HEMMERA
ENVIROCHEM

DETAILED SITE INVESTIGATION

Brooks Brook
Alaska Highway
Yukon

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December, 2001
File: 316-003.04

EXECUTIVE SUMMARY

Hemmera Envirochem Inc. (Hemmera) was retained by Indian and Northern Affairs Canada (INAC) to undertake a Detailed site investigation at the former Alaska Highway construction camp located along the Alaska Highway at mile post 830. The drilling program was initiated to delineate soil and groundwater contamination in the vicinity of Foundation AB (former generator) and to confirm that delineation of soil contamination in the vicinity of Foundation K is complete. Previous investigations indicated that hydrocarbons were the primary contaminant of concern. Site information that was required to complete a risk assessment of the Foundation AB area was collected simultaneously during the drilling works. A risk assessment will be completed based on the information gathered and will be forwarded to INAC in a separate report.

The Detailed site investigation was conducted in September 2001 and consisted of drilling eight boreholes and installing seven monitoring wells in the vicinity of Foundation AB. Three boreholes were advanced in the vicinity of Foundation K. No monitoring wells were installed in this area because groundwater contamination had not been previously detected.

The results of the recent and historical investigations in the vicinity of Foundation AB indicated that hydrocarbon contamination was present in the surficial sand and gravel fill to an approximate maximum depth of 2.5 metres below grade northeast, east, and southeast of Foundation AB. Non-detectable concentrations of the contaminants of concern were present in the lower silt. Soils exceeded regulated Yukon standards for volatile petroleum hydrocarbons, light and heavy extractable petroleum hydrocarbons, and naphthalene. Boreholes advanced for the purpose of delineating contamination towards Brooks Brook were drilled as close to the brook as possible without disturbing the numerous trees and vegetation, placed to maintain brook bank stability.

In September 2001, groundwater quality in one monitoring well located adjacent to Brooks Brook exceeded the Yukon and CCME regulated standards for toluene, naphthalene, and pyrene. Elevated

concentrations of iron and manganese were present in three monitoring wells located east and southeast of Foundation AB in excess of YCSR AW standards. The concentrations are likely background levels. It should be noted that the BC CSR was amended in 1999 to remove standards for iron and manganese. It is possible that in the future, the Yukon standards may follow the lead of the BC CSR in amending these standards for metals.

LEPHw concentrations in groundwater were compared to the British Columbia Contaminated Sites Regulation for reference only, as there are currently no Yukon or CCME regulated standards for LEPHw. The results indicated that nine groundwater samples exceeded the BC CSR LEPHw standard.

The results of the current and historical investigation in the vicinity of Foundation K indicated that minor soil contamination was detected at one location only that exceeded the regulated standards for LEPH and VPH. Groundwater in the one well in the immediate vicinity of Foundation K did not previously exceed regulated groundwater standards. A groundwater sample was collected from the well during the September site investigation works and the results indicated that manganese concentrations exceeded the YCSR AW standard and LEPHw concentrations exceeded the BC CSR standard.

In preparation for completing a risk assessment, information was gathered to assess where human health and ecological exposure could occur in the Foundation AB area. The general site characteristics of the area were recorded and a local resident was interviewed for historical information. Physical tasks included collecting surface water samples from Brooks Brook. Water samples collected upstream and downstream of the Foundation AB area were within all regulated guidelines for hydrocarbon and metals parameters in surface waters. Sediment soil samples were collected from the banks of Brooks Brook and the results indicated that the soils were within all guidelines. Surficial soil samples were collected from select locations within the suspect plume to identify any shallow contamination and analytical results indicated that none was present. Soil vapour surveys were conducted at several locations to determine potential risk of vapours to human

health. Marginal concentrations of toluene and xylenes were detected, while benzene and ethylbenzene were below analytical detection limits.

Based on site investigation works completed to date, an approximate area of 400 m^2 contains impacted soils in the vicinity of Foundation AB. It is recommended that the proposed Risk Assessment proceed as planned to determine if the contamination can be managed in place. Minor soil contamination is present in an approximate 70 m^2 area in the vicinity of Foundation K and it appears that the soils can be excavated with minor disturbance as there are no nearby structures or vegetation that would be damaged. It is recommended that the soil be removed in the future in conjunction with any other site works that would involve mobilizing excavating equipment to the site. Groundwater quality should be monitored in this area on a routine basis.

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1.0 INTRODUCTION

Hemmera Envirochem Inc. (Hemmera) was retained by Indian and Northern Affairs Canada (INAC) to conduct a Detailed site investigation and complete a subsequent risk assessment at the former Alaska Highway construction camp located along the Alaska Highway at mile post 830 (**Figure 1**). The investigation was limited to the completion of delineation of hydrocarbon contamination in the vicinity of Foundation AB and to confirm that delineation of soil contamination in the vicinity of Foundation K is complete. It is Hemmera's understanding that the property is currently under the jurisdiction of the Teslin Tlingit Council but it is the responsibility of INAC to ensure that any contamination resulting from historical activities is acceptable for present and proposed future land use. The Tlingit Band has converted the site into a meeting ground that includes an assembly hall, a cook shack, several single room sheds and outhouses (**Photographs 1 and 2, Appendix E**). A site location plan is included as **Figure 2**.

The contamination near Foundation K was estimated to be minimal and more intensive investigations occurred in the vicinity of Foundation AB. This report presents the findings of the delineation drilling investigation and information gathered for use in completing a risk assessment of the Foundation AB area as identified in **Figure 2**. The risk assessment will be completed and the results will be presented in a report to be forwarded at a later date. Information gathered for the risk assessment included data from soil vapour surveys, surface water sampling of Brooks Brook, soil sediment sampling along the banks of Brooks Brook, surficial soil sampling within the suspect plume and overall observation of site characteristics.

As per the terms of reference, a review of the soil and groundwater conditions at locations other than Foundations AB and K were not completed.

1.1 HISTORICAL BACKGROUND

The subject area is referred to as "Brooks Brook" due to its proximity to a stream with the same name. "Brooks Brook" was originally commissioned in 1942 as a line camp for construction of the

Alaska Highway. The camp was also used as a telephone relay station for the U.S. Relay Stations network. The stations were used to relay telephone, teletype and radio messages. The camp also functioned as a base for the truck drivers, pipe-layers and construction workers involved in the construction of the Canol (Canadian Oil) project oil pipeline in the vicinity of Brooks Brook. This project was abandoned in 1945.

In 1946, the camp was transferred to the Canadian Army, with the Royal Canadian Air Force (RCAF) being made responsible for the land communications. The relay line was transferred from the RCAF to Canadian National Telegraphs, which was responsible for the actual operation of the line, while the Canadian Army continued to supervise the maintenance and road improvements of the Alaska Highway until 1964. This task then became the responsibility of the Federal Department of Public Works. In 1965 the "Brooks Brook" road maintenance station was moved near the Teslin Airport and the repeater station was shut down. The inhabitants of "Brooks Brook" gradually moved from the site.

As part of the Teslin Tlingit Council land claim agreement, the "Brooks Brook" site is now under the jurisdiction of the Teslin Tlingit Council.

Historically, the site has contained between 20 to 30 buildings at the site. These buildings included barracks, married personnel living quarters, a school, a curling rink, at least two powerhouses, fuel storage tanks, at least two fuel dispensing locations, garages, storage sheds, a pumphouse and a relay station building. Sewer lines ran from each building into Brooks Brook. The structures no longer exist at the site (refer to **Figure 2** – former structures outlined in gray). Three landfills were later identified during investigative works in 1997. The landfills were located at the north end of the main site and at the western edge of the site in the woods near Teslin Lake and approximately 2 km south of the main site along the Alaska Highway.

1.2 PREVIOUS INVESTIGATIVE WORKS

In 1997, the Environmental Sciences Group (ESG) completed an environmental assessment of the site. Lorimer and Associates Ltd. and Hemmera completed several phases of Environmental Site Assessments of the Site in the summer and fall of 1997 and in 1998, based on the ESG report results. The assessments of the camp indicated the presence of minor metals contamination in the vicinity of Foundations "Y" and "P" as identified in Figure 2. No further investigative work was deemed necessary in these areas.

Hydrocarbon and total organochlorine pesticides (OCP) in exceedence of the Yukon Contaminated Sites Regulation (YCSR) and equivalent standards from other jurisdictions for OCP were detected in the vicinity of the cook shack. In September 1999, Hemmera supervised the remedial excavation of an area of 3900 m^2 of OCP (i.e. DDT) contaminated soil at the Site. Confirmatory soil samples analyzed by a laboratory indicated that the site had been remediated to within the remedial criterion of 0.7 parts per million DDT.

Soil and groundwater hydrocarbon contamination exceeding the regulated standards were detected in the vicinity of Foundation AB, the site of a former generator. Delineation of contamination of this area was not completed.

Hydrocarbon contamination was detected in the soils adjacent to Foundation "K". Test pits were advanced in an approximate 10 m step-out from the impacted area but no soil analyses from the test pits were completed as visual observations and headspace vapour levels did not indicate contamination was present.

The hydrocarbon parameters LEPH, HEPH, BTEX, VPH, and PAHs are the contaminants of concern at this site.

1.3 SCOPE OF WORK

Based on the results of previous investigative works and in consultation with INAC, it was decided that delineation of the impacted soil and groundwater in the vicinity of Foundation AB should be completed and confirmation of the extent of soil contamination in the Foundation K area be defined more accurately. In conjunction with the drilling investigation, information would be gathered to allow a risk assessment of the Foundation AB area to be completed, to determine whether contamination can be managed in place.

The Scope of Work for the drilling investigation and the information gathered for the Risk Assessment included the following:

Detailed site investigation in the Vicinities of Foundations AB and K

a) Advance boreholes in the vicinity of Foundation AB to complete the delineation of soil and groundwater contamination. Advance boreholes in the vicinity of Foundation K to confirm the extent of contamination and define the impacted soil volume more accurately.
b) Collect soil samples from each borehole and field screen for combustible headspace vapour concentrations.
c) Submit all collected soil samples to CanTest Ltd. of Burnaby, BC. Select soil samples would be analysed for BTEX, VPH, EPH, PAH and/or metals.
d) Install monitoring wells in select boreholes in the vicinity of Foundation AB. No monitoring wells will be installed in the vicinity of Foundation K as groundwater in the existing well was previously within applicable standards.
e) Monitor all new and existing monitoring wells for combustible headspace vapours, liquid-phase petroleum hydrocarbon levels (if present), and water levels.

f) Collect groundwater samples from all new monitoring wells and select existing wells. Submit the samples to CanTest for analyses of BTEX, VPH, EPH, PAH, and/or dissolved metals.

Information Gathering For Risk Assessment in the Vicinity of Foundation AB:

In order to complete a risk assessment, information was required to determine ecological and human health risks. Tasks included the following:

a) Record general observations of the site area including types of vegetation (e.g. trees, berries, plants), wildlife in area, and organic life in subsurface soils (e.g. worms, insects, larvae).
b) Collect surface water samples from Brooks Brook at locations upstream, adjacent to and downstream of the Foundation AB area.
c) Collect sediment samples from the banks of Brooks Brook.
d) Conduct soil vapour surveys in select areas. Submit the air samples to CanTest for analysis of BTEX and VPH.
e) Collect surficial soil samples to determine if any shallow contamination is present and submit to CanTest for analysis of BTEX, VPH, EPH, PAH and/or metals.

2.0 REGULATORY PARAMETERS

Soil

The Yukon Territory Renewable Resource Office released the Yukon Contaminated Sites Regulations (YCSR) in 1996. The YCSR standards classify land as either agricultural, urban park, residential, commercial or industrial. Compounds are regulated under either generic standards or standards that are specifically related to environmental health risks (such as toxicity to soil invertebrates and plants).

Based on the current and suspect future land use of the site, the Yukon Contaminated Sites Regulation Residential/Parkland (RL/PL) standards were deemed applicable at the site. Soil analytical data were compared to the most stringent matrix standard of the following: "intake of contaminated soil", "groundwater flow to surface water used by aquatic life", and "toxicity to soil invertebrates and plants". The 1999 Canadian Council of the Ministers of the Environment (CCME) Residential/Parkland (RL/PL) Guidelines were also deemed applicable at the site.

Groundwater

Based on interviews with residents of the area, there are no drinking water wells in the immediate vicinity of the site. Area residents have historically obtained drinking water from Brooks Brook and Teslin Lake but it is our understanding that residents of the subject area obtain their drinking water by trucking water from Johnston's Crossing which is upstream of the subject area. Water from the lake and brook may be used for general household purposes such as laundry but not for drinking water. In discussions with residents, it appears unlikely that water wells will be developed in the future in a downgradient area that would be affected by any contamination existing at the site and thus, the YCSR Drinking Water standards were not considered applicable at the site.

The closest receiving surface water body to the subject area is the stream Brooks Brook directly

adjacent to the site. Teslin Lake is located approximately 200 m south of the site. There is potential for impacts from the site on the closest aquatic life receptor and thus, the YCSR Aquatic Life standards were considered applicable at the site. The CCME Freshwater Aquatic Life guidelines were designed for comparison to surface water but it is an acceptable industry practice to compare subsurface groundwater concentrations to CCME guidelines assuming a 1:10 dilution occurs in the groundwater prior to it reaching a surface water body.

The YCSR standards are very similar to the British Columbia Contaminated Sites Regulations (BC CSR). Amendments to the BC CSR standards were recently approved for VPHw, VHw, EPHw10-19 and LEPHw in groundwater. There are currently no standards for these parameters in either the YCSR standards or the CCME guidelines. For comparison purposes and future consideration, the groundwater results for the site were compared to the BC CSR standards for VPHw, VHw, EPHw10-19 and LEPHw.

Sediments

The interim CCME Sediment Quality guidelines for Protection of Aquatic Life are used to evaluate the sediment quality of Brooks Brook. The guidelines include numerical values that represent Interim Sediment Quality guidelines (ISQG) and probable effect levels (PELs). Any concentrations in excess of the ISQG would require further assessment of possible impacts.

3.0 DETAILED SITE INVESTIGATION

3.1 DRILLING PROGRAM

On September 24 to 27, 2001, eight boreholes were advanced in the vicinity of Foundation AB (**Photograph 3, Appendix E**) and three boreholes were advanced in the vicinity of Foundation K. The boreholes were advanced to maximum depths of 3.0 to 3.8 m below grade using a rubber tired, all terrain mounted auger drill rig operated by Midnight Sun Drilling Ltd. of Whitehorse, Yukon. The boreholes were advanced using a hollow stem auger system.

3.2 SOIL SAMPLING

Soil samples were obtained by means of a 0.46 m long (1.5 foot) split-spoon sampler during the drilling process. The split-spoon sampler was washed in a solution of Alconox detergent and water between samples. Soil samples were generally collected at 0.8 m intervals. The soil stratigraphy was logged in each split-spoon with respect to geologic properties; specifically colour, moisture, density, grain size and soil type. Samples were collected in glass jars supplied by the laboratory and packed in coolers for shipment to the laboratory for analyses. Nitrile gloves were replaced after each sample collection to prevent cross-contamination. Soil samples were also collected into clear ziplock bags for combustible soil vapour concentrations (CSVs) using the Gastechtor Model 1238ME, set in methane elimination mode and calibrated to hexane.

3.3 MONITORING WELL INSTALLATION

Seven of the boreholes in the vicinity of Foundation AB were completed as 50 mm diameter PVC monitoring wells in depths varying from 3.0 to 3.8 m below grade, with the bottom 2.1 m portion comprised of a screened section. The annulus around the screen was backfilled with 10/20 silica sand up to a minimum of 0.3 m above the top of the screen. An approximate 0.3 m thick bentonite plug was placed above the sand. Drill cuttings were used to fill the remaining void above the plug. The stickup portion of the well was protected with a lockable upright metal well protector that was cemented into place. The new wells were developed using dedicated disposable PVC bailers and a

minimum of three well-volumes of water were removed until minimal fines were noted in the purged water. **Figures 3 and 4** show the locations of the boreholes and monitoring wells in the vicinities of Foundation AB and K, respectively. The borehole and monitoring well logs are included in **Appendix A**.

All existing and new monitoring wells were surveyed with respect to a local benchmark (top of piezometer of MW97-12, assumed elevation of 100.00 m).

3.4 GROUNDWATER MONITORING AND SAMPLING

On September 27, 2001, all new and existing monitoring wells were monitored for combustible headspace vapours, liquid-phase petroleum hydrocarbon levels (if present), and water levels. Groundwater samples were collected from the new wells and six existing monitoring wells on September 23, 24, 26, and 27, 2001 using a low-flow technique employing peristaltic pumps and dedicated sample tubing. Samples were collected once readings of pH, conductivity, and temperature had stabilized in order to ensure that a representative sample was obtained. Samples were placed directly into laboratory prepared glass and plastic bottles and were packed in coolers prior to shipment to CanTest for analyses.

3.5 SOIL RESULTS

3.5.1 Soil Stratigraphy

The general soil stratigraphy as observed in the boreholes in the vicinity of Foundation AB is summarized below in **Table 1**.

Table 1: Summary of Stratigraphy – Foundation AB

Average depth below grade (m)	Stratigraphic Unit
Surface to approximately 1.5 m in depth	sand fill – some gravel, brown
1.5 to 2.3 m in depth	sand and gravel fill – brown
2.3 to 3.8 m in depth	native silt – some sand, grey

Refer to the borehole logs in **Appendix A** for detailed descriptions of the soil stratigraphy. Cross-sections A-A' and B-B' showing the soil stratigraphy in the vicinity of Foundation AB is shown on **Figures 5 and 6**.

The general soil stratigraphy as observed in the boreholes in the vicinity of Foundation K is summarized below in **Table 2**.

Table 2: Summary of Stratigraphy – Foundation K

Average depth below grade (m)	Stratigraphic Unit
Surface to approximately 2.0 m in depth	sand and gravel fill – some cobbles, brown
2.0 to 3.0 m in depth	native silt – some sand, grey

Refer to the borehole logs in **Appendix A** for detailed descriptions of the soil stratigraphy.

3.5.2 Combustible Soil Vapour Concentrations

A combustible soil vapour concentration (CSV) survey was conducted on the soil samples collected from the boreholes. CSVs were measured using a Gastechtor 1238ME Hydrocarbon Surveyor set in methane elimination mode and calibrated to hexane. CSVs for all soil samples collected are shown on the borehole logs in **Appendix A**. The CSV concentrations for all soil samples in the vicinities of Foundations AB and K ranged from less than the detection limit of the field instrument (LTDL) to 75 ppmv (MW01-08) and LTDL to 20 ppmv (BH01-11), respectively.

Olfactory evidence of petroleum hydrocarbons was detected in soil samples collected from BH01-01 at 2.29 m, MW01-02 at 1.52 m, MW01-06 at 3.05 m, MW01-07 at 1.52 m, and MW01-08 at 0.76 m and 1.52 m. A light sheen was visible on the water in the split-spoon sampler at 3.05 m below grade in MW01-05.

3.5.3 *Chemical Analysis*

Foundation AB

Ten soil samples and one duplicate soil sample were submitted to CanTest for analyses of BTEX, VPH, and EPH. Five soil samples and one duplicate soil sample were also submitted for analyses of PAHs. Two soil samples and one duplicate sample were submitted for analyses of metals. The results of the analyses are included in **Tables 3** to **6**.

All soil exceedances in the vicinity of Foundation AB are shown on **Figure 7**. Certified laboratory reports are provided in **Appendix B**, for reference.

The results indicated that VPH concentrations in MW01-02 SA2 and MW01-08 SA1 exceeded the YCSR CL/IL standard. LEPH concentrations exceeded the YCSR RL/PL standard in MW01-06 SA3 and exceeded the YCSR CL/IL standard in MW01-02 SA2. EPH10-19 concentrations exceeded the YCSR CL/IL standard in MW01-08 SA1. HEPH concentrations exceeded the YCSR RL/PL standard in MW01-02 SA2. EPH19-32 concentrations exceeded the YCSR RL/PL standard in MW01-07 SA2. Naphthalene concentrations exceeded the CCME RL/PL standard in MW01-06 SA3 and MW01-07 SA3. The remaining samples tested were within both the YCSR RL/PL standards and the CCME RL/PL guidelines for BTEX, VPH, EPH and PAHs. A metals analyses indicated that all samples tested were within the YCSR RL/PL standards and CCME RL/PL guidelines for all regulated constituents.

Foundation K

Three soil samples and one duplicate soil sample were submitted to CanTest for analyses of BTEX, VPH, and EPH. One soil sample was also submitted for analyses of PAHs. One soil sample and one duplicate sample were submitted for analyses of metals. The results of the analyses are included in **Tables 3** to **6**.

The results indicated that concentrations of BTEX, VPH, EPH and PAHs were less than the analytical detection limits in all samples tested. A metals analyses on one soil sample indicated that concentrations were within the YCSR RL/PL standards and CCME RL/PL guidelines for all regulated constituents.

Historical soil exceedances in the vicinity of Foundation K are shown on **Figure 8**. Certified laboratory reports are provided in **Appendix B**, for reference.

3.6 GROUNDWATER

3.6.1 Hydrogeology

Foundation AB

On September 27, 2001, a groundwater monitoring event was conducted on all new and existing wells in the vicinity of Foundation AB and included the measurement of combustible headspace vapours, liquid-phase petroleum hydrocarbon levels (if present) and depth to water.

On September 24, 26 and 27, 2001, Hemmera completed groundwater sampling of all newly installed monitoring wells (MW01-02 to MW01-08) and six existing monitoring wells (H97-12, H97-15, H97-16, H98-18, H98-20, and H98-23).

Groundwater was observed at a minimum depth of 1.67 m below grade in MW98-23 and at a maximum depth of 2.08 m below grade in MW98-25. The average depth to groundwater was 1.85 m below grade. No apparent phase separated product was detected in any of the monitoring wells. The monitoring data for each well is provided in **Table 7**.

The relative groundwater elevations and contours for the September 27, 2001 groundwater monitoring event are included on **Figure 9**. Based on the groundwater elevations, an inferred groundwater flow oriented in the southwest direction, away from Brooks Brook was shown. The

estimated hydraulic gradient for the area of Foundation AB on September 27, 2001 is 0.034 m/m, as measured between MW01-07 and MW01-04.

On September 25 and 27, 2001, single well response tests were conducted on H97-15 and H98-23, respectively. Hemmera conducted calculations based on the rising head data to determine the hydraulic conductivity of the saturated soils at the Site. Using Hvorslev's method, an estimated hydraulic conductivity of 9.82×10^{-8} m/s was obtained for monitoring well H97-15 which was completed with a screened section in the silt layer only. A hydraulic conductivity of 1.47×10^{-5} m/s was estimated for monitoring well H98-23 which was completed with a screened section across both the sand layer and the silt layer. Conducting a rising head test on a well screened across two different stratigraphic units could affect the conductivity value calculated as the different conductivity properties in each layer contributes to the overall value. Based on the calculated conductivity values, approximate groundwater velocities would range from 0.00072 m/day (H97-15) to 0.087 m/day (H98-23). Results of the rising head test analyses are included in **Appendix C**.

Foundation K

On September 24, 2001, one groundwater well (H97-7) in the vicinity of Foundation K was monitored for depth to water and liquid-phase hydrocarbon levels (if present). A groundwater sample was collected from the well on the same day and submitted to the laboratory for analyses.

Groundwater was observed at a depth of 4.41 m below top of piezometer. No apparent phase separated product was detected in the monitoring well.

3.6.2 Monitoring Well Vapour Concentrations

Monitoring well vapours (MWVs) were measured using a Gastechtor 1238ME Hydrocarbon Surveyor set in methane elimination mode, calibrated to hexane. The MWV measured in each monitoring well in the vicinity of Foundation AB on September 27, 2001 is provided in **Table 7**. All MHVs in the monitoring wells in the vicinity of Foundation AB were low, ranging from less than the

detection limit of the field instrument (MW97-12) to 115 ppmv (MW01-02).

The MWV was not measured in the monitoring well (H97-7) located in the vicinity of Foundation K.

3.6.3 Chemical Analysis

Foundation AB

Thirteen groundwater samples and two duplicate samples were submitted to CanTest for analyses of BTEX, VPHw and EPHw. Eight samples and two duplicates were submitted for analyses of PAHs. Two samples and two duplicates were submitted for analyses of dissolved metals. The results of the analyses are included in **Tables 8** to **11**.

Groundwater exceedances in the wells in the vicinity of Foundation AB are shown on **Figure 10**. Certified laboratory reports are provided in **Appendix B**, for reference.

The results of groundwater samples collected from the vicinity of Foundation AB indicated that concentrations of toluene exceeded the CCME Freshwater Aquatic Life (FAL) Guideline in MW01-08. Naphthalene concentrations exceeded the YCSR AW standard and CCME FAL guideline in MW01-08. Pyrene concentrations exceeded the YCSR AW standard in MW01-08 but was within the CCME FAL guideline. LEPHw concentrations were compared to the BC CSR AW standard (500 ppb) for *comparison purposes only* as there is no YCSR AW standard or CCME FAL guideline. EPHw10-19 was also compared to the LEPHw standard due to non-detectable to minimal PAH parameters used to correct for LEPHw. LEPHw concentrations exceeded the BC CSR AW standard in H97-7, H97-15, H98-18, H98-20, MW01-02, MW01-03, MW01-04, MW01-07 and MW01-08.

Iron concentrations exceeded the YCSR AW standard and CCME FAL guideline in H98-18 and MW01-02. Dissolved manganese concentrations exceeded the YCSR AW standard in MW01-02. It should be noted that the standards for iron and manganese were recently removed from the BC Contaminated Sites Regulation. The elevated iron and manganese concentrations probably represent background levels.

Foundation K

One groundwater sample from the vicinity of Foundation K was submitted for analysis of BTEX, VPHw, LEPHw, HEPHw, PAHs and dissolved metals. The results of the analyses are included in **Tables 8** to **11**.

The analytical results of the samples collected from the vicinity of Foundation K indicated that dissolved manganese concentrations exceeded the YCSR AW standard in H97-7. It should be noted that due to elevated background concentrations of manganese (as well as iron and aluminum) in British Columbia, standards for these elements have been removed from the BC Contaminated Sites Regulation. *For comparison purposes only*, LEPHw concentrations exceeded the BC CSR AW standard in H97-7.

Groundwater exceedances in the wells in the vicinity of Foundation K are shown on **Figure 11**. Certified laboratory reports are provided in **Appendix B**, for reference.

3.7 QUALITY ASSURANCE/QUALITY CONTROL

The quality assurance and quality control (QA/QC) program is a method of evaluating data practices and procedures. The goals of the QA/QC program are:

- To quantify those errors so that subsequent statistical analysis and interpretation can take the errors into account;
- To monitor the error so that spurious or biased data can be recognized and, if possible, corrected, and
- To provide information that can be used to improve sampling practices and analytical procedures so that the impact of errors can be minimized. The QA/QC program evaluates analytical variability, however, it is difficult to distinguish between laboratory error and soil sampling variability.

3.7.1 Field QA/QC

To check the precision and accuracy of the field data, QA/QC samples were collected for analysis. Field QA/QC consists of the collection of field duplicate samples. Field duplicates are defined as two discrete samples collected from the same approximate location (stratigraphy). Field duplicates are samples of identical physical material from the same contaminant zone.

During the investigation, two soil samples (MW01-07 SA3 and BH01-09 SA3) and two groundwater samples (MW01-02 and H98-18) were each analysed in duplicate. The relative percent differences (RPD) reached a maximum of 24% (sodium) in the soils. For groundwater samples the RPD reached a maximum of 21% (EPHw10-19). The RPDs are within acceptable limits. BC Ministry of Land, Water and Air Protection has an acceptable RPD of 25% for laboratory duplicates. RPDs greater than 50% for field samples indicate either of: high variability in field conditions; poor sampling procedures; or, questionable laboratory procedures.

4.0 RISK ASSESSMENT DATA GATHERING (FOUNDATION AB)

4.1 CHARACTERIZATION OF SITE

The Foundation AB area is located in the southeastern portion of the site, adjacent to Brooks Brook. The Alaska Highway is located northeast of the area and Brooks Brook. The general area slopes steeply down from the highway towards Teslin Lake which is southwest of the site as shown in **Figure 2**. Water in Brooks Brook travels from the northeast and crosses underneath the Alaska Highway via a culvert and initially flows from the northwest to southeast then the creek bed turns and flows towards the southwest until it drains into Teslin Lake (**Photographs 4** and **6, Appendix E**). The brook historically crossed under the old highway at a location further southeast but was rerouted to its current location when the Alaska Highway was built. The banks of Brooks Brook are approximately sloped 1:1 adjacent to the Foundation AB area and are on the average 1.5 m in height. During the site visit the brook was observed to be approximately 0.25 m deep and was flowing at approximately 1.2 metres per second.

The area of Foundation AB is relatively flat and surface water appears to drain to the south-southwest. Approximately 50% of the area is covered by vegetation. A majority of the vegetation is located along both sides of the banks of the brook and in the vicinity of the foundation. No berries or edible plants were observed at the time of the site visit. There are primarily poplar trees in the general Foundation AB area and alder trees are present along the banks of Brooks Brook for the entire length that it crosses the site (**Photograph 5**). A small area of suspect stressed vegetation (i.e. browned leaves, wilted grass) was present east of Foundation AB, in the vicinity of H98-24. It is suspected the alders were placed to maintain slope stability along the brook.

No obvious signs of wildlife were visible with the exception of a beaver dam in Brooks Brook located downstream of the site. Residents of the area have observed fish (graylings) in the brook seasonally. Shallow holes were dug during collection of surficial soil samples as described in Section 4.4. No signs of organic life such as worms, insects or larvae were observed in the soils

close to surface.

It was observed that a picnic table and garbage can were located along the west bank of the brook and thus, it is likely that area residents use the Foundation AB area for recreational activities. An area resident indicated that local residents do not use the brook for swimming.

4.2 SURFACE WATER SAMPLING FROM BROOKS BROOK

Surface water samples were collected from Brooks Brook at locations upstream and downstream of the impacted area of Foundation AB. The water samples were collected from the west bank of the brook by directly lowering a laboratory prepared glass jar into the water. The samples were shipped to CanTest for chemical analysis of BTEX, VPHw, LEPHw, HEPHw, PAH and total metals.

The results of the analyses are included in **Tables 12** to **15**. The results indicated that concentrations of BTEX, VPHw, LEPHw, HEPHw and PAHs were less than the analytical detection limits in both samples tested. Total metal concentrations were within the CCME FAL guidelines for all regulated parameters. No differences were noted in the water quality of stream samples obtained upgradient and downgradient of the site.

4.3 SEDIMENT SAMPLES FROM THE BANKS OF BROOKS BROOK

Sediment soil samples (SED-UP, SED-ADJ and SED-DN) were collected at three locations along the west bank of Brooks Brook, (upgradient, adjacent to and downgradient of the suspect soil contaminant plume). Samples were collected in glass sample jars supplied by the laboratory and packed in coolers for shipment to the laboratory for analyses of BTEX, VPH and EPH. One sample was also analysed for PAHs and two samples were analysed for total metals. The results of the analyses are included in **Tables 16** to **19**.

The results indicated that concentrations of BTEX, VPH and EPH were less than the analytical detection limits in the three samples tested. PAH concentrations in the one sample tested were less than analytical detection limits. The metals analysis on sediment samples upgradient and adjacent to

the soil plume indicated concentrations were within the YCSR RL/PL standards and CCME interim Freshwater Sediment Quality guidelines.

4.4 SURFICIAL SOIL SAMPLES

Three surficial soil samples (Surface1, Surface2 and Surface3) were collected in the impacted soil plume to a maximum depth of 0.15 m below grade. The samples were transferred directly into laboratory prepared glass jars and submitted to CanTest for analysis of BTEX, VPH and EPH. One soil sample was also submitted for analyses of PAHs and one sample was analysed for total metals. The results of the analyses are included in **Tables 20** to **23**. The locations that the three soil samples were collected is shown on **Figure 3**.

The analytical results indicated that concentrations of BTEX, VPH and EPH were less than the analytical detection limits in the three samples tested. PAH concentrations in the one sample tested were less than analytical detection limits. The metal concentrations in one soil sample tested was within the YCSR RL/PL standards and the CCME RL/PL guidelines.

4.5 SOIL VAPOUR SURVEYS

Soil vapour surveys were conducted at four locations (SV#1, SV#2, SV#3, and SV#4) to determine any potential for human health risks from soil vapours at the site. The survey consisted of advancing steel vapour points into the ground to approximately 0.45 m deep and connecting a sampling tube to the top. The vapour points comprised a steel tube perforated across the bottom 0.25 m. The sampling tube was connected to an air sampling pump provided by CanTest. A charcoal tube was exposed to the extracted air stream for a period of time at each location. At the end of the test the charcoal tube was capped and submitted to the laboratory for analysis of BTEX and total hydrocarbons. A monitoring site (SV#4) is shown on **Photograph 7** in **Appendix E**. Details of the installation of the sampling point are included in **Appendix D, Table D1**. The locations at which soil vapour surveys were conducted are shown on **Figure 3**. The charcoal tube results were used to calculate mass concentrations in the air stream. The analytical BTEX and total hydrocarbon results are presented in **Appendix D, Table D2**. Total hydrocarbon and BTEX concentration calculations

are presented in **Appendix D**, **Tables D3** and **D4**, respectively.

The results of the soil vapour survey revealed non-detectable concentrations of benzene for all four survey points. Total hydrocarbon concentrations ranged from 0.341 ug/L in SV#1 to 0.973 ug/L in SV#3. Detailed laboratory reports are provided in **Appendix B**.

The impacts, if any, of the observed vapour concentrations will be evaluated in the risk assessment. It is noted, the concentrations of discrete compounds (benzene, toluene, ethylbenzene and xylenes) are well within the 8-hour exposure limits specified by the Yukon Workers' Compensation Health and Safety Board.

5.0 SUMMARY

Based on the Detailed site investigation conducted at Brooks Brook, located in the Yukon, the following conclusions were made:

1. The assessment of soil contamination in excess of YCSR and/or CCME RL/PL standards/guidelines in the Foundation AB area has been completed to the extent possible without disturbance to the site area, including removal of trees and vegetation. Soil contamination is present northeast, east and southeast of Foundation AB and extends to the west bank of Brooks Brook. Contamination was primarily identified in the sand and gravel fill above the silt and was detected at depths ranging from 1.0 m to 2.5 m below grade. An approximate area of 400 m^2 of soil is estimated to be impacted. Sediment samples collected from the brook had non-detectable levels of the pollutants of concern.
2. Assessment of groundwater contamination in the Foundation AB area has been completed to the extent possible without disturbance and removal of trees and vegetation in order to install additional wells. Dissolved hydrocarbon contamination in excess of applicable YCSR standards and CCME guidelines was detected east and northeast of the site, between the foundation and the brook. Water samples collected from the brook revealed non-detectable levels of the contaminants of concern (i.e. hydrocarbons).
3. Minor soil contamination in the Foundation K area is identified by testpit TP6. An area of approximately 70 m^2 of soil is estimated to be impacted.
4. Groundwater in the well in the Foundation K area has never exceeded regulated standards during previous sampling. Groundwater contamination was detected in the well during September 2001, in the form of a manganese exceedance. Iron and manganese are found in elevated concentrations in wells throughout the area and is likely due to background concentrations.

6.0 STATEMENT OF LIMITATIONS

This report ("Report") was prepared by Hemmera Envirochem Inc. ("Hemmera") for the sole benefit and exclusive use of Indian and Northern Affairs Canada ("INAC"). The material in it reflects Hemmera's best judgement in light of the information available to them at the time of preparing the Report. Any use which a third party makes of this Report, or any reliance on or decision made based on it, are the responsibility of such third parties. Hemmera accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this Report.

Hemmera has performed the work as described in the Scope of Work and made the findings and conclusions set out in this Report in a manner consistent with the level of care and skill normally exercised by members of the environmental science profession practising under similar conditions at the time the work was performed.

This Report was prepared by Hemmera for INAC and represents a reasonable review of the information available to Hemmera within the established Scope of Work, work schedule and budgetary constraints. It is therefore possible that currently unrecognised contamination or potentially hazardous materials may exist at the site(s) and that the levels of contamination or hazardous materials may vary across the site(s). No warranty, expressed or implied, is given concerning the presence or level of contamination on the site. The conclusions and recommendations contained in this Report are based upon applicable legislation existing at the time the Report was drafted and changes in the legislation may alter the conclusions and/or recommendations. Further, any discussion of regulatory implications is based on the applicable legislation existing at time of drafting the Report.

In preparing this Report, Hemmera has relied in good faith on information provided by others as noted in this Report, and has assumed the information provided by those individuals is both factual and accurate. Hemmera accepts no responsibility for any deficiency, misstatement or inaccuracy in this Report resulting from the information provided by those individuals.
The liability of Hemmera to INAC shall be limited to injury or loss caused by the negligent acts of Hemmera. The total aggregate liability of Hemmera related to this agreement shall not exceed the lesser of the actual damages incurred, or the total fee of Hemmera for services rendered on this project.

7.0 REFERENCES

Canada Council of Ministers of the Environment 1991. *Interim Canadian Environment Quality Criteria for Contaminated Sites*. CCME EPC-CS34. September, 1991.

Canada Council of Ministers of the Environment 1999. Canadian Environmental Quality Guidelines.

Yukon Department of Renewable Resources. 1996. *Contaminated Sites Regulations,* November 18, 1996.

British Columbia Ministry of the Environment Lands and Parks. 1997. Waste Management Act, Contaminated Sites Regulation, BC Reg, 375/96, (as amended by BC Reg 132/99 and 244/99) February 1997.

8.0 REPORT CREDITS

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HEMMERA ENVIROCHEM INC.

Per: Brenda Wong, E.I.T. — Date: Dec 21/01

Per: Philip Lowery, P.Eng. — Date: Dec. 21/01

Per: Dennis Konasewich, Ph.D., P.Eng. — Date: Dec 21/01

Table 3

SOIL ANALYSIS OF MONOCYCLIC AROMATIC HYDROCARBONS

Brooks Brook, Yukon

				Foundation AB								
			Sample ID:	**BH01-01 SA3**	**MW01-02 SA2**	**MW01-03 SA2**	**MW01-04 SA3**	**MW01-05 SA4**	**MW01-06 SA3**	**MW01-07 SA2**	**MW01-07 SA3**	**DUP 2**
			Depth:	1.5-2.0	1.5-2.0	1.5-2.0	2.3-2.7	3.0-3.5	2.3-2.7	1.5-2.0	2.3-2.7	2.3-2.7
			CSV:	20 ppmv	60 ppmv	25 ppmv	10 ppmv	LTDL	25 ppmv	na	10 ppmv	na
			Date sampled:	9/24/2001	9/25/2001	9/25/2001	9/25/2001	9/25/2001	9/26/2001	9/26/2001	9/26/2001	9/26/2001
PARAMETER	**YCSR RL/PL**	**YCSR CL/IL**	**CCME RL/PL**									
Benzene	8*	8*	0.5	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Ethylbenzene	5‡	50‡	1.2	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Styrene	5	50	5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Toluene	3‡	30‡	0.8	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Xylenes	5‡	50‡	1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
VHs (C6-10)	ns	ns	ng	< 100	130	< 100	< 100	< 100	< 100	< 100	< 100	< 100
VPHs	200	200	ng	< 100	270	< 100	< 100	< 100	< 100	< 100	< 100	< 100

cont'd on following page

Footnotes:

All values in mg/kg (ppm)

YCSR RL/PL - Yukon Contaminated Sites Regulation Residential/Park Land Standards

YCSR CL/IL - Yukon Contaminated Sites Regulation Commercial/Industrial Land Standards

CCME RL/PL - Canadian Council of Ministers of the Environment Residential/Park Land Guidelines

* YCSR - Groundwater Flow to Surface Water used by Aquatic Life

‡ YCSR - Toxicity to Soil Invertebrates and Plants

CSV - combustible soil vapour concentration (parts per million by volume)

DUP2 is a duplicate sample of MW01-07 SA2

- = Not Analysed

ns = No Standard

ng = No Guideline

LTDL - less than detection limit of field instrument

na - not applicable

X = Exceeds YCSR RL/PL standard

X = Exceeds CCME RL/PL Guideline

X = Exceeds YCSR CL/IL standard

Table 3

SOIL ANALYSIS OF MONOCYCLIC AROMATIC HYDROCARBONS

Brooks Brook, Yukon

				Foundation AB		Foundation K			
			Sample ID:	**MW01-08 SA1**	**MW01-08 SA3**	**BH01-09 SA3**	**DUP 5**	**BH01-10 SA2**	**BH01-11 SA3**
			Depth:	0.8-1.2	2.3-2.7	2.3-2.7	2.3-2.7	1.5-2.0	2.3-2.7
			CSV:	75 ppmv	15 ppmv	10 ppmv	na	LTDL	20 ppmv
			Date sampled:	9/26/2001	9/26/2001	9/27/2001	9/27/2001	9/27/2001	9/27/2001
PARAMETER	**YCSR RL/PL**	**YCSR CL/IL**	**CCME RL/PL**						
Benzene	0.04**	8*	0.5	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Ethylbenzene	5‡	50‡	1.2	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Styrene	5	50	5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Toluene	2.5**	30‡	0.8	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Xylenes	5‡	50‡	1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
VHs (C6-10)	ns	ns	ng	270	< 100	< 100	< 100	< 100	< 100
VPHs	200	200	ng	270	< 100	< 100	< 100	< 100	< 100

Footnotes:

All values in mg/kg (ppm)

YCSR RL/PL - Yukon Contaminated Sites Regulation Residential/Park Land Standards

YCSR CL/IL - Yukon Contaminated Sites Regulation Commercial/Industrial Land Standards

CCME RL/PL - Canadian Council of Ministers of the Environment Residential/Park Land Guidelines

* YCSR - Groundwater Flow to Surface Water used by Aquatic Life

‡ YCSR - Toxicity to Soil Invertebrates and Plants

CSV - combustible soil vapour concentration (parts per million by volume)

DUP5 is a duplicate sample of BH01-09 SA3

- = Not Analysed

ns = No Standard

ng = No Guideline

LTDL - less than detection limit of field instrument

na - not applicable

X = Exceeds YCSR RL/PL standard

X = Exceeds CCME RL/PL Guideline

X = Exceeds YCSR CL/IL standard

Table 4

SOIL ANALYSIS OF EXTRACTABLE PETROLEUM HYDROCARBONS

Brooks Brook, Yukon

				Foundation AB								
			Sample ID:	**BH01-01 SA3**	**MW01-02 SA2**	**MW01-03 SA2**	**MW01-04 SA3**	**MW01-05 SA4**	**MW01-06 SA3**	**MW01-07 SA2**	**MW01-07 SA3**	**DUP 2**
			Depth:	1.5-2.0	1.5-2.0	1.5-2.0	2.3-2.7	3.0-3.5	2.3-2.7	1.5-2.0	2.3-2.7	2.3-2.7
			CSV:	20 ppmv	60 ppmv	25 ppmv	10 ppmv	LTDL	25 ppmv	na	10 ppmv	na
			Date sampled:	9/24/2001	9/25/2001	9/25/2001	9/25/2001	9/25/2001	9/26/2001	9/26/2001	9/26/2001	9/26/2001
PARAMETER	**YCSR RL/PL**	**YCSR CL/IL**	**CCME RL/PL**									
EPHs10-19	1000*	2000*	ng	< 250	6100	< 250	< 250	< 250	1500	670	< 250	< 250
EPHs19-32	1000*	5000*	ng	< 250	1000	< 250	< 250	< 250	930	**4500**	< 250	< 250
LEPHs10-19	1000	2000	ng	-	**6100**	-	-	< 250	**1500**	-	< 250	< 250
HEPHs19-32	1000	5000	ng	-	**1000**	-	-	< 250	930	-	< 250	< 250

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Footnotes:

All values in mg/kg (ppm)

YCSR RL/PL - Yukon Contaminated Sites Regulation Residential/Park Land Standards

YCSR CL/IL - Yukon Contaminated Sites Regulation Commercial/Industrial Land Standards

CCME RL/PL - Canadian Council of Ministers of the Environment Residential/Park Land Guidelines

DUP2 is a duplicate sample of MW01-07 SA2

* - Stated standard is for LEPH or HEPH, as LEPH and HEPH are EPH(C10-C19) and EPH(C19-C32), respectively, corrected for PAHs.

