of 2.4 m. In one of the rooms, grey asbestos board (approximately 60 $m^2$) is above the drywall and covers the ceiling (Photograph 04). It appears that one layer of 12 mm thick plywood is on the ceiling in the other room. The white paint on the plywood ceiling (approximately 30 $m^2$) is peeling. A sample of the peeling paint was collected and submitted to the laboratory for analysis.
3. Green asphalt shingles (approximately 150 $m^2$) remain on half of the roof (Photograph 03). The other half of the roof has been removed.
4. Window frames and fascia board are painted green. This paint was sampled in 1996 and was found to contain PCBs and elevated metal concentrations.

The green/brown exterior tile was found to contain 10% chrysotile. The white paint from the ceiling was below the analytical detection limit for PCB (<7 ppm) but contained detectable levels of lead (69 ppm). An explanation of the PCB detection limit is provided in Appendix C. The green paint sample collected from the window frame and fascia board in the 1996 study, contained 5.8 ppm PCBs as well as elevated levels of lead (66 000 ppm), barium (1 610 ppm), zinc (19 700 ppm) and other metals (UMA 1996). It is estimated that approximately 50 $m^2$ of exterior siding tile, 60 $m^2$ of grey asbestos board, and 2 to 3 $m^3$ of PCB contaminated painted building components exist on the building. The volume of non-hazardous building components is estimated at 20 $m^3$.

**Surface Debris**

Scattered surface debris is found around the site. The debris consists primarily of scrap metal, cans, wood and roofing material. Photographs 05 to 08, in the site specific Appendix, show typical surface debris areas and Photographs 09 and 10 show remnant concrete foundations at the Takhini River site. It is estimated that approximately 90 $m^3$ of surface debris is present on the site.

**Buried Debris**

Four shallow hand augered test holes were drilled in the area of exposed debris found in the riverbank to investigate the extent of buried debris. Drawing 3-1 shows the location of the test holes. Test hole 97TR-1 encountered fill with some minor metal debris to a depth of 0.65 metres. The fill is comprised mainly of sand with occasional pebbles. It is dry and grey brown in colour. Test holes 97TR-2, 97TR-3, and 97TR-4 encountered silt overlying sand. Test hole logs are included in the site specific Appendix. The silt is homogeneous, dry, grey brown and ranged in thickness from 0.1 to 0.3 metres. An ash layer approximately 2 centimetres thick occurred at a depth of about 0.05 metres below ground surface within the silt deposit. The sand underlying the silt is medium grained, uniform, dry, contains occasional pebbles and is brown in colour. Test hole sloughing in the sand was common.

Drawing 3-2 shows the limit of buried debris based on visual examination of exposed debris in the riverbank and the shallow test hole drilling program. The buried debris consists mainly of scrap metal. Topographic surveys were completed in the buried debris area to estimate the volume of material. Using the debris limit identified on Drawing 3-2 and a bottom relative elevation of the riverbank of 97.0 metres, it is estimated that 1,000 $m^3$ of soil and debris exists adjacent to the Takhini River. This estimate is based on an excavation depth of 3 m and a surface area of 330 $m^2$. Erosion of the bank by the Takhini River occurs during high water levels. No bank erosion was taking place at the time of this investigation.

## 3.2 RECOMMENDED CLEANUP REQUIREMENTS

The recommended cleanup requirements for the Takhini River site are based on mitigation of public safety risks. In summary, the cleanup requirements include:

- dismantling of the building into components and disposal:
  - asbestos materials (green/brown siding tile, grey wallboard);
  - green painted (window frame and fascia board);
  - white painted plywood and drywall;
  - all other materials;

- excavation of debris from the riverbank:
  - sorting of excavated materials;
  - confirmation of non-hazardous nature of debris;
  - confirmatory testing of excavated soil; and
- collection and disposal of scattered debris.

### 3.2.1 Disposal Options

The asbestos containing materials at the Takhini River site are considered non-friable, and can generally be removed intact with proper precautions, or in pieces or sections, without producing crumbled or powdered wastes. Asbestos materials must be double bagged/wrapped in accordance with Yukon Occupational Health and Safety Guidelines for handling and disposal. Asbestos is considered a hazardous waste under the Transportation of Dangerous Goods Act and must be transported to a landfill site licensed to accept asbestos waste.

The green and white painted materials from the building contain low levels of PCBs. Due to the concern regarding PCBs, it is recommended that this material be shipped to the south for disposal. Laidlaw's facility at Ryley, Alberta, is licensed to accept contaminated materials. The green and white painted materials should be wrapped in polyethylene and containerized for transport to the south. The acceptance cost at the Laidlaw facility is approximately $125 per cubic metre of waste material.

During excavation of material from the riverbank, debris should be sorted from the soil matrix. Suspected hazardous materials (such as asbestos, any barrels containing product) should be tested and disposed of accordingly. Any stained soils should be tested to characterize contamination. Following excavation to in situ material, select samples should be obtained from the in situ material for analyses to confirm that no contamination is present.

The remaining non-hazardous, uncontaminated materials are to be disposed of in an appropriate landfill site.

## 3.3 OUTLINE SPECIFICATIONS

This section of the report presents an outline of the requirements of specifications for the cleanup of this site. This outline is provided as a guideline only. As indicated in the previous section, the primary work components include:

- demolition;
- asbestos removal; and
- debris removal.

### 3.3.1 Demolition

This section of the Specifications would define the requirements for the demolition, removal and disposal of the building at the Takhini River site. Related work would include asbestos removal.

The following subsections should be included under Demolition:

- Requirement for Health and Safety Precautions
  - The existing building is in poor structural condition. Appropriate safety equipment and supervised dismantling of the building is required.
- Fires
  - Burning of unpainted wood waste materials is subject to approval under a Land Use Permit. Supervision and attendance during burning would be required.
- Products Required
  - This section would describe the minimum standard for containers required for transport of the PCB contaminated painted materials.
- Measurement for Payment
  - Details identifying what items are included in the price for demolition are described in this section.
  - The recommended payment method is lump sum for the overall demolition, with specific unit prices as required for disposal of the various types of demolition waste.

- Execution
  - Clearly identify that asbestos materials, and green painted materials are to be removed and disposed of separately from the remainder of the building.
  - Identify the disposal location for all types of material.

### 3.3.2 Asbestos Abatement

This section would describe the requirement for the removal, encapsulation, transport and disposal of asbestos containing materials. The following subsections should be included under Asbestos Abatement:

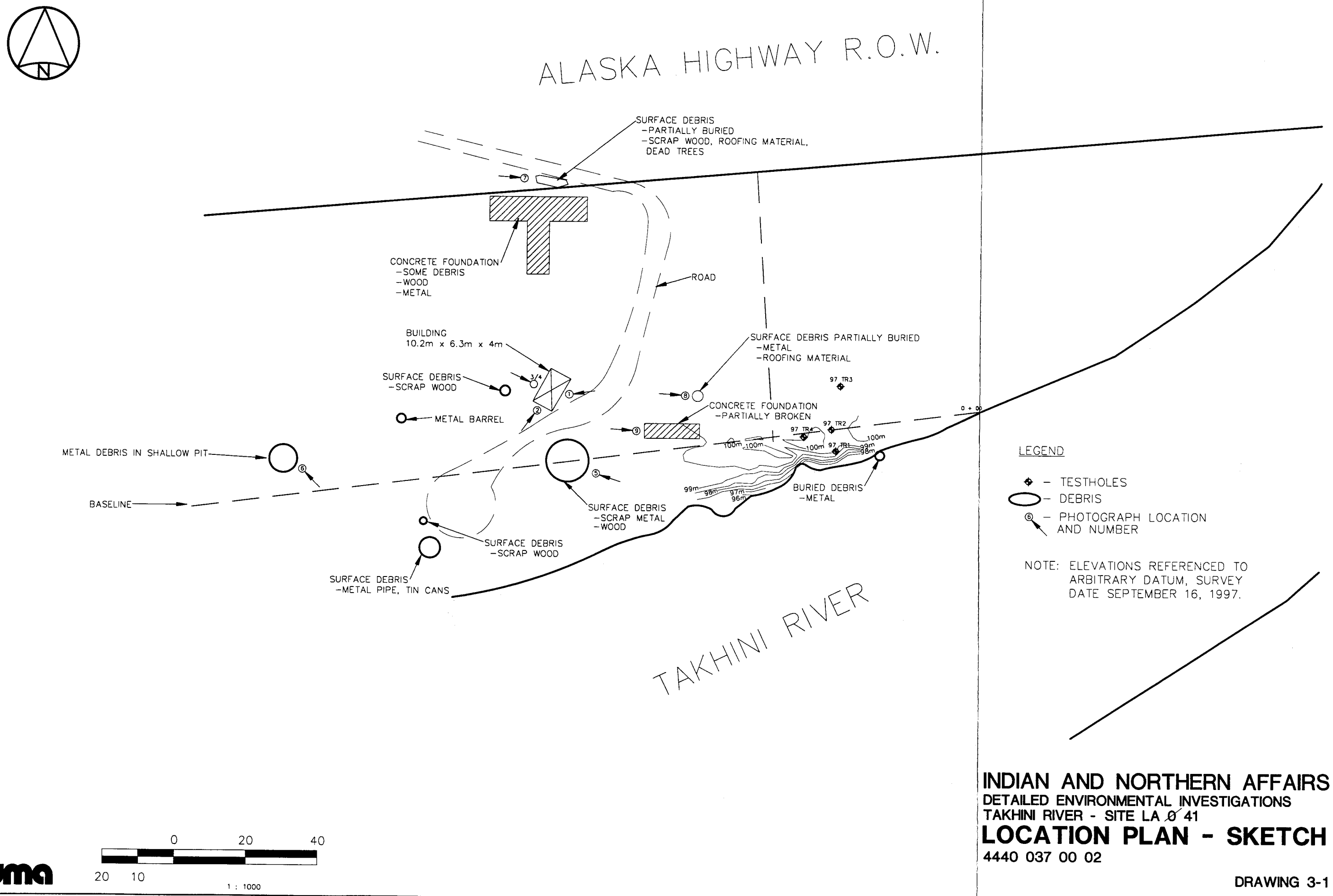
- Definitions
  - All pertinent definitions relating to asbestos abatement would be defined in this section. These would include, type of asbestos, personal protective equipment, and other terms specific to asbestos abatement.
- Regulatory Requirements
  - Pertinent regulatory requirements include the Yukon Territorial Government Occupational Health and Safety Regulations Handbook, Section 33 to 41 and the Transportation of Dangerous Goods Act.
- Work Methodology Requirements and Submittals
  - Due to the hazardous nature of asbestos containing materials, the Contractor should be required to submit a Work Methodology Plan that demonstrates his knowledge and capability to work with asbestos.
- Instruction and Training
  - A requirement for the Contractor to demonstrate that the supervisor and workers are trained to work with asbestos containing materials.
- Personnel Protection Requirements
  - The minimum personal protection requirements are outlined in this section.
- Measurement for Payment
  - Details identifying what items are included in the price for asbestos abatement are described in this section.
  - The recommended payment option for asbestos removal is lump sum.

- Products
  - An outline of the minimum materials required for the work is outlined, e.g. waste receptacles; 6 mil polyethylene, sprayer, etc.
- Execution
  - This section would identify the primary work components including:
    - location of asbestos materials;
    - requirements for decontamination, if needed;
    - disposal location for asbestos materials;
    - requirements for manifesting asbestos as hazardous waste; and
    - submittal of acceptance certificate from the landfill facility.

### 3.3.3 Debris Removal

This section would describe the requirement for the removal, sorting, handling and disposal of debris excavated from the riverbank as well as the debris scattered across the site. The following subsections should be included under Debris Removal:

- Definitions of Debris
  - All pertinent definitions relating to debris would be provided in this section. These would include a definition of hazardous material.
- Measurement for Payment
  - Details identifying what items are included in the price for debris removal described in this section. It is suggested that the excavation of the material from the riverbank be treated separately from that of the surface debris scattered around the site.
- Execution
  - This section would identify the primary work components including:
    - location of debris areas;
    - requirements for sorting of excavated materials;
    - requirements for testing of suspected contaminated soil;
    - disposal location for non-hazardous debris;
    - regrading of the riverbank following excavation; and
    - submittal of acceptance certificate from the landfill facility.




LEGEND

◆ – TESTHOLES
⬭ – DEBRIS
⑥ – PHOTOGRAPH LOCATION AND NUMBER

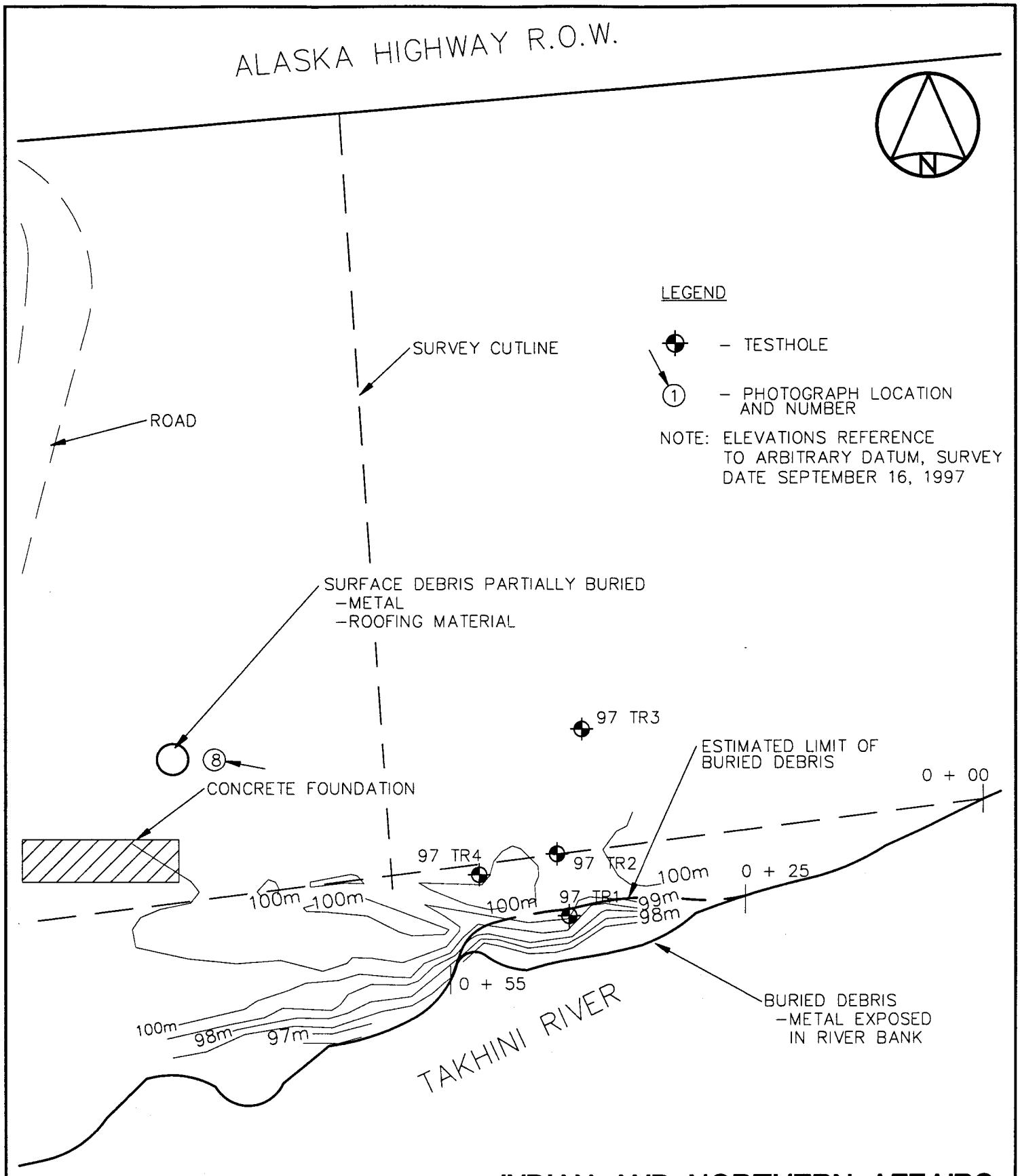
NOTE: ELEVATIONS REFERENCED TO ARBITRARY DATUM, SURVEY DATE SEPTEMBER 16, 1997.

0 20 40
20 10
1 : 1000

uma

**INDIAN AND NORTHERN AFFAIRS**
**DETAILED ENVIRONMENTAL INVESTIGATIONS**
**TAKHINI RIVER - SITE LA Ø 41**
# LOCATION PLAN - SKETCH
**4440 037 00 02**

**DRAWING 3-1**




# INDIAN AND NORTHERN AFFAIRS

**DETAILED ENVIRONMENTAL INVESTIGATIONS**
**TAKHINI RIVER - SITE LA Ø 41**

# BURIED DEBRIS - SKETCH

**4440 037 00 02**

uma

0 5 10
5 2.5
1 : 500

**DRAWING 3-2**

# 4.0 STONY CREEK

In 1996, UMA carried out a preliminary environmental investigation of the Stony Creek Site. Stony Creek is located approximately 62 km west of Whitehorse, on the north side of the Alaska Highway. The site contains three separate areas as shown on Drawing 4-1. These areas included the main camp, which is divided into the west and east sides of Stony Creek, both at approximately Mile 956. The third area is the former Canol Pump Station, at Mile 956.8.

Based on the analytical results of soil and water samples collected at this site in 1996, environmental risks attributed to this site were considered low. Soil stain areas at the east site at Mile 956, are localized with elevated concentrations of lead, zinc and TEH. Elevated concentrations of inorganic elements were measured in a water sample taken from a slough in the west area; however, it was recommended that confirmation of these results be carried out. Scattered surface debris, including asbestos containing materials were also identified in this area. At the former Canol Pump Station, at Mile 956.8, several PAH compounds were detected in one soil sample; however, no apparent source was ascertained.

As related to the above, the following recommendations were made with respect to additional investigation and cleanup of this site:

- Delineation testing of stained areas to confirm the extent and depth, and correspondingly the volume of affected soil.
- Collection and analyses of sediments in the slough to confirm the elevated concentrations of inorganic elements measured in the water.
- Resampling of the slough water to verify results reported in 1996.
- Collection and disposal of surface debris scattered around the site, with specific attention paid to the proper handling and disposal of asbestos containing materials.
- Although PAH concentrations in one sample from the former Canol Pump Station were below remediation criteria, it was recommended that further investigation be conducted to evaluate the extent and magnitude of potential hydrocarbon and PAH contamination.

In 1997, DIAND retained UMA to carry out the additional work related to developing specific cleanup requirements for this site. This section of the report includes the following:

- a summary of the site investigation activities;
- presentation of results and comparison to appropriate guidelines;
- recommended cleanup requirements for contaminated soil and debris:
  - estimated volumes
  - disposal options
- an outline of the specification requirements.

## 4.1 SUMMARY OF THE 1997 SITE INVESTIGATION ACTIVITIES

### 4.1.1 Field Investigation

Table 4.1 outlines the activities carried out during the 1997 investigation of Stony Creek.

**TABLE 4.1**
**SUMMARY OF FIELD INVESTIGATION ACTIVITIES AT STONY CREEK**

| Objective | Field Investigation Activities |
|---|---|
| Delineation of known areas of PAH, metal and hydrocarbon contaminated soil. | • Shallow soil samples were collected, using a hand auger, to delineate the known PAH contaminated area.<br>• Field screening of collected soil samples was conducted with a photo ionization detector (PID) to determine the presence of organic vapours.<br>• Based on these results, nine soil samples were collected from these test pits, at varying depths, and six were submitted for laboratory analyses of PAH compounds.<br>• One sample was collected from debris on the pumphouse foundation and submitted for asbestos analysis.<br>• One water sample, one soil sample and three sediment samples were collected from the slough area to confirm the presence of elevated levels of inorganic elements.<br>• Shallow soil samples were collected, using a hand auger and drill rig, to delineate the known metal and hydrocarbon stained areas.<br>• Eight samples were collected and ten samples were submitted for laboratory analyses of metals and extractable hydrocarbons. |
| Estimate the volume of site debris and recommend corresponding disposal options. | • Volumes and types of debris to be removed were confirmed. |

Specific site information, including test hole logs and photographs, are in Appendix B.

### 4.1.2 Results

**Debris**

Drawing 4-1 identifies the location of the debris areas at the site. Debris generally consists of metal pipe, sheet and scrap metal, wood, shingles, one vehicle chassis, chain, empty 45 gallon drums, metal cans and (tiles) asbestos. The estimated volume of non-hazardous debris is 100 $m^3$ and 3 $m^3$ of asbestos bearing material. Photographs 11 to 14, in the site specific Appendix, show typical debris at the east and west sides of Stony Creek.

A sample of yellowish disintegrated fibrous material (97-CAN-ASB1) was collected from the concrete foundation at Mile 956.8, the Canol Pumphouse, for asbestos analysis. The sample was found to contain approximately 10% chrysotile asbestos. It is estimated that approximately 0.5 $m^3$ of asbestos bearing material is present at the former Canol Pumphouse.

**Contamination**

All analytical results are provided in Appendix A.

Three sediment samples (97-SC-S1, 97-SC-S2, and 97-SC-S3) were collected from the slough at Mile 956, to determine if aluminum, barium, manganese, phosphorus and zinc, that were detected from the slough water in 1996, were present in the sediment. One additional soil sample (97-SC-S4) was collected 10 m from the slough to determine local background conditions. All concentrations were below the CCME R/P remediation criteria. Sample locations are shown on Drawing 4-1.

One water sample (97-SC-W2), was collected from the standing water in the slough. This sample was submitted for analyses of inorganic elements. The concentration of manganese (62 ppm) was slightly elevated above CCME drinking water criteria (50 ppm) but below the BCMOE criteria (100 ppm). Concentrations of all other measured analytes were below criteria.

Four test holes (97-SC-S5 to S8) were drilled on the east side of Stony Creek. Test hole logs are included in the site specific Appendix. The soil on the east side of Stony Creek consists primarily of fill. The fill is comprised primarily of sand and gravel and contains numerous cobbles. It is dense, dry and brown in colour. Sand was encountered in test hole 97-SC-S8. The sand is medium grained, uniform, medium dense, shows signs of iron oxidation and is dry. Twelve soil samples, including one field duplicate, were collected from the stained areas on the east side of Stony Creek and ten samples were submitted for analyses of metals, heavy and light extractable hydrocarbons. Surface sample locations are shown on Drawing 4-1. Two samples, 97-SC-S5-0.5 (1,590 ppm) and 97-SC-S12-0.1 (16,240 ppm) exceed the Yukon Territorial Guidelines for total extractable hydrocarbons. All measured metal concentrations were below criteria. The volume of contaminated soil at this location is estimated to be approximately 30 $m^3$ and the approximate boundary is shown on Drawing 4-1. The stained area is assumed to delineate the lateral boundary of the hydrocarbon contamination and is estimated at 1 m depth.

Six test holes were hand augered in an area suspected of containing PAH affected soil at the former Canol Pump Station. The main soil type encountered was silt. The silt contains some sand and occasional pebbles. It is dense, dry and grey in colour. A thin organic layer, approximately 0.05 metres, consisting of peat and roots is found at the ground surface. No groundwater seepage was encountered in the test holes. Drawing 4-1 shows the location of the test holes. Test hole logs are in the site specific Appendix. Nine soil samples, including one field duplicate, were collected from the six test hole at the former Canol Pump Station. Six samples where submitted for analyses of PAHs. Very low levels of phananthrene, anthracene, fluoranthene, pyrene,B(a)A/Chrysene/B(c)P, benzo(b,j,k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, and benzo(ghi)perylene were detected in soil samples collected from test hole CAN5 at a depth of 0.3 and 1.2 metres below ground surface. Concentrations of these PAH compounds were well below both the CCME and BCMOE criteria.

## 4.2 RECOMMENDED CLEANUP REQUIREMENTS

Based on the 1996 and 1997 site investigation, two primary areas of concern were identified: localized areas of hydrocarbon contaminated soil and scattered surface debris, including asbestos.

The recommended cleanup requirements for the Stony Creek site are based on mitigation of public safety risks. Low environmental risk is associated with the localized areas of hydrocarbon contaminated soil; however, as the contamination in these stained areas exceeds Yukon criteria, cleanup recommendations are provided. In summary, the cleanup requirements include:

- excavation and disposal of hydrocarbon contaminated soils; and
- collection and disposal of scattered debris, including asbestos.

### 4.2.1 Disposal Options

**Soil**

It is estimated that 30 $m^3$ of hydrocarbon contaminated soil (extractable hydrocarbons) requires remediation. The Yukon Territory does not permit the landfilling of hydrocarbon contaminated soil (Brian Levia, Personal Communication). Therefore, remediation options considered include: implementation of a landfarming program; the soil be excavated, containerized and shipped to a southern disposal facility that accepts hydrocarbon contaminated soil; or covering in-place with granular fill.

Landfarming utilizes microbial, chemical and physical processes to volatilize, transform, immobilize and degrade hydrocarbons in a contained area. Landfarming is not considered appropriate due to the nature of the hydrocarbon contamination (heavy oils) identified at the site. If the contaminated soil is excavated, it would have to be containerized and shipped south for disposal at a licensed disposal facility. Laidlaw's facility at Ryley, Alberta would accept these waste materials. Alternatively, covering the contaminated soils in-place could be considered. The staining, or hydrocarbon contamination, is relatively localized, and non-mobile due to the heavy nature of the oil. Low environmental risk is associated with leaving the contaminated soil in-place. This latter option is subject to approval of the relevant regulatory authorities. For the purposes of this report, we have assumed off-site disposal.

**Asbestos**

The asbestos containing materials at the Stony Creek site are considered friable, producing crumbled or powdered wastes. It is estimated that approximately 3.5 $m^3$ of asbestos containing material is present at the Stony Creek Site. Asbestos materials must be double bagged/wrapped in accordance with Yukon Occupational Health and Safety Guidelines for handling and disposal. Asbestos is considered a hazardous waste under the Transportation of Dangerous Goods Act and must be transported to a landfill site licensed to accept asbestos waste.

**Debris**

It is estimated that 100 $m^3$ of non-hazardous debris is scattered around the sites at Mile 956 and Mile 956.8. All non-hazardous, uncontaminated materials are to be disposed of in an appropriate landfill site.

## 4.3 OUTLINE SPECIFICATIONS

This section of the report presents on outline of the requirements of specifications for the cleanup of this site. This outline is provided as a guideline only. As indicated in the previous section, the primary work components include:

- removal of contaminated soil;
- asbestos removal; and
- debris removal.

### 4.3.1 Contaminated Soil

This section would identify the requirements for the excavation, removal, and disposal of the hydrocarbon contaminated soils. The following subsections would be included under Contaminated Soil:

- Definitions
  - The definition of hydrocarbon contaminated soils, based on the Yukon Guidelines, would be provided.

- Work Methodology Plan
  - Due to the contaminated nature of the materials, the Contractor should be required to submit a Work Methodology Plan. This plan should address:
    - Method for excavating contaminated soil; cleaning equipment;
    - Identification of the off-site landfill to be used for the disposal of the hydrocarbon contaminated soil;
    - Description of the method and equipment to be used for the transport of the hydrocarbon contaminated soil to the off-site landfill facility (i.e. truck-box liners, containers);
    - Worker Health and Safety Requirements.
- Measurement for Payment
  - This section identifies how the Contractor is to be paid; either lump sum or unit price, and identify what components are to be included in the price. For example:
    - excavation;
    - tipping fees;
    - transportation;
    - truck box liners;
    - safety equipment;
    - backfilling of the excavated area if required.
- Execution
  - This section would identify the primary work components including:
    - the extent of excavation of the contaminated soil - areal extent and depth;
    - containers (if required), or truck box liners;
    - transportation requirements;
    - equipment cleaning;
    - disposal location;
    - submittal of acceptance certificate from the landfill facility; and
    - backfilling or reshaping the excavated area.

### 4.3.2 Asbestos Abatement

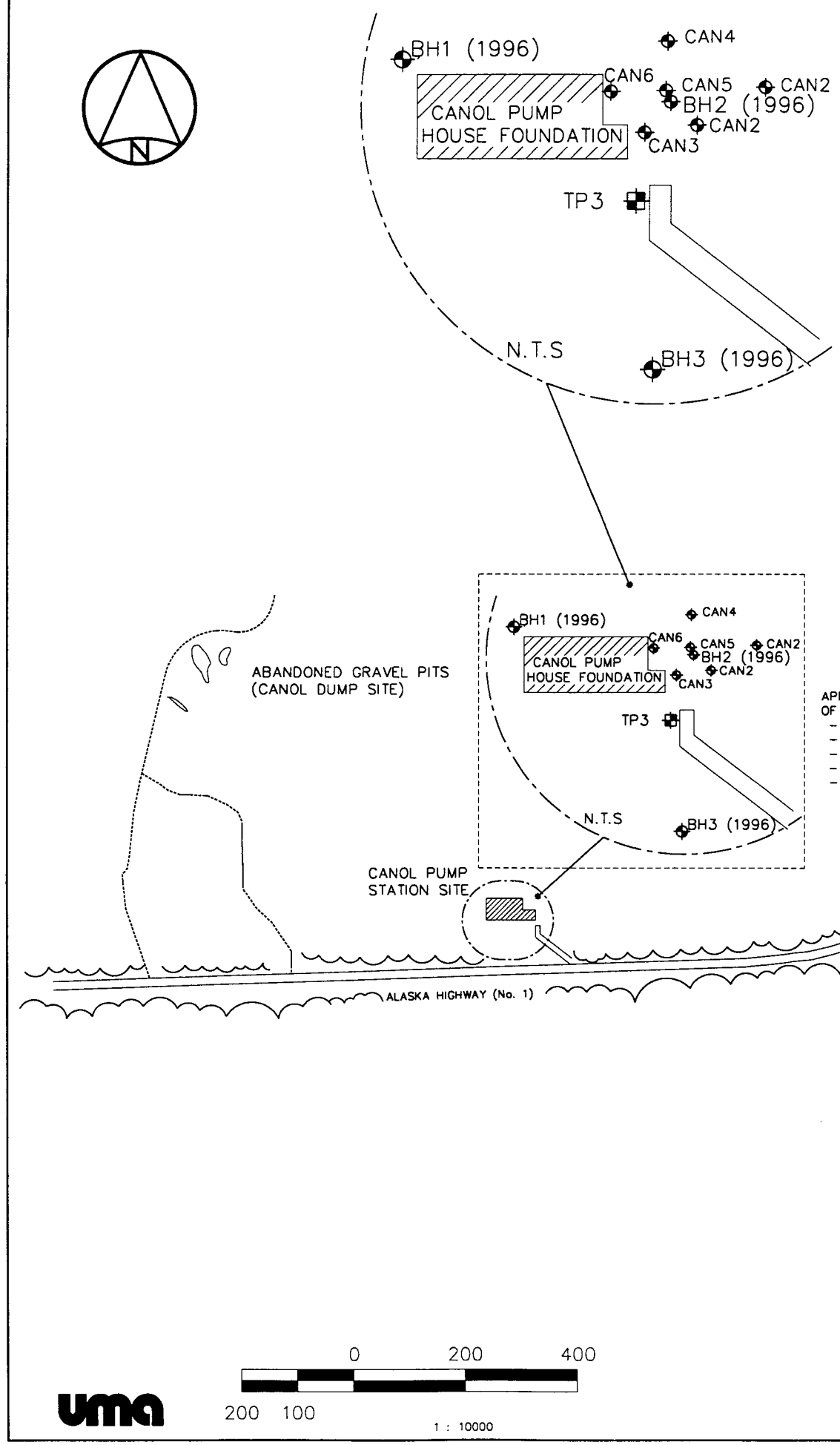
This section would describe the requirement for the removal, encapsulation, transport and disposal of asbestos containing materials. The following subsections should be included under Asbestos Abatement:

- Definitions
  - All pertinent definitions relating to asbestos abatement would be defined in this section. These would include, type of asbestos, personal protective equipment, and other terms specific to asbestos abatement.
- Regulatory Requirements
  - Pertinent regulatory requirements include the Yukon Territorial Government Occupational Health and Safety Regulations Handbook, Section 33 to 41 and the Transportation of Dangerous Goods Act.
- Work Methodology Requirements and Submittals
  - Due to the hazardous nature of asbestos containing materials, the Contractor should be required to submit a Work Methodology Plan that demonstrates his knowledge and capability to work with asbestos.
- Instruction and Training
  - A requirement for the Contractor to demonstrate that the supervisor and workers are trained to work with asbestos containing materials.
- Personnel Protection Requirements
  - The minimum personal protection requirements are outlined in this section.
- Measurement for Payment
  - Details identifying what items are included in the price for asbestos abatement are described in this section.
- Products
  - An outline of the minimum materials required for the work is outlined e.g. waste receptacles; 6 mil polyethylene, sprayer, etc.
- Execution
  - This section would identify the primary work components including:
    - location of asbestos materials;
    - requirements for decontamination, if needed;
    - disposal location for asbestos materials;
    - requirements for manifesting asbestos as hazardous waste; and
    - submittal of acceptance certificate at landfill facility.

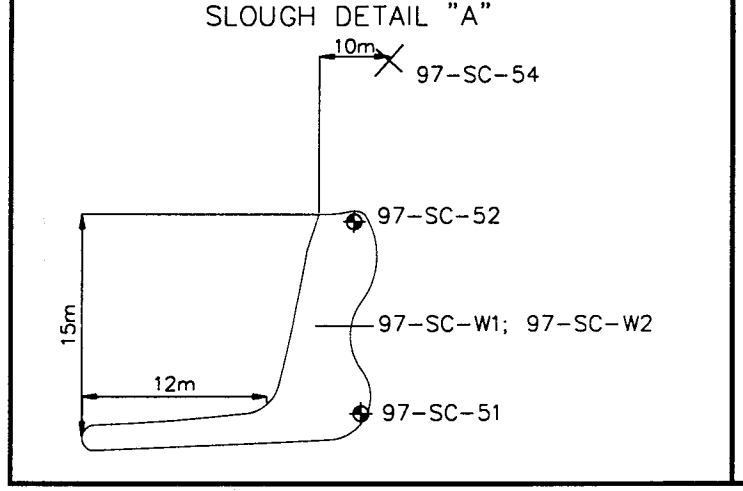
### 4.3.3 Debris Removal

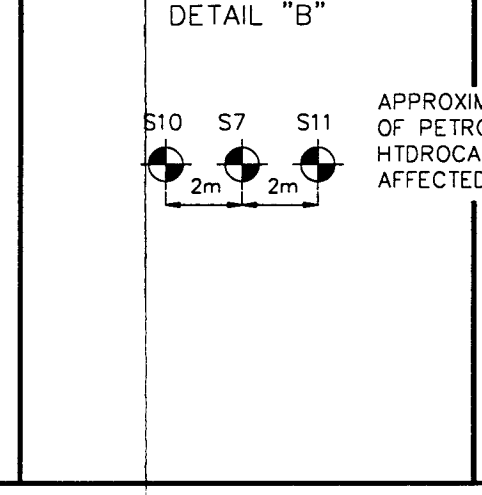
This section would describe the requirement for the removal, sorting, handling and disposal of the debris scattered across the site. The following subsections should be included under Debris Removal:

- Definitions of Debris
  - All pertinent definitions relating to debris would be provided in this section. These would include a definition of hazardous material.
- Measurement for Payment
  - Details identifying what items are included in the price for debris removal described in this section.
- Execution
  - This section would identify the primary work components including:
    - location of debris areas;
    - disposal location for non-hazardous debris; and
    - submittal of acceptance certificate at landfill facility.

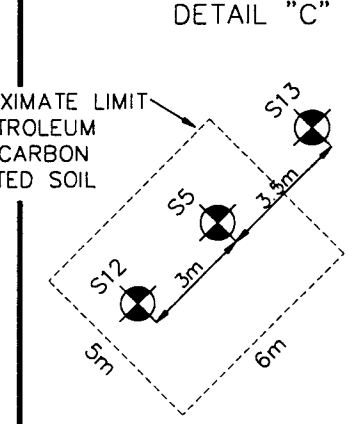



SEDIMENT SAMPLE LOCATION SKETCH
N.T.S.



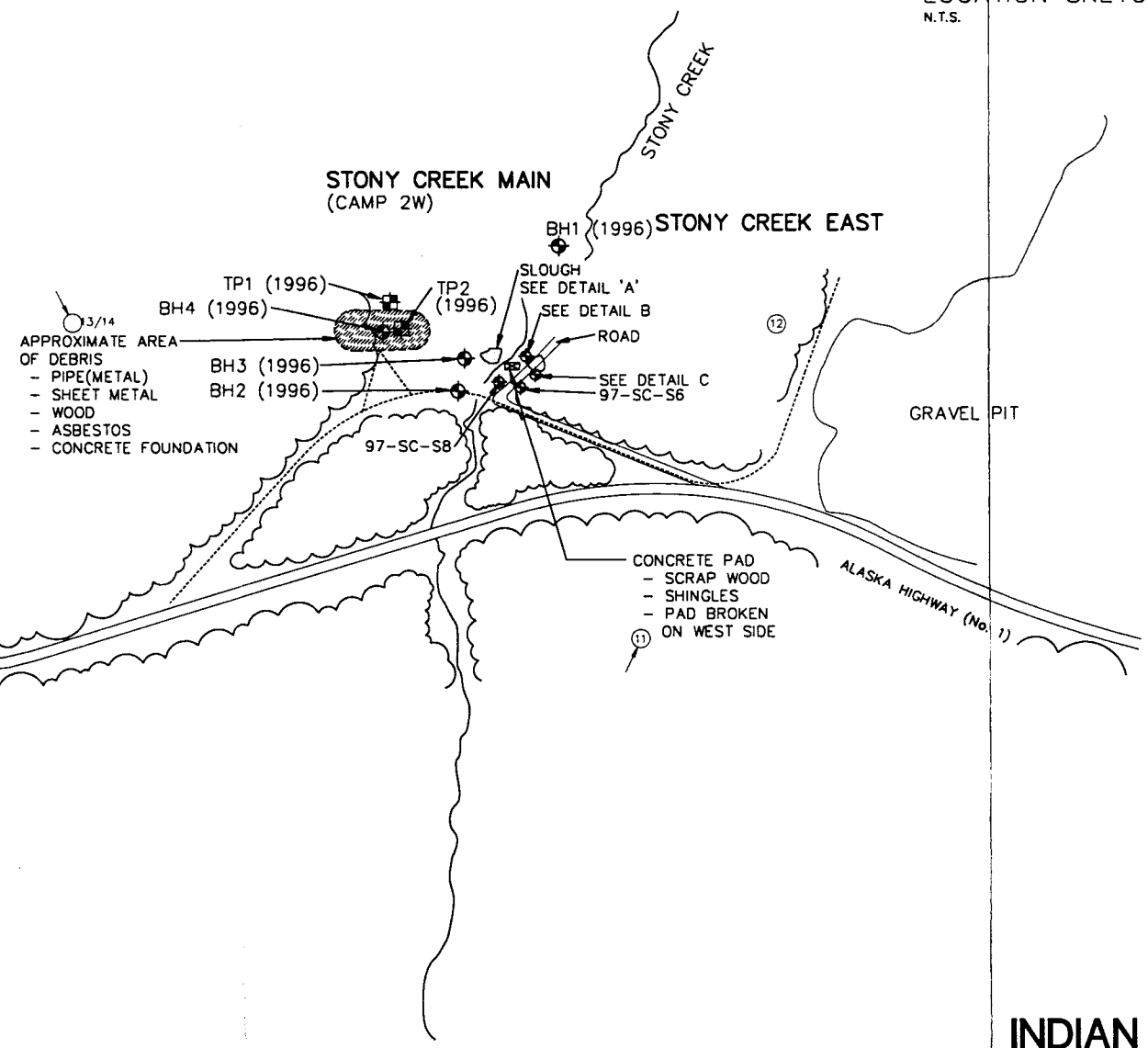




SURFACE SOIL SAMPLE
LOCATION SKETCH
N.T.S.




SURFACE SOIL SAMPLE
LOCATION SKETCH
N.T.S.




## LEGEND

- CAN5 — BORE HOLES
- TP5 — TEST PITS (1996)
- TRAILS
- EXISTING TREELINE
- EXISTING BUILDING\STRUCTURE
- ① — PHOTOGRAPH LOCATION AND NUMBER

NOTE: DATE OF INVESTIGATION
SEPTEMBER 17 TO 21, 1997.

0 200 400
200 100
1 : 10000

uma

# INDIAN AND NORTHERN AFFAIRS

DETAILED ENVIRONMENTAL INVESTIGATIONS
STONY CREEK - LA Ø 10

# LOCATION PLAN - SKETCH

4440 037 00 02

DRAWING 4-1

# 5.0 MENDENHALL RIVER

In 1996, UMA carried out a preliminary environmental investigation of the Mendenhall River Site. The Mendenhall River site was a former U.S. Military Maintenance Camp, located at Mile 968 of the Alaska Highway, approximately 80 kilometres west of Whitehorse. The site encompasses an area of about 5 hectares adjacent to the east side of Mendenhall River, south of the Alaska Highway. Records show that a private retail fuel outlet was operated in this area. Records also indicate that the Yukon Territorial Government operated a campground in the area adjacent to the river. Concrete building foundations were identifiable in the campground area. A clear area, adjacent to the highway, appeared to be the site of the former retail fuel outlet. An overall site plan is provided on Drawing 5-1.

Based on the 1996 site investigation, low to moderate public safety and environmental risks exist at the Mendenhall Site given that the site may be used as a campground and the presence of hydrocarbon contamination in the subsurface was identified. Scattered surface debris consisting of scrap metal and construction material are of public safety concern. Significant concentrations of hydrocarbon constituents were measured in soil samples collected from test pits around the former fuel retail outlet. Given that hydrocarbon impacted soil was found at 2 metres below ground surface in TP4, downward vertical movement of hydrocarbon constituents to the groundwater table is possible.

As related to the above, the following remedial actions and investigations were recommended:

- collection and disposal/recycling of scattered debris;
- completion of additional test pitting and test drilling to define the extent and magnitude of hydrocarbon in the soil;
- installation of up and downgradient monitoring wells from the impacted area to establish horizontal groundwater flow direction and gradients and to facilitate the sampling of groundwater; and
- installation of at least one monitoring well nest to determine vertical groundwater flow direction and gradient.

In 1997, DIAND retained UMA to carry out additional work related to obtaining additional information and, if required, to develop specific cleanup requirements for this site. This section of the report includes the following information:

- a summary of the site investigation activities;
- presentation of soil and water analytical results and comparison to appropriate guidelines;
- identification of contaminant migration, based on groundwater flow system;
- a qualitative assessment of environmental risk; and
- recommended cleanup requirements for contaminated soil and debris:
  - estimated volumes
  - disposal options.

## 5.1 SUMMARY OF THE 1997 SITE INVESTIGATION ACTIVITIES

### 5.1.1 Field Investigation

Table 5.1 outlines the field investigation activities carried out at Mendenhall River.

**TABLE 5.1**
**SUMMARY OF FIELD INVESTIGATION ACTIVITIES AT MENDENHALL RIVER**

| Objective | Program |
|---|---|
| Delineation of hydrocarbon contaminated soil and evaluation of potential migration of hydrocarbon contamination towards the Mendenhall River. | • Ten holes were drilled, to a maximum depth of 15 m.<br>• Field screening of collected soil samples was conducted with a photo ionization detector (PID) to determine the presence of organic vapours. Based on these results, thirteen soil samples were collected from these test holes, at varying depths, and ten samples were submitted for laboratory analyses of hydrocarbon compounds.<br>• Three groundwater monitoring wells were installed to facilitate the sampling of groundwater and to evaluate the horizontal movement of groundwater. Two drive point piezometers were installed adjacent to the riverbank.<br>• Five water samples were collected from the wells and submitted for analyses of hydrocarbon compounds. |
| Estimate the volume of site debris and recommend corresponding disposal options. | • Volumes and types of debris to be removed were confirmed. |

Specific site information, including test hole logs, photographs, water level and slug test data, are provided in Appendix B.

### 5.1.2 Results

**Debris**

No buildings remain at the former U.S. Military Camp. However, one building foundation remains on site. One dump area was observed on the east slope of the Mendenhall River valley. Debris included wood, scrap metal, small motor oil cans, other metal cans, an occasional 45 gallon barrel, as well as more recent domestic waste. The dump area extends out from the slope at an angle of 30° off horizontal for 12 m. One test hole was excavated to determine the horizontal extent of the dump area. Natural soil material was encountered, thus indicating that the buried debris does not extend into the slope. Photographs 15, 16 and 17 show the more significant debris areas at the Mendenhall River site. The location and extent of debris is shown on Drawing 5-1. The estimated volume of debris in all areas is 250 $m^3$.

The area of the former retail fuel outlet is clear, and no buildings remain, with the exception of the concrete pump island and light post. During the pre-investigation meeting with DIAND, it was noted that this area is titled land (Plan 41886, L.S. &A.C., Lot 16, Group 803) and therefore no intrusive investigations were undertaken on this parcel of land.

**Soil**

A total of ten test holes were drilled. One test hole was drilled to 15.2 m, three test holes were drilled to a depth of 12.2 m (MEN4, MEN5, MEN7), four test holes were drilled to a depth of 7.6 m (MEN1, MEN2, MEN3, MEN8). Two hand augered holes (MEN9, MEN10) were advanced to depths of 2.7 m and 2.4 metres respectively. No hydrocarbon odours were detected and no anomalies were detected with the PID. The soil stratigraphy at the test hole locations generally consisted of sand overlying native silt materials. The primary stratigraphic units encountered at the Mendenhall site are interbedded silt and fine sand.

In test holes near the river, silt was generally encountered overlying fine sand. The silt is dense, homogeneous, contains trace amounts of fine sand in the upper section of the overburden and is grey in colour. Trace clay in silt was encountered in test hole 97MEN-2 at a depth of 7 metres below ground surface.

A sand unit generally underlies the silt but is also interbedded with the silt. The sand is medium dense, very fine to fine grained, uniform and grey in colour. A sand thickness of at least 12 metres was encountered in test holes 97MEN-4, 97MEN-5, and 97MEN-7.

Thirteen soil samples were collected as grab samples and ten samples were submitted for analyses of BTEX, VPH, HEPH, and LEPH. The concentration of all measured analytes were well below CCME R/P criteria. All BTEX and VPH concentrations were below the method detection limit. Analytical results are summarized in Table A.9.

**Groundwater**

Monitoring wells were installed in test holes 97MEN-4, 97MEN-5, 97MEN-6, 97MEN-9 and 97MEN-10. Construction details are shown on the test hole logs in the site specific Appendix. These monitoring wells were installed downgradient from the former fuel retail outlet at Mendenhall to determine the direction of horizontal groundwater flow and facilitate the collection of groundwater samples. Photographs 18 to 21 show the stages of the monitoring well installations.