CSV - combustible soil vapour concentration (parts per million by volume)

- = Not Analysed

ns = No Standard

ng = No Guideline

X = Exceeds YCSR RL/PL standard

X = Exceeds CCME RL/PL Guideline

X = Exceeds YCSR CL/IL standard

Table 4

SOIL ANALYSIS OF EXTRACTABLE PETROLEUM HYDROCARBONS

Brooks Brook, Yukon

				Foundation AB		Foundation K			
			Sample ID:	**MW01-08 SA1**	**MW01-08 SA3**	**BH01-09 SA3**	**DUP 5**	**BH01-10 SA2**	**BH01-11 SA3**
			Depth:	0.8-1.2	2.3-2.7	2.3-2.7	2.3-2.7	1.5-2.0	2.3-2.7
			CSV:	75 ppmv	15 ppmv	10 ppmv	na	LTDL	20 ppmv
			Date sampled:	9/26/2001	9/26/2001	9/27/2001	9/27/2001	9/27/2001	9/27/2001
PARAMETER	**YCSR RL/PL**	**YCSR CL/IL**	**CCME RL/PL**						
EPHs10-19	1000*	2000*	ng	**8000**	< 250	< 250	< 250	< 250	< 250
EPHs19-32	1000*	5000*	ng	580	< 250	< 250	< 250	< 250	< 250
LEPHs10-19	1000	2000	ng	-	< 250	< 250	-	-	-
HEPHs19-32	1000	5000	ng	-	< 250	< 250	-	-	-

Footnotes:

All values in mg/kg (ppm)

YCSR RL/PL - Yukon Contaminated Sites Regulation Residential/Park Land Standards

YCSR CL/IL - Yukon Contaminated Sites Regulation Commercial/Industrial Land Standards

CCME RL/PL - Canadian Council of Ministers of the Environment Residential/Park Land Guidelines

DUP5 is a duplicate sample of BH01-09 SA3

* - Stated standard is for LEPH or HEPH, as LEPH and HEPH are EPH(C10-C19) and EPH(C19-C32), respectively, corrected for PAHs

CSV - combustible soil vapour concentration (parts per million by volume)

- = Not Analysed

ns = No Standard

ng = No Guideline

X = Exceeds YCSR RL/PL standard

X = Exceeds CCME RL/PL Guideline

X = Exceeds YCSR CL/IL standard

Table 5

SOIL ANALYSIS OF POLYCYCLIC AROMATIC HYDROCARBONS

Brooks Brook, Yukon

				Foundation AB						Foundation K
			Sample ID:	MW01-02 SA2	MW01-05 SA4	MW01-06 SA3	MW01-07 SA3	DUP 2	MW01-08 SA3	BH01-09 SA3
			Depth:	1.5-2.0 m	3.0-3.5 m	2.3-2.7 m	2.3-2.7 m	2.3-2.7 m	0.8-1.2 m	2.3-2.7 m
			CSV:	60 ppmv	LTDL	25 ppmv	10 ppmv	75 ppmv	na	10 ppmv
			Date sampled:	9/25/2001	9/25/2001	9/26/2001	9/26/2001	9/26/2001	9/26/2001	9/27/2001
PARAMETER	**YCSR RL/PL**	**CCME RL/PL**	**CCME CL/IL**							
PAHs										
Naphthalene	5	0.6	22	< 0.5	< 0.05	**0.8**	**0.7**	0.5	< 0.05	< 0.05
Acenaphthylene	ns	ng	ng	< 0.5	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	ns	ng	ng	< 0.5	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	ns	ng	ng	< 0.5	< 0.05	0.29	< 0.05	0.06	< 0.05	< 0.05
Phenanthrene	5	5	50	< 0.5	< 0.05	0.14	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	ns	ng	ng	< 0.5	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Total LMW-PAH's	ns	ng	ng	-	-	1.23	0.7	0.56	-	-
Fluoranthene	ns	ng	ng	< 0.5	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Pyrene	10	10	100	< 0.5	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	1	1	10	< 0.5	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	ns	ng	ng	< 0.5	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	1	1	10	< 0.5	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	1	1	10	-	-	-	-	-	-	-
Benzo(a)pyrene	1‡	0.7	0.7	< 0.5	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	1	1	10	< 0.5	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	1	1	10	< 0.5	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(g,h,i)perylene	ns	ng	ng	< 0.5	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Total HMW-PAH's	ns	ng	ng	-	-	-	-	-	-	-
Total PAH's	ns	ng	ng	-	-	1.23	0.7	0.56	-	-

Footnotes:

All values in mg/kg (ppm)

YCSR RL/PL - Yukon Contaminated Sites Regulation Residential/Park Land Standards

CCME RL/PL - Canadian Council of Ministers of the Environment Residential/Park Land Guidelines

CCME CL/IL - Canadian Council of Ministers of the Environment Commercial/Industrial Land Guidelines

‡ YCSR - Toxicity to Soil Invertebrates and Plants

DUP2 is a duplicate sample of MW01-07 SA3

CSV - combustible soil vapour concentration (parts per million by volume)

- = Not Analysed

ns = No Standard

ng = No Guideline

X = Exceeds YCSR RL/PL standard

X = Exceeds CCME RL/PL Guideline

Table 6
SOIL ANALYSIS OF METALS
Brooks Brook, Yukon

			Foundation AB			Foundation K	
		Sample ID:	**MW01-02 SA2**	**MW01-07 SA3**	**DUP 2**	**BH01-09 SA3**	**DUP 5**
		Depth:	1.5-2.0 m	2.3-2.7 m	2.3-2.7 m	2.3-2.7 m	2.3-2.7 m
		CSV:	60 ppmv	10 ppmv	na	10 ppmv	na
		Date sampled:	9/25/2001	9/26/2001	9/26/2001	9/27/2001	9/27/2001
PARAMETER	**YCSR RL/PL**	**CCME RL/PL**					
Conventional Parameters							
Moisture			3.6	20.5	20	20.6	20.6
pH			6.8	7.4	7.6	7.6	7.9
Metals Analysis							
Aluminum Al	ns	ng	6580	6460	5510	7300	8040
Antimony Sb	20	20	< 10	< 10	< 10	< 10	< 10
Arsenic As	60*	12	< 10	< 10	< 10	< 10	< 10
Barium Ba	500	500	47	128	108	146	159
Beryllium Be	4	4	< 1	< 1	< 1	< 1	< 1
Boron B	ns	ng	< 1	< 1	< 1	< 1	< 1
Cadmium Cd	8 (pH6.5- <7.0)*† 35 ‡‡	10	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Calcium Ca	ns	ng	2470	9350	7680	11000	11600
Chromium Cr	60*	64	19	32	29	35	37
Cobalt Co	50	50	3	1	2	2	2
Copper Cu	150‡	63	15	19	18	23	24
Iron Fe	ns	ng	15700	18300	16500	20100	21500
Lead Pb	500 ‡‡	140	< 30	< 30	< 30	< 30	< 30
Magnesium Mg	ns	ng	5320	7400	6910	8520	8740
Manganese Mn	ns	ng	230	335	277	373	389
Mercury Hg	2	6.6	0.057	0.084	0.081	0.083	0.099
Molybdenum Mo	10	10	< 4	< 4	< 4	< 4	< 4
Nickel Ni	100	50	15	37	34	40	41
Phosphorus PO4	ns	ng	1010	1320	1140	1240	1420
Selenium Se	3	3	< 3	< 3	< 3	< 3	< 3
Silver Ag	20	20	< 2	< 2	< 2	< 2	< 2
Sodium Na	ns	ng	47	135	106	117	158
Strontium Sr	ns	ng	9	40	36	44	48
Tin Sn	50	50	< 5	< 5	< 5	< 5	< 5
Titanium Ti	ns	ng	238	667	543	699	802
Vanadium V	200	130	26	27	25	29	32
Zinc Zn	450‡	200	23	35	31	41	43

Footnotes:

All values in mg/kg (ppm)

YCSR RL/PL - Yukon Contaminated Sites Regulation Residential/Park Land Standards

CCME RL/PL - Canadian Council of Ministers of the Environment Residential/Park Land Guidelines

* YCSR - Groundwater Flow to Surface Water used by Aquatic Life

‡ YCSR - Toxicity to Soil Invertebrates and Plants

† YCSR - Standard varies with pH

‡‡ YCSR - Intake of Contaminated Soil

CSV - combustible soil vapour concentration (parts per million by volume)

DUP2 is a duplicate sample of MW01-07 SA3, DUP5 is a duplicate sample of BH01-09 SA3

ns = No Standard

ng = No Guideline

X = Exceeds CCME RL/PL guideline

X = Exceeds YCSR RL/PL standard

Table 7

GROUNDWATER MONITORING DATA

Brooks Brook, Yukon

Borehole ID	Screened Interval	Elevation (m)		Depth to Water (m)		Groundwater Elevation (m)	Apparent Free- Phase Product Thickness (m)	Monitoring Well Vapour Level (ppmv)
		T.O.P.	Grade	T.O.P.	Grade			
September 24, 2001								
H97-7	5.5 - 8.5	n.m.	n.m.	4.41	n.m.	na	nil	n.m.
September 27, 2001								
H97-12	2.3 - 3.8	100	n.m.	2.47	n.m.	na	nil	LTDL
H97-14	2.3 - 3.8	100.05	99.42	2.64	2.01	97.410	nil	25
H97-15	2.3 - 3.8	100.2	99.59	2.52	1.91	97.680	nil	10
H97-16	1.2 - 2.7	100.22	99.61	2.36	1.75	97.860	nil	25
H98-18	1.1 - 2.6	100.14	99.67	2.23	1.76	97.910	nil	15
H98-20	1.1 - 2.6	100.37	99.81	2.24	1.68	98.130	nil	60
H98-23	1.1 - 2.6	100.01	99.52	2.16	1.67	97.850	nil	15
H98-25	1.1 - 2.6	100.31	99.73	2.66	2.08	97.650	nil	15
MW01-02	1.2 - 3.4	100.00	99.48	2.54	2.02	97.460	nil	115
MW01-03	1.2 - 3.4	99.87	99.34	2.41	1.88	97.460	nil	100
MW01-04	1.2 - 3.4	99.84	99.27	2.38	1.81	97.460	nil	75
MW01-05	1.2 - 3.4	100.13	99.60	2.33	1.80	97.800	nil	85
MW01-06	1.2 - 3.4	100.08	99.56	2.22	1.70	97.860	nil	40
MW01-07	1.2 - 3.4	100.16	99.64	2.32	1.80	97.840	nil	75
MW01-08	1.2 - 2.7	100.28	99.78	2.52	2.02	97.760	nil	65

Notes:

T.O.P. - top of piezometer

ppmv - parts per million by volume

LTDL - less than the detection limit of the field instrument

n.m. - not measured

na - not applicable

Table 8

GROUNDWATER ANALYSIS OF VOLATILE ORGANIC COMPOUNDS

Brooks Brook, Yukon

			Foundation K	Foundation AB								
		SAMPLE ID:	**H97-7**	**H97-15**	**H97-16**	**H98-18**	**DUP1**	**H98-20**	**H98-23**	**H98-25**	**MW01-02**	**DUP2**
		Date sampled:	9/24/2001	9/23/2001	9/23/2001	9/23/2001	9/23/2001	9/24/2001	9/24/2001	9/24/2001	9/26/2001	9/26/2001
PARAMETER	**YCSR AW**	**CCME FAL****										
Benzene	3000	3700	< 0.1	0.3	0.3	< 0.5	< 0.5	< 0.5	< 0.1	< 0.1	< 0.1	< 0.1
Ethylbenzene	7000	900	< 0.1	0.5	1.3	14	12	0.7	0.2	< 0.1	< 0.1	< 0.1
Toluene	3000	20	< 0.1	< 0.1	3.3	< 0.5	< 0.5	< 0.5	< 0.1	< 0.1	0.1	0.1
Xylenes	ns	ng	0.2	0.4	5.6	48	42	3.7	1.2	0.1	1.3	1.5
VHs (C6-10)	ns (15000*)	ng	< 100	< 100	< 100	320	310	150	< 100	< 100	100	110
VPHs	ns(1500*)	ng	< 100	< 100	< 100	260	260	150	< 100	< 100	100	110

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Footnotes:

All values in ug/L (ppb)

YCSR AW - Yukon Contaminated Sites Regulation Aquatic Life Standards

CCME FAL - Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guidelines

DUP1 is a duplicate sample of H98-18, DUP2 is a duplicate sample of MW01-04

- = Not Analysed

ns = No Standard

ng = No Guideline

*=British Columbia Contaminated Sites Regulation Aquatic Life Standards (AW) provided for comparison purposes only

** - CCME FAL guidelines were created for surface water concentrations but for application to subsurface groundwater, the CCME guidelines are referenced, assuming a 1:10 dilution occurs

X	= Exceeds YCSR AW standard
X	= Exceeds CCME FAL guideline
X	= Exceeds BC CSR AW standard for *comparison purposes only*

Table 8

GROUNDWATER ANALYSIS OF VOLATILE ORGANIC COMPOUNDS

Brooks Brook, Yukon

			Foundation AB					
		SAMPLE ID:	**MW01-03**	**MW01-04**	**MW01-05**	**MW01-06**	**MW01-07**	**MW01-08**
		Date sampled:	9/26/2001	9/26/2001	9/27/2001	9/27/2001	9/27/2001	9/27/2001
PARAMETER	**YCSR AW**	**CCME FAL****						
Benzene	3000	3700	< 0.1	< 0.1	< 0.1	< 0.1	0.6	3.8
Ethylbenzene	7000	900	< 0.1	< 0.1	< 0.1	0.2	1.7	33
Toluene	3000	20	< 0.1	< 0.1	< 0.1	< 0.1	0.5	**24**
Xylenes	ns	ng	0.6	0.3	0.8	5.1	11	160
VHs (C6-10)	ns (15000*)	ng	< 100	< 100	< 100	< 100	130	690
VPHs	ns(1500*)	ng	< 100	< 100	< 100	< 100	120	470

Footnotes:

All values in ug/L (ppb)

YCSR AW - Yukon Contaminated Sites Regulation Aquatic Life Standards

CCME FAL - Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guidelines

- = Not Analysed

ns = No Standard

ng = No Guideline

*=British Columbia Contaminated Sites Regulation Aquatic Life Standards (AW) provided for comparison purposes only

** - CCME FAL guidelines were created for surface water concentrations but for application to subsurface groundwater, the CCME guidelines are referenced, assuming a 1:10 dilution occurs.

X = Exceeds YCSR AW standard

X = Exceeds CCME FAL Guideline

X = Exceeds BC CSR AW standard for *Comparison purposes only*

Table 9

GROUNDWATER ANALYSIS OF EXTRACTABLE PETROLEUM HYDROCARBONS

Brooks Brook, Yukon

			Foundation K	Foundation AB						
		SAMPLE ID:	**H97-7**	**H97-15**	**H97-16**	**H98-18**	**DUP1**	**H98-20**	**H98-23**	**H98-25**
		Date sampled:	9/24/2001	9/23/2001	9/23/2001	9/23/2001	9/23/2001	9/24/2001	9/24/2001	9/24/2001
PARAMETER	**YCSR AW**	**CCME FAL**								
EPHw10-19	ns (5000*)	ng	1800	1500	490	960	780	1100	490	< 250
EPHw19-32	ns	ng	800	< 250	< 250	< 250	< 250	< 250	< 250	< 250
LEPHw10-19	ns(500*)	ng	**1800**	**1500****	490	**960**	**780**	**1100**	490	<250**
HEPHw19-32	ns	ng	800	<250**	< 250	< 250	< 250	< 250	< 250	<250**

cont'd on following page

Footnotes:

All values in ug/L (ppb)

YCSR AW - Yukon Contaminated Sites Regulation Aquatic Life Standards

CCME FAL - Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guidelines

DUP1 is a duplicate sample of H98-18

- = Not Analysed

ns = No Standard

ng = No Guideline

*=British Columbia Contaminated Sites Regulation Aquatic Life Standards (AW) provided for comparison purposes only

** - EPHw10-19 and EPHw19-32 inferred to be equivalent to LEPHw and HEPH, respectively, due to non-detectable to minimal PAH constituents

X = Exceeds YCSR AW standard

X = Exceeds CCME FAL guideline

X = Exceeds BC CSR AW standard for *comparison purposes only*

Table 9

GROUNDWATER ANALYSIS OF EXTRACTABLE PETROLEUM HYDROCARBONS

Brooks Brook, Yukon

			Foundation AB							
		SAMPLE ID:	**MW01-02**	**DUP2**	**MW01-03**	**MW01-04**	**MW01-05**	**MW01-06**	**MW01-07**	**MW01-08**
		Date sampled:	9/26/2001	9/26/2001	9/26/2001	9/26/2001	9/27/2001	9/27/2001	9/27/2001	9/27/2001
PARAMETER	**YCSR AW**	**CCME FAL**								
EPHw10-19	ns (5000*)	ng	970	990	2500	750	260	430	610	1900
EPHw19-32	ns	ng	< 250	< 250	420	< 250	< 250	< 250	< 250	280
LEPHw10-19	ns(500*)	ng	**970**	**990**	**2500**	**750****	260	430**	**610****	**1900**
HEPHw19-32	ns	ng	< 250	< 250	420	<250**	< 250	<250**	<250**	280

Footnotes:

All values in ug/L (ppb)

YCSR AW - Yukon Contaminated Sites Regulation Aquatic Life Standards

CCME FAL - Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guidelines

DUP2 is a duplicate sample of MW01-02

- = Not Analysed

ns = No Standard

ng = No Guideline

*=British Columbia Contaminated Sites Regulation Aquatic Life Standards (AW) provided for comparison purposes only

** - EPHw10-19 and EPHw19-32 inferred to be equivalent to LEPHw and HEPH, respectively, due to non-detectable to minimal PAH constituents

X = Exceeds YCSR AW standard

X = Exceeds CCME FAL guideline

X = Exceeds BC CSR AW standard for *comparison purposes only*

Table 10

GROUNDWATER ANALYSIS OF POLYCYCLIC AROMATIC HYDROCARBONS

Brooks Brook, Yukon

			Foundation K	Foundation AB				
		SAMPLE ID:	**H97-7**	**H97-16**	**H98-18**	**DUP1**	**H98-20**	**H98-23**
		Date sampled:	9/24/2001	9/23/2001	9/23/2001	9/23/2001	9/24/2001	9/24/2001
PARAMETER	**YCSR AW**	**CCME FAL***						
PAHs								
Naphthalene	10	11	< 1.5	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Acenaphthylene	ns	ng	< 0.5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	60	58	< 0.5	< 0.1	< 0.1	< 0.1	0.2	< 0.1
Fluorene	120	30	< 0.25	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	3	4	< 0.25	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	1	0.12	< 0.25	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acridine	0.5	44	< 0.25	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Total LMW-PAH's	ns	ng	-	-	-	-	0.2	-
Fluoranthene	2	0.4	< 0.25	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Pyrene	0.2	0.25	< 0.1	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Benzo(a)anthracene	1	0.18	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	ns	ng	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	ns	ng	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	ns	ng	-	-	-	-	-	-
Benzo(a)pyrene	0.1	0.15	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	ns	ng	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	ns	ng	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(g,h,i)perylene	ns	ng	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Total HMW-PAH's	ns	ng	-	-	-	-	-	-
Total PAH's	ns	ng	-	-	-	-	0.2	-

cont'd on following page

Footnotes:

All values in ug/L (ppb)

YCSR AW - Yukon Contaminated Sites Regulation Aquatic Life Standards

CCME FAL - Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guidelines

DUP1 is a duplicate sample of H98-18

* - CCME FAL guidelines were created for surface water concentrations but for application to subsurface groundwater, the CCME guidelines are referenced, assuming a 1:10 dilution occurs.

- = Not Analysed

ns = No Standard

ng = No Guideline

X = Exceeds YCSR AW standard

X = Exceeds CCME FAL guideline

Table 10

GROUNDWATER ANALYSIS OF POLYCYCLIC AROMATIC HYDROCARBONS

Brooks Brook, Yukon

			Foundation AB				
		SAMPLE ID:	**MW01-02**	**DUP2**	**MW01-03**	**MW01-05**	**MW01-08**
		Date sampled:	9/26/2001	9/26/2001	9/26/2001	9/27/2001	9/27/2001
PARAMETER	**YCSR AW**	**CCME FAL***					
PAHs							
Naphthalene	10	11	< 0.3	< 0.3	< 0.3	< 0.3	12
Acenaphthylene	ns	ng	< 0.1	< 0.1	< 0.1	< 0.1	< 0.5
Acenaphthene	60	58	< 0.1	< 0.1	< 0.1	< 0.1	0.6
Fluorene	120	30	< 0.05	< 0.05	< 0.05	< 0.05	1.3
Phenanthrene	3	4	< 0.05	< 0.05	< 0.05	< 0.05	0.7
Anthracene	1	0.12	< 0.05	< 0.05	< 0.05	< 0.05	< 0.25
Acridine	0.5	44	< 0.05	< 0.05	< 0.05	< 0.05	< 0.25
Total LMW-PAH's	ns	ng	-	-	-	-	14.6
Fluoranthene	2	0.4	< 0.05	< 0.05	< 0.05	< 0.05	< 0.25
Pyrene	0.2	0.25	< 0.02	< 0.02	< 0.02	< 0.02	0.2
Benzo(a)anthracene	1	0.18	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05
Chrysene	ns	ng	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05
Benzo(b)fluoranthene	ns	ng	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05
Benzo(k)fluoranthene	ns	ng	-	-	-	-	-
Benzo(a)pyrene	0.1	0.15	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05
Indeno(1,2,3-cd)pyrene	ns	ng	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05
Dibenz(a,h)anthracene	ns	ng	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05
Benzo(g,h,i)perylene	ns	ng	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05
Total HMW-PAH's	ns	ng	-	-	-	-	0.2
Total PAH's	ns	ng	-	-	-	-	14.8

Footnotes:

All values in ug/L (ppb)

YCSR AW - Yukon Contaminated Sites Regulation Aquatic Life Standards

CCME FAL - Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guidelines

DUP2 is a duplicate sample of MW01-02

* - CCME FAL guidelines were created for surface water concentrations but for application to subsurface groundwater, the CCME guidelines are referenced, assuming a 1:10 dilution occurs.

- = Not Analysed

ns = No Standard

ng = No Guideline

X = Exceeds YCSR AW standard

X = Exceeds CCME FAL guideline

Table 11

GROUNDWATER ANALYSIS OF DISSOLVED METALS

Brooks Brook, Yukon

			Foundation K	Foundation AB			
		SAMPLE ID:	**H97-7**	**H98-18**	**DUP1**	**MW01-02**	**DUP2**
		Date sampled:	9/24/2001	9/23/2001	9/23/2001	9/26/2001	9/26/2001
PARAMETER	**YCSR AW**	**CCME FAL***					
Conventional Parameters							
Hardness CaCO3 (H)			325	98	99	136	137
pH			7.05	6.45		6.44	
Metals Analysis							
Dissolved Aluminum Al	0.50 @ pH >=6.4	0.05 (pH < 6.5;[Ca^{+2}] < 4.0mg/L) 1 (pH >or = 6.5;[Ca^{+2}] > or = 4.0mg/L)	< 0.005	0.02	0.021	0.027	0.028
Dissolved Antimony Sb	0.3	ng	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Dissolved Arsenic As	0.5	0.05	0.004	0.01	0.01	0.003	0.005
Dissolved Barium Ba	10	ng	0.15	0.076	0.075	0.13	0.13
Dissolved Beryllium Be	0.053	ng	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Dissolved Boron B	ns	ng	< 0.05	< 0.05	< 0.05	0.05	< 0.05
Dissolved Cadmium Cd	0.008 @ H 60 < 120 0.013 @ H 120 < 180 0.018 @ H > 180	0.17	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Dissolved Calcium Ca	ns	ng	87.7	28.6	29	38.8	38.6
Dissolved Chromium Cr	0.02	0.089	0.001	0.002	0.002	0.002	0.002
Dissolved Cobalt Co	0.5	ng	0.002	< 0.001	< 0.001	0.003	0.003
Dissolved Copper Cu	0.04 @ H 75 < 100 0.05 @ H 100 < 125 0.06 @ H 125 < 150 0.07 @ H 150 < 175 0.08 @ H 175 < 200 0.09 @ H > 200	0.02 @ H** 0 - 120 0.03 @ H** 120 - 180 0.04 @ H** > 180	< 0.001	< 0.001	< 0.001	0.002	0.001
Dissolved Iron Fe	3	3	2.46	13.1	13.1	11.1	11.1
Dissolved Lead Pb	0.05 @ H 50 < 100 0.06 @ H 100 < 200 0.11 @ H 200 < 300 0.16 @ H > 300	0.02 @ H** 60 - 120 0.04 @ H** 120 - 180 0.07 @ H** > 180	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Dissolved Magnesium Mg	ns	ng	25.7	6.42	6.39	9.54	9.74
Dissolved Manganese Mn	1	ng	1.59	0.6	0.6	1.17	1.15
Dissolved Mercury Hg	0.001	0.001	< 0.00002	0.00005	< 0.00002	< 0.00002	< 0.00002
Dissolved Molybdenum Mo	10	ng	0.002	< 0.001	< 0.001	0.001	< 0.001
Dissolved Nickel Ni	0.650 @ H 60 < 120 1.1 @ H 120 < 180 1.5 @ H > 180	0.65 @ H** 60 - 120 1.10 @ H** 120 - 180 1.50 @ H** > 180	0.006	< 0.001	< 0.001	0.005	0.005
Dissolved Phosphorus PO4	ns	ng	0.25	0.49	0.53	0.26	0.26
Dissolved Potassium K	ns	ng	2.36	0.75	0.74	1.5	1.39
Dissolved Selenium Se	0.01	0.01	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Dissolved Silicon SiO2	ns	ng	18.9	16.5	16.5	17	17.2
Dissolved Silver Ag	0.001	0.001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Dissolved Sodium Na	ns	ng	41.2	2.66	2.57	7.7	5.9
Dissolved Strontium Sr	ns	ng	0.43	0.11	0.11	0.17	0.17
Dissolved Tellurium Te	ns	ng	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Dissolved Thallium Tl	0.003	ng	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Dissolved Thorium Th	ns	ng	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Tin Sn	ns	ng	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Dissolved Titanium Ti	ns	ng	< 0.001	0.002	0.002	0.004	0.003
Dissolved Uranium U	3	ng	0.0026	< 0.0005	< 0.0005	0.0014	0.0014
Dissolved Vanadium V	ns	ng	0.003	0.004	0.004	0.004	0.004
Dissolved Zinc Zn	0.3	0.3	< 0.005	< 0.005	< 0.005	0.006	0.007
Dissolved Zirconium Zr	ns	ng	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Footnotes:

All values in mg/L

YCSR AW - Yukon Contaminated Sites Regulation Aquatic Life Standards

CCME FAL - Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guidelines

**H indicates sample water hardness in mg/L; guideline varies with hardness

DUP1 is a duplicate sample of H98-18, DUP2 is a duplicate sample of MW01-02

* - CCME FAL guidelines were created for surface water concentrations but for application to subsurface groundwater, the CCME guidelines are referenced, assuming a 1:10 dilution occurs.

ns = No Standard

ng = No Guideline

X = Exceeds YCSR AW standard

X = Exceeds CCME FAL guideline

Table 12

ANALYSIS OF SURFACE WATER BROOK SAMPLES FOR VOLATILE ORGANIC COMPOUNDS

Brooks Brook, Yukon

	SAMPLE ID:	**Upstream**	**Downstream**
	Date sampled:	9/27/2001	9/27/2001
PARAMETER	**CCME FAL**		
Benzene	370	< 0.1	< 0.1
Ethylbenzene	90	< 0.1	< 0.1
Toluene	2	< 0.1	< 0.1
Xylenes	ng	< 0.1	< 0.1
VHs (C6-10)	ng	< 100	< 100
VPHs	ng	< 100	< 100

Footnotes:

All values in ug/L (ppb)

CCME FAL - Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guidelines

ng = No Guideline

X

= Exceeds CCME FAL guideline

Table 13

ANALYSIS OF SURFACE WATER BROOK SAMPLES FOR EXTRACTABLE PETROLEUM HYDROCARBONS
Brooks Brook, Yukon

	SAMPLE ID:	Upstream	Downstream
	Date sampled:	9/27/2001	9/27/2001
PARAMETER	**CCME FAL**		
EPHw10-19	ng	< 250	< 250
EPHw19-32	ng	< 250	< 250
LEPHw10-19	ng	< 250	< 250
HEPHw19-32	ng	< 250	< 250

Footnotes:

All values in ug/L (ppb)

CCME FAL - Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guidelines

ng = no guideline

X

= Exceeds CCME FAL guideline

Table 14

ANALYSIS OF SURFACE WATER BROOK SAMPLES FOR POLYCYCLIC AROMATIC HYDROCARBONS
Brooks Brook, Yukon

	SAMPLE ID:	**Upstream**	**Downstream**
	Date sampled:	9/27/2001	9/27/2001
PARAMETER	**CCME FAL**		
Polycyclic Aromatic Hydrocarbons			
Naphthalene	1.1	< 0.3	< 0.3
Acenaphthylene	ng	< 0.1	< 0.1
Acenaphthene	5.8	< 0.1	< 0.1
Fluorene	3	< 0.05	< 0.05
Phenanthrene	0.4	< 0.05	< 0.05
Anthracene	0.012	< 0.05	< 0.05
Acridine	4.4	< 0.05	< 0.05
Total LMW-PAH's	ng	-	-
Fluoranthene	0.04	< 0.05	< 0.05
Pyrene	0.025	< 0.02	< 0.02
Benzo(a)anthracene	0.018	< 0.01	< 0.01
Chrysene	ng	< 0.01	< 0.01
Benzo(b)fluoranthene	ng	< 0.01	< 0.01
Benzo(k)fluoranthene		-	-
Benzo(a)pyrene	0.015	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	ng	< 0.01	< 0.01
Dibenz(a,h)anthracene	ng	< 0.01	< 0.01
Benzo(g,h,i)perylene	ng	< 0.01	< 0.01
Total HMW-PAH's	ng	-	-
Total PAH's	ng	-	-

Footnotes:

All values in ug/L (ppb)

CCME FAL - Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guidelines

- = Not Analysed

ng = No Guideline

X

= Exceeds CCME FAL guideline

Table 15

ANALYSIS OF SURFACE WATER BROOK SAMPLES FOR TOTAL METALS

Brooks Brook, Yukon

	SAMPLE ID:	Upstream	Downstream
	Date sampled:	9/27/2001	9/27/2001
PARAMETER	**CCME FAL**		
Conventional Parameters			
Hardness CaCO3 (H)		78	77
pH		8.33	8.18
Metals Analysis			
Aluminum Al	0.1 (pH >or = 6.5;[Ca^{+2}] > or = 4.0mg/L)	0.021	0.011
Antimony Sb	ng	< 0.001	< 0.001
Arsenic As	0.005	< 0.001	< 0.001
Barium Ba	ng	0.023	0.022
Beryllium Be	ng	< 0.001	< 0.001
Bismuth Bi	ng	< 0.001	< 0.001
Boron B	ng	< 0.05	< 0.05
Cadmium Cd	0.017	< 0.0002	< 0.0002
Calcium Ca	ng	21.8	21
Chromium Cr	0.0089	< 0.001	< 0.001
Cobalt Co	ng	< 0.001	< 0.001
Copper Cu	0.002 @ H** 0 - 120	< 0.001	< 0.001
Iron Fe	0.3	0.06	0.06
Lead Pb	0.002 @ H** 60 - 120	< 0.001	< 0.001
Lithium Li	ng	< 0.001	< 0.001
Magnesium Mg	ng	5.81	5.93
Manganese Mn	ng	0.009	0.01
Mercury Hg	0.0001	< 0.02	< 0.02
Molybdenum Mo	ng	< 0.001	< 0.001
Nickel Ni	0.065 @ H** 60 - 120	< 0.001	< 0.001
Phosphorus PO4	ng	< 0.01	< 0.01
Potassium K	ng	0.63	0.58
Selenium Se	0.001	< 0.002	< 0.002
Silicon SiO2	ng	10.2	10.5
Silver Ag	0.0001	< 0.0001	< 0.0001
Sodium Na	ng	2.17	2.18
Strontium Sr	ng	0.082	0.082
Tellurium Te	ng	< 0.001	< 0.001
Thallium Tl	ng	< 0.0001	< 0.0001
Thorium Th	ng	< 0.0005	< 0.0005
Tin Sn	ng	< 0.001	< 0.001
Titanium Ti	ng	< 0.001	< 0.001
Uranium U	ng	0.0008	0.0008
Vanadium V	ng	< 0.001	< 0.001
Zinc Zn	0.03	< 0.005	< 0.005
Zirconium Zr	ng	< 0.01	< 0.01

Footnotes:

All values in mg/L

CCME FAL - Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guidelines

**H indicates sample water hardness in mg/L; guideline varies with hardness

ng = No Guideline

X = Exceeds CCME FAL guideline

Table 16

SOIL ANALYSIS OF SEDIMENT SAMPLES FOR MONOCYCLIC AROMATIC HYDROCARBONS

Brooks Brook, Yukon

			Sample ID:	**SED-UP**	**SED-ADJ**	**SED-DN**
			Depth:	0.08 m	0.08 m	0.08 m
			CSV:	na	na	na
			Date sampled:	9/24/2001	9/24/2001	9/24/2001
PARAMETER	**YCSR RL/PL**	**CCME SQG**				
Benzene	8*	ng		< 0.04	< 0.04	< 0.04
Ethylbenzene	5‡	ng		< 0.5	< 0.5	< 0.5
Styrene	5	ng		< 0.5	< 0.5	< 0.5
Toluene	3‡	ng		< 0.5	< 0.5	< 0.5
Xylenes	5‡	ng		< 0.5	< 0.5	< 0.5
VHs (C6-10)	ns	ng		< 100	< 100	< 100
VPHs	200	ng		< 100	< 100	< 100

Footnotes:

All values in mg/kg (ppm)

YCSR RL/PL - Yukon Contaminated Sites Regulation Residential/Park Land Standards

CCME SQG - Canadian Council of Ministers of the Environment Sediment Quality guidelines

* YCSR - Groundwater Flow to Surface Water used by Aquatic Life

‡ YCSR - Toxicity to Soil Invertebrates and Plants

ns = No Standard

ng = No Guideline

X = Exceeds YCSR RL/PL standard

X = Exceeds CCME SQG

Table 17

SOIL ANALYSIS OF SEDIMENT SAMPLES FOR EXTRACTABLE PETROLEUM HYDROCARBONS

Brooks Brook, Yukon

			Sample ID:	**SED-UP**	**SED-ADJ**	**SED-DN**
			Depth:	0.08 m	0.08 m	0.08 m
			CSV:	na	na	na
			Date sampled:	9/24/2001	9/24/2001	9/24/2001
PARAMETER	**YCSR RL/PL**	**CCME SQG**				
EPHs10-19	ns	ng		< 250	< 250	< 250
EPHs19-32	ns	ng		< 250	< 250	< 250
LEPHs10-19	1000	ng		-	< 250	-
HEPHs19-32	1000	ng		-	< 250	-

Footnotes:

All values in mg/kg (ppm)

YCSR RL/PL - Yukon Contaminated Sites Regulation Residential/Park Land Standards

CCME SQG - Canadian Council of Ministers of the Environment Sediment Quality guidelines

- = Not Analysed

ns = No Standard

ng = No Guideline

X = Exceeds YCSR RL/PL standard

X = Exceeds CCME SQG

Table 18

SOIL ANALYSIS OF A SEDIMENT SAMPLE FOR POLYCYCLIC AROMATIC HYDROCARBONS

Brooks Brook, Yukon

			Sample ID:	**SED-ADJ**
			Depth:	0.08 m
			CSV:	na
			Date sampled:	9/24/2001
PARAMETER	**YCSR RL/PL**	**CCME SQG**		
		ISQC	**PEL**	
PAHs				
Naphthalene	5	0.035	0.39	< 0.05
Acenaphthylene	ns	0.006	0.13	< 0.05
Acenaphthene	ns	0.007	0.09	< 0.05
Fluorene	ns	0.02	0.20	< 0.05
Phenanthrene	5	0.04	0.52	< 0.05
Anthracene	ns	0.05	0.25	< 0.05
Total LMW-PAH's	ns	ng	ng	-
Fluoranthene	ns	0.11	2.4	< 0.05
Pyrene	10	0.05	0.88	< 0.05
Benzo(a)anthracene	1	0.03	0.39	< 0.05
Chrysene	ns	0.06	0.86	< 0.05
Benzo(b)fluoranthene	1	ng	ng	< 0.05
Benzo(k)fluoranthene	1	ng	ng	-
Benzo(a)pyrene	1‡	0.32	0.39	< 0.05
Indeno(1,2,3-cd)pyrene	1	ng	ng	< 0.05
Dibenz(a,h)anthracene	1	0.01	0.14	< 0.05
Benzo(g,h,i)perylene	ns	ng	ng	< 0.05
Total HMW-PAH's	ns	ng	ng	-
Total PAH's	ns	ng	ng	-

Footnotes:

All values in mg/kg (ppm)

YCSR RL/PL - Yukon Contaminated Sites Regulation Residential/Park Land Standards

CCME SQG - Canadian Council of Ministers of the Environment Sediment Quality guidelines

ISQC - Interim Freshwater Quality guidelines

PEL - Probable Effect Levels

‡ YCSR - Toxicity to Soil Invertebrates and Plants

- = Not Analysed

ns = No Standard

ng = No Guideline

X = Exceeds YCSR RL/PL standard

X = Exceeds CCME SQG

Table 19

SOIL ANALYSIS OF SEDIMENT SAMPLES FOR METALS

Brooks Brook, Yukon

			Sample ID:	**SED-UP**	**SED-ADJ**
			Depth:	0.08 m	0.08 m
			CSV:	na	na
			Date sampled:	9/24/2001	9/24/2001
PARAMETER	**YCSR RL/PL**	**CCME SQG**			
		ISQC	**PEL**		
Conventional Parameters					
Moisture				15.5	31.8
pH				7.5	7
Metals Analysis					
Aluminum Al	ns	ng	ng	4060	4660
Antimony Sb	20	ng	ng	< 10	< 10
Arsenic As	60*	5.9	17	< 10	< 10
Barium Ba	500	ng	ng	34	72
Beryllium Be	4	ng	ng	< 1	< 1
Boron B	ns	ng	ng	30	34
Cadmium Cd	35 ‡‡	0.6	3.5	< 0.3	< 0.3
Calcium Ca	ns	ng	ng	2080	3220
Chromium Cr	60*	37.3	90	16	19
Cobalt Co	50	ng	ng	1	2
Copper Cu	150‡	35.7	197	6	9
Iron Fe	ns	ng	ng	9710	11700
Lead Pb	500 ‡‡	35	91	< 30	< 30
Magnesium Mg	ns	ng	ng	3510	3940
Manganese Mn	ns	ng	ng	197	570
Mercury Hg	2	0.17	0.49	0.03	0.05
Molybdenum Mo	10	ng	ng	< 4	< 4
Nickel Ni	100	ng	ng	13	17
Phosphorus PO4	ns	ng	ng	715	1040
Selenium Se	3	ng	ng	< 3	< 3
Silver Ag	20	ng	ng	< 2	< 2
Sodium Na	ns	ng	ng	20	32
Strontium Sr	ns	ng	ng	9	16
Tin Sn	50	ng	ng	< 5	< 5
Titanium Ti	ns	ng	ng	235	254
Vanadium V	200	ng	ng	16	17
Zinc Zn	450‡	123	315	16	23

Footnotes:

All values in mg/kg (ppm)

YCSR RL/PL - Yukon Contaminated Sites Regulation Residential/Park Land Standards

CCME SQG - Canadian Council of Ministers of the Environment Sediment Quality guidelines

ISQC - Interim Freshwater Quality guidelines

PEL - Probable Effect Levels

* YCSR - Groundwater Flow to Surface Water used by Aquatic Life

‡ YCSR - Toxicity to Soil Invertebrates and Plants

† YCSR - Standard varies with pH

‡‡ YCSR - Intake of Contaminated Soil

ns = No Standard

ng = No Guideline

X = Exceeds CCME SQG

X = Exceeds YCSR RL/PL standard

Table 20

SOIL ANALYSIS OF SURFICIAL SAMPLES FOR MONOCYCLIC AROMATIC HYDROCARBONS

Brooks Brook, Yukon

			Sample ID:	SURFACE 1	SURFACE 2	SURFACE 3
			Depth:	0.1 m	0.1 m	0.1 m
			CSV:	15 ppmv	15 ppmv	20 ppmv
			Date sampled:	9/24/2001	9/24/2001	9/24/2001
PARAMETER	**YCSR RL/PL**	**CCME RL/PL**				
Benzene	8*	0.5		< 0.04	< 0.04	< 0.04
Ethylbenzene	5‡	1.2		< 0.5	< 0.5	< 0.5
Styrene	5	5		< 0.5	< 0.5	< 0.5
Toluene	3‡	0.8		< 0.5	< 0.5	< 0.5
Xylenes	5‡	1		< 0.5	< 0.5	< 0.5
VHs (C6-10)	ns	ng		< 100	< 100	< 100
VPHs	200	ng		< 100	< 100	< 100

Footnotes:

All values in mg/kg (ppm)

YCSR RL/PL - Yukon Contaminated Sites Regulation Residential/Park Land Standards

CCME RL/PL - Canadian Council of Ministers of the Environment Residential/Park Land Guidelines

* YCSR - Groundwater Flow to Surface Water used by Aquatic Life

‡ YCSR - Toxicity to Soil Invertebrates and Plants

CSV - combustible soil vapour concentration (parts per million by volume)

ns = No Standard

ng = No Guideline

X	= Exceeds YCSR RL/PL standard
X	= Exceeds CCME RL/PL Guideline

Table 21

SOIL ANALYSIS OF SURFICIAL SAMPLES FOR EXTRACTABLE PETROLEUM HYDROCARBONS

Brooks Brook, Yukon

		Sample ID:	SURFACE 1	SURFACE 2	SURFACE 3
		Depth:	0.1 m	0.1 m	0.1 m
		CSV:	15 ppmv	15 ppmv	20 ppmv
		Date sampled:	9/24/2001	9/24/2001	9/24/2001
PARAMETER	YCSR RL/PL	CCME RL/PL			
EPHs10-19	1000*	2000*	< 250	< 250	< 250
EPHs19-32	1000*	5000*	< 250	< 250	< 250
LEPHs10-19	1000	2000	-	< 250	-
HEPHs19-32	1000	5000	-	< 250	-

Footnotes:

All values in mg/kg (ppm)

YCSR RL/PL - Yukon Contaminated Sites Regulation Residential/Park Land Standards

CCME RL/PL - Canadian Council of Ministers of the Environment Residential/Park Land Guidelines

* - Stated standard is for LEPH or HEPH, as LEPH and HEPH are EPH(C10-C19) and EPH(C19-C32), respectively, corrected for PAHs.