Groundwater levels in the installed monitoring wells were measured on several occasions to determine when equilibrium was achieved. A summary of measured groundwater water levels is in the site specific Appendix. A hydrograph summarizing each monitoring well is also in the Appendix.

The horizontal groundwater flow direction in the silt/sand units as determined from groundwater levels measured on October 27, 1997 is to the west towards the Mendenhall River (Drawing 5-2). The horizontal gradient is approximately 0.026 m/m. Groundwater flow is consistent with the slope of the topography towards the Mendenhall River. The groundwater in the silt/sand deposits occurs under water table conditions (unconfined). The measured water table surface elevation is higher than the measured Mendenhall River elevation of 93.54 metres on September 19, 1997. As the water table elevation is higher than the river level, it is likely that groundwater seeps into the river channel.

The hydraulic conductivity of the silt and sand deposits was estimated by conducting field slug/bail tests. The Hvorslev (1951) slug/bail test was used to estimate the hydraulic conductivity of the deposits surrounding the monitoring well screen. In a slug test, water is instantaneously added raising the water level in the well. The rate of outflow is proportional to the hydraulic conductivity of the soil. A summary of the hydraulic conductivity of the silt and sand deposits as estimated by Aquifer Test software follows:

**TABLE 5.2**
**FIELD HYDRAULIC CONDUCTIVITY SUMMARY**

| Monitoring Well | Soil Type | Screen Intake (m) | Field Hydraulic Conductivity (m/sec) |
|---|---|---|---|
| 97MEN-4 | silty sand | 89.81 - 88.29 | $1.96 \times 10^{-6}$ |
| 97MEN-5 | fine sand | 88.88 - 87.36 | $1.22 \times 10^{-6}$ |
| 97MEN-6 | sandy silt | 89.82 - 88.30 | $9.42 \times 10^{-7}$ |
| 97MEN-9 | sandy silt | 93.43 - 92.21 | $4.33 \times 10^{-7}$ |
| 97MEN-10 | sandy silt | 94.11 - 92.89 | $6.32 \times 10^{-7}$ |

These estimated hydraulic conductivity values are similar to values reported in the literature for the above soil types. Data files and graphical plots are in the site specific Appendix.

As the water table in the sand/silt deposits is higher than the Mendenhall River water level, the river is termed effluent. Groundwater seepage into the river is low, estimated as 0.007 cubic metres/day/m, given the hydraulic parameters measured in the field.

Water samples were collected and analyzed for BTEX, VPH, LEH, and TEH. The concentration of toluene was slightly elevated in all five water samples but well below the MOEE non-potable groundwater criteria and the CCME fresh water criteria. Light and heavy extractable hydrocarbon parameters were also identified in the collected groundwater from each of the wells. Light extractable hydrocarbon concentrations ranged from 3,900 to 17,000 $\mu$g/L and heavy extractable hydrocarbon concentrations ranged from

2,200 to 11,000 μg/L. These measured concentrations exceed MOEE non-potable groundwater criteria (1,000 μg/L). Specific criteria for light and heavy extractable hydrocarbon parameters have not been established by CCME or the Yukon. Analytical results are summarized in Table A.8 in Appendix A.

The likely source of hydrocarbon found in the groundwater is suspected to be a result of operations at the former retail fuel outlet on titled land upgradient and east of the Mendenhall River. Based on the inferred groundwater flow direction, groundwater likely seeps into the Mendenhall River. Hydraulic parameters measured in the field (hydraulic conductivity and gradient) were used to estimate a groundwater horizontal flow velocity in the sand/silt deposit.

Relatively low flow velocities of approximately one metre/year were estimated, which when reviewed in the context of the apparent hydrocarbon contamination, indicate:

- it is suspected that preferential flow paths exist in interconnected sand lenses (i.e. at high hydraulic conductivity);
- hydraulic gradients vary on a seasonal basis, corresponding to the amount of precipitation and infiltration; higher gradients are expected in the spring and early summer; and
- continued monitoring of groundwater levels and chemical analyses is required to confirm these results.

## 5.2 QUALITATIVE ENVIRONMENTAL RISK ASSESSMENT - GROUNDWATER

The assessment of environmental risk posed by hydrocarbon constituents identified in the groundwater may be evaluated on the basis of the following two components:

- human health risks; and
- ecological risks.

This section briefly describes the primary considerations for each of the two components, and relates these to the conditions encountered at the Mendenhall River site. The assessment presented in this section does not constitute a comprehensive risk assessment. The assessment is qualitative and not quantitative.

**Human Health Risk** includes the characterization of type, concentration, and extent of contamination, identification of exposure pathways, and evaluation of the likelihood of exposure impact.

Given that petroleum hydrocarbon constituents were found in the soil at the former retail fuel outlet, the primary objective of the site investigation was to characterize the hydrocarbon constituents that may have entered the groundwater flow system. Five monitoring wells were installed downgradient from the hydrocarbon affected soil. Light extractable and heavy extractable hydrocarbon concentrations measured in collected groundwater samples ranged from 3,900 to 17,000 $\mu$g/L and 2,200 to 11,000 $\mu$g/L, respectively. Toluene was also detected in groundwater from each well, with concentrations ranging from 2.5 to 14 $\mu$g/L. Measured light and heavy extractable hydrocarbon concentrations exceed the MOEE potable groundwater criteria of 1,000 $\mu$g/L. As groundwater at the site is not utilized as a drinking water source, there is low risk to human health. However, should the site be developed in the future, groundwater use as a drinking source should be restricted.

**Ecological Risk** relates to the potential adverse impacts on overall ecosystem health, and correspondingly, the ability of the ecosystem to sustain itself. Groundwater at the site discharges into the river, based on data collected during the 1997 investigation. Evaluation of the risk included a visual assessment of impacts such as the presence of dead or stunted vegetation downstream along the riverbank.

The ecosystem health risks attributed to this site as a result of affected groundwater likely discharging into the river is considered low. There were no signs along the riverbank that the vegetation in the area was stressed at this time. The source of the groundwater contamination was likely associated with operations at the former fuel retail outlet. As the retail fuel outlet has been decommissioned, there does not appear to be a continuous source of hydrocarbon contaminants. Groundwater sampling from the installed wells and hydrocarbon analysis is recommended to establish decreasing or increasing chemical trends.

## 5.3 RECOMMENDED CLEANUP REQUIREMENTS

The recommended cleanup requirements for the Mendenhall River site are based on mitigation of public safety risks. In summary, the cleanup requirements include:

- excavation of debris from the top of the slope:
  - sorting of excavated materials;
  - confirmation of non-hazardous nature of debris;
  - confirmatory testing of excavated soil; and
- collection and disposal of scattered debris.

### 5.3.1 Disposal Options

During excavation of material from the top of slope, debris should be sorted from the soil matrix. Suspected hazardous materials (such as asbestos, any barrels containing product) should be tested and disposed of accordingly. Any stained soils should be tested to characterize contamination. Following excavation to in situ material, select samples should be obtained from the in situ material for analyses to confirm that no contamination is present.

The remaining non-hazardous, uncontaminated materials are to be disposed of in an appropriate landfill site.

### 5.3.2 Environmental Monitoring

Given that hydrocarbon constituents have been detected in the groundwater, it is recommended that a monitoring program be implemented to indicate change in water quality. Light and heavy extractable hydrocarbon and benzene, toluene, ethyl benzene and xylene concentrations should be measured twice a year in 1998 and then on an annual basis. A review of the chemical data should be conducted after each sampling event to determine whether the monitoring frequency could be adjusted.

## 5.4 OUTLINE SPECIFICATIONS

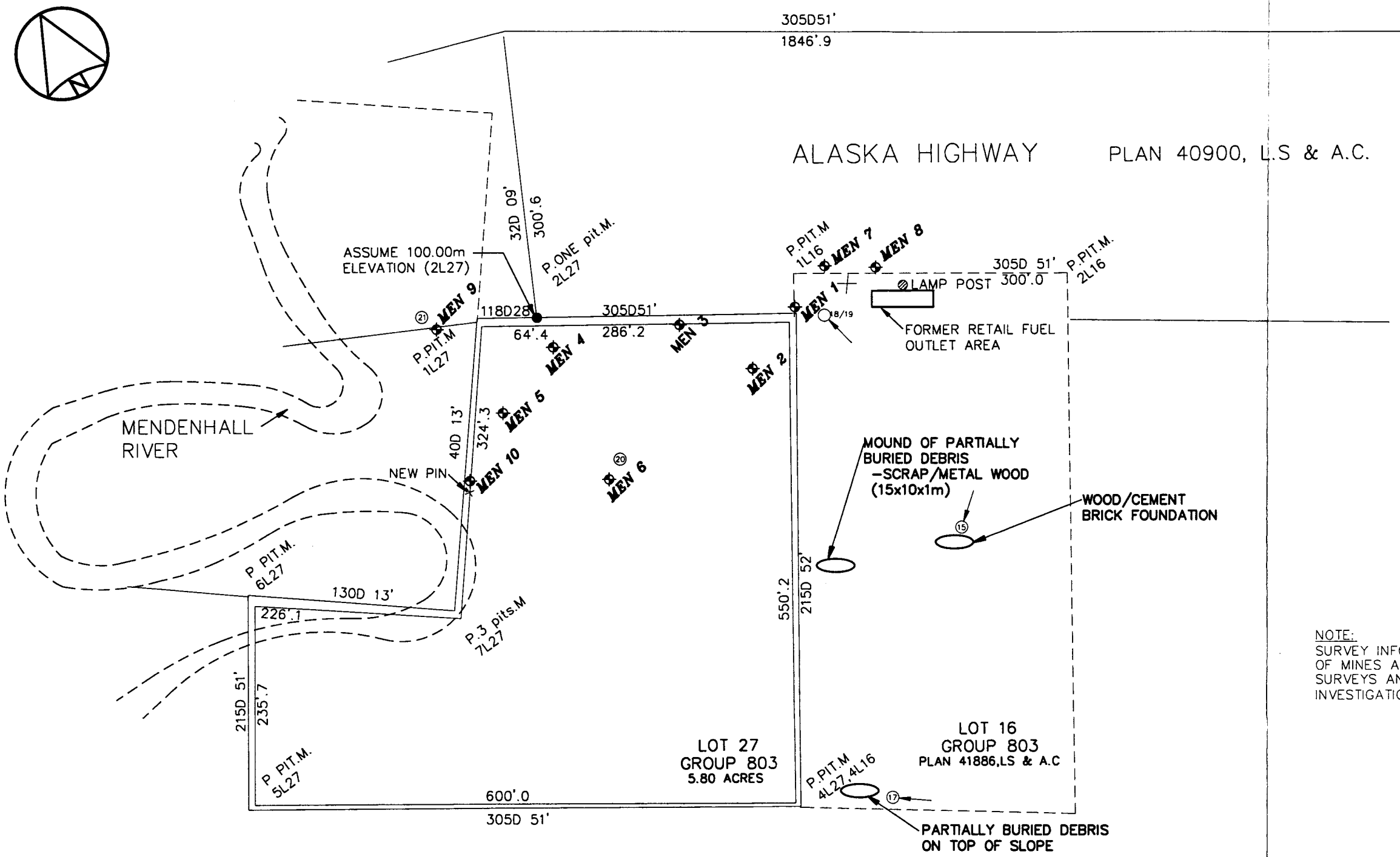
### 5.4.1 Debris Removal

This section would describe the requirement for the removal, sorting, handling and disposal of debris excavated from the riverbank as well as the debris scattered across the site. The following subsections should be included under Debris Removal:

- Definitions of Debris
  - All pertinent definitions relating to debris would be provided in this section. These would include a definition of hazardous material.
- Measurement for Payment
  - Details identifying what items are included in the price for debris removal described in this section. It is suggested that the excavation of the material from the riverbank be treated separately from that of the surface debris scattered around the site.
- Execution
  - This section would identify the primary work components including:
    - location of debris areas;
    - requirements for sorting of excavated materials;
    - requirements for testing of suspected contaminated soil;
    - disposal location for non-hazardous debris;
    - regrading of the riverbank following excavation; and
    - submittal of acceptance certificate at landfill facility.

The debris located on the top of the slope should be excavated and sorted to ensure that no hazardous debris is present. All non-hazardous debris should be landfilled at an acceptable disposal facility.

In the event that hazardous debris is encountered (i.e. suspected asbestos material, paint, oil, fuel, etc.), representative samples should be collected and submitted for analyses to determine the magnitude and extent of contamination and to determine appropriate management/disposal options for the hazardous waste.




LEGEND

- TEST HOLE LOCATION
- DEBRIS AREA
- PHOTOGRAPH LOCATION AND NUMBER

NOTE:
SURVEY INFORMATION WAS TAKEN FROM DEPARTMENT OF MINES AND TECHNICAL SURVEYS, LEGAL SURVEYS AND AERONAUTICAL CHARTS. DATE OF INVESTIGATION SEPTEMBER 17 TO 21, 1997

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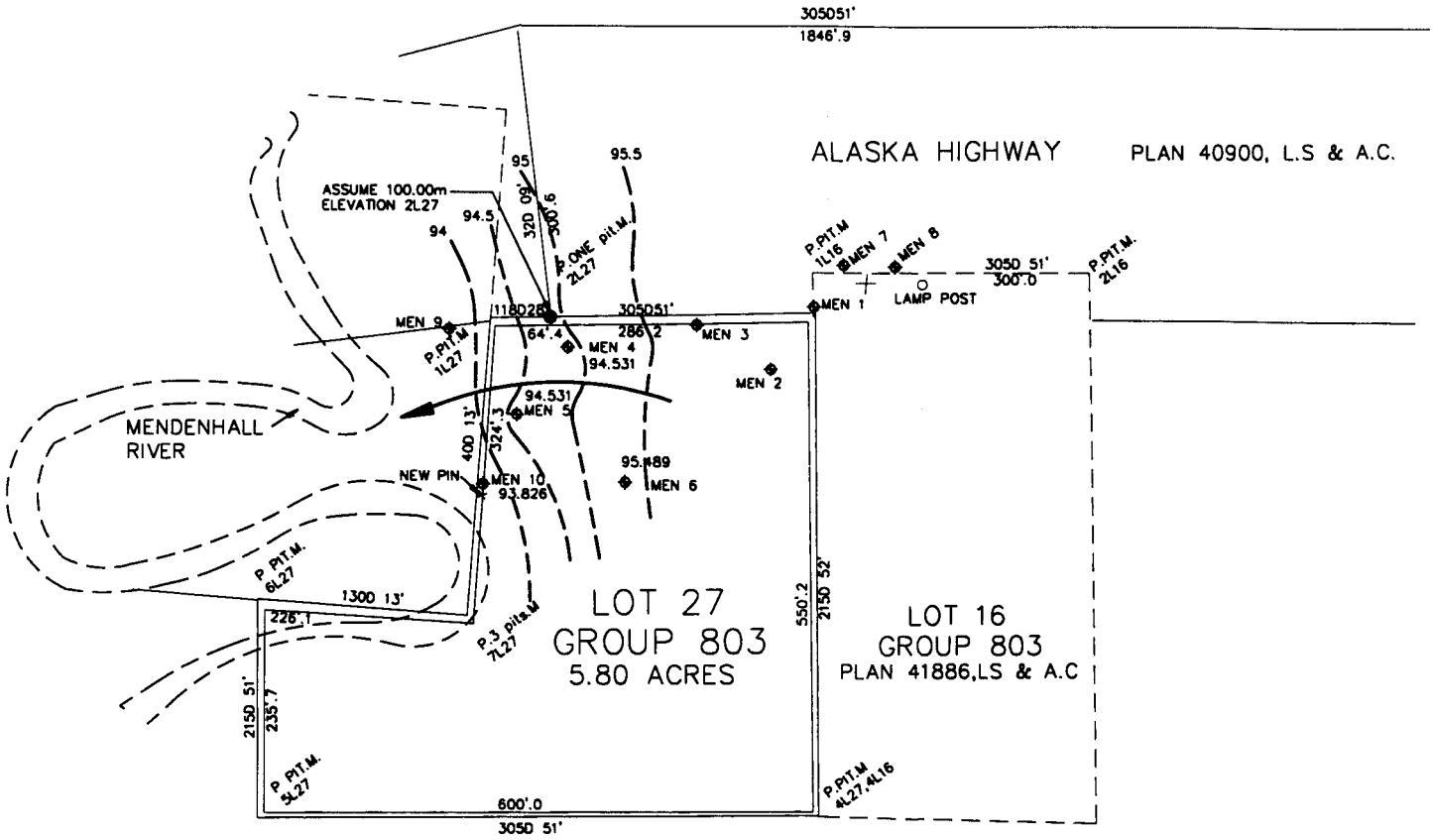
# INDIAN AND NORTHERN AFFAIRS

DETAILED ENVIRONMENTAL INVESTIGATIONS
MENDENHALL RIVER - LA Ø 42

# LOCATION PLAN - SKETCH

4440 037 00 02

DRAWING 5-1




LEGEND

- TESTHOLE LOCATION
- INFERRED HORIZONTAL DIRECTION OF GROUND WATER FLOW (OCTOBER 27, 1997)
- RELATIVE PIEZOMETRIC ELEVATION, METRES

NOTE:
SURVEY INFORMATION WAS TAKEN FROM DEPARTMENT OF MINES AND TECHNICAL SURVEYS, LEGAL SURVEYS AND AERONAUTICAL CHARTS

# INDIAN AND NORTHERN AFFAIRS

## DETAILED ENVIRONMENTAL INVESTIGATIONS
## MENDENHALL RIVER - LA Ø 42

# INFERRED GROUND WATER FLOW

4440 037 00 02

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DRAWING 5-2

# 6.0 LIMITATIONS

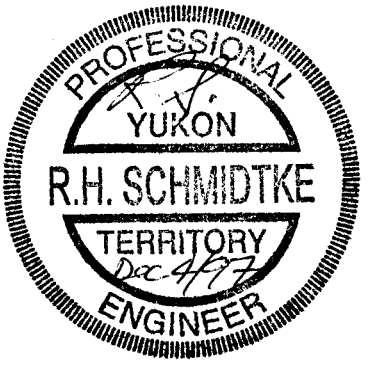
This report has been prepared by UMA Engineering Ltd. ("UMA") for the benefit of Indian and Northern Affairs Canada. The information and data contained herein, including without limitation the results of any sampling and analyses conducted by UMA pursuant to its Agreement with Indian and Northern Affairs Canada, represent UMA's best professional judgement in light of the knowledge and information available to UMA at the time of preparation. Although every effort has been made to confirm that all such information and data is factual, complete and accurate, UMA makes no guarantees or warranties whatsoever, whether expressed or implied, with respect to such information or data and UMA accepts no responsibility for any injury, loss or damage arising therefrom or related thereto.

UMA shall not by the act of issuing this report be deemed to have represented thereby that any sampling and analyses conducted by it have been exhaustive or will identify all contamination at the site, and persons relying on the results thereof do so at their own risk.

Except as required by law, this report and the information and data contained herein are to be treated as confidential and, unless otherwise agreed to by UMA and Indian and Northern Affairs Canada, may be used and relied upon only by Indian and Northern Affairs Canada, its officers and employees, subject to the limitations set forth in the preceding paragraphs. UMA denies any liability whatsoever to other parties who may obtain access to this report for any injury, loss or damage suffered by such parties arising from their use of, or reliance upon, this report or any of its contents without the express written consent of UMA and Indian and Northern Affairs Canada.

Respectfully submitted,

**UMA Engineering Ltd.**

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# APPENDIX A
# ANALYTICAL RESULTS

# APPENDIX A - ANALYTICAL RESULTS

## TABLE A.1 - TAKHINI RIVER ASBESTOS ANALYSIS

| | 97-TR-ASB1 |
|---|---|
| Bulk Asbestos Content | 10% Chrysotile |

## TABLE A.2 - TAKHINI RIVER PAINT ANALYSIS

| PCB and LEAD CONCENTRATION* | |
|---|---|
| | 97-TR-P1 |
| Lead | 69 |
| PCBs | <7.0 |

* mg/kg or ppm

# TABLE A.3 - STONY CREEK WATER ANALYSIS

| INORGANIC ELEMENT ANALYSES* | | | | |
|---|---|---|---|---|
| | CCME Freshwater Criteria | CCME Drinking Water Criteria | MOEE Potable Groundwater Criteria | 97-SC-W2 |
| Aluminum | 5-100 | - | 100 | 10 |
| Antimony | - | - | | 0.4 |
| Arsenic | 50 | 25 | 25 | 1.1 |
| Barium | - | 1000 | 1000 | 51 |
| Beryllium | - | - | | < 2 |
| Boron | - | 5000 | 5000 | < 50 |
| Cadmium | 0.2-1.8 | 5 | 5 | < 1 |
| Calcium | - | - | | 50 |
| Chromium | 2-20 | 50 | 50 | < 5 |
| Cobalt | - | - | | < 2 |
| Copper | 2-4 | 1000 | 1000 | < 1 |
| Iron | 300 | 300 | 300 | 116 |
| Lead | 1-7 | 10 | 10 | < 5 |
| Magnesium | - | - | | 15300 |
| Manganese | - | 50 | 50 | 62 |
| Mercury | 0.1 | 1 | 1 | < 0.2 |
| Molybdenum | - | - | | < 5 |
| Nickel | 25-150 | - | | < 2 |
| Phosphorus | - | - | | < 50 |
| Potassium | - | - | | 2100 |
| Selenium | 1 | 10 | 10 | < 0.4 |
| Silicon | - | - | | 4090 |
| Silver | 0.1 | - | | < 5 |
| Sodium | - | 200000 | 200000 | 9000 |
| Strontium | - | - | | 322 |
| Thallium | - | - | | < 50 |
| Tin | - | - | | < 50 |
| Titanium | - | - | | < 1 |
| Vanadium | - | - | | < 1 |
| Zinc | 30 | 5000 | 5000 | 10 |

* All concentrations reported in ug/L or ppb.

## TABLE A.4 - STONY CREEK SOIL AND SEDIMENT ANALYSIS

| INORGANIC ELEMENT ANALYSES* | | | | | |
|---|---|---|---|---|---|
| | **CCME R/P Criteria** | **97-SC-S1** | **97-SC-S2** | **97-SC-S3** | **97-SC-S4** |
| Barium | 500 | 387 | 381 | 245 | 413 |
| Beryllium | 4 | < 1 | < 1 | < 1 | < 1 |
| Cadmium | 5 | 0.6 | < 0.5 | < 0.5 | < 0.5 |
| Chromium | 250 | 67.4 | 62.4 | 43.5 | 68.3 |
| Cobalt | 50 | 19 | 18 | 13 | 19 |
| Copper | 100 | 55 | 48 | 36 | 51 |
| Lead | 500 | 34 | 23 | 28 | 23 |
| Molybdenum | 10 | 4 | 3 | 13 | < 1 |
| Nickel | 100 | 67 | 64 | 42 | 68 |
| Silver | 20 | < 1 | < 1 | < 1 | < 1 |
| Strontium | - | 99 | 93 | 126 | 83 |
| Thallium | - | < 1 | < 1 | < 1 | < 1 |
| Tin | 50 | < 5 | < 5 | < 5 | < 5 |
| Vanadium | 200 | 84 | 75 | 59 | 85 |
| Zinc | 500 | 164 | 118 | 91.3 | 119 |

* All concentrations reported in mg/kg or ppm.

## TABLE A.5 - STONY CREEK ASBESTOS ANALYSIS

| | 97-CAN-ASB1 |
|---|---|
| Bulk Asbestos Content | 10% Chrysotile |

## TABLE A.6 - STONY CREEK SOIL ANALYSIS

| INORGANIC ELEMENT and HYDROCARBON ANALYSES* | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Yukon Guidelines R/P** | **CCME R/P Criteria** | **97-SC-S5-0.5** | **97-SC-S5-1.5** | **97-SC-S6-0.5** | **97-SC-S6-1.5** | **97-SC-S7-0.5** | **97-SC-S9-0.5** | **97-SC-S10-0.1** | **97-SC-S11-0.1** | **97-SC-S12-0.1** | **97-SC-S13-0.1** |
| Barium | 500 | 500 | 64.1 | - | - | - | 55.1 | 53.6 | 99.6 | 102 | 102 | 96 |
| Beryllium | 4 | 4 | < 1 | - | - | - | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 |
| Cadmium | | 5 | < 0.5 | - | - | - | < 0.5 | < 0.5 | < 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Chromium | 250 | 250 | 19.4 | - | - | - | 15.3 | 15.3 | 19.9 | 20.3 | 20.3 | 19.2 |
| Cobalt | 50 | 50 | 7 | - | - | - | 6 | 7 | 8 | 9 | 9 | 8 |
| Copper | 150 | 100 | 14 | - | - | - | 11 | 10 | 19 | 19 | 18 | 18 |
| Lead | | 500 | < 5 | - | - | - | 7 | < 5 | 24 | 43 | 15 | 11 |
| Molybdenum | 10 | 10 | < 1 | - | - | - | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 |
| Nickel | 100 | 100 | 13 | - | - | - | 13 | 11 | 17 | 16 | 15 | 15 |
| Silver | 20 | 20 | < 1 | - | - | - | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 |
| Strontium | | - | 32 | - | - | - | 24 | 26 | 37 | 37 | 32 | 31 |
| Thallium | - | - | < 1 | - | - | - | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 |
| Tin | 50 | 50 | < 5 | - | - | - | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 |
| Vanadium | 200 | 200 | 46 | - | - | - | 39 | 39 | 46 | 47 | 49 | 46 |
| Zinc | | 500 | 40.3 | - | - | - | 37.5 | 33.0 | 54.3 | 70.9 | 84.0 | 60.6 |
| | | | | | | | | | | | | |
| Heavy Extractables | 1000 | | 390 | 270 | 30 | < 5 | 57 | 59 | 240 | 480 | 16000 | < 5 |
| Light Extractables | 1000 | | 1200 | 200 | < 5 | 21 | 35 | 33 | < 5 | 23 | 240 | < 5 |

* All concentrations reported in mg/kg or ppm.

# TABLE A.7 - STONY CREEK SOIL ANALYSIS

| PAH ANALYSES* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | CCME R/P Criteria | BCMOE Criteria | 97-CAN-1-0.3 | 97-CAN-4-0.4 | 97-CAN-5-0.3 | 97-CAN-5-1.2 | 97-CAN-6-0.25 | 97-CAN-8-1.2 |
| Naphthalene | 5 | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthylene | | 10 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthene | | 10 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Fluorene | | 10 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Phananthrene/ Anthracene | 5 | | <0.01 | <0.01 | 0.13 | 0.03 | <0.01 | 0.05 |
| Fluoranthene | | 10 | <0.01 | <0.01 | 0.30 | 0.08 | <0.01 | 0.12 |
| Pyrene | 10 | | <0.01 | <0.01 | 0.36 | 0.10 | <0.01 | 0.16 |
| B(a)A/Chrysene/B(c)P | | | <0.01 | <0.01 | 0.34 | 0.09 | <0.01 | 0.16 |
| 7,12-dimethylbenz(a)anthracene | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benzo(b,j,k)fluoranthene | 1 | | <0.01 | <0.01 | 0.21 | 0.06 | <0.01 | 0.09 |
| Benzo(a)pyrene | 1 | | <0.01 | <0.01 | 0.14 | 0.03 | <0.01 | 0.04 |
| 3-Methlycholanthrene | | 1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Indeno(1,2,3-cd)pyrene | 1 | | <0.01 | <0.01 | 0.08 | 0.02 | <0.01 | 0.03 |
| Dibenzo(a,h)anthracene | 1 | | <0.01 | <0.01 | 0.02 | <0.01 | <0.01 | <0.01 |
| Benzo(ghi)perylene | | 1 | <0.01 | <0.01 | 0.08 | 0.01 | <0.01 | 0.03 |
| Dibenz(ah,al,aj)pyrene | | 1 | <0.01 | <0.01 | 0.02 | <0.01 | <0.01 | <0.01 |

* All concentrations reported in mg/kg or ppm.

# TABLE A.8 - MENDENHALL RIVER WATER ANALYSIS

| HYDROCARBON ANALYSES* | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | CCME Freshwater Criteria | CCME Drinking Water Criteria | MOEE Potable Groundwater Criteria | MOEE Nonpotable Groundwater | 97-MEN4-W1 | 97-MEN5-W1 | 97-MEN6-W1 | 97-MEN9-W1 | 97-MEN10-W1 |
| Benzene | 300 | 5.0 | 5.0 | 1900 | < 0.5 | < 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Toluene | 300 | 24 | 24 | 5900 | 5.3 | 9.5 | 2.5 | 29 | 14 |
| Ethylbenzene | 700 | 2.4 | 2.4 | 28000 | < 0.5 | < 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Xylenes | - | 300 | 300 | 5600 | < 0.5 | < 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Volatile Petroleum Hydrocarbon | - | - | - | - | < 100 | < 100 | < 100 | < 100 | < 100 |
| Heavy Extractables | - | - | 1000 | - | 2300 | 2500 | 3100 | 11000 | 2200 |
| Light Extractables | - | - | 1000 | - | 3900 | 6400 | 6900 | 17000 | 5000 |
| **Routine Water Chemistry**: | | | | | | | | | |
| Bicarbonate | - | - | - | | | < 5 mg/L | | | |
| Calcium | - | - | - | | | 0.5 mg/L | | | |
| Carbonate | - | - | - | | | < 5 mg/L | | | |
| Chloride | - | 250 mg/L | 250 mg/L | | | 165 mg/L | | | |
| Conductance | - | - | - | | | 963 uS/cm | | | |
| Hardness | - | - | 80-100 mg/L | | | 168 mg/L | | | |
| Hydroxide | - | - | - | | | < 5 mg/L | | | |
| Magnesium | - | - | - | | | 15.5 mg/L | | | |
| Nitrate + Nitrite | - | - | 10.0 mg/L | | | < 0.05 mg/L | | | |
| pH | 6.5-9.0 | 6.5-8.5 | 6.5-8.5 | | | 2.9 | | | |
| Potassium | - | - | - | | | 5.0 mg/L | | | |
| Sodium | - | 200 mg/L | 200 mg/L | | | 27 mg/L | | | |
| Sulphate | - | 500 mg/L | 500 mg/L | | | 26.0 mg/L | | | |
| TDS | - | 500 mg/L | 500 mg/L | | | 280 mg/L | | | |
| Total Alkalinity | - | - | 30-500 mg/L | | | < 5 mg/L | | | |

* All concentrations reported in ug/L or ppb unless otherwise noted

## TABLE A.9 - MENDENHALL RIVER SOIL ANALYSIS

| HYDROCARBON ANALYSES* | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Yukon Guidelines** | **CCME R/P** | **97-MEN1-3.0** | **97-MEN1-4.6** | **97-MEN2-3.0** | **97-MEN3-3.0** | **97-MEN3-4.6** | **97-MEN4-3.0** | **97-MEN5-3.0** | **97-MEN6-3.0** | **97-MEN8-3.0** | **97-MEN8-4.6** |
| Benzene | - | 0.5 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Toluene | - | 3 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Ethylbenzene | - | 5 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Xylenes | - | 5 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Volatile Petroleum Hydrocarbon | 200 | 200 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Heavy Extractables | 1000 | | <5 | 13 | 7 | 7 | 16 | <5 | <5 | <5 | 21 | 8 |
| Light Extractables | 1000 | | <5 | <5 | <5 | 30 | 11 | <5 | <5 | <5 | 62 | <5 |

* All concentrations reported in mg/kg or ppm.

ETL Enviro-Test
LABORATORIES
A DIVISION OF ETL CHEMSPEC ANALYTICAL LIMITED

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## CHEMICAL ANALYSIS REPORT

**UMA ENGINEERING LTD**
**BOX 2545**
**YELLOWKNIFE NT X1A 2P8**

**DATE: November 20, 1997**

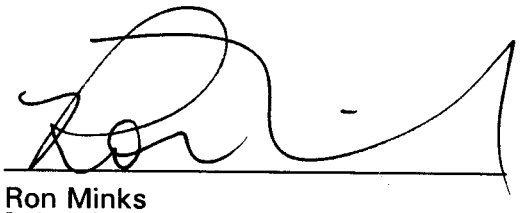
**ATTN: NATALIE PLATO**

| | | | |
|---|---|---|---|
| **Lab Work Order #:** | E709751 &E709760 Revised | **Sampled By:** | NP/RS |
| **Project Reference:** | 4440-037-00-02 | **Date Received:** | 09/22/97 |
| **Project P.O.#:** | NOT SUBMITTED | | |

**Comments:**

Additional analysis requested for 97-SC-S5-1.5, 97-SC-S6-0.5 and 97-SC-S6-1.5 on October 23, 1997.
*PCB detection limit raised due to interferences which could not be removed with clean-ups.

**APPROVED BY:**



Ron Minks
Project Manager



**ACCREDITATIONS:** **STANDARDS COUNCIL OF CANADA (SCC)**, IN COOPERATION WITH **THE CANADIAN ASSOCIATION FOR ENVIRONMENTAL ANALYTICAL LABORATORIES (CAEAL)**: FOR SPECIFIC TESTS AS REGISTERED BY THE COUNCIL (EDMONTON, CALGARY)
**AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA)**: FOR INDUSTRIAL HYGIENE ANALYSIS (EDMONTON)
**AGRICULTURE CANADA**: UNDER THE CANADIAN FERTILIZER QUALITY ASSURANCE PROGRAM (SASKATOON)

# ENVIRO-TEST CHEMICAL ANALYSIS REPORT

| LAB ID | SAMPLE ID | TEST DESCRIPTION | RESULT | D.L. | UNITS | EXTRACTED | ANALYZED | BY |
|---|---|---|---|---|---|---|---|---|
| E709751-01 | 97-SC-S7-0.5 | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| Collected:09/18/97 | | | | | | | | |
| | | **LEPH/HEPH in Soil** | | | | | | |
| | | % Moisture | 3.5 | | % | 09/23/97 | 09/24/97 | JNB |
| | | Heavy Extractables (Soil) | 57 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | THT |
| | | Light Extractables (Soil) | 35 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | THT |
| | | **Metals (SW3051)** | | | | | | |
| | | Barium (Ba) | 55.1 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Beryllium (Be) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Cadmium (Cd) | <0.5 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Chromium (Cr) | 15.3 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Cobalt (Co) | 6 | 1 | mg/kg | | 10/01/97 | CC |
| | | Copper (Cu) | 11 | 1 | mg/kg | | 10/01/97 | CC |
| | | Lead (Pb) | 7 | 5 | mg/kg | | 10/01/97 | CC |
| | | Molybdenum (Mo) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Nickel (Ni) | 13 | 2 | mg/kg | | 10/01/97 | CC |
| | | Silver (Ag) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Strontium (Sr) | 24 | 1 | mg/kg | | 10/01/97 | CC |
| | | Thallium (Tl) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Tin (Sn) | <5 | 5 | mg/kg | | 10/01/97 | CC |
| | | Vanadium (V) | 39 | 1 | mg/kg | | 10/01/97 | CC |
| | | Zinc (Zn) | 37.5 | 0.5 | mg/kg | | 10/01/97 | CC |
| E709751-04 | 97-SC-S9-0.5 | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| Collected:09/19/97 | | | | | | | | |
| | | **LEPH/HEPH in Soil** | | | | | | |
| | | % Moisture | 2.9 | | % | 09/23/97 | 09/24/97 | JNB |
| | | Heavy Extractables (Soil) | 59 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | THT |
| | | Light Extractables (Soil) | 33 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | THT |
| | | **Metals (SW3051)** | | | | | | |
| | | Barium (Ba) | 53.6 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Beryllium (Be) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Cadmium (Cd) | <0.5 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Chromium (Cr) | 15.3 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Cobalt (Co) | 7 | 1 | mg/kg | | 10/01/97 | CC |
| | | Copper (Cu) | 10 | 1 | mg/kg | | 10/01/97 | CC |
| | | Lead (Pb) | <5 | 5 | mg/kg | | 10/01/97 | CC |
| | | Molybdenum (Mo) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Nickel (Ni) | 11 | 2 | mg/kg | | 10/01/97 | CC |
| | | Silver (Ag) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Strontium (Sr) | 26 | 1 | mg/kg | | 10/01/97 | CC |
| | | Thallium (Tl) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Tin (Sn) | <5 | 5 | mg/kg | | 10/01/97 | CC |
| | | Vanadium (V) | 39 | 1 | mg/kg | | 10/01/97 | CC |
| | | Zinc (Zn) | 33.0 | 0.5 | mg/kg | | 10/01/97 | CC |
| E709751-05 | 97-SC-S10-0.1 | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| Collected:09/19/97 | | | | | | | | |
| | | **LEPH/HEPH in Soil** | | | | | | |
| | | % Moisture | 3.1 | | % | 09/23/97 | 09/24/97 | JNB |
| | | Heavy Extractables (Soil) | 240 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | QVP |
| | | Light Extractables (Soil) | <5 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | QVP |
| | | **Metals (SW3051)** | | | | | | |
| | | Barium (Ba) | 99.6 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Beryllium (Be) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Cadmium (Cd) | <0.5 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Chromium (Cr) | 19.9 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Cobalt (Co) | 8 | 1 | mg/kg | | 10/01/97 | CC |
| | | Copper (Cu) | 19 | 1 | mg/kg | | 10/01/97 | CC |
| | | Lead (Pb) | 24 | 5 | mg/kg | | 10/01/97 | CC |
| | | Molybdenum (Mo) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Nickel (Ni) | 17 | 2 | mg/kg | | 10/01/97 | CC |
| | | Silver (Ag) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Strontium (Sr) | 37 | 1 | mg/kg | | 10/01/97 | CC |
| | | Thallium (Tl) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Tin (Sn) | <5 | 5 | mg/kg | | 10/01/97 | CC |
| | | Vanadium (V) | 46 | 1 | mg/kg | | 10/01/97 | CC |
| | | Zinc (Zn) | 54.3 | 0.5 | mg/kg | | 10/01/97 | CC |

# ENVIRO-TEST CHEMICAL ANALYSIS REPORT

| LAB ID | SAMPLE ID | TEST DESCRIPTION | RESULT | D.L. | UNITS | EXTRACTED | ANALYZED | BY |
|---|---|---|---|---|---|---|---|---|
| E709751-06 | 97-SC-S11-0.1 | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| Collected:09/19/97 | | | | | | | | |
| | | **LEPH/HEPH in Soil** | | | | | | |
| | | % Moisture | 2.7 | | % | 09/23/97 | 09/24/97 | JNB |
| | | Heavy Extractables (Soil) | 480 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | QVP |
| | | Light Extractables (Soil) | 23 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | QVP |
| | | **Metals (SW3051)** | | | | | | |
| | | Barium (Ba) | 102 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Beryllium (Be) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Cadmium (Cd) | <0.5 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Chromium (Cr) | 20.3 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Cobalt (Co) | 9 | 1 | mg/kg | | 10/01/97 | CC |
| | | Copper (Cu) | 19 | 1 | mg/kg | | 10/01/97 | CC |
| | | Lead (Pb) | 43 | 5 | mg/kg | | 10/01/97 | CC |
| | | Molybdenum (Mo) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Nickel (Ni) | 16 | 2 | mg/kg | | 10/01/97 | CC |
| | | Silver (Ag) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Strontium (Sr) | 37 | 1 | mg/kg | | 10/01/97 | CC |
| | | Thallium (Tl) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Tin (Sn) | <5 | 5 | mg/kg | | 10/01/97 | CC |
| | | Vanadium (V) | 47 | 1 | mg/kg | | 10/01/97 | CC |
| | | Zinc (Zn) | 70.9 | 0.5 | mg/kg | | 10/01/97 | CC |
| E709751-07 | 97-SC-S12-0.1 | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| Collected:09/19/97 | | | | | | | | |
| | | **LEPH/HEPH in Soil** | | | | | | |
| | | % Moisture | 4.1 | | % | 09/23/97 | 09/24/97 | JNB |
| | | Heavy Extractables (Soil) | 16000 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | THT |
| | | Light Extractables (Soil) | 240 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | THT |
| | | **Metals (SW3051)** | | | | | | |
| | | Barium (Ba) | 102 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Beryllium (Be) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Cadmium (Cd) | <0.5 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Chromium (Cr) | 20.3 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Cobalt (Co) | 9 | 1 | mg/kg | | 10/01/97 | CC |
| | | Copper (Cu) | 18 | 1 | mg/kg | | 10/01/97 | CC |
| | | Lead (Pb) | 15 | 5 | mg/kg | | 10/01/97 | CC |
| | | Molybdenum (Mo) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Nickel (Ni) | 15 | 2 | mg/kg | | 10/01/97 | CC |
| | | Silver (Ag) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Strontium (Sr) | 32 | 1 | mg/kg | | 10/01/97 | CC |
| | | Thallium (Tl) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Tin (Sn) | <5 | 5 | mg/kg | | 10/01/97 | CC |
| | | Vanadium (V) | 49 | 1 | mg/kg | | 10/01/97 | CC |
| | | Zinc (Zn) | 84.0 | 0.5 | mg/kg | | 10/01/97 | CC |
| E709751-08 | 97-SC-S13-0.1 | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| Collected:09/19/97 | | | | | | | | |
| | | **LEPH/HEPH in Soil** | | | | | | |
| | | % Moisture | 2.3 | | % | 09/23/97 | 09/24/97 | JNB |
| | | Heavy Extractables (Soil) | <5 | 5 | ug/g (ppm) | 09/23/97 | 09/26/97 | CAS |
| | | Light Extractables (Soil) | <5 | 5 | ug/g (ppm) | 09/23/97 | 09/26/97 | CAS |
| | | **Metals (SW3051)** | | | | | | |
| | | Barium (Ba) | 96.0 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Beryllium (Be) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Cadmium (Cd) | <0.5 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Chromium (Cr) | 19.2 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Cobalt (Co) | 8 | 1 | mg/kg | | 10/01/97 | CC |
| | | Copper (Cu) | 18 | 1 | mg/kg | | 10/01/97 | CC |
| | | Lead (Pb) | 11 | 5 | mg/kg | | 10/01/97 | CC |
| | | Molybdenum (Mo) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Nickel (Ni) | 15 | 2 | mg/kg | | 10/01/97 | CC |
| | | Silver (Ag) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Strontium (Sr) | 31 | 1 | mg/kg | | 10/01/97 | CC |
| | | Thallium (Tl) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Tin (Sn) | <5 | 5 | mg/kg | | 10/01/97 | CC |
| | | Vanadium (V) | 46 | 1 | mg/kg | | 10/01/97 | CC |
| | | Zinc (Zn) | 60.6 | 0.5 | mg/kg | | 10/01/97 | CC |

# ENVIRO-TEST CHEMICAL ANALYSIS REPORT

| LAB ID | SAMPLE ID | TEST DESCRIPTION | RESULT | D.L. | UNITS | EXTRACTED | ANALYZED | BY |
|---|---|---|---|---|---|---|---|---|
| E709751-09 | 97-MEN1-3.0 | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| Collected:09/19/97 | | | | | | | | |
| | | **BTEX/VPH/LEPH/HEPH in Soil** | | | | | | |
| | | % Moisture | 17.1 | | % | 09/23/97 | 09/24/97 | JNB |
| | | **BTEX and VPH in Soil** | | | | | | |
| | | Benzene | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Toluene | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Ethylbenzene | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Xylenes | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Volatile Petroleum Hydrocarbon | < 0.5 | 0.5 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Heavy Extractables (Soil) | <5 | 5 | ug/g (ppm) | 09/23/97 | 09/26/97 | CAS |
| | | Light Extractables (Soil) | <5 | 5 | ug/g (ppm) | 09/23/97 | 09/26/97 | CAS |
| E709751-10 | 97-MEN1-4.6 | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| Collected:09/19/97 | | | | | | | | |
| | | **BTEX/VPH/LEPH/HEPH in Soil** | | | | | | |
| | | % Moisture | 5.1 | | % | 09/23/97 | 09/24/97 | JNB |
| | | **BTEX and VPH in Soil** | | | | | | |
| | | Benzene | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Toluene | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Ethylbenzene | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Xylenes | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Volatile Petroleum Hydrocarbon | < 0.5 | 0.5 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Heavy Extractables (Soil) | 13 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | QVP |
| | | Light Extractables (Soil) | <5 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | QVP |
| E709751-11 | 97-MEN2-3.0 | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| Collected:09/19/97 | | | | | | | | |
| | | **BTEX/VPH/LEPH/HEPH in Soil** | | | | | | |
| | | % Moisture | 16.4 | | % | 09/23/97 | 09/24/97 | JNB |
| | | **BTEX and VPH in Soil** | | | | | | |
| | | Benzene | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Toluene | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Ethylbenzene | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Xylenes | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Volatile Petroleum Hydrocarbon | < 0.5 | 0.5 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Heavy Extractables (Soil) | 7 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | QVP |
| | | Light Extractables (Soil) | <5 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | QVP |
| E709751-13 | 97-MEN3-3.0 | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| Collected:09/19/97 | | | | | | | | |
| | | **BTEX/VPH/LEPH/HEPH in Soil** | | | | | | |
| | | % Moisture | 20.0 | | % | 09/23/97 | 09/24/97 | JNB |
| | | **BTEX and VPH in Soil** | | | | | | |
| | | Benzene | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Toluene | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Ethylbenzene | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Xylenes | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Volatile Petroleum Hydrocarbon | < 0.5 | 0.5 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Heavy Extractables (Soil) | 7 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | QVP |
| | | Light Extractables (Soil) | 30 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | QVP |
| E709751-14 | 97-CAN1-0.3 | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| Collected:09/17/97 | | | | | | | | |
| | | **Tier1-PAHs in Soil** | | | | | | |
| | | Naphthalene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Acenaphthylene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Acenaphthene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Fluorene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Phenanthrene/Anthracene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Fluoranthene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Pyrene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | B(a)A/Chrysene/B(c)P | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | 7,12-Dimethylbenz(a)anthracene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Benzo(b/j/k)fluoranthene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Benzo(a)pyrene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | 3-Methylcholanthrene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Indeno(1,2,3-cd)pyrene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |

# ENVIRO-TEST CHEMICAL ANALYSIS REPORT

| LAB ID | SAMPLE ID | TEST DESCRIPTION | RESULT | D.L. | UNITS | EXTRACTED | ANALYZED | BY |
|---|---|---|---|---|---|---|---|---|
| | | Dibenzo(ah)anthracene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Benzo(ghi)perylene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Dibenz(ah,ai,aj)pyrene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| **E709751-17** | **97-CAN4-0.4** | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| Collected:09/17/97 | | | | | | | | |
| | | **Tier1-PAHs in Soil** | | | | | | |
| | | Naphthalene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Acenaphthylene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Acenaphthene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Fluorene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Phenanthrene/Anthracene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Fluoranthene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Pyrene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | B(a)A/Chrysene/B(c)P | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | 7,12-Dimethylbenz(a)anthracene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Benzo(b/j/k)fluoranthene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Benzo(a)pyrene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | 3-Methylcholanthrene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Indeno(1,2,3-cd)pyrene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Dibenzo(ah)anthracene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Benzo(ghi)perylene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Dibenz(ah,ai,aj)pyrene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| **E709751-18** | **97-CAN5-0.3** | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| Collected:09/17/97 | | | | | | | | |
| | | **Tier1-PAHs in Soil** | | | | | | |
| | | Naphthalene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Acenaphthylene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Acenaphthene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Fluorene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Phenanthrene/Anthracene | 0.13 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Fluoranthene | 0.30 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Pyrene | 0.36 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | B(a)A/Chrysene/B(c)P | 0.34 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | 7,12-Dimethylbenz(a)anthracene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Benzo(b/j/k)fluoranthene | 0.21 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Benzo(a)pyrene | 0.14 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | 3-Methylcholanthrene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Indeno(1,2,3-cd)pyrene | 0.08 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Dibenzo(ah)anthracene | 0.02 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Benzo(ghi)perylene | 0.08 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Dibenz(ah,ai,aj)pyrene | 0.02 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| **E709751-19** | **97-CAN5-1.2** | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| Collected:09/17/97 | | | | | | | | |
| | | **Tier1-PAHs in Soil** | | | | | | |
| | | Naphthalene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Acenaphthylene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Acenaphthene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Fluorene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Phenanthrene/Anthracene | 0.03 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Fluoranthene | 0.08 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Pyrene | 0.10 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | B(a)A/Chrysene/B(c)P | 0.09 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | 7,12-Dimethylbenz(a)anthracene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Benzo(b/j/k)fluoranthene | 0.06 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Benzo(a)pyrene | 0.03 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | 3-Methylcholanthrene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Indeno(1,2,3-cd)pyrene | 0.02 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Dibenzo(ah)anthracene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Benzo(ghi)perylene | 0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Dibenz(ah,ai,aj)pyrene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| **E709751-21** | **97-CAN6-0.25** | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| Collected:09/17/97 | | | | | | | | |
| | | **Tier1-PAHs in Soil** | | | | | | |
| | | Naphthalene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Acenaphthylene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Acenaphthene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |

# ENVIRO-TEST CHEMICAL ANALYSIS REPORT

| LAB ID | SAMPLE ID | TEST DESCRIPTION | RESULT | D.L. | UNITS | EXTRACTED | ANALYZED | BY |
|---|---|---|---|---|---|---|---|---|
| | | Fluorene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Phenanthrene/Anthracene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Fluoranthene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Pyrene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | B(a)A/Chrysene/B(c)P | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | 7,12-Dimethylbenz(a)anthracene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Benzo(b/j/k)fluoranthene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Benzo(a)pyrene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | 3-Methylcholanthrene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Indeno(1,2,3-cd)pyrene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Dibenzo(ah)anthracene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Benzo(ghi)perylene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Dibenz(ah,ai,aj)pyrene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| **E709751-22** | **97-CAN8-1.2** | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| Collected:09/17/97 | | | | | | | | |
| | | **Tier1-PAHs in Soil** | | | | | | |
| | | Naphthalene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Acenaphthylene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Acenaphthene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Fluorene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Phenanthrene/Anthracene | 0.05 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Fluoranthene | 0.12 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Pyrene | 0.16 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | B(a)A/Chrysene/B(c)P | 0.16 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | 7,12-Dimethylbenz(a)anthracene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Benzo(b/j/k)fluoranthene | 0.09 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Benzo(a)pyrene | 0.04 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | 3-Methylcholanthrene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Indeno(1,2,3-cd)pyrene | 0.03 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Dibenzo(ah)anthracene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Benzo(ghi)perylene | 0.03 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| | | Dibenz(ah,ai,aj)pyrene | <0.01 | 0.01 | ug/g (ppm) | 09/29/97 | 10/08/97 | SRJ |
| **E709751-23** | **97-SC-S5-0.5** | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| Collected:09/18/97 | | | | | | | | |
| | | **LEPH/HEPH in Soil** | | | | | | |
| | | % Moisture | 8.6 | | % | 09/23/97 | 09/24/97 | JNB |
| | | Heavy Extractables (Soil) | 390 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | QVP |
| | | Light Extractables (Soil) | 1200 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | QVP |
| | | **Metals (SW3051)** | | | | | | |
| | | Barium (Ba) | 64.1 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Beryllium (Be) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Cadmium (Cd) | <0.5 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Chromium (Cr) | 19.4 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Cobalt (Co) | 7 | 1 | mg/kg | | 10/01/97 | CC |
| | | Copper (Cu) | 14 | 1 | mg/kg | | 10/01/97 | CC |
| | | Lead (Pb) | <5 | 5 | mg/kg | | 10/01/97 | CC |
| | | Molybdenum (Mo) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Nickel (Ni) | 13 | 2 | mg/kg | | 10/01/97 | CC |
| | | Silver (Ag) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Strontium (Sr) | 32 | 1 | mg/kg | | 10/01/97 | CC |
| | | Thallium (Tl) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Tin (Sn) | <5 | 5 | mg/kg | | 10/01/97 | CC |
| | | Vanadium (V) | 46 | 1 | mg/kg | | 10/01/97 | CC |
| | | Zinc (Zn) | 40.3 | 0.5 | mg/kg | | 10/01/97 | CC |
| **E709751-24** | **97-SC-S5-1.5** | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| Collected:09/18/97 | | | | | | | | |
| | | **LEPH/HEPH in Soil** | | | | | | |
| | | % Moisture | 7.0 | | % | 10/23/97 | 10/24/97 | TDV |
| | | Heavy Extractables (Soil) | 270 | 5 | ug/g (ppm) | 10/24/97 | 10/25/97 | CAS |
| | | Light Extractables (Soil) | 200 | 5 | ug/g (ppm) | 10/24/97 | 10/25/97 | CAS |
| **E709751-25** | **97-SC-S6-0.5** | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| Collected:09/18/97 | | | | | | | | |
| | | **LEPH/HEPH in Soil** | | | | | | |
| | | % Moisture | 16.0 | | % | 10/23/97 | 10/24/97 | TDV |
| | | Heavy Extractables (Soil) | 30 | 5 | ug/g (ppm) | 10/24/97 | 10/25/97 | CAS |

# ENVIRO-TEST CHEMICAL ANALYSIS REPORT

| LAB ID | SAMPLE ID | TEST DESCRIPTION | RESULT | D.L. | UNITS | EXTRACTED | ANALYZED | BY |
|---|---|---|---|---|---|---|---|---|
| | | Light Extractables (Soil) | <5 | 5 | ug/g (ppm) | 10/24/97 | 10/25/97 | CAS |
| **E709751-26** | **97-SC-S6-1.5** | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| Collected:09/18/97 | | | | | | | | |
| | | **LEPH/HEPH in Soil** | | | | | | |
| | | % Moisture | 14.9 | | % | 10/23/97 | 10/24/97 | TDV |
| | | Heavy Extractables (Soil) | 21 | 5 | ug/g (ppm) | 10/24/97 | 10/25/97 | CAS |
| | | Light Extractables (Soil) | <5 | 5 | ug/g (ppm) | 10/24/97 | 10/25/97 | CAS |
| **E709751-27** | **97-MEN3-4.6** | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| | | **BTEX/VPH/LEPH/HEPH in Soil** | | | | | | |
| | | % Moisture | 10.2 | | % | 09/23/97 | 09/24/97 | JNB |
| | | **BTEX and VPH in Soil** | | | | | | |
| | | Benzene | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Toluene | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Ethylbenzene | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Xylenes | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Volatile Petroleum Hydrocarbon | < 0.5 | 0.5 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Heavy Extractables (Soil) | 16 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | THT |
| | | Light Extractables (Soil) | 11 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | THT |
| **E709751-28** | **97-MEN4-3.0** | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| | | **BTEX/VPH/LEPH/HEPH in Soil** | | | | | | |
| | | % Moisture | 2.7 | 0 | % | | 10/28/97 | JOB |
| | | **BTEX and VPH in Soil** | | | | | | |
| | | Benzene | < 0.02 | 0.02 | ug/g (ppm) | 10/28/97 | 10/28/97 | YDY |
| | | Toluene | < 0.02 | 0.02 | ug/g (ppm) | 10/28/97 | 10/28/97 | YDY |
| | | Ethylbenzene | < 0.02 | 0.02 | ug/g (ppm) | 10/28/97 | 10/28/97 | YDY |
| | | Xylenes | < 0.02 | 0.02 | ug/g (ppm) | 10/28/97 | 10/28/97 | YDY |
| | | Volatile Petroleum Hydrocarbon | < 0.5 | 0.5 | ug/g (ppm) | 10/28/97 | 10/28/97 | YDY |
| | | Heavy Extractables (Soil) | <5 | 5 | ug/g (ppm) | 10/28/97 | 10/29/97 | YDY |
| | | Light Extractables (Soil) | <5 | 5 | ug/g (ppm) | 10/28/97 | 10/29/97 | YDY |
| **E709751-29** | **97-MEN5-3.0** | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| | | **BTEX/VPH/LEPH/HEPH in Soil** | | | | | | |
| | | % Moisture | 16.2 | 0 | % | | 10/28/97 | JOB |
| | | **BTEX and VPH in Soil** | | | | | | |
| | | Benzene | < 0.02 | 0.02 | ug/g (ppm) | 10/28/97 | 10/28/97 | YDY |
| | | Toluene | < 0.02 | 0.02 | ug/g (ppm) | 10/28/97 | 10/28/97 | YDY |
| | | Ethylbenzene | < 0.02 | 0.02 | ug/g (ppm) | 10/28/97 | 10/28/97 | YDY |
| | | Xylenes | < 0.02 | 0.02 | ug/g (ppm) | 10/28/97 | 10/28/97 | YDY |
| | | Volatile Petroleum Hydrocarbon | < 0.5 | 0.5 | ug/g (ppm) | 10/28/97 | 10/28/97 | YDY |
| | | Heavy Extractables (Soil) | <5 | 5 | ug/g (ppm) | 10/28/97 | 10/29/97 | YDY |
| | | Light Extractables (Soil) | <5 | 5 | ug/g (ppm) | 10/28/97 | 10/29/97 | YDY |
| **E709751-30** | **97-MEN6-3.0** | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| | | **BTEX/VPH/LEPH/HEPH in Soil** | | | | | | |
| | | % Moisture | 3.3 | 0 | % | | 10/28/97 | JOB |
| | | **BTEX and VPH in Soil** | | | | | | |
| | | Benzene | < 0.02 | 0.02 | ug/g (ppm) | 10/28/97 | 10/28/97 | YDY |
| | | Toluene | < 0.02 | 0.02 | ug/g (ppm) | 10/28/97 | 10/28/97 | YDY |
| | | Ethylbenzene | < 0.02 | 0.02 | ug/g (ppm) | 10/28/97 | 10/28/97 | YDY |
| | | Xylenes | < 0.02 | 0.02 | ug/g (ppm) | 10/28/97 | 10/28/97 | YDY |
| | | Volatile Petroleum Hydrocarbon | < 0.5 | 0.5 | ug/g (ppm) | 10/28/97 | 10/28/97 | YDY |
| | | Heavy Extractables (Soil) | <5 | 5 | ug/g (ppm) | 10/28/97 | 10/29/97 | YDY |
| | | Light Extractables (Soil) | <5 | 5 | ug/g (ppm) | 10/28/97 | 10/29/97 | YDY |
| **E709751-33** | **97-MEN8-3.0** | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| | | **BTEX/VPH/LEPH/HEPH in Soil** | | | | | | |
| | | % Moisture | 20.7 | | % | 09/23/97 | 09/24/97 | JNB |
| | | **BTEX and VPH in Soil** | | | | | | |
| | | Benzene | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Toluene | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Ethylbenzene | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Xylenes | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |

# ENVIRO-TEST CHEMICAL ANALYSIS REPORT

| LAB ID | SAMPLE ID | TEST DESCRIPTION | RESULT | D.L. | UNITS | EXTRACTED | ANALYZED | BY |
|---|---|---|---|---|---|---|---|---|
| | | Volatile Petroleum Hydrocarbon | < 0.5 | 0.5 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Heavy Extractables (Soil) | 21 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | THT |
| | | Light Extractables (Soil) | 62 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | THT |
| E709751-34 | 97-MEN8-4.6 | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| | | **BTEX/VPH/LEPH/HEPH in Soil** | | | | | | |
| | | % Moisture | 3.0 | | % | 09/23/97 | 09/24/97 | JNB |
| | | **BTEX and VPH in Soil** | | | | | | |
| | | Benzene | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Toluene | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Ethylbenzene | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Xylenes | < 0.02 | 0.02 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Volatile Petroleum Hydrocarbon | < 0.5 | 0.5 | ug/g (ppm) | 09/23/97 | 09/25/97 | THT |
| | | Heavy Extractables (Soil) | 8 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | THT |
| | | Light Extractables (Soil) | <5 | 5 | ug/g (ppm) | 09/23/97 | 09/24/97 | THT |
| E709751-35 | 97-SC-S4 | | | | | | | |
| Sample Type:SOIL | | | | | | | | |
| | | **Metals (SW3051)** | | | | | | |
| | | Barium (Ba) | 413 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Beryllium (Be) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Cadmium (Cd) | <0.5 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Chromium (Cr) | 68.3 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Cobalt (Co) | 19 | 1 | mg/kg | | 10/01/97 | CC |
| | | Copper (Cu) | 51 | 1 | mg/kg | | 10/01/97 | CC |
| | | Lead (Pb) | 23 | 5 | mg/kg | | 10/01/97 | CC |
| | | Molybdenum (Mo) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Nickel (Ni) | 68 | 2 | mg/kg | | 10/01/97 | CC |
| | | Silver (Ag) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Strontium (Sr) | 83 | 1 | mg/kg | | 10/01/97 | CC |
| | | Thallium (Tl) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Tin (Sn) | <5 | 5 | mg/kg | | 10/01/97 | CC |
| | | Vanadium (V) | 85 | 1 | mg/kg | | 10/01/97 | CC |
| | | Zinc (Zn) | 119 | 0.5 | mg/kg | | 10/01/97 | CC |
| E709760-02 | 97-SC-W2 | | | | | | | |
| Sample Type:WATER | | | | | | | | |
| Collected:09/17/97 | | | | | | | | |
| | | **Hydride Metals in Water** | | | | | | |
| | | Antimony (Sb) | 0.0004 | 0.0004 | mg/L | | 09/25/97 | RG |
| | | Arsenic (As) | 0.0011 | 0.0004 | mg/L | | 09/25/97 | RG |
| | | Mercury (Hg), Total | <0.0002 | 0.0002 | mg/L | | 09/25/97 | RG |
| | | Selenium (Se) | <0.0004 | 0.0004 | mg/L | | 09/25/97 | RG |
| | | **Metals, Total** | | | | | | |
| | | Aluminum (Al) | 0.01 | 0.01 | mg/L | | 09/25/97 | RG |
| | | Barium (Ba) | 0.051 | 0.003 | mg/L | | 09/25/97 | RG |
| | | Beryllium (Be) | <0.002 | 0.002 | mg/L | | 09/25/97 | RG |
| | | Boron (B) | <0.05 | 0.05 | mg/L | | 09/25/97 | RG |
| | | Cadmium (Cd) | <0.001 | 0.001 | mg/L | | 09/25/97 | RG |
| | | Calcium (Ca) | 50.0 | 0.5 | mg/L | | 09/25/97 | RG |
| | | Chromium (Cr) | <0.005 | 0.005 | mg/L | | 09/25/97 | RG |
| | | Cobalt (Co) | <0.002 | 0.002 | mg/L | | 09/25/97 | RG |
| | | Copper (Cu) | <0.001 | 0.001 | mg/L | | 09/25/97 | RG |
| | | Iron (Fe) | 0.116 | 0.005 | mg/L | | 09/25/97 | RG |
| | | Lead (Pb) | <0.005 | 0.005 | mg/L | | 09/25/97 | RG |
| | | Magnesium (Mg) | 15.3 | 0.1 | mg/L | | 09/25/97 | RG |
| | | Manganese (Mn), Total | 0.062 | 0.001 | mg/L | | 09/25/97 | RG |
| | | Molybdenum (Mo) | <0.005 | 0.005 | mg/L | | 09/25/97 | RG |
| | | Nickel (Ni) | <0.002 | 0.002 | mg/L | | 09/25/97 | RG |
| | | Phosphorus (P) | <0.05 | 0.05 | mg/L | | 09/25/97 | RG |
| | | Potassium (K) | 2.1 | 0.1 | mg/L | | 09/25/97 | RG |
| | | Silicon (Si) | 4.09 | 0.1 | mg/L | | 10/01/97 | CC |
| | | Silver (Ag) | <0.005 | 0.005 | mg/L | | 09/25/97 | RG |
| | | Sodium (Na) | 9 | 1 | mg/L | | 09/25/97 | RG |
| | | Strontium (Sr) | 0.322 | 0.002 | mg/L | | 09/25/97 | RG |
| | | Thallium (Tl) | <0.05 | 0.05 | mg/L | | 09/25/97 | RG |
| | | Tin (Sn) | <0.05 | 0.05 | mg/L | | 09/25/97 | RG |
| | | Titanium (Ti) | <0.001 | 0.001 | mg/L | | 09/25/97 | RG |
| | | Vanadium (V) | <0.001 | 0.001 | mg/L | | 09/25/97 | RG |
| | | Zinc (Zn) | 0.010 | 0.001 | mg/L | | 09/25/97 | RG |

# ENVIRO-TEST CHEMICAL ANALYSIS REPORT

| LAB ID | SAMPLE ID | TEST DESCRIPTION | RESULT | D.L. | UNITS | EXTRACTED | ANALYZED | BY |
|---|---|---|---|---|---|---|---|---|
| E709760-03 | 97-MEN4-W1 | | | | | | | |
| Sample Type:WATER | | | | | | | | |
| Collected:09/19/97 | | | | | | | | |
| | | **BTEX/VPH/LEPH/HEPH in H2O** | | | | | | |
| | | **BTEX and VPH in Water** | | | | | | |
| | | Benzene | < 0.5 | 0.5 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Toluene | 5.3 | 0.5 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Ethylbenzene | < 0.5 | 0.5 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Xylenes | < 0.5 | 0.5 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Volatile Petroleum Hydrocarbon | < 100 | 100 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Heavy Extractables (Water) | 2300 | 50 | ug/L (ppb) | 09/23/97 | 09/26/97 | QVP |
| | | Light Extractables (Water) | 3900 | 50 | ug/L (ppb) | 09/23/97 | 09/26/97 | QVP |
| E709760-04 | 97-MEN5-W1 | | | | | | | |
| Sample Type:WATER | | | | | | | | |
| Collected:09/19/97 | | | | | | | | |
| | | **BTEX/VPH/LEPH/HEPH in H2O** | | | | | | |
| | | **BTEX and VPH in Water** | | | | | | |
| | | Benzene | < 0.5 | 0.5 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Toluene | 9.5 | 0.5 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Ethylbenzene | < 0.5 | 0.5 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Xylenes | < 0.5 | 0.5 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Volatile Petroleum Hydrocarbon | < 100 | 100 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Heavy Extractables (Water) | 2500 | 50 | ug/L (ppb) | 09/23/97 | 09/26/97 | QVP |
| | | Light Extractables (Water) | 6400 | 50 | ug/L (ppb) | 09/23/97 | 09/26/97 | QVP |
| | | **Routine Water Chemistry** | | | | | | |
| | | Balance | 90 | | % | | 09/29/97 | PY |
| | | Bicarbonate (HCO3) | <5 | 5 | mg/L | | 09/23/97 | PTT |
| | | Calcium (Ca) | 41.8 | 0.5 | mg/L | | 09/29/97 | PY |
| | | Carbonate (CO3) | <5 | 5 | mg/L | | 09/23/97 | PTT |
| | | Chloride (Cl) | 165 | 0.5 | mg/L | | 09/24/97 | MAR |
| | | Conductance (EC) | 963 | 0.2 | uS/cm | | 09/23/97 | PTT |
| | | Hardness | 168 | 1 | mg/L | | 09/29/97 | PY |
| | | Hydroxide | <5 | 5 | mg/L | | 09/23/97 | PTT |
| | | Magnesium (Mg) | 15.5 | 0.1 | mg/L | | 09/29/97 | PY |
| | | Nitrate+Nitrite (N) | <0.05 | 0.05 | mg/L | | 09/25/97 | MAR |
| | | pH in Water | 2.9 | | pH | | 09/23/97 | PTT |
| | | Potassium (K) | 5.0 | 0.1 | mg/L | | 09/29/97 | PY |
| | | Sodium (Na) | 27 | 1 | mg/L | | 09/29/97 | PY |
| | | Sulfate (SO4) | 26.0 | 0.5 | mg/L | | 09/29/97 | PY |
| | | TDS (Calculated) | 280 | 1 | mg/L | | 09/29/97 | PY |
| | | Total Alkalinity | <5 | 5 | mg/L | | 09/23/97 | PTT |
| E709760-05 | 97-MEN6-W1 | | | | | | | |
| Sample Type:WATER | | | | | | | | |
| Collected:09/19/97 | | | | | | | | |
| | | pH in Water | 2.8 | | pH | | 11/07/97 | PTT |
| | | **BTEX/VPH/LEPH/HEPH in H2O** | | | | | | |
| | | **BTEX and VPH in Water** | | | | | | |
| | | Benzene | < 0.5 | 0.5 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Toluene | 2.5 | 0.5 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Ethylbenzene | < 0.5 | 0.5 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Xylenes | < 0.5 | 0.5 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Volatile Petroleum Hydrocarbon | < 100 | 100 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Heavy Extractables (Water) | 3100 | 50 | ug/L (ppb) | 09/23/97 | 09/26/97 | QVP |
| | | Light Extractables (Water) | 6900 | 50 | ug/L (ppb) | 09/23/97 | 09/26/97 | QVP |
| E709760-06 | 97-MEN9-W1 | | | | | | | |
| Sample Type:WATER | | | | | | | | |
| Collected:09/19/97 | | | | | | | | |
| | | **BTEX/VPH/LEPH/HEPH in H2O** | | | | | | |
| | | **BTEX and VPH in Water** | | | | | | |
| | | Benzene | < 0.5 | 0.5 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Toluene | 29 | 0.5 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Ethylbenzene | < 0.5 | 0.5 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Xylenes | < 0.5 | 0.5 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Volatile Petroleum Hydrocarbon | < 100 | 100 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Heavy Extractables (Water) | 11000 | 50 | ug/L (ppb) | 09/23/97 | 09/26/97 | QVP |
| | | Light Extractables (Water) | 17000 | 50 | g/L (ppb) | 09/23/97 | 09/26/97 | QVP |

# ENVIRO-TEST CHEMICAL ANALYSIS REPORT

| LAB ID | SAMPLE ID | TEST DESCRIPTION | RESULT | D.L. | UNITS | EXTRACTED | ANALYZED | BY |
|---|---|---|---|---|---|---|---|---|
| E709760-07 | 97-MEN10-W1 | | | | | | | |
| Sample Type:WATER | | | | | | | | |
| Collected:09/19/97 | | | | | | | | |
| | | pH in Water | 7.2 | | pH | | 11/07/97 | PTT |
| | | **BTEX/VPH/LEPH/HEPH in H2O** | | | | | | |
| | | **BTEX and VPH in Water** | | | | | | |
| | | Benzene | < 0.5 | 0.5 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Toluene | 14 | 0.5 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Ethylbenzene | < 0.5 | 0.5 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Xylenes | < 0.5 | 0.5 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Volatile Petroleum Hydrocarbon | < 100 | 100 | ug/L (ppb) | 09/23/97 | 09/24/97 | YDY |
| | | Heavy Extractables (Water) | 2200 | 50 | ug/L (ppb) | 09/23/97 | 09/26/97 | QVP |
| | | Light Extractables (Water) | 5000 | 50 | ug/L (ppb) | 09/23/97 | 09/26/97 | QVP |
| E709760-08 | 97-SC-S1 | | | | | | | |
| Sample Type:SEDIMENT | | | | | | | | |
| Collected:09/17/97 | | | | | | | | |
| | | **Metals (SW3051)** | | | | | | |
| | | Barium (Ba) | 387 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Beryllium (Be) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Cadmium (Cd) | 0.6 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Chromium (Cr) | 67.4 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Cobalt (Co) | 19 | 1 | mg/kg | | 10/01/97 | CC |
| | | Copper (Cu) | 55 | 1 | mg/kg | | 10/01/97 | CC |
| | | Lead (Pb) | 34 | 5 | mg/kg | | 10/01/97 | CC |
| | | Molybdenum (Mo) | 4 | 1 | mg/kg | | 10/01/97 | CC |
| | | Nickel (Ni) | 67 | 2 | mg/kg | | 10/01/97 | CC |
| | | Silver (Ag) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Strontium (Sr) | 99 | 1 | mg/kg | | 10/01/97 | CC |
| | | Thallium (Tl) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Tin (Sn) | <5 | 5 | mg/kg | | 10/01/97 | CC |
| | | Vanadium (V) | 84 | 1 | mg/kg | | 10/01/97 | CC |
| | | Zinc (Zn) | 164 | 0.5 | mg/kg | | 10/01/97 | CC |
| E709760-09 | 97-SC-S2 | | | | | | | |
| Sample Type:SEDIMENT | | | | | | | | |
| Collected:09/17/97 | | | | | | | | |
| | | **Metals (SW3051)** | | | | | | |
| | | Barium (Ba) | 381 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Beryllium (Be) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Cadmium (Cd) | <0.5 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Chromium (Cr) | 62.4 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Cobalt (Co) | 18 | 1 | mg/kg | | 10/01/97 | CC |
| | | Copper (Cu) | 48 | 1 | mg/kg | | 10/01/97 | CC |
| | | Lead (Pb) | 23 | 5 | mg/kg | | 10/01/97 | CC |
| | | Molybdenum (Mo) | 3 | 1 | mg/kg | | 10/01/97 | CC |
| | | Nickel (Ni) | 64 | 2 | mg/kg | | 10/01/97 | CC |
| | | Silver (Ag) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Strontium (Sr) | 93 | 1 | mg/kg | | 10/01/97 | CC |
| | | Thallium (Tl) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Tin (Sn) | <5 | 5 | mg/kg | | 10/01/97 | CC |
| | | Vanadium (V) | 75 | 1 | mg/kg | | 10/01/97 | CC |
| | | Zinc (Zn) | 118 | 0.5 | mg/kg | | 10/01/97 | CC |
| E709760-10 | 97-SC-S3 | | | | | | | |
| Sample Type:SEDIMENT | | | | | | | | |
| Collected:09/17/97 | | | | | | | | |
| | | **Metals (SW3051)** | | | | | | |
| | | Barium (Ba) | 245 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Beryllium (Be) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Cadmium (Cd) | <0.5 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Chromium (Cr) | 43.5 | 0.5 | mg/kg | | 10/01/97 | CC |
| | | Cobalt (Co) | 13 | 1 | mg/kg | | 10/01/97 | CC |
| | | Copper (Cu) | 36 | 1 | mg/kg | | 10/01/97 | CC |
| | | Lead (Pb) | 28 | 5 | mg/kg | | 10/01/97 | CC |
| | | Molybdenum (Mo) | 13 | 1 | mg/kg | | 10/01/97 | CC |
| | | Nickel (Ni) | 42 | 2 | mg/kg | | 10/01/97 | CC |
| | | Silver (Ag) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Strontium (Sr) | 126 | 1 | mg/kg | | 10/01/97 | CC |
| | | Thallium (Tl) | <1 | 1 | mg/kg | | 10/01/97 | CC |
| | | Tin (Sn) | <5 | 5 | mg/kg | | 10/01/97 | CC |
| | | Vanadium (V) | 59 | 1 | mg/kg | | 10/01/97 | CC |
| | | Zinc (Zn) | 91.3 | 0.5 | mg/kg | | 10/01/97 | CC |

# ENVIRO-TEST CHEMICAL ANALYSIS REPORT

| LAB ID | SAMPLE ID | TEST DESCRIPTION | RESULT | D.L. | UNITS | EXTRACTED | ANALYZED | BY |
|---|---|---|---|---|---|---|---|---|
| E709760-11 | 97-CAN-ASB1 | | | | | | | |
| Sample Type:MATERIAL | | | | | | | | |
| Collected:09/17/97 | | | | | | | | |
| | | **Bulk Asbestos Content** | | | | | | |
| | | CHRYSOTILE | 10 | 1 | % | | 09/24/97 | ALK |
| E709760-12 | 97-TR-ASB1 | | | | | | | |
| Sample Type:TILE | | | | | | | | |
| Collected:09/17/97 | | | | | | | | |
| | | **Bulk Asbestos Content** | | | | | | |
| | | CHRYSOTILE | 10 | 1 | % | | 09/24/97 | ALK |
| E709760-13 | 97-TR-P1 | | | | | | | |
| Sample Type:PAINT | | | | | | | | |
| Collected:09/17/97 | | | | | | | | |
| | | Lead, (Pb) | 69 | 10 | mg/kg | | 10/06/97 | GC |
| | | **PCBs in Paint** | | | | | | |
| | | All Aroclors | <7.0 | * 7.0 | ug/g | 10/09/97 | 10/14/97 | CSI |

N.D. - NOT DETECTED, LESS THAN THE DETECTION LIMIT

THIS IS THE FINAL PAGE OF THE REPORT
NOT INCLUDING APPENDICES

# ENVIRO-TEST QC REPORT

| PARAMETER | SPIKES | | | | DUPLICATES | | | QCS/SRM | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Level (ppm) | %REC | 95%CI Low | 95%CI High | RPD | 95%CI Low | 95%CI High | Level (ppm) | AMT (ppm) | 95%CI Low | 95%CI High |
| **Metals (SW3051)** | | | | | | | | | | | |
| Barium (Ba) | 0.5 | 91.7 | 58.5 | 124.8 | 2.3 | 0 | 6.7 | 83 | 72 | 50 | 93 |
| Beryllium (Be) | 0.5 | 99.2 | 74.2 | 124.1 | 2.1 | 0 | 6.3 | N.A | | | |
| Cadmium (Cd) | 0.25 | 107.3 | 83.0 | 131.6 | 2.4 | 0 | 7.0 | 3.0 | 3.0 | 2.2 | 3.8 |
| Chromium (Cr) | 0.5 | 96.0 | 72.6 | 119.3 | 2.4 | 0 | 7.0 | 80.0 | 72.2 | 60.9 | 83.4 |
| Cobalt (Co) | 0.5 | 93.1 | 71.0 | 115.2 | 2.3 | 0 | 6.8 | 11.0 | 8.2 | 6.9 | 9.5 |
| Copper (Cu) | 0.5 | 98.4 | 79.1 | 117.6 | 2.6 | 0 | 7.8 | 80.0 | 80.9 | 70.8 | 91.0 |
| Lead (Pb) | 0.5 | 96.3 | 77.0 | 115.5 | 2.5 | 0 | 7.4 | 145 | 130.7 | 110.4 | 151.1 |
| Molybdenum (Mo) | 0.5 | 96.4 | 75.9 | 116.9 | 2.3 | 0 | 6.8 | N.A | | | |
| Nickel (Ni) | 0.5 | 96.8 | 77.4 | 116.2 | 2.6 | 0 | 7.7 | 37.0 | 33.4 | 25.3 | 41.5 |
| Silver (Ag) | 0.5 | 98.2 | 73.9 | 122.5 | 3.0 | 0 | 8.9 | N.A | | | |
| Strontium (Sr) | 0.25 | 92.5 | 71.3 | 113.6 | 3.1 | 0 | 9.2 | 32.0 | 35.4 | 28.2 | 42.6 |
| Thallium (Tl) | 0.5 | 100.3 | 83.3 | 117.3 | 2.7 | 0 | 8.0 | N.A | | | |
| Tin (Sn) | 0.5 | 97.9 | 73.2 | 122.6 | 2.8 | 0 | 8.4 | N.A | | | |
| Vanadium (V) | 0.5 | 97.3 | 75.3 | 119.2 | 2.2 | 0 | 6.5 | 23.0 | 16.8 | 6.2 | 27.4 |
| Zinc (Zn) | 0.5 | 97.2 | 72.5 | 121.9 | 2.7 | 0 | 8.2 | 500.0 | 352.8 | 311.3 | 394.4 |

QCS/SRM: QUALITY STANDARD (CERTIFIED) OR STANDARD REFERENCE MATERIAL (NIST TRACEABLE)
Level: TARGET VALUE(ppm)
%REC: PERCENT RECOVERY
95%CI: 95 % CONFIDENCE INTERVALS
RPD: RELATIVE % DIFFERENCE
AMT: AMOUNT RECOVERED
N.A.: QC DATA UNAVAILABLE
THE ABOVE HISTORICAL REPORT PROVIDES A SUMMARY OF QC DATA COLLECTED OVER A PERIOD OF TIME (UP TO ONE YEAR). THIS REPORT IS UPDATED ON A SEMI-ANNUAL BASIS.

THIS IS THE FINAL PAGE OF THE QC HISTORICAL REPORT.

# ENVIRO-TEST QA/QC REPORT

**BTEX and VPH in Soil**
**Tier1-PAHs in Soil**

| Surrogate Recovery for E70975114A | % |
|---|---|
| Nitrobenzene d5 | 79 |
| 2-Fluorobiphenyl | 84 |
| p-Terphenyl d14 | 104 |

| Surrogate Recovery for E70975117A | % |
|---|---|
| Nitrobenzene d5 | 75 |
| 2-Fluorobiphenyl | 87 |
| p-Terphenyl d14 | 109 |

| Surrogate Recovery for E70975118A | % |
|---|---|
| Nitrobenzene d5 | 91 |
| 2-Fluorobiphenyl | 91 |
| p-Terphenyl d14 | 103 |

| Surrogate Recovery for E70975119A | % |
|---|---|
| Nitrobenzene d5 | 85 |
| 2-Fluorobiphenyl | 84 |
| p-Terphenyl d14 | 98 |

| Surrogate Recovery for E70975121A | % |
|---|---|
| Nitrobenzene d5 | 84 |
| 2-Fluorobiphenyl | 83 |
| p-Terphenyl d14 | 101 |

| Surrogate Recovery for E70975122A | % |
|---|---|
| Nitrobenzene d5 | 91 |
| 2-Fluorobiphenyl | 89 |
| p-Terphenyl d14 | 107 |

*Relative percent difference is expressed as RPD.*
*Percent Recovery is expressed as %.*
THIS IS THE LAST PAGE OF THE QAQC REPORT

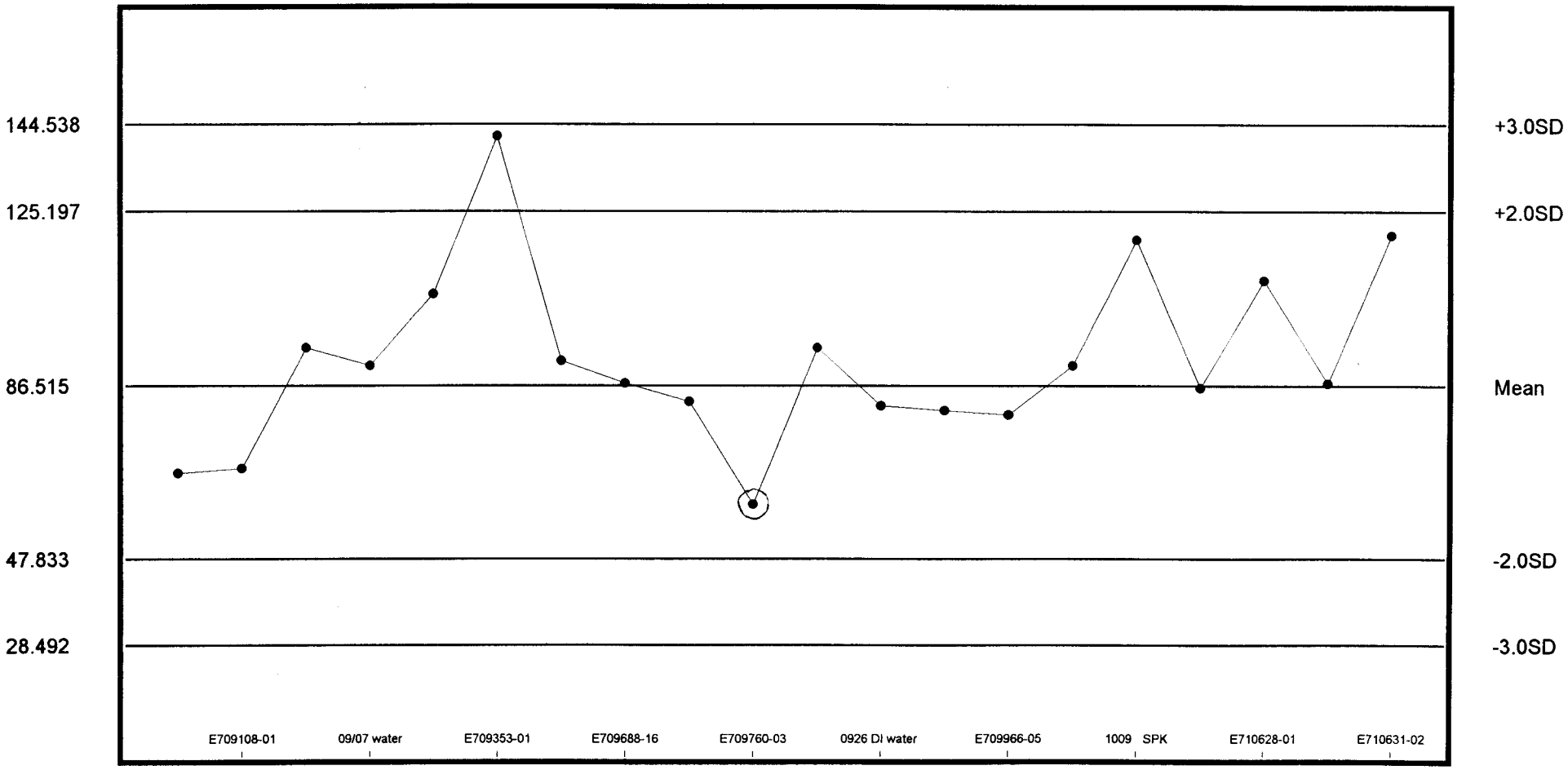
Total Extractable Hydrocarbons in water spikes

Statistics for file: H:\QCCHARTS\ORGANIC\UST\TEHWTSPK.CCP
% Recovery Column
n = 33
Mean = 86.5152
Std Dev = 19.3409
%CV = 22.36
Min = 57.0000
Max = 142.0000

| | Lab # | Analyst | Spike Level (ppm) | % Recovery | Bundle date | F |
|---|---|---|---|---|---|---|
| 225 | 09/02 DI WATE | CAH | | 67 | 9/2/97 | CHAN A |
| 226 | E709108-01 | QVP | 13.154 | 68 | 9/4/97 | Channel A |
| 227 | 0908 water | QVP | 13.154 | 95 | 9/8/97 | Channel B |
| 228 | 09/07 water | QVP | 13.154 | 91 | 9/8/97 | Channel A |
| 229 | E709309-03 | CAH | | 107 | 9/10/97 | CHAN A |
| 230 | E709353-01 | CAH | | 142 | 9/17/97 | CHAN B |
| 231 | 09/16 WATER | CAH | | 92 | 9/16/97 | CHAN B |
| 232 | E709688-16 | YDY | 10.914 | 87 | 9/21/97 | CHANNEL |
| 233 | 0922 DI WTR | YDY | 10.337 | 83 | 9/22/97 | CHANNEL |
| 234 | E709760-03 | QVP | 12.5 | 60 | 9/25/97 | Channel B |
| 235 | 0926 DI water | QVP | 12.5 | 95 | 9/27/97 | Channel A |
| 236 | 0926 DI water | QVP | 12.5 | 82 | 9/28/97 | Channel A |
| 237 | DI water | QVP | 12.5 | 81 | 9/28/97 | Channel B |
| 238 | E709966-05 | QVP | 12.5 | 80 | 9/30/97 | Channel A |
| 239 | E710191-01 | CAH | | 91 | 10/6/97 | SIDE B |
| 240 | 1009 SPK | YDY | 14.86223 | 119 | 10/9/97 | SIDE A |
| 241 | DI water 10/16 | QVP | 12.5 | 86 | 10/17/97 | SIDE B |
| 242 | E710628-01 | QVP | 12.5 | 110 | 10/18/97 | SIDE A |
| 243 | DI water (+) | QVP | 12.5 | 87 | 10/18/97 | SIDE B |
| 244 | E710631-02 | QVP | 12.5 | 120 | 10/21/97 | SIDE A |
| 245 | E710671-01 | QVP | 12.5 | 95 | 10/21/97 | SIDE B |
| 246 | E710719-01 | QVP | 12.5 | 64 | 10/23/97 | SIDE A |
| 247 | E710855-03 | CAH | | 109 | 10/24/97 | SIDE A |
| 248 | E710641-02 | CAH | | 69 | 10/24/97 | SIDE A |
| 249 | DI WATER | CAH | | 76 | 10/26/97 | SIDE A |
| 250 | DI WATER | CAH | | 75 | 10/26/97 | SIDE B |
| 251 | E710969-02 | CAH | | 67 | 10/27/97 | SIDE A |
| 252 | DI WATER | CAH | | 100 | 10/27/97 | SIDE A |
| 253 | DI WATER | CAH | | 57 | 10/27/97 | SIDE B |
| 254 | DI WATER | CAH | 11.299 | 90 | 10/29/97 | SIDE A |
| 255 | DI WATER | CAH | 7.883 | 63 | 10/29/97 | SIDE B |
| 256 | E710C30-04B | YDY | 9.70745 | 77 | 11/1/97 | SIDE A |
| 257 | E710B55-25A | YDY | 8.74057 | 70 | 11/1/97 | SIDE A |

**Total Extractable Hydrocarbons in Water Spike Recoveries**

**Last updated: NOV 18, 1997**




n= 33 Mean= 86.515 SD= 19.341 CV= 22.36% Min= 57.000 Max= 142.000

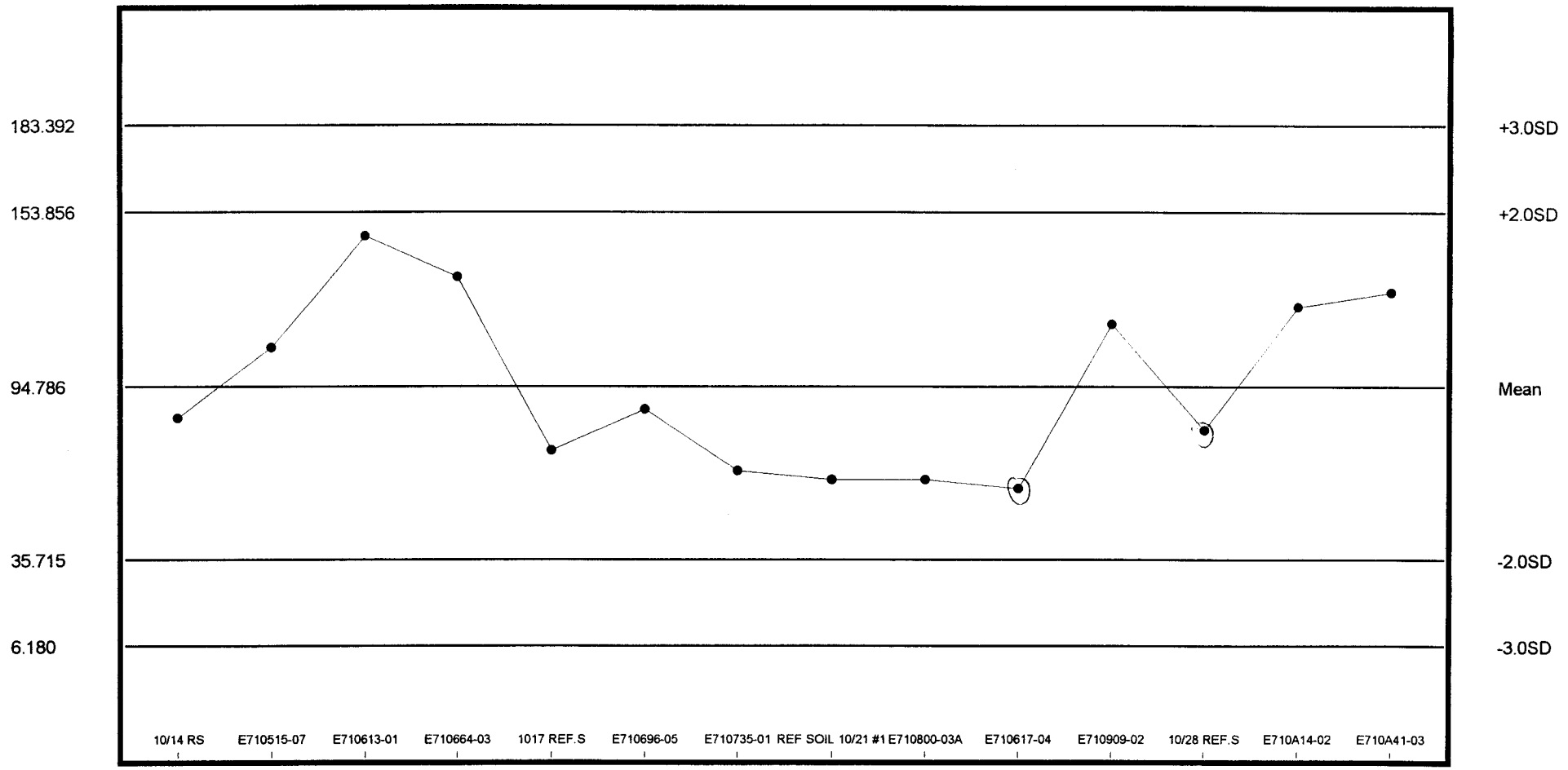
File: H:\QCCHARTS\ORGANIC\UST\TEHWTSPK.CCP