CSV - combustible soil vapour concentration (parts per million by volume)

- = Not Analysed

ns = No Standard

ng = No Guideline

X = Exceeds YCSR - Residential/Park Land Use Standard

X = Exceeds CCME Residential/Parkland Guideline for Soil

Table 22

SOIL ANALYSIS OF A SURFICIAL SAMPLE FOR POLYCYCLIC AROMATIC HYDROCARBONS

Brooks Brook, Yukon

		Sample ID:	**SURFACE 2**
		Depth:	0.1 m
		CSV:	15 ppmv
		Date sampled:	9/24/2001
PARAMETER	**YCSR RL/PL**	**CCME RL/PL**	
PAHs			
Naphthalene	5	0.6	< 0.05
Acenaphthylene	ns	ng	< 0.05
Acenaphthene	ns	ng	< 0.05
Fluorene	ns	ng	< 0.05
Phenanthrene	5	5	< 0.05
Anthracene	ns	ng	< 0.05
Total LMW-PAH's	ns	ng	-
Fluoranthene	ns	ng	< 0.05
Pyrene	10	10	< 0.05
Benzo(a)anthracene	1	1	< 0.05
Chrysene	ns	ng	< 0.05
Benzo(b)fluoranthene	1	1	< 0.05
Benzo(k)fluoranthene	1	1	-
Benzo(a)pyrene	1‡	0.7	< 0.05
Indeno(1,2,3-cd)pyrene	1	1	< 0.05
Dibenz(a,h)anthracene	1	1	< 0.05
Benzo(g,h,i)perylene	ns	ng	< 0.05
Total HMW-PAH's	ns	ng	-
Total PAH's	ns	ng	-

Footnotes:

All values in mg/kg (ppm)

YCSR RL/PL - Yukon Contaminated Sites Regulation Residential/Park Land Standards

CCME RL/PL - Canadian Council of Ministers of the Environment Residential/Park Land Guidelines

‡ YCSR - Toxicity to Soil Invertebrates and Plants

CSV - combustible soil vapour concentration (parts per million by volume)

- = Not Analysed

ns = No Standard

ng = No Guideline

X = Exceeds YCSR RL/PL standard

X = Exceeds CCME RL/PL Guideline

Table 23

SOIL ANALYSIS OF SURFICIAL SAMPLE FOR METALS

Brooks Brook, Yukon

		Sample ID:	**SURFACE 1**
		Depth:	0.1 m
		CSV:	15 ppmv
		Date sampled:	9/24/2001
PARAMETER	**YCSR RL/PL**	**CCME RL/PL**	
Conventional Parameters			
Moisture			7.1
pH			7.2
Metals Analysis			
Aluminum Al	ns	ng	6190
Antimony Sb	20	20	< 10
Arsenic As	35‡	12	< 10
Barium Ba	500	500	70
Beryllium Be	4	4	< 1
Boron B	ns	ng	< 1
Cadmium Cd	45 (pH7.0-<7.5)*†	10	< 0.3
Calcium Ca	ns	ng	3010
Chromium Cr	60*	64	24
Cobalt Co	50	50	2
Copper Cu	150‡	63	15
Iron Fe	ns	ng	14300
Lead Pb	500 ‡‡	140	< 30
Magnesium Mg	ns	ng	5600
Manganese Mn	ns	ng	239
Mercury Hg	2	6.6	0.041
Molybdenum Mo	10	10	< 4
Nickel Ni	100	50	24
Phosphorus PO4	ns	ng	932
Selenium Se	3	3	< 3
Silver Ag	20	20	< 2
Sodium Na	ns	ng	55
Strontium Sr	ns	ng	12
Tin Sn	50	50	< 5
Titanium Ti	ns	ng	328
Vanadium V	200	130	22
Zinc Zn	450‡	200	27

Footnotes:

All values in mg/kg (ppm)

YCSR RL/PL - Yukon Contaminated Sites Regulation Residential/Park Land Standards

CCME RL/PL - Canadian Council of Ministers of the Environment Residential/Park Land Guidelines

* YCSR - Groundwater Flow to Surface Water used by Aquatic Life

‡ YCSR - Toxicity to Soil Invertebrates and Plants

† YCSR - Standard varies with pH

‡‡ YCSR - Intake of Contaminated Soil

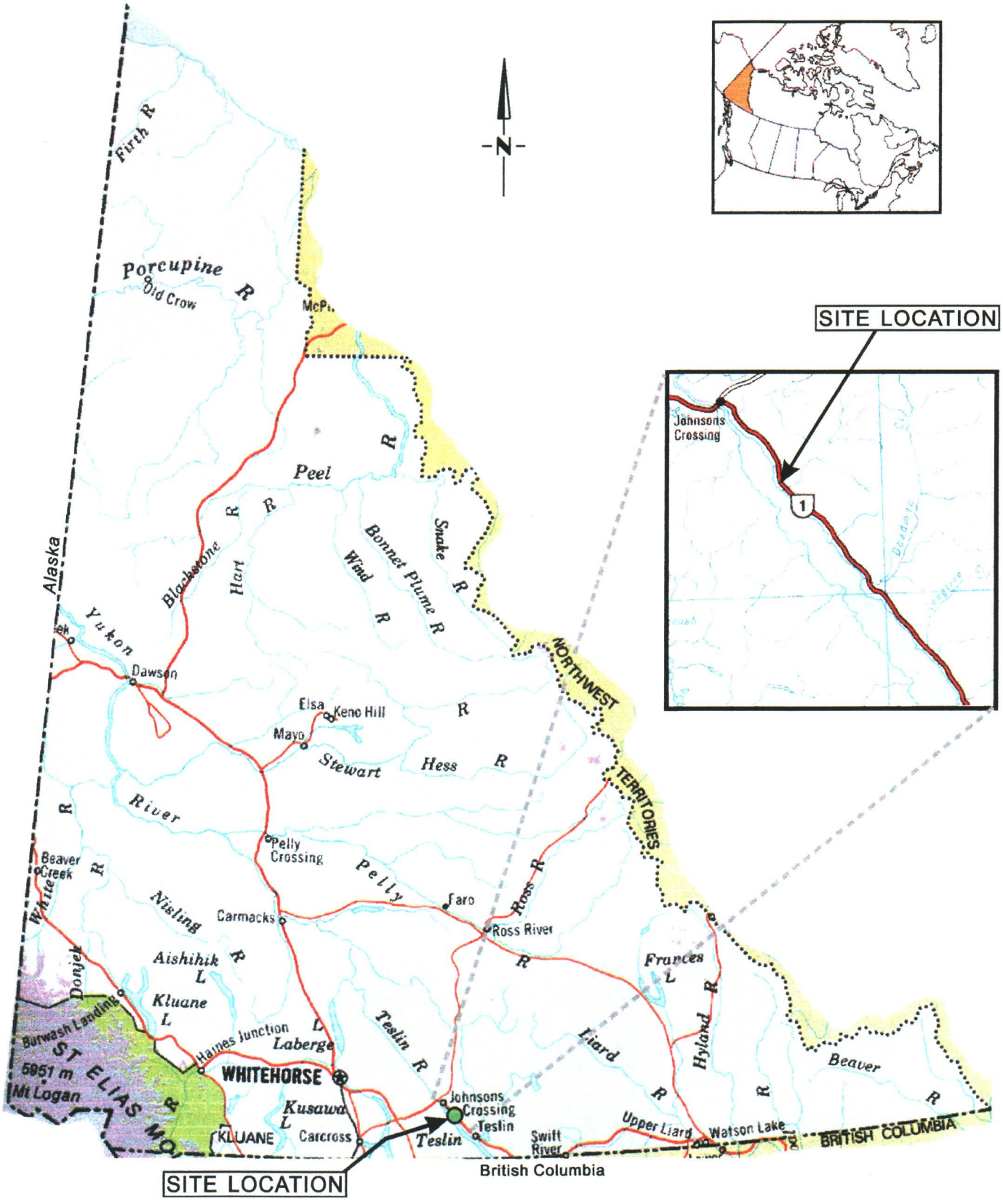
CSV - combustible soil vapour concentration (parts per million by volume)

ns = No Standard

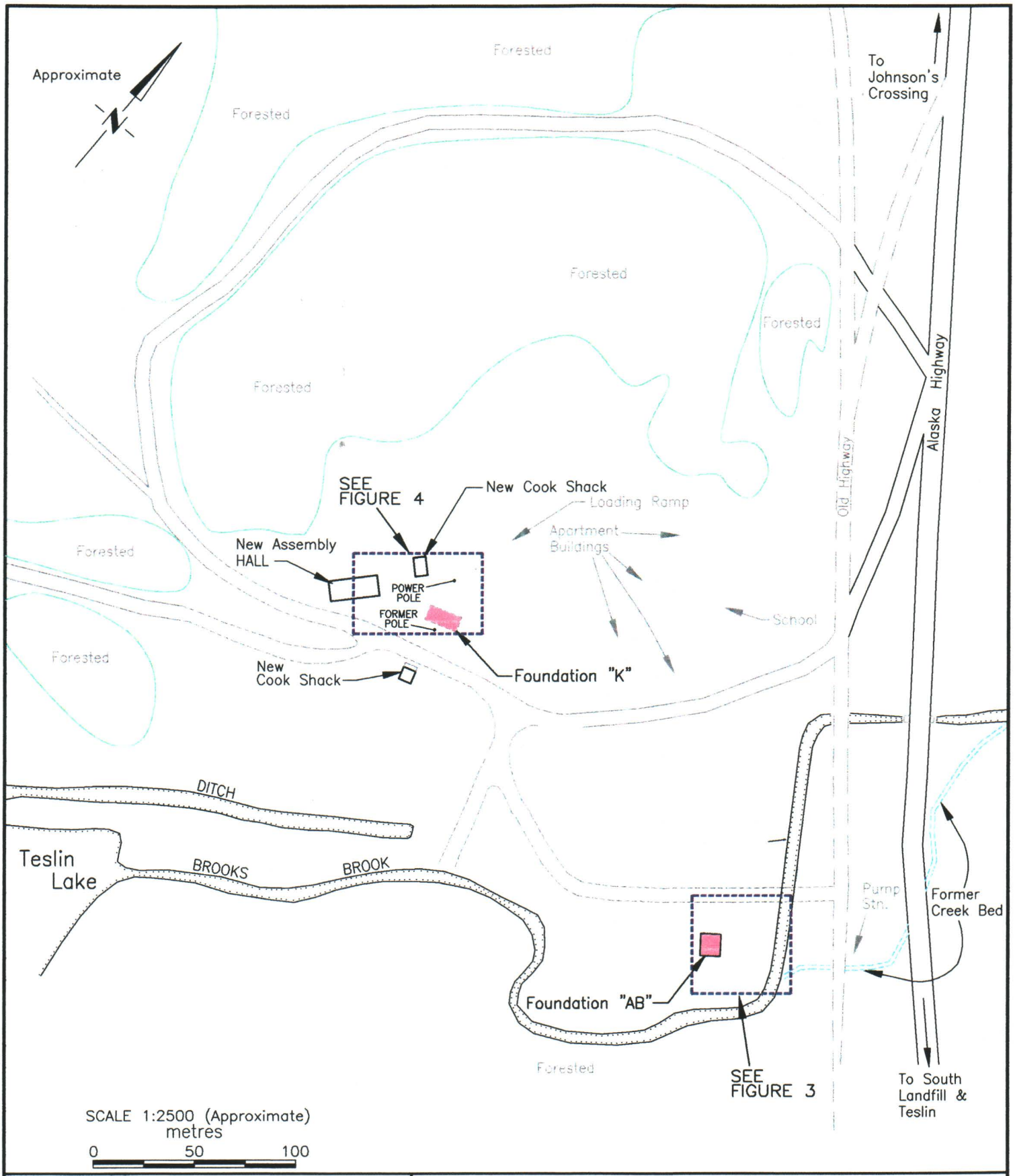
ng = No Guideline

X = Exceeds CCME RL/PL Guideline

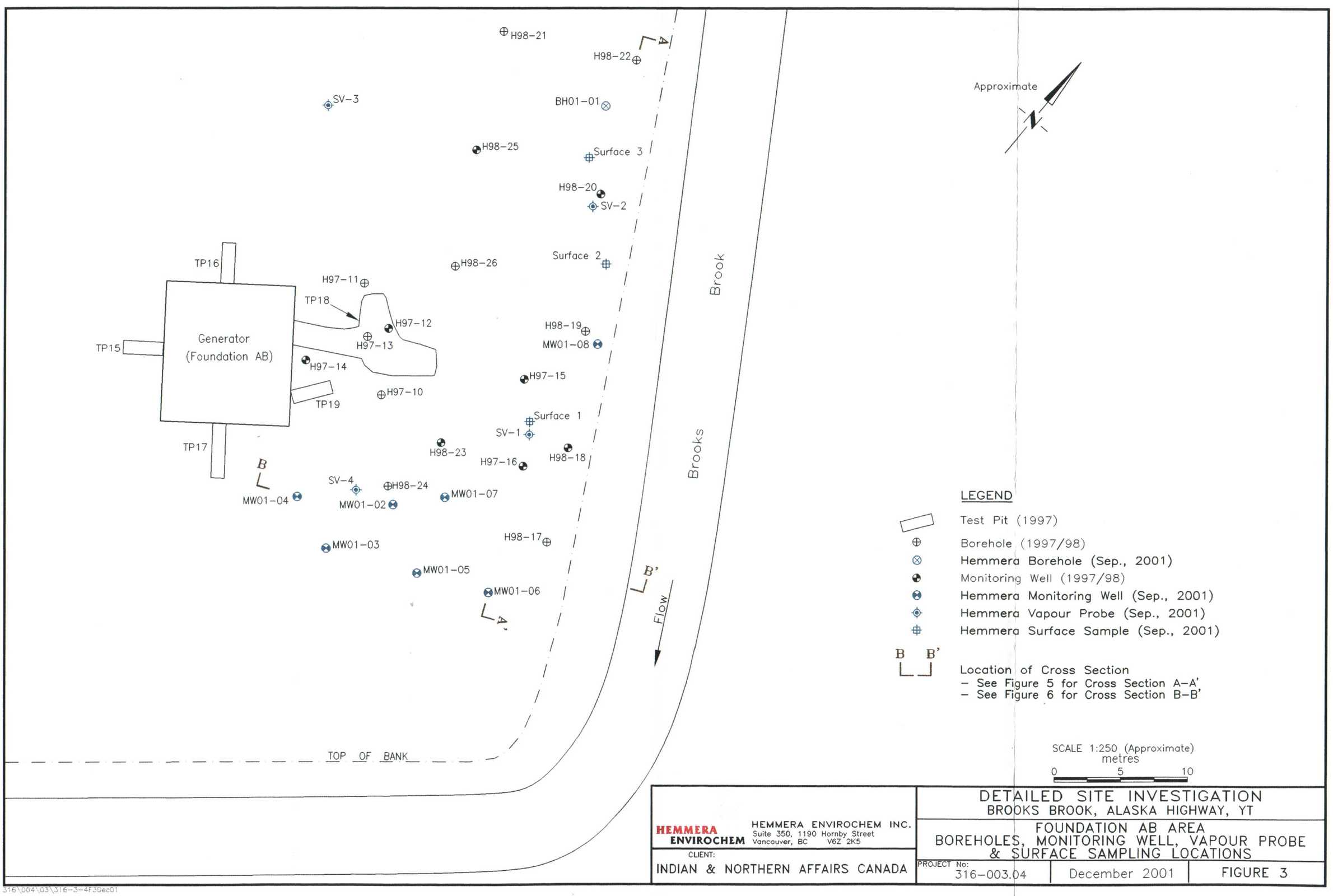
X = Exceeds YCSR RL/PL standard



HEMMERA ENVIROCHEM HEMMERA ENVIROCHEM INC. Suite 350, 1190 Hornby Street Vancouver, BC V6Z 2K5	DETAILED SITE INVESTIGATION Brooks Brook, Yukon Territory		
	LOCATION MAP		
CLIENT: **INDIAN & NORTHERN AFFAIRS CANADA**	PROJECT No. 316-003.04	December 2001	Figure 1



HEMMERA ENVIROCHEM HEMMERA ENVIROCHEM INC. Suite 350, 1190 Hornby Street Vancouver, BC V6Z 2K5	DETAILED SITE INVESTIGATION BROOKS BROOK , ALASKA HIGHWAY, YT		
	SITE LAYOUT BROOKS BROOK, YT		
CLIENT: INDIAN & NORTHERN AFFAIRS CANADA	File No. 316-003.04	December 2001	FIGURE 2



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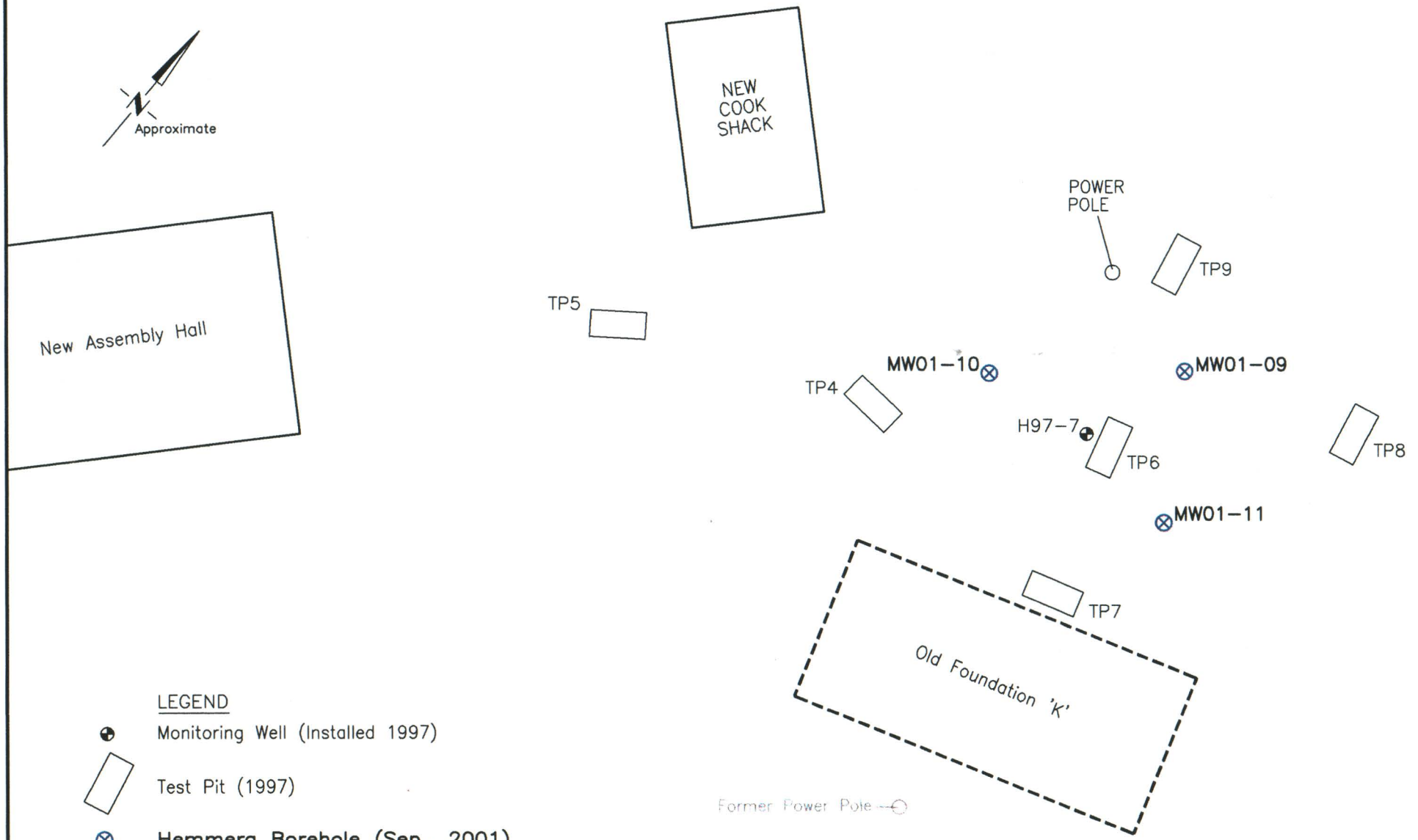
Suite 350, 1190 Hornby Street
Vancouver, BC V6Z 2K5

CLIENT:
INDIAN & NORTHERN AFFAIRS CANADA

DETAILED SITE INVESTIGATION
BROOKS BROOK, ALASKA HIGHWAY, YT
FOUNDATION AB AREA
BOREHOLES, MONITORING WELL, VAPOUR PROBE & SURFACE SAMPLING LOCATIONS

PROJECT No: 316-003.04 | December 2001 | FIGURE 3

316\004\03\316-3-4F3Dec01



SCALE 1:250 (Approximate)
metres
0 5 10

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Vancouver, BC V6Z 2K5

CLIENT:
INDIAN & NORTHERN AFFAIRS CANADA

DETAILED SITE INVESTIGATION
BROOKS BROOK, ALASKA HIGHWAY, YT
FOUNDATION K AREA
BOREHOLE & MONITORING WELL LOCATIONS

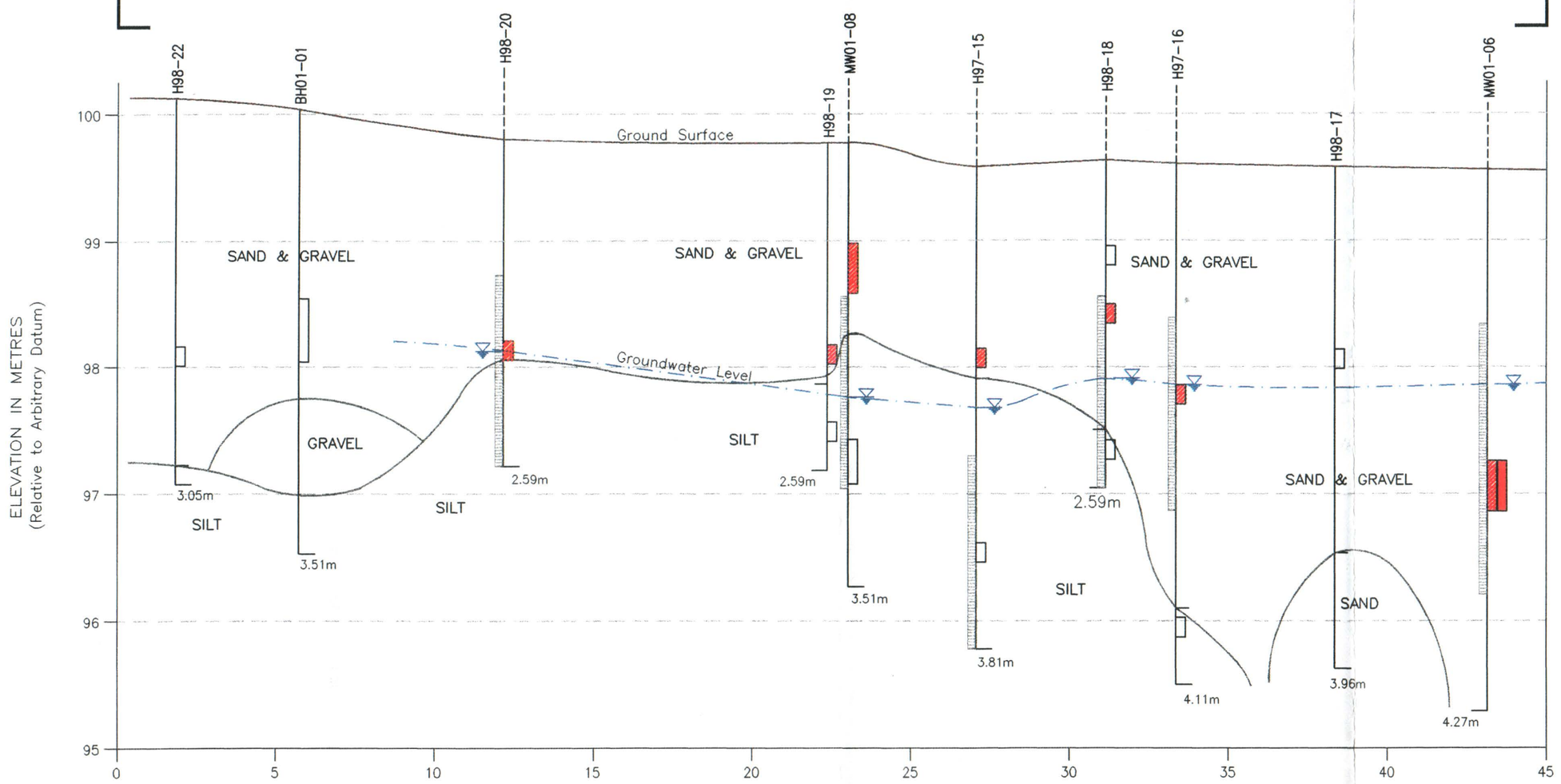
File No. 316–003.04 | December 2001 | FIGURE 4

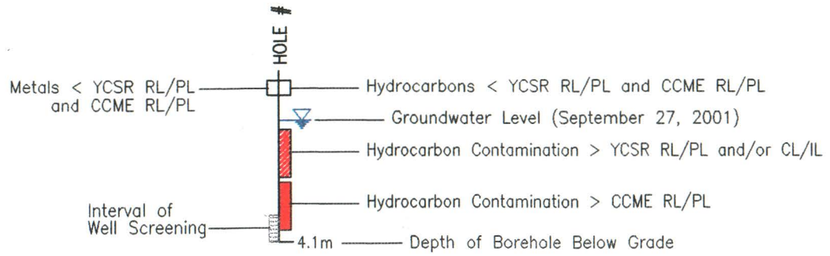
STRATIGRAPHY

A

A'

South





NOTE: SEE TABLES FOR DETAILS OF ANALYSIS.

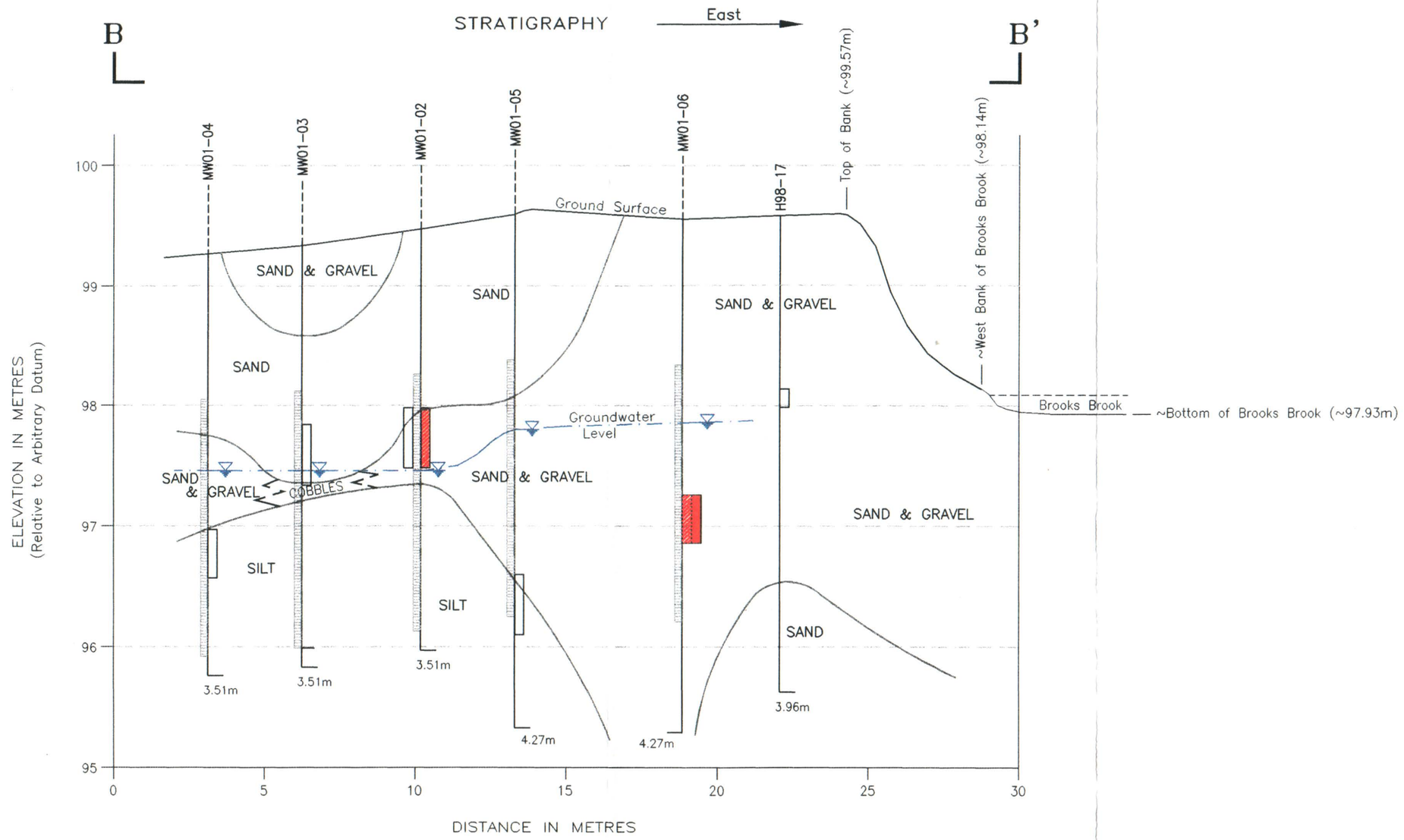
HORIZONTAL SCALE:
1:150 (Approximate)
metres
0 3 6

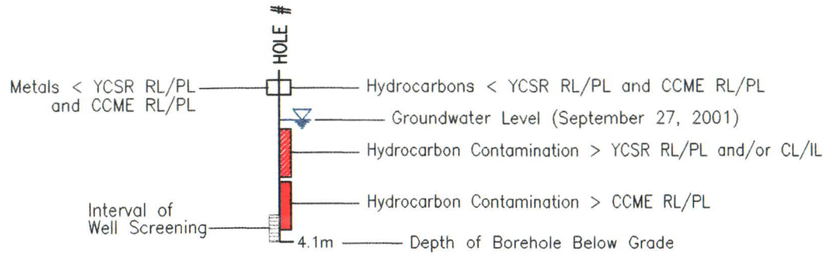
VERTICAL SCALE EXAGGERATED 4X.

NOTE: See Figure 3 for location of section.

HEMMERA ENVIROCHEM HEMMERA ENVIROCHEM INC. Suite 350, 1190 Hornby Street Vancouver, BC V6Z 2K5	DETAILED SITE INVESTIGATION BROOKS BROOK, ALASKA HIGHWAY, YT
CLIENT: INDIAN & NORTHERN AFFAIRS CANADA	FOUNDATION AB AREA CROSS SECTION A-A'
PROJECT No: 316-003.04	December 2001 | FIGURE 5

316\004\03\316-3-4F5B-Dec01





NOTE: SEE TABLES FOR DETAILS OF ANALYSIS.

HORIZONTAL SCALE:
1:150 (Approximate)
metres
0 3 6

VERTICAL SCALE EXAGGERATED 4X.

NOTE: See Figure 3 for location of section.

HEMMERA ENVIROCHEM

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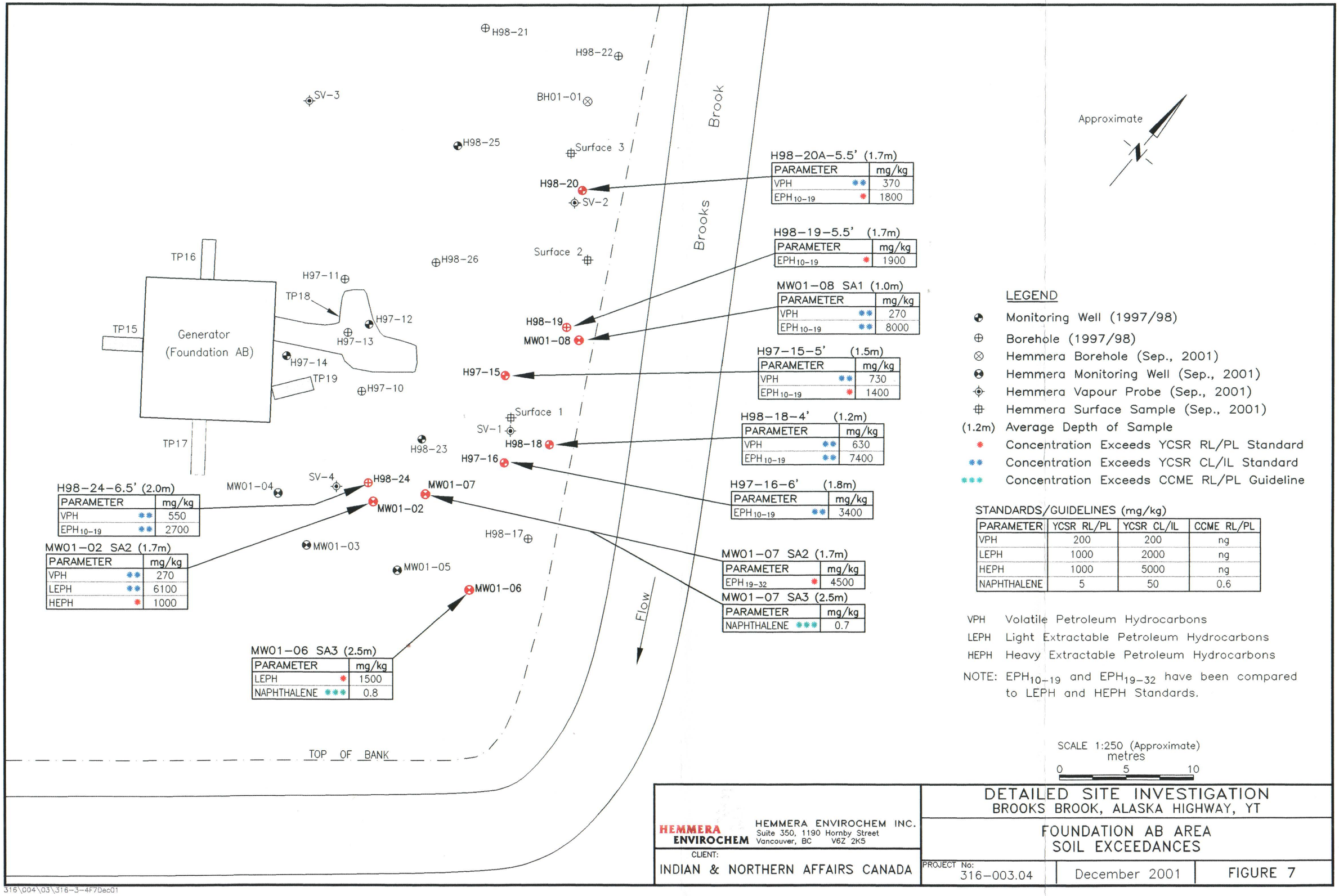
CLIENT:
INDIAN & NORTHERN AFFAIRS CANADA

DETAILED SITE INVESTIGATION
BROOKS BROOK, ALASKA HIGHWAY, YT
FOUNDATION AB AREA
CROSS SECTION B-B'

PROJECT No: 316-003.04 | December 2001 | FIGURE 6

316\004\03\316-3-4F6B-Dec01



LEGEND

- Monitoring Well (1997/98)
- Borehole (1997/98)
- Hemmera Borehole (Sep., 2001)
- Hemmera Monitoring Well (Sep., 2001)
- Hemmera Vapour Probe (Sep., 2001)
- Hemmera Surface Sample (Sep., 2001)
- (1.2m) Average Depth of Sample
- * Concentration Exceeds YCSR RL/PL Standard
- ** Concentration Exceeds YCSR CL/IL Standard
- *** Concentration Exceeds CCME RL/PL Guideline

STANDARDS/GUIDELINES (mg/kg)

PARAMETER	YCSR RL/PL	YCSR CL/IL	CCME RL/PL
VPH	200	200	ng
LEPH	1000	2000	ng
HEPH	1000	5000	ng
NAPHTHALENE	5	50	0.6

VPH Volatile Petroleum Hydrocarbons
LEPH Light Extractable Petroleum Hydrocarbons
HEPH Heavy Extractable Petroleum Hydrocarbons

NOTE: EPH_{10-19} and EPH_{19-32} have been compared to LEPH and HEPH Standards.