Column % Recovery

Total Extractable Hydrocarbons in soil spikes
Statistics for file: H:\QCCHARTS\ORGANIC\UST\TEHSLSPK.CCP
% Recovery Column
n = 30
Mean = 100.0333
Std Dev = 31.6059
%CV = 31.60
Min = 49.0000
Max = 161.0000

| | Lab # | Analyst | Spike Level (ppm) | % Recovery | E | F |
|---|---|---|---|---|---|---|
| 361 | E709729-01 | QVP | 305 | 132 | 9/23/97 | 3600A |
| 362 | E709754-01 | THT | 212 | 101 | 9/23/97 | 3600 B |
| 363 | E709881-01 | THT | 114.9 | 61 | 9/25/97 | 3600 A |
| 364 | E709949-06 | THT | 269 | 66 | 9/27/97 | 3600 B |
| 365 | E709938-16 | THT | 200 | 49 | 9/27/97 | 3600 A |
| 366 | E709751-07 | CAH | | 106 | 9/26/97 | 3600 B |
| 367 | E709831-04 | CAH | | 118 | 9/26/97 | 3600 A |
| 368 | E709656-12 | CAH | | 90 | 9/26/97 | 3600 B |
| 369 | E709977-05 | CAH | | 120 | 9/29/97 | 3600 A |
| 370 | E709938-16 | CAH | | 118 | 9/29/97 | 3600 B |
| 371 | E709A11-04 | CAH | | 151 | 10/1/97 | 3600 B |
| 372 | 1001 REF SOIL #1 | CAH | | 161 | 10/1/97 | 3600 A |
| 373 | 1001 REF SOIL #2 | CAH | | 132 | 10/1/97 | 3600 B |
| 374 | E709720-09B | YDY | 456.63 | 95 | 10/7/97 | 3600 A |
| 375 | 1008 REF.S | YDY | 105.53 | 56 | 10/8/97 | 3600 A |
| 376 | E710354-02 | THT | 322 | 133 | 10/9/97 | 3600 B |
| 377 | E710368-06 | YDY | 254.48 | 117 | 10/10/97 | 3600 A |
| 378 | E710423-02 | YDY | 187.02 | 117 | 10/11/97 | 3600 B |
| 379 | 10/14 RS | QVP | 135.35 | 84 | 10/15/97 | 3600A |
| 380 | E710515-07 | QVP | 238 | 108 | 10/15/97 | 3600B |
| 381 | E710613-01 | THT | 330 | 146 | 10/17/97 | 3600 A |
| 382 | E710664-03 | THT | 242.6 | 132 | 10/20/97 | 3600 A |
| 383 | 1017 REF.S | THT | 163.5 | 73 | 10/19/97 | 3600 A |
| 384 | E710696-05 | CAH | | 87 | 10/20/97 | 3600 B |
| 385 | E710735-01 | CAH | | 66 | 10/22/97 | 3600 A |
| 386 | REF SOIL 10/21 #1 | CAH | | 63 | 10/22/97 | 3600 A |
| 387 | E710800-03A | CAH | | 63 | 10/23/97 | 3600 A |
| 388 | E710617-04 | CAH | | 60 | 10/24/97 | 3600 B |
| 389 | E710909-02 | YDY | 229.91 | 116 | 10/28/97 | 3600 A |
| 390 | 10/28 REF.S | YDY | 138.42 | 80 | 10/28/97 | 3600 A |

## Total Extractable Hydrocarbons in Soil Spike Recoveries

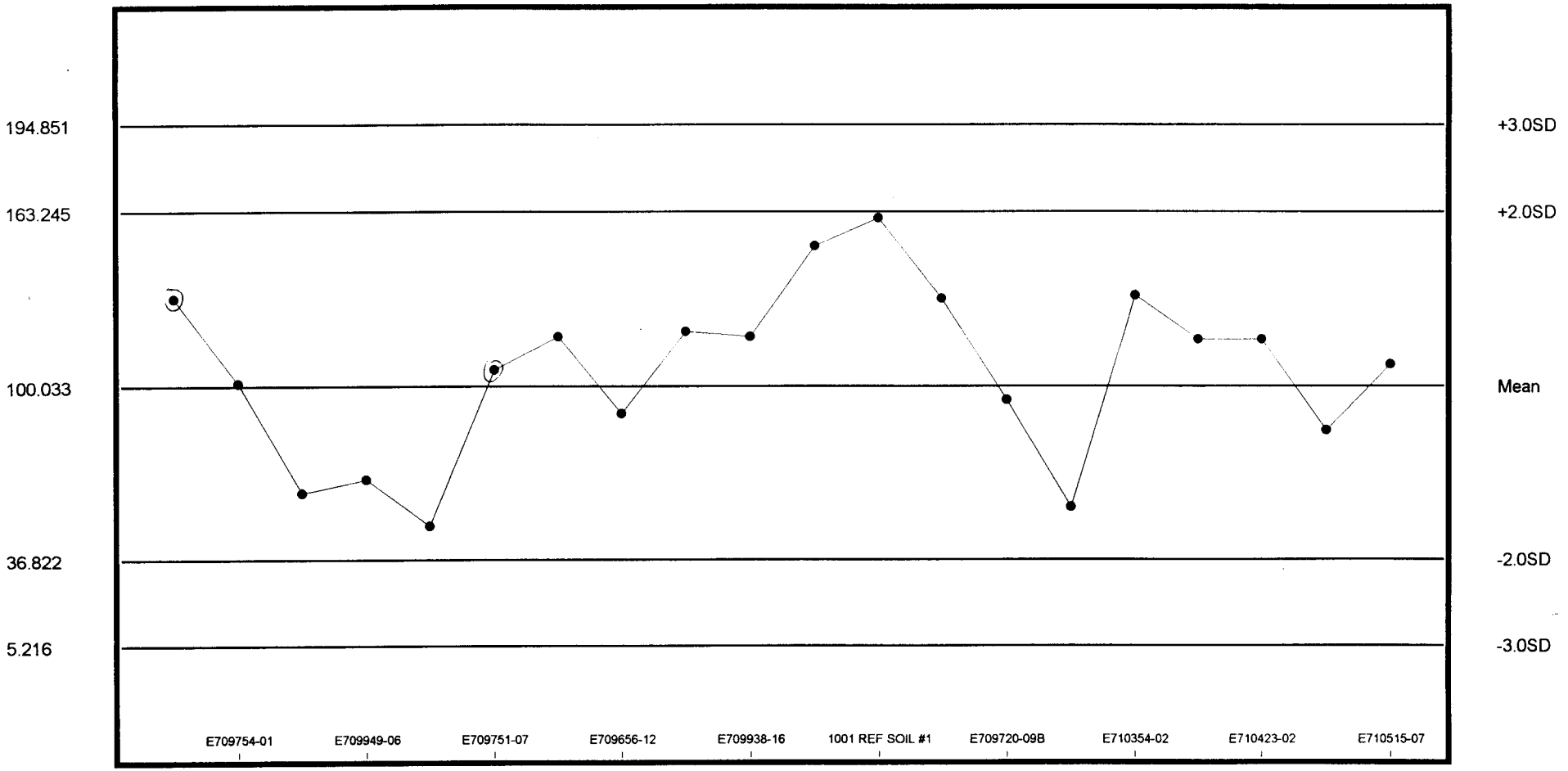



n= 14 Mean= 94.786 SD= 29.535 CV= 31.16% Min= 60.000 Max= 146.000

File: H:\QCCHARTS\ORGANIC\UST\TEHSLSPK.CCP

Column % Recovery

**Total Extractable Hydrocarbons in Soil Spike Recoveries**




n= 30 Mean= 100.033 SD= 31.606 CV= 31.60% Min= 49.000 Max= 161.000

File: H:\QCCHARTS\ORGANIC\UST\TEHSLSPK.CCP

Column % Recovery

# Appendix A Test Methodologies

## Acid Digestion

Preparation: Microwave digestion of sample in a closed vessel with concentrated nitric acid on a wet or dry soil/solids
Reference: E.P.A. SW 846 Method 3051

## BTEX and VPH in Soil

PREPARATION METHOD: Methanol extraction with purge and trap analysis.

INSTRUMENTAL METHOD: GC/PID for BTEX.
GC/FID for VPH - summation of hydrocarbons from C5 to C9 carbon range and is calculated against m+p-Xylenes.
NOTE: Results based upon dry weight.

METHOD REFERENCE: Modified SW-846 USEPA Method 5030 and 8015/8020.

BTEX QC SUMMARY:

| Accuracy | Precision |
|---|---|
| 97% | +/- 22% |

NOTE: Accuracy is expressed as the average % recovery and Precision as the relative standard deviation (RSD) of fortifications made using certified standards (BTEX).

## ICP Method Descriptions

Metals by Inductively Coupled Plasma in digests of soils/solids
METHOD REFERENCE: E.P.A. SW846 Method 6010
NOTE: Wavelengths selected for analysis are the determination of the laboratory

*The actual detection limits reported will vary with the digestion extraction ratio.
NOTE: Wavelenghts and detection limits may vary with matrix and sample composition.

## % Moisture

Preparation Method: Sample is oven dried at 105 degrees C
Instrumental Method: Gravimetric analysis

## Tier1-PAHs in Soil

Preparation Method: Soxhlet extraction with DCM or by accelerated solvent extraction with DCM/Acetone

Instrument Method: GC/MSD analysis

Method Reference: Extraction Method: EPA 3540 (modified) or EPA 3545 (modified)
Analytical Method: EPA 8270 (modified)

## Dry and Grind

PREPARATION METHOD: Sample is air dried and ground to pass a 2 mm sieve

## Light Extractables (Soil)

PREPARATION METHOD: Shake and sonication extraction with organic solvent

INSTRUMENTAL METHOD: GC/FID - summation of hydrocarbons from C10 to C18 carbon

# Appendix A Test Methodologies

range (excluding benzene, toluene, ethylbenzene, and xylenes) and calculated against a calibrated n-decane standard. Result is not corrected for PAH concentration. NOTE: Results based upon dry weight.

METHOD REFERENCE: Modified SW-846 USEPA Method 3550/3580 and 8000

## Heavy Extractables (Soil)

PREPARATION METHOD: Shake and sonication extraction with organic solvent

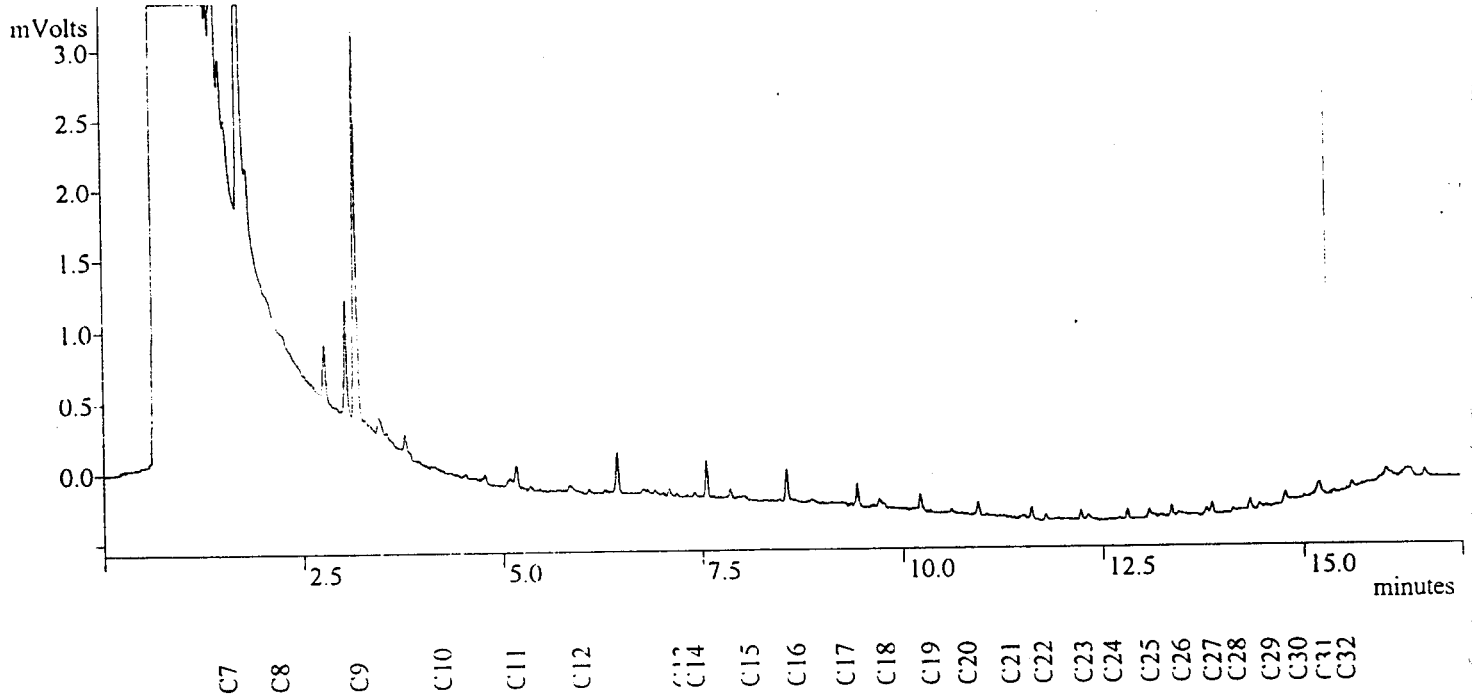
INSTRUMENTAL METHOD: GC/FID - summation of hydrocarbons from C19 to C32 carbon range (excluding benzene, toluene, ethylbenzene, and xylenes) and calculated against a calibrated n-eicosane standard. Result is not corrected for PAH concentration. NOTE: Results based upon dry weight.

METHOD REFERENCE: Modified SW-846 USEPA Method 3550/3580 and 8000

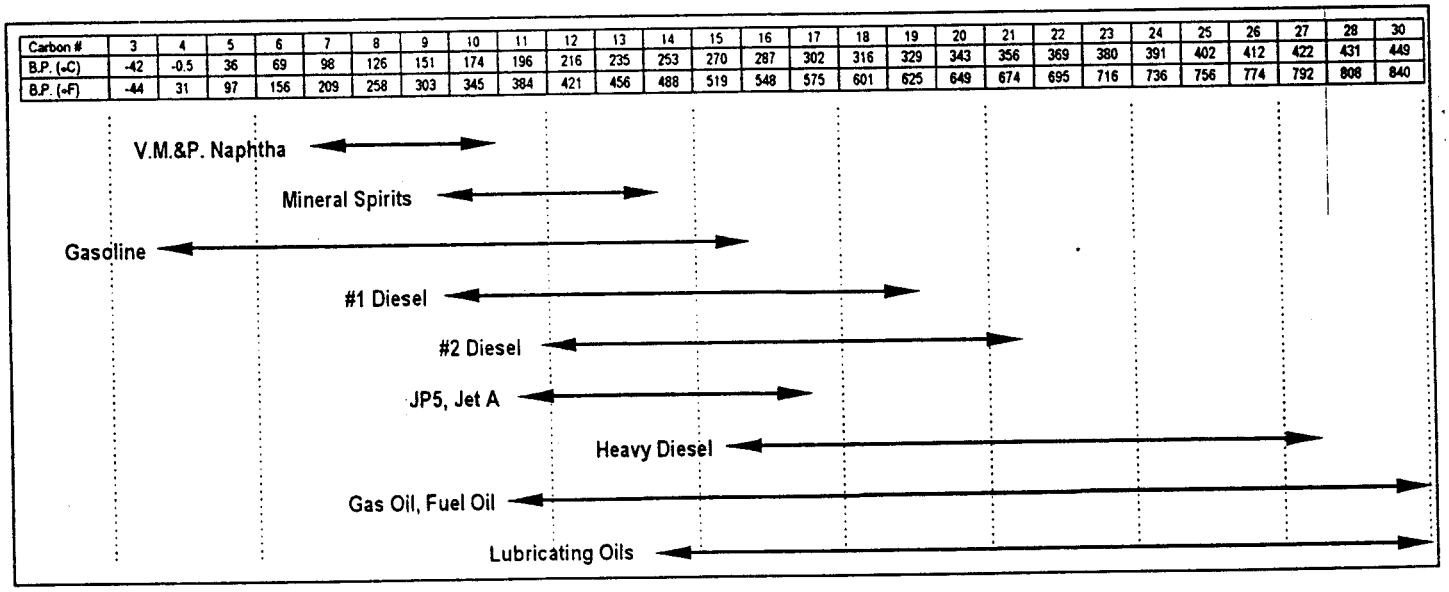
THIS IS THE LAST PAGE OF THE METHODOLOGY APPENDIX.

**CLIENT I.D.:** 97-SC-S7-0.5

| | |
|---|---|
| Data File: | c:\star\module18\star281.run |
| Sample ID: | E709751-01-10 |
| Injection Date: | 09/24/97 10:33:08 AM |
| Instrument (Inj): | GC 3600 SIDE B |




| Carbon # | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B.P. (-C) | -42 | -0.5 | 36 | 69 | 98 | 126 | 151 | 174 | 196 | 216 | 235 | 253 | 270 | 287 | 302 | 316 | 329 | 343 | 356 | 369 | 380 | 391 | 402 | 412 | 422 | 431 | 449 |
| B.P. (-F) | -44 | 31 | 97 | 156 | 209 | 258 | 303 | 345 | 384 | 421 | 456 | 488 | 519 | 548 | 575 | 601 | 625 | 649 | 674 | 695 | 716 | 736 | 756 | 774 | 792 | 808 | 840 |

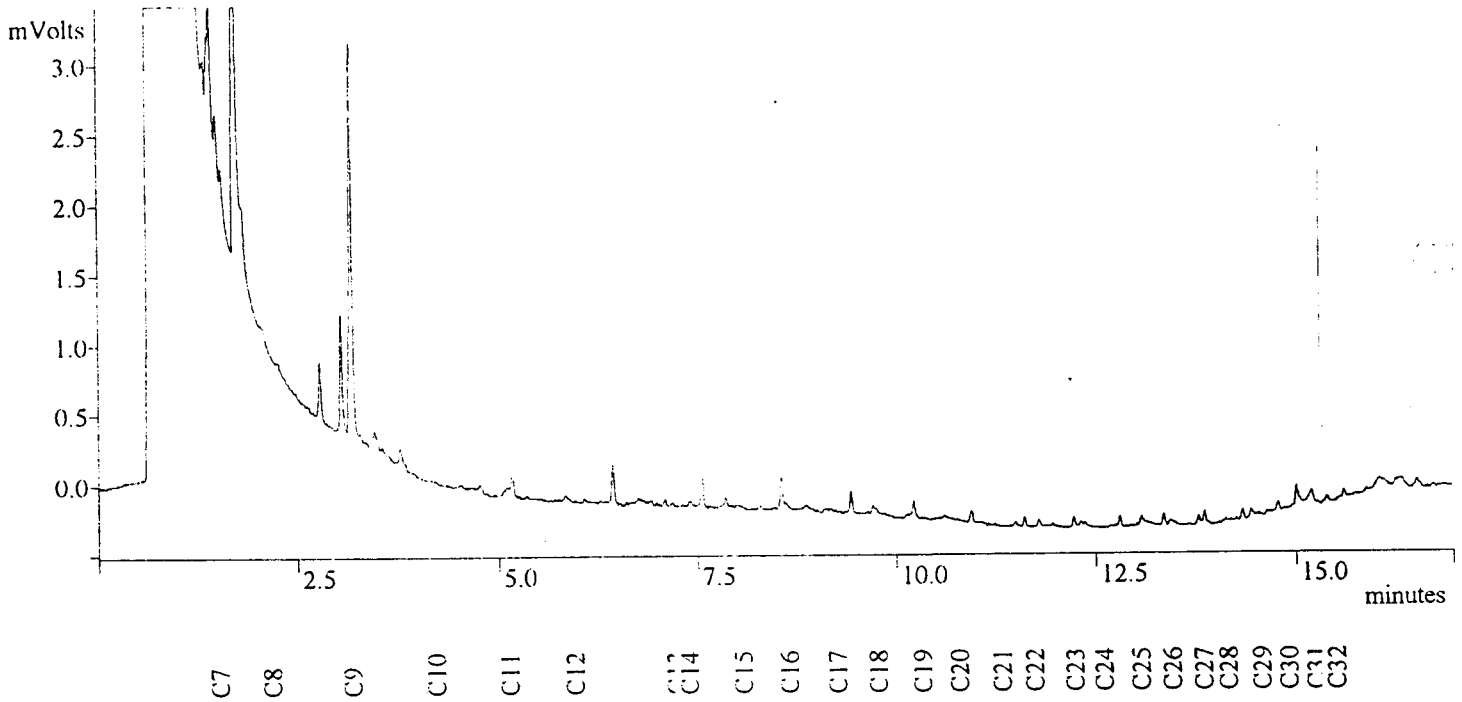



## Boiling Point Distribution Range for Petroleum Based Fuel Products

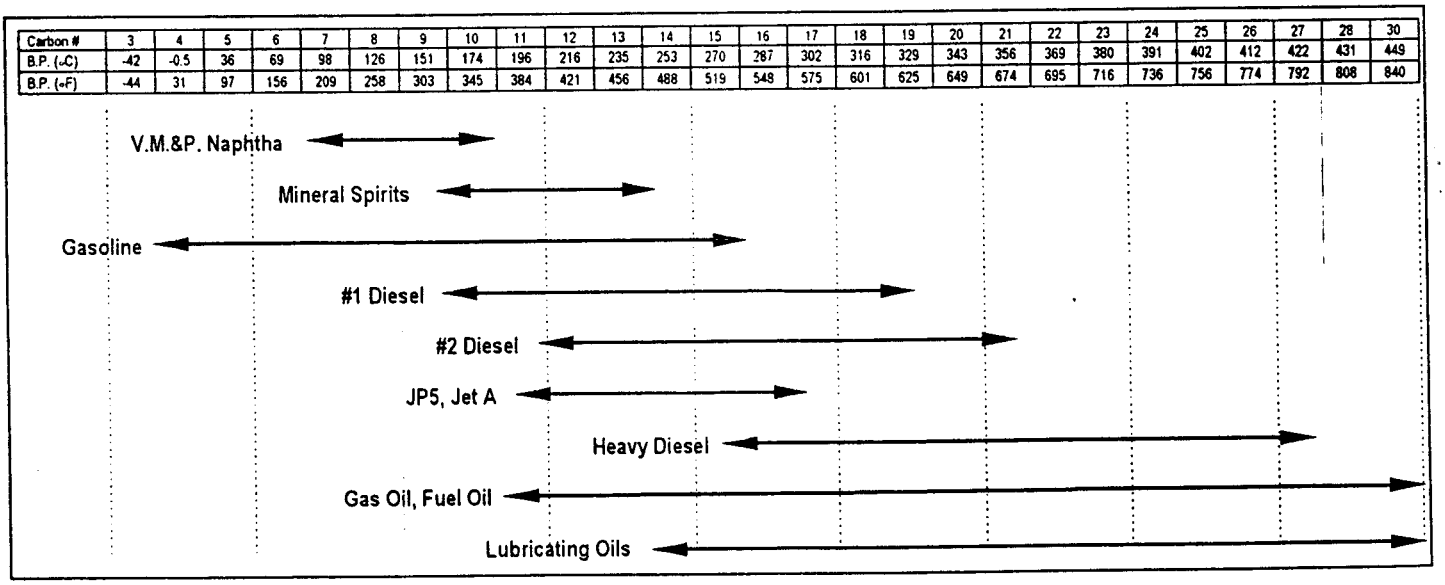
Adapted from: Drews, A.W., ED; Manual on Hydrocarbon Anaysis; 4th ed.; American Society for Testing and Materials: Philadelphia, PA, 1989; p XVIII.

**CLIENT I.D.:** 97-SC-S9-0.5

| | |
|---|---|
| Data File: | c:\star\module18\star282.run |
| Sample ID: | E709751-04-10 |
| Injection Date: | 09/24/97 11:06:45 AM |
| Instrument (Inj): | GC 3600 SIDE B |




| Carbon # | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B.P. (-C) | -42 | -0.5 | 36 | 69 | 98 | 126 | 151 | 174 | 196 | 216 | 235 | 253 | 270 | 287 | 302 | 316 | 329 | 343 | 356 | 369 | 380 | 391 | 402 | 412 | 422 | 431 | 449 |
| B.P. (-F) | -44 | 31 | 97 | 156 | 209 | 258 | 303 | 345 | 384 | 421 | 456 | 488 | 519 | 548 | 575 | 601 | 625 | 649 | 674 | 695 | 716 | 736 | 756 | 774 | 792 | 808 | 840 |

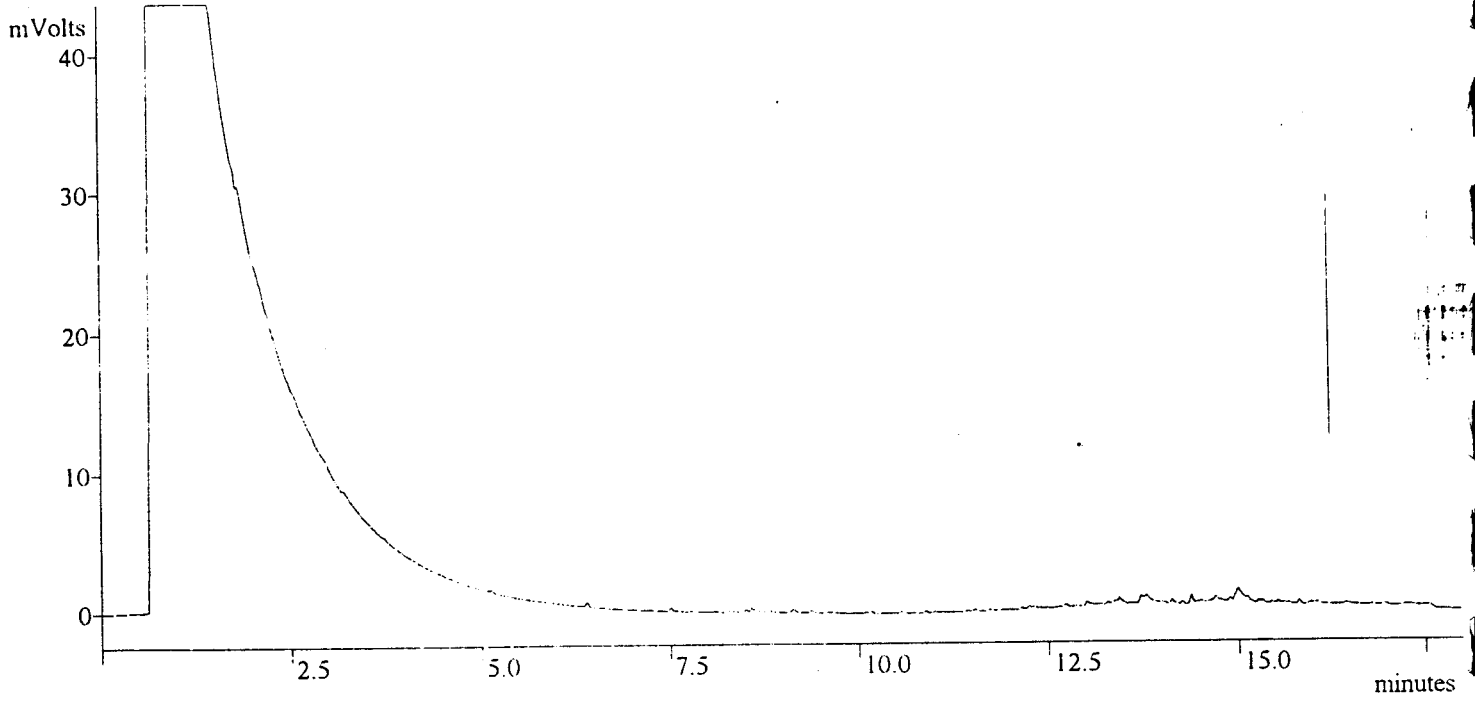



## Boiling Point Distribution Range for Petroleum Based Fuel Products

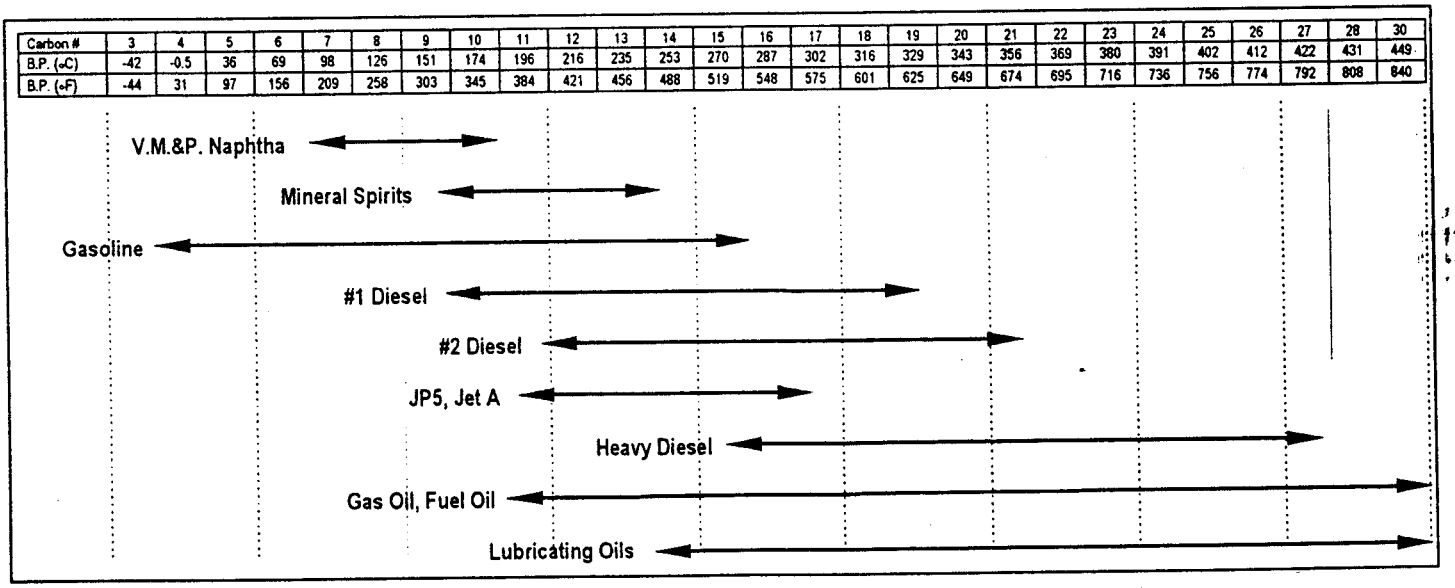
Adapted from: Drews, A.W., ED; Manual on Hydrocarbon Anaysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA, 1989; p XVIII.

**CLIENT I.D.:** 97-SC-S10-0.1

| | |
|---|---|
| Data File: | c:\star\module16\star306.run |
| Sample ID: | E709751-05-10 rein |
| Injection Date: | 09/24/97 07:12:01 PM |
| Instrument (Inj): | GC 3600 SIDE A |




| Carbon # | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B.P. (•C) | -42 | -0.5 | 36 | 69 | 98 | 126 | 151 | 174 | 196 | 216 | 235 | 253 | 270 | 287 | 302 | 316 | 329 | 343 | 356 | 369 | 380 | 391 | 402 | 412 | 422 | 431 | 449 |
| B.P. (•F) | -44 | 31 | 97 | 156 | 209 | 258 | 303 | 345 | 384 | 421 | 456 | 488 | 519 | 548 | 575 | 601 | 625 | 649 | 674 | 695 | 716 | 736 | 756 | 774 | 792 | 808 | 840 |

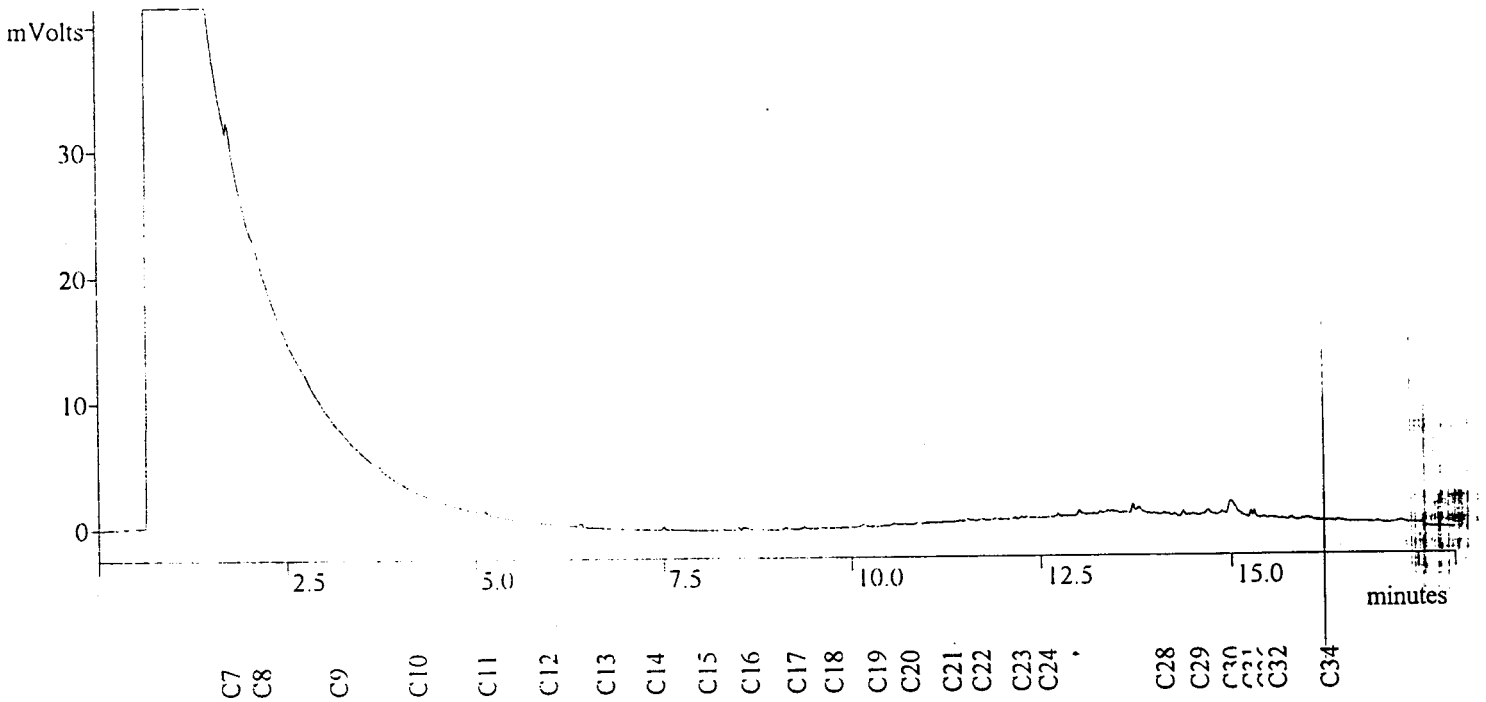



## Boiling Point Distribution Range for Petroleum Based Fuel Products

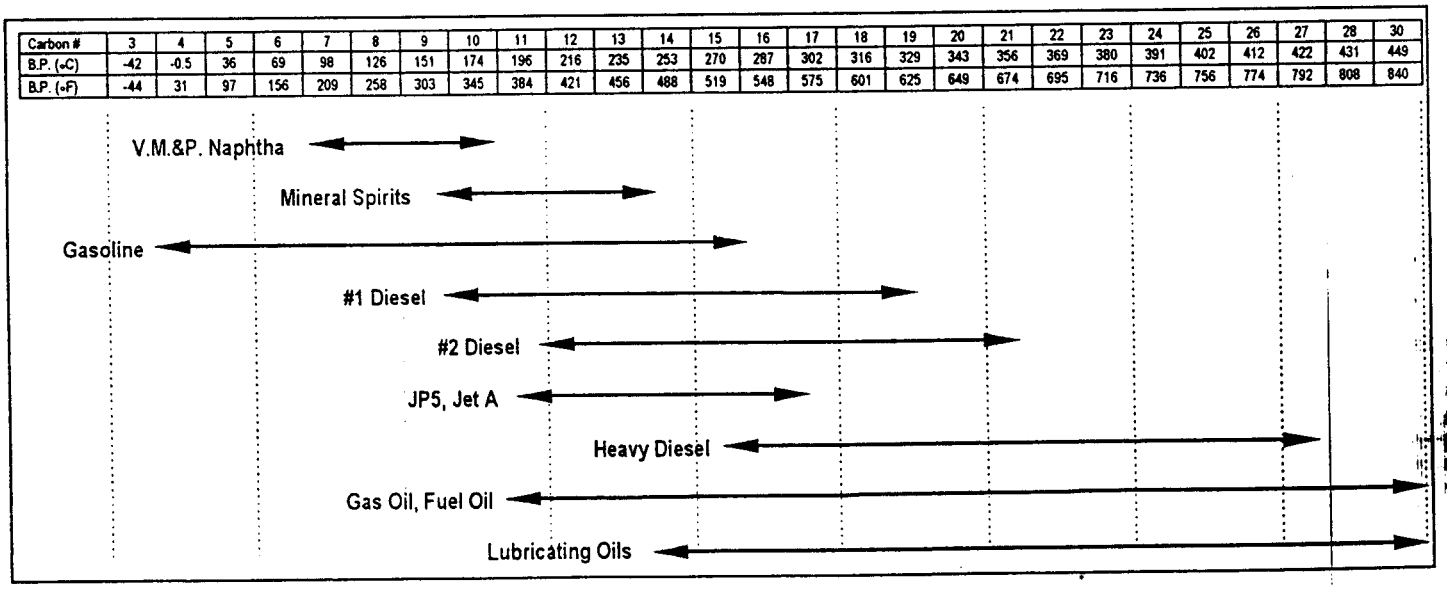
Adapted from: Drews, A.W., ED; Manual on Hydrocarbon Anaysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA, 1989: p XVIII.

**CLIENT I.D.:** 97-SC-S11-0.1

| | |
|---|---|
| Data File: | c:\star\module16\star307.run |
| Sample ID: | 1:709751-06-10 rein |
| Injection Date: | 09/24/97 07:44:39 PM |
| Instrument (Inj): | GC 3600 SIDE A |




| Carbon # | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B.P. (•C) | -42 | -0.5 | 36 | 69 | 98 | 126 | 151 | 174 | 196 | 216 | 235 | 253 | 270 | 287 | 302 | 316 | 329 | 343 | 356 | 369 | 380 | 391 | 402 | 412 | 422 | 431 | 449 |
| B.P. (•F) | -44 | 31 | 97 | 156 | 209 | 258 | 303 | 345 | 384 | 421 | 456 | 488 | 519 | 548 | 575 | 601 | 625 | 649 | 674 | 695 | 716 | 736 | 756 | 774 | 792 | 808 | 840 |

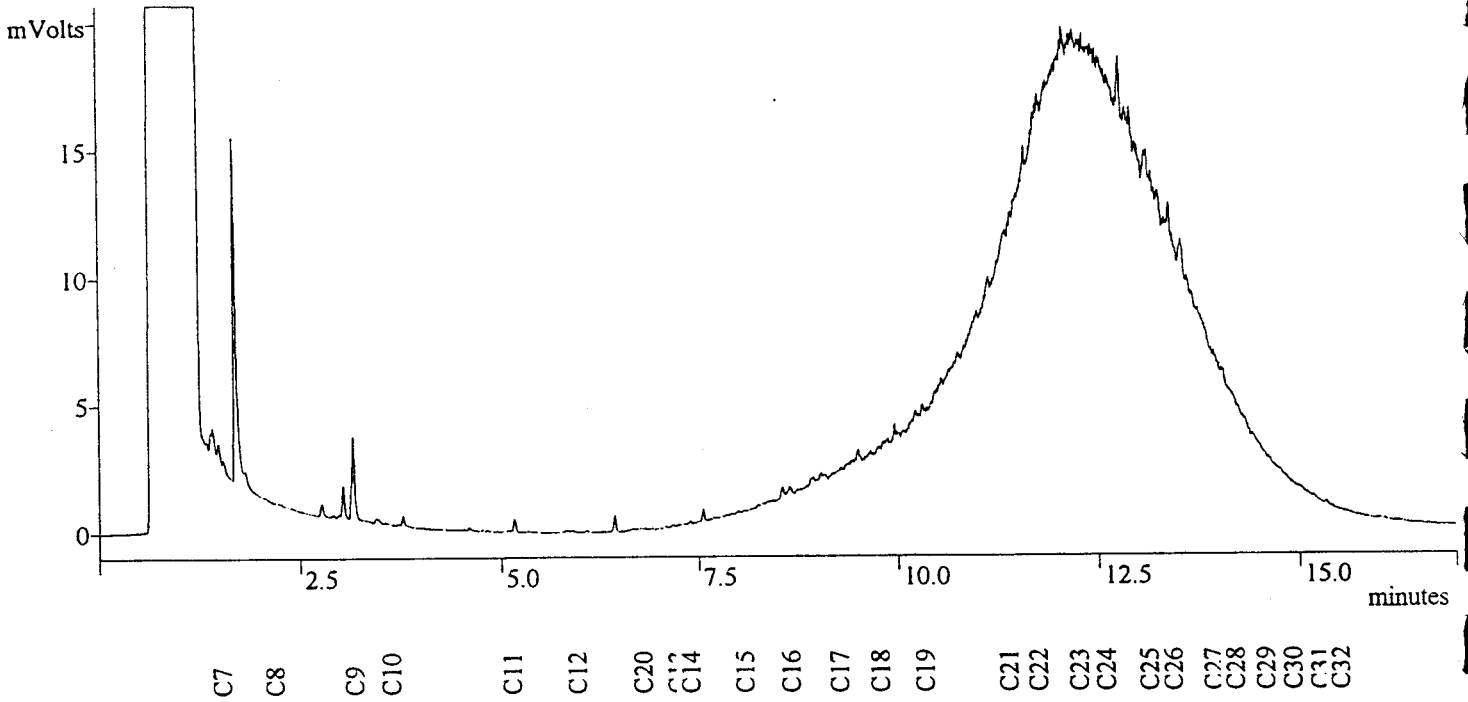



## Boiling Point Distribution Range for Petroleum Based Fuel Products

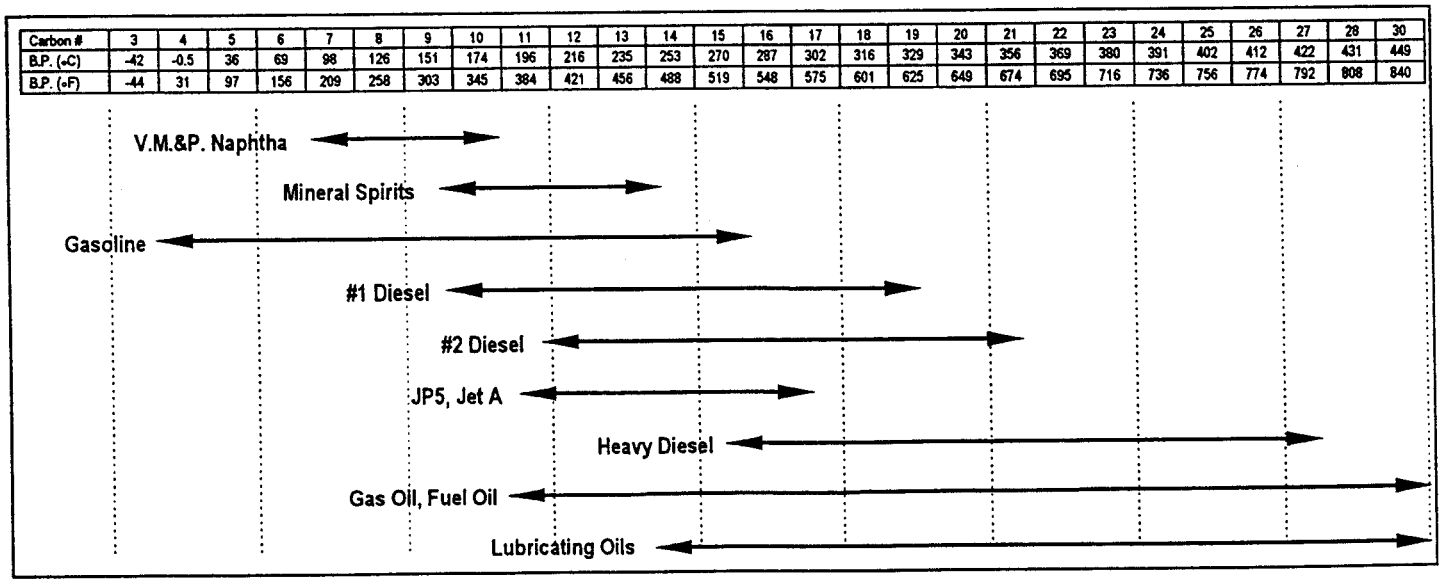
Adapted from: Drews, A.W.., ED; Manual on Hydrocarbon Anaysis, 4th ed.: American Society for Testing and Materials: Philadelphia, PA, 1989: p XVIII.

**CLIENT I.D.:** 97-SC-S12-0.1

| | |
|---|---|
| Data File: | c:\star\module18\star296.run |
| Sample ID: | E709751-07-10 rein |
| Injection Date: | 09/24/97 07:44:39 PM |
| Instrument (Inj): | GC 3600 SIDE B |




| Carbon # | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B.P. (•C) | -42 | -0.5 | 36 | 69 | 98 | 126 | 151 | 174 | 196 | 216 | 235 | 253 | 270 | 287 | 302 | 316 | 329 | 343 | 356 | 369 | 380 | 391 | 402 | 412 | 422 | 431 | 449 |
| B.P. (•F) | -44 | 31 | 97 | 156 | 209 | 258 | 303 | 345 | 384 | 421 | 456 | 488 | 519 | 548 | 575 | 601 | 625 | 649 | 674 | 695 | 716 | 736 | 756 | 774 | 792 | 808 | 840 |

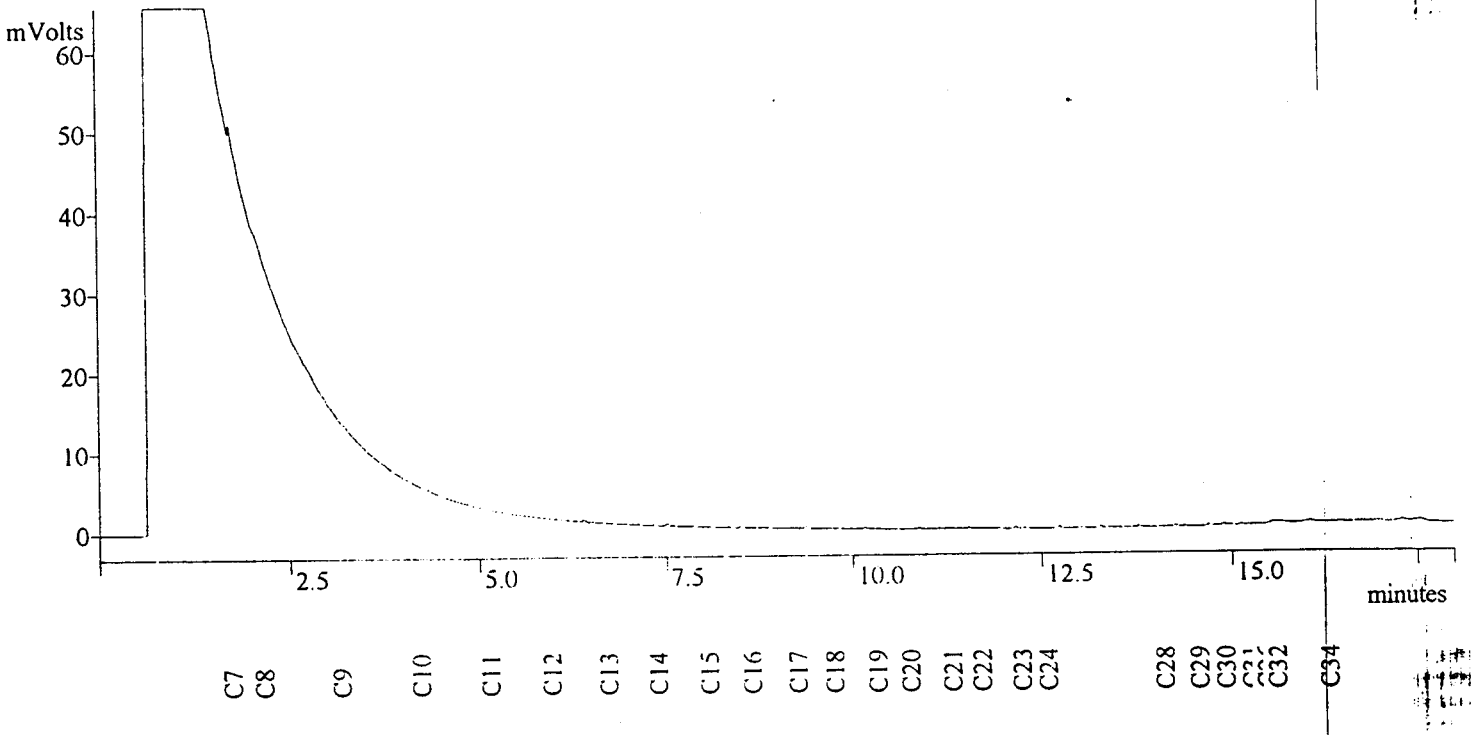



## Boiling Point Distribution Range for Petroleum Based Fuel Products

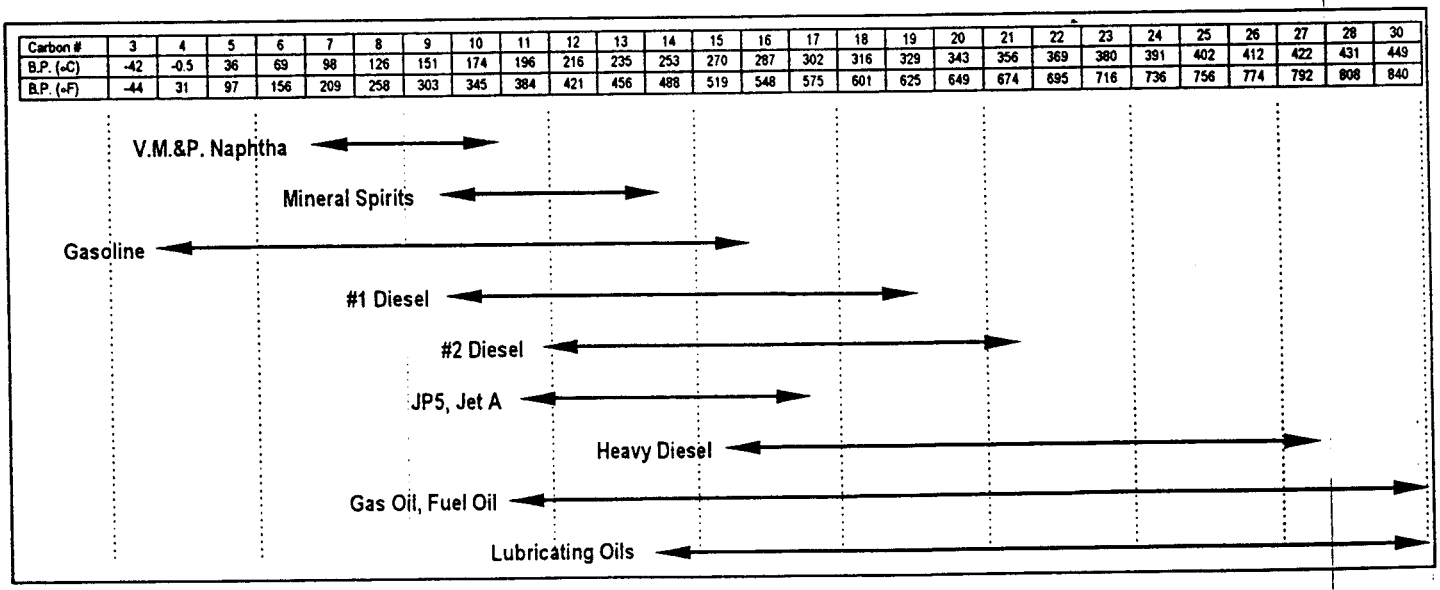
Adapted from: Drews, A.W.., ED; Manual on Hydrocarbon Anaysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA, 1989: p XVIII.

**CLIENT I.D.:** 97-MEN2-3.0

| | |
|---|---|
| Data File: | c:\star\module16\star302.run |
| Sample ID: | E709751-10-10 |
| Injection Date: | 09/24/97 04:59:47 PM |
| Instrument (Inj): | GC 3600 SIDE A |




| Carbon # | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B.P. (•C) | -42 | -0.5 | 36 | 69 | 98 | 126 | 151 | 174 | 196 | 216 | 235 | 253 | 270 | 287 | 302 | 316 | 329 | 343 | 356 | 369 | 380 | 391 | 402 | 412 | 422 | 431 | 449 |
| B.P. (•F) | -44 | 31 | 97 | 156 | 209 | 258 | 303 | 345 | 384 | 421 | 456 | 488 | 519 | 548 | 575 | 601 | 625 | 649 | 674 | 695 | 716 | 736 | 756 | 774 | 792 | 808 | 840 |

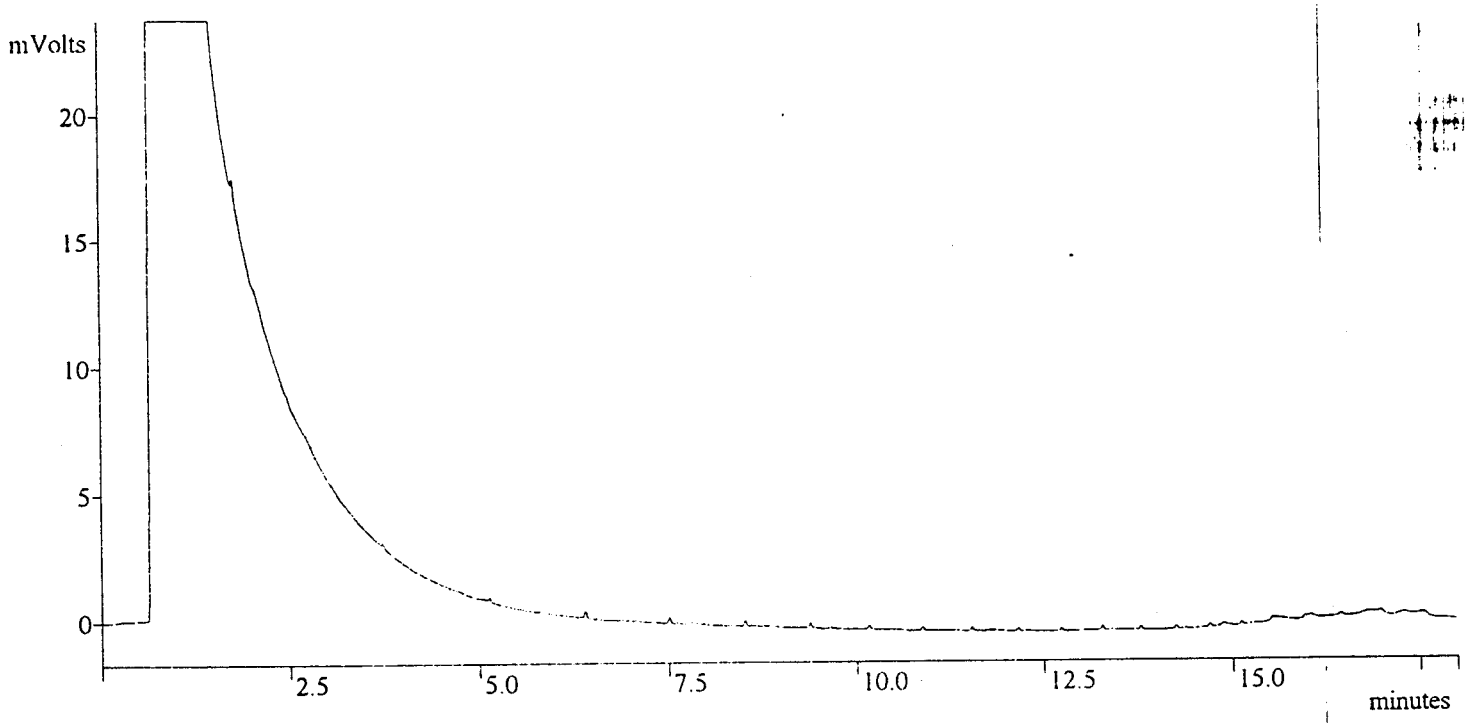


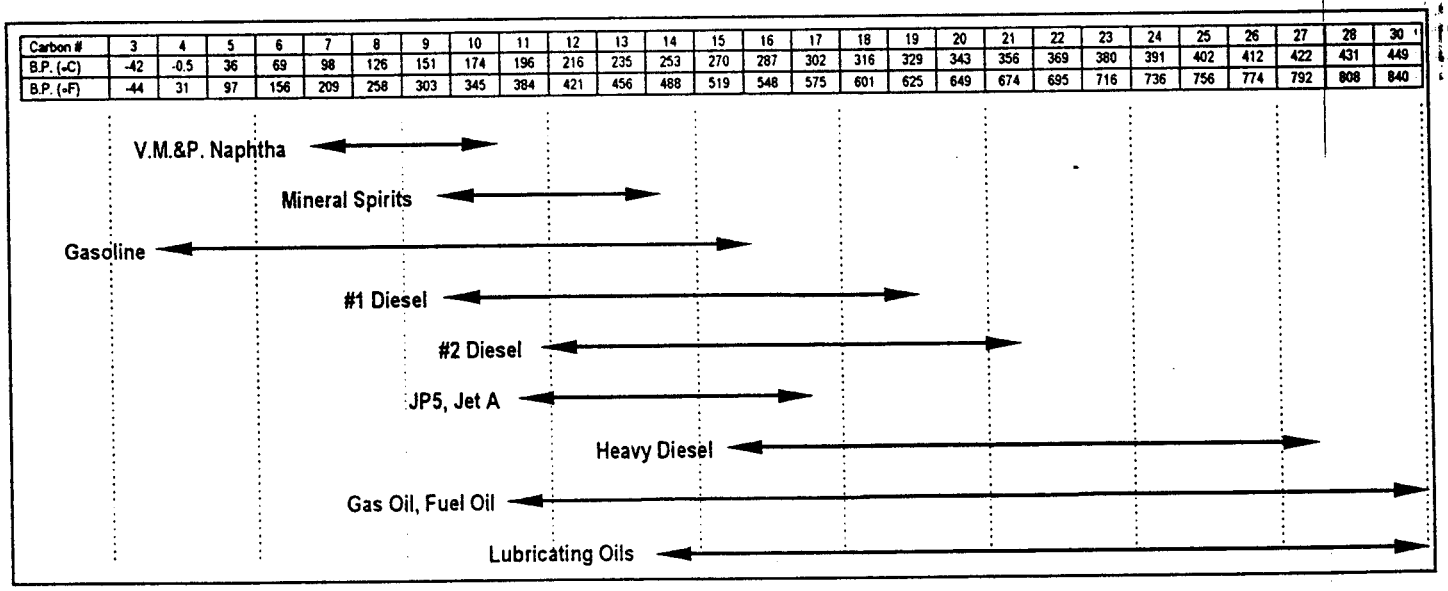

## Boiling Point Distribution Range for Petroleum Based Fuel Products

Adapted from: Drews, A.W.., ED; Manual on Hydrocarbon Anaysis, 4th ed.: American Society for Testing and Materials: Philadelphia, PA, 1989: p XVIII.

**CLIENT I.D.:** **97-MEN2-3.0**

| | |
|---|---|
| Data File: | c:\star\module16\star303.run |
| Sample ID: | E709751-11-10 |
| Injection Date: | 09/24/97 05:33:07 PM |
| Instrument (Inj): | GC 3600 SIDE A |



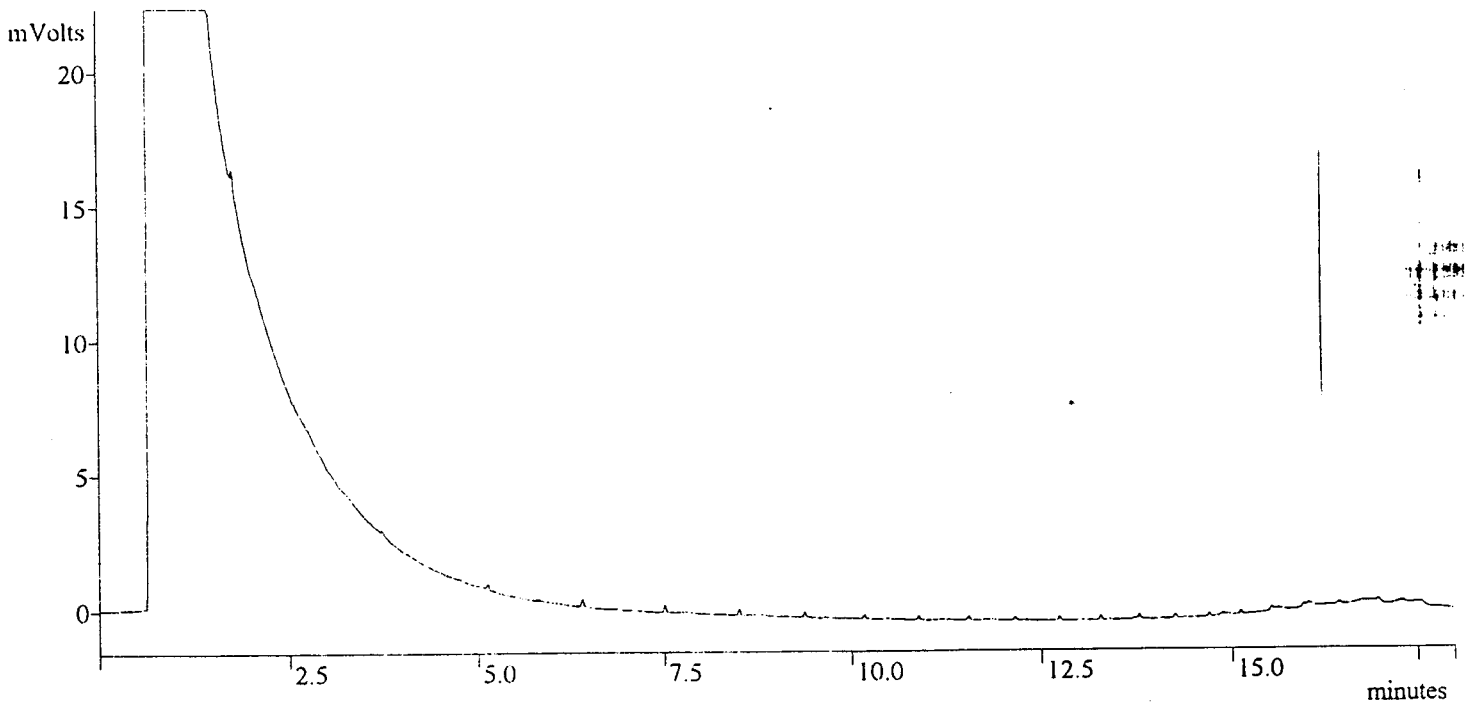




## Boiling Point Distribution Range for Petroleum Based Fuel Products

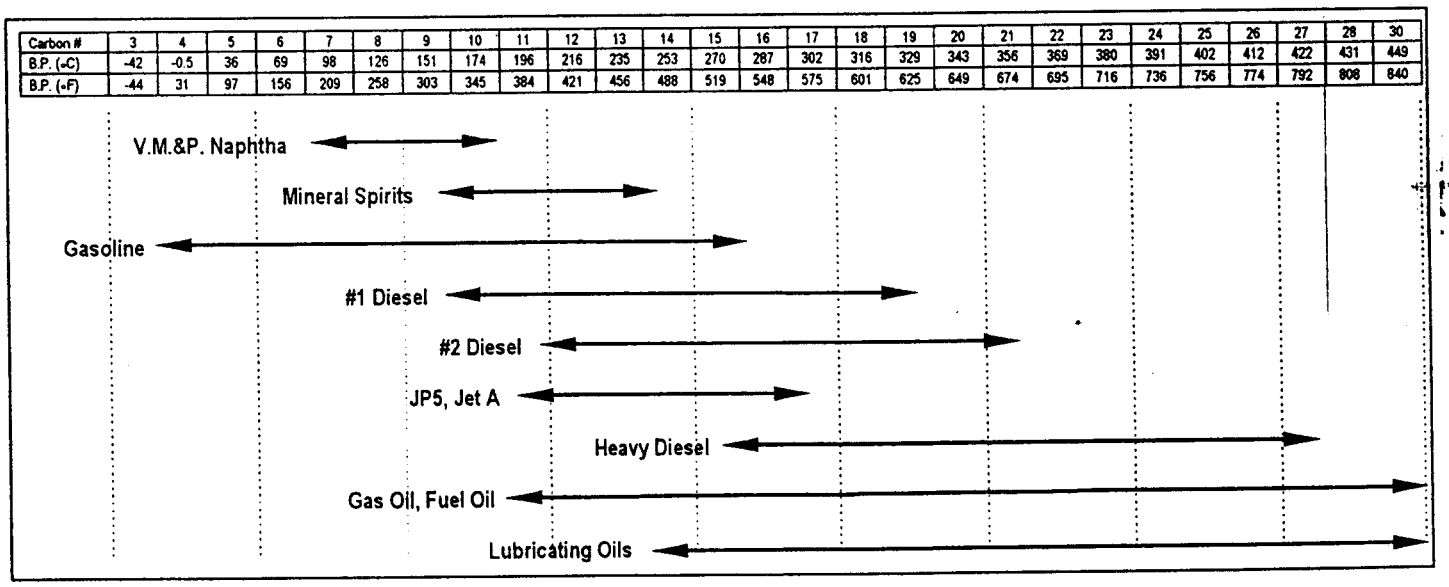
Adapted from: Drews, A.W., ED; Manual on Hydrocarbon Anaysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA, 1989; p XVIII.

**CLIENT I.D.:** 97-MEN3-3.0

| | |
|---|---|
| Data File: | c:\star\module16\star304.run |
| Sample ID: | E709751-13-10 |
| Injection Date: | 09/24/97 06:06:10 PM |
| Instrument (Inj): | GC 3600 SIDE A |




| Carbon # | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B.P. (-C) | -42 | -0.5 | 36 | 69 | 98 | 126 | 151 | 174 | 196 | 216 | 235 | 253 | 270 | 287 | 302 | 316 | 329 | 343 | 356 | 369 | 380 | 391 | 402 | 412 | 422 | 431 | 449 |
| B.P. (-F) | -44 | 31 | 97 | 156 | 209 | 258 | 303 | 345 | 384 | 421 | 456 | 488 | 519 | 548 | 575 | 601 | 625 | 649 | 674 | 695 | 716 | 736 | 756 | 774 | 792 | 808 | 840 |

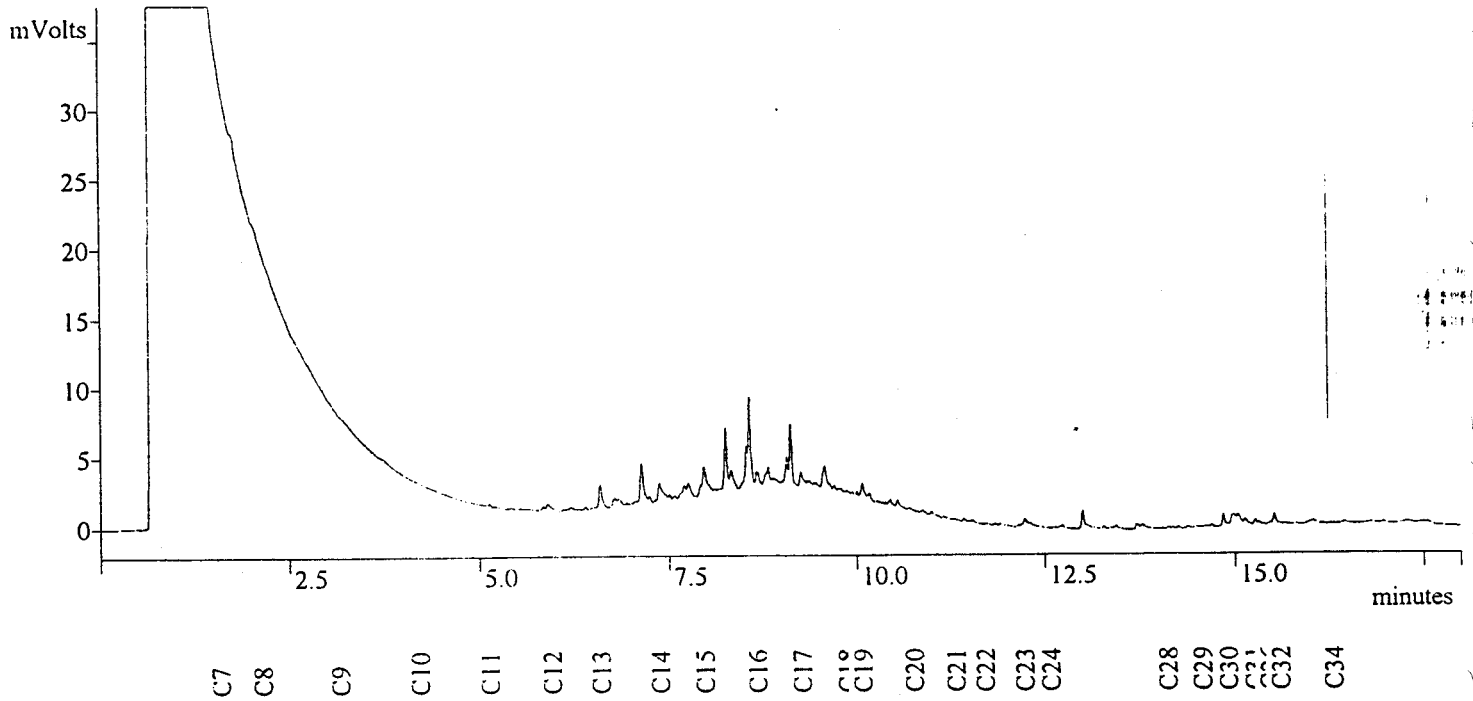


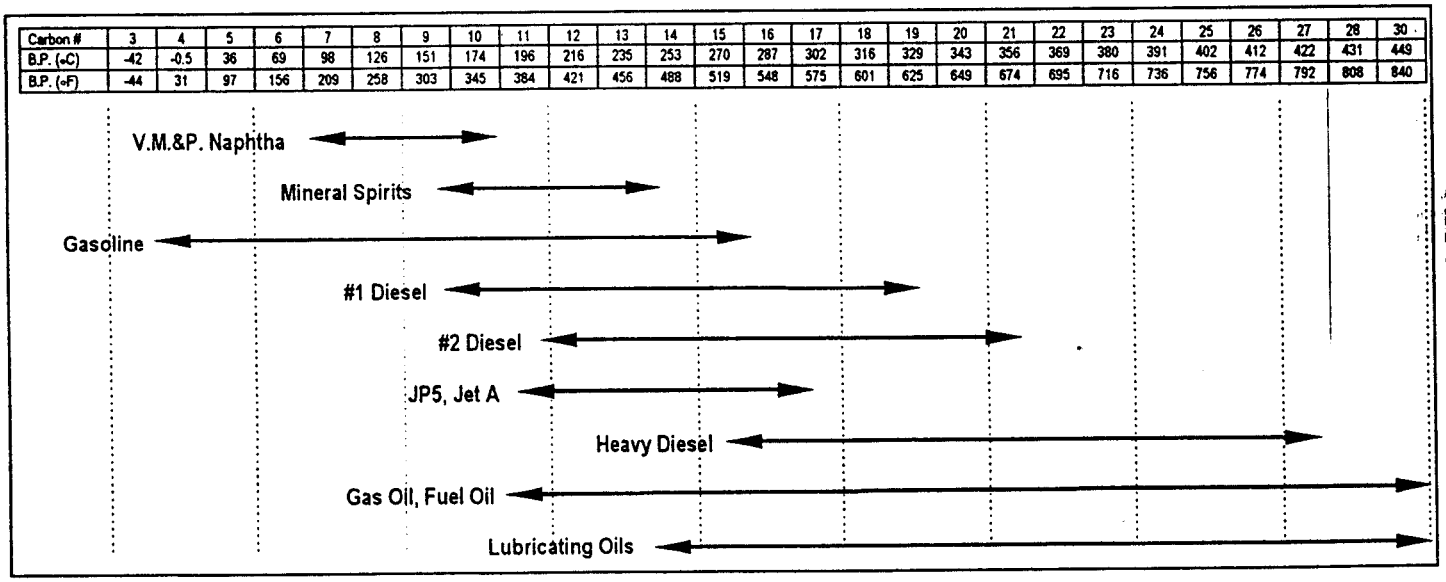

## Boiling Point Distribution Range for Petroleum Based Fuel Products

Adapted from: Drews, A.W., ED; Manual on Hydrocarbon Anaysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA, 1989: p XVIII.

**CLIENT I.D.:** 97-SC-S5-0.5

| | |
|---|---|
| Data File: | c:\star\module16\star305.run |
| Sample ID: | E709751-23-10 |
| Injection Date: | 09/24/97 06:39:10 PM |
| Instrument (Inj): | GC 3600 SIDE A |



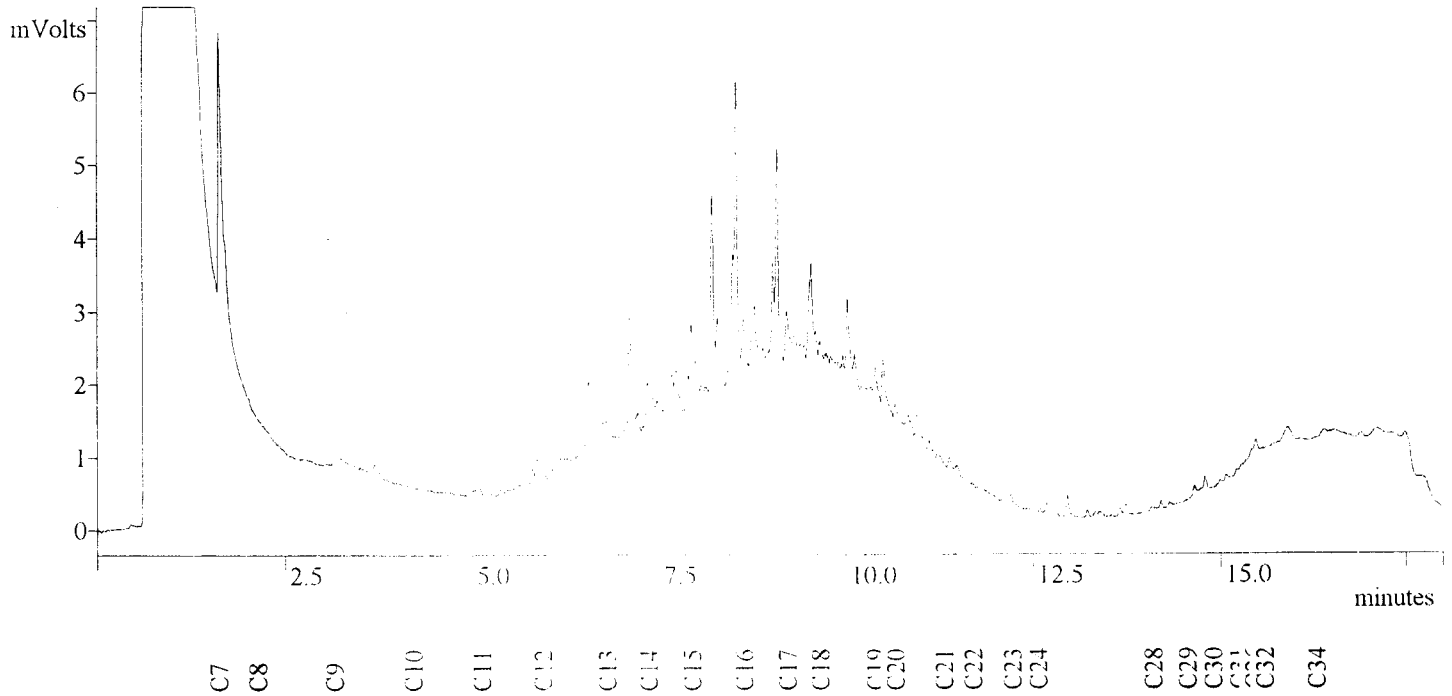

| Carbon # | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B.P. (•C) | -42 | -0.5 | 36 | 69 | 98 | 126 | 151 | 174 | 196 | 216 | 235 | 253 | 270 | 287 | 302 | 316 | 329 | 343 | 356 | 369 | 380 | 391 | 402 | 412 | 422 | 431 | 449 |
| B.P. (•F) | -44 | 31 | 97 | 156 | 209 | 258 | 303 | 345 | 384 | 421 | 456 | 488 | 519 | 548 | 575 | 601 | 625 | 649 | 674 | 695 | 716 | 736 | 756 | 774 | 792 | 808 | 840 |

## Boiling Point Distribution Range for Petroleum Based Fuel Products

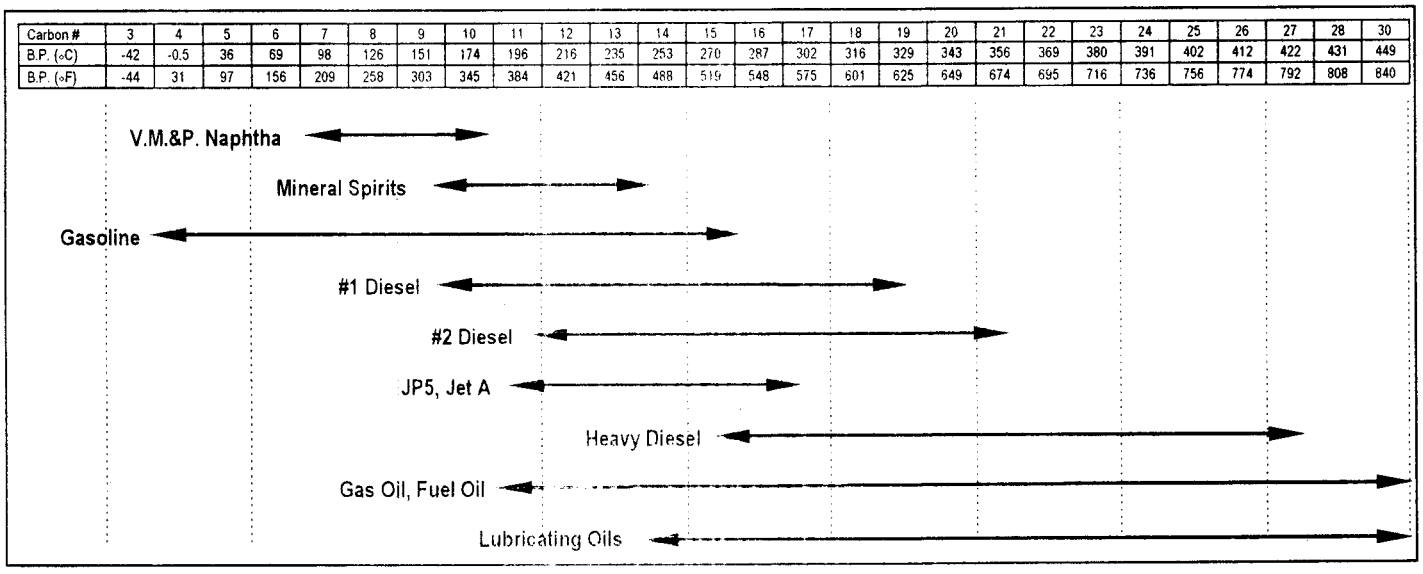
Adapted from: Drews, A.W.., ED; Manual on Hydrocarbon Anaysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA, 1989: p XVIII.

**CLIENT I.D.:** 97-SC-S5-1.5

| | |
|---|---|
| Data File: | c:\star\module16\oct501.run |
| Sample ID: | E709751-24A-10 |
| Injection Date: | 10/25/97 06:14:26 AM |
| Instrument (Inj): | GC 3600 SIDE A |




| Carbon # | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B.P. (°C) | -42 | -0.5 | 36 | 69 | 98 | 126 | 151 | 174 | 196 | 216 | 235 | 253 | 270 | 287 | 302 | 316 | 329 | 343 | 356 | 369 | 380 | 391 | 402 | 412 | 422 | 431 | 449 |
| B.P. (°F) | -44 | 31 | 97 | 156 | 209 | 258 | 303 | 345 | 384 | 421 | 456 | 488 | 519 | 548 | 575 | 601 | 625 | 649 | 674 | 695 | 716 | 736 | 756 | 774 | 792 | 808 | 840 |

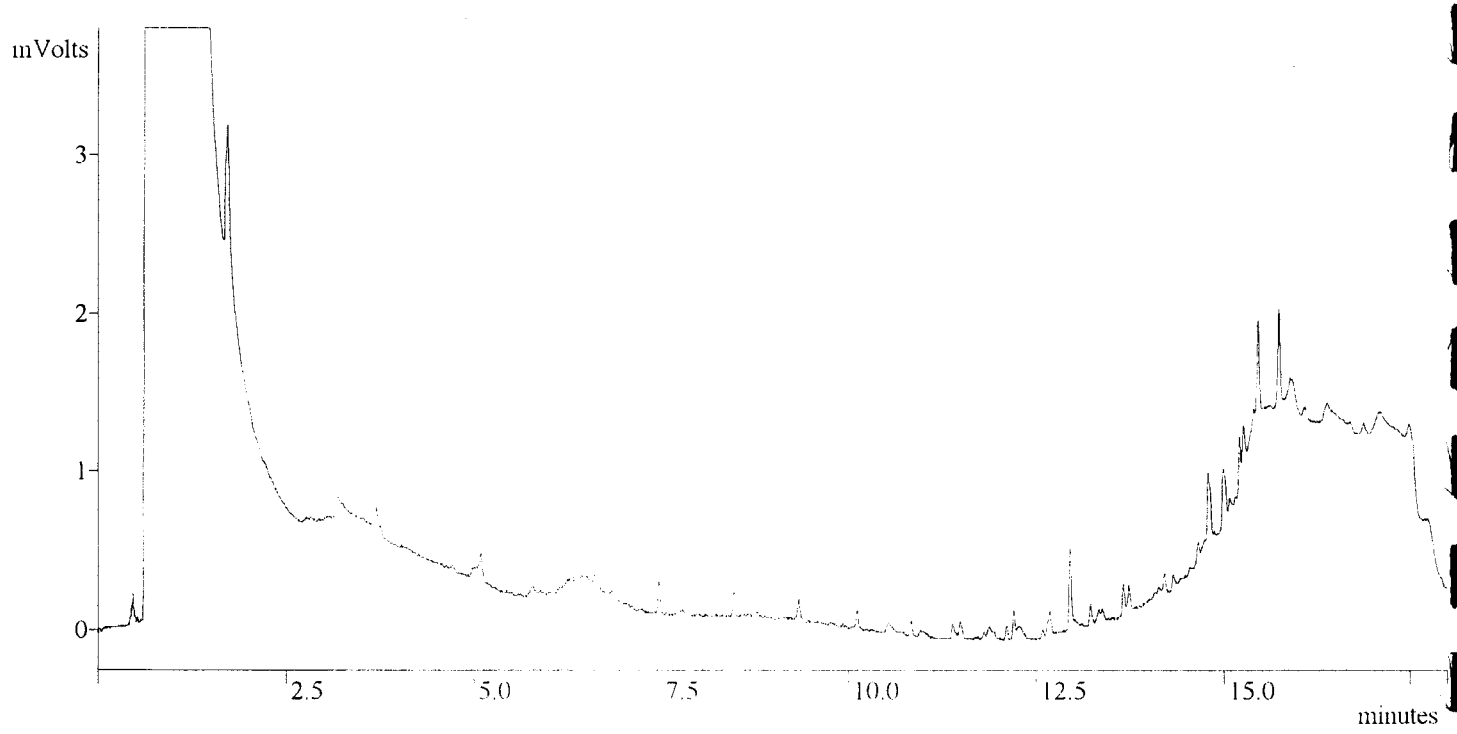



## Boiling Point Distribution Range for Petroleum Based Fuel Products

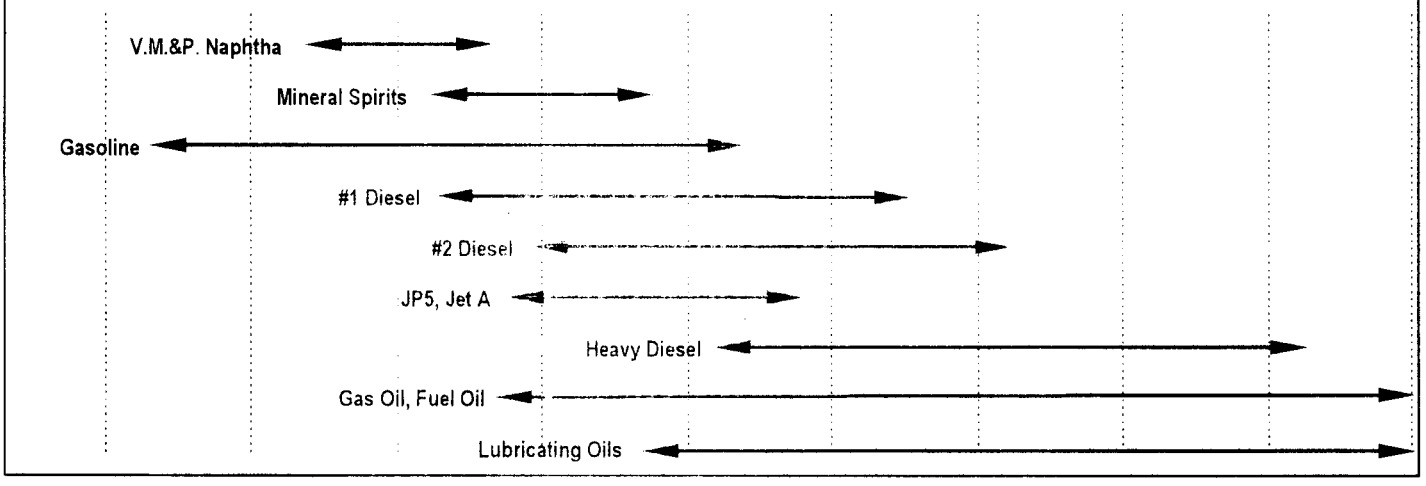
Adapted from: Drews, A.W., ED; Manual on Hydrocarbon Anaysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA, 1989; p XVIII.

**CLIENT I.D.:** 97-SC-S6-0.5

| | |
|---|---|
| Data File: | c:\star\module16\oct502.run |
| Sample ID: | E709751-25A-10 |
| Injection Date: | 10/25/97 06:46:20 AM |
| Instrument (Inj): | GC 3600 SIDE A |




| Carbon # | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B.P. (°C) | -42 | -0.5 | 36 | 69 | 98 | 126 | 151 | 174 | 196 | 216 | 235 | 253 | 270 | 287 | 302 | 316 | 329 | 343 | 356 | 369 | 380 | 391 | 402 | 412 | 422 | 431 | 449 |
| B.P. (°F) | -44 | 31 | 97 | 156 | 209 | 258 | 303 | 345 | 384 | 421 | 456 | 488 | 519 | 548 | 575 | 601 | 625 | 649 | 674 | 695 | 716 | 736 | 756 | 774 | 792 | 808 | 840 |

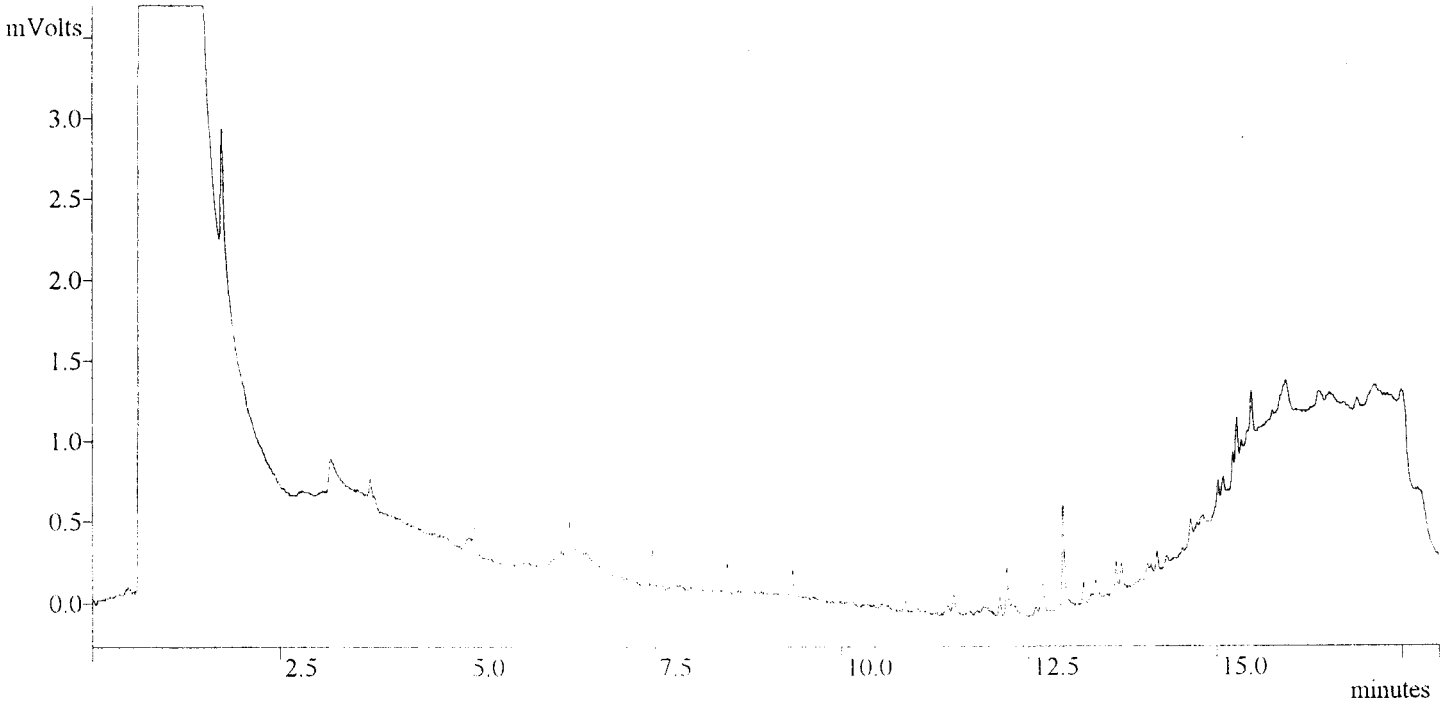



## Boiling Point Distribution Range for Petroleum Based Fuel Products

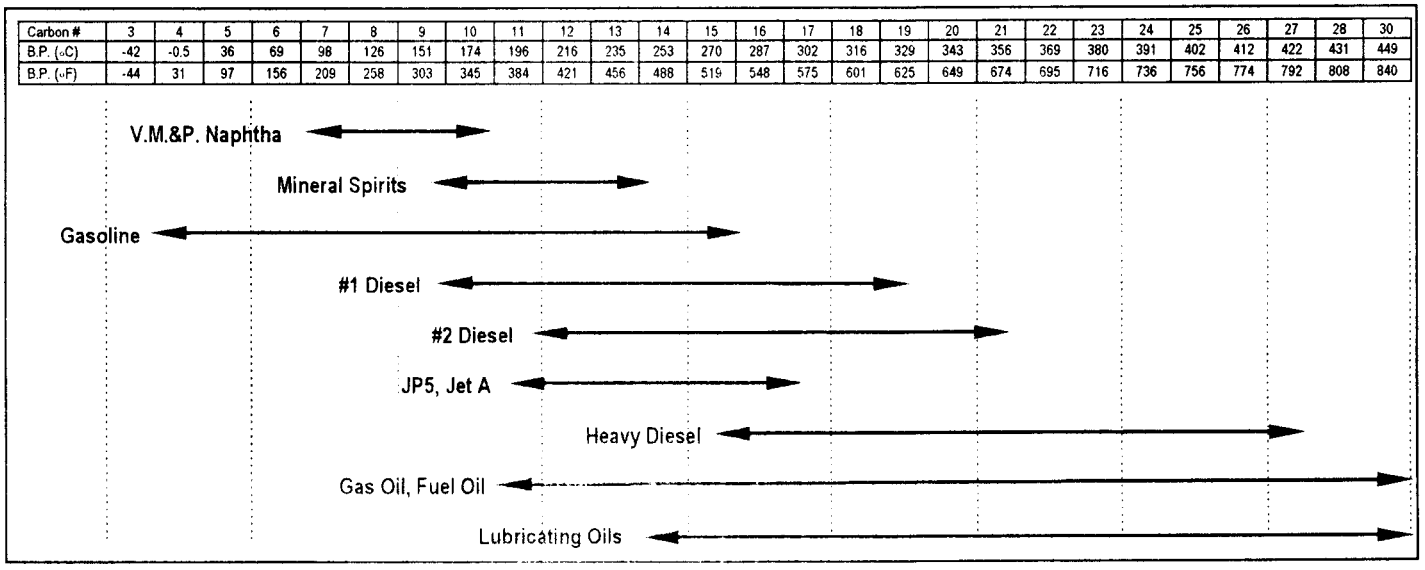
Adapted from: Drews, A.W.., ED; Manual on Hydrocarbon Anaysis, 4th ed.: American Society for Testing and Materials: Philadelphia, PA, 1989: p XVIII.