SCALE 1:250 (Approximate)
metres
0 5 10

HEMMERA ENVIROCHEM
HEMMERA ENVIROCHEM INC.
Suite 350, 1190 Hornby Street
Vancouver, BC V6Z 2K5

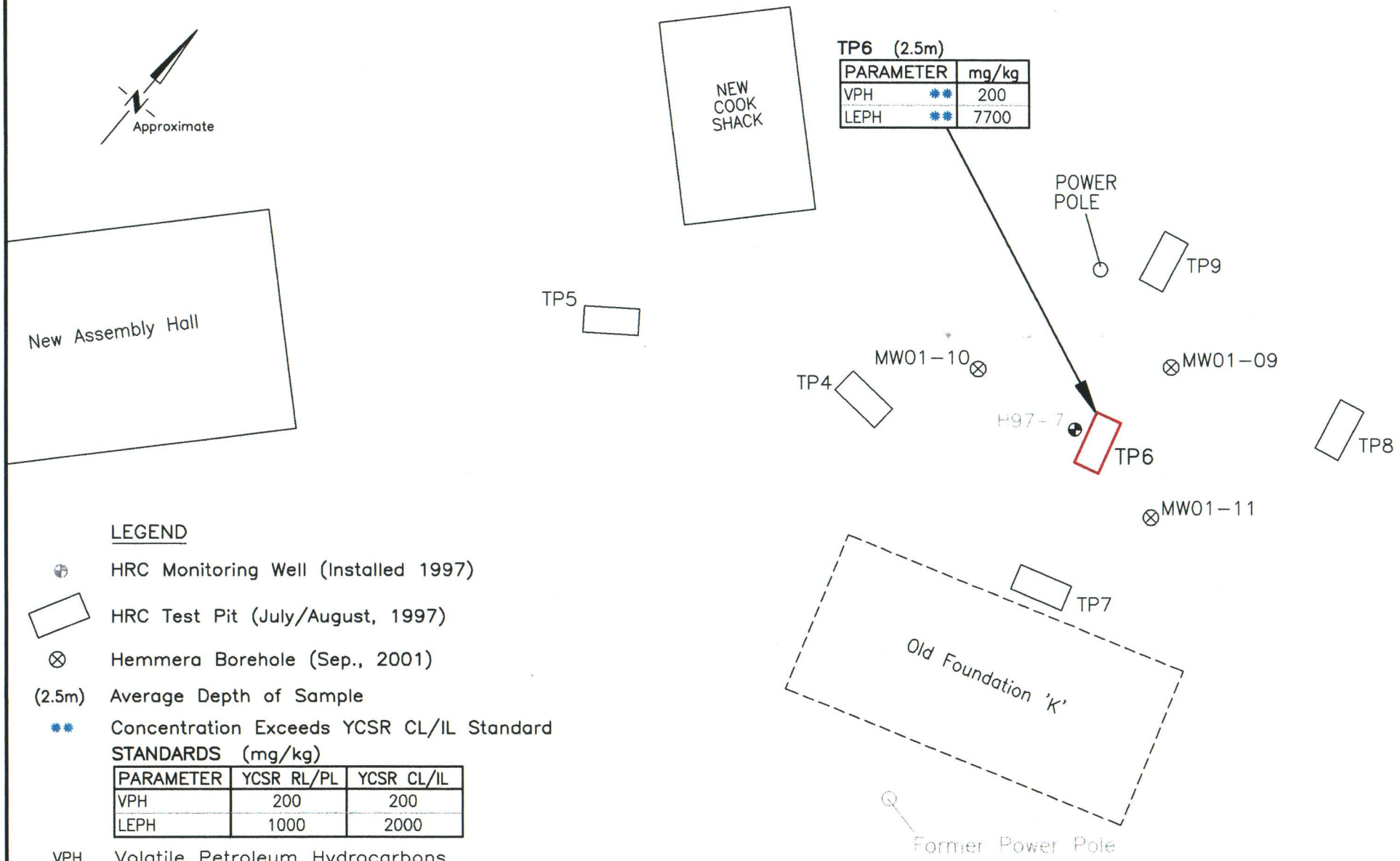
CLIENT:
INDIAN & NORTHERN AFFAIRS CANADA

DETAILED SITE INVESTIGATION
BROOKS BROOK, ALASKA HIGHWAY, YT

FOUNDATION AB AREA
SOIL EXCEEDANCES

PROJECT No: 316-003.04 | December 2001 | FIGURE 7

316\004\03\316-3-4F7Dec01



LEGEND

- HRC Monitoring Well (Installed 1997)
- HRC Test Pit (July/August, 1997)
- ⊗ Hemmera Borehole (Sep., 2001)
- (2.5m) Average Depth of Sample
- ** Concentration Exceeds YCSR CL/IL Standard

STANDARDS (mg/kg)

PARAMETER	YCSR RL/PL	YCSR CL/IL
VPH	200	200
LEPH	1000	2000

VPH Volatile Petroleum Hydrocarbons
LEPH Light Extractable Petroleum Hydrocarbons

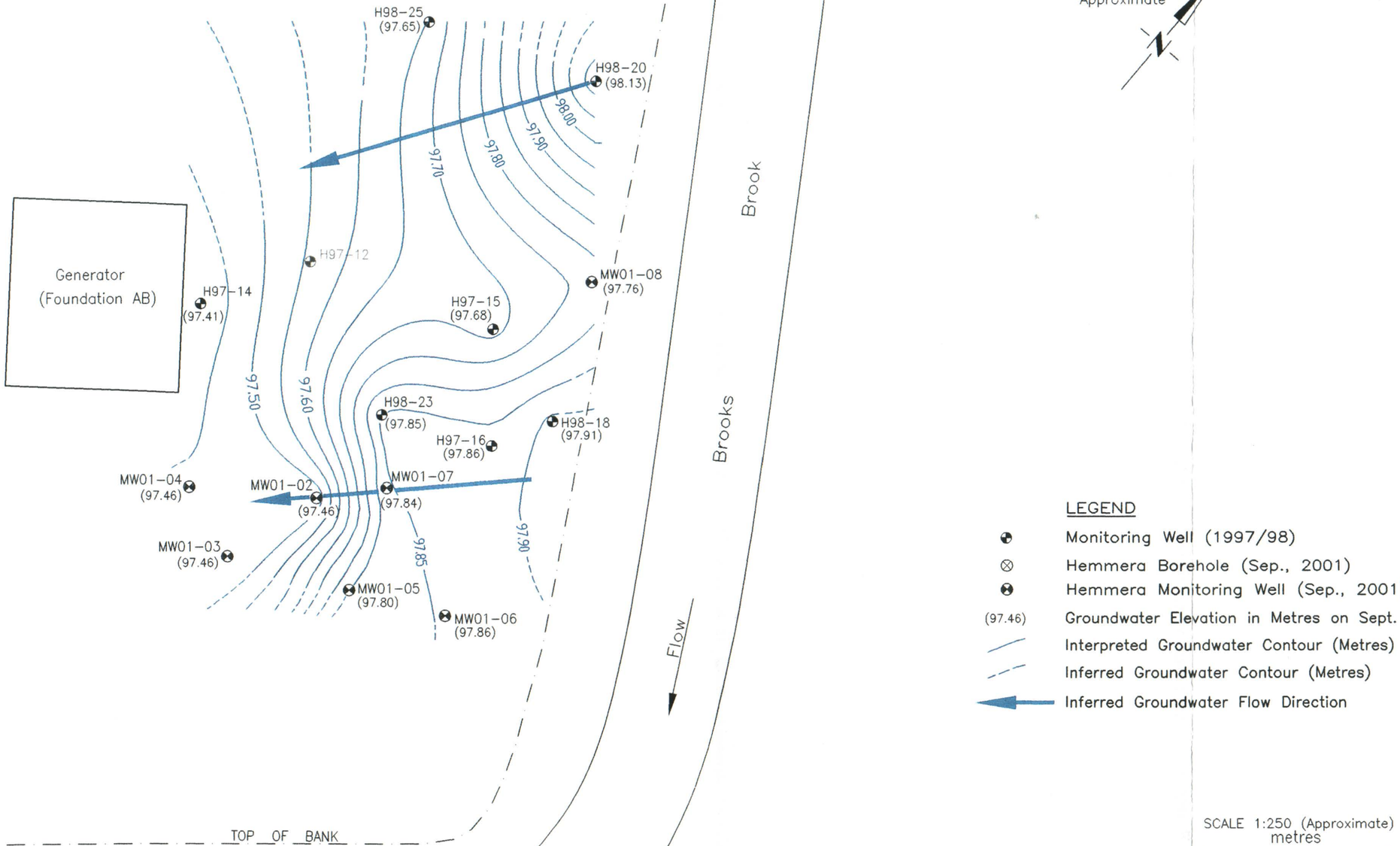
SCALE 1:250 (Approximate)
metres
0 5 10

HEMMERA ENVIROCHEM
HEMMERA ENVIROCHEM INC.
Suite 350, 1190 Hornby Street
Vancouver, BC V6Z 2K5

CLIENT:
INDIAN & NORTHERN AFFAIRS CANADA

DETAILED SITE INVESTIGATION
BROOKS BROOK, ALASKA HIGHWAY, YT
FOUNDATION K AREA
SOIL EXCEEDANCES

File No. 316-003.04 | December 2001 | FIGURE 8



LEGEND

- Monitoring Well (1997/98)
- Hemmera Borehole (Sep., 2001)
- Hemmera Monitoring Well (Sep., 2001)
- (97.46) Groundwater Elevation in Metres on Sept. 27, 2001
- Interpreted Groundwater Contour (Metres)
- Inferred Groundwater Contour (Metres)
- Inferred Groundwater Flow Direction

SCALE 1:250 (Approximate)
metres
0 5 10

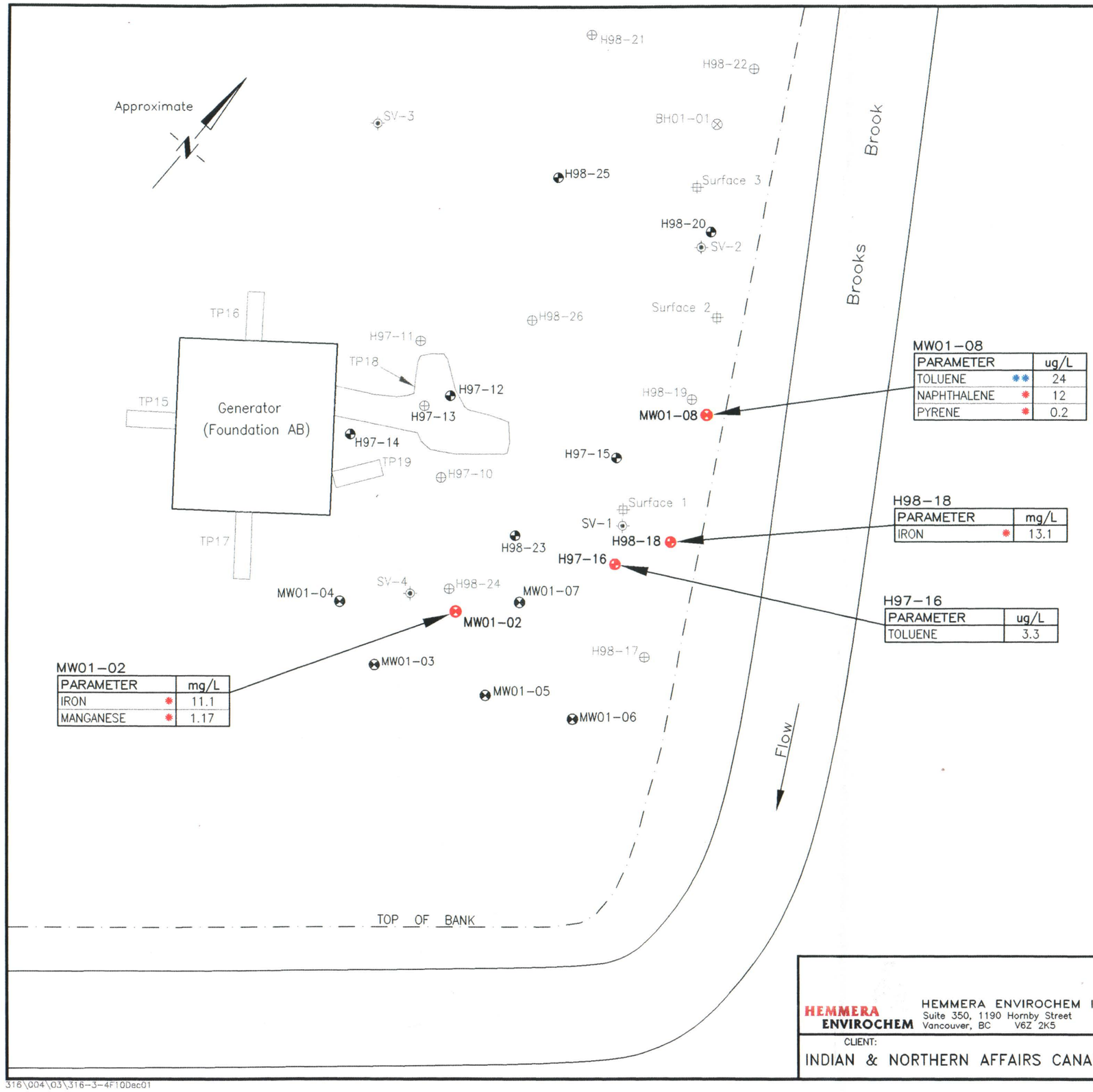
HEMMERA ENVIROCHEM
HEMMERA ENVIROCHEM INC.
Suite 350, 1190 Hornby Street
Vancouver, BC V6Z 2K5

CLIENT:
INDIAN & NORTHERN AFFAIRS CANADA

DETAILED SITE INVESTIGATION
BROOKS BROOK, ALASKA HIGHWAY, YT
FOUNDATION AB AREA
INFERRED GROUNDWATER FLOW DIRECTION (SEPTEMBER 27, 2001)

PROJECT No: 316-003.04 | December 2001 | FIGURE 9

316\004\03\316-3-4F9Dec01



BC CSR $LEPH_W$ AW COMPARISON

WELL ID	LEPH CONCENTRATION (ug/L)
H97-7	1800
H97-15	1500
H98-18	960
H98-20	1100
MW01-02	970
MW01-03	2500
MW01-04	750
MW01-07	610
MW01-08	1900
BC CSR AW Standard	500

LEGEND

- Monitoring Well (1997/98)
- Borehole (1997/98)
- Hemmera Borehole (Sep., 2001)
- Hemmera Monitoring Well (Sep., 2001)
- Hemmera Vapour Probe (Sep., 2001)
- Hemmera Surface Sample (Sep., 2001)
- * Concentration Exceeds YCSR Groundwater Aquatic Life Standard
- ** Concentration Exceeds CCME Freshwater Aquatic Life Guideline (Ambient Waters)

STANDARDS/GUIDELINES (ug/L)

PARAMETER	YCSR AW	CCME FAL
TOLUENE	3000	2
NAPHTHALENE	10	1.1
PYRENE	0.2	0.025
	(mg/L)	
IRON	3	3
MANAGANESE	1	ng

LEPH Light Extractable Petroleum Hydrocarbons

NOTE: See tables for analytical details.

SCALE 1:250 (Approximate)
metres
0 5 10

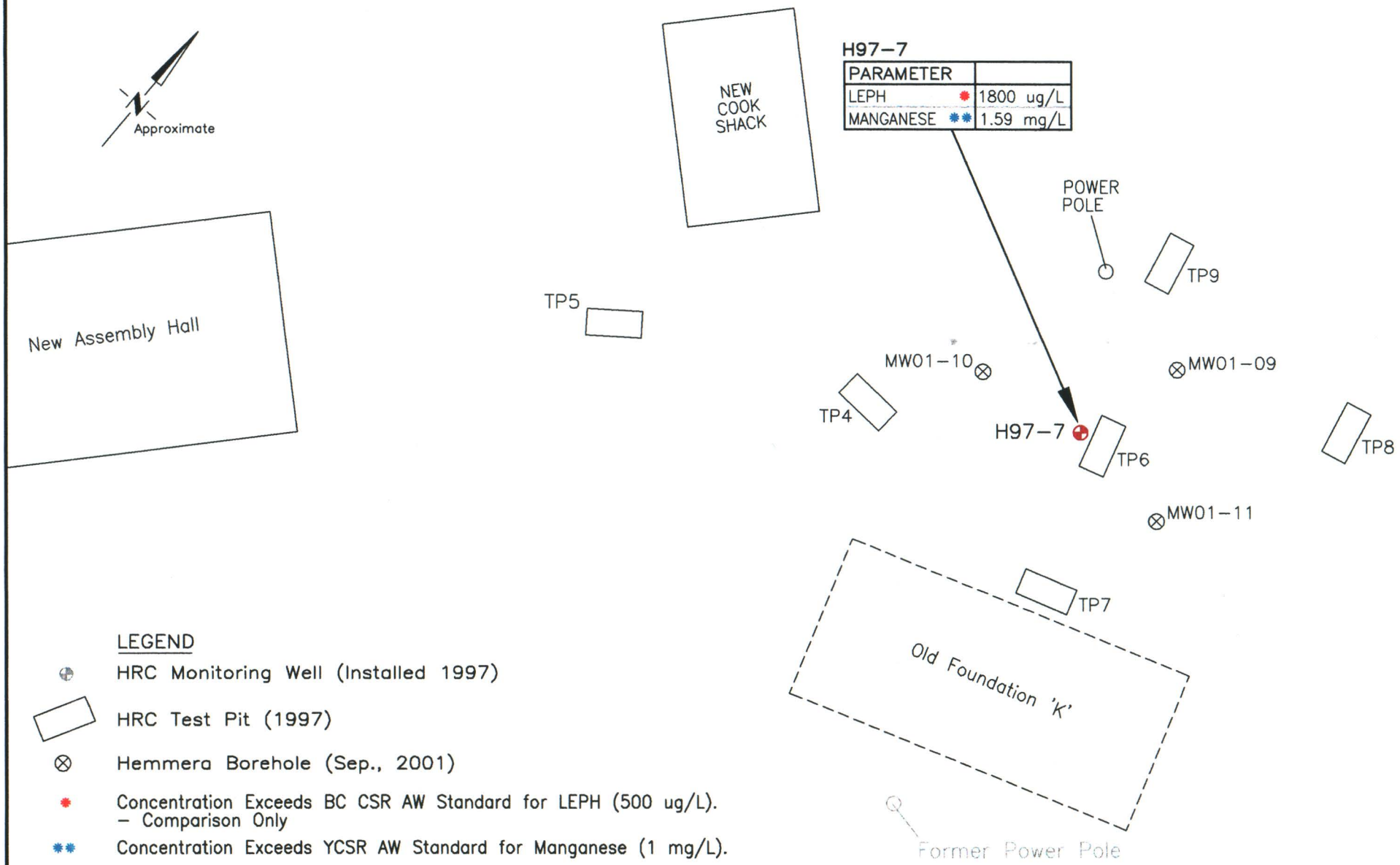
HEMMERA ENVIROCHEM
HEMMERA ENVIROCHEM INC.
Suite 350, 1190 Hornby Street
Vancouver, BC V6Z 2K5

CLIENT:
INDIAN & NORTHERN AFFAIRS CANADA

DETAILED SITE INVESTIGATION
BROOKS BROOK, ALASKA HIGHWAY, YT
FOUNDATION AB AREA GROUNDWATER EXCEEDANCES

PROJECT No: 316-003.04 | December 2001 | FIGURE 10

316\004\03\316-3-4F10Dec01



LEGEND

- HRC Monitoring Well (Installed 1997)
- HRC Test Pit (1997)
- ⊗ Hemmera Borehole (Sep., 2001)
- * Concentration Exceeds BC CSR AW Standard for LEPH (500 ug/L). – Comparison Only
- ** Concentration Exceeds YCSR AW Standard for Manganese (1 mg/L).
- LEPH Light Extractable Petroleum Hydrocarbons

SCALE 1:250 (Approximate)
metres
0 5 10

HEMMERA ENVIROCHEM
HEMMERA ENVIROCHEM INC.
Suite 350, 1190 Hornby Street
Vancouver, BC V6Z 2K5

CLIENT:
INDIAN & NORTHERN AFFAIRS CANADA

DETAILED SITE INVESTIGATION
BROOKS BROOK, ALASKA HIGHWAY, YT
FOUNDATION K AREA GROUNDWATER EXCEEDANCES

File No. 316-003.04 | December 2001 | FIGURE 11

APPENDIX A

BOREHOLE LOGS

Project: Detailed Site Investigation
Project No.: 316-003.04
Date: September 24, 2001
Elevation: Gnd=100.04m

BOREHOLE BH01-01

Location: Brooks Brook, Yukon Territory
Contractor: Midnight Sun Drilling (CME Rig)
Method: Hollow Stem Auger
- Split Spoon Sampling
Logged By: Brenda Wong

Vapour Level ppm/%LEL	Sample # Bold = Analyzed (Underscore = Exceedance)	Depth (m)	Depth (ft)	Symbols	Soil Description	Depth (m)	Borehole Backfill Details
					Surface		
	ALL SAMPLES PREFIXED BH01-01		1		0-2.29m **Fill - Sand,** medium to coarse grained, some medium to coarse grained gravel, some cobbles; brown, moist		
15	SA1						
			2				
			3				
15	SA2	1				1	
			4				
			5		fine to coarse grained sand below 1.52m, cobbly from 1.52m to 1.83m		
20	**SA3**		6				Hole Cuttings 0-3.51m
		2				2	
			7				
					2.29-3.05m **Fill - Gravel,** medium to coarse grained gravel, some coarse grained sand; brown, saturated, light hydrocarbon odour		
			8				
No Sample	SA4						
			9				
		3				3	
			10		3.05-3.51m **Silt,** some fine grained sand; grey, saturated		
25	SA5		11				
			12		E.O.H. at 3.51m		
					See Tables for Details on Analysis		
		4	13			4	
			14				
			15				
			16				
		5				5	

Client:
INDIAN & NORTHERN AFFAIRS CANADA

HEMMERA ENVIROCHEM INC.

Project: Detailed Site Investigation
Project No.: 316-003.04
Date: September 24/25, 2001
Elevation: Gnd=99.48m, TOP=100.00m

MONITORING WELL MW01-02

Location: Brooks Brook, Yukon Territory
Contractor: Midnight Sun Drilling (CME Rig)
Method: Hollow Stem Auger
- Split Spoon Sampling
Logged By: Brenda Wong

Vapour Level ppm/%LEL	Sample # Bold = Analyzed (Underscore = Exceedance)
	ALL SAMPLES PREFIXED MW01-02
15	SA1
60	**SA2**
LTDL	SA3
LTDL	SA4

Depth (m) / Depth (ft) / Symbols

Soil Description

Surface

0-1.52m **Fill - Sand,** fine to coarse grained, some fine to coarse grained gravel, some organics (rootlets); brown, moist

medium to coarse grained sand, some medium to coarse grained gravel below 0.76m

1.52-2.13m **Fill - Sand & Gravel,** medium to coarse grained sand, fine to coarse grained gravel; brown, wet, light hydrocarbon odour

cobbly from 1.83 to 2.13m

2.13-3.51m **Sandy Silt,** fine grained sand; grey, saturated

E.O.H. at 3.51m

See Tables for Details on Analysis

Piezometer Construction Details

Depth (m)

Well Protector
Stickup =0.52m

Concrete
0-0.30m

Hole Cuttings
0.30-0.61m

Bentonite Chips
0.61-0.91m

Sand
0.91-3.20m

Sept. 27, 2001
Elev.=97.46m

Screening
1.22-3.35m

Slough
3.20-3.51m

Client:
INDIAN & NORTHERN AFFAIRS CANADA

HEMMERA ENVIROCHEM INC.

Project: Detailed Site Investigation
Project No.: 316-003.04
Date: September 25, 2001
Elevation: Gnd=99.34m, TOP=99.87m

MONITORING WELL MW01-03

Location: Brooks Brook, Yukon Territory
Contractor: Midnight Sun Drilling (CME Rig)
Method: Hollow Stem Auger
- Split Spoon Sampling
Logged By: Brenda Wong

Vapour Level ppm/%LEL	Sample # Bold = Analyzed (Underscore = Exceedance)	Soil Description
	ALL SAMPLES PREFIXED MW01-03	Surface 0-0.76m **Fill - Sand & Gravel,** fine to coarse grained sand, fine to coarse grained gravel; brown, moist
		cobbly from 0.30m to 0.76m
20	SA1	0.76-1.98m **Fill - Sand,** fine to medium grained, some fine grained gravel; brown, moist
		cobbly from 1.22m to 1.52m
25	**SA2**	medium to coarse grained sand, some medium to coarse grained gravel below 1.52m
		1.98-2.13m **Cobbles**
		2.13-3.35m **Sandy Silt,** fine grained sand; grey, saturated
15	SA3	
LTDL	SA4	3.35-3.51m **Sand,** fine grained, some silt; grey, saturated
		E.O.H. at 3.51m
		See Tables for Details on Analysis

Depth (m): 1, 2, 3, 4, 5
Depth (ft): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

Piezometer Construction Details
Well Protector
Stickup =0.53m

- Concrete 0-0.30m
- Hole Cuttings 0.30-0.61m
- Bentonite Chips 0.61-0.91m
- Sept. 27, 2001 Elev.=97.46m
- Sand 0.91-3.35m
- Screening 1.22-3.35m
- Slough 3.35-3.51m

Client:
INDIAN & NORTHERN AFFAIRS CANADA

HEMMERA ENVIROCHEM INC.

Project: Detailed Site Investigation
Project No.: 316-003.04
Date: September 25, 2001
Elevation: Gnd=99.27m, TOP=99.84m

MONITORING WELL MW01-04

Location: Brooks Brook, Yukon Territory
Contractor: Midnight Sun Drilling (CME Rig)
Method: Hollow Stem Auger
- Split Spoon Sampling
Logged By: Brenda Wong

VApour Level ppm/%LEL	Sample # Bold = Analyzed (Underscore = Exceedance)
	ALL SAMPLES PREFIXED MW01-04
LTDL	SA1
15	SA2
10	**SA3**
LTDL	SA4

Depth (m) / Depth (ft) / Symbols

Soil Description

Surface

0-1.52m **Fill - Sand,** fine to coarse grained, some fine to coarse grained gravel; brown, moist

cobbly from 0.67m to 1.52m

1.52-2.29m **Fill - Sand & Gravel,** medium to coarse grained sand, fine to coarse grained gravel, cobbly; brown, wet

2.29-3.51m **Silt,** some fine grained sand; grey, saturated

E.O.H. at 3.51m

See Tables for Details on Analysis

Piezometer Construction Details

Depth (m)

Well Protector
Stickup =0.57m

Concrete
0-0.30m

Hole Cuttings
0.30-0.61m

Bentonite Chips
0.61-0.91m

▼ Sept. 27, 2001
Elev.=97.46m

Sand
0.91-3.35m

Screening
1.22-3.35m

Slough
3.35-3.51m

Client:
INDIAN & NORTHERN AFFAIRS CANADA

HEMMERA ENVIROCHEM INC.

Project: Detailed Site Investigation
Project No.: 316-003.04
Date: September 25, 2001
Elevation: Gnd=99.60m, TOP=100.13m

MONITORING WELL MW01-05

Location: Brooks Brook, Yukon Territory
Contractor: Midnight Sun Drilling (CME Rig)
Method: Hollow Stem Auger
- Split Spoon Sampling
Logged By: Brenda Wong

Vapour Level ppm/%LEL	Sample # Bold = Analyzed (Underscore = Exceedance)	Depth (m)	Depth (ft)	Symbols	Soil Description
					Surface
	ALL SAMPLES PREFIXED MW01-05		1		0-1.52m **Fill - Sand,** medium to coarse grained, some fine to medium grained gravel, some rootlets; brown, moist
			2		
25	SA1	1	3		cobbly from 0.76m to 1.22m
			4		
			5		1.52-3.05m **Fill - Sand & Gravel,** medium to coarse grained sand, fine to coarse grained gravel; brown, wet
No Sample	SA2	2	6		
			7		saturated at 2.29m
No Sample	SA3		8		
			9		
		3	10		3.05-4.27m **Silt,** some fine grained sand; grey, saturated, light sheen on water
LTDL	**SA4**		11		
			12		
LTDL	SA5 +DUP1	4	13		
			14		
			15		E.O.H. at 4.27m
			16		See Tables for Details on Analysis
		5			

Piezometer Construction Details

Well Protector
Stickup =0.53m

Concrete
0-0.30m

Hole Cuttings
0.30-0.61m

Bentonite Chips
0.61-0.91m

Sept. 27, 2001
Elev.=97.80m

Sand
0.91-3.81m

Screening
1.22-3.35m

Slough
3.81-4.27m

Client:
INDIAN & NORTHERN AFFAIRS CANADA

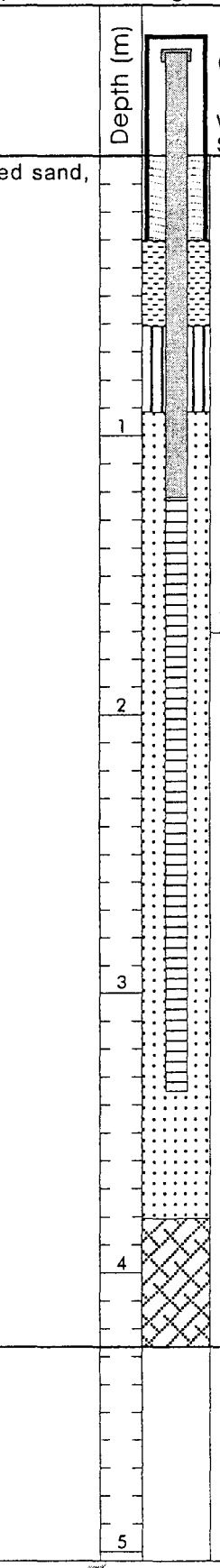
HEMMERA ENVIROCHEM INC.

Project: Detailed Site Investigation
Project No.: 316-003.04
Date: September 26, 2001
Elevation: Gnd=99.56m, TOP=100.08m

MONITORING WELL MW01-06

Location: Brooks Brook, Yukon Territory
Contractor: Midnight Sun Drilling (CME Rig)
Method: Hollow Stem Auger
- Split Spoon Sampling
Logged By: Brenda Wong

VApour Level ppm/%LEL	Sample # Bold = Analyzed (Underscore = Exceedance)	Depth (m)	Depth (ft)	Symbols	Soil Description
	ALL SAMPLES PREFIXED MW01-06				Surface
					0-4.27m **Fill - Sand & Gravel,** medium to coarse grained sand, fine to coarse grained gravel; brown, moist
			1		
			2		cobbly from 0.46m to 0.76m
			3		
LTDL	SA1	1			
			4		
			5		
LTDL	SA2		6		some rounded cobbles from 1.52m to 1.83m
		2			
			7		saturated at 2.13m
					silty below 2.29m
25	**SA3**		8		
			9		
		3			
			10		light hydrocarbon odour at 3.05m
No Sample	SA4		11		
			12		
No Sample	No Sample	4	13		
			14		
			15		E.O.H. at 4.27m
			16		See Tables for Details on Analysis
		5			



Piezometer Construction Details
Well Protector
Stickup =0.52m

Concrete
0-0.30m

Hole Cuttings
0.30-0.61m

Bentonite Chips
0.61-0.91m

Sept. 27, 2001
Elev.=97.86m

Sand
0.91-3.81m

Screening
1.22-3.35m

Slough
3.81-4.27m

Client:
INDIAN & NORTHERN AFFAIRS CANADA

HEMMERA ENVIROCHEM INC.

Project: Detailed Site Investigation
Project No.: 316-003.04
Date: September 26, 2001
Elevation: Gnd=99.64m, TOP=100.16m

MONITORING WELL MW01-07

Location: Brooks Brook, Yukon Territory
Contractor: Midnight Sun Drilling (CME Rig)
Method: Hollow Stem Auger
- Split Spoon Sampling
Logged By: Brenda Wong

Vapour Level ppm/%LEL	Sample # Bold = Analyzed (Underscore = Exceedance)	Depth (m)	Depth (ft)	Symbols	Soil Description
					Surface
	ALL SAMPLES PREFIXED MW01-07				0-2.29m **Fill - Sand & Gravel,** medium to coarse grained sand, fine to coarse grained gravel; brown, moist
			1		
			2		
			3		cobbly from 0.61m to 0.91m
50	SA1	1			
			4		some silt and some wood from 0.76m to 1.52m
			5		
					wet, light hydrocarbon odour from 1.52m to 2.29m
No Sample	**SA2**	2	6		
			7		silty, some rounded cobbles below 2.13m
					2.29-4.27m **Silt,** some fine grained sand; grey, saturated
10	**SA3 +DUP2**		8		
			9		
		3	10		
LTDL	SA4		11		
			12		
LTDL	SA5 +DUP3	4	13		
			14		
			15		E.O.H. at 4.27m
			16		See Tables for Details on Analysis
		5			

Depth (m)	Piezometer Construction Details
	Well Protector Stickup =0.52m
	Concrete 0-0.30m
	Hole Cuttings 0.30-0.61m
	Bentonite Chips 0.61-0.91m
1	
	Sand 0.91-3.81m
	▼ Sept. 27, 2001 Elev.=97.84m
2	Screening 1.22-3.35m
3	
4	Slough 3.81-4.27m
5	

Client:
INDIAN & NORTHERN AFFAIRS CANADA

HEMMERA ENVIROCHEM INC.

Project: Detailed Site Investigation
Project No.: 316-003.04
Date: September 26, 2001
Elevation: Gnd=99.78m, TOP=100.28m

MONITORING WELL MW01-08

Location: Brooks Brook, Yukon Territory
Contractor: Midnight Sun Drilling (CME Rig)
Method: Hollow Stem Auger
- Split Spoon Sampling
Logged By: Brenda Wong

VApour Level ppm/%LEL	Sample # Bold = Analyzed (Underscore = Exceedance)
	ALL SAMPLES PREFIXED MW01-08
75	**SA1**
No Sample	SA2
15	**SA3** +DUP4
LTDL	SA4

Depth (m) / Depth (ft) / Symbols

Soil Description

Surface

0-1.52m **Fill - Sand & Gravel,** fine to coarse grained sand, fine to coarse grained gravel, some cobbles, some grass and roots; brown, moist

cobbly below 0.30m

some silt, light hydrocarbon odour from 0.76m to 1.52m

1.52-3.51m **Silt,** some fine grained sand; grey, moist, light hydrocarbon odour from 1.52 to 1.98m

large piece of wood at 1.68m

saturated at 2.29m

E.O.H. at 3.51m

See Tables for Details on Analysis

Piezometer Construction Details

Well Protector
Stickup =0.50m

Concrete
0-0.30m

Hole Cuttings
0.30-0.61m

Bentonite Chips
0.61-0.91m

Sand
0.91-3.51m

Screening
1.22-2.74m

Sept. 27, 2001
Elev.=97.76m

Client:
INDIAN & NORTHERN AFFAIRS CANADA

HEMMERA ENVIROCHEM INC.

Project: Detailed Site Investigation
Project No.: 316-003.04
Date: September 27, 2001
Elevation: Not Measured

BOREHOLE BH01-09

Location: Brooks Brook, Yukon Territory
Contractor: Midnight Sun Drilling (CME Rig)
Method: Hollow Stem Auger
- Split Spoon Sampling
Logged By: Brenda Wong

VApour Level ppm/%LEL	Sample # Bold = Analyzed (Underscore = Exceedance)	Depth (m)	Depth (ft)	Symbols	Soil Description
	ALL SAMPLES PREFIXED BH01-09		1 2		Surface 0-1.98m **Fill - Sand & Gravel,** fine to coarse grained sand, fine to coarse grained gravel, some cobbles; brown,dry
			3		moist, cobbly below 0.76m
LTDL	SA1	1	4		
			5		
LTDL	SA2		6		1.98-3.51m **Silt,** some fine grained sand; grey, moist
		2	7		
LTDL	**SA3 +DUP5**		8		
			9		
		3	10		
LTDL	SA4		11		
			12		E.O.H. at 3.51m
		4	13		See Tables for Details on Analysis
			14		
			15		
			16		
		5			

Depth (m)	Borehole Backfill Details
1	Hole Cuttings 0-3.51m
2	
3	
4	
5	

Client:
INDIAN & NORTHERN AFFAIRS CANADA

HEMMERA ENVIROCHEM INC.

Project: Detailed Site Investigation
Project No.: 316-003.04
Date: September 27, 2001
Elevation: Not Measured

BOREHOLE BH01-10

Location: Brooks Brook, Yukon Territory
Contractor: Midnight Sun Drilling (CME Rig)
Method: Hollow Stem Auger
- Split Spoon Sampling
Logged By: Brenda Wong

VApour Level ppm/%LEL	Sample # Bold = Analyzed (Underscore = Exceedance)	Depth (m)	Depth (ft)	Symbols	Soil Description	Depth (m)	Borehole Backfill Details
					Surface		
	ALL SAMPLES PREFIXED BH01-10		1 2		0-1.52m **Fill - Sand & Gravel,** medium to coarse grained sand, fine to coarse grained gravel, some cobbles; brown, dry		
LTDL	SA1	1	3 4			1	
			5		1.52-2.29m **Silty Sand,** fine grained sand; brown with orange mottling, moist		
LTDL	**SA2**	2	6 7			2	Hole Cuttings 0-3.51m
					2.29-3.51m **Silt,** some fine grained sand; grey, wet		
LTDL	SA3 +DUP6		8 9				
		3	10			3	
LTDL	SA4		11				
			12		E.O.H. at 3.51m		
					See Tables for Details on Analysis		
		4	13 14			4	
			15				
			16				
		5				5	

Client:
INDIAN & NORTHERN AFFAIRS CANADA

HEMMERA ENVIROCHEM INC.

Project: Detailed Site Investigation
Project No.: 316-003.04
Date: September 27, 2001
Elevation: Not Measured

BOREHOLE BH01-11

Location: Broo's Brook, Yukon Territory
Contractor: Midnight Sun Drilling (CME Rig)
Method: Hollow Stem Auger
- Split Spoon Sampling
Logged By: Brenda Wong

Vapour Level ppm/%LEL	Sample # Bold = Analyzed (Underscore = Exceedance)	Depth (m)	Depth (ft)	Symbols	Soil Description	Depth (m)	Borehole Backfill Details
					Surface		
	ALL SAMPLES PREFIXED BH01-11		1 2		0-2.29m **Fill - Sand & Gravel,** medium to coarse grained sand, fine to coarse grained gravel, some cobbles; brown, moist		
LTDL	SA1	1	3 4			1	
			5				
LTDL	SA2		6		cobbly from 1.22m to 1.83m		Hole Cuttings 0-3.51m
		2	7			2	
					2.29-3.51m **Silt,** some fine grained sand; grey, wet		
20	**SA3**		8 9				
		3	10			3	
LTDL	SA4		11				
			12		E.O.H. at 3.51m		
					See Tables for Details on Analysis		
		4	13 14			4	
			15				
			16				
		5				5	

Client:
INDIAN & NORTHERN AFFAIRS CANADA

HEMMERA ENVIROCHEM INC.

APPENDIX B

CERTIFIED LABORATORY REPORTS

Analysis Report

CANTEST®

CANTEST LTD.
Professional
Analytical
Services

4606 Canada Way
Burnaby, B.C.
V5G 1K5

Fax: 604 731 2386

Tel: 604 734 7276

1 800 665 8566

REPORT ON: Analysis of Water Samples

REPORTED TO: Hemmera Envirochem Inc.
Suite 350
1190 Hornby Street
Vancouver, B.C.
V6Z 2K5

Att'n: Mr. Philip Lowery

CHAIN OF CUSTODY: 90283
PROJECT NAME: Brooks Brook
PROJECT NUMBER: 316-003.04

NUMBER OF SAMPLES: 4

REPORT DATE: October 15, 2001

DATE SUBMITTED: October 1, 2001

GROUP NUMBER: 11001021

SAMPLE TYPE: Water

TEST METHODS:

Volatile Organic Compounds in Water and Soil - analysis was performed using procedures based on U.S. EPA Methods 624/8240/8260, involving sparging with a Purge and Trap apparatus and analysis using GC/MS.

Volatile Hydrocarbons (VH) and Volatile Petroleum Hydrocarbons (VPH) in Water - analysis was performed using B.C. MOELP CSR-Analytical Method 2 "Volatile Hydrocarbons in Water by GC/FID" and CSR-Analytical Method 5 "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water (VPH)" approved August 12, 1999. The method involves sparging/collection using a Purge & Trap apparatus with GC/FID analysis; VH components ranging from C6 to C10 are quantified against m-xylene and 1,2,4-trimethylbenzene. VPH is calculated by subtraction of specified MAH compounds from VH concentrations.

Conventional Parameters - analyses were performed using procedures based on those described in "British Columbia Environmental Laboratory Manual For the Analysis of Water, Wastewater, Sediment and Biological Materials" (1994 Edition), Province of British Columbia and "Standard Methods for the Examination of Water and Wastewater" 20th Edition, (1998), published by the American Public Health Association.

Extractable Petroleum Hydrocarbons and Light and Heavy Extractable Petroleum Hydrocarbons in Water - analysis was performed using B.C. MOELP CSR-Analytical Method 4 "Extractable Petroleum Hydrocarbons in Water by GC/FID" and CSR-Analytical Method 6 "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water (LEPH & HEPH)". The method involves DCM extraction and GC/FID analysis. EPH components ranging from C10 to C19 and C19 to C32 are quantified against eicosane (n-C20). LEPH & HEPH are calculated by subtraction of specified PAH's.

Mercury in Water - analysis was performed using procedures based on U. S. EPA Method 1631, oxidative

(Continued)

CANTEST LTD.

Zhenyong Gao, M.Sc.
Coordinator, Trace Organics

Mercury in Water

digestion using bromination, and analysis using Cold Vapour Atomic Fluorescence Spectroscopy.

Metals in Water - analysis was performed using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP), Inductively Coupled Plasma-Mass Spectroscopy (ICP/MS) or Graphite Furnace Atomic Absorption Spectrophotometry.

Polynuclear Aromatic Hydrocarbons - analysis was performed using procedures based on U.S. EPA Methods 625/8270, involving extraction, clean-up steps, and analysis using GC/MS.