**CLIENT I.D.:** 97-SC-S6-1.5

| | |
|---|---|
| Data File: | c:\star\module16\oct503.run |
| Sample ID: | E709751-26A-10 |
| Injection Date: | 10/25/97 07:17:58 AM |
| Instrument (Inj): | GC 3600 SIDE A |




| Carbon # | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B.P. (oC) | -42 | -0.5 | 36 | 69 | 98 | 126 | 151 | 174 | 196 | 216 | 235 | 253 | 270 | 287 | 302 | 316 | 329 | 343 | 356 | 369 | 380 | 391 | 402 | 412 | 422 | 431 | 449 |
| B.P. (oF) | -44 | 31 | 97 | 156 | 209 | 258 | 303 | 345 | 384 | 421 | 456 | 488 | 519 | 548 | 575 | 601 | 625 | 649 | 674 | 695 | 716 | 736 | 756 | 774 | 792 | 808 | 840 |

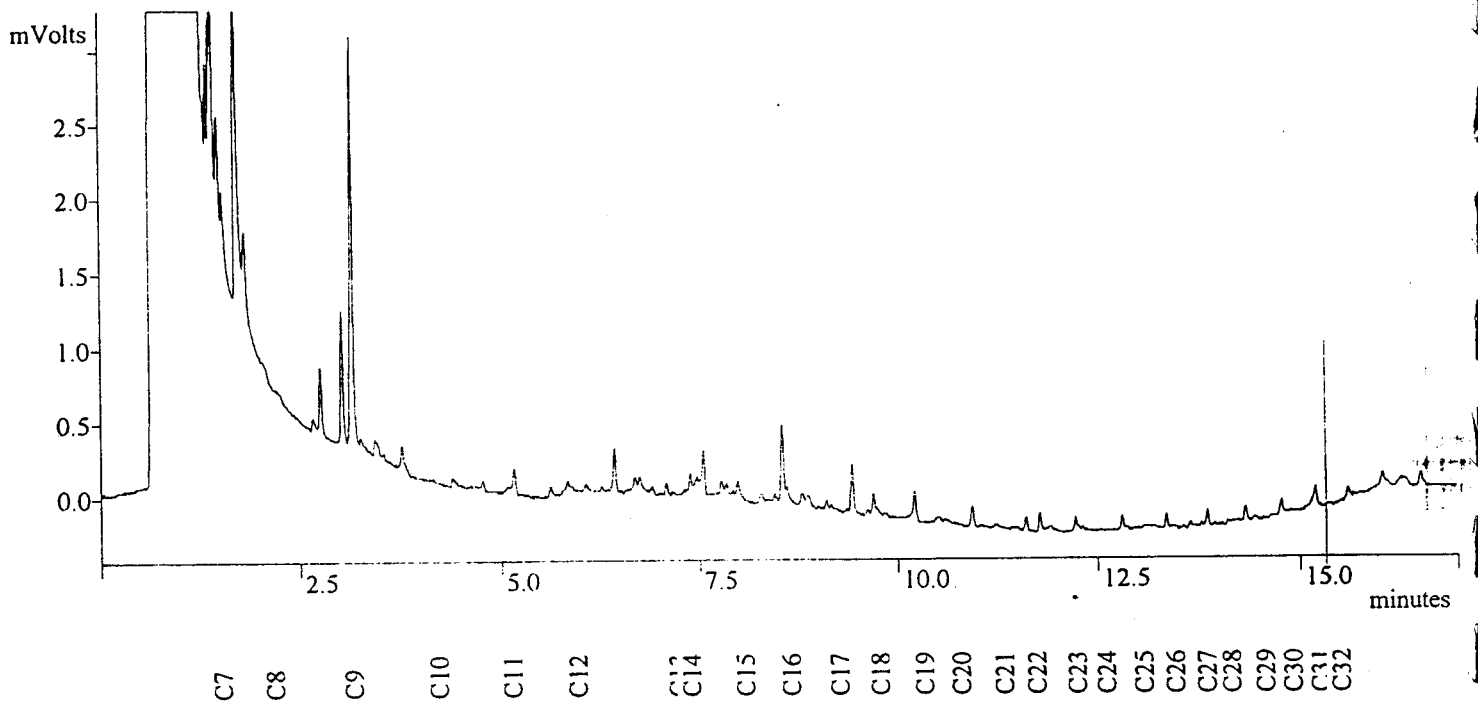


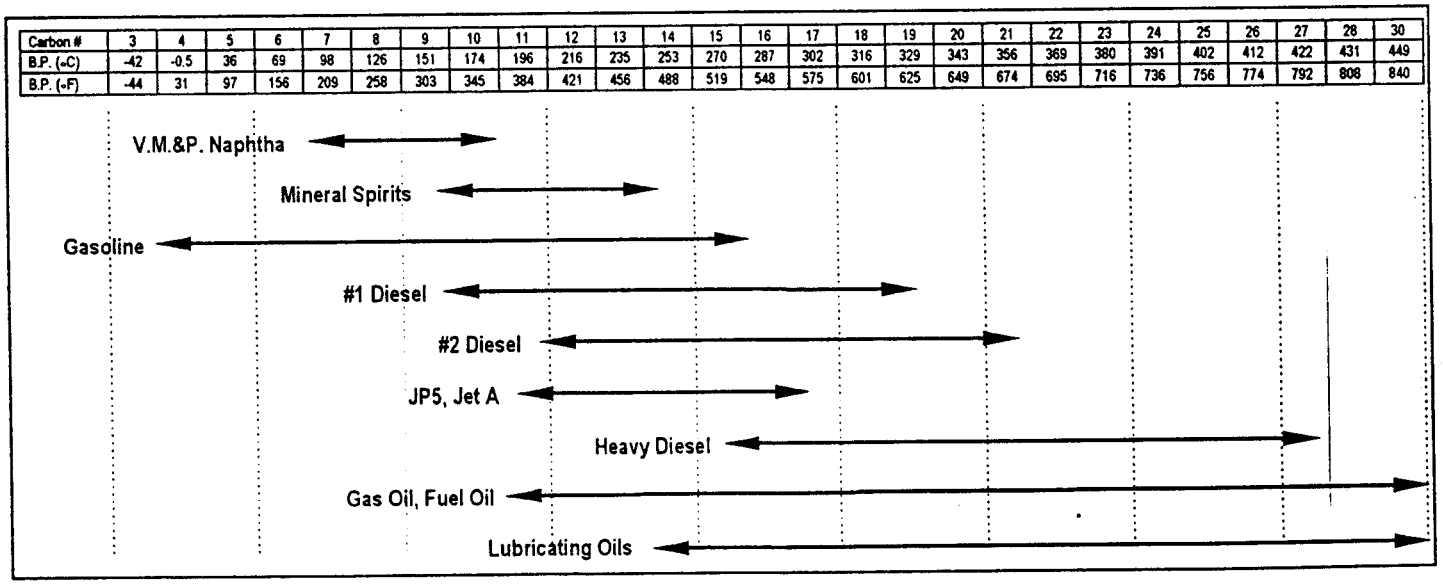

## Boiling Point Distribution Range for Petroleum Based Fuel Products

Adapted from: Drews, A.W.., ED; Manual on Hydrocarbon Anaysis. 4th ed.: American Society for Testing and Materials: Philadelphia, PA, 1989: p XVIII.

**CLIENT I.D.:** 97-MEN3-4.6

| | |
|---|---|
| Data File: | c:\star\module18\star289.run |
| Sample ID: | E709751-27-10 |
| Injection Date: | 09/24/97 03:53:43 PM |
| Instrument (Inj): | GC 3600 SIDE B |



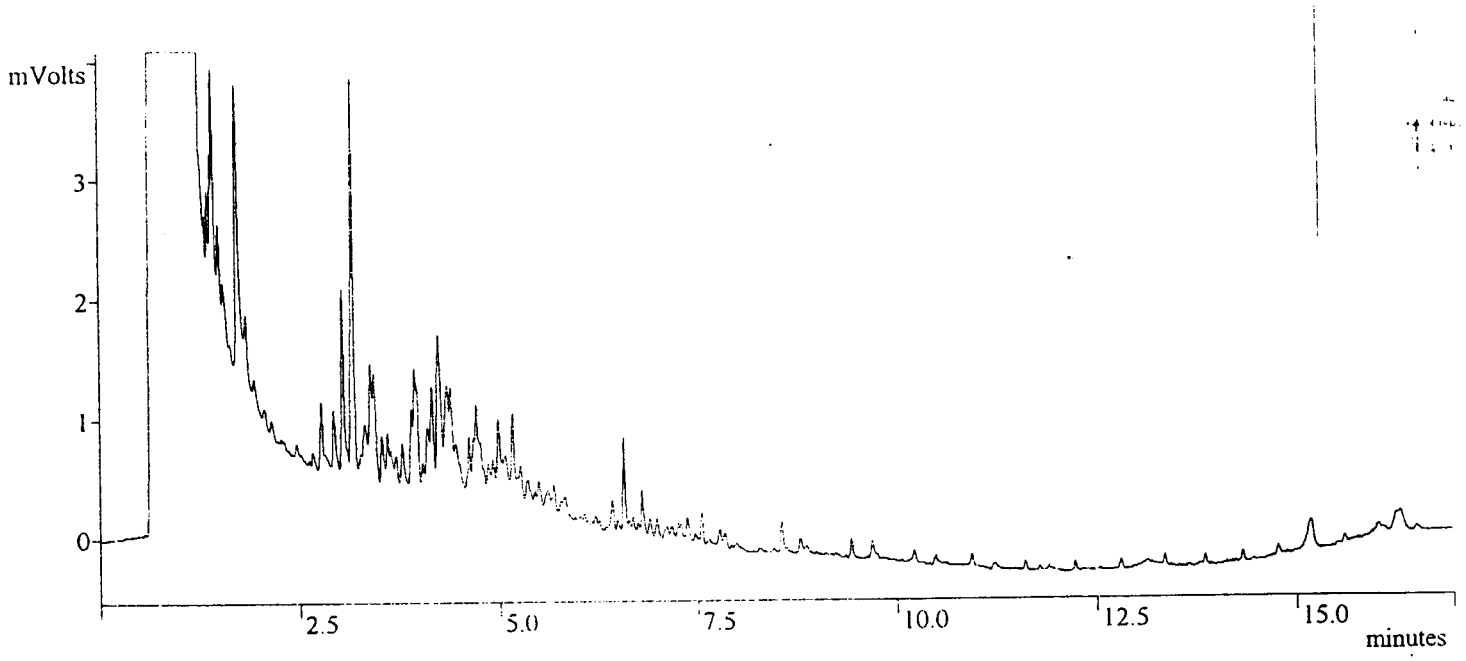

| Carbon # | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B.P. (-C) | -42 | -0.5 | 36 | 69 | 98 | 126 | 151 | 174 | 196 | 216 | 235 | 253 | 270 | 287 | 302 | 316 | 329 | 343 | 356 | 369 | 380 | 391 | 402 | 412 | 422 | 431 | 449 |
| B.P. (-F) | -44 | 31 | 97 | 156 | 209 | 258 | 303 | 345 | 384 | 421 | 456 | 488 | 519 | 548 | 575 | 601 | 625 | 649 | 674 | 695 | 716 | 736 | 756 | 774 | 792 | 808 | 840 |

## Boiling Point Distribution Range for Petroleum Based Fuel Products

Adapted from: Drews, A.W., ED; Manual on Hydrocarbon Anaysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA, 1989: p XVIII.

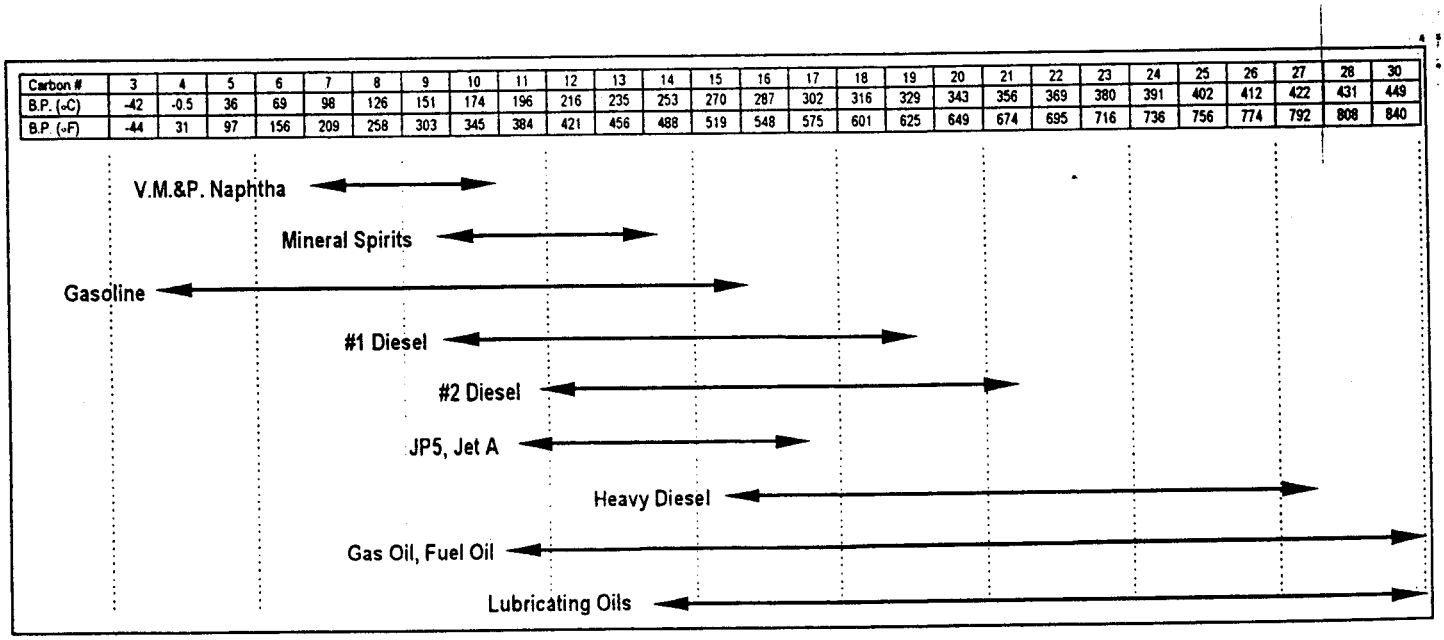
**CLIENT I.D.:** **97-MEN8-3.0**

| | |
|---|---|
| Data File: | c:\star\module18\star290.run |
| Sample ID: | E709751-33-10 |
| Injection Date: | 09/24/97 04:26:30 PM |
| Instrument (Inj): | GC 3600 SIDE B |




C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21 C22 C23 C24 C25 C26 C27 C28 C29 C30 C31 C32

| Carbon # | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B.P. (oC) | -42 | -0.5 | 36 | 69 | 98 | 126 | 151 | 174 | 196 | 216 | 235 | 253 | 270 | 287 | 302 | 316 | 329 | 343 | 356 | 369 | 380 | 391 | 402 | 412 | 422 | 431 | 449 |
| B.P. (oF) | -44 | 31 | 97 | 156 | 209 | 258 | 303 | 345 | 384 | 421 | 456 | 488 | 519 | 548 | 575 | 601 | 625 | 649 | 674 | 695 | 716 | 736 | 756 | 774 | 792 | 808 | 840 |

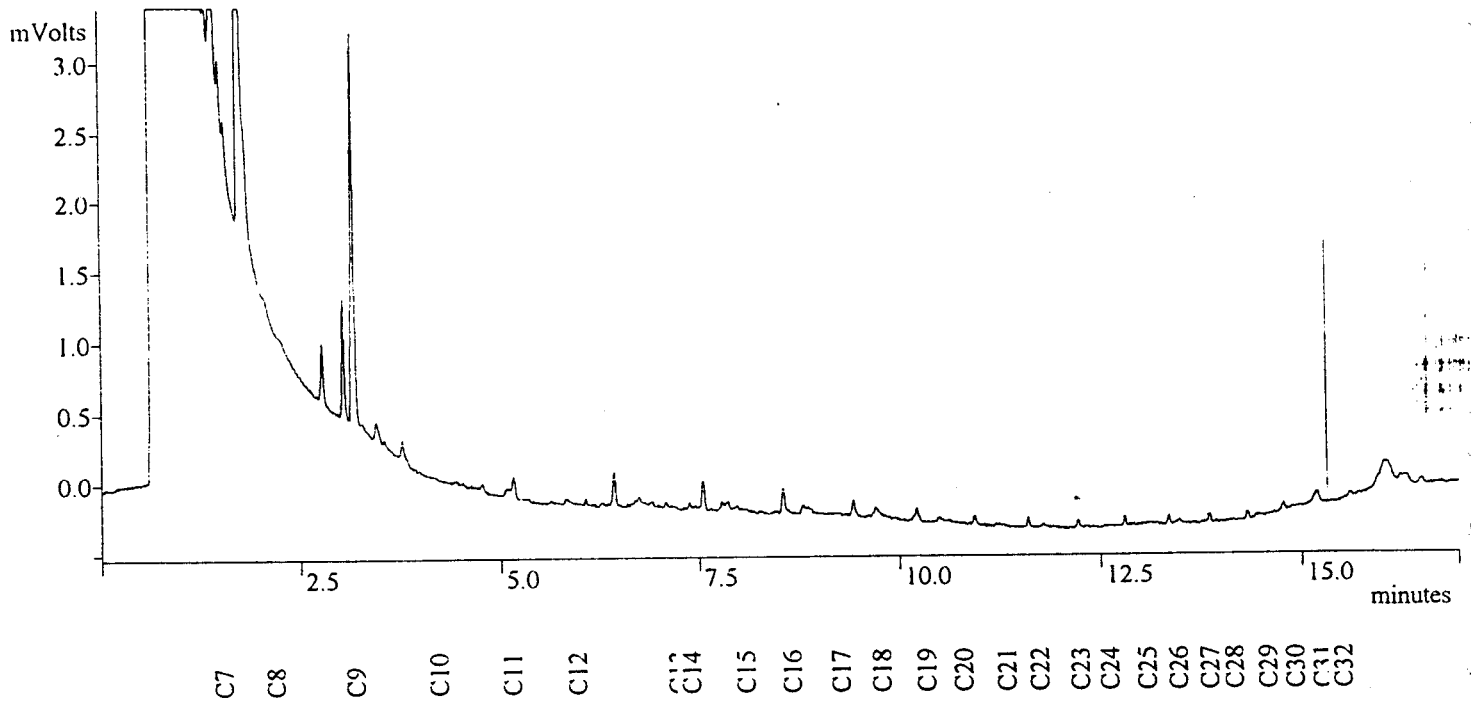



## Boiling Point Distribution Range for Petroleum Based Fuel Products

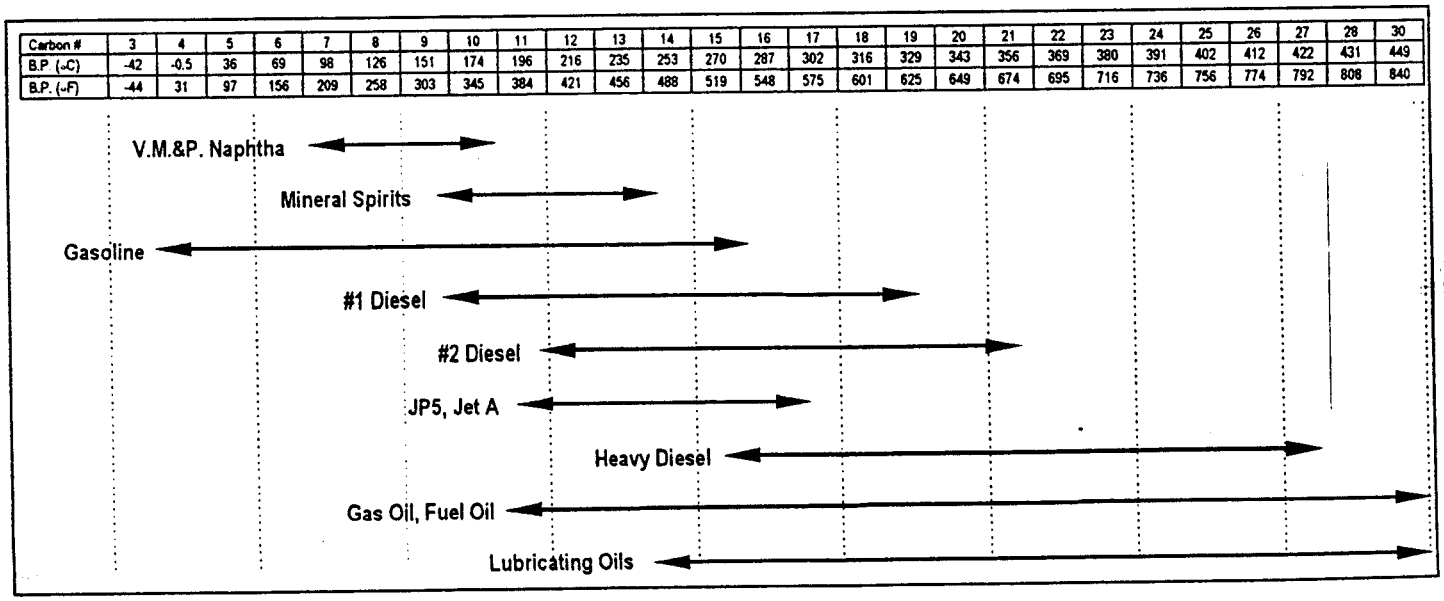
Adapted from: Drews, A.W., ED; Manual on Hydrocarbon Anaysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA, 1989; p XVIII.

**CLIENT I.D.:** 97-MEN8-4.6

| | |
|---|---|
| Data File: | c:\star\module18\star291.run |
| Sample ID: | E709751-34-10 D1 |
| Injection Date: | 09/24/97 04:59:46 PM |
| Instrument (Inj): | GC 3600 SIDE B |




| Carbon # | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B.P. (-C) | -42 | -0.5 | 36 | 69 | 98 | 126 | 151 | 174 | 196 | 216 | 235 | 253 | 270 | 287 | 302 | 316 | 329 | 343 | 356 | 369 | 380 | 391 | 402 | 412 | 422 | 431 | 449 |
| B.P. (-F) | -44 | 31 | 97 | 156 | 209 | 258 | 303 | 345 | 384 | 421 | 456 | 488 | 519 | 548 | 575 | 601 | 625 | 649 | 674 | 695 | 716 | 736 | 756 | 774 | 792 | 808 | 840 |

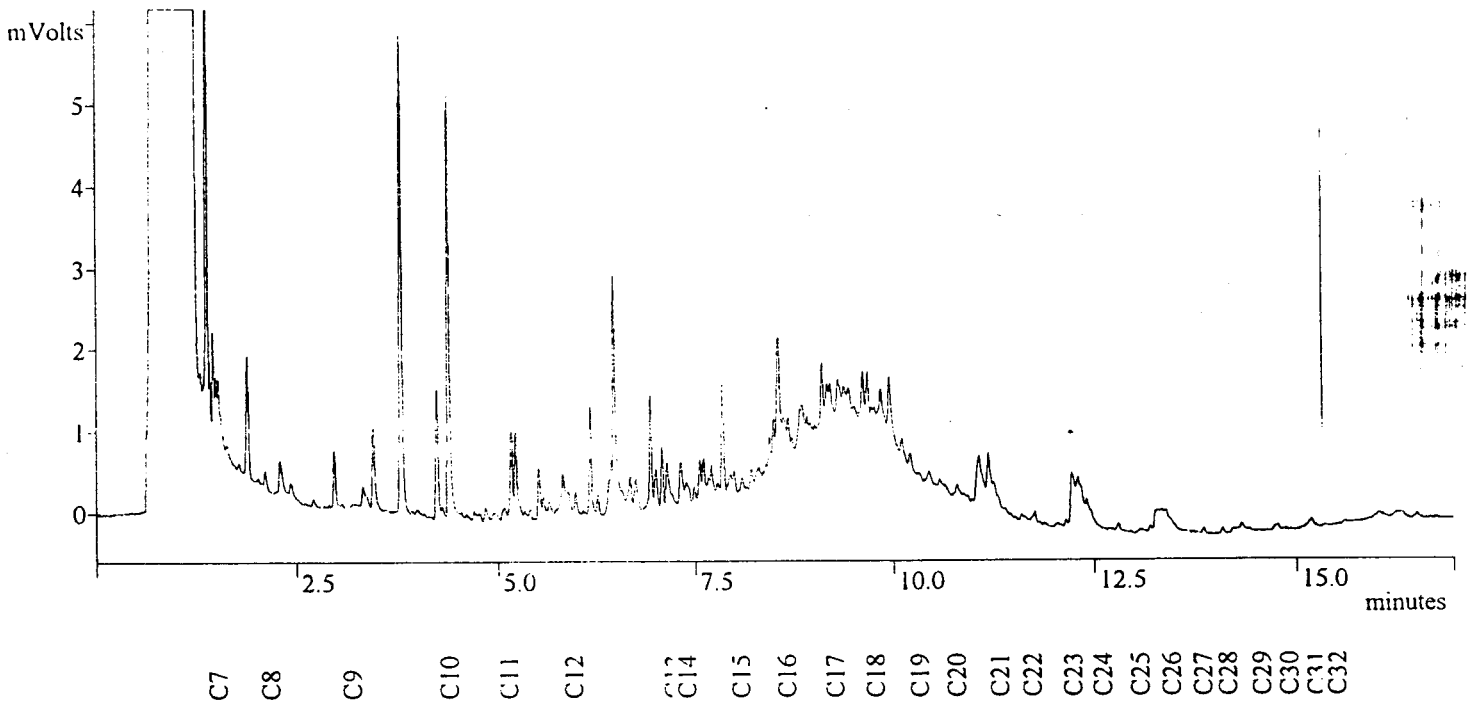


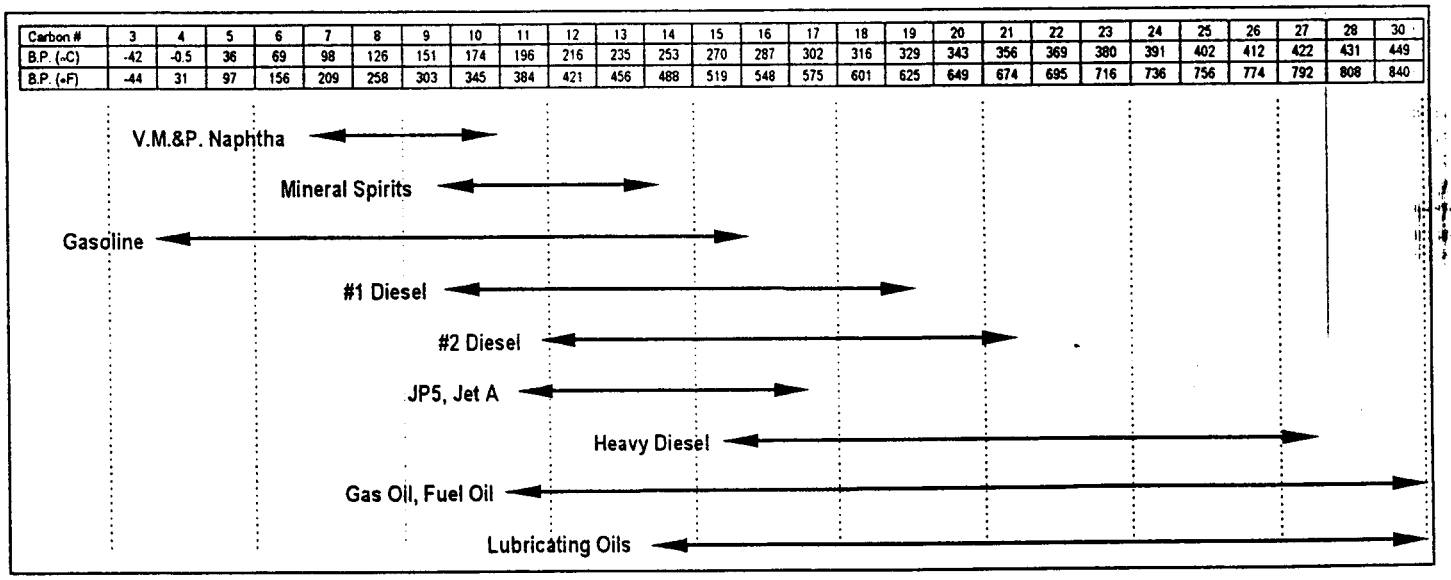

## Boiling Point Distribution Range for Petroleum Based Fuel Products

Adapted from: Drews, A.W., ED; Manual on Hydrocarbon Anaysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA, 1989: p XVIII.

**CLIENT I.D.:** 97-MEN4-W1

| | |
|---|---|
| Data File: | c:\star\module18\star305.run |
| Sample ID: | E709760-03-2 |
| Injection Date: | 09/25/97 12:42:35 AM |
| Instrument (Inj): | GC 3600 SIDE B |



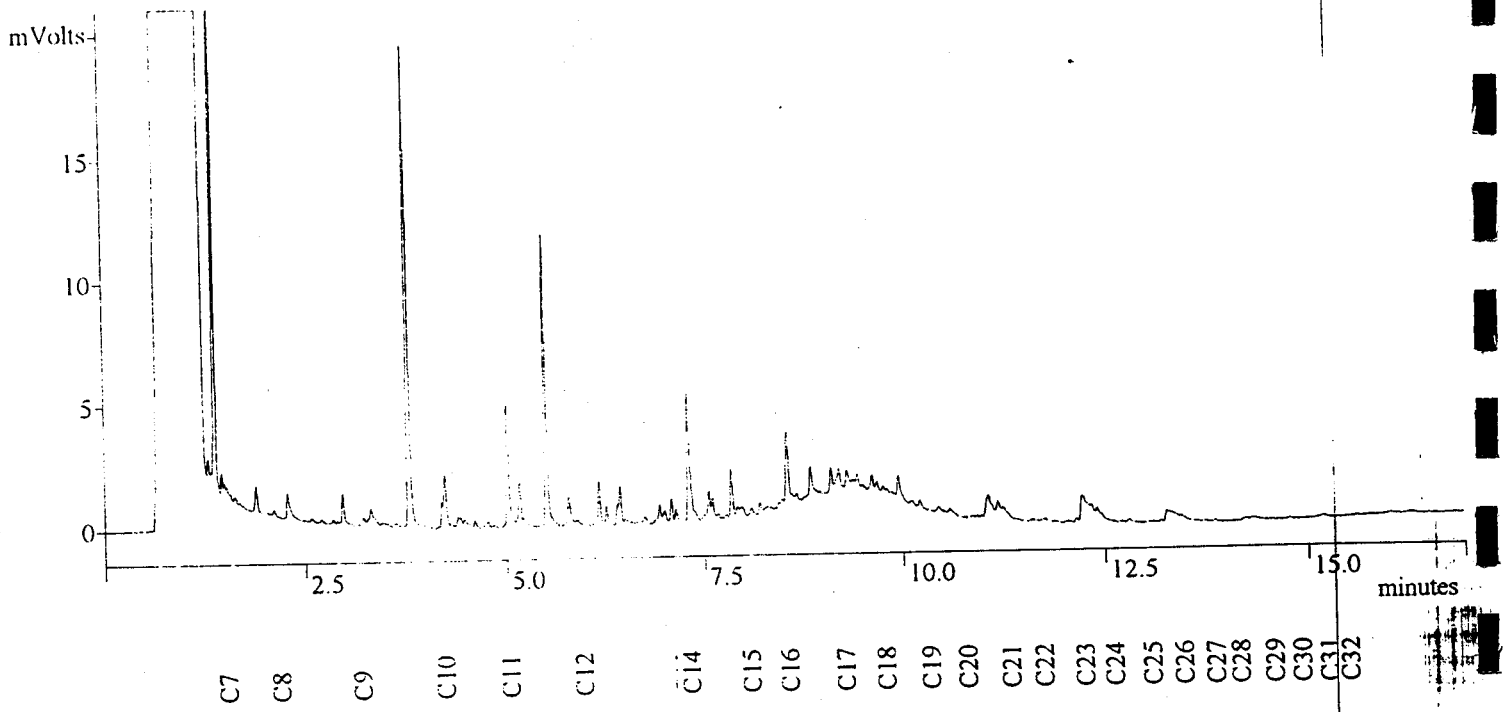

| Carbon # | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B.P. (-C) | -42 | -0.5 | 36 | 69 | 98 | 126 | 151 | 174 | 196 | 216 | 235 | 253 | 270 | 287 | 302 | 316 | 329 | 343 | 356 | 369 | 380 | 391 | 402 | 412 | 422 | 431 | 449 |
| B.P. (+F) | -44 | 31 | 97 | 156 | 209 | 258 | 303 | 345 | 384 | 421 | 456 | 488 | 519 | 548 | 575 | 601 | 625 | 649 | 674 | 695 | 716 | 736 | 756 | 774 | 792 | 808 | 840 |

## Boiling Point Distribution Range for Petroleum Based Fuel Products

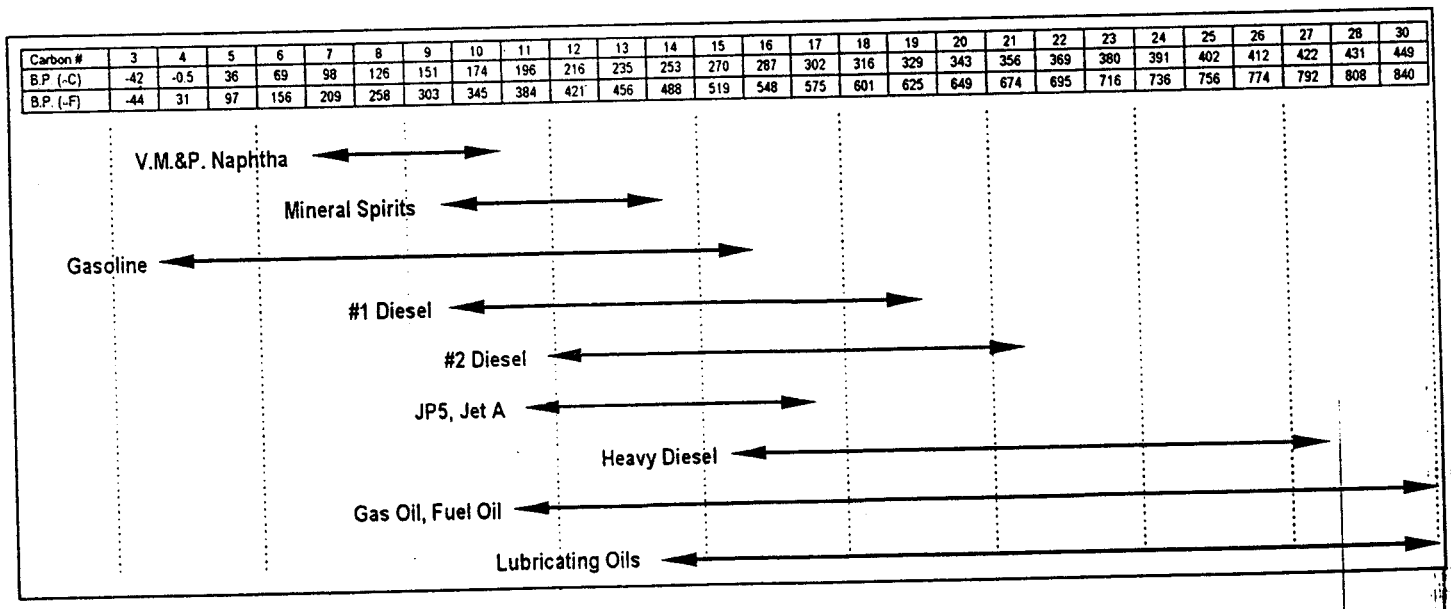
Adapted from: Drews, A.W., ED; Manual on Hydrocarbon Anaysis, 4th ed ; American Society for Testing and Materials: Philadelphia, PA, 1989: p XVIII.

**CLIENT I.D.:** 97-MEN10-W1

| | |
|---|---|
| Data File: | c:\star\module18\star311.run |
| Sample ID: | E709760-07-2 |
| Injection Date: | 09/25/97 04:03:18 AM |
| Instrument (Inj): | GC 3600 SIDE B |




| Carbon # | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B.P. (-C) | -42 | -0.5 | 36 | 69 | 98 | 126 | 151 | 174 | 196 | 216 | 235 | 253 | 270 | 287 | 302 | 316 | 329 | 343 | 356 | 369 | 380 | 391 | 402 | 412 | 422 | 431 | 449 |
| B.P. (-F) | -44 | 31 | 97 | 156 | 209 | 258 | 303 | 345 | 384 | 421 | 456 | 488 | 519 | 548 | 575 | 601 | 625 | 649 | 674 | 695 | 716 | 736 | 756 | 774 | 792 | 808 | 840 |




## Boiling Point Distribution Range for Petroleum Based Fuel Products

Adapted from: Drews, A.W., ED; Manual on Hydrocarbon Anaysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA, 1989; p XVIII.

File : TOTAL PCB'S
Run File : c:\star\module16\pcb200.run
Method File : C:\STAR\MODULE16\PCB.MTH
Sample ID : E709760-13-800

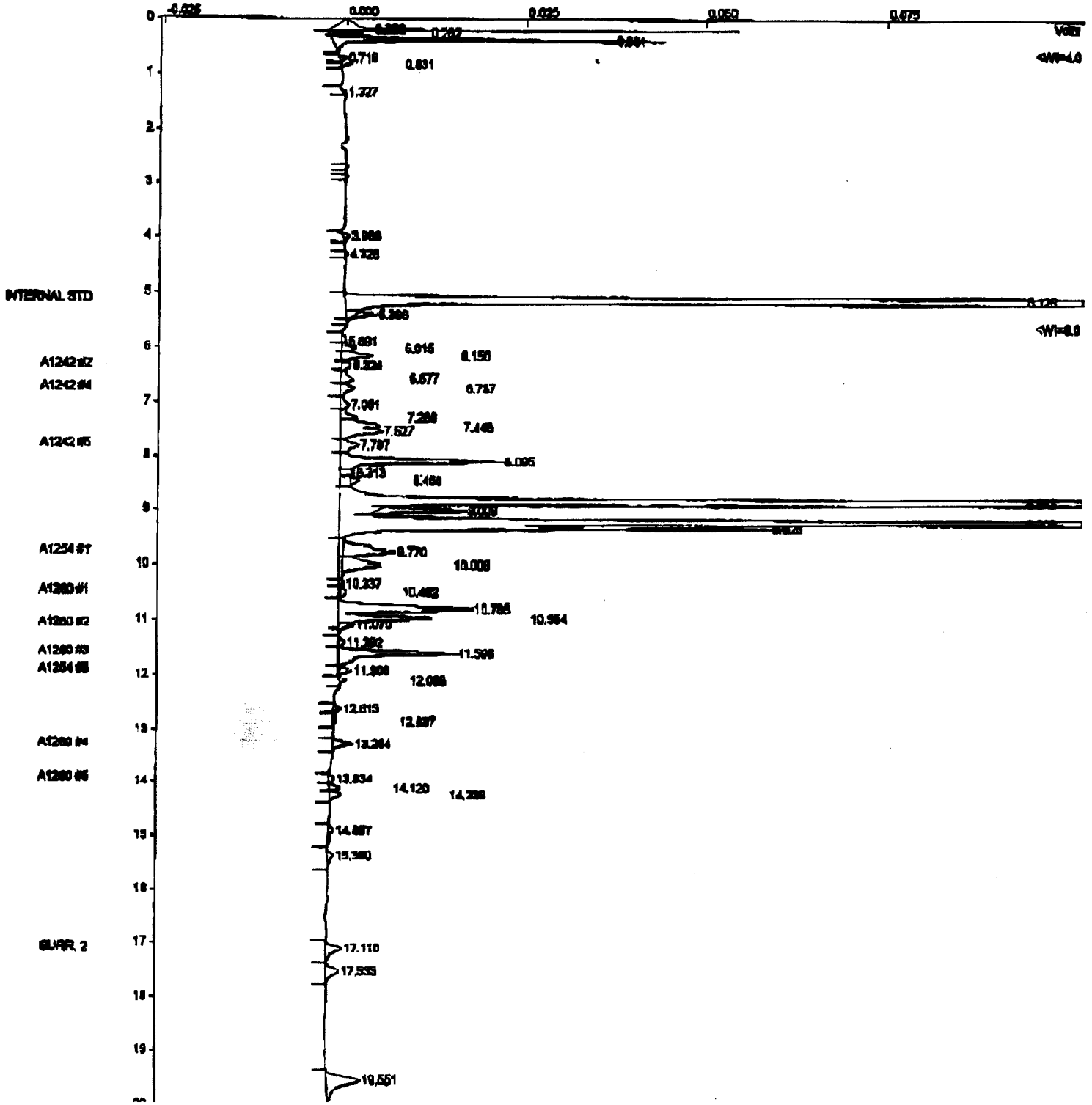
Injection Date: 28-NOV-97 8:10 AM Calculation Date: 28-NOV-97 8:31 AM

Operator : CI
Workstation: DISK1_VOL1
Instrument : V3400
Channel : B = B

Detector Type: ADC8 (1 Volt)
Bus Address : 16
Sample Rate : 10.00 Hz
Run Time : 20.002 min

********** Star Chromatography Workstation ******* Version 4.5 **********

Chart Speed = 0.99 cm/min Attenuation = 524 Zero Offset = 20%
Start Time = 0.000 min End Time = 20.000 min Min / Tick = 1.00



# APPENDIX B
# SITE INFORMATION

# APPENDIX B1
# TAKHINI RIVER

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97TR-1 |
| Location: TAKHINI RIVER | Driller: UMA ENGINEERING LTD. | PROJECT NO: 4440-037-00-02 |
| Location: MILE 946.6, ALASKA HIGHWAY, YT | Drilling Method: 50 mm HAND AUGER | ELEVATION: 99.78 (m) |

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT SAMPLE | GLASS JAR | NO RECOVERY | CORE

| DEPTH(m) | ◆ PID (ppm in air) ◆ 20 40 60 80<br>PLASTIC M.C. LIQUID 20 40 60 80 | SAMPLE TYPE | USC | SOIL SYMBOL | Soil Description | COMMENTS | DEPTH(m) |
|---|---|---|---|---|---|---|---|
| 0.0 | | | FILL | | FILL – silt, dry, grey to brown | | 0.0 |
| | | | SA | | FILL – sand, with pebbles, medium grained, dry, grey-brown<br>– rusty nail at 0.2 m | | |
| 1.0 | | | | | – possible landfill<br>– test hole sloughing<br>END OF TEST HOLE AT 0.65 m | | 1.0 |
| 2.0 | | | | | | | 2.0 |

UMA Engineering Ltd.
Edmonton, Alberta

| | |
|---|---|
| LOGGED BY: RHS | COMPLETION DEPTH: 0.7 m |
| REVIEWED BY: RHS | COMPLETE: 09/16/97 |
| Fig. No: 1 | Page 1 of 1 |

97/11/28 11:34AM (ENVIRO)

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97TR-2 |
| Location: TAKHINI RIVER | Driller: UMA ENGINEERING LTD. | PROJECT NO: 4440-037-00-02 |
| Location: MILE 946.4, ALASKA HIGHWAY, YT | Drilling Method: 50 mm HAND AUGER | ELEVATION: 99.95 (m) |

SAMPLE TYPE ■ GRAB ▨ SHELBY TUBE ▩ SPT SAMPLE ▤ GLASS JAR ▥ NO RECOVERY ▮ CORE

| DEPTH(m) | ◆ PID (ppm in air) ◆ 20 40 60 80 | SAMPLE TYPE | USC | SOIL SYMBOL | Soil Description | COMMENTS | DEPTH(m) |
|---|---|---|---|---|---|---|---|
| 0.0 | PLASTIC M.C. LIQUID 20 40 60 80 | | SI | | SILT – dry, grey to brown<br>– ash layer approximately 2 cm thick at 0.05 m | | 0.0 |
| | | | SA | | SAND – with pebbles, dry, medium grained<br>– test hole sloughing | | |
| 1.0 | | | | | END OF TEST HOLE AT 0.6 m | | 1 |
| 2.0 | | | | | | | 2 |

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| | |
|---|---|
| LOGGED BY: RHS | COMPLETION DEPTH: 0.6 m |
| REVIEWED BY: RHS | COMPLETE: 09/16/97 |
| Fig. No: 2 | Page 1 of |

97/11/28 11:34AM (ENVIRO)

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97TR-3 |
| Location: TAKHINI RIVER | Driller: UMA ENGINEERING LTD. | PROJECT NO: 4440-037-00-02 |
| Location: MILE 946.4, ALASKA HIGHWAY, YT | Drilling Method: 50 mm HAND AUGER | ELEVATION: 99.94 (m) |

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT SAMPLE | GLASS JAR | NO RECOVERY | CORE

DEPTH(m) | ◆ PID (ppm in air) ◆ 20 40 60 80 | PLASTIC M.C. LIQUID 20 40 60 80 | SAMPLE TYPE | USC | SOIL SYMBOL

## Soil Description

| DEPTH(m) | USC | Soil Description | COMMENTS |
|---|---|---|---|
| 0.0 | SI | SILT – dry, grey-brown<br>– ash layer approximately 2 cm thick at 0.05 m | |
| | SA | SAND – with stones, pebbles, medium grained, dry<br>– test hole sloughing | |
| 1.0 | | END OF TEST HOLE AT 0.4 m | |
| 2.0 | | | |

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|---|---|
| LOGGED BY: RHS | COMPLETION DEPTH: 0.4 m |
| REVIEWED BY: RHS | COMPLETE: 09/16/97 |
| Fig. No: 3 | Page 1 of 1 |

97/11/28 11:35AM (ENVIRO)

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97TR-4 |
| Location: TAKHINI RIVER | Driller: UMA ENGINEERING LTD. | PROJECT NO: 4440-037-00-02 |
| Location: MILE 946.4, ALASKA HIGHWAY, YT | Drilling Method: 50 mm HAND AUGER | ELEVATION: 99.99 (m) |

SAMPLE TYPE ■ GRAB ☒ SHELBY TUBE ☒ SPT SAMPLE ☰ GLASS JAR ▥ NO RECOVERY ▮ CORE

| DEPTH(m) | ◆ PID (ppm in air) ◆ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80 | SAMPLE TYPE | USC | SOIL SYMBOL | Soil Description | COMMENTS | DEPTH(m) |
|---|---|---|---|---|---|---|---|
| 0.0 | | | | | SILT – dry, grey-brown<br>– ash layer approximately 2 cm thick at 0.05 m | | 0.0 |
| | | | SI | | | | |
| | | | | | SAND – with stones and pebbles, medium grained, dry, brown | | |
| | | | SA | | | | |
| | | | | | END OF TEST HOLE AT 0.6 m | | |
| 1.0 | | | | | | | 1 |
| 2.0 | | | | | | | 2 |

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|---|---|
| LOGGED BY: RHS | COMPLETION DEPTH: 0.6 m |
| REVIEWED BY: RHS | COMPLETE: 09/16/97 |
| Fig. No: 4 | Page 1 of |

97/11/28 11:35AM (ENVIRO)

Photograph 01 - Takhini River - Green/brown speckled siding tile, looking northwest.