TEST RESULTS:

(See following pages)

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11001021

CANTEST®

Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		MW01-02	DUP2	DETECTION LIMIT	UNITS
SAMPLE PREPARATION:		DISSOLVED	DISSOLVED		
DATE SAMPLED:		Sep 26/01	Sep 26/01		
CANTEST ID:		110010102	110010107		
Aluminum	Al	0.027	0.028	0.005	mg/L
Antimony	Sb	<	<	0.001	mg/L
Arsenic	As	0.003	0.005	0.001	mg/L
Barium	Ba	0.13	0.13	0.001	mg/L
Beryllium	Be	<	<	0.001	mg/L
Bismuth	Bi	<	<	0.001	mg/L
Boron	B	0.05	<	0.05	mg/L
Cadmium	Cd	<	<	0.0002	mg/L
Calcium	Ca	38.8	38.6	0.05	mg/L
Chromium	Cr	0.002	0.002	0.001	mg/L
Cobalt	Co	0.003	0.003	0.001	mg/L
Copper	Cu	0.002	0.001	0.001	mg/L
Iron	Fe	11.1	11.1	0.05	mg/L
Lead	Pb	<	<	0.001	mg/L
Lithium	Li	0.002	0.002	0.001	mg/L
Magnesium	Mg	9.54	9.74	0.05	mg/L
Manganese	Mn	1.17	1.15	0.001	mg/L
Mercury	Hg	<	<	0.02	µg/L
Molybdenum	Mo	0.001	<	0.001	mg/L
Nickel	Ni	0.005	0.005	0.001	mg/L
Phosphorus	PO4	0.26	0.26	0.01	mg/L
Potassium	K	1.50	1.39	0.01	mg/L
Selenium	Se	<	<	0.002	mg/L
Silicon	SiO2	17.0	17.2	0.05	mg/L
Silver	Ag	<	<	0.0001	mg/L
Sodium	Na	7.70	5.90	0.05	mg/L
Strontium	Sr	0.17	0.17	0.001	mg/L
Tellurium	Te	<	<	0.001	mg/L
Thallium	Tl	<	<	0.0001	mg/L
Thorium	Th	<	<	0.0005	mg/L
Tin	Sn	<	<	0.001	mg/L

(Continued on next page)

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11001021

CANTEST®

Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		MW01-02	DUP2	DETECTION LIMIT	UNITS
SAMPLE PREPARATION:		DISSOLVED	DISSOLVED		
DATE SAMPLED:		Sep 26/01	Sep 26/01		
CANTEST ID:		110010102	110010107		
Titanium	Ti	0.004	0.003	0.001	mg/L
Uranium	U	0.0014	0.0014	0.0005	mg/L
Vanadium	V	0.004	0.004	0.001	mg/L
Zinc	Zn	0.006	0.007	0.005	mg/L
Zirconium	Zr	<	<	0.01	mg/L

mg/L = milligrams per liter
< = Less than detection limit

µg/L = micrograms per liter

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11001021

CANTEST®

Polycyclic Aromatic Hydrocarbons in Water

CLIENT SAMPLE IDENTIFICATION:	MW01-03	MW01-02	DUP2	
DATE SAMPLED:	Sep 26/01	Sep 26/01	Sep 26/01	
CANTEST ID:	110010099	110010102	110010107	DETECTION LIMIT
ANALYSIS DATE:	Oct 8/01	Oct 8/01	Oct 8/01	
Naphthalene	<	<	<	0.3
Acenaphthylene	<	<	<	0.1
Acenaphthene	<	<	<	0.1
Fluorene	<	<	<	0.05
Phenanthrene	<	<	<	0.05
Anthracene	<	<	<	0.05
Acridine	<	<	<	0.05
Total LMW-PAH's				
Fluoranthene	<	<	<	0.05
Pyrene	<	<	<	0.02
Benzo(a)anthracene	<	<	<	0.01
Chrysene	<	<	<	0.01
Benzo(b)fluoranthene	<	<	<	0.01
Benzo(k)fluoranthene	<	<	<	0.01
Benzo(a)pyrene	<	<	<	0.01
Indeno(1,2,3-cd)pyrene	<	<	<	0.01
Dibenz(a,h)anthracene	<	<	<	0.01
Benzo(g,h,i)perylene	<	<	<	0.01
Total HMW-PAH's				
Total PAH's				

Results expressed as micrograms per liter (μg/L)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11001021

CANTEST®

Monocyclic Aromatic Hydrocarbons in Water

CLIENT SAMPLE IDENTIFICATION:	MW01-03	MW01-04	MW01-02	DUP2	
DATE SAMPLED:	Sep 26/01	Sep 26/01	Sep 26/01	Sep 26/01	
CANTEST ID:	110010099	110010101	110010102	110010107	DETECTION LIMIT
ANALYSIS DATE:	Oct 5/01	Oct 5/01	Oct 5/01	Oct 5/01	
Benzene	<	<	<	<	0.1
Ethylbenzene	<	<	<	<	0.1
Toluene	<	<	0.1	0.1	0.1
Xylenes	0.6	0.3	1.3	1.5	0.1
Volatile Hydrocarbons VHw6-10	<	<	100	110	100
VPHw	<	<	100	110	100
Surrogate Recovery					
Toluene-d8	91	104	104	104	-
Bromofluorobenzene	95	109	109	108	-

Results expressed as micrograms per liter (μg/L)
Surrogate recoveries expressed as percent (%)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11001021

CANTEST®

Extractable Petroleum Hydrocarbons in Water

CLIENT SAMPLE IDENTIFICATION:	MW01-03	MW01-04	MW01-02	DUP2	
DATE SAMPLED:	Sep 26/01	Sep 26/01	Sep 26/01	Sep 26/01	DETECTION LIMIT
CANTEST ID:	110010099	110010101	110010102	110010107	
EPHw10-19	2500	750	970	990	250
EPHw19-32	420	<	<	<	250
LEPHw (corrected for PAH's)	2500	-	970	990	250
HEPHw (corrected for PAH's)	420	-	<	<	250

Results expressed as micrograms per liter (µg/L)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11001021

CANTEST®

Batch Quality Control for Monocyclic Aromatic Hydrocarbons in Water (QC# 26567)

Parameter	Blank (ug/L)	Blank Limits	Volatiles Water Spike (% Recovery)	Volatiles Water Spike Limits
Benzene	< 0.1	0.1	100	79 - 117
Ethylbenzene	< 0.1	0.1	96	76 - 124
Toluene	< 0.1	0.2	96	83 - 118
Xylenes	< 0.1	0.1	97	75 - 125
Volatile Hydrocarbons VHw6-10	< 100	100	-	-

ug/L = micrograms per liter

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11001021

CANTEST®

Batch Quality Control for Extractable Petroleum Hydrocarbons in Water (QC# 26479)

Parameter	Blank (ug/L)	Blank Limits
EPHw10-19	< 250	250
EPHw19-32	< 250	250

ug/L = micrograms per liter

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11001021

CANTEST®

Batch Quality Control for Dissolved Metals Analysis in Water (QC# 26687)

Parameter	Duplicate (R.P.D.) 109270147	Duplicate Limits	Spike (% Recovery) 109270147	Spike Limits
Mercury Hg	NC	20	105	80 - 120

ug/L = micrograms per liter
R.P.D. = Relative Percent Difference
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

CANTEST®

Batch Quality Control for Polycyclic Aromatic Hydrocarbons in Water (QC# 26430)

Parameter	Blank (ug/L)	Blank Limits	Spike (% Recovery)	Spike Limits
Naphthalene	< 0.3	0.3	100	38 - 115
Acenaphthylene	< 0.1	0.1	100	50 - 118
Acenaphthene	< 0.1	0.1	100	50 - 118
Fluorene	< 0.05	0.05	92	50 - 118
Phenanthrene	< 0.05	0.05	96	63 - 120
Anthracene	< 0.05	0.05	94	63 - 120
Acridine	< 0.05	0.05	94	63 - 120
Fluoranthene	< 0.05	0.05	94	63 - 120
Pyrene	< 0.02	0.02	94	63 - 120
Benzo(a)anthracene	< 0.01	0.01	90	63 - 120
Chrysene	< 0.01	0.01	94	63 - 120
Benzo(b)fluoranthene	< 0.01	0.01	86	59 - 138
Benzo(k)fluoranthene	< 0.01	0.01	86	59 - 138
Indeno(1,2,3-cd)pyrene	< 0.01	0.01	78	65 - 134
Dibenz(a,h)anthracene	< 0.01	0.01	78	65 - 134
Benzo(g,h,i)perylene	< 0.01	0.01	80	65 - 134

ug/L = micrograms per liter

CANTEST®

Batch Quality Control Frequency Summary

PAH's in Water Sample Prep (Batch# 26430)

QC Type	No. Samples
Blank	1
Spike	1

TEH/EPH Water Preparation (Batch# 26479)

QC Type	No. Samples
Blank	1
Method Performance Check Spike	1

Volatiles Analysis (Batch# 26567)

QC Type	No. Samples
Blank	1
Volatiles Soil Spike	1
Volatiles Water Spike	1
Duplicate	2

Mercury Water Bromination Prep (Batch# 26687)

QC Type	No. Samples
Duplicate	2
Spike	2

PAH's in Water Sample Prep (Batch# 26430)

QC Type	No. Samples
Batch Size	17

(Continued on next page)

CANTEST®

Batch Quality Control Frequency Summary

TEH/EPH Water Preparation (Batch# 26479)

QC Type	No. Samples
Batch Size	18

Volatiles Analysis (Batch# 26567)

QC Type	No. Samples
Batch Size	41

Mercury Water Bromination Prep (Batch# 26687)

QC Type	No. Samples
Batch Size	24

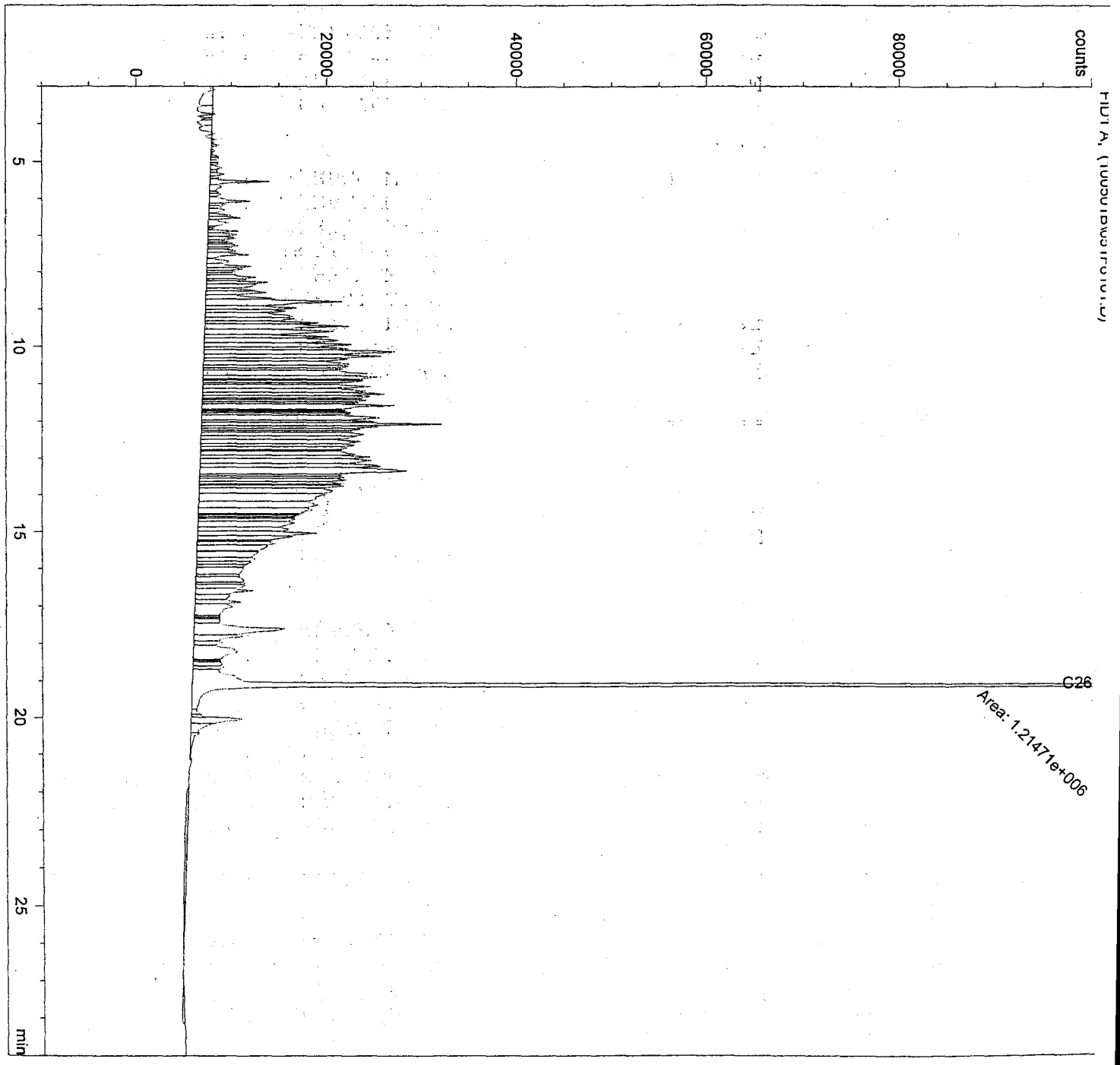
Data File C:\HPCHEM\2\DATA\100501B\051F6101.D Sample Name: 110010107 SAMPLE

==========

Injection Date	: 10/8/01 6:46:59 AM	Seq. Line	: 61
Sample Name	: 110010107 SAMPLE	Vial	: 51
Acq. Operator	: kf	Inj	: 1
		Inj Volume	: 2 µl

Sequence File : C:\HPCHEM\2\SEQUENCE\100501B.S
Acq. Method : C:\HPCHEM\2\METHODS\!EPH.M
Last changed : 10/8/01 7:13:11 AM by kf
(modified after loading)
Analysis Method : C:\HPCHEM\2\METHODS\!EPH.M
Last changed : 10/8/01 7:41:34 AM by kf
Total Extractable Hydrocarbons. Soils and Waters are extracted using methylene chloride and then analyzed using an HPGC-FID. Calculations are based on an internal standard and reported in ug/L for waters and ug/g for soils.

==========



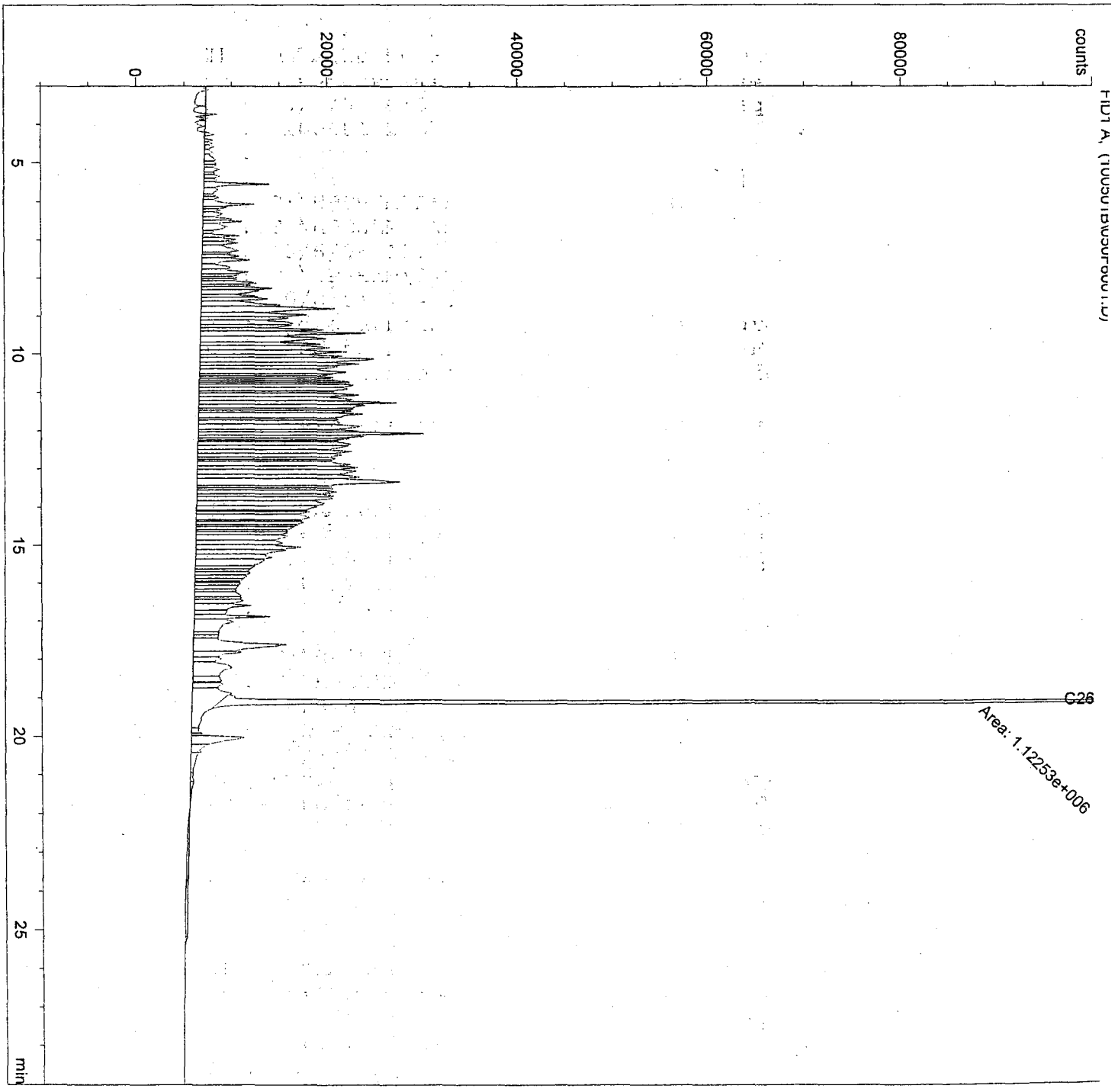
Data File C:\HPCHEM\2\DATA\100501B\050F6001.D Sample Name: 110010102 SAMPLE

==========

Injection Date : 10/8/01 6:06:42 AM Seq. Line : 60
Sample Name : 110010102 SAMPLE Vial : 50
Acq. Operator : kf Inj : 1
Inj Volume : 2 µl

Sequence File : C:\HPCHEM\2\SEQUENCE\100501B.S
Acq. Method : C:\HPCHEM\2\METHODS\!EPH.M
Last changed : 10/6/01 10:53:46 AM by kf
Analysis Method : C:\HPCHEM\2\METHODS\!EPH.M
Last changed : 10/8/01 7:41:34 AM by kf
Total Extractable Hydrocarbons. Soils and Waters are extracted using methylene chloride and then analyzed using an HPGC-FID. Calculations are based on an internal standard and reported in ug/L for waters and ug/g for soils.

==========



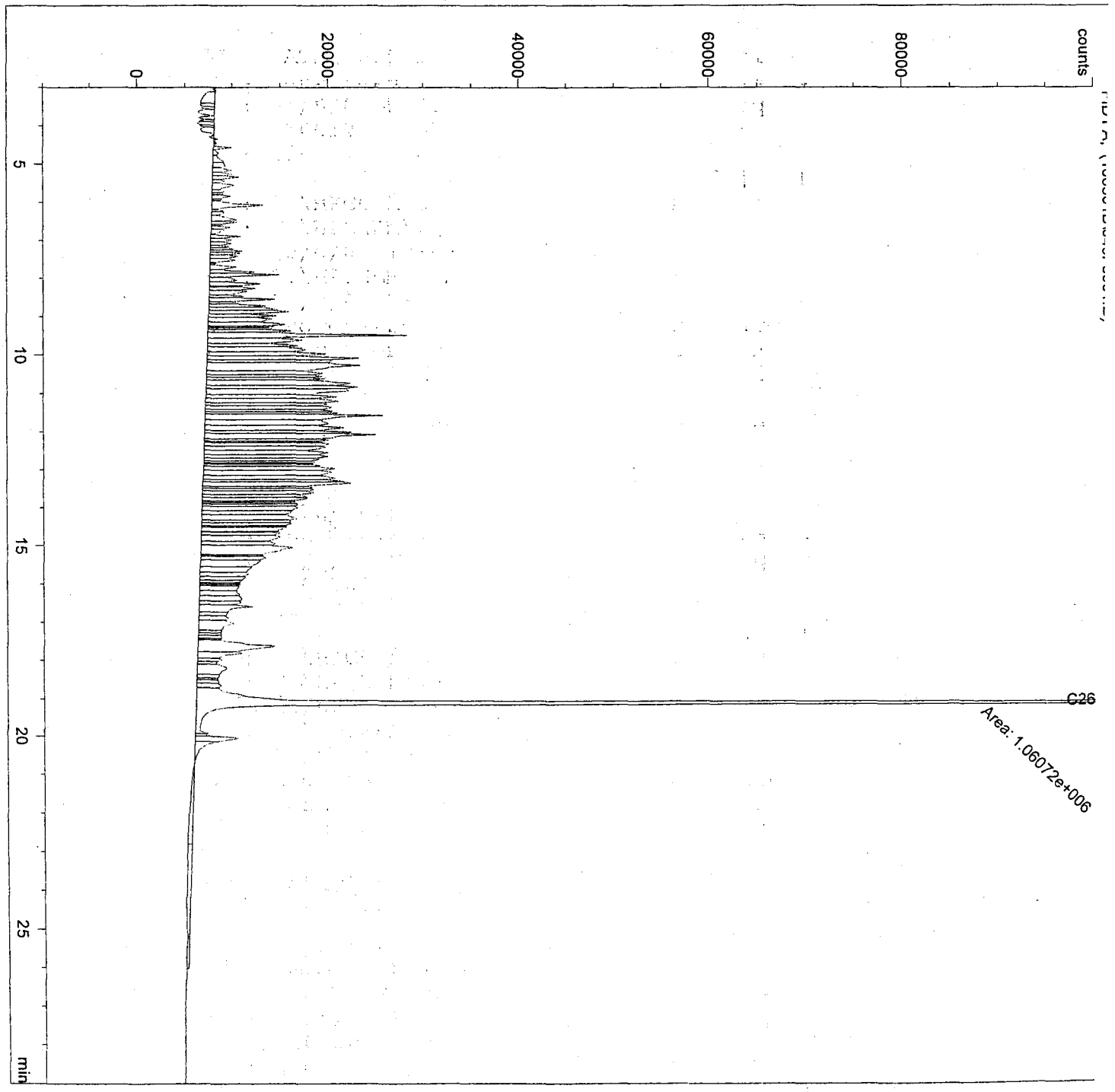
Data File C:\HPCHEM\2\DATA\100501B\049F3901.D Sample Name: 110010101 SAMPLE

Injection Date : 10/8/01 5:26:42 AM
Sample Name : 110010101 SAMPLE
Acq. Operator : kf

Seq. Line : 59
Vial : 49
Inj : 1
Inj Volume : 2 µl

Sequence File : C:\HPCHEM\2\SEQUENCE\100501B.S
Acq. Method : C:\HPCHEM\2\METHODS\!EPH.M
Last changed : 10/6/01 10:53:46 AM by kf
Analysis Method : C:\HPCHEM\2\METHODS\!EPH.M
Last changed : 10/8/01 7:41:34 AM by kf

Total Extractable Hydrocarbons. Soils and Waters are extracted using methylene chloride and then analyzed using an HPGC-FID. Calculations are based on an internal standard and reported in ug/L for waters and ug/g for soils.



Data File C:\HPCHEM\2\DATA\100501B\048F3801.D Sample Name: 110010099 SAMPLE

==========

Injection Date : 10/8/01 4:46:43 AM
Sample Name : 110010099 SAMPLE
Acq. Operator : kf

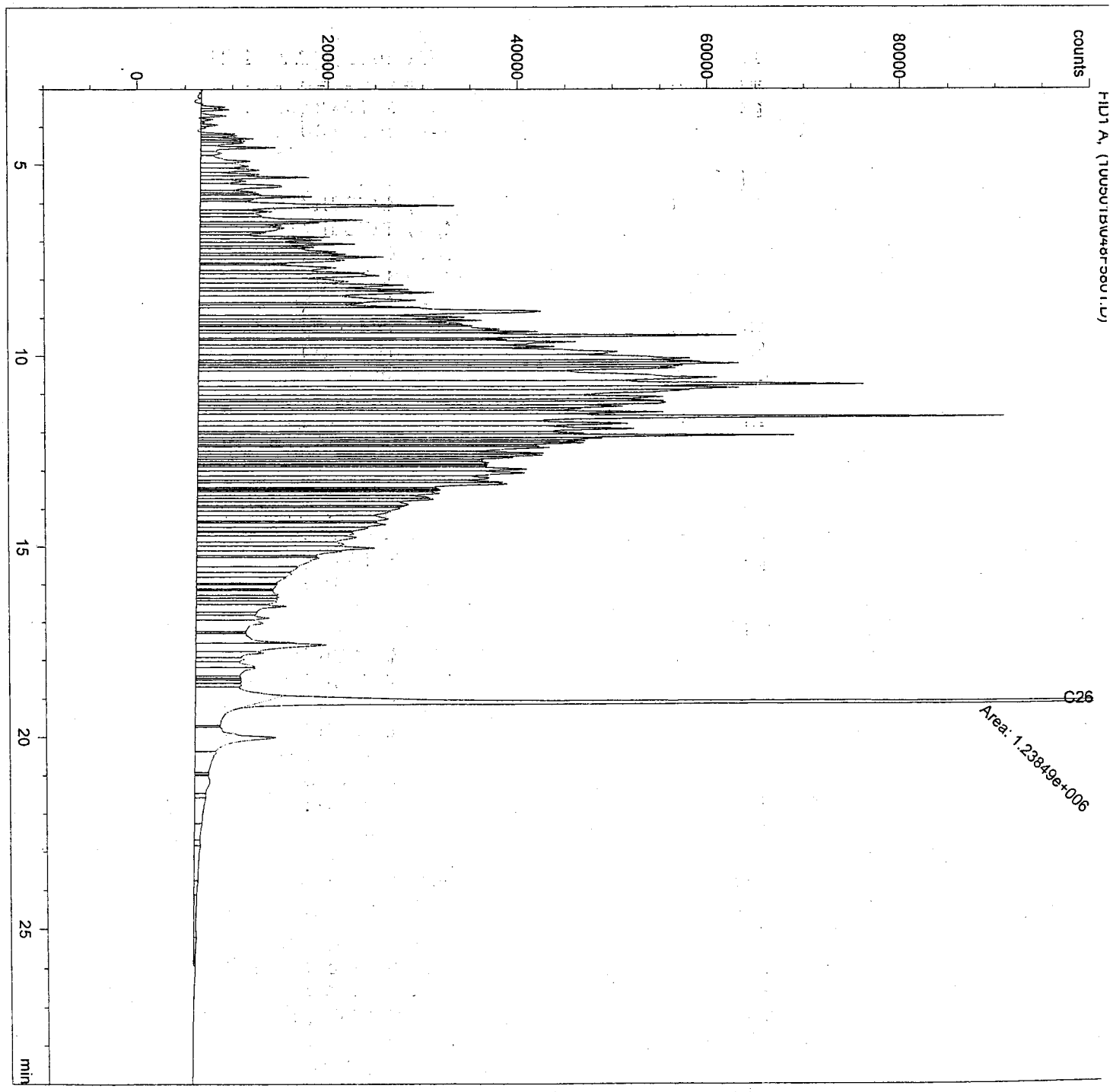
Seq. Line : 58
Vial : 48
Inj : 1
Inj Volume : 2 µl

Sequence File : C:\HPCHEM\2\SEQUENCE\100501B.S
Acq. Method : C:\HPCHEM\2\METHODS\!EPH.M
Last changed : 10/6/01 10:53:46 AM by kf
Analysis Method : C:\HPCHEM\2\METHODS\!EPH.M
Last changed : 10/8/01 7:41:34 AM by kf

HEMMERA
1100102J

Total Extractable Hydrocarbons. Soils and Waters are extracted using methylene chloride and then analyzed using an HPGC-FID. Calculations are based on an internal standard and reported in ug/L for waters and ug/g for soils.

==========



CHAIN OF CUSTODY RECORD

CANTEST

4606 Canada Way
Burnaby, B.C.
V5G 1K5

Tel: 604.734.7276
Fax: 604.731.2386
Toll Free: 800.665.8566

www.cantest.com
cantest@cantest.com

4 IAGS ZDM
2H690283
8 VOLU

Client Name:* Hemmera Envirochem HEM 101
Postal Code:

Street Address (including suite number):* Suite 350 1190 Hornby St
City: Vancouver

Telephone:* 604 669-0424
Fax: 604 669-0430
E-Mail Address (Required for "AutoEmail" Reports): plowery @ hemmera.com

Contact Name:*
Sampler's Name: P. Lowery

Project Name: Brooks Brook
Project Number: 316-003.04
Quotation Number:
P.O. Number

Page 1 of 1

RESULTS REQUESTED BY:*
Regular
Day Month Year
(Surcharges May Apply)

Special Instructions: ☐ AutoFax ☐ AutoEmail ☐ Return Cooler ☐ Ship Sampling Containers (please specify below)

FOR LABORATORY USE ONLY

Please circle options as appropriate →

Group Number: 1106102

Laboratory Number	Sample Identification*	Date Sampled (M / D / Y)	Sample Type	Metals (AW) ICP ET (D) (F)	Metals ALS CLI RLPL	PH	Conductivity	TSS	TDS	Alkalinity (total / spec.)	BOD	COD	Coliform Bacteria Fecal/Total	F Cl SO_4 NO_3	Nitrite (NO_2)	Nitrate and Nitrite	Oil & Grease (Total / HC)	PCP (Tri, Tetra and Penta)	PCP (Mono and Di)	BETX	VPH	VOC	PAH	EPH (not PAH corrected)	LEPH/HEPH (PAH corrected)	PCB					HOLD - DO NOT ANALYZE	Number of Containers
0099	MW01-03	9/26/01	Water																	X	X				X							3
0101	MW01-04	"	"																	X	X			X								3
0102	MW01-02	"	"	X																X	X				X							5
0107	DUP 2	"	"	X																X	X				X							5

Relinquished by: [signature]
Date: 09/26/01
Time:
Received by:

*** = Required Field**

Total Number of Containers:

Method of Shipment: Greyhound
Waybill No.: 1134198 6972
Received for Lab by:
Date
Time

You will be paid directly by our client: ☐

Shipped by:
Shipment Condition:
Cooler opened by: BJ
Date: Oct 1/01
Time: 1225

Company Name:
Address:
Contact:
Postal Code:
Phone:
Fax:

FOR LABORATORY USE ONLY
Sample State at Receipt: ☐ Ambient ☐ Cold ☐ Frozen ☐ N/A
Comments:
Temperature 13.8 °C
Shelf Number

WHITE: FOLLOWS REPORT YELLOW: LAB COPY PINK: CLIENT COPY/GENERAL INFORMATION

RECEIVED NOV 0 7 2001

Analysis Report

CANTEST®

CANTEST LTD.
Professional
Analytical
Services

4606 Canada Way
Burnaby, B.C.
V5G 1K5

Fax: 604 731 2386

Tel: 604 734 7276

1 800 665 8566

REPORT ON: Analysis of Air, Water Samples

REPORTED TO: Hemmera Envirochem Inc.
Suite 350
1190 Hornby Street
Vancouver, B.C.
V6Z 2K5

Att'n: Mr. Philip Lowery

CHAIN OF CUSTODY: 90285
PROJECT NAME: Brooks Brook
PROJECT NUMBER: 316-003.04

NUMBER OF SAMPLES: 10

REPORT DATE: October 29, 2001

DATE SUBMITTED: October 1, 2001

GROUP NUMBER: 11001028

SAMPLE TYPE: Water and Air in Charcoal Tubes

TEST METHODS:

Volatile Organic Compounds in Water and Soil - analysis was performed using procedures based on U.S. EPA Methods 624/8240/8260, involving sparging with a Purge and Trap apparatus and analysis using GC/MS.

Volatile Hydrocarbons (VH) and Volatile Petroleum Hydrocarbons (VPH) in Water - analysis was performed using B.C. MOELP CSR-Analytical Method 2 "Volatile Hydrocarbons in Water by GC/FID" and CSR-Analytical Method 5 "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water (VPH)" approved August 12, 1999. The method involves sparging/collection using a Purge & Trap apparatus with GC/FID analysis; VH components ranging from C6 to C10 are quantified against m-xylene and 1,2,4-trimethylbenzene. VPH is calculated by subtraction of specified MAH compounds from VH concentrations.

Conventional Parameters - analyses were performed using procedures based on those described in "British Columbia Environmental Laboratory Manual For the Analysis of Water, Wastewater, Sediment and Biological Materials" (1994 Edition), Province of British Columbia and "Standard Methods for the Examination of Water and Wastewater" 20th Edition, (1998), published by the American Public Health Association.

Total or Light Hydrocarbons in Air - analysis was performed using procedures based on WCB Method 2901. The procedure involves sampling using charcoal tubes, desorption of analytes from the charcoal using carbon disulphide, and analysis using gas chromatography with flame ionization detection.

Volatile Organic Compounds in Air - analysis was performed using procedures based on WCB Method 3302. The procedure involves sampling using charcoal tubes, desorption of analytes from the charcoal using carbon disulphide, and analysis using gas chromatography with flame ionization detection.

(Continued)

CANTEST LTD.

Walter Brandl, B.Sc.
Manager, Environmental Services

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 29, 2001

GROUP NUMBER: 11001028

Extractable Petroleum Hydrocarbons and Light and Heavy Extractable Petroleum Hydrocarbons in Water - analysis was performed using B.C. MOELP CSR-Analytical Method 4 "Extractable Petroleum Hydrocarbons in Water by GC/FID" and CSR-Analytical Method 6 "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water (LEPH & HEPH)". The method involves DCM extraction and GC/FID analysis. EPH components ranging from C10 to C19 and C19 to C32 are quantified against eicosane (n-C20). LEPH & HEPH are calculated by subtraction of specified PAH's.

Mercury in Water - analysis was performed using procedures based on U. S. EPA Method 1631, oxidative digestion using bromination, and analysis using Cold Vapour Atomic Fluorescence Spectroscopy.

Metals in Water - analysis was performed using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP), Inductively Coupled Plasma-Mass Spectroscopy (ICP/MS) or Graphite Furnace Atomic Absorption Spectrophotometry.

Polynuclear Aromatic Hydrocarbons - analysis was performed using procedures based on U.S. EPA Methods 625/8270, involving extraction, clean-up steps, and analysis using GC/MS.

TEST RESULTS:

(See following pages)

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 29, 2001

GROUP NUMBER: 11001028

CANTEST®

Conventional Parameters in Water

CLIENT SAMPLE IDENTIFICATION:	SAMPLE DATE	CANTEST ID	Hardness (Total) CaCO3
Upstream	Sep 27/01	110010127	78
Downstream	Sep 27/01	110010129	77
DETECTION LIMIT			1
UNITS			mg/L

mg/L = milligrams per liter

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 29, 2001

GROUP NUMBER: 11001028

CANTEST®

Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		Upstream	Downstream		
SAMPLE PREPARATION:		TOTAL	TOTAL		
DATE SAMPLED:		Sep 27/01	Sep 27/01		
CANTEST ID:		110010127	110010129	DETECTION LIMIT	UNITS
Aluminum	Al	0.021	0.011	0.005	mg/L
Antimony	Sb	<	<	0.001	mg/L
Arsenic	As	<	<	0.001	mg/L
Barium	Ba	0.023	0.022	0.001	mg/L
Beryllium	Be	<	<	0.001	mg/L
Bismuth	Bi	<	<	0.001	mg/L
Boron	B	<	<	0.05	mg/L
Cadmium	Cd	<	<	0.0002	mg/L
Calcium	Ca	21.8	21.0	0.05	mg/L
Chromium	Cr	<	<	0.001	mg/L
Cobalt	Co	<	<	0.001	mg/L
Copper	Cu	<	<	0.001	mg/L
Iron	Fe	0.06	0.06	0.05	mg/L
Lead	Pb	<	<	0.001	mg/L
Lithium	Li	<	<	0.001	mg/L
Magnesium	Mg	5.81	5.93	0.05	mg/L
Manganese	Mn	0.009	0.010	0.001	mg/L
Mercury	Hg	<	<	0.02	µg/L
Molybdenum	Mo	<	<	0.001	mg/L
Nickel	Ni	<	<	0.001	mg/L
Phosphorus	PO4	<	<	0.01	mg/L
Potassium	K	0.63	0.58	0.01	mg/L
Selenium	Se	<	<	0.002	mg/L
Silicon	SiO2	10.2	10.5	0.05	mg/L
Silver	Ag	<	<	0.0001	mg/L
Sodium	Na	2.17	2.18	0.05	mg/L
Strontium	Sr	0.082	0.082	0.001	mg/L
Tellurium	Te	<	<	0.001	mg/L
Thallium	Tl	<	<	0.0001	mg/L
Thorium	Th	<	<	0.0005	mg/L
Tin	Sn	<	<	0.001	mg/L

(Continued on next page)

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 29, 2001

GROUP NUMBER: 11001028

CANTEST®

Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		Upstream	Downstream	DETECTION LIMIT	UNITS
SAMPLE PREPARATION:		TOTAL	TOTAL		
DATE SAMPLED:		Sep 27/01	Sep 27/01		
CANTEST ID:		110010127	110010129		
Titanium	Ti	<	<	0.001	mg/L
Uranium	U	0.0008	0.0008	0.0005	mg/L
Vanadium	V	<	<	0.001	mg/L
Zinc	Zn	<	<	0.005	mg/L
Zirconium	Zr	<	<	0.01	mg/L

mg/L = milligrams per liter
< = Less than detection limit

µg/L = micrograms per liter

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 29, 2001

GROUP NUMBER: 11001028

CANTEST®

Polycyclic Aromatic Hydrocarbons in Water

CLIENT SAMPLE IDENTIFICATION:	Upstream	Downstream	MW01-05	MW01-08	
DATE SAMPLED:	Sep 27/01	Sep 27/01	Sep 27/01	Sep 27/01	
CANTEST ID:	110010127	110010129	110010130	110010133	DETECTION LIMIT
ANALYSIS DATE:	Oct 5/01	Oct 8/01	Oct 8/01	Oct 8/01	
Naphthalene	<	<	<	12	0.3
Acenaphthylene	<	<	<	< 0.5	0.1
Acenaphthene	<	<	<	0.6	0.1
Fluorene	<	<	<	1.3	0.05
Phenanthrene	<	<	<	0.7	0.05
Anthracene	<	<	<	< 0.25	0.05
Acridine	<	<	<	< 0.25	0.05
Total LMW-PAH's				14.6	
Fluoranthene	<	<	<	< 0.25	0.05
Pyrene	<	<	<	0.2	0.02
Benzo(a)anthracene	<	<	<	< 0.05	0.01
Chrysene	<	<	<	< 0.05	0.01
Benzo(b)fluoranthene	<	<	<	< 0.05	0.01
Benzo(k)fluoranthene	<	<	<	< 0.05	0.01
Benzo(a)pyrene	<	<	<	< 0.05	0.01
Indeno(1,2,3-cd)pyrene	<	<	<	< 0.05	0.01
Dibenz(a,h)anthracene	<	<	<	< 0.05	0.01
Benzo(g,h,i)perylene	<	<	<	< 0.05	0.01
Total HMW-PAH's				0.2	
Total PAH's				14.8	

Results expressed as micrograms per liter (μg/L)
< = Less than detection limit
Sample# 110010133 - Detection limits adjusted: Dilution required

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 29, 2001

GROUP NUMBER: 11001028

CANTEST®

Monocyclic Aromatic Hydrocarbons in Water

CLIENT SAMPLE IDENTIFICATION:	Upstream	Downstream	MW01-05	MW01-06	
DATE SAMPLED:	Sep 27/01	Sep 27/01	Sep 27/01	Sep 27/01	
CANTEST ID:	110010127	110010129	110010130	110010132	DETECTION LIMIT
ANALYSIS DATE:	Oct 5/01	Oct 5/01	Oct 5/01	Oct 5/01	
Benzene	<	<	<	<	0.1
Ethylbenzene	<	<	<	0.2	0.1
Toluene	<	<	<	<	0.1
Xylenes	<	<	0.8	5.1	0.1
Volatile Hydrocarbons VHw6-10	<	<	<	<	100
VPHw	<	<	<	<	100
Surrogate Recovery					
Toluene-d8	100	100	93	102	-
Bromofluorobenzene	101	102	99	105	-

Results expressed as micrograms per liter (μg/L)
Surrogate recoveries expressed as percent (%)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 29, 2001

GROUP NUMBER: 11001028

CANTEST®

Monocyclic Aromatic Hydrocarbons in Water

CLIENT SAMPLE IDENTIFICATION:	MW01-08	MW01-07	
DATE SAMPLED:	Sep 27/01	Sep 27/01	
CANTEST ID:	110010133	110010134	DETECTION LIMIT
ANALYSIS DATE:	Oct 5/01	Oct 5/01	
Benzene	3.8	0.6	0.1
Ethylbenzene	33	1.7	0.1
Toluene	24	0.5	0.1
Xylenes	160	11	0.1
Volatile Hydrocarbons VHw6-10	690	130	100
VPHw	470	120	100
Surrogate Recovery			
Toluene-d8	104	101	-
Bromofluorobenzene	108	98	-

Results expressed as micrograms per liter (μg/L)
Surrogate recoveries expressed as percent (%)

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 29, 2001

GROUP NUMBER: 11001028

CANTEST®

Volatile Organics in Air

CLIENT SAMPLE IDENTIFICATION:	SV1	SV2	SV3	SV4	
DATE SAMPLED:	Sep 23/01	Sep 23/01	Sep 24/01	Sep 27/01	DETECTION LIMIT
CANTEST ID:	110010135	110010136	110010137	110010138	
Benzene	<	<	<	<	0.5
Toluene	2.7	4.1	3.0	<	0.5
Ethylbenzene	1.7	<	<	<	0.5
Total Xylenes	1.8	1.8	0.6	<	0.5
Total Hydrocarbons	24.5	33.6	45.6	<	5

Results expressed as total micrograms (ug)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 29, 2001

GROUP NUMBER: 11001028

CANTEST®

Extractable Petroleum Hydrocarbons in Water

CLIENT SAMPLE IDENTIFICATION:	Upstream	Downstream	MW01-05	MW01-06	
DATE SAMPLED:	Sep 27/01	Sep 27/01	Sep 27/01	Sep 27/01	DETECTION LIMIT
CANTEST ID:	110010127	110010129	110010130	110010132	
EPHw10-19	<	<	260	430	250
EPHw19-32	<	<	<	<	250
LEPHw (corrected for PAH's)	<	<	260	-	250
HEPHw (corrected for PAH's)	<	<	<	-	250

Results expressed as micrograms per liter (μg/L)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 29, 2001

GROUP NUMBER: 11001028

CANTEST®

Extractable Petroleum Hydrocarbons in Water

CLIENT SAMPLE IDENTIFICATION:	MW01-08	MW01-07	
DATE SAMPLED:	Sep 27/01	Sep 27/01	DETECTION LIMIT
CANTEST ID:	110010133	110010134	
EPHw10-19	1900	610	250
EPHw19-32	280	<	250
LEPHw (corrected for PAH's)	1900	-	250
HEPHw (corrected for PAH's)	280	-	250

Results expressed as micrograms per liter (μg/L)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 29, 2001

GROUP NUMBER: 11001028

CANTEST®

Batch Quality Control for Monocyclic Aromatic Hydrocarbons in Water (QC# 26567)

Parameter	Blank (ug/L)	Blank Limits	Volatiles Water Spike (% Recovery)	Volatiles Water Spike Limits
Benzene	< 0.1	0.1	100	79 - 117
Ethylbenzene	< 0.1	0.1	96	76 - 124
Toluene	< 0.1	0.2	96	83 - 118
Xylenes	< 0.1	0.1	97	75 - 125
Volatile Hydrocarbons VHw6-10	< 100	100	-	-

ug/L = micrograms per liter

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 29, 2001

GROUP NUMBER: 11001028

CANTEST®

Batch Quality Control for Extractable Petroleum Hydrocarbons in Water (QC# 26531)

Parameter	Blank (ug/L)	Blank Limits
EPHw10-19	< 250	250
EPHw19-32	< 250	250

ug/L = micrograms per liter

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 29, 2001

GROUP NUMBER: 11001028

CANTEST®

Batch Quality Control for Total Metals Analysis in Water (QC# 26526)

Parameter		Duplicate (R.P.D.) 109280302	Duplicate Limits	ICPMS Spike (% Recovery) 109280296	ICPMS Spike Limits	ICPMS Spike (% Recovery) 109280301	ICPMS Spike Limits
Aluminum	Al	PASS	20	-	-	-	-
Antimony	Sb	NC	20	95	70 - 130	90	70 - 130
Arsenic	As	NC	20	95	70 - 130	95	70 - 130
Beryllium	Be	-	-	95	70 - 130	95	70 - 130
Cadmium	Cd	NC	20	95	70 - 130	95	70 - 130
Calcium	Ca	0.4	20	-	-	-	-
Chromium	Cr	NC	20	90	70 - 130	85	70 - 130
Cobalt	Co	NC	20	100	70 - 130	95	70 - 130
Copper	Cu	NC	20	100	70 - 130	95	70 - 130
Lead	Pb	NC	20	95	70 - 130	90	70 - 130
Magnesium	Mg	5	20	-	-	-	-
Manganese	Mn	-	-	95	70 - 130	90	70 - 130
Molybdenum	Mo	NC	20	85	70 - 130	80	70 - 130
Nickel	Ni	NC	20	95	70 - 130	90	70 - 130
Potassium	K	4.5	20	-	-	-	-
Silver	Ag	NC	20	-	-	-	-
Sodium	Na	3.3	20	-	-	-	-
Thallium	Tl	NC	20	95	70 - 130	90	70 - 130
Thorium	Th	NC	20	-	-	-	-
Tin	Sn	NC	20	-	-	-	-
Titanium	Ti	-	-	95	70 - 130	90	70 - 130
Uranium	U	PASS	20	115	70 - 130	115	70 - 130
Vanadium	V	-	-	90	70 - 130	90	70 - 130

mg/L = milligrams per liter
R.P.D. = Relative Percent Difference
PASS = Duplicate sample results were in the range of one to five times the detection limit. R.P.D. calculation is not applicable in this range. Acceptance criteria is a maximum difference between the duplicates equivalent to the value of the detection limit.
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 29, 2001

GROUP NUMBER: 11001028

CANTEST®

Batch Quality Control for Total Metals Analysis in Water (QC# 26526)

Parameter		ICPMS Lab Fortified Blank (% Recovery)	ICPMS Lab Fortified Blank Limits	Total Blank (mg/L)	Total Blank Limits
Aluminum	Al	110	80 - 120	0.002	0.015
Antimony	Sb	90	85 - 115	< 0.0002	0.001
Arsenic	As	85	75 - 115	< 0.0002	0.001
Barium	Ba	95	85 - 115	< 0.0002	0.001
Beryllium	Be	90	85 - 115	< 0.0002	0.001
Boron	B	100	85 - 115	-	-
Cadmium	Cd	88	85 - 115	< 0.00004	0.001
Chromium	Cr	90	85 - 115	< 0.0002	0.001
Cobalt	Co	100	85 - 115	< 0.0002	0.001
Copper	Cu	100	85 - 115	0.001	0.001
Lead	Pb	95	85 - 115	< 0.0002	0.001
Manganese	Mn	90	85 - 115	< 0.0002	0.001
Molybdenum	Mo	95	85 - 115	< 0.0002	0.001
Nickel	Ni	95	85 - 115	< 0.0002	0.001
Potassium	K	-	-	0.006	0.05
Selenium	Se	75	75 - 115	-	-
Silver	Ag	90	85 - 115	0.00006	0.001
Strontium	Sr	100	85 - 115	< 0.0002	0.001
Thallium	Tl	92	85 - 115	< 0.00002	0.001
Thorium	Th	-	-	< 0.0001	0.0005
Tin	Sn	-	-	0.0003	0.005
Titanium	Ti	95	85 - 115	< 0.0002	0.001
Uranium	U	115	85 - 115	< 0.0001	0.0005
Vanadium	V	90	85 - 115	< 0.0002	0.001
Zinc	Zn	80	80 - 120	0.002	0.01
Zirconium	Zr	-	-	< 0.002	0.01

mg/L = milligrams per liter

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 29, 2001

GROUP NUMBER: 11001028

CANTEST®

Batch Quality Control for Total Metals Analysis in Water (QC# 26687)

Parameter	Duplicate (R.P.D.) 109240002	Duplicate Limits	Spike (% Recovery) 109240002	Spike Limits
Mercury Hg	PASS	20	87	80 - 120

ug/L = micrograms per liter
R.P.D. = Relative Percent Difference
PASS = Duplicate sample results were in the range of one to five times the detection limit. R.P.D. calculation is not applicable in this range. Acceptance criteria is a maximum difference between the duplicates equivalent to the value of the detection limit.

CANTEST®

Batch Quality Control for Polycyclic Aromatic Hydrocarbons in Water (QC# 26513)

Parameter	Blank (ug/L)	Blank Limits	Spike (% Recovery)	Spike Limits
Naphthalene	< 0.3	0.3	100	38 - 115
Acenaphthylene	< 0.1	0.1	100	50 - 118
Acenaphthene	< 0.1	0.1	100	50 - 118
Fluorene	< 0.05	0.05	90	50 - 118
Phenanthrene	< 0.05	0.05	94	63 - 120
Anthracene	< 0.05	0.05	94	63 - 120
Acridine	< 0.05	0.05	96	63 - 120
Fluoranthene	< 0.05	0.05	98	63 - 120
Pyrene	< 0.02	0.02	96	63 - 120
Benzo(a)anthracene	< 0.01	0.01	92	63 - 120
Chrysene	< 0.01	0.01	96	63 - 120
Benzo(b)fluoranthene	< 0.01	0.01	90	59 - 138
Benzo(k)fluoranthene	< 0.01	0.01	92	59 - 138
Indeno(1,2,3-cd)pyrene	< 0.01	0.01	90	65 - 134
Dibenz(a,h)anthracene	< 0.01	0.01	90	65 - 134
Benzo(g,h,i)perylene	< 0.01	0.01	90	65 - 134

ug/L = micrograms per liter

CANTEST®

Batch Quality Control Frequency Summary

PAH's in Water Sample Prep (Batch# 26513)

QC Type	No. Samples
Blank	1
Spike	2

Total Metals Preparation (Batch# 26526)

QC Type	No. Samples
Graphite Furnace Spike	1
ICP Spike	1
Potassium/Silicon Spike	1
ICPMS Lab Fortified Blank	1
Total Blank	1
Duplicate	2
ICPMS Spike	2

TEH/EPH Water Preparation (Batch# 26531)

QC Type	No. Samples
Blank	1
Method Performance Check Spike	1
Matrix Spike Duplicate	1

Volatiles Analysis (Batch# 26567)

QC Type	No. Samples
Blank	1
Volatiles Soil Spike	1
Volatiles Water Spike	1
Duplicate	2

(Continued on next page)

CANTEST®

Batch Quality Control Frequency Summary

Mercury Water Bromination Prep (Batch# 26687)

QC Type	No. Samples
Duplicate	2
Spike	2

PAH's in Water Sample Prep (Batch# 26513)

QC Type	No. Samples
Batch Size	17

Total Metals Preparation (Batch# 26526)

QC Type	No. Samples
Batch Size	69

TEH/EPH Water Preparation (Batch# 26531)

QC Type	No. Samples
Batch Size	19

Volatiles Analysis (Batch# 26567)

QC Type	No. Samples
Batch Size	41

Mercury Water Bromination Prep (Batch# 26687)

QC Type	No. Samples
Batch Size	24

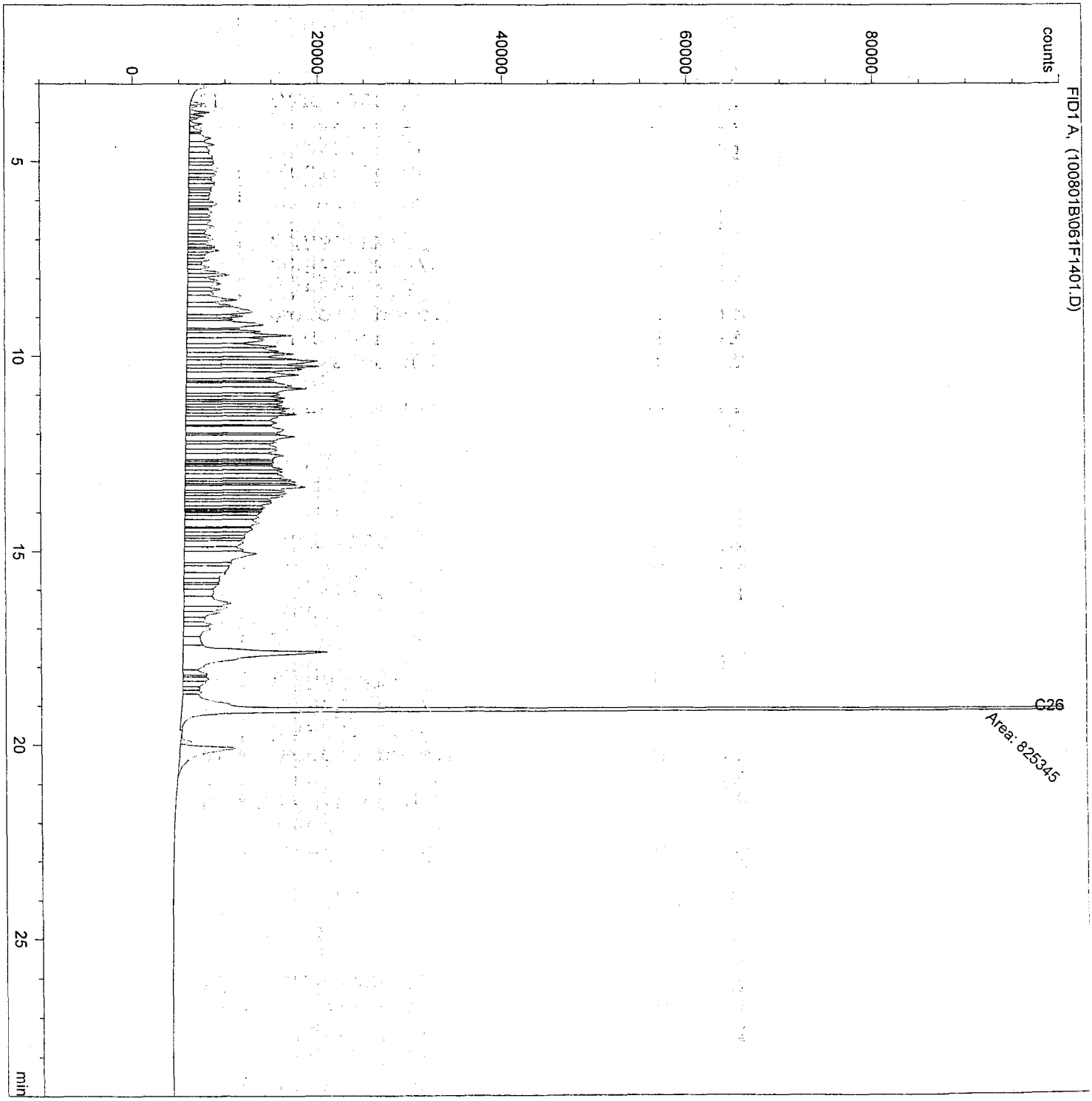
Data File C:\HPCHEM\2\DATA\100801B\061F1401.D Sample Name: 110010134 SAMPLE

==========

Injection Date : 10/8/01 5:46:39 PM Seq. Line : 14
Sample Name : 110010134 SAMPLE Vial : 61
Acq. Operator : kf Inj : 1
Inj Volume : 2 µl

Sequence File : C:\HPCHEM\2\SEQUENCE\100801B.S
Method : C:\HPCHEM\2\METHODS\!EPH.M
Last changed : 10/8/01 10:40:46 AM by kf
Total Extractable Hydrocarbons. Soils and Waters are extracted using methylene chloride and then analyzed using an HPGC-FID. Calculations are based on an internal standard and reported in ug/L for waters and ug/g for soils.

==========

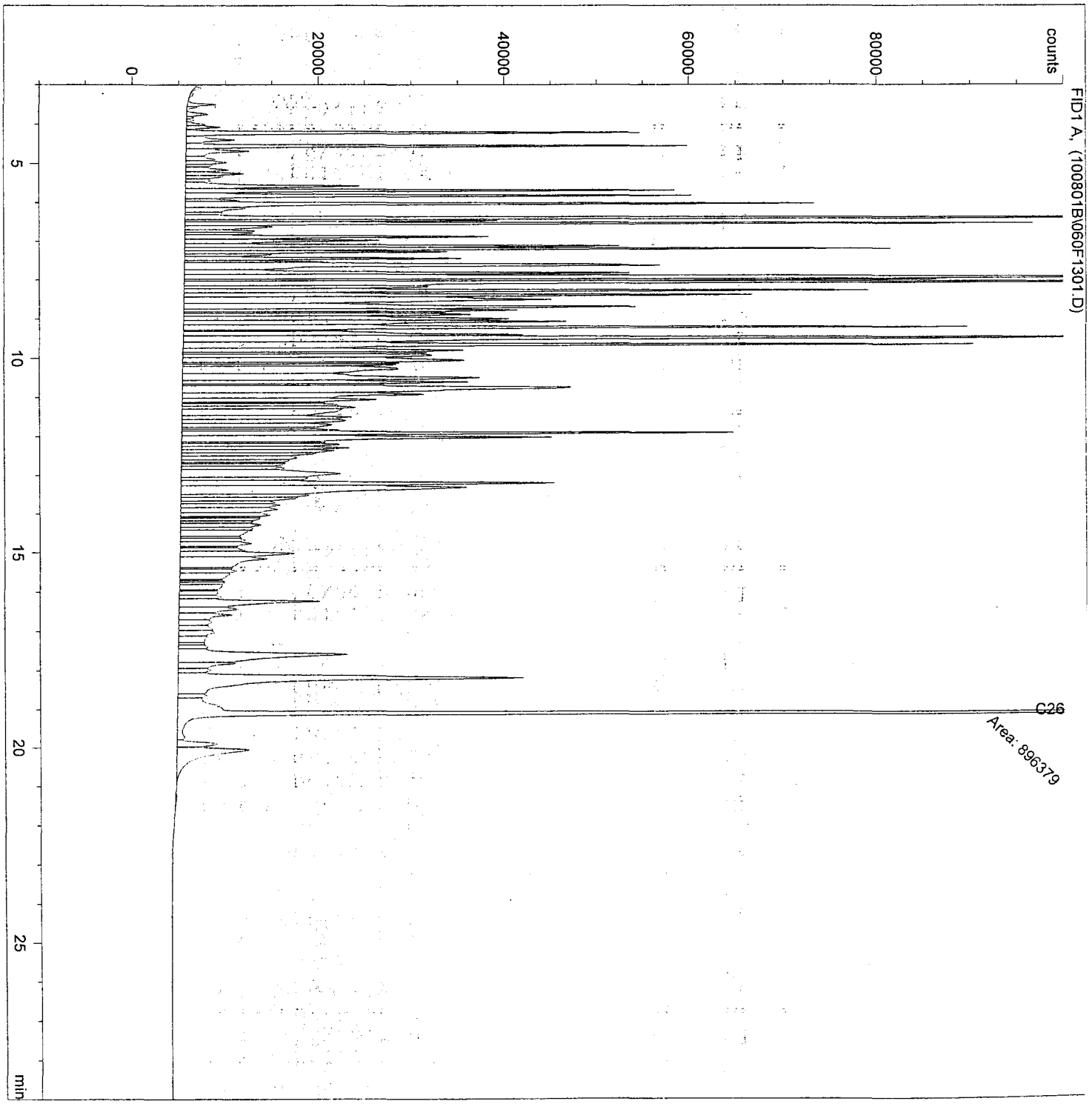


Data File C:\HPCHEM\2\DATA\100801B\060F1301.D Sample Name: 110010133 SAMPLE

Injection Date : 10/8/01 5:06:36 PM Seq. Line : 13
Sample Name : 110010133 SAMPLE Vial : 60
Acq. Operator : kf Inj : 1
Inj Volume : 2 µl

Sequence File : C:\HPCHEM\2\SEQUENCE\100801B.S
Method : C:\HPCHEM\2\METHODS\!EPH.M
Last changed : 10/8/01 10:40:46 AM by kf

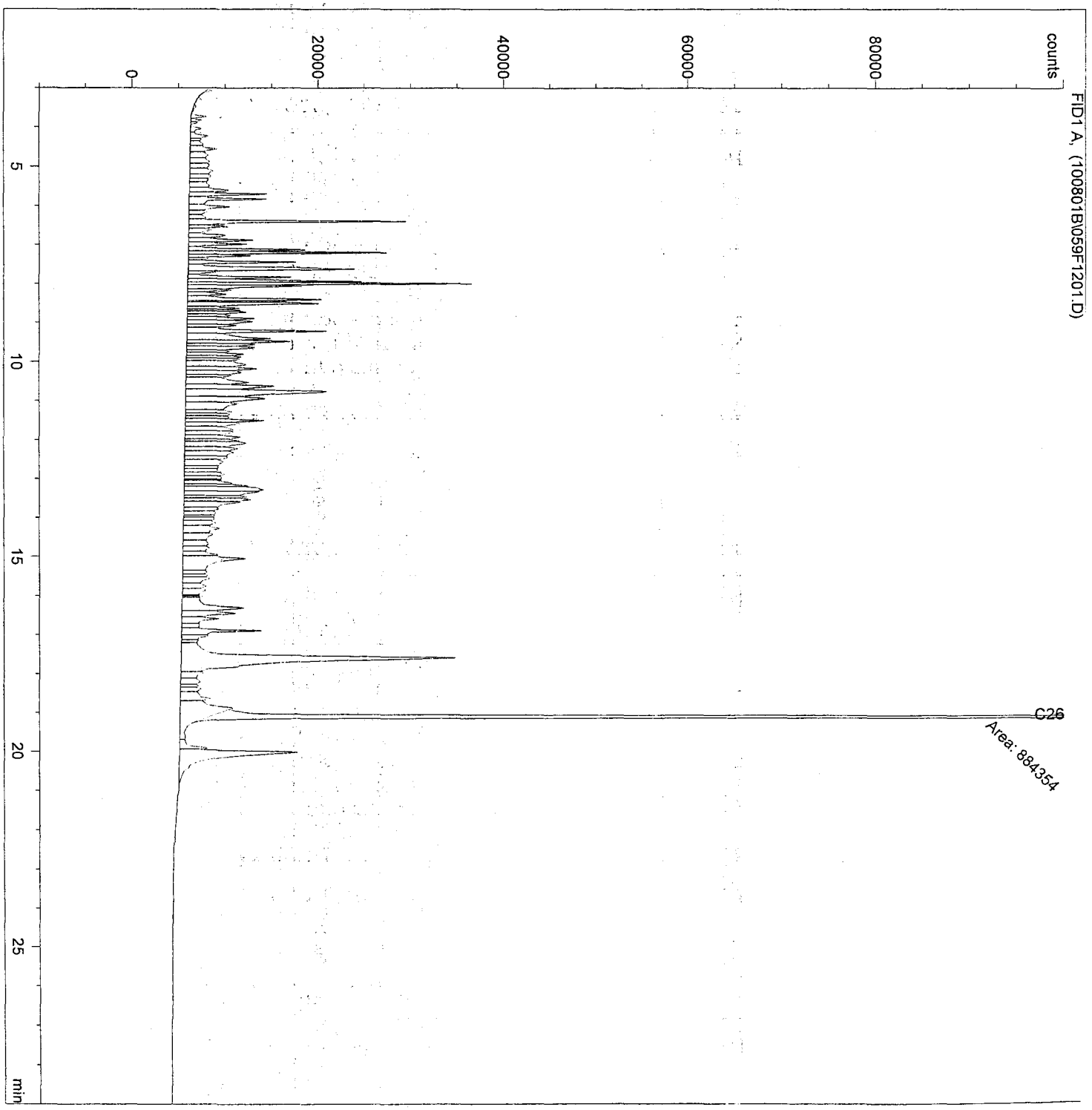
Total Extractable Hydrocarbons. Soils and Waters are extracted using methylene chloride and then analyzed using an HPGC-FID. Calculations are based on an internal standard and reported in ug/L for waters and ug/g for soils.



Data File C:\HPCHEM\2\DATA\100801B\059F1201.D Sample Name: 110010132 SAMPLE

Injection Date	: 10/8/01 4:26:35 PM	Seq. Line	: 12
Sample Name	: 110010132 SAMPLE	Vial	: 59
Acq. Operator	: kf	Inj	: 1
		Inj Volume	: 2 µl
Sequence File	: C:\HPCHEM\2\SEQUENCE\100801B.S		
Method	: C:\HPCHEM\2\METHODS\!EPH.M		
Last changed	: 10/8/01 10:40:46 AM by kf		

Total Extractable Hydrocarbons. Soils and Waters are extracted using methylene chloride and then analyzed using an HPGC-FID. Calculations are based on an internal standard and reported in ug/L for waters and ug/g for soils.

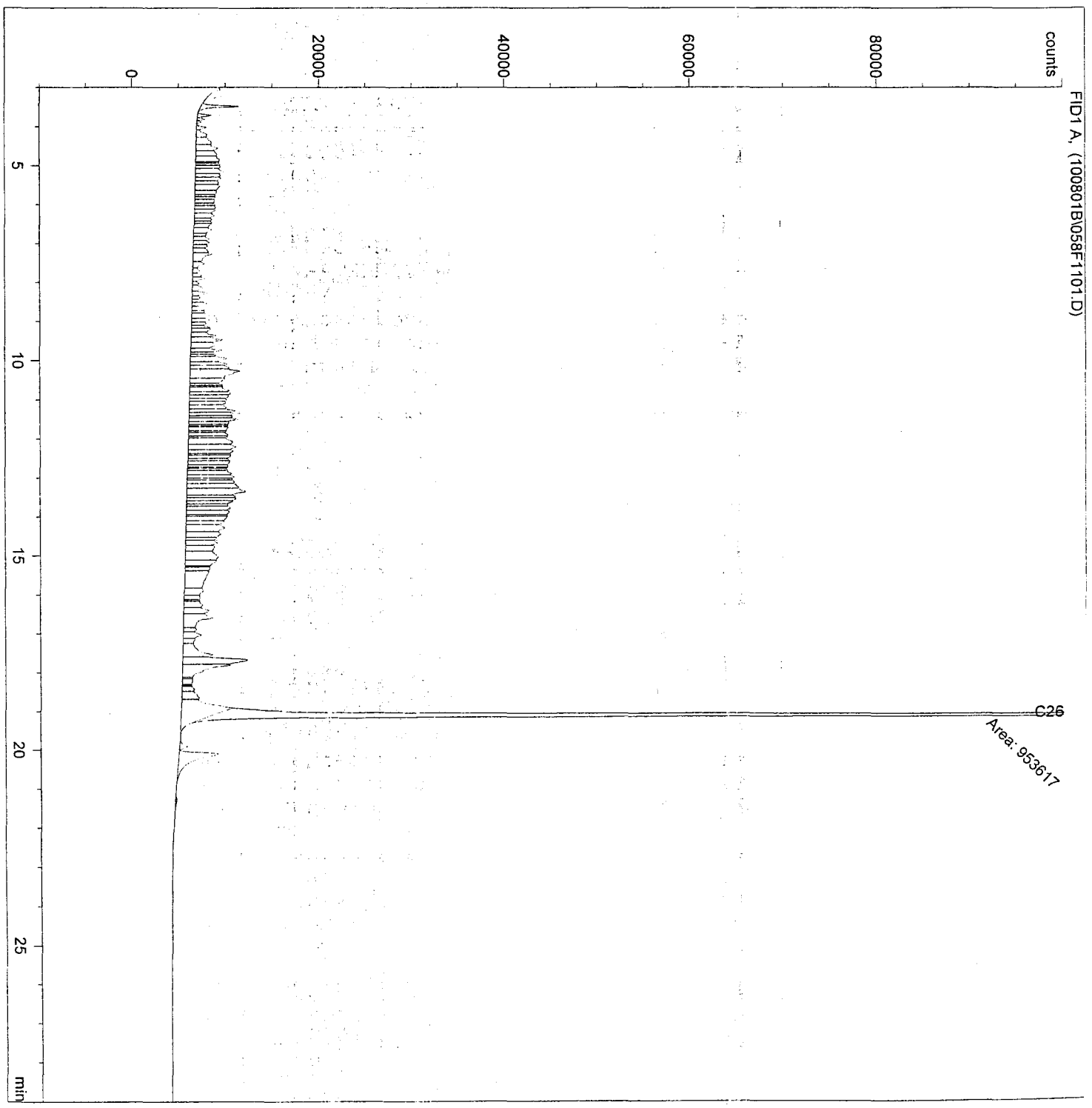


Data File C:\HPCHEM\2\DATA\100801B\058F1101.D Sample Name: 110010130 SAMPLE

Injection Date	: 10/8/01 3:46:38 PM	Seq. Line :	11
Sample Name	: 110010130 SAMPLE	Vial :	58
Acq. Operator	: kf	Inj :	1
		Inj Volume :	2 µl
Sequence File	: C:\HPCHEM\2\SEQUENCE\100801B.S		
Method	: C:\HPCHEM\2\METHODS\!EPH.M		
Last changed	: 10/8/01 10:40:46 AM by kf		

HEMMERA
1100 1028

Total Extractable Hydrocarbons. Soils and Waters are extracted using methylene chloride and then analyzed using an HPGC-FID. Calculations are based on an internal standard and reported in ug/L for waters and ug/g for soils.



CHAIN OF CUSTODY RECORD

CANTEST

4606 Canada Way
Burnaby, B.C.
V5G 1K5

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Fax: 604.731.2386
Toll Free: 800.665.8566

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90285
6x1AGS 12xVOEV
2x Tm 2xHG #xcharcoal tubes

Client Name:* Hemmera Envirochem
Postal Code:
Street Address (including suite number):* Suite 350 1190 Hornby St
City: Vancouver
Telephone:* 604 669-0424
Fax: 669-0430
E-Mail Address (Required for "AutoEmail" Reports): plowery@hemmera.com
Contact Name:*
Sampler's Name: Philip Lowery
Project Name: Brooks Brook
Project Number: 316-003.04
Quotation Number:
P.O. Number

RESULTS REQUESTED BY:* Regular
Day Month Year
(Surcharges May Apply)

Special Instructions: ☐ AutoFax ☐ AutoEmail ☐ Return Cooler ☐ Ship Sampling Containers (please specify below)

Charcoal tubes in 1 container

FOR LABORATORY USE ONLY

Please circle options as appropriate (AW and T circled)

Group Number: 11001028

Laboratory Number	Sample Identification*	Date Sampled (M / D / Y)	Sample Type	Metals AW ICP T D FP	Metals ALS CL L RL PL	PH	Conductivity	TSS	TDS	Alkalinity (total / spec.)	BOD	COD	Coliform Bacteria Fecal/Total	F Cl SO_4 NO_3	Nitrite (NO_2)	Nitrate and Nitrite	Oil & Grease (Total / HC)	PCP (Tri, Tetra and Penta)	PCP (Mono and Di)	BETX	VPH	VOC	PAH	EPH (not PAH corrected)	LEPH/HEPH (PAH corrected)	PCB					HOLD - DO NOT ANALYZE	Number of Containers
127	UPSTREAM	9/27/01	Water	X																X	X				X							5
129	DOWNSTREAM	"	"	X																X	X				X							5
130	MW01-05	"	"																	X	X				X							3
132	MW01-06	"	"																	X	X			X								3
133	MW01-08	"	"																	X	X				X							3
134	MW01-07	"	"																	X	X			X								3
135	SV1	9/23/01	Air																	X	X								charcoal tube			1
136	SV2	9/23/01	"																	X	X								"			1
137	SV3	9/24/01	"																	X	X								"			1
139	SV4	9/27/01	"																	X	X								"			1

Relinquished by: B Wong
Date: 9/27/01
Time:
Received by:

*** = Required Field**

Total Number of Containers: 22

Method of Shipment: Greyhound
Waybill No.: 11341986983
Received for Lab by: Date Time
Shipped by:
Shipment Condition:
Cooler opened by: Date Time

You will be paid directly by our client: ☐
Company Name:
Address:
Contact: Postal Code:
Phone: Fax:

FOR LABORATORY USE ONLY
Sample State at Receipt: ☐ Ambient ☐ Cold ☐ Frozen ☐ N/A Comments:
Temperature ____ °C Shelf Number ____

WHITE: FOLLOWS REPORT YELLOW: LAB COPY PINK: CLIENT COPY/GENERAL INFORMATION

CHAIN OF CUSTODY RECORD

CANTEST

90286

4606 Canada Way
Burnaby, B.C.
V5G 1K5

Tel: 604.734.7276
Fax: 604.731.2386
Toll Free: 800.665.8566

www.cantest.com
cantest@cantest.com

Client Name: Hemmera Envirochem V6Z 2K5

Street Address (including suite number):* Suite 350, 1190 Hornby St | City: Vancouver

Telephone:* 604 669-0424 | Fax: 604 669-0430 | E-Mail Address (Required for "AutoEmail" Reports): bwong@hemmera.com

Contact Name: Brenda Wong/Philip Lowry | Sampler's Name: Brenda Wong

Project Name: Brooks Brook | Project Number: 316-003.04 | Quotation Number: | P.O. Number 316-003.04

Page 1 of 1

RESULTS REQUESTED BY:* regular

Day Month Year

(Surcharges May Apply)

Special Instructions: ☐ AutoFax ☐ AutoEmail ☐ Return Cooler ☐ Ship Sampling Containers (please specify below)

FOR LABORATORY USE ONLY

Please circle options as appropriate → WATER / SOIL

Group Number / Laboratory Number	Sample Identification*	Date Sampled (M / D / Y)	Sample Type	PH	Conductivity	TSS	TDS	Alkalinity (total / spec.)	BOD	COD	Coliform Bacteria Fecal/Total	F Cl SO_4 No_3	Nitrite (No_2)	Nitrate and Nitrite	Oil & Grease (Total / HC)	PCP (Tri, Tetra and Penta)	PCP (Mono and Di)	BETX	VPH	VOC	PAH	EPH (not PAH corrected)	LEPH/HEPH (PAH corrected)	PCB	HOLD - DO NOT ANALYZE	Number of Containers
	BH01-09 SA1	09/27/01	SOIL																						X	1
	BH01-09 SA2																								X	1
	BH01-09 SA3																								X	1
	BH01-09 SA4																								X	1
	DUP 5																								X	1
	BH01-10 SA1																								X	1
	BH01-10 SA2																								X	1
	BH01-10 SA3																								X	1
	BH01-10 SA4																								X	1
	DUP 6																								X	1

Relinquished by: Brenda | Date 9/27/01 | Time | Received by:

* = Required Field | Total Number of Containers:

Method of Shipment: Greyhound | Waybill No.: 113419869 83 | Received for Lab by: | Date | Time

You will be paid directly by our client: ☐

Shipped by: | Shipment Condition: | Cooler opened by: | Date | Time

Company Name:

Address:

Contact: | Postal Code:

Phone: | Fax:

FOR LABORATORY USE ONLY

Sample State at Receipt: ☐ Ambient ☐ Cold ☐ Frozen ☐ N/A Comments:

Temperature °C Shelf Number

WHITE: FOLLOWS REPORT YELLOW: LAB COPY PINK: CLIENT COPY/GENERAL INFORMATION

CHAIN OF CUSTODY RECORD

CANTEST

4606 Canada Way
Burnaby, B.C.
V5G 1K5

Tel: 604.734.7276
Fax: 604.731.2386
Toll Free: 800.665.8566

www.cantest.com
cantest@cantest.com

90287

Client Name: Hemmera EnviroChem — V6Z 2K5

Street Address (including suite number):* Suite 350, 1190 Hornby St — City: Vancouver

Telephone:* 604 669-0424 — Fax: 604 669-0430 — E-Mail Address (Required for "AutoEmail" Reports): bwong@hemmera.com

Contact Name:* Brenda Wong / Philip L. — Sampler's Name: Brenda Wong

Project Name: Brooks Brook — Project Number: 316-003.04 — Quotation Number: — P.O. Number 316-003.04

RESULTS REQUESTED BY:*

regular

Day Month Year

(Surcharges May Apply)

Special Instructions: ☐ AutoFax ☐ AutoEmail ☐ Return Cooler ☐ Ship Sampling Containers (please specify below)

FOR LABORATORY USE ONLY

Please circle options as appropriate →

Group Number / Laboratory Number	Sample Identification*	Date Sampled (M / D / Y)	Sample Type	Metals (AW) ICP T D FF	Metals ALS [illegible]	PH	Conductivity	TSS	TDS	Alkalinity (total / spec.)	BOD	COD	Coliform Bacteria Fecal/Total	F Cl SO_4 No_3	Nitrite (No_2)	Nitrate and Nitrite	Oil & Grease (Total / HC)	PCP (Tri, Tetra and Penta)	PCP (Mono and Di)	BETX	VPH	VOC	PAH	EPH (not PAH corrected)	LEPH/HEPH (PAH corrected)	PCB					HOLD - DO NOT ANALYZE	Number of Containers
	BH01-11 SA1	09/27/01	SOIL																												X	1
	BH01-11 SA2	↓	↓																												X	1
	BH01-11 SA3	↓	↓																												X	1
	BH01-11 SA4	↓	↓																												X	1

Relinquished by: BWong — Date 9/27/01 — Time — Received by:

*** = Required Field** — Total Number of Containers:

Method of Shipment: Greyhound — Waybill No.: 1134198698 3 — Received for Lab by: — Date — Time

You will be paid directly by our client: ☐

Shipped by: — Shipment Condition: — Cooler opened by: — Date — Time

Company Name:

Address:

Contact: — Postal Code:

Phone: — Fax:

FOR LABORATORY USE ONLY

Sample State at Receipt: ☐ Ambient ☐ Cold ☐ Frozen ☐ N/A Comments:

Temperature ____°C Shelf Number ____

WHITE: FOLLOWS REPORT YELLOW: LAB COPY PINK: CLIENT COPY/GENERAL INFORMATION

RECEIVED OCT 2 4 2001

Analysis Report

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Tel: 604 734 7276

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REPORT ON: Analysis of Water Sampling

REPORTED TO: Hemmera Envirochem Inc.
Suite 350
1190 Hornby Street
Vancouver, B.C.
V6Z 2K5

Att'n: Brenda Wong/ Philip Lowery

CHAIN OF CUSTODY: 90278
PROJECT NAME: Brooks Brook
PROJECT NUMBER: 316-003.04
P.O. NUMBER: 316-003.04

NUMBER OF SAMPLES: 8

REPORT DATE: October 16, 2001

DATE SUBMITTED: September 28, 2001

GROUP NUMBER: 10929010

SAMPLE TYPE: Water

TEST METHODS:

Volatile Organic Compounds in Water and Soil - analysis was performed using procedures based on U.S. EPA Methods 624/8240/8260, involving sparging with a Purge and Trap apparatus and analysis using GC/MS.

Volatile Hydrocarbons (VH) and Volatile Petroleum Hydrocarbons (VPH) in Water - analysis was performed using B.C. MOELP CSR-Analytical Method 2 "Volatile Hydrocarbons in Water by GC/FID" and CSR-Analytical Method 5 "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water (VPH)" approved August 12, 1999. The method involves sparging/collection using a Purge & Trap apparatus with GC/FID analysis; VH components ranging from C6 to C10 are quantified against m-xylene and 1,2,4-trimethylbenzene. VPH is calculated by subtraction of specified MAH compounds from VH concentrations.

Conventional Parameters - analyses were performed using procedures based on those described in "British Columbia Environmental Laboratory Manual For the Analysis of Water, Wastewater, Sediment and Biological Materials" (1994 Edition), Province of British Columbia and "Standard Methods for the Examination of Water and Wastewater" 20th Edition, (1998), published by the American Public Health Association.

Extractable Petroleum Hydrocarbons and Light and Heavy Extractable Petroleum Hydrocarbons in Water - analysis was performed using B.C. MOELP CSR-Analytical Method 4 "Extractable Petroleum Hydrocarbons in Water by GC/FID" and CSR-Analytical Method 6 "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water (LEPH & HEPH)". The method involves DCM extraction and GC/FID analysis. EPH components ranging from C10 to C19 and C19 to C32 are quantified against eicosane (n-C20). LEPH & HEPH are calculated by subtraction of specified PAH's.

(Continued)

CANTEST LTD.

Zhenyong Gao, M.Sc.
Coordinator, Trace Organics

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 16, 2001

GROUP NUMBER: 10929010

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Mercury in Water - analysis was performed using procedures based on U. S. EPA Method 1631, oxidative digestion using bromination, and analysis using Cold Vapour Atomic Fluorescence Spectroscopy.

Metals in Water - analysis was performed using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP), Inductively Coupled Plasma-Mass Spectroscopy (ICP/MS) or Graphite Furnace Atomic Absorption Spectrophotometry.

Polynuclear Aromatic Hydrocarbons - analysis was performed using procedures based on U.S. EPA Methods 625/8270, involving extraction, clean-up steps, and analysis using GC/MS.

TEST RESULTS:

(See following pages)

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 16, 2001

GROUP NUMBER: 10929010

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Conventional Parameters in Water

CLIENT SAMPLE IDENTIFICATION:	SAMPLE DATE	CANTEST ID	Hardness CaCO3
H98-18	Sep 23/01	109290094	98
DUP1	Sep 23/01	109290095	99
H97-7	Sep 24/01	109290099	325
DETECTION LIMIT			1
UNITS			mg/L

mg/L = milligrams per liter

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 16, 2001

GROUP NUMBER: 10929010

CANTEST®

Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		H98-18	DUP1	H97-7		
SAMPLE PREPARATION:		DISSOLVED	DISSOLVED	DISSOLVED		
DATE SAMPLED:		Sep 23/01	Sep 23/01	Sep 24/01		
CANTEST ID:		109290094	109290095	109290099	DETECTION LIMIT	UNITS
Aluminum	Al	0.020	0.021	<	0.005	mg/L
Antimony	Sb	<	<	<	0.001	mg/L
Arsenic	As	0.010	0.010	0.004	0.001	mg/L
Barium	Ba	0.076	0.075	0.15	0.001	mg/L
Beryllium	Be	<	<	<	0.001	mg/L
Bismuth	Bi	<	<	<	0.001	mg/L
Boron	B	<	<	<	0.05	mg/L
Cadmium	Cd	<	<	<	0.0002	mg/L
Calcium	Ca	28.6	29.0	87.7	0.05	mg/L
Chromium	Cr	0.002	0.002	0.001	0.001	mg/L
Cobalt	Co	<	<	0.002	0.001	mg/L
Copper	Cu	<	<	<	0.001	mg/L
Iron	Fe	13.1	13.1	2.46	0.05	mg/L
Lead	Pb	<	<	<	0.001	mg/L
Lithium	Li	0.001	0.001	0.003	0.001	mg/L
Magnesium	Mg	6.42	6.39	25.7	0.05	mg/L
Manganese	Mn	0.60	0.60	1.59	0.001	mg/L
Mercury	Hg	0.05	<	<	0.02	µg/L
Molybdenum	Mo	<	<	0.002	0.001	mg/L
Nickel	Ni	<	<	0.006	0.001	mg/L
Phosphorus	PO4	0.49	0.53	0.25	0.01	mg/L
Potassium	K	0.75	0.74	2.36	0.01	mg/L
Selenium	Se	<	<	<	0.002	mg/L
Silicon	SiO2	16.5	16.5	18.9	0.05	mg/L
Silver	Ag	<	<	<	0.0001	mg/L
Sodium	Na	2.66	2.57	41.2	0.05	mg/L
Strontium	Sr	0.11	0.11	0.43	0.001	mg/L
Tellurium	Te	<	<	<	0.001	mg/L
Thallium	Tl	<	<	<	0.0001	mg/L
Thorium	Th	<	<	<	0.0005	mg/L
Tin	Sn	<	<	<	0.001	mg/L

(Continued on next page)

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 16, 2001

GROUP NUMBER: 10929010

CANTEST®

Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		H98-18	DUP1	H97-7		
SAMPLE PREPARATION:		DISSOLVED	DISSOLVED	DISSOLVED		
DATE SAMPLED:		Sep 23/01	Sep 23/01	Sep 24/01		
CANTEST ID:		109290094	109290095	109290099	DETECTION LIMIT	UNITS
Titanium	Ti	0.002	0.002	<	0.001	mg/L
Uranium	U	<	<	0.0026	0.0005	mg/L
Vanadium	V	0.004	0.004	0.003	0.001	mg/L
Zinc	Zn	<	<	<	0.005	mg/L
Zirconium	Zr	<	<	<	0.01	mg/L

mg/L = milligrams per liter
< = Less than detection limit

µg/L = micrograms per liter

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 16, 2001

GROUP NUMBER: 10929010

CANTEST®

Polycyclic Aromatic Hydrocarbons in Water

CLIENT SAMPLE IDENTIFICATION:	H97-16	H98-18	DUP1	H98-20	
DATE SAMPLED:	Sep 23/01	Sep 23/01	Sep 23/01	Sep 24/01	
CANTEST ID:	109290093	109290094	109290095	109290096	DETECTION LIMIT
ANALYSIS DATE:	Oct 8/01	Oct 8/01	Oct 8/01	Oct 8/01	
Naphthalene	<	<	<	<	0.3
Acenaphthylene	<	<	<	<	0.1
Acenaphthene	<	<	<	0.2	0.1
Fluorene	<	<	<	<	0.05
Phenanthrene	<	<	<	<	0.05
Anthracene	<	<	<	<	0.05
Acridine	<	<	<	<	0.05
Total LMW-PAH's				0.2	
Fluoranthene	<	<	<	<	0.05
Pyrene	<	<	<	<	0.02
Benzo(a)anthracene	<	<	<	<	0.01
Chrysene	<	<	<	<	0.01
Benzo(b)fluoranthene	<	<	<	<	0.01
Benzo(k)fluoranthene	<	<	<	<	0.01
Benzo(a)pyrene	<	<	<	<	0.01
Indeno(1,2,3-cd)pyrene	<	<	<	<	0.01
Dibenz(a,h)anthracene	<	<	<	<	0.01
Benzo(g,h,i)perylene	<	<	<	<	0.01
Total HMW-PAH's					
Total PAH's				0.2	

Results expressed as micrograms per liter (μg/L)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 16, 2001

GROUP NUMBER: 10929010

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Monocyclic Aromatic Hydrocarbons in Water

CLIENT SAMPLE IDENTIFICATION:	H97-15	H97-16	H98-18	DUP1	
DATE SAMPLED:	Sep 23/01	Sep 23/01	Sep 23/01	Sep 23/01	
CANTEST ID:	109290081	109290093	109290094	109290095	DETECTION LIMIT
ANALYSIS DATE:	Oct 3/01	Oct 3/01	Oct 3/01	Oct 3/01	
Benzene	0.3	0.3	< 0.5	< 0.5	0.1
Ethylbenzene	0.5	1.3	14	12	0.1
Toluene	<	3.3	< 0.5	< 0.5	0.1
Xylenes	0.4	5.6	48	42	0.1
Volatile Hydrocarbons VHw6-10	<	<	320	310	100
VPHw	<	<	260	260	100
Surrogate Recovery					
Toluene-d8	102	89	92	90	-
Bromofluorobenzene	101	85	97	93	-

Results expressed as micrograms per liter (μg/L)
Surrogate recoveries expressed as percent (%)
< = Less than detection limit
Sample# 109290094 , 109290095 - Detection limits adjusted: Dilution required

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Monocyclic Aromatic Hydrocarbons in Water

CLIENT SAMPLE IDENTIFICATION:	H98-20	H98-25	H98-23	H97-7	
DATE SAMPLED:	Sep 24/01	Sep 24/01	Sep 24/01	Sep 24/01	
CANTEST ID:	109290096	109290097	109290098	109290099	DETECTION LIMIT
ANALYSIS DATE:	Oct 3/01	Oct 3/01	Oct 3/01	Oct 3/01	
Benzene	< 0.5	<	<	<	0.1
Ethylbenzene	0.7	<	0.2	<	0.1
Toluene	< 0.5	<	<	<	0.1
Xylenes	3.7	0.1	1.2	0.2	0.1
Volatile Hydrocarbons VHw6-10	150	<	<	<	100
VPHw	150	<	<	<	100
Surrogate Recovery					
Toluene-d8	92	91	88	88	-
Bromofluorobenzene	96	97	93	94	-

Results expressed as micrograms per liter (µg/L)
Surrogate recoveries expressed as percent (%)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 16, 2001

GROUP NUMBER: 10929010

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Extractable Petroleum Hydrocarbons in Water