Photograph 02 - Takhini River - Exterior wall scavenging, looking north.

Photograph 03 - Takhini River - Exterior wall scavenging, looking east.

Photograph 04 - Takhini River - Grey asbestos board above drywall, looking east.

Photograph 05 - Takhini River - Scattered debris located southeast of building.

Photograph 06 - Takhini River - Small debris area at the west side of the site, looking northwest.

Photograph 07 - Takhini River - Debris pile near the Alaska Highway, looking east.

Photograph 08 - Takhini River - Debris and roofing material that is partially embedded in the ground, looking east.

Photograph 09 - Takhini River - Concrete foundation located east of the building, looking east.

Photograph 10 - Takhini River - Building foundation at the north end of the site, looking north.

# APPENDIX B2
# STONY CREEK

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97-S5 |
| Location: STONY CREEK | Driller: UMA ENGINEERING LTD. | PROJECT NO: 4440-037-00-02 |
| Location: MILE 956, ALASKA HIGHWAY, YT | Drilling Method: 50 mm HAND AUGER | ELEVATION: |

SAMPLE TYPE ■ GRAB ▨ SHELBY TUBE ▩ SPT SAMPLE ▤ GLASS JAR ▥ NO RECOVERY ▮ CORE

| DEPTH(m) | ◆ PID (ppm in air) ◆ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80 | SAMPLE TYPE | USC | SOIL SYMBOL | Soil Description | COMMENTS | DEPTH(m) |
|---|---|---|---|---|---|---|---|
| 0.0 | | | | | FILL – sand and gravel, stones and cobbles, dense, dry | | 0.0 |
| | | | FILL | | | | |
| 1.0 | | | | | END OF TEST HOLE AT 1.5 m | | 1.0 |
| 2.0 | | | | | | | 2.0 |
| 3.0 | | | | | | | 3.0 |
| 4.0 | | | | | | | 4.0 |
| 5.0 | | | | | | | 5.0 |

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|---|---|
| LOGGED BY: RHS | COMPLETION DEPTH: 1.5 m |
| REVIEWED BY: RHS | COMPLETE: 09/18/97 |
| Fig. No: 5 | Page 1 of 1 |

97/11/28 11:36AM (ENVIRO)

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97-S6 |
| Location: STONY CREEK | Driller: UMA ENGINEERING LTD. | PROJECT NO: 4440-037-00-02 |
| Location: MILE 956, ALASKA HIGHWAY, YT | Drilling Method: 50 mm HAND AUGER | ELEVATION: |

SAMPLE TYPE ■ GRAB ⊘ SHELBY TUBE ⊠ SPT SAMPLE ▤ GLASS JAR ▥ NO RECOVERY ▮ CORE

| DEPTH(m) | ◆ PID (ppm in air) ◆ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80 | SAMPLE TYPE | USC | SOIL SYMBOL | Soil Description | COMMENTS | DEPTH(m) |
|---|---|---|---|---|---|---|---|
| 0.0 | | ■ | FILL | ▨ | FILL – sand and gravel, stones and cobbles, dense, dry | | 0 |
| 1.0 | | ■ | | | END OF TEST HOLE AT 1.5 m | | 1 |
| 2.0 | | | | | | | 2.0 |
| 3.0 | | | | | | | 3.0 |
| 4.0 | | | | | | | 4.0 |
| 5.0 | | | | | | | 5 |

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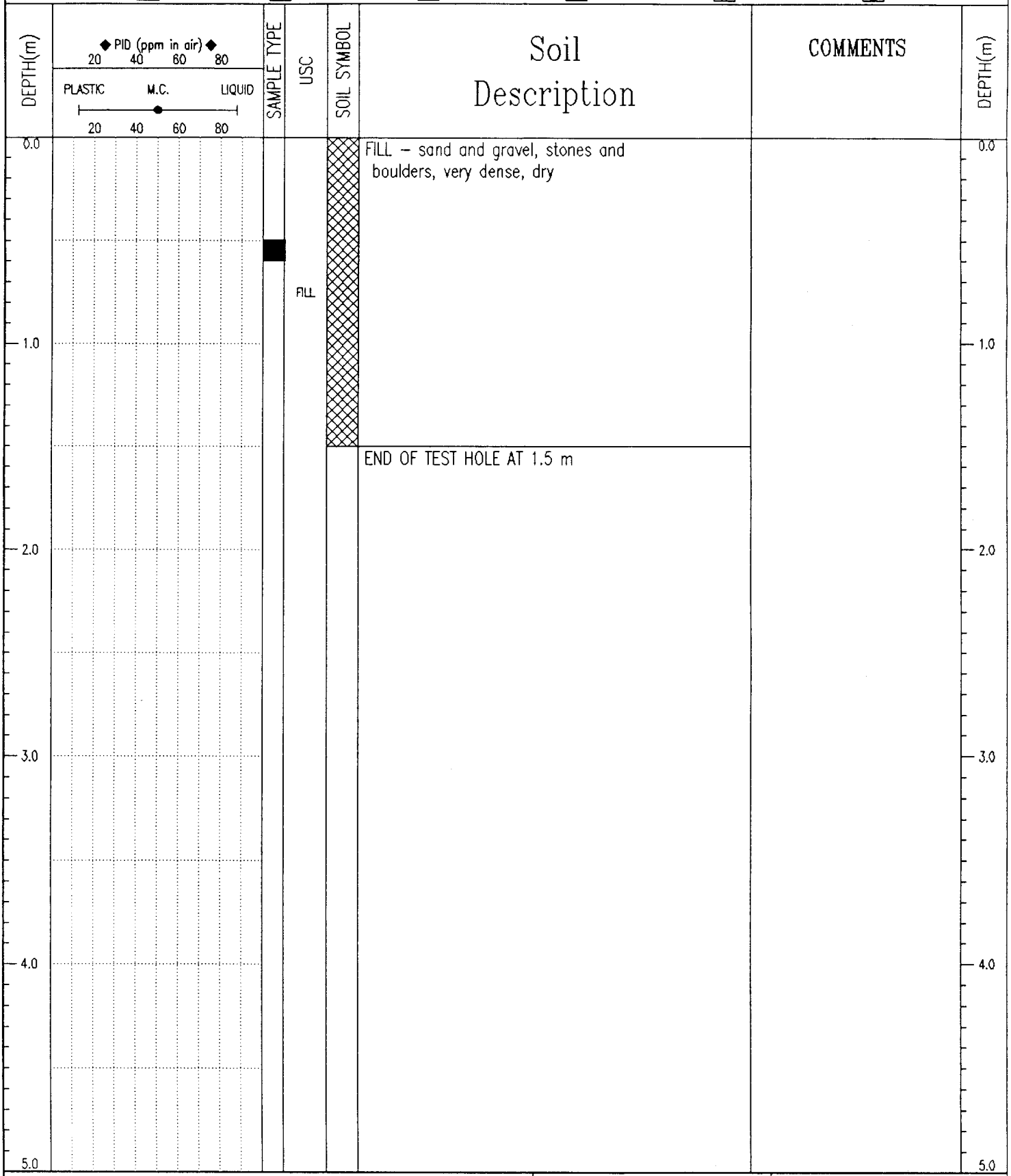
|---|---|
| LOGGED BY: RHS | COMPLETION DEPTH: 1.5 m |
| REVIEWED BY: RHS | COMPLETE: 09/18/97 |
| Fig. No: 6 | Page 1 of |

97/11/28 11:36AM (ENVIRO)

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97-S7 |
| Location: STONY CREEK | Driller: UMA ENGINEERING LTD. | PROJECT NO: 4440-037-00-02 |
| Location: MILE 956, ALASKA HIGHWAY, YT | Drilling Method: 50 mm HAND AUGER | ELEVATION: |

SAMPLE TYPE ■ GRAB ▨ SHELBY TUBE ⊠ SPT SAMPLE ▤ GLASS JAR ▥ NO RECOVERY ▮ CORE




## Soil Description

FILL – sand and gravel, stones and boulders, very dense, dry

END OF TEST HOLE AT 1.5 m

COMMENTS

DEPTH(m)

| | | |
|---|---|---|
| UMA Engineering Ltd. Edmonton, Alberta | LOGGED BY: RHS | COMPLETION DEPTH: 1.5 m |
| | REVIEWED BY: RHS | COMPLETE: 09/18/97 |
| | Fig. No: 7 | Page 1 of 1 |

97/11/28 11:37AM (ENVIRO)

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97-S8 |
| Location: STONY CREEK | Driller: UMA ENGINEERING LTD. | PROJECT NO: 4440-037-00-02 |
| Location: MILE 956, ALASKA HIGHWAY, YT | Drilling Method: 50 mm HAND AUGER | ELEVATION: |

SAMPLE TYPE ■ GRAB ☒ SHELBY TUBE ☒ SPT SAMPLE ☰ GLASS JAR ▥ NO RECOVERY ▮ CORE

| DEPTH(m) | ◆ PID (ppm in air) ◆ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80 | SAMPLE TYPE | USC | SOIL SYMBOL | Soil Description | COMMENTS | DEPTH(m) |
|---|---|---|---|---|---|---|---|
| 0.0 | | | | | SAND - medium grained, uniform, medium dense, dry, iron oxidation | | 0.0 |
| | | | SA | | | | |
| 1.0 | | | | | | | 1 |
| | | | | | END OF TEST HOLE AT 1.5 m | | |
| 2.0 | | | | | | | 2 |
| 3.0 | | | | | | | 3.0 |
| 4.0 | | | | | | | 4.0 |
| 5.0 | | | | | | | 5.0 |

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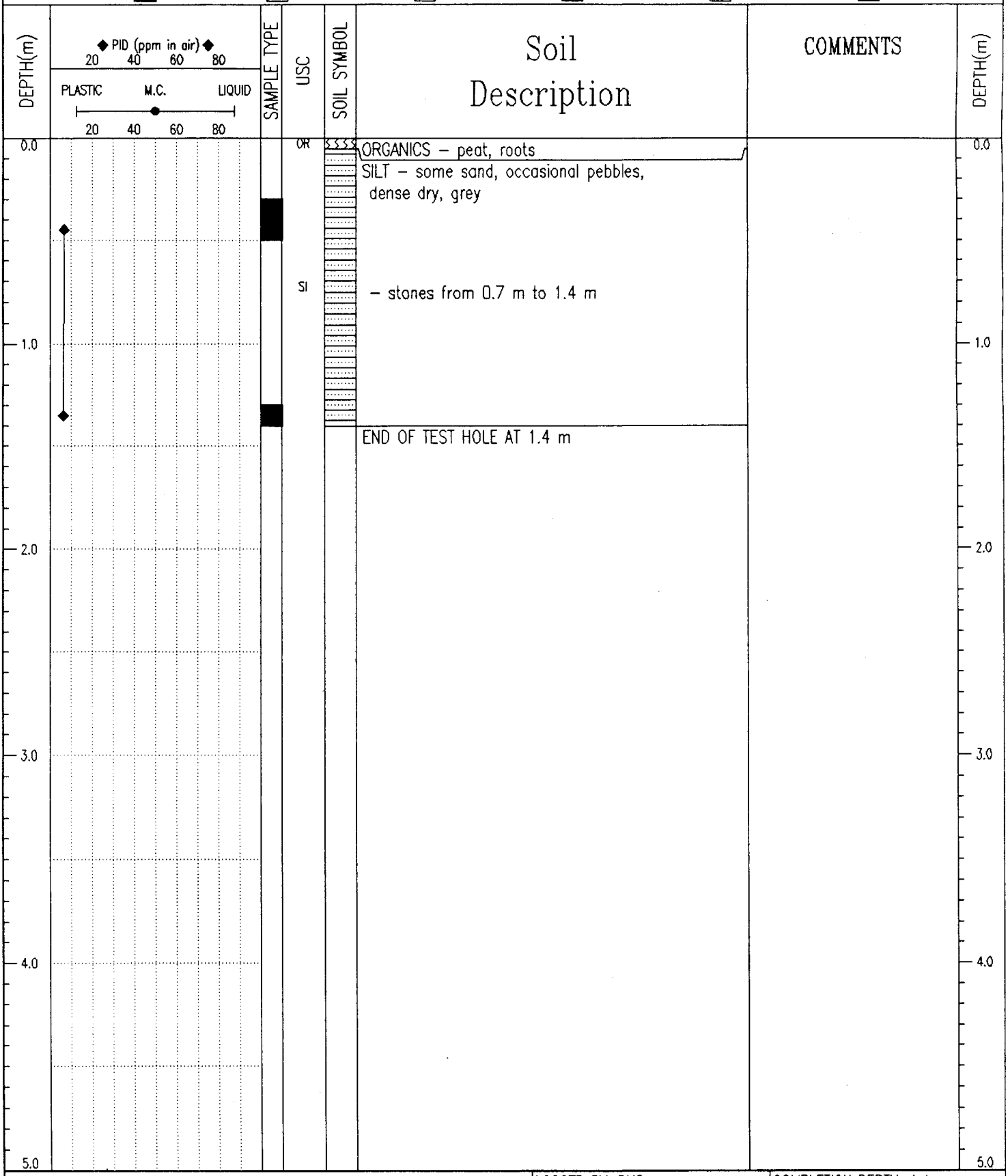
| | |
|---|---|
| LOGGED BY: RHS | COMPLETION DEPTH: 1.5 m |
| REVIEWED BY: RHS | COMPLETE: 09/18/97 |
| Fig. No: 8 | Page 1 of 1 |

97/11/28 11:37AM (ENVIRO)

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97CAN-1 |
| Location: STONY CREEK | Driller: UMA ENGINEERING LTD. | PROJECT NO: 4440-037-00-02 |
| Location: MILE 956, ALASKA HIGHWAY, YT | Drilling Method: 50 mm HAND AUGER | ELEVATION: |

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT SAMPLE | GLASS JAR | NO RECOVERY | CORE




| | | |
|---|---|---|
| UMA Engineering Ltd. Edmonton, Alberta | LOGGED BY: RHS | COMPLETION DEPTH: 1.4 m |
| | REVIEWED BY: RHS | COMPLETE: 09/17/97 |
| | Fig. No: 1 | Page 1 of 1 |

97/11/28 11:38AM (ENVIRO)

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97CAN-2 |
| Location: STONY CREEK | Driller: UMA ENGINEERING LTD. | PROJECT NO: 4440-037-00-02 |
| Location: MILE 956, ALASKA HIGHWAY, YT | Drilling Method: 50 mm HAND AUGER | ELEVATION: |

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT SAMPLE | GLASS JAR | NO RECOVERY | CORE

| DEPTH(m) | ◆ PID (ppm in air) ◆ 20 40 60 80 | SAMPLE TYPE | USC | SOIL SYMBOL | Soil Description | COMMENTS | DEPTH(m) |
|---|---|---|---|---|---|---|---|
| 0.0 | PLASTIC M.C. LIQUID 20 40 60 80 | | OR | | ORGANICS – some fill, bolt nut | | 0.0 |
| | | | | | SILT – some sand, occasional stones, dense, dry, grey | | |
| 1.0 | | | SI | | | | 1.0 |
| | | | | | END OF TEST HOLE AT 1.4 m | | |
| 2.0 | | | | | | | 2.0 |
| 3.0 | | | | | | | 3.0 |
| 4.0 | | | | | | | 4.0 |
| 5.0 | | | | | | | 5.0 |

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|---|---|
| LOGGED BY: RHS | COMPLETION DEPTH: 1.4 m |
| REVIEWED BY: RHS | COMPLETE: 09/17/97 |
| Fig. No: 2 | Page 1 of |

97/11/28 11:38AM (ENVIRO)

| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97CAN-3 |
|---|---|---|
| Location: STONY CREEK | Driller: UMA ENGINEERING LTD. | PROJECT NO: 4440-037-00-02 |
| Location: MILE 956, ALASKA HIGHWAY, YT | Drilling Method: 50 mm HAND AUGER | ELEVATION: |

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT SAMPLE | GLASS JAR | NO RECOVERY | CORE

| DEPTH(m) | ◆ PID (ppm in air) ◆ 20 40 60 80<br>PLASTIC M.C. LIQUID<br>20 40 60 80 | SAMPLE TYPE | USC | SOIL SYMBOL | Soil Description | COMMENTS | DEPTH(m) |
|---|---|---|---|---|---|---|---|
| 0.0 | | | OR | | ORGANICS – peat, roots | | 0.0 |
| | | | | | SILT – some sand with occasional stones and pebbles, dense, dry, grey | | |
| 1.0 | | | SI | | | | 1.0 |
| | | | | | END OF TEST HOLE AT 1.4 m | | |
| 2.0 | | | | | | | 2.0 |
| 3.0 | | | | | | | 3.0 |
| 4.0 | | | | | | | 4.0 |
| 5.0 | | | | | | | 5.0 |

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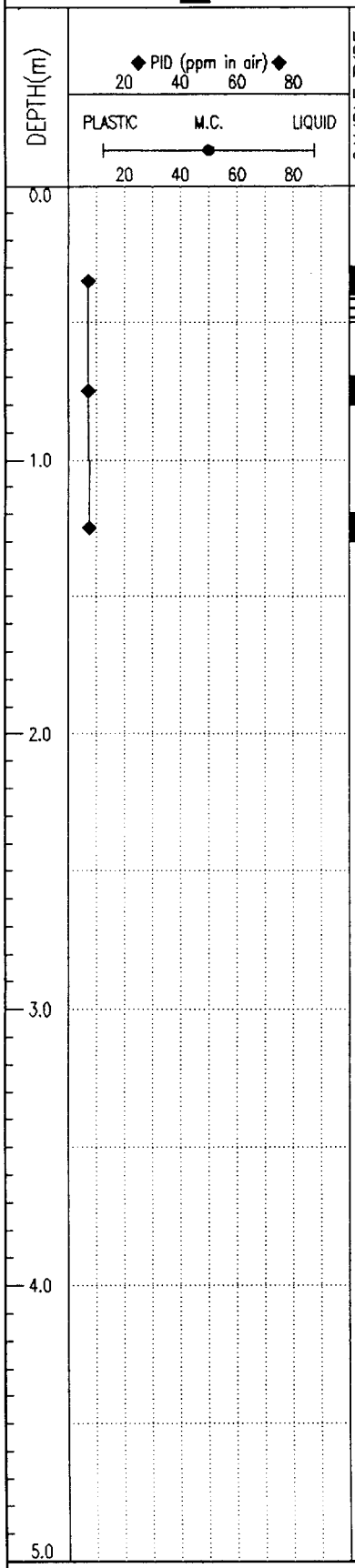
| LOGGED BY: RHS | COMPLETION DEPTH: 1.4 m |
|---|---|
| REVIEWED BY: RHS | COMPLETE: 09/17/97 |
| Fig. No: 3 | Page 1 of 1 |

97/11/28 11:38AM (ENVIRO)

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97CAN-4 |
| Location: STONY CREEK | Driller: UMA ENGINEERING LTD. | PROJECT NO: 4440-037-00-02 |
| Location: MILE 956, ALASKA HIGHWAY, YT | Drilling Method: 50 mm HAND AUGER | ELEVATION: |

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT SAMPLE | GLASS JAR | NO RECOVERY | CORE




## Soil Description

ORGANICS – peat, roots

SILT – trace sand, occasional stones, very dense, dry, grey

END OF TEST HOLE AT 1.4 m

COMMENTS

DEPTH(m)

| | | |
|---|---|---|
| UMA Engineering Ltd. Edmonton, Alberta | LOGGED BY: RHS | COMPLETION DEPTH: 1.4 m |
| | REVIEWED BY: RHS | COMPLETE: 09/17/97 |
| | Fig. No: 4 | Page 1 of 1 |

97/11/28 11:39AM (ENVIRO)

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97CAN-5 |
| Location: STONY CREEK | Driller: UMA ENGINEERING LTD. | PROJECT NO: 4440-037-00-02 |
| Location: MILE 956, ALASKA HIGHWAY, YT | Drilling Method: 50 mm HAND AUGER | ELEVATION: |

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT SAMPLE | GLASS JAR | NO RECOVERY | CORE

| DEPTH(m) | ◆ PID (ppm in air) ◆ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80 | SAMPLE TYPE | USC | SOIL SYMBOL | Soil Description | COMMENTS | DEPTH(m) |
|---|---|---|---|---|---|---|---|
| 0.0 | | | OR | | ORGANICS – peat, roots | | 0.0 |
| | | | | | SILT – some sand, dense, dry, grey | | |
| 1.0 | | | | | | | 1.0 |
| | | | SI | | | | |
| 2.0 | | | | | | | 2.0 |
| 3.0 | | | | | | | 3.0 |
| | | | | | END OF TEST HOLE AT 3.1 m | | |
| 4.0 | | | | | | | 4.0 |
| 5.0 | | | | | | | 5.0 |

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|---|---|
| LOGGED BY: RHS | COMPLETION DEPTH: 3.1 m |
| REVIEWED BY: RHS | COMPLETE: 09/17/97 |
| Fig. No: 5 | Page 1 of 1 |

97/11/28 11:39AM (ENVIRO)

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97CAN-6 |
| Location: STONY CREEK | Driller: UMA ENGINEERING LTD. | PROJECT NO: 4440-037-00-02 |
| Location: MILE 956, ALASKA HIGHWAY, YT | Drilling Method: 50 mm HAND AUGER | ELEVATION: |

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT SAMPLE | GLASS JAR | NO RECOVERY | CORE

| DEPTH(m) | ◆ PID (ppm in air) ◆ 20 40 60 80<br>PLASTIC M.C. LIQUID 20 40 60 80 | SAMPLE TYPE | USC | SOIL SYMBOL | Soil Description | COMMENTS | DEPTH(m) |
|---|---|---|---|---|---|---|---|
| 0.0 | ◆ | | OR | | ORGANICS – peat, roots | | 0.0 |
| | ◆ | | | | SAND – very fine, occasional stones, dense, dry, grey-brown | | |
| 1.0 | ◆ | | SA | | | | 1 |
| | ◆ | | | | | | |
| | | | | | END OF TEST HOLE AT 1.2 m | | |
| 2.0 | | | | | | | 2 |
| 3.0 | | | | | | | 3.0 |
| 4.0 | | | | | | | 4.0 |
| 5.0 | | | | | | | 5 |

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|---|---|
| LOGGED BY: RHS | COMPLETION DEPTH: 1.2 m |
| REVIEWED BY: RHS | COMPLETE: 09/17/97 |
| Fig. No: 6 | Page 1 of |

97/11/28 11:39AM (ENVIRO)

Photograph 11 - Stony Creek (East) - Concrete foundation and minor building debris.

Photograph 12 - Stony Creek (East) - Vehicle hulk and minor surface debris.

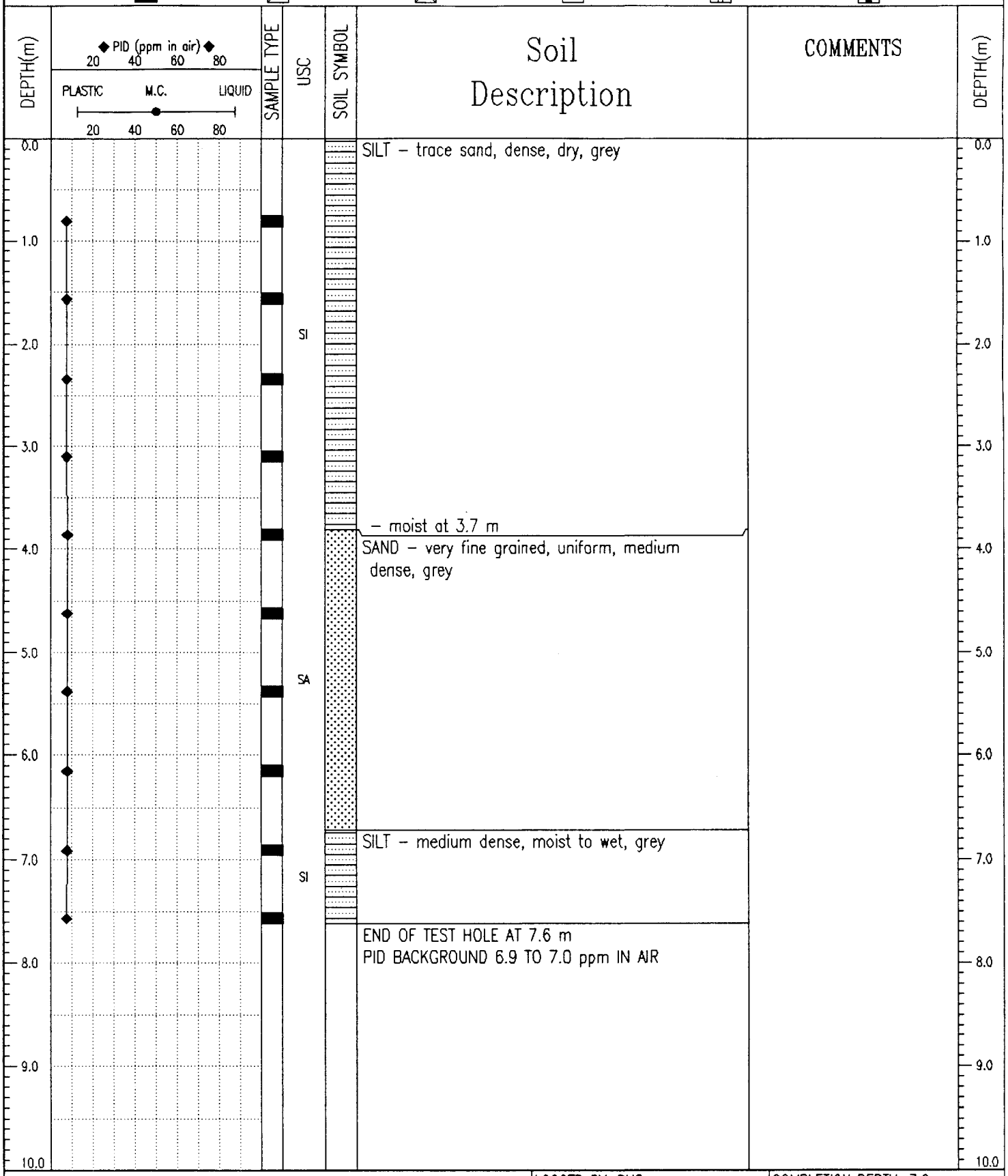
Photograph 13 - Stony Creek (Main) - Typical surface debris including 45 gallon drum.

Photograph 14 - Stony Creek (Main) - Surface building debris containing asbestos bearing tile.

# APPENDIX B3
# MENDENHALL RIVER

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97MEN-1 |
| Location: MENDENHALL RIVER | Driller: MIDNIGHT SUN | PROJECT NO: 4440-037-00-02 |
| Location: MILE 968, ALASKA HIGHWAY, YT | Drilling Method: SOLID STEM AUGER | ELEVATION: 105.32 (m) |

SAMPLE TYPE ■ GRAB ⊘ SHELBY TUBE ⊠ SPT SAMPLE ☰ GLASS JAR ▯ NO RECOVERY ▮ CORE

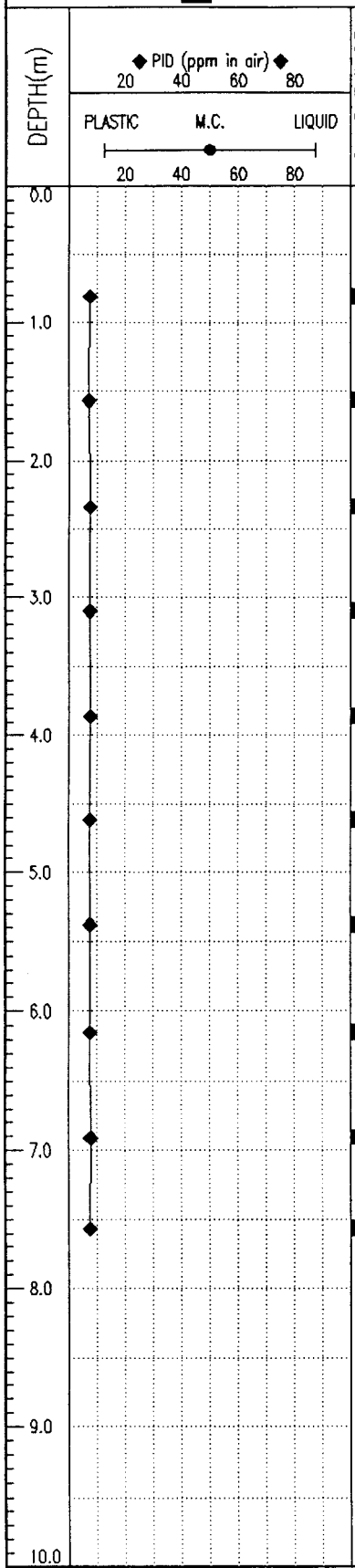



| | | |
|---|---|---|
| UMA Engineering Ltd. Edmonton, Alberta | LOGGED BY: RHS | COMPLETION DEPTH: 7.6 m |
| | REVIEWED BY: RHS | COMPLETE: 09/17/97 |
| | Fig. No: 1 | Page 1 of 1 |

97/11/28 11:40AM (ENVIRO)

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97MEN-2 |
| Location: MENDENHALL RIVER | Driller: MIDNIGHT SUN | PROJECT NO: 4440-037-00-02 |
| Location: MILE 968, ALASKA HIGHWAY, YT | Drilling Method: SOLID STEM AUGER | ELEVATION: 105.04 (m) |

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT SAMPLE | GLASS JAR | NO RECOVERY | CORE




## Soil Description

SAND – medium grained, occasional pebbles, uniform, medium dense, grey

SILT – dense, moist, grey

SAND – fine grained, uniform, medium dense, grey

SILT – trace clay, medium dense, moist to wet, grey

END OF TEST HOLE AT 7.6 m
PID BACKGROUND 6.8 TO 7.1 ppm IN AIR

COMMENTS

DEPTH(m)

0 1.0 2.0 3.0 4.0 6.0 7.0 8.0 9.0

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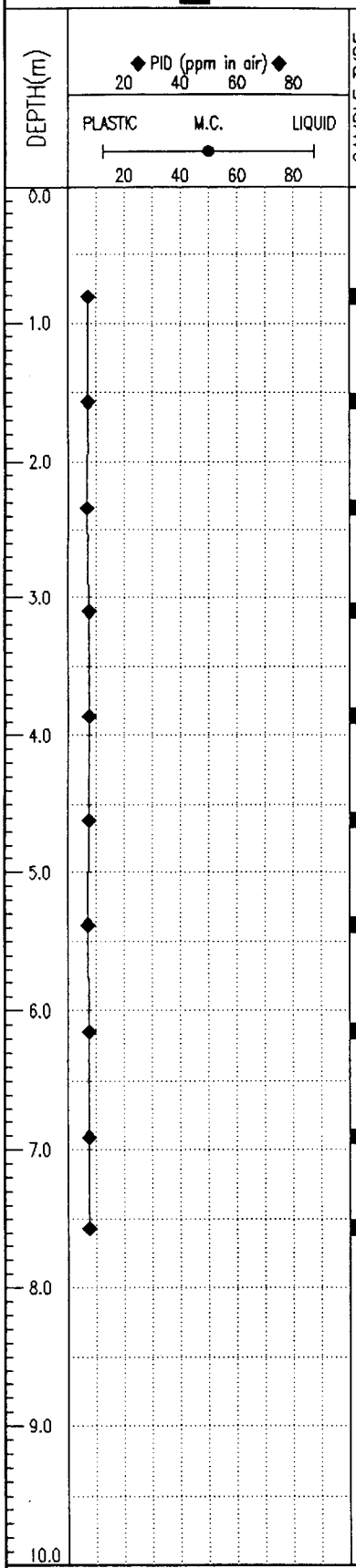
| | |
|---|---|
| LOGGED BY: RHS | COMPLETION DEPTH: 7.6 m |
| REVIEWED BY: RHS | COMPLETE: 09/17/97 |
| Fig. No: 2 | Page 1 of |

97/11/28 11:40AM (ENVIRO)

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97MEN-3 |
| Location: MENDENHALL RIVER | Driller: MIDNIGHT SUN | PROJECT NO: 4440-037-00-02 |
| Location: MILE 968, ALASKA HIGHWAY, YT | Drilling Method: SOLID STEM AUGER | ELEVATION: 104.37 (m) |

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT SAMPLE | GLASS JAR | NO RECOVERY | CORE




## Soil Description

SAND – medium grained, medium dense, loose, mottled, brown

SAND (till) – with silt and clay, very dense, pebbles, brown

SILT – with sand, medium dense, moist, grey

SAND – trace fine gravel, uniform, medium dense, dry to moist, light grey

SILT – with sand, medium dense, moist, grey

SAND – fine, uniform, dense, moist to dry, grey

SILT – with fine sand, dense, moist, grey

END OF TEST HOLE AT 7.6 m
PID BACKGROUND 6.6 TO 6.8 ppm IN AIR

COMMENTS

DEPTH(m)

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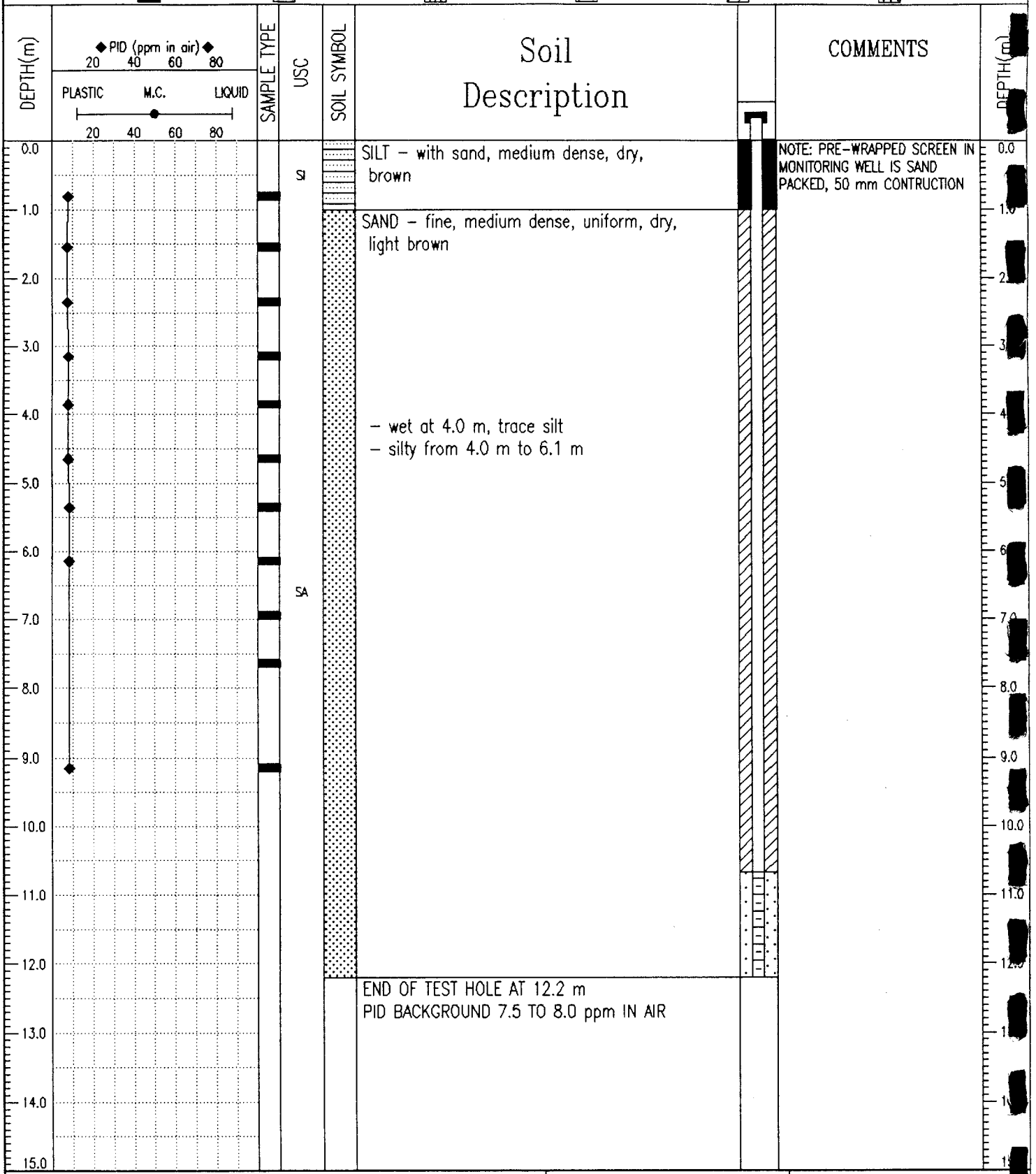
| | |
|---|---|
| LOGGED BY: RHS | COMPLETION DEPTH: 7.6 m |
| REVIEWED BY: RHS | COMPLETE: 09/17/97 |
| Fig. No: 3 | Page 1 of 1 |

97/11/28 11:41AM (ENVIRO)

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97MEN-4 |
| Location: MENDENHALL RIVER | Driller: MIDNIGHT SUN | PROJECT NO: 4440-037-00-02 |
| Location: MILE 968, ALASKA HIGHWAY, YT | Drilling Method: SOLID STEM AUGER | ELEVATION: 100.491 (m) |

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT SAMPLE | GLASS JAR | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | PRE-WRAPPED | SLOUGH | GROUT | DRILL CUTTINGS | SAND



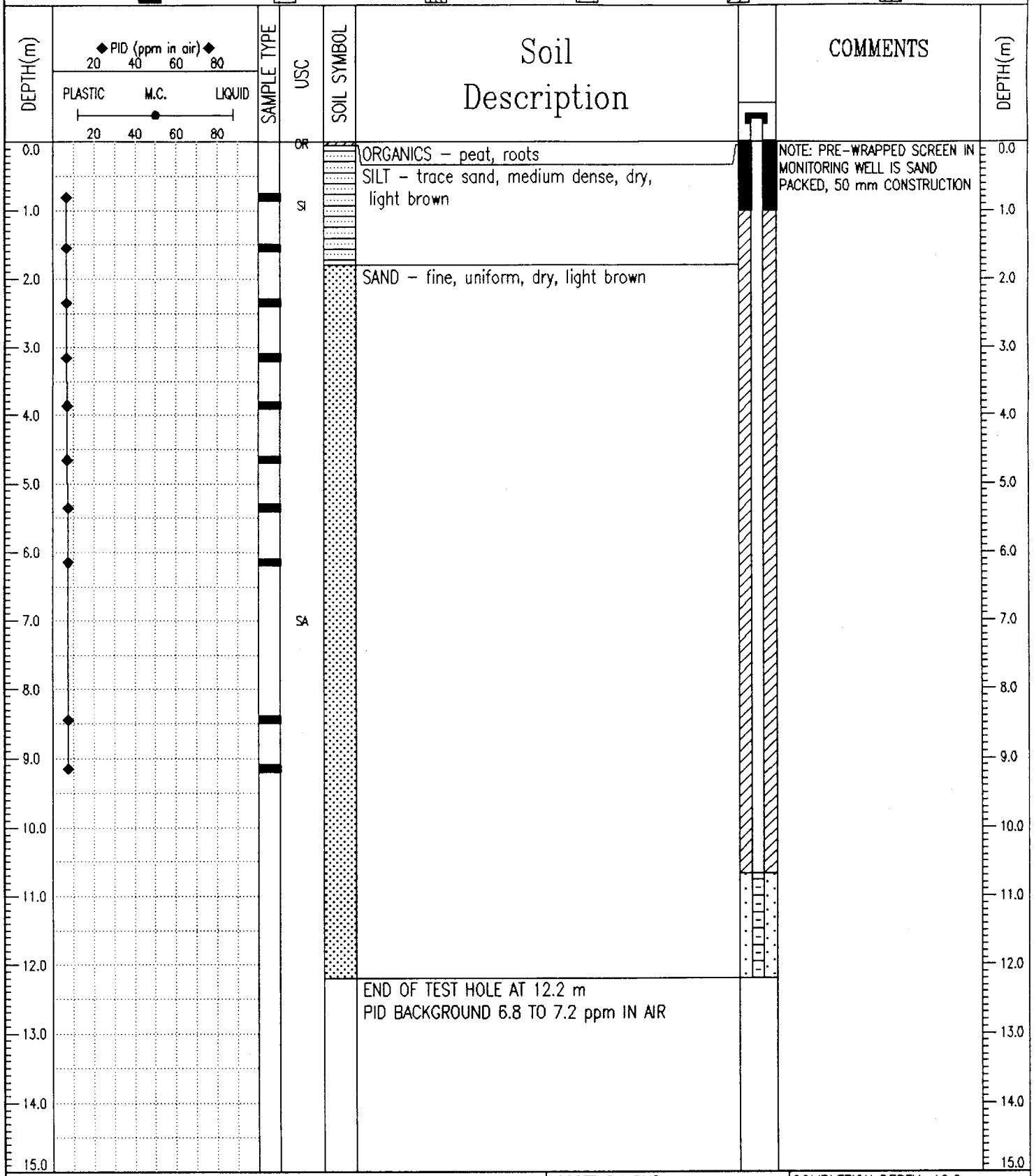

| | | |
|---|---|---|
| UMA Engineering Ltd. Edmonton, Alberta | LOGGED BY: RHS | COMPLETION DEPTH: 12.2 m |
| | REVIEWED BY: RHS | COMPLETE: 09/18/97 |
| | Fig. No: 4 | Page 1 of 1 |

97/11/28 11:43AM (ENVIRO)

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97MEN-5 |
| Location: MENDENHALL RIVER | Driller: MIDNIGHT SUN | PROJECT NO: 4440-037-00-02 |
| Location: MILE 968, ALASKA HIGHWAY, YT | Drilling Method: SOLID STEM AUGER | ELEVATION: 99.56 (m) |

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT SAMPLE | GLASS JAR | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | PRE-WRAPPED | SLOUGH | GROUT | DRILL CUTTINGS | SAND




UMA Engineering Ltd.
Edmonton, Alberta

| | |
|---|---|
| LOGGED BY: RHS | COMPLETION DEPTH: 12.2 m |
| REVIEWED BY: RHS | COMPLETE: 09/18/97 |
| Fig. No: 5 | Page 1 of 1 |

97/11/28 11:43AM (ENVIRO)

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97MEN-6 |
| Location: MENDENHALL RIVER | Driller: MIDNIGHT SUN | PROJECT NO: 4440-037-00-02 |
| Location: MILE 968, ALASKA HIGHWAY, YT | Drilling Method: SOLID STEM AUGER | ELEVATION: 103.54 (m) |

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT SAMPLE | GLASS JAR | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | PRE-WRAPPED | SLOUGH | GROUT | DRILL CUTTINGS | SAND

◆ PID (ppm in air) ◆ 20 40 60 80

PLASTIC M.C. LIQUID 20 40 60 80

| DEPTH(m) | SAMPLE TYPE | USC | SOIL SYMBOL | Soil Description | COMMENTS |
|---|---|---|---|---|---|
| 0.0 | | OR | | ORGANICS – peat, roots | NOTE: PRE-WRAPPED SCREEN IN MONITORING WELL IS SAND PACKED, 50 mm CONSTRUCTION |
| 1.0 | | SI | | SILT – with sand, medium dense, dry, moist, brown | |
| 1.5 | | | | – fine sand at 1.5 m | |
| 1.7 | | | | – trace clay at 1.7 m | |
| 2.0 | | | | SAND – fine, uniform, dry, grey | |
| 3.0 | | | | | |
| 4.0 | | SA | | | |
| 5.0 | | | | | |
| 6.0 | | | | SILT – with fine sand, medium dense, wet, brown to grey | |
| 7.0 | | | | | |
| 8.0 | | | | – sandy at 8 m | |
| 9.0 | | | | | |
| 10.0 | | SI | | | |
| 11.0 | | | | | |
| 12.0 | | | | | |
| 13.0 | | | | | |
| 14.0 | | | | | |
| 15.0 | | | | | |
| 15.2 | | | | END OF TEST HOLE AT 15.2 m<br>SLOUGHING COMMON,<br>REDRILLED AFTER FIRST WELL INSTALLATION ATTEMPT<br>PID BACKGROUND 7.0 TO 9.2 ppm IN AIR | |
| 16.0 | | | | | |
| 17.0 | | | | | |
| 18.0 | | | | | |
| 19.0 | | | | | |
| 20.0 | | | | | |

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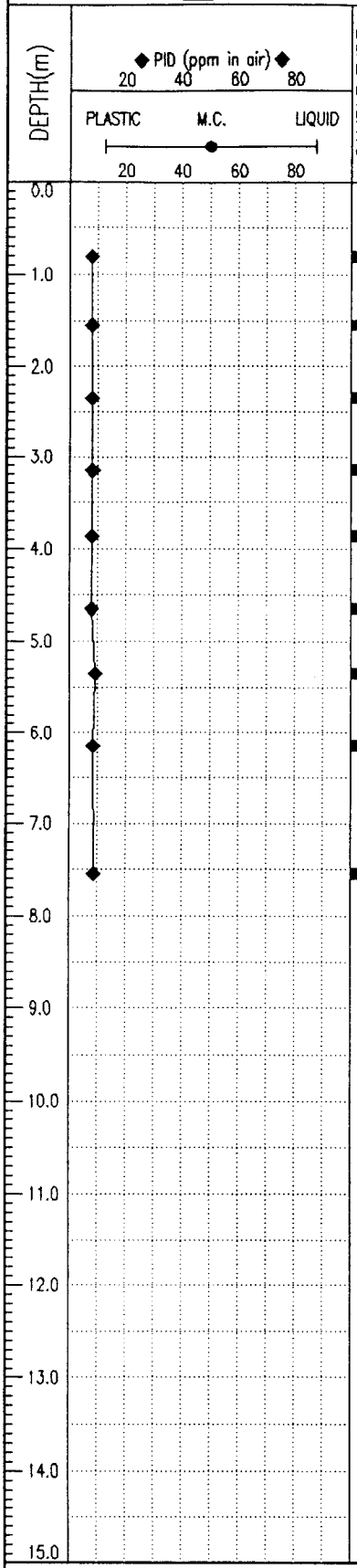
| | |
|---|---|
| LOGGED BY: RHS | COMPLETION DEPTH: 15.2 m |
| REVIEWED BY: RHS | COMPLETE: 09/18/97 |
| Fig. No: 6 | Page 1 of 1 |

97/11/28 11:44AM (ENVIRO)

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97MEN-7 |
| Location: MENDENHALL RIVER | Driller: MIDNIGHT SUN | PROJECT NO: 4440-037-00-02 |
| Location: MILE 968, ALASKA HIGHWAY, YT | Drilling Method: SOLID STEM AUGER | ELEVATION: 101.735 (m) |