CLIENT SAMPLE IDENTIFICATION:	H97-15	H97-16	H98-18	DUP1	
DATE SAMPLED:	Sep 23/01	Sep 23/01	Sep 23/01	Sep 23/01	DETECTION LIMIT
CANTEST ID:	109290081	109290093	109290094	109290095	
EPHw10-19	1500	490	960	780	250
EPHw19-32	<	<	<	<	250
LEPHw (corrected for PAH's)	-	490	960	780	250
HEPHw (corrected for PAH's)	-	<	<	<	250

Results expressed as micrograms per liter (μg/L)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 16, 2001

GROUP NUMBER: 10929010

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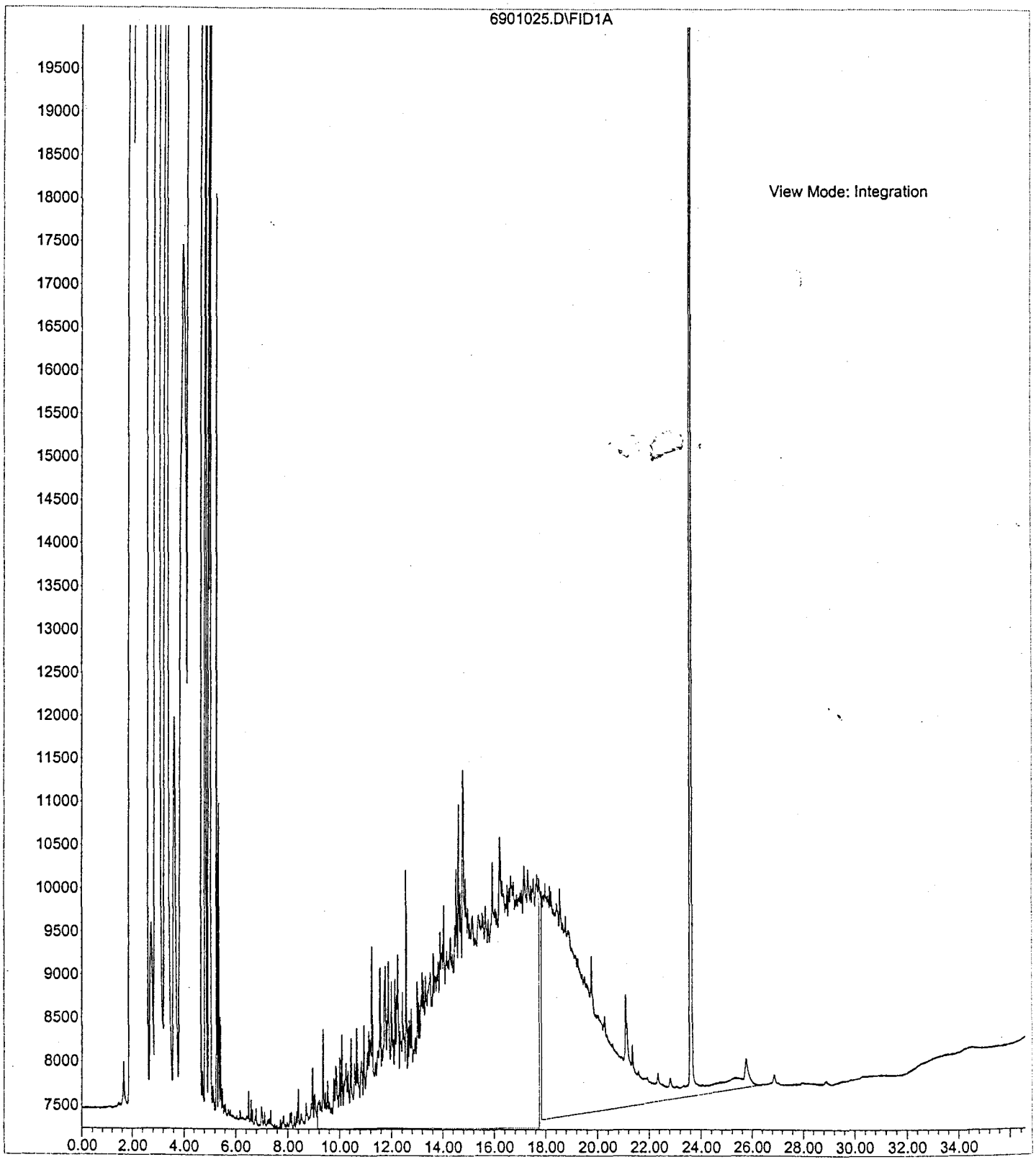
Extractable Petroleum Hydrocarbons in Water

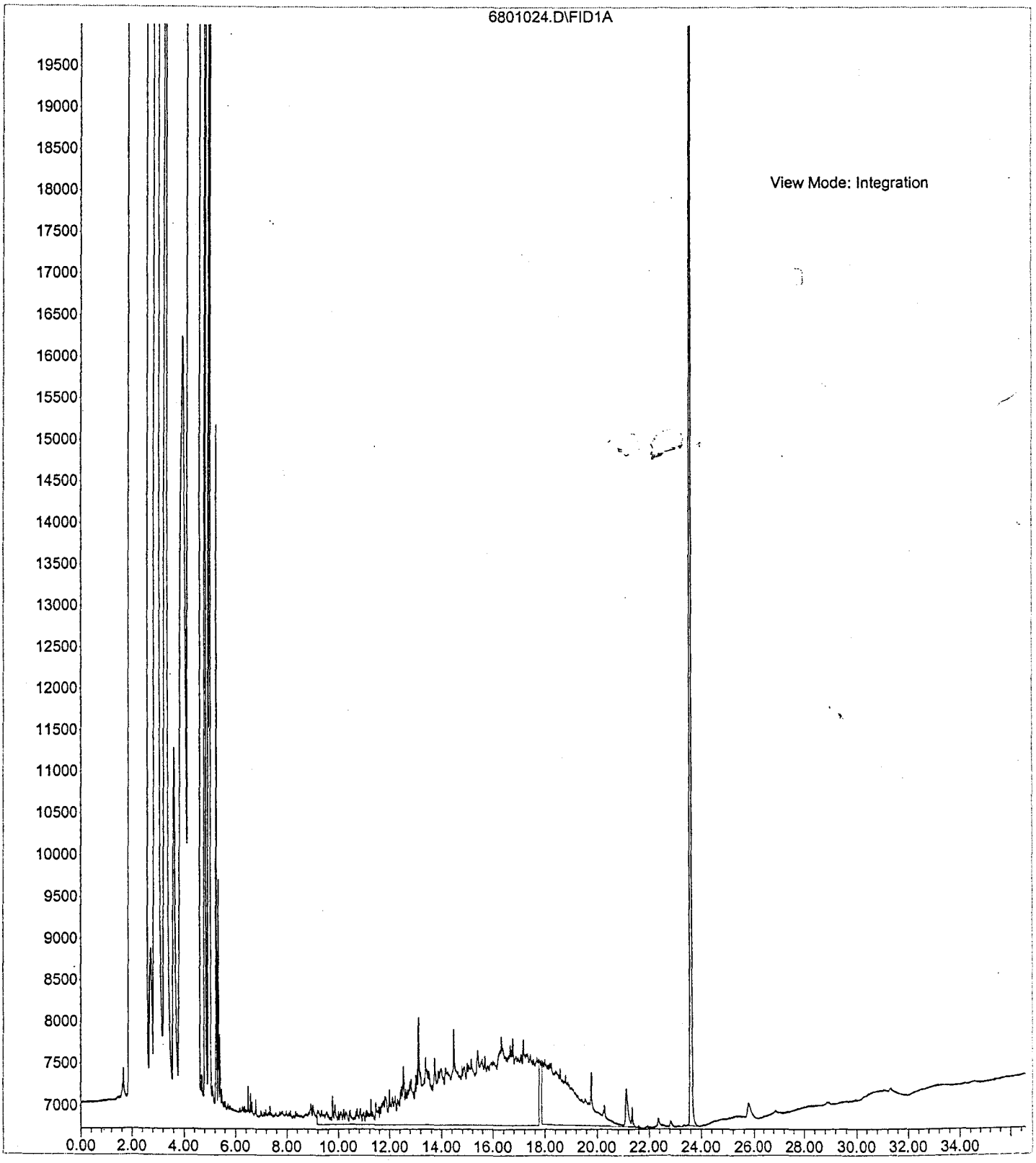
CLIENT SAMPLE IDENTIFICATION:	H98-20	H98-25	H98-23	H97-7	
DATE SAMPLED:	Sep 24/01	Sep 24/01	Sep 24/01	Sep 24/01	DETECTION LIMIT
CANTEST ID:	109290096	109290097	109290098	109290099	
EPHw10-19	1100	<	490	1800	250
EPHw19-32	<	<	<	800	250
LEPHw (corrected for PAH's)	1100	-	490	1800	250
HEPHw (corrected for PAH's)	<	-	<	800	250

Results expressed as micrograms per liter (μg/L)
< = Less than detection limit

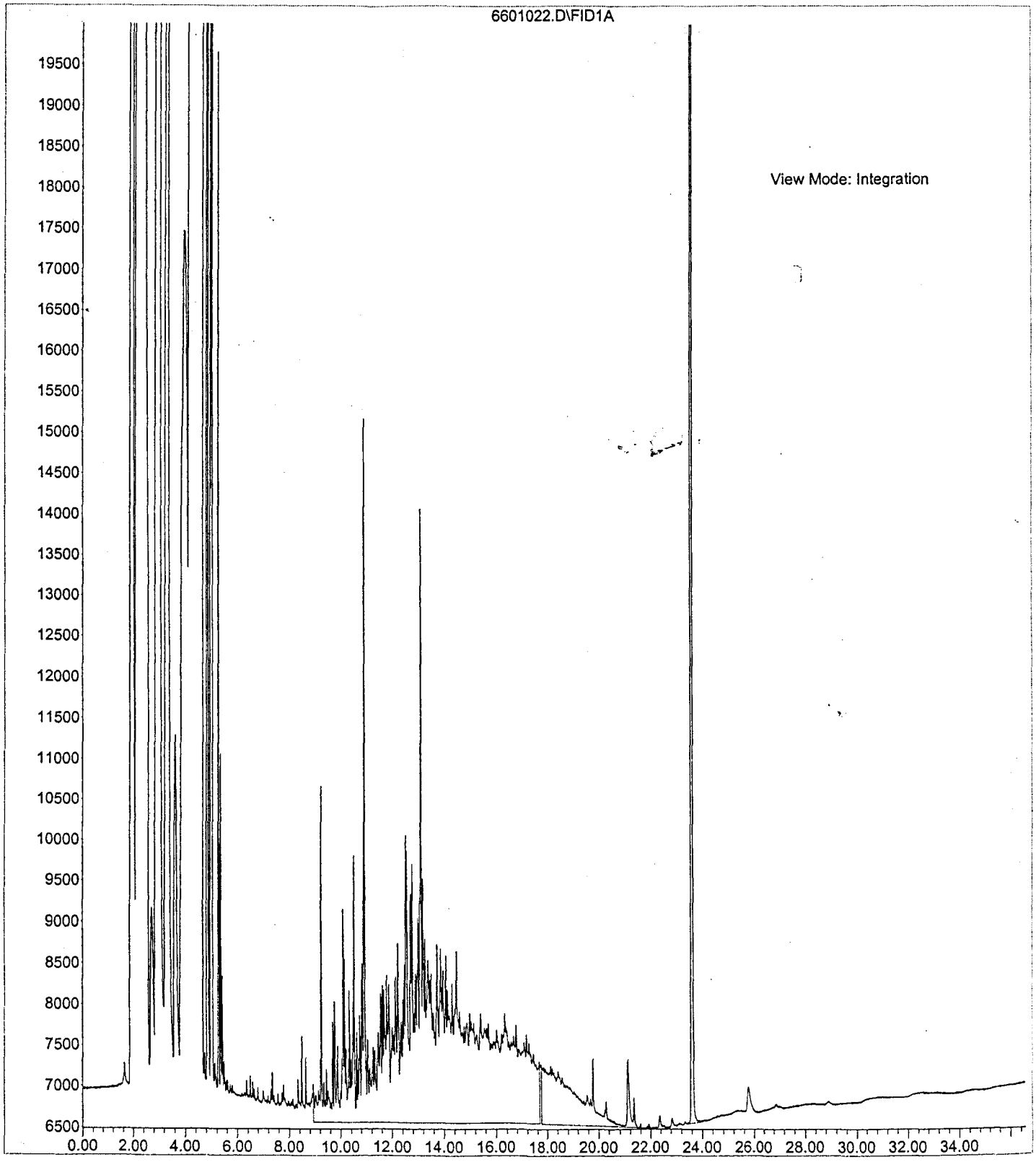
File : C:\HPCHEM\1\DATA\11003EPH\6901025.D
Operator : kf
Acquired : 4 Oct 2001 9:06 using AcqMethod EPH.M
Instrument : HP5890
Sample Name: 109290099
Misc Info :
Vial Number: 69



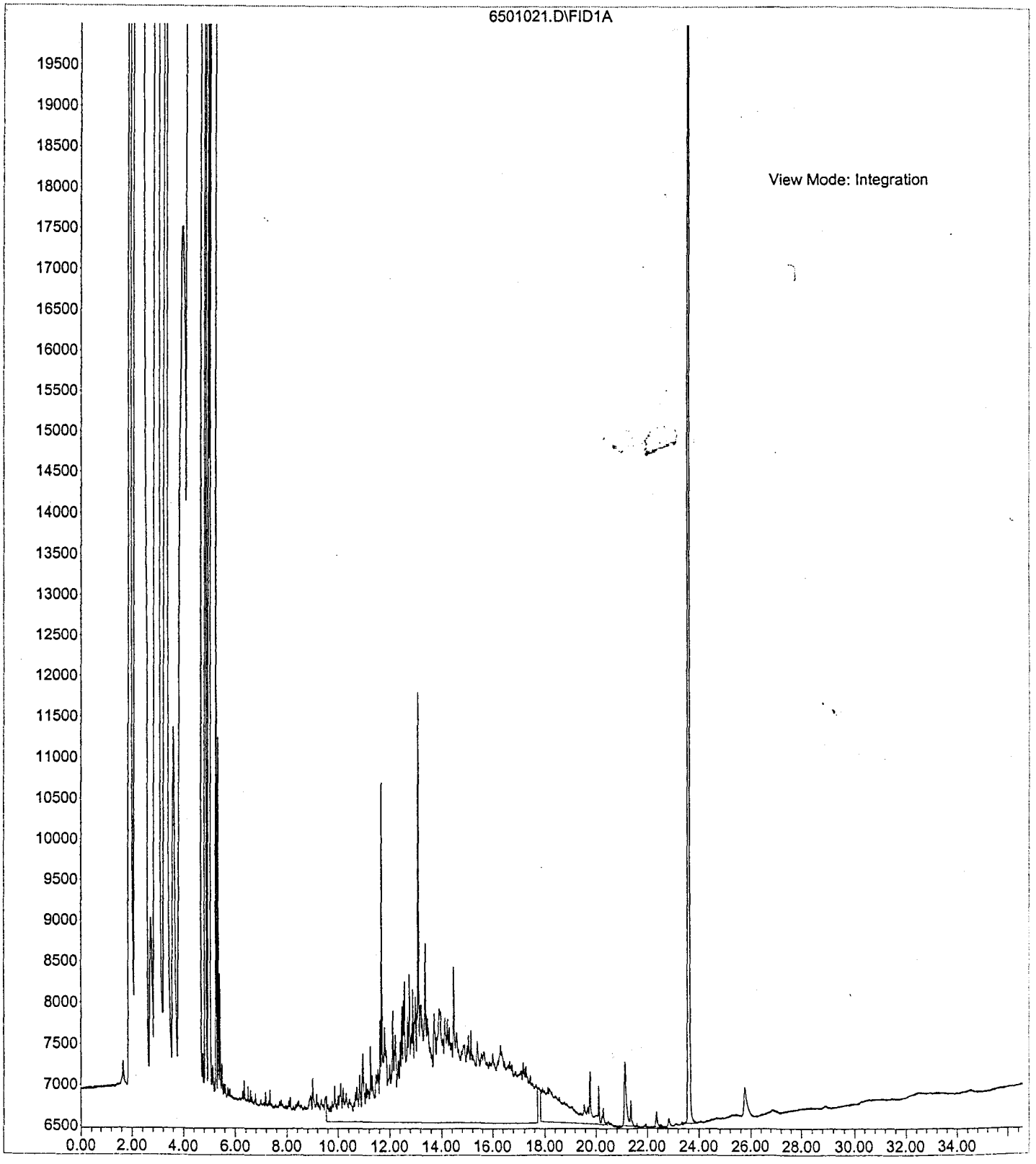
File : C:\HPCHEM\1\DATA\11003EPH\6801024.D
Operator : kf
Acquired : 4 Oct 2001 8:21 using AcqMethod EPH.M
Instrument : HP5890
Sample Name: 109290098
Misc Info :
Vial Number: 68



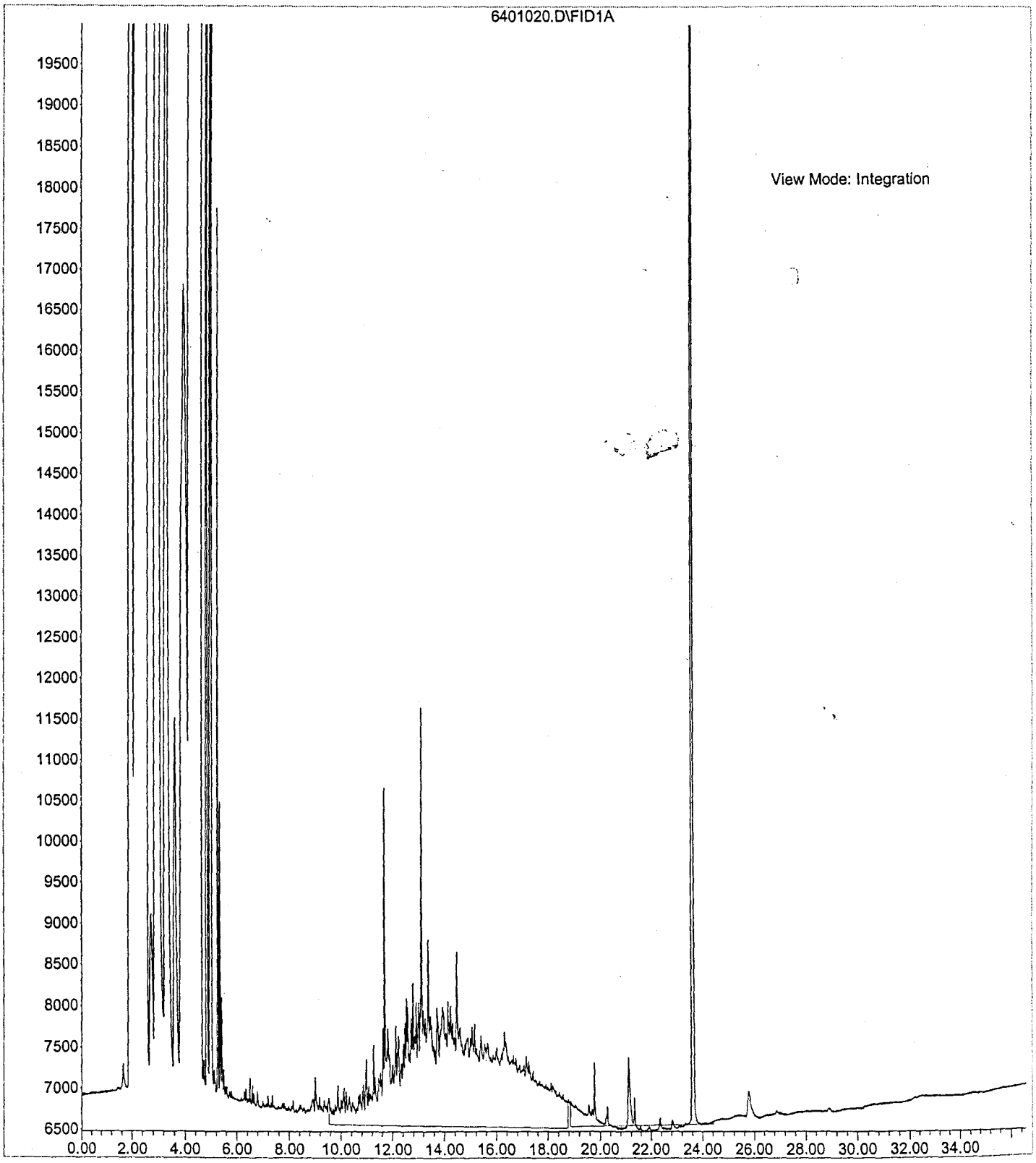
File : C:\HPCHEM\1\DATA\11003EPH\6601022.D
Operator : kf
Acquired : 4 Oct 2001 6:51 using AcqMethod EPH.M
Instrument : HP5890
Sample Name: 109290096
Misc Info :
Vial Number: 66



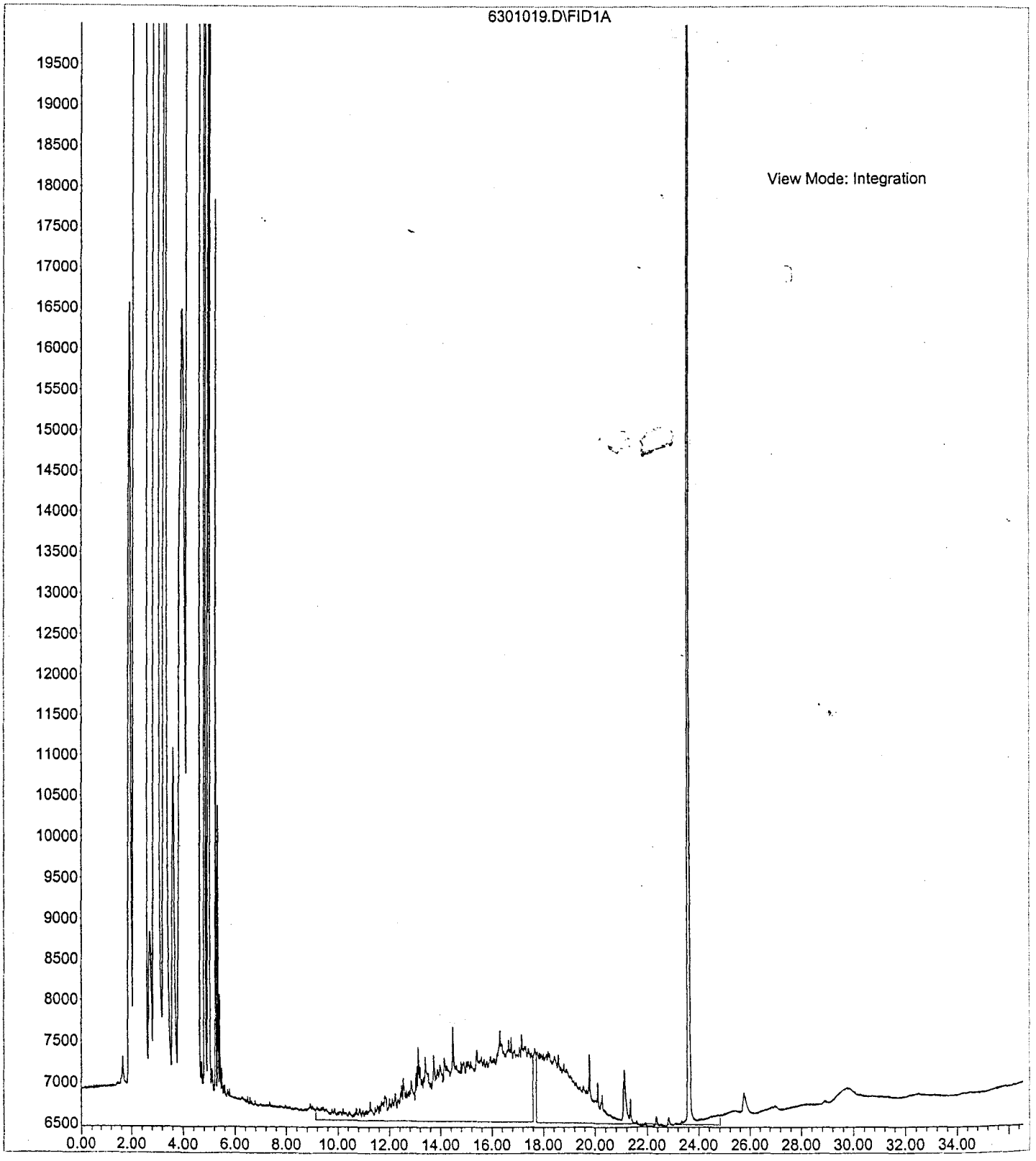
File : C:\HPCHEM\1\DATA\11003EPH\6501021.D
Operator : kf
Acquired : 4 Oct 2001 6:07 using AcqMethod EPH.M
Instrument : HP5890
Sample Name: 109290095
Misc Info :
Vial Number: 65



File : C:\HPCHEM\1\DATA\11003EPH\6401020.D
Operator : kf
Acquired : 4 Oct 2001 5:22 using AcqMethod EPH.M
Instrument : HP5890
Sample Name: 109290094
Misc Info :
Vial Number: 64

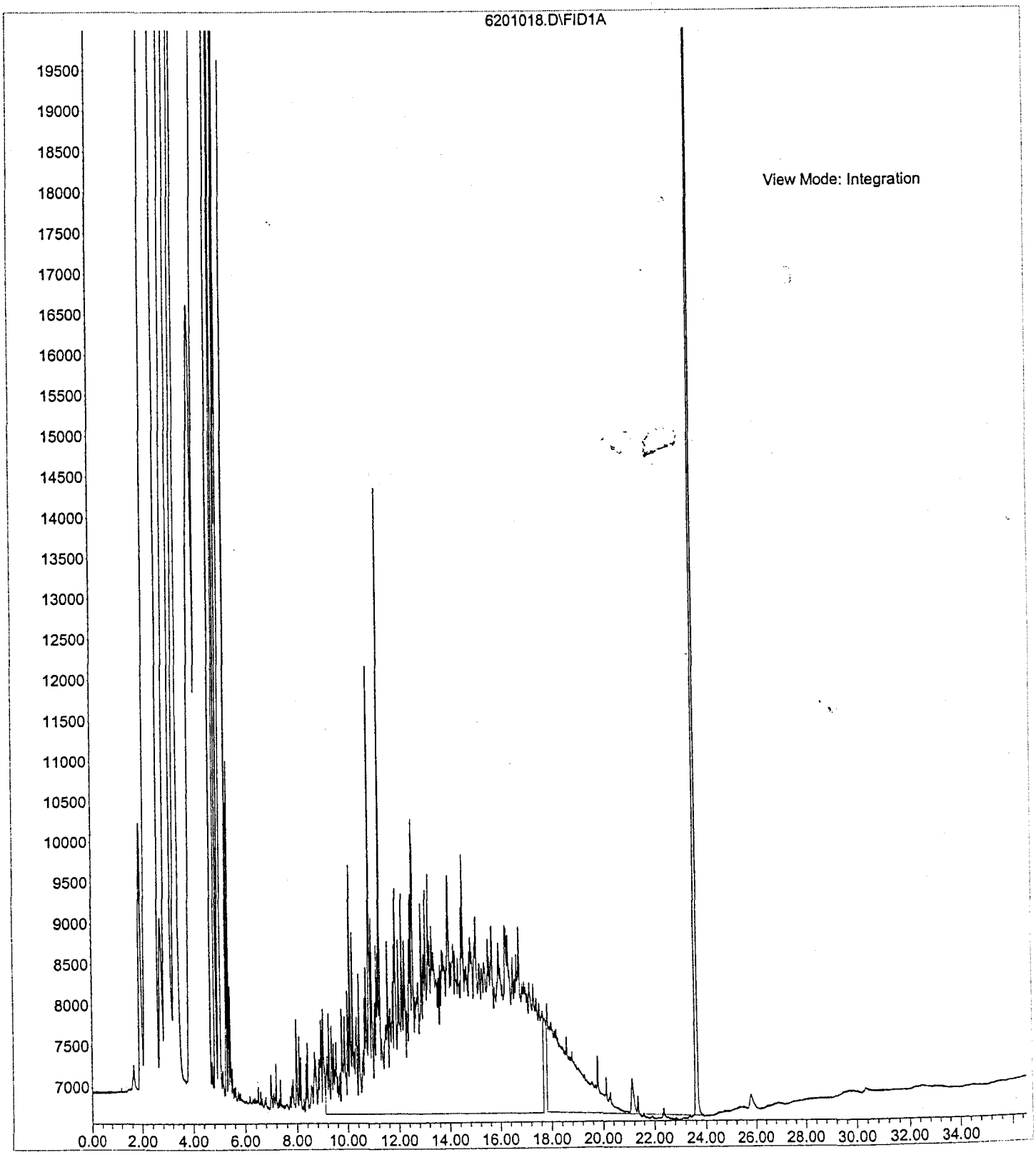


File : C:\HPCHEM\1\DATA\11003EPH\6301019.D
Operator : kf
Acquired : 4 Oct 2001 4:37 using AcqMethod EPH.M
Instrument : HP5890
Sample Name: 109290093
Misc Info :
Vial Number: 63



HEMMERA
10929010

File : C:\HPCHEM\1\DATA\11003EPH\6201018.D
Operator : kf
Acquired : 4 Oct 2001 3:52 using AcqMethod EPH.M
Instrument : HP5890
Sample Name: 109290081
Misc Info :
Vial Number: 62



CHAIN OF COUSTODY RECORD

CANTEST

4606 Canada Way
Burnaby, B.C.
V5G 1K5

Tel: 604.734.7276
Fax: 604.731.2386
Toll Free: 800.665.8566

www.cantest.com
cantest@cantest.com

3 IAGS
3 DM 3HG
90278
16 VOCV

Client Name: Hemmera Envirochem Inc HEM101 V6Z 2K5

Page 1 of 1

Street Address (including suite number):* Suite 350 - 1190 Hornby St,
City: Vancouver

Telephone:* (604) 669-0424
Fax: (604) 669-0430
E-Mail Address (Required for "AutoEmail" Reports): bwong@hemmera.com

Contact Name:* Brenda Wong / Philip Lowery
Sampler's Name: Philip Lowery / Brenda Wong

Project Name: Brooks Brook
Project Number: 316-003.04
Quotation Number:
P.O. Number 316-003.04

RESULTS REQUESTED BY:* Regular

Day Month Year

(Surcharges May Apply)

Special Instructions: ☐ AutoFax ☐ AutoEmail ☐ Return Cooler ☐ Ship Sampling Containers (please specify below)

metals samples have been filtered in field and HNO3 added

FOR LABORATORY USE ONLY

Please circle options as appropriate →

Group Number: 1092900 / Laboratory Number	Sample Identification*	Date Sampled (M / D / Y)	Sample Type	WATER (Metals)	SOIL (Metals)	PH	Conductivity	TSS	TDS	Alkalinity (total / spec.)	BOD	COD	Coliform Bacteria Fecal/Total	F Cl SO_4 No_3	Nitrite (No_2)	Nitrate and Nitrite	Oil & Grease (Total / HC)	PCP (Tri, Tetra and Penta)	PCP (Mono and Di)	BETX	VPH	VOC	PAH	EPH (not PAH corrected)	LEPH/HEPH (PAH corrected)	PCB	HOLD - DO NOT ANALYZE	Number of Containers
0091	H97-15	09/23/01	WATER																	X	X			X				3
0093	H97-16	09/23/01	"																	X	X				X			3
0094	H98-18	09/23/01	"	X																X	X				X			5
0095	DUP1	09/23/01	"	X																X	X				X			5
0096	H98-20	09/24/01	"																	X	X				X			3
0097	H98-25	09/24/01	"																	X	X			X				3
0098	H98-23	09/24/01	"																	X	X				X			3
0099	H97-7	09/24/01	"	X																X	X			~~X~~	X			5

Relinquished by: [signature] Date 09/24/01 Time
Received by:

*** = Required Field**

Total Number of Containers: 30

Method of Shipment: Greyhound
Waybill No.: 1134198696 1
Received for Lab by: [initials] Date Sept 28/01 Time 1015

You will be paid directly by our client: ☐

Shipped by:
Shipment Condition:
Cooler opened by: [initials] Date Sept 29/01 Time 210

Company Name:
Address:
Contact: Postal Code:
Phone: Fax:

FOR LABORATORY USE ONLY
Sample State at Receipt: ☐ Ambient ☐ Cold ☐ Frozen ☐ N/A Comments:
Temperature 2.1 °C Shelf Number

WHITE: FOLLOWS REPORT YELLOW: LAB COPY PINK: CLIENT COPY/GENERAL INFORMATION

Analysis Report

CANTEST®

CANTEST LTD.

Professional
Analytical
Services

4606 Canada Way
Burnaby, B.C.
V5G 1K5

Fax: 604 731 2386

Tel: 604 734 7276

1 800 665 8566

REPORT ON: Analysis of Soil Samples

REPORTED TO: Hemmera Envirochem Inc.
Suite 350
1190 Hornby Street
Vancouver, B.C.
V6Z 2K5

Att'n: Brenda Wong/ Philip Lowery

CHAIN OF CUSTODY: 90279, 90280, 90281, 90284, 90282, 90286, 90287
PROJECT NAME: Brooks Brook
PROJECT NUMBER: 316-003.04

NUMBER OF SAMPLES: 21

REPORT DATE: October 15, 2001

DATE SUBMITTED: September 26, 2001 - October 3, 2001

GROUP NUMBER: 11003069

SAMPLE TYPE: Soil

TEST METHODS:

Volatile Hydrocarbons (VH) in Soil - analysis was performed using B.C. MOELP CSR-Analytical Method 1 "Volatile Hydrocarbons in Solids by GC/FID" approved August 12, 1999. The method involves methanol extraction and direct injection GC/FID analysis; components ranging from C6 to C10 are quantitated against m-xylene and 1,2,4-trimethylbenzene.

Volatile Petroleum Hydrocarbons (VPH) in Soil - results were obtained using B.C. MOELP CSR-Analytical Method Method 5 "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water (VPH)" approved August 12, 1999. VPH is calculated by subtraction of specified MAH compounds from VH concentrations.

Volatile Organic Compounds in Soil - analysis was performed using procedures based on U.S. EPA Methods 624/8240/8260, involving methanol extraction, and direct injection/GCMS analysis.

Moisture in Soil - analysis was performed gravimetrically by heating a separate sample portion at 105 C and measuring the weight loss.

pH in Soil or Solid - analysis was performed based on procedures described in the Manual on Soil Sampling and Methods of Analysis, published by the Canadian Society of Soil Science,1993. The test was performed using a deionized water leach with measurement by pH meter.

Extractable Petroleum Hydrocarbons and Light and Heavy Extractable Petroleum Hydrocarbons in Soil - analysis was performed using B.C. MOELP CSR-Analytical Method 3 "Extractable Petroleum Hydrocarbons in Solids by GC/FID" and CSR-Analytical Method 6 "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water (LEPH & HEPH)". The method involves acetone/hexane extraction and GC/FID analysis. EPH components ranging

(Continued)

CANTEST LTD.

Walter Brandl, B.Sc.
Manager, Environmental Services

Extractable Petroleum Hydrocarbons and Light and Heavy Extractable Petroleum Hydrocarbons in Soil

from C10 to C19 and C19 to C32 are quantified against eicosane (n-C20). LEPH & HEPH are calculated by subtraction of specified PAH's.

Polynuclear Aromatic Hydrocarbons - analysis was performed using procedures based on U.S. EPA Methods 625/8270, involving extraction, clean-up steps, and analysis using GC/MS.

Cadmium in Soil - analysis was performed using background-corrected Flame Atomic Absorption Spectrophotometry.

Mercury in Soil - analysis was performed using Cold Vapour Atomic Fluorescence.

Strong Acid Leachable Metals in Soil - analysis was performed using B.C. MOELP Method "Strong Acid Leachable Metals in Soil, Version 1.0". The method involves drying the sample at 60 C, sieving using a 2 mm (10 mesh) sieve and digestion using a mixture of hydrochloric and nitric acids. Analysis was performed using Inductively Coupled Argon Plasma Spectroscopy (ICAP) or by specific techniques as described.

Selenium in Soil - analysis was performed using Graphite Furnace Atomic Absorption Spectrophotometry.