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT SAMPLE | GLASS JAR | NO RECOVERY | CORE

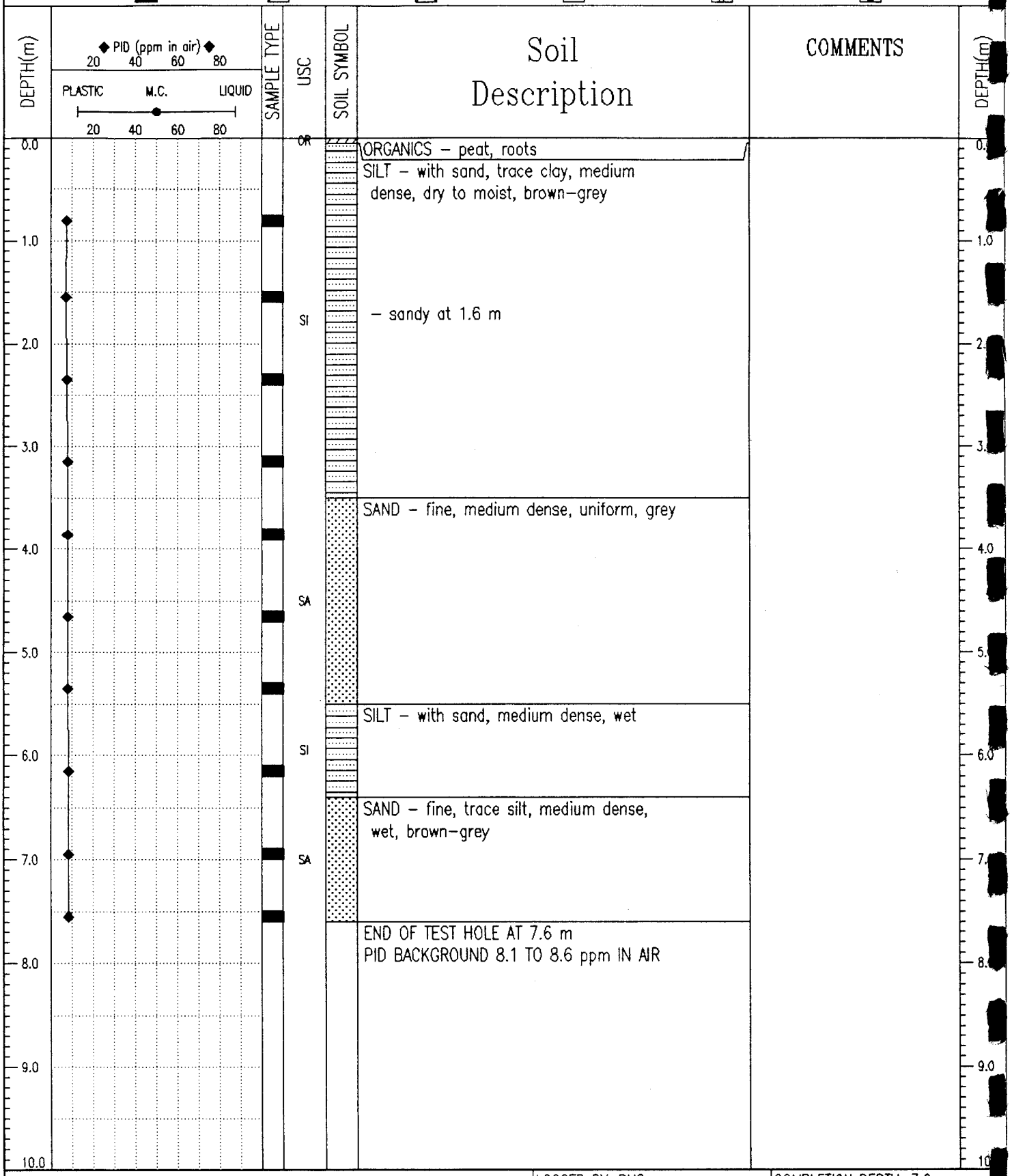



| | | |
|---|---|---|
| UMA Engineering Ltd. Edmonton, Alberta | LOGGED BY: RHS | COMPLETION DEPTH: 12.2 m |
| | REVIEWED BY: RHS | COMPLETE: 09/18/97 |
| | Fig. No: 7 | Page 1 of 1 |

97/11/28 11:48AM (ENVIRO)

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97MEN-8 |
| Location: MENDENHALL RIVER | Driller: MIDNIGHT SUN | PROJECT NO: 4440-037-00-02 |
| Location: MILE 968, ALASKA HIGHWAY, YT | Drilling Method: SOLID STEM AUGER | ELEVATION: 105.055 (m) |

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT SAMPLE | GLASS JAR | NO RECOVERY | CORE




| | | |
|---|---|---|
| UMA Engineering Ltd. Edmonton, Alberta | LOGGED BY: RHS | COMPLETION DEPTH: 7.6 m |
| | REVIEWED BY: RHS | COMPLETE: 09/18/97 |
| | Fig. No: 8 | Page 1 of 1 |

97/11/28 11:47AM (ENVIRO)

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97MEN-9 |
| Location: MENDENHALL RIVER | Driller: UMA ENGINEERING LTD. | PROJECT NO: 4440-037-00-02 |
| Location: MILE 968, ALASKA HIGHWAY, YT | Drilling Method: 50 mm HAND AUGER | ELEVATION: 94.95 (m) |

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT SAMPLE | GLASS JAR | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | PRE-WRAPPED | SLOUGH | GROUT | DRILL CUTTINGS | SAND

| DEPTH(m) | ◆PID (ppm in air)◆ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80 | SAMPLE TYPE | USC | SOIL SYMBOL | Soil Description | SLOTTED PIEZOMETER | COMMENTS | DEPTH(m) |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | SI | | SILT – with fine sand, loose to medium dense, moist to wet, grey | | NOTE: PRE-WRAPPED SCREEN IN MONITORING WELL IS SAND PACKED, 25 mm CONSTRUCTION | 0.0 |
| 1.0 | | | | | | | | 1.0 |
| 2.0 | | | | | | | | 2.0 |
| 3.0 | | | | | END OF TEST HOLE AT 2.74 m | | | 3.0 |
| 4.0 | | | | | | | | 4.0 |
| 5.0 | | | | | | | | 5.0 |

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| | |
|---|---|
| LOGGED BY: RHS | COMPLETION DEPTH: 2.7 m |
| REVIEWED BY: RHS | COMPLETE: 09/18/97 |
| Fig. No: 9 | Page 1 of 1 |

97/11/28 11:46AM (ENVIRO)

| | | |
|---|---|---|
| Project: AES FOLLOW-UP INVESTIGATION '97 | Client: DIAND YUKON | TEST HOLE NO: 97MEN-10 |
| Location: MENDENHALL RIVER | Driller: UMA ENGINEERING LTD. | PROJECT NO: 4440-037-00-02 |
| Location: MILE 968, ALASKA HIGHWAY, YT | Drilling Method: 50 mm HAND AUGER | ELEVATION: 95.33 (m) |

SAMPLE TYPE: GRAB | SHELBY TUBE | SPT SAMPLE | GLASS JAR | NO RECOVERY | CORE

BACKFILL TYPE: BENTONITE | PRE-WRAPPED | SLOUGH | GROUT | DRILL CUTTINGS | SAND

| DEPTH(m) | ◆PID (ppm in air)◆ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80 | SAMPLE TYPE | USC | SOIL SYMBOL | Soil Description | SLOTTED PIEZOMETER | COMMENTS | DEPTH(m) |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | SI | | SILT – with fine sand, loose to medium dense, moist to wet, grey | | NOTE: PRE-WRAPPED SCREEN IN MONITORING WELL IS SAND PACKED, 25 mm CONSTRUCTION | 0.0 |
| 1.0 | | | | | | | | 1.0 |
| 2.0 | | | | | END OF TEST HOLE AT 2.44 m | | | 2.0 |
| 3.0 | | | | | | | | 3.0 |
| 4.0 | | | | | | | | 4.0 |
| 5.0 | | | | | | | | 5.0 |

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| | |
|---|---|
| LOGGED BY: RHS | COMPLETION DEPTH: 2.4 m |
| REVIEWED BY: RHS | COMPLETE: 09/18/97 |
| Fig. No: 10 | Page 1 of 1 |

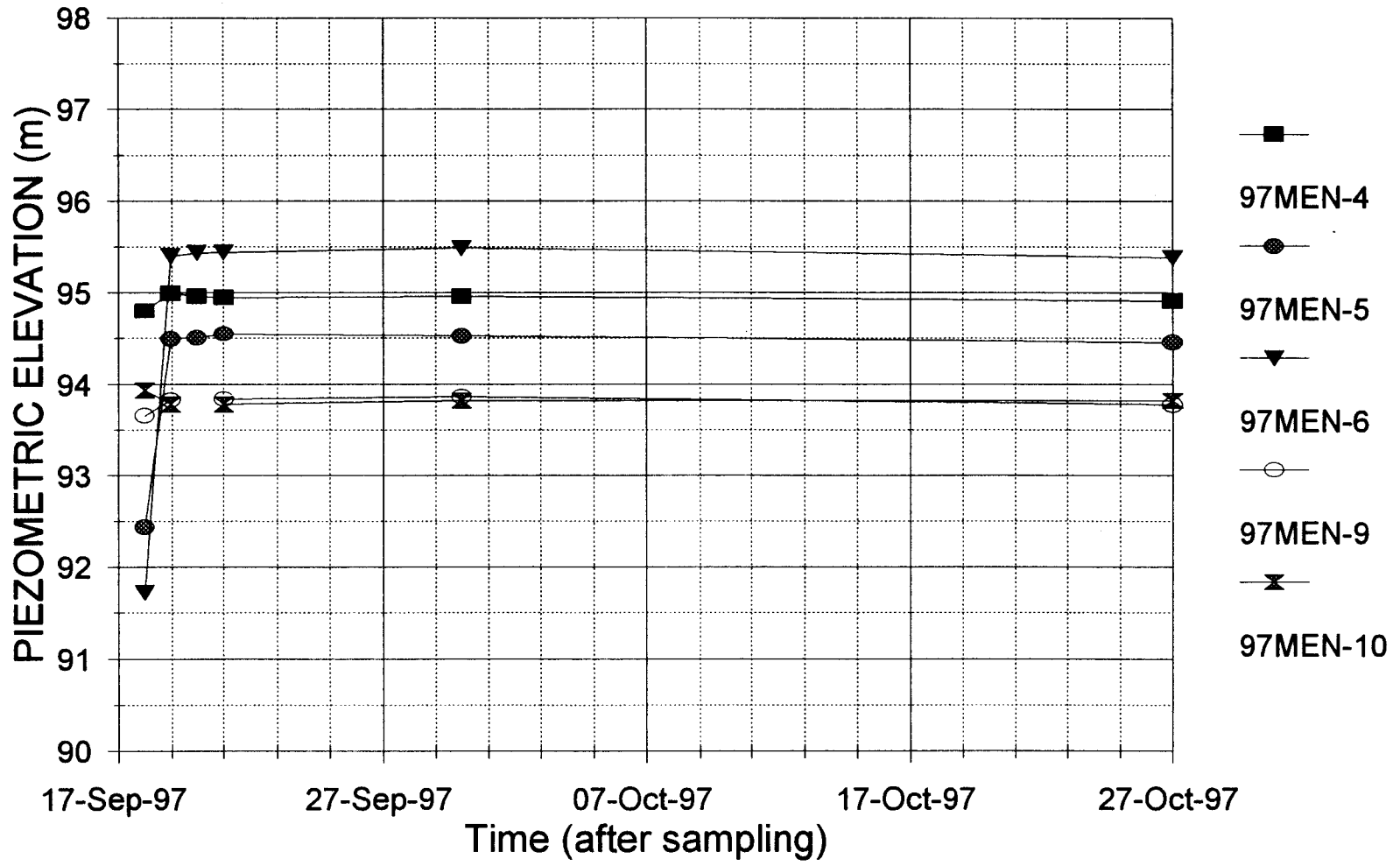
97/11/28 11:46AM (ENVIRO)

**MENDENHALL RIVER**
GROUNDWATER MONITORING

| | Piezometric Elevations (metres) | | | | |
|---|---|---|---|---|---|
| **DATE** | **MEN-4** | **MEN-5** | **MEN-6** | **MEN-9** | **MEN-10** |
| 18-Sep-97 | 94.805 | 92.441 | 91.729 | 93.659 | 93.936 |
| 19-Sep-97 | 94.995 | 94.501 | 95.399 | 93.829 | 93.786 |
| 20-Sep-97 | 94.965 | 94.511 | 95.439 | | |
| 21-Sep-97 | 94.955 | 94.551 | 95.449 | 93.839 | 93.786 |
| 30-Sep-97 | 94.965 | 94.531 | 95.489 | 93.869 | 93.826 |
| 27-Oct-97 | 94.915 | 94.461 | 95.389 | 93.779 | 93.826 |

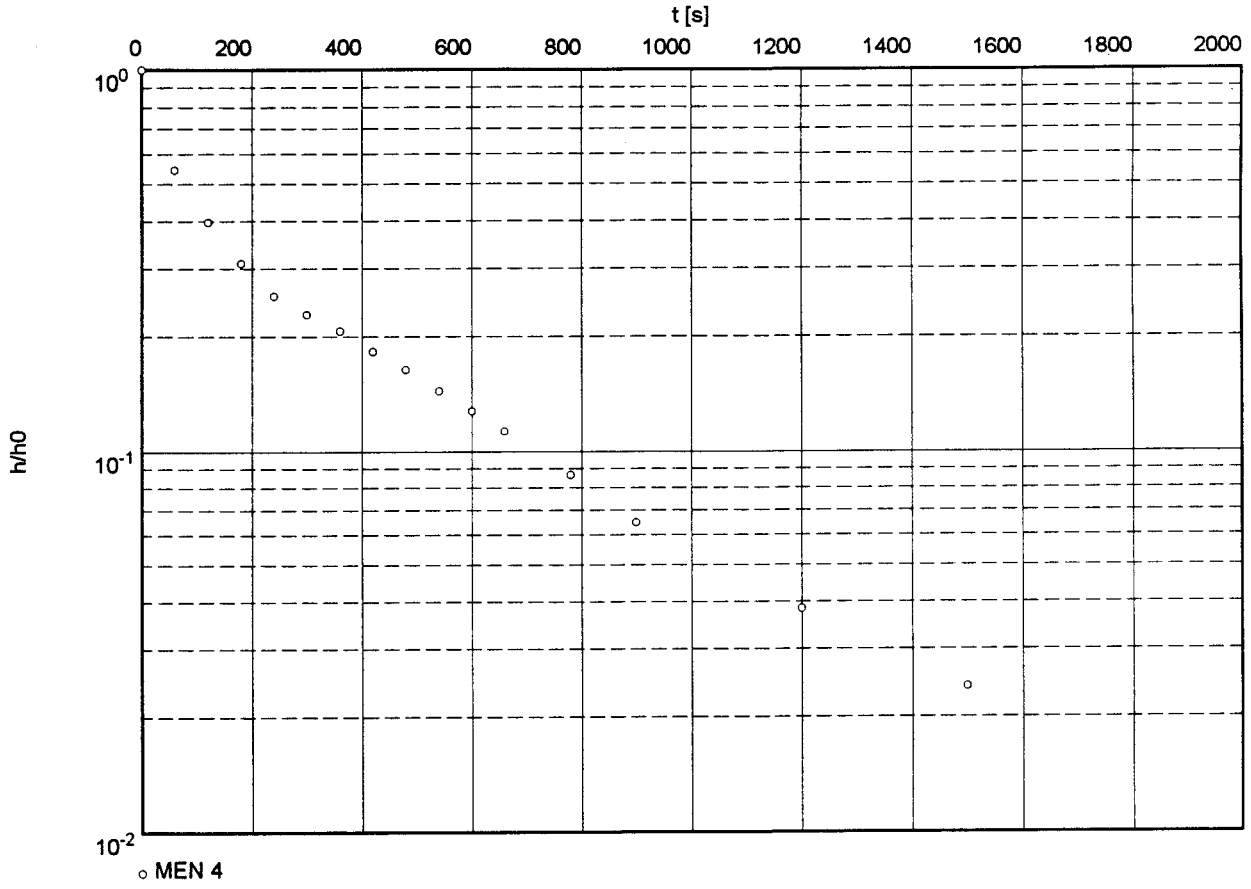
# HYDROGRAPH

## Mendenhall River



| Waterloo Hydrogeologic<br>180 Columbia St. W.<br>Waterloo, Ontario, Canada<br>ph.(519)746-1798 | slug/bail test analysis<br>HVORSLEV's method | Date: 23.10.1997 | Page 1 |
|---|---|---|---|
| | | Project: DIAND YUKON | |
| | | Evaluated by: RS | |

| Slug Test No. 1 | Test conducted on: SEPTEMBER 18, 1997 |
|---|---|
| MEN 4 | |
| | |




Hydraulic conductivity [m/s]: $1.96 \times 10^{-6}$

**Waterloo Hydrogeologic**
180 Columbia St. W.
Waterloo, Ontario, Canada
ph.(519)746-1798

slug/bail test analysis
HVORSLEV's method

Date: 23.10.1997 | Page 2

Project: DIAND YUKON

Evaluated by: RS

Slug Test No. 1

Test conducted on: SEPTEMBER 18, 1997

MEN 4

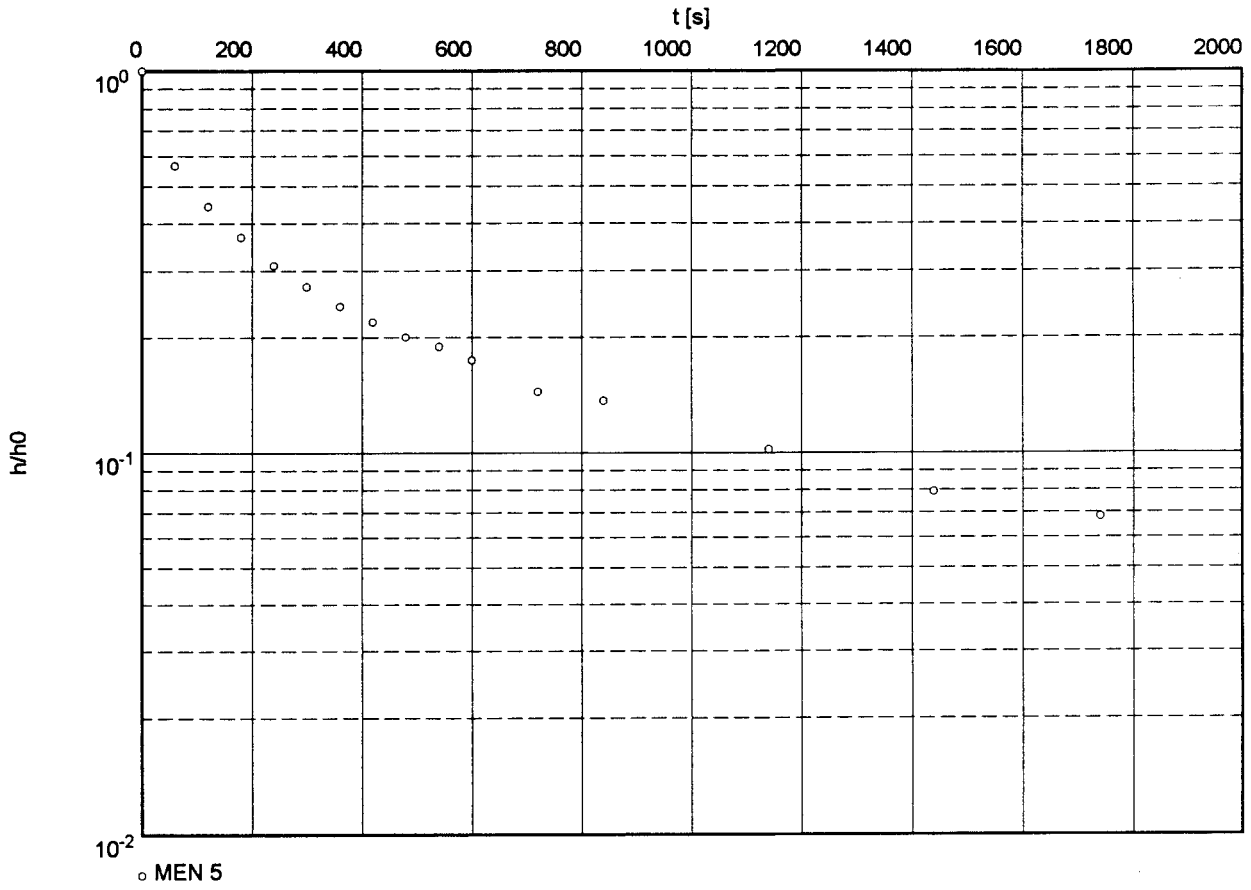
MEN 4

Static water level: 5.180 m below datum

| | Pumping test duration [s] | Water level [m] | Change in Waterlevel [m] |
|---|---|---|---|
| 1 | 0 | 9.350 | 4.170 |
| 2 | 60 | 7.450 | 2.270 |
| 3 | 120 | 6.830 | 1.650 |
| 4 | 180 | 6.470 | 1.290 |
| 5 | 240 | 6.240 | 1.060 |
| 6 | 300 | 6.130 | 0.950 |
| 7 | 360 | 6.040 | 0.860 |
| 8 | 420 | 5.940 | 0.760 |
| 9 | 480 | 5.860 | 0.680 |
| 10 | 540 | 5.780 | 0.600 |
| 11 | 600 | 5.710 | 0.530 |
| 12 | 660 | 5.650 | 0.470 |
| 13 | 780 | 5.540 | 0.360 |
| 14 | 900 | 5.450 | 0.270 |
| 15 | 1200 | 5.340 | 0.160 |
| 16 | 1500 | 5.280 | 0.100 |

| Waterloo Hydrogeologic<br>180 Columbia St. W.<br>Waterloo, Ontario, Canada<br>ph.(519)746-1798 | slug/bail test analysis<br>HVORSLEV's method | Date: 23.10.1997 | Page 1 |
|---|---|---|---|
| | | Project: DIAND YUKON | |
| | | Evaluated by: RS | |

| Slug Test No. 1 | Test conducted on: SEPTEMBER 18, 1997 |
|---|---|
| MEN 5 | |
| | |




Hydraulic conductivity [m/s]: $1.22 \times 10^{-6}$

| Waterloo Hydrogeologic<br>180 Columbia St. W.<br>Waterloo, Ontario, Canada<br>ph.(519)746-1798 | slug/bail test analysis<br>HVORSLEV's method | Date: 23.10.1997 | Page 2 |
|---|---|---|---|
| | | Project: DIAND YUKON | |
| | | Evaluated by: RS | |

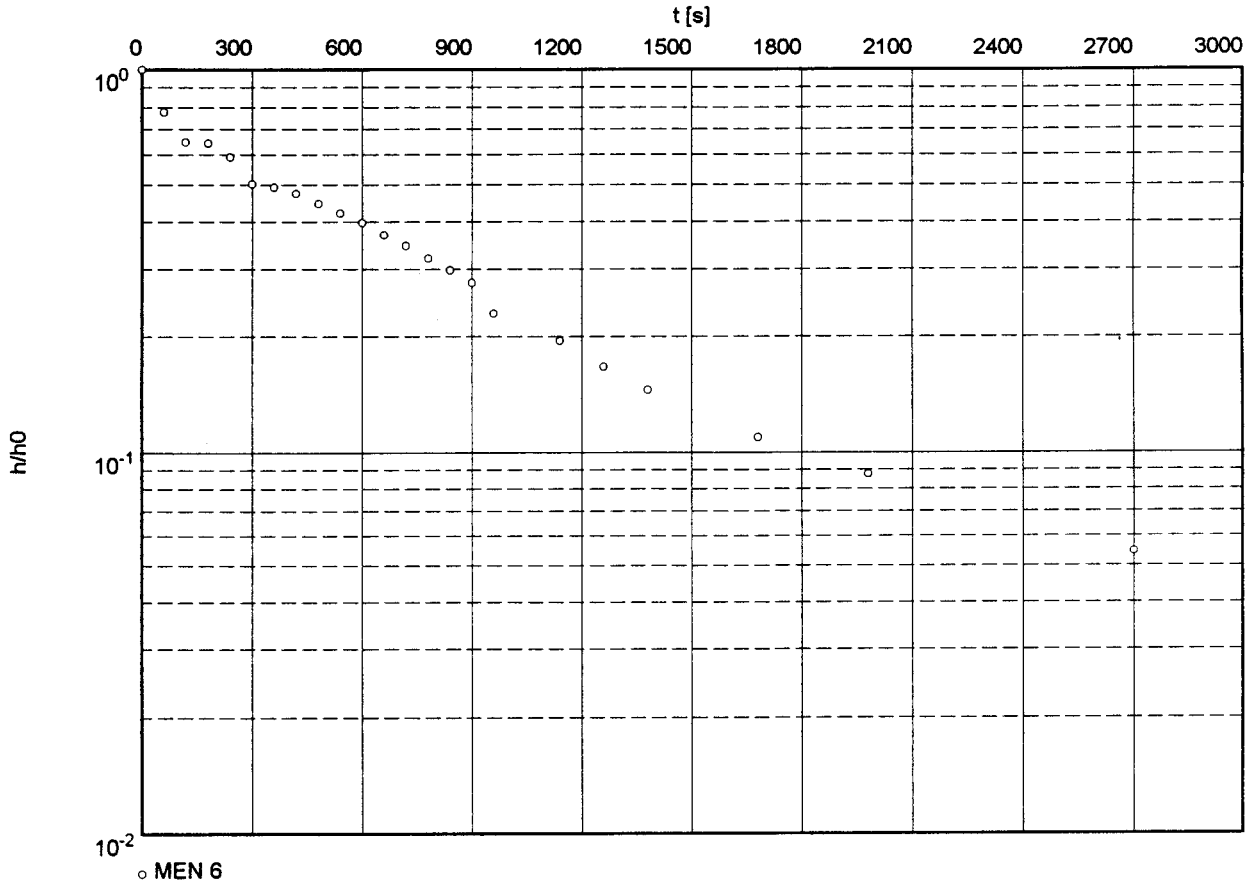
| Slug Test No. 1 | Test conducted on: SEPTEMBER 18, 1997 |
|---|---|
| MEN 5 | MEN 5 |
| | |

Static water level: 5.620 m below datum

| | Pumping test duration [s] | Water level [m] | Change in Waterlevel [m] |
|---|---|---|---|
| 1 | 0 | 8.270 | 2.650 |
| 2 | 60 | 7.120 | 1.500 |
| 3 | 120 | 6.790 | 1.170 |
| 4 | 180 | 6.590 | 0.970 |
| 5 | 240 | 6.440 | 0.820 |
| 6 | 300 | 6.340 | 0.720 |
| 7 | 360 | 6.260 | 0.640 |
| 8 | 420 | 6.200 | 0.580 |
| 9 | 480 | 6.150 | 0.530 |
| 10 | 540 | 6.120 | 0.500 |
| 11 | 600 | 6.080 | 0.460 |
| 12 | 720 | 6.000 | 0.380 |
| 13 | 840 | 5.980 | 0.360 |
| 14 | 1140 | 5.890 | 0.270 |
| 15 | 1440 | 5.830 | 0.210 |
| 16 | 1740 | 5.800 | 0.180 |

| | | | |
|---|---|---|---|
| **Waterloo Hydrogeologic**<br>180 Columbia St. W.<br>Waterloo,Ontario,Canada<br>ph.(519)746-1798 | slug/bail test analysis<br>HVORSLEV's method | Date: 23.10.1997 | Page 1 |
| | | Project: DIAND YUKON | |
| | | Evaluated by: RS | |

| | |
|---|---|
| Slug Test No. 1 | Test conducted on: SEPTEMBER 18, 1997 |
| MEN 6 | |
| | |




Hydraulic conductivity [m/s]: $9.42 \times 10^{-7}$

| Waterloo Hydrogeologic<br>180 Columbia St. W.<br>Waterloo,Ontario,Canada<br>ph.(519)746-1798 | slug/bail test analysis<br>HVORSLEV's method | Date: 23.10.1997 | Page 2 |
|---|---|---|---|
| | | Project: DIAND YUKON | |
| | | Evaluated by: RS | |

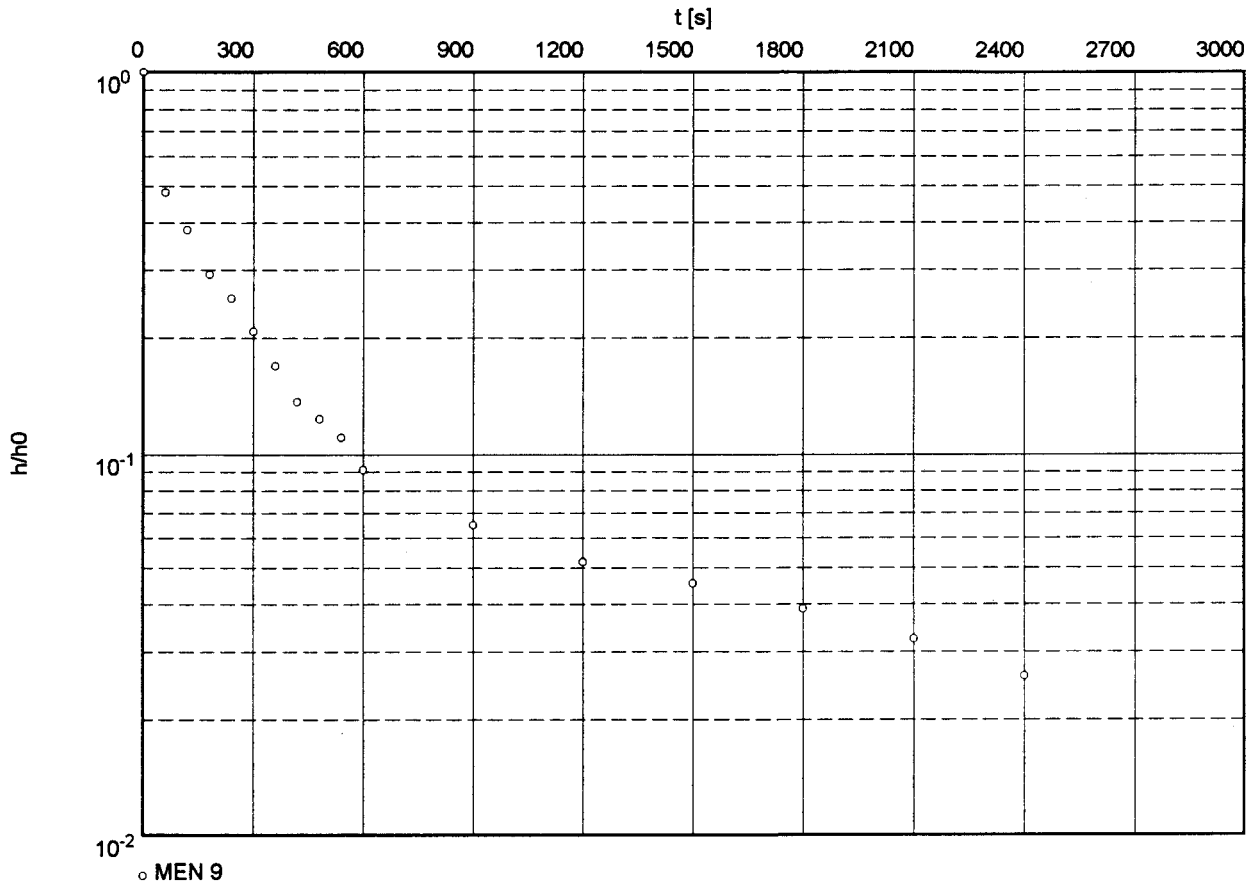
| Slug Test No. 1 | Test conducted on: SEPTEMBER 18, 1997 |
|---|---|
| MEN 6 | MEN 6 |
| | |

Static water level: 5.620 m below datum

| | Pumping test duration [s] | Water level [m] | Change in Waterlevel [m] |
|---|---|---|---|
| 1 | 0 | 9.280 | 3.660 |
| 2 | 60 | 8.460 | 2.840 |
| 3 | 120 | 7.990 | 2.370 |
| 4 | 180 | 7.970 | 2.350 |
| 5 | 240 | 7.780 | 2.160 |
| 6 | 300 | 7.460 | 1.840 |
| 7 | 360 | 7.420 | 1.800 |
| 8 | 420 | 7.350 | 1.730 |
| 9 | 480 | 7.250 | 1.630 |
| 10 | 540 | 7.160 | 1.540 |
| 11 | 600 | 7.070 | 1.450 |
| 12 | 660 | 6.970 | 1.350 |
| 13 | 720 | 6.880 | 1.260 |
| 14 | 780 | 6.790 | 1.170 |
| 15 | 840 | 6.710 | 1.090 |
| 16 | 900 | 6.630 | 1.010 |
| 17 | 960 | 6.460 | 0.840 |
| 18 | 1140 | 6.330 | 0.710 |
| 19 | 1260 | 6.230 | 0.610 |
| 20 | 1380 | 6.150 | 0.530 |
| 21 | 1680 | 6.020 | 0.400 |
| 22 | 1980 | 5.940 | 0.320 |
| 23 | 2700 | 5.820 | 0.200 |

| | | | |
|---|---|---|---|
| **Waterloo Hydrogeologic**<br>180 Columbia St. W.<br>Waterloo,Ontario,Canada<br>ph.(519)746-1798 | slug/bail test analysis<br>HVORSLEV's method | Date: 24.10.1997 | Page 1 |
| | | Project: DIAND YUKON | |
| | | Evaluated by: RS | |

| | |
|---|---|
| Slug Test No. 1 | Test conducted on: SEPTEMBER 19. 1997 |
| MEN 9 | |
| | |




Hydraulic conductivity [m/s]: $4.33 \times 10^{-7}$

| **Waterloo Hydrogeologic**<br>180 Columbia St. W.<br>Waterloo,Ontario,Canada<br>ph.(519)746-1798 | slug/bail test analysis<br>HVORSLEV's method | Date: 24.10.1997 | Page 2 |
|---|---|---|---|
| | | Project: DIAND YUKON | |
| | | Evaluated by: RS | |

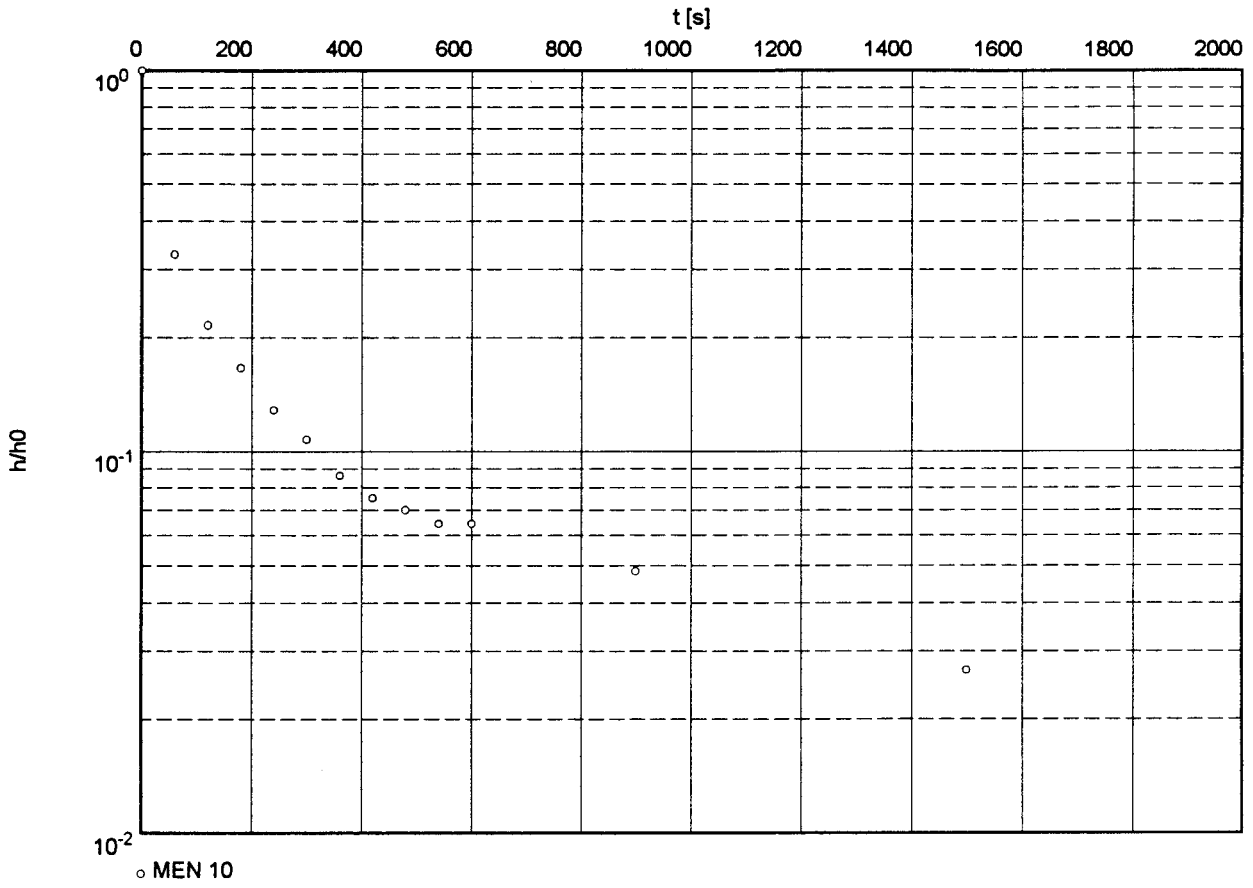
| Slug Test No. 1 | Test conducted on: SEPTEMBER 19. 1997 |
|---|---|
| MEN 9 | MEN 9 |
| | |

Static water level: 0.400 m below datum

| | Pumping test duration [s] | Water level [m] | Change in Waterlevel [m] |
|---|---|---|---|
| 1 | 0 | 1.940 | 1.540 |
| 2 | 60 | 1.140 | 0.740 |
| 3 | 120 | 0.990 | 0.590 |
| 4 | 180 | 0.850 | 0.450 |
| 5 | 240 | 0.790 | 0.390 |
| 6 | 300 | 0.720 | 0.320 |
| 7 | 360 | 0.660 | 0.260 |
| 8 | 420 | 0.610 | 0.210 |
| 9 | 480 | 0.590 | 0.190 |
| 10 | 540 | 0.570 | 0.170 |
| 11 | 600 | 0.540 | 0.140 |
| 12 | 900 | 0.500 | 0.100 |
| 13 | 1200 | 0.480 | 0.080 |
| 14 | 1500 | 0.470 | 0.070 |
| 15 | 1800 | 0.460 | 0.060 |
| 16 | 2100 | 0.450 | 0.050 |
| 17 | 2400 | 0.440 | 0.040 |

| Waterloo Hydrogeologic<br>180 Columbia St. W.<br>Waterloo, Ontario, Canada<br>ph.(519)746-1798 | slug/bail test analysis<br>HVORSLEV's method | Date: 23.10.1997 | Page 1 |
|---|---|---|---|
| | | Project: DIAND YUKON | |
| | | Evaluated by: RS | |

| Slug Test No. 1 | Test conducted on: SEPTEMBER 19,1997 |
|---|---|
| MEN 10 | |
| | |




Hydraulic conductivity [m/s]: $6.32 \times 10^{-7}$

**Waterloo Hydrogeologic**
180 Columbia St. W.
Waterloo, Ontario, Canada
ph.(519)746-1798

slug/bail test analysis
HVORSLEV's method

Date: 23.10.1997 | Page 2

Project: DIAND YUKON

Evaluated by: RS

Slug Test No. 1

Test conducted on: SEPTEMBER 19,1997

MEN 10

MEN 10

Static water level: 0.900 m below datum

| | Pumping test duration [s] | Water level [m] | Change in Waterlevel [m] |
|---|---|---|---|
| 1 | 0 | 2.760 | 1.860 |
| 2 | 60 | 1.510 | 0.610 |
| 3 | 120 | 1.300 | 0.400 |
| 4 | 180 | 1.210 | 0.310 |
| 5 | 240 | 1.140 | 0.240 |
| 6 | 300 | 1.100 | 0.200 |
| 7 | 360 | 1.060 | 0.160 |
| 8 | 420 | 1.040 | 0.140 |
| 9 | 480 | 1.030 | 0.130 |
| 10 | 540 | 1.020 | 0.120 |
| 11 | 600 | 1.020 | 0.120 |
| 12 | 900 | 0.990 | 0.090 |
| 13 | 1500 | 0.950 | 0.050 |

Photograph 15 - Mendenhall River - Mounded, partially buried debris area.

Photograph 16 - Mendenhall River - Surface debris on slope.

Photograph 17 - Mendenhall River - Partially buried debris at the top of slope.

Photograph 18 - Mendenhall River - Truck mounted CME auger drilling rig used to install groundwater monitoring wells.

Photograph 19 - Mendenhall River - Pre-packed well screen constructed in the field to filter fine sand and silt.

Photograph 20 - Mendenhall River - Typical above ground protective well casing.

Photograph 21 - Mendenhall River - Typical monitoring well installed using small diameter hand auger.

# APPENDIX C
# QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PROGRAM

# APPENDIX C
# QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PROGRAM

A quality assurance/quality control program was used to monitor data quality and reliability. The program included:

- Internal spikes (using a known concentration of an analyte) and surrogate standards to monitor analytical accuracy.
- Analytical or procedural duplicates of samples to monitor internally the precision or repeatability of the results.
- Submission of blind field duplicates obtained during the sampling program to monitor the precision or repeatability of results.

The results of the QA/QC are discussed below.

## C.1 INORGANIC ELEMENT (METAL ANALYSES)

Analytical precision for inorganic elements was performed internally at EnviroTest using Standard Reference Material and a spiked matrix sample as shown in Table C.1. Recoveries of the spiked sample were good, with all values lying above 90%. Good analytical accuracy was found for the majority of the inorganic analytes in the standard reference material. Determined concentrations in the standard reference material were typically underestimated, but were still within the range of acceptable limits.

One pair of duplicate samples of soil were submitted for analyses as external monitors of analytical precision. Agreement between duplicates can be measured either by direct comparison or by calculating the relative standard deviation (RSD), the standard deviation of the duplicates divided by the mean (expressed as a percentage). Values of RSD less than 30% indicate reasonable to good precision. Table C.2 provides a comparison of the soil duplicate samples. For the field duplicate of the soil sample, all RSD values were within the 30% limit indicating good precision for the analytes.

## C.2 EXTRACTABLE HYDROCARBONS

Table C.3 provides a summary of the QA/QC for Total Extractable Hydrocarbons (TEH) in water and soil. Good recovery percentages were recorded for both soil and water spiked samples.

**TABLE C.3**
**SUMMARY OF QA/QC FOR TEH**

| Media | % Recovery | % RSD |
|---|---|---|
| Soil | 100 | 32 |
| Water | 87 | 22 |

## C.3 POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)

Six surrogate samples were run to evaluate the QA/QC of the PAH analyses for soil. The percent surrogate recovery is provided in Table C.4.

**TABLE C.4**
**SUMMARY OF QA/QC FOR PAH**

| | % Surrogate Recovery | | | | | |
|---|---|---|---|---|---|---|
| | 97-CAN1-0.3 | 97-CAN4-0.4 | 97-CAN5-0.3 | 97-CAN5-1.2 | 97-CAN6-0.25 | 97-CAN8-1.2 |
| Nitrobenzene d5 | 79 | 75 | 91 | 85 | 84 | 91 |
| 2-Fluorobiphenyl | 84 | 87 | 91 | 84 | 83 | 89 |
| p-Terphenyl d14 | 104 | 109 | 103 | 98 | 101 | 107 |

One pair of duplicate samples of soil were submitted for analyses as external monitors of analytical precision. Agreement between duplicates can be measured either by direct comparison or by calculating the relative standard deviation (RSD), the standard deviation of the duplicates divided by the mean (expressed as a percentage). Values of RSD less than 30% usually indicate reasonable to good precision. However, when the numbers being compared are small ($< 1$), the RSD is not a reliable indicator of the precision. In this case, the best method for equating the results is by direct comparison. Table C.5 provides a comparison of the soil duplicate samples. For the field duplicate of the soil sample, RSD values were within the 20- 70 % range. However, by directly comparing the results it can be seen that good precision for the analytes was achieved.

| TABLE C.5<br>PAH ANALYSES DUPLICATE COMPARISON | | | |
|---|---|---|---|
| Parameter | Sample | | RSD (%) |
| | 97-CAN-5-1.2 | 97-CAN-8-1.2 | |
| Naphthalene | <0.01 | <0.01 | n/a |
| Acenaphthylene | <0.01 | <0.01 | n/a |
| Acenaphthene | <0.01 | <0.01 | n/a |
| Fluorene | <0.01 | <0.01 | n/a |
| Phenanthrene/Anthracene | 0.03 | 0.05 | 36 |
| Fluoranthene | 0.08 | 0.12 | 28 |
| Pyrene | 0.10 | 0.16 | 33 |
| B(a)A/Chrysene/B(c)P | 0.09 | 0.16 | 40 |
| 7,12-dimethylbenz(a)anthracene | <0.01 | <0.01 | n/a |
| Benzo(b,j,k)fluoranthene | 0.06 | 0.09 | 28 |
| Benzo(a)pyrene | 0.03 | 0.04 | 20 |
| 3-Methlycholanthrene | <0.01 | <0.01 | n/a |
| Indeno(1,2,3-cd)anthracene | 0.02 | 0.03 | 28 |
| Dibenzo(a,h)anthracene | <0.01 | <0.01 | n/a |
| Benzo(ghi)perylene | 0.01 | 0.03 | 71 |
| Dibenz(ah,al,aj)pyrene | <0.01 | <0.01 | n/a |

## C.4 PCBs

The test methodology used for the analysis of PCBs in paint was extraction with acetone/ hexane followed by GC/ECD analysis. The minimum detection limit is 0.30 ppm. The analysis of the paint sample, obtained from the Takhini River site, resulted in a value of $<7.0$ ppm. This unusually high detection limit was the result of interferences which could not be removed by standard clean up techniques. On this sample three cleanup techniques were employed: Fluorsil, acid charring and multi-silica column. The resulting analysis produced a chromatogram with many interferences that made the PCB value unreadable. The sample was diluted to 800 mL to reduce the interferences. In doing so the detection limit was raised to 7.0 ppm. Common interferences by this method of analysis include halogenated compounds, oxygenated compounds and sulphur compounds. A GC/MS open scan would likely identify the compounds causing the interferences. However, this would unlikely result in a lower detection limit for the PCBs. A copy of the laboratory chromatogram is provided.