TEST RESULTS:

(See following pages)

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

Conventional Parameters in Soil

CLIENT SAMPLE IDENTIFICATION:	SAMPLE DATE	CANTEST ID	Moisture	pH
BH01-01 SA3	Sep 24/01	110030413	5.5	-
MW01-02 SA2	Sep 25/01	110030418	3.6	6.8
MW01-03 SA2	Sep 25/01	110030420	4.0	-
MW01-04 SA3	Sep 25/01	110030421	21.5	-
MW01-05 SA4	Sep 25/01	110030423	15.5	-
MW01-06 SA3	Sep 26/01	110030426	14.9	-
MW01-07 SA2	Sep 26/01	110030429	8.4	-
MW01-07 SA3	Sep 26/01	110030430	20.5	7.4
DUP 2	Sep 26/01	110030431	20.0	7.6
MW01-08 SA1	Sep 26/01	110030432	14.5	-
MW01-08 SA3	Sep 26/01	110030434	19.9	-
SED-UP	Sep 24/01	110030436	15.5	7.5
SED-ADJ	Sep 24/01	110030437	31.8	7.0
SED-DN	Sep 24/01	110030438	10.6	-
SURFACE 1	Sep 24/01	110030439	7.1	7.2
SURFACE 2	Sep 24/01	110030440	7.9	-
SURFACE 3	Sep 24/01	110030441	8.9	-
BH01-09 SA3	Sep 27/01	110030442	20.6	7.6
DUP 5	Sep 27/01	110030443	20.6	7.9
BH01-10 SA2	Sep 27/01	110030444	21.3	-
BH01-11 SA3	Sep 27/01	110030445	21.2	-
DETECTION LIMIT			0.1	0.1
UNITS			%	pH units

% = percent

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

Monocyclic Aromatic Hydrocarbons-Direct Injection- in Soil

CLIENT SAMPLE IDENTIFICATION:	BH01-01 SA3	MW01-02 SA2	MW01-03 SA2	MW01-04 SA3	
DATE SAMPLED:	Sep 24/01	Sep 25/01	Sep 25/01	Sep 25/01	DETECTION LIMIT
CANTEST ID:	110030413	110030418	110030420	110030421	
Benzene	<	<	<	<	0.04
Ethylbenzene	<	<	<	<	0.5
Toluene	<	<	<	<	0.5
Xylenes	<	<	<	<	0.5
Styrene	<	<	<	<	0.5

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

Monocyclic Aromatic Hydrocarbons-Direct Injection- in Soil

CLIENT SAMPLE IDENTIFICATION:	MW01-05 SA4	MW01-06 SA3	MW01-07 SA2	MW01-07 SA3	
DATE SAMPLED:	Sep 25/01	Sep 26/01	Sep 26/01	Sep 26/01	DETECTION LIMIT
CANTEST ID:	110030423	110030426	110030429	110030430	
Benzene	<	<	<	<	0.04
Ethylbenzene	<	<	<	<	0.5
Toluene	<	<	<	<	0.5
Xylenes	<	<	<	<	0.5
Styrene	<	<	<	<	0.5

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

Monocyclic Aromatic Hydrocarbons-Direct Injection- in Soil

CLIENT SAMPLE IDENTIFICATION:	DUP 2	MW01-08 SA1	MW01-08 SA3	SED-UP	
DATE SAMPLED:	Sep 26/01	Sep 26/01	Sep 26/01	Sep 24/01	DETECTION LIMIT
CANTEST ID:	110030431	110030432	110030434	110030436	
Benzene	<	<	<	<	0.04
Ethylbenzene	<	<	<	<	0.5
Toluene	<	<	<	<	0.5
Xylenes	<	<	<	<	0.5
Styrene	<	<	<	<	0.5

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

Monocyclic Aromatic Hydrocarbons-Direct Injection- in Soil

CLIENT SAMPLE IDENTIFICATION:	SED-ADJ	SED-DN	SURFACE 1	SURFACE 2	
DATE SAMPLED:	Sep 24/01	Sep 24/01	Sep 24/01	Sep 24/01	DETECTION LIMIT
CANTEST ID:	110030437	110030438	110030439	110030440	
Benzene	<	<	<	<	0.04
Ethylbenzene	<	<	<	<	0.5
Toluene	<	<	<	<	0.5
Xylenes	<	<	<	<	0.5
Styrene	<	<	<	<	0.5

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

CANTEST®

Monocyclic Aromatic Hydrocarbons-Direct Injection- in Soil

CLIENT SAMPLE IDENTIFICATION:	**SURFACE 3**	**BH01-09 SA3**	**DUP 5**	**BH01-10 SA2**	
DATE SAMPLED:	Sep 24/01	Sep 27/01	Sep 27/01	Sep 27/01	DETECTION LIMIT
CANTEST ID:	110030441	110030442	110030443	110030444	
Benzene	<	<	<	<	0.04
Ethylbenzene	<	<	<	<	0.5
Toluene	<	<	<	<	0.5
Xylenes	<	<	<	<	0.5
Styrene	<	<	<	<	0.5

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

Polycyclic Aromatic Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	MW01-02 SA2	MW01-05 SA4	MW01-06 SA3	MW01-07 SA3	DETECTION LIMIT
DATE SAMPLED:	Sep 25/01	Sep 25/01	Sep 26/01	Sep 26/01	
CANTEST ID:	110030418	110030423	110030426	110030430	
ANALYSIS DATE:	Oct 11/01	Oct 10/01	Oct 12/01	Oct 11/01	
Naphthalene	< 0.5	<	0.80	0.7	0.05
Acenaphthylene	< 0.5	<	<	<	0.05
Acenaphthene	< 0.5	<	<	<	0.05
Fluorene	< 0.5	<	0.29	<	0.05
Phenanthrene	< 0.5	<	0.14	<	0.05
Anthracene	< 0.5	<	<	<	0.05
Total LMW-PAH's			1.23	0.7	
Fluoranthene	< 0.5	<	<	<	0.05
Pyrene	< 0.5	<	<	<	0.05
Benzo(a)anthracene	< 0.5	<	<	<	0.05
Chrysene	< 0.5	<	<	<	0.05
Benzo(b)fluoranthene	< 0.5	<	<	<	0.05
Benzo(k)fluoranthene	< 0.5	<	<	<	0.05
Benzo(a)pyrene	< 0.5	<	<	<	0.05
Indeno(1,2,3-cd)pyrene	< 0.5	<	<	<	0.05
Dibenz(a,h)anthracene	< 0.5	<	<	<	0.05
Benzo(g,h,i)perylene	< 0.5	<	<	<	0.05
Total HMW-PAH's					
Total PAH's			1.23	0.70	

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit
Sample# 110030418 - Detection limits adjusted: Interference present in sample

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

Polycyclic Aromatic Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	DUP 2	MW01-08 SA3	SED-ADJ	SURFACE 2	
DATE SAMPLED:	Sep 26/01	Sep 26/01	Sep 24/01	Sep 24/01	
CANTEST ID:	110030431	110030434	110030437	110030440	DETECTION LIMIT
ANALYSIS DATE:	Oct 11/01	Oct 10/01	Oct 11/01	Oct 10/01	
Naphthalene	0.50	<	<	<	0.05
Acenaphthylene	<	<	<	<	0.05
Acenaphthene	<	<	<	<	0.05
Fluorene	0.06	<	<	<	0.05
Phenanthrene	<	<	<	<	0.05
Anthracene	<	<	<	<	0.05
Total LMW-PAH's	0.56				
Fluoranthene	<	<	<	<	0.05
Pyrene	<	<	<	<	0.05
Benzo(a)anthracene	<	<	<	<	0.05
Chrysene	<	<	<	<	0.05
Benzo(b)fluoranthene	<	<	<	<	0.05
Benzo(k)fluoranthene	<	<	<	<	0.05
Benzo(a)pyrene	<	<	<	<	0.05
Indeno(1,2,3-cd)pyrene	<	<	<	<	0.05
Dibenz(a,h)anthracene	<	<	<	<	0.05
Benzo(g,h,i)perylene	<	<	<	<	0.05
Total HMW-PAH's					
Total PAH's	0.56				

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

Polycyclic Aromatic Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	**BH01-09 SA3**	
DATE SAMPLED:	Sep 27/01	
CANTEST ID:	110030442	DETECTION LIMIT
ANALYSIS DATE:	Oct 11/01	
Naphthalene	<	0.05
Acenaphthylene	<	0.05
Acenaphthene	<	0.05
Fluorene	<	0.05
Phenanthrene	<	0.05
Anthracene	<	0.05
Total LMW-PAH's		
Fluoranthene	<	0.05
Pyrene	<	0.05
Benzo(a)anthracene	<	0.05
Chrysene	<	0.05
Benzo(b)fluoranthene	<	0.05
Benzo(k)fluoranthene	<	0.05
Benzo(a)pyrene	<	0.05
Indeno(1,2,3-cd)pyrene	<	0.05
Dibenz(a,h)anthracene	<	0.05
Benzo(g,h,i)perylene	<	0.05
Total HMW-PAH's		
Total PAH's		

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

Extractable Petroleum Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	BH01-01 SA3	MW01-02 SA2	MW01-03 SA2	MW01-04 SA3	
DATE SAMPLED:	Sep 24/01	Sep 25/01	Sep 25/01	Sep 25/01	DETECTION LIMIT
CANTEST ID:	110030413	110030418	110030420	110030421	
EPHs10-19	<	6100	<	<	250
EPHs19-32	<	1000	<	<	250
LEPHs (corrected for PAH's)	-	6100	-	-	250
HEPHs (corrected for PAH's)	-	1000	-	-	250

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

Extractable Petroleum Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	MW01-05 SA4	MW01-06 SA3	MW01-07 SA2	MW01-07 SA3	
DATE SAMPLED:	Sep 25/01	Sep 26/01	Sep 26/01	Sep 26/01	DETECTION LIMIT
CANTEST ID:	110030423	110030426	110030429	110030430	
EPHs10-19	<	1500	670	<	250
EPHs19-32	<	930	4500	<	250
LEPHs (corrected for PAH's)	<	1500	-	<	250
HEPHs (corrected for PAH's)	<	930	-	<	250

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

CANTEST®

Extractable Petroleum Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	DUP 2	MW01-08 SA1	MW01-08 SA3	SED-UP	
DATE SAMPLED:	Sep 26/01	Sep 26/01	Sep 26/01	Sep 24/01	DETECTION LIMIT
CANTEST ID:	110030431	110030432	110030434	110030436	
EPHs10-19	<	8000	<	<	250
EPHs19-32	<	580	<	<	250
LEPHs (corrected for PAH's)	<	-	<	-	250
HEPHs (corrected for PAH's)	<	-	<	-	250

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

Extractable Petroleum Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	SED-ADJ	SED-DN	SURFACE 1	SURFACE 2	
DATE SAMPLED:	Sep 24/01	Sep 24/01	Sep 24/01	Sep 24/01	DETECTION LIMIT
CANTEST ID:	110030437	110030438	110030439	110030440	
EPHs10-19	<	<	<	<	250
EPHs19-32	<	<	<	<	250
LEPHs (corrected for PAH's)	<	-	-	<	250
HEPHs (corrected for PAH's)	<	-	-	<	250

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

CANTEST®

Extractable Petroleum Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	SURFACE 3	BH01-09 SA3	DUP 5	BH01-10 SA2	
DATE SAMPLED:	Sep 24/01	Sep 27/01	Sep 27/01	Sep 27/01	DETECTION LIMIT
CANTEST ID:	110030441	110030442	110030443	110030444	
EPHs10-19	<	<	<	<	250
EPHs19-32	<	<	<	<	250
LEPHs (corrected for PAH's)	-	<	-	-	250
HEPHs (corrected for PAH's)	-	<	-	-	250

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

Extractable Petroleum Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	**BH01-11 SA3**	
DATE SAMPLED:	Sep 27/01	DETECTION LIMIT
CANTEST ID:	110030445	
EPHs10-19	<	250
EPHs19-32	<	250

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

Monocyclic Aromatic Hydrocarbons-Methanol Extraction- in Soil

CLIENT SAMPLE IDENTIFICATION:	SAMPLE DATE	CANTEST ID	Volatile Hydrocarbons VHs6-10	VPHs
BH01-01 SA3	Sep 24/01	110030413	<	<
MW01-02 SA2	Sep 25/01	110030418	130	270
MW01-03 SA2	Sep 25/01	110030420	<	<
MW01-04 SA3	Sep 25/01	110030421	<	<
MW01-05 SA4	Sep 25/01	110030423	<	<
MW01-06 SA3	Sep 26/01	110030426	<	<
MW01-07 SA2	Sep 26/01	110030429	<	<
MW01-07 SA3	Sep 26/01	110030430	<	<
DUP 2	Sep 26/01	110030431	<	<
MW01-08 SA1	Sep 26/01	110030432	270	270
MW01-08 SA3	Sep 26/01	110030434	<	<
SED-UP	Sep 24/01	110030436	<	<
SED-ADJ	Sep 24/01	110030437	<	<
SED-DN	Sep 24/01	110030438	<	<
SURFACE 1	Sep 24/01	110030439	<	<
SURFACE 2	Sep 24/01	110030440	<	<
SURFACE 3	Sep 24/01	110030441	<	<
BH01-09 SA3	Sep 27/01	110030442	<	<
DUP 5	Sep 27/01	110030443	<	<
BH01-10 SA2	Sep 27/01	110030444	<	<
BH01-11 SA3	Sep 27/01	110030445	<	<
DETECTION LIMIT			100	100
UNITS			µg/g	µg/g

µg/g = micrograms per gram, on a dry weight basis.
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

CSR Metals Analysis in Soil

CLIENT SAMPLE IDENTIFICATION:		MW01-02 SA2	MW01-07 SA3	DUP 2	SED-UP	
DATE SAMPLED:		Sep 25/01	Sep 26/01	Sep 26/01	Sep 24/01	DETECTION LIMIT
CANTEST ID:		110030418	110030430	110030431	110030436	
Antimony	Sb	<	<	<	<	10
Arsenic	As	<	<	<	<	10
Barium	Ba	47	128	108	34	1
Beryllium	Be	<	<	<	<	1
Cadmium	Cd	<	<	<	<	0.3
Chromium	Cr	19	32	29	16	2
Cobalt	Co	3	1	2	1	1
Copper	Cu	15	19	18	6	1
Lead	Pb	<	<	<	<	30
Mercury	Hg	0.057	0.084	0.081	0.030	0.001
Molybdenum	Mo	<	<	<	<	4
Nickel	Ni	15	37	34	13	2
Selenium	Se	<	<	<	<	3
Silver	Ag	<	<	<	<	2
Tin	Sn	<	<	<	<	5
Vanadium	V	26	27	25	16	1
Zinc	Zn	23	35	31	16	1
Aluminum	Al	6580	6460	5510	4060	10
Boron	B	<	<	<	30	1
Calcium	Ca	2470	9350	7680	2080	1
Iron	Fe	15700	18300	16500	9710	2
Magnesium	Mg	5320	7400	6910	3510	0.1
Manganese	Mn	230	335	277	197	1
Phosphorus	PO4	1010	1320	1140	715	20
Potassium	K	276	548	474	258	10
Sodium	Na	47	135	106	20	5
Strontium	Sr	9	40	36	9	1
Titanium	Ti	238	667	543	235	1
Zirconium	Zr	3	8	7	2	1

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

CSR Metals Analysis in Soil

CLIENT SAMPLE IDENTIFICATION:		SED-ADJ	SURFACE 1	BH01-09 SA3	DUP 5	
DATE SAMPLED:		Sep 24/01	Sep 24/01	Sep 27/01	Sep 27/01	DETECTION LIMIT
CANTEST ID:		110030437	110030439	110030442	110030443	
Antimony	Sb	<	<	<	<	10
Arsenic	As	<	<	<	<	10
Barium	Ba	72	70	146	159	1
Beryllium	Be	<	<	<	<	1
Cadmium	Cd	<	<	<	<	0.3
Chromium	Cr	19	24	35	37	2
Cobalt	Co	2	2	2	2	1
Copper	Cu	9	15	23	24	1
Lead	Pb	<	<	<	<	30
Mercury	Hg	0.050	0.041	0.083	0.099	0.001
Molybdenum	Mo	<	<	<	<	4
Nickel	Ni	17	24	40	41	2
Selenium	Se	<	<	<	<	3
Silver	Ag	<	<	<	<	2
Tin	Sn	<	<	<	<	5
Vanadium	V	17	22	29	32	1
Zinc	Zn	23	27	41	43	1
Aluminum	Al	4660	6190	7300	8040	10
Boron	B	34	<	<	<	1
Calcium	Ca	3220	3010	11000	11600	1
Iron	Fe	11700	14300	20100	21500	2
Magnesium	Mg	3940	5600	8520	8740	0.1
Manganese	Mn	570	239	373	389	1
Phosphorus	PO4	1040	932	1240	1420	20
Potassium	K	452	395	629	649	10
Sodium	Na	32	55	117	158	5
Strontium	Sr	16	12	44	48	1
Titanium	Ti	254	328	699	802	1
Zirconium	Zr	2	4	9	8	1

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

Batch Quality Control for Monocyclic Aromatic Hydrocarbons-Methanol Extraction- in Soil (QC# 26686)

Parameter	Blank (ug/g)	Blank Limits
Volatile Hydrocarbons VHs6-10	< 100	100

ug/g = micrograms per gram

CANTEST®

Batch Quality Control for Monocyclic Aromatic Hydrocarbons-Direct Injection- in Soil (QC# 26686)

Parameter	Blank (ug/g)	Blank Limits	Method Performance Check Spike (% Recovery)	Method Performance Check Spike Limits
Benzene	< 0.04	0.5	103	80 - 120
Ethylbenzene	< 0.5	0.5	93	80 - 120
Toluene	< 0.5	0.5	92	80 - 120
Xylenes	< 0.5	0.5	-	-
Styrene	< 0.5	0.5	-	-

ug/g = micrograms per gram

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

Batch Quality Control for Extractable Petroleum Hydrocarbons in Soil (QC# 26584)

Parameter	Blank (ug/g)	Blank Limits	Duplicate (R.P.D.) 110030262	Duplicate Limits
EPHs10-19	< 250	250	NC	20
EPHs19-32	< 250	250	NC	20

ug/g = micrograms per gram
R.P.D. = Relative Percent Difference
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

CANTEST®

Batch Quality Control for Extractable Petroleum Hydrocarbons in Soil (QC# 26594)

Parameter	Blank (ug/g)	Blank Limits	Duplicate (R.P.D.) 110040361	Duplicate Limits
EPHs10-19	< 250	250	NC	20
EPHs19-32	< 250	250	NC	20

ug/g = micrograms per gram
R.P.D. = Relative Percent Difference
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

CANTEST®

Batch Quality Control for Polycyclic Aromatic Hydrocarbons in Soil (QC# 26573)

Parameter	Blank (ug/g)	Blank Limits	NRC HS-5 Cert. Ref. Material (% Recovery)	NRC HS-5 Cert. Ref. Material Limits
Naphthalene	< 0.05	0.05	88	57 - 111
Acenaphthylene	< 0.05	0.05	73	45 - 135
Acenaphthene	< 0.05	0.05	-	-
Fluorene	< 0.05	0.05	-	-
Phenanthrene	< 0.05	0.05	58	49 - 97
Anthracene	< 0.05	0.05	79	54 - 129
Fluoranthene	< 0.05	0.05	67	59 - 124
Pyrene	< 0.05	0.05	52	46 - 84
Benzo(a)anthracene	< 0.05	0.05	-	-
Chrysene	< 0.05	0.05	61	53 - 114
Benzo(b)fluoranthene	< 0.05	0.05	-	-
Benzo(a)pyrene	< 0.05	0.05	-	-
Indeno(1,2,3-cd)pyrene	< 0.05	0.05	57	49 - 102
Dibenz(a,h)anthracene	< 0.05	0.05	90	61 - 126
Benzo(g,h,i)perylene	< 0.05	0.05	-	-

ug/g = micrograms per gram

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

Batch Quality Control for Polycyclic Aromatic Hydrocarbons in Soil (QC# 26576)

Parameter	Blank (ug/g)	Blank Limits	Duplicate (R.P.D.) 110040020	Duplicate Limits	NRC HS-5 Cert. Ref. Material (% Recovery)	NRC HS-5 Cert. Ref. Material Limits
Naphthalene	< 0.05	0.05	NC	40	80	57 - 111
Acenaphthylene	< 0.05	0.05	NC	40	80	45 - 135
Acenaphthene	< 0.05	0.05	NC	40	-	-
Fluorene	< 0.05	0.05	NC	40	-	-
Phenanthrene	< 0.05	0.05	NC	40	62	49 - 97
Anthracene	< 0.05	0.05	NC	40	100	54 - 129
Fluoranthene	< 0.05	0.05	NC	40	71	59 - 124
Pyrene	< 0.05	0.05	NC	40	55	46 - 84
Benzo(a)anthracene	< 0.05	0.05	NC	40	-	-
Chrysene	< 0.05	0.05	NC	40	86	53 - 114
Benzo(b)fluoranthene	< 0.05	0.05	NC	40	-	-
Benzo(a)pyrene	< 0.05	0.05	NC	40	-	-
Indeno(1,2,3-cd)pyrene	< 0.05	0.05	NC	40	65	49 - 102
Dibenz(a,h)anthracene	< 0.05	0.05	NC	40	85	61 - 126
Benzo(g,h,i)perylene	< 0.05	0.05	NC	40	-	-

ug/g = micrograms per gram
R.P.D. = Relative Percent Difference
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

Batch Quality Control for CSR Metals Analysis in Soil (QC# 26627)

Parameter		Duplicate (R.P.D.) 110030221	Duplicate Limits	Duplicate (R.P.D.) 110030231	Duplicate Limits	Duplicate (R.P.D.) 110030255	Duplicate Limits
Antimony	Sb	NC	30	NC	30	NC	30
Arsenic	As	NC	30	NC	30	NC	30
Barium	Ba	10.7	30	2.6	30	0	30
Beryllium	Be	PASS	30	PASS	30	PASS	30
Cadmium	Cd	NC	30	17.3	30	NC	30
Chromium	Cr	PASS	30	0	30	PASS	30
Cobalt	Co	NC	30	NC	30	NC	30
Copper	Cu	16.7	30	8.5	30	PASS	30
Lead	Pb	PASS	30	PASS	30	NC	30
Mercury	Hg	0	30	4	30	15.9	30
Molybdenum	Mo	NC	30	NC	30	NC	30
Nickel	Ni	PASS	30	PASS	30	PASS	30
Selenium	Se	NC	30	NC	30	NC	30
Tin	Sn	NC	30	NC	30	NC	30
Vanadium	V	5.7	30	12.5	30	0	30
Zinc	Zn	0	30	4.4	30	0	30

ug/g = micrograms per gram
R.P.D. = Relative Percent Difference
PASS = Duplicate sample results were in the range of one to five times the detection limit. R.P.D. calculation is not applicable in this range. Acceptance criteria is a maximum difference between the duplicates equivalent to the value of the detection limit.
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

Batch Quality Control for CSR Metals Analysis in Soil (QC# 26627)

Parameter		Duplicate (R.P.D.) 110030457	Duplicate Limits	Duplicate (R.P.D.) 110030469	Duplicate Limits	Duplicate (R.P.D.) 110040056	Duplicate Limits
Antimony	Sb	NC	30	NC	30	NC	30
Barium	Ba	5.9	30	3.3	30	8.5	30
Beryllium	Be	PASS	30	PASS	30	NC	30
Chromium	Cr	7.8	30	0	30	4.4	30
Cobalt	Co	NC	30	NC	30	NC	30
Copper	Cu	5.2	30	12.8	30	0	30
Lead	Pb	7.3	30	6.9	30	NC	30
Mercury	Hg	18.2	30	0	30	4.3	30
Molybdenum	Mo	4.5	30	6.5	30	NC	30
Nickel	Ni	PASS	30	PASS	30	9.5	30
Tin	Sn	4.8	30	6.3	30	NC	30
Vanadium	V	0	30	7.4	30	10	30
Zinc	Zn	6.8	30	4.8	30	6.9	30

ug/g = micrograms per gram
R.P.D. = Relative Percent Difference
PASS = Duplicate sample results were in the range of one to five times the detection limit. R.P.D. calculation is not applicable in this range. Acceptance criteria is a maximum difference between the duplicates equivalent to the value of the detection limit.
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

Batch Quality Control for CSR Metals Analysis in Soil (QC# 26627)

Parameter		Duplicate (R.P.D.) 110040058	Duplicate Limits	Duplicate (R.P.D.) 110040071	Duplicate Limits	Duplicate (R.P.D.) 110040081	Duplicate Limits
Antimony	Sb	NC	30	NC	30	NC	30
Barium	Ba	5.1	30	7.4	30	2.6	30
Beryllium	Be	NC	30	PASS	30	PASS	30
Chromium	Cr	PASS	30	8	30	26.1	30
Cobalt	Co	NC	30	NC	30	NC	30
Copper	Cu	13.3	30	13.3	30	22.2	30
Lead	Pb	NC	30	NC	30	NC	30
Mercury	Hg	0	30	5.1	30	9.5	30
Molybdenum	Mo	NC	30	NC	30	NC	30
Nickel	Ni	PASS	30	PASS	30	PASS	30
Tin	Sn	NC	30	NC	30	NC	30
Vanadium	V	12.5	30	11.1	30	8.7	30
Zinc	Zn	PASS	30	8.7	30	14.3	30

ug/g = micrograms per gram
R.P.D. = Relative Percent Difference
PASS = Duplicate sample results were in the range of one to five times the detection limit. R.P.D. calculation is not applicable in this range. Acceptance criteria is a maximum difference between the duplicates equivalent to the value of the detection limit.
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

REPORTED TO: Hemmera Envirochem Inc.

REPORT DATE: October 15, 2001

GROUP NUMBER: 11003069

CANTEST®

Batch Quality Control for CSR Metals Analysis in Soil (QC# 26627)

Parameter		NIST 2711 Montana Soil-SALM (% Recovery)	NIST 2711 Montana Soil-SALM Limits
Arsenic	As	79	79 - 120
Cadmium	Cd	95	74 - 114
Copper	Cu	87	78 - 115
Lead	Pb	87	77 - 115
Mercury	Hg	105	74 - 114
Nickel	Ni	90	41 - 116
Vanadium	V	43	39 - 97
Zinc	Zn	80	80 - 110

ug/g = micrograms per gram

CANTEST®

Batch Quality Control Frequency Summary

PAH's in Soil Sample Prep (Batch# 26573)

QC Type	No. Samples
Blank	1
NRC HS-5 Cert. Ref. Material	1

PAH's in Soil Sample Prep (Batch# 26576)

QC Type	No. Samples
Blank	1
Duplicate	1
NRC HS-5 Cert. Ref. Material	1

EPH (LEPH/HEPH)- Soil Prep (Batch# 26584)

QC Type	No. Samples
Blank	1
Cert Ref Material RTC CRM355	1
Duplicate	1
Method Performance Check Spike	1

EPH (LEPH/HEPH)- Soil Prep (Batch# 26594)

QC Type	No. Samples
Blank	1
Cert Ref Material RTC CRM355	1
Duplicate	1
Method Performance Check Spike	1

(Continued on next page)

CANTEST®

Batch Quality Control Frequency Summary

SALM in Soil Digestion (Batch# 26627)

QC Type	No. Samples
NIST 2711 Montana Soil-SALM	1
Duplicate	9

MeOH Extr'n Prep BTEX/VPH Soil (Batch# 26686)

QC Type	No. Samples
Blank	1
Method Performance Check Spike	1

SALM Metals in Soil Sieve (Batch# 26483)

QC Type	No. Samples
Batch Size	79

PAH's in Soil Sample Prep (Batch# 26573)

QC Type	No. Samples
Batch Size	20

PAH's in Soil Sample Prep (Batch# 26576)

QC Type	No. Samples
Batch Size	20

(Continued on next page)

CANTEST®

Batch Quality Control Frequency Summary

EPH (LEPH/HEPH)- Soil Prep (Batch# 26584)

QC Type	No. Samples
Batch Size	18

EPH (LEPH/HEPH)- Soil Prep (Batch# 26594)

QC Type	No. Samples
Batch Size	18

SALM in Soil Digestion (Batch# 26627)

QC Type	No. Samples
Batch Size	93

MeOH Extr'n Prep BTEX/VPH Soil (Batch# 26686)

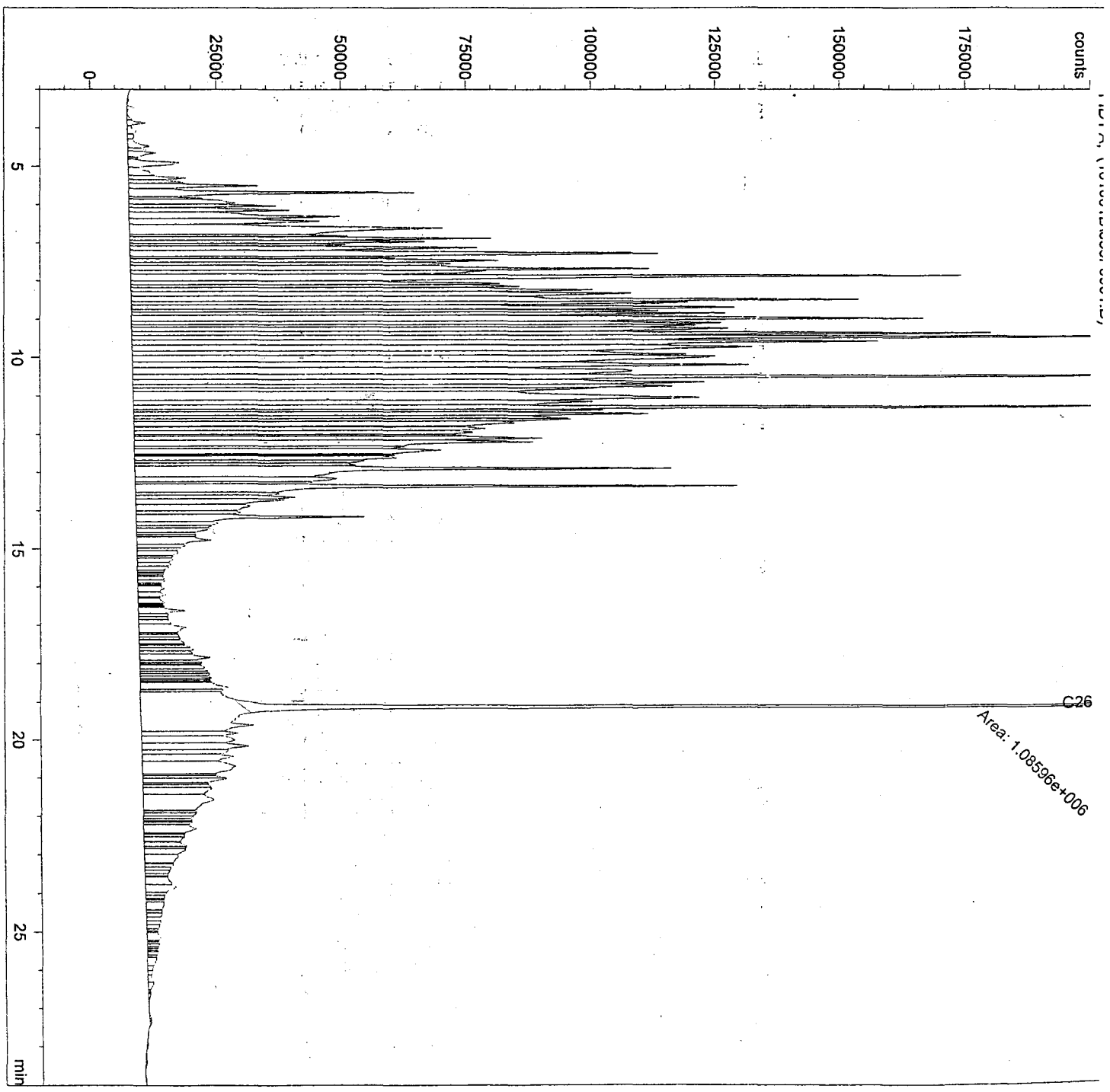
QC Type	No. Samples
Batch Size	42

Data File C:\HPCHEM\2\DATA\101001B\035F0901.D Sample Name: 110030418 SAMPLE

Injection Date	: 10/10/01 6:21:40 PM	Seq. Line	: 9
Sample Name	: 110030418 SAMPLE	Vial	: 35
Acq. Operator	: kf	Inj	: 1
		Inj Volume	: 2 µl
Acq. Method	: C:\HPCHEM\2\METHODS\!EPH.M		
Last changed	: 10/10/01 3:02:56 PM by kf		
Analysis Method	: C:\HPCHEM\2\METHODS\!EPH.M		
Last changed	: 10/11/01 8:53:23 AM by kf (modified after loading)		

110030418
Hemmer

Total Extractable Hydrocarbons. Soils and Waters are extracted using methylene chloride and then analyzed using an HPGC-FID. Calculations are based on an internal standard and reported in ug/L for waters and ug/g for soils.



Data File C:\HPCHEM\1\DATA\100801A\023F6201.D Sample Name: 110030426 SAMPLE

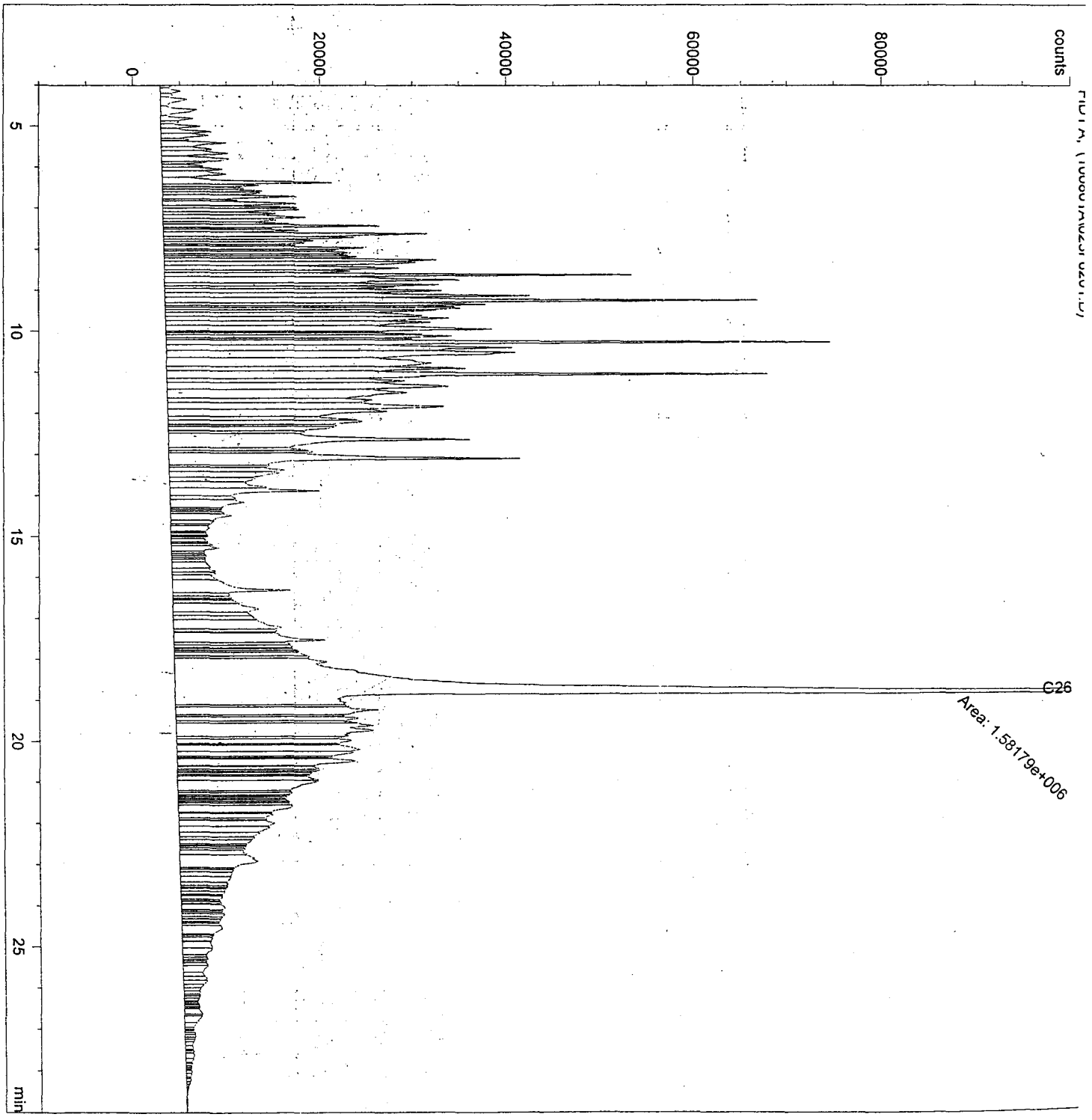
==========

Injection Date : 10/10/01 2:45:32 AM Seq. Line : 62
Sample Name : 110030426 SAMPLE Vial : 23
Acq. Operator : kf Inj : 1
Inj Volume : 2 µl

Sequence File : C:\HPCHEM\1\SEQUENCE\100801A.S
Method : C:\HPCHEM\1\METHODS\!EPH.M
Last changed : 10/9/01 11:30:42 AM by kf

Total Extractable Hydrocarbons. Soils and Waters are extracted using methylene chloride and then analyzed using an HPGC-FID. Calculations are based on an internal standard and reported in ug/L for waters and ug/g for soils.

==========



Data File C:\HPCHEM\1\DATA\100801A\024F6301.D Sample Name: 110030429 SAMPLE

==========

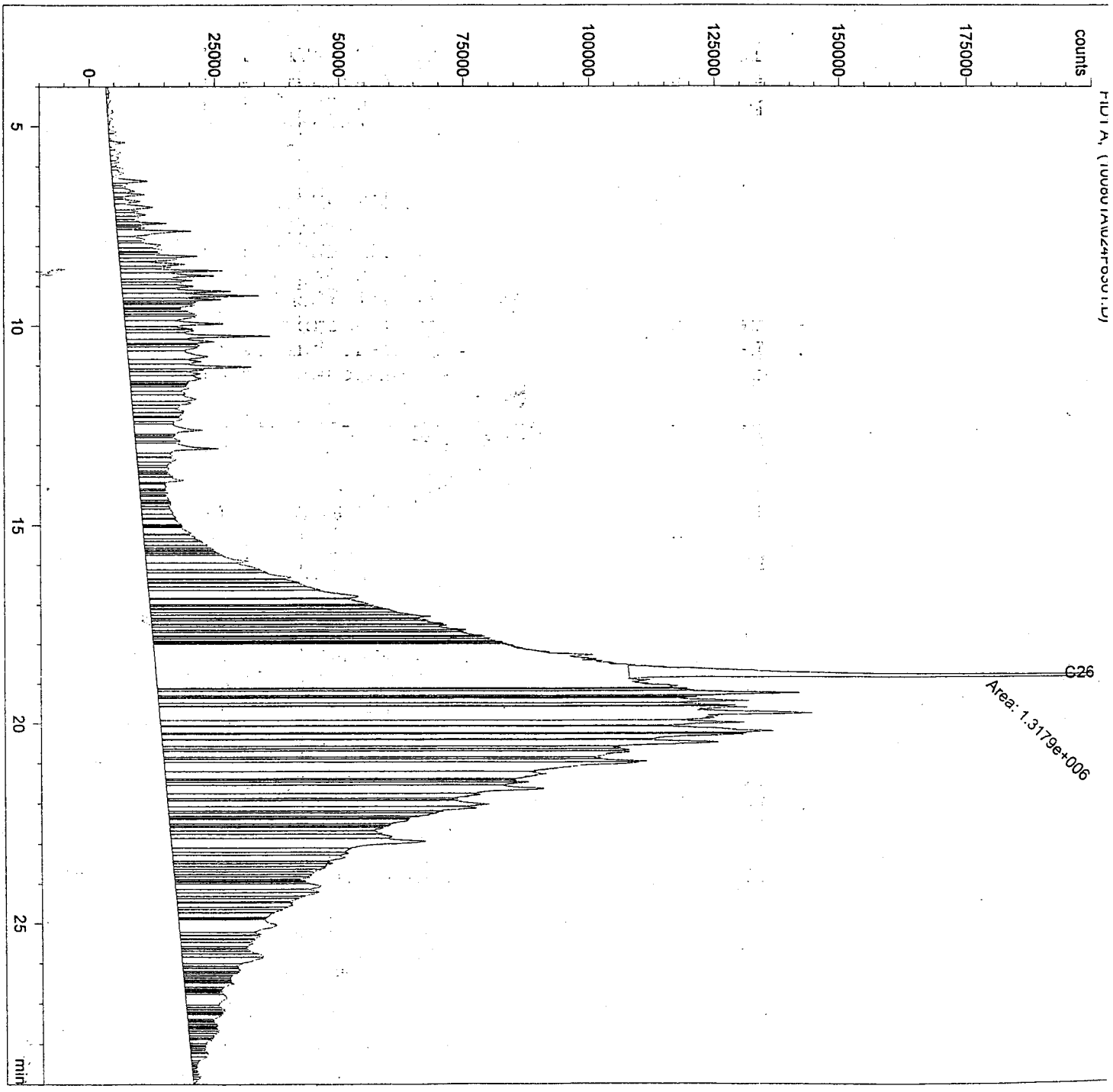
Injection Date : 10/10/01 3:23:02 AM
Sample Name : 110030429 SAMPLE
Acq. Operator : kf

Seq. Line : 63
Vial : 24
Inj : 1
Inj Volume : 2 µl

Acq. Method : C:\HPCHEM\1\METHODS\!EPH.M
Last changed : 10/9/01 11:30:42 AM by kf
Analysis Method : C:\HPCHEM\1\METHODS\!EPH.M
Last changed : 10/10/01 10:58:11 AM by kf
(modified after loading)

Total Extractable Hydrocarbons. Soils and Waters are extracted using methylene chloride and then analyzed using an HPGC-FID. Calculations are based on an internal standard and reported in ug/L for waters and ug/g for soils.

==========



Data File C:\HPCHEM\1\DATA\100801A\026F6601.D Sample Name: 110030432 SAMPLE

==========

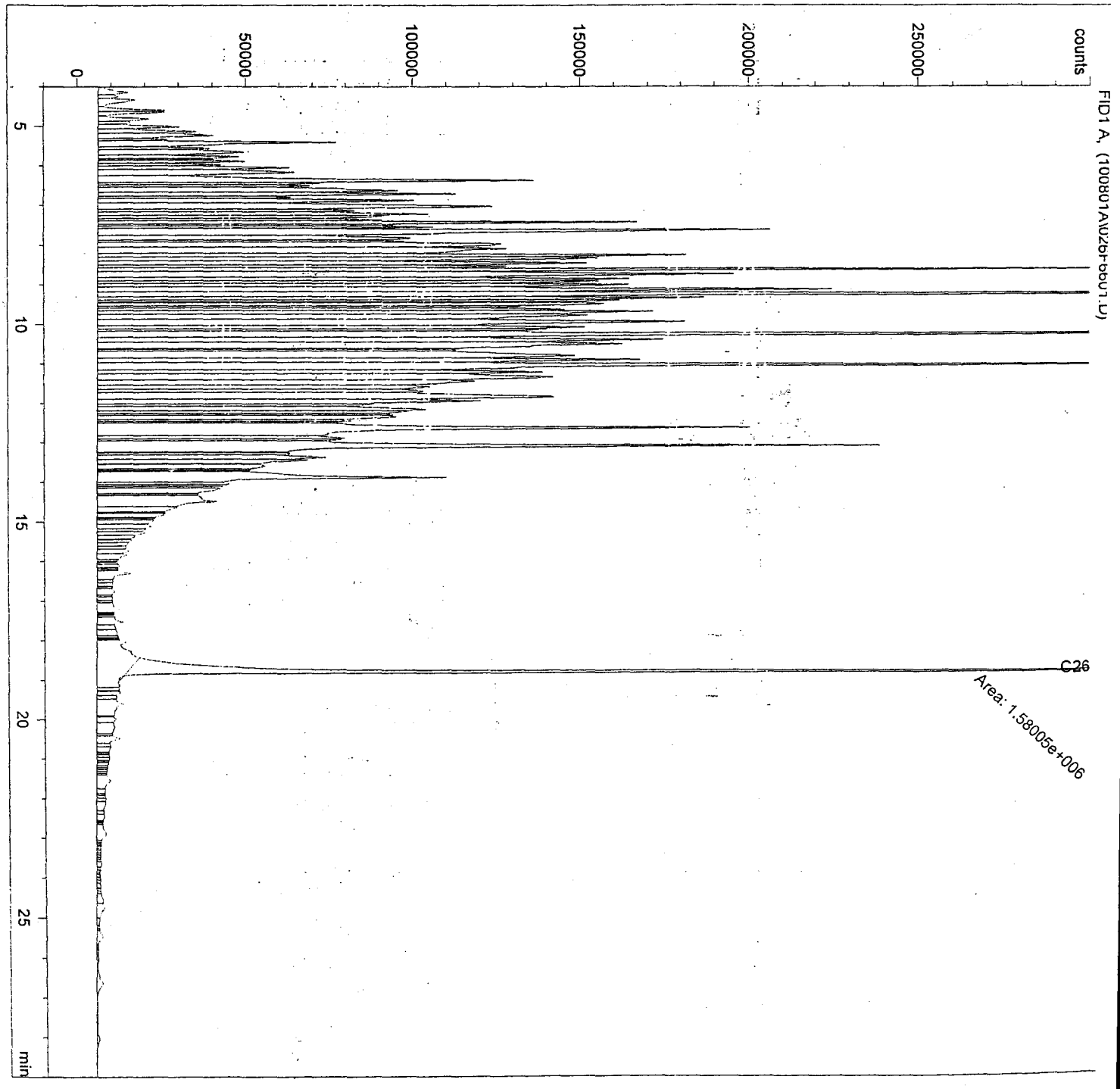
Injection Date : 10/10/01 12:05:10 PM
Sample Name : 110030432 SAMPLE
Acq. Operator : kf

Seq. Line : 66
Vial : 26
Inj : 1
Inj Volume : 2 µl

Acq. Method : C:\HPCHEM\1\METHODS\!EPH.M
Last changed : 10/9/01 11:30:42 AM by kf
Analysis Method : C:\HPCHEM\1\METHODS\!EPH.M
Last changed : 10/11/01 8:43:35 AM by kf
(modified after loading)

Total Extractable Hydrocarbons. Soils and Waters are extracted using methylene chloride and then analyzed using an HPGC-FID. Calculations are based on an internal standard and reported in ug/L for waters and ug/g for soils.

==========



CHAIN OF CUSTODY RECORD

CANTEST

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Fax: 604.731.2386
Toll Free: 800.665.8566

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90279

Client Name:* Hemmera Envirochem
Postal Code:* V6Z 2K5
Street Address (including suite number):* Suite 350, 1190 Hornby St
City: Vancouver
Telephone:* 604 669-0424
Fax: 604 669-0430
E-Mail Address (Required for "AutoEmail" Reports): bwong@hemmera.com
Contact Name:* Brenda Wong / Philip Lowery
Sampler's Name: Brenda Wong
Project Name: Brooks Brook
Project Number: 316-003.04
Quotation Number:
P.O. Number 316-003.04

RESULTS REQUESTED BY:*
regular
Day Month Year
(Surcharges May Apply)

Special Instructions: ☐ AutoFax ☐ AutoEmail ☐ Return Cooler ☐ Ship Sampling Containers (please specify below)

FOR LABORATORY USE ONLY

Please circle options as appropriate →

Group Number / Laboratory Number	Sample Identification*	Date Sampled (M / D / Y)	Sample Type	Metals WATER D/T F	Metals SOIL	PH	Conductivity	TSS	TDS	Alkalinity (total / spec.)	BOD	COD	Coliform Bacteria Fecal/Total	F Cl SO_4 No_3	Nitrite (No_2)	Nitrate and Nitrite	Oil & Grease (Total / HC)	PCP (Tri, Tetra and Penta)	PCP (Mono and Di)	BETX	VPH	VOC	PAH	EPH (not PAH corrected)	LEPH/HEPH (PAH corrected)	PCB					HOLD - DO NOT ANALYZE	Number of Containers
	BH01-01 SA1	09/24/01	SOIL																												X	1
	BH01-01 SA2	″	↓																												X	1
	BH01-01 SA3	″																													X	1
	BH01-01 SA4	″																													X	1
	BH01-01 SA5	″																													X	1
	MW01-02 SA1	″																													X	1
	MW01-02 SA2	9/25/01																													X	1
	MW01-02 SA3	″																													X	1
	MW01-02 SA4	″																													X	1
	MW01-03 SA1	″																													X	1

Relinquished by: [signature] Date 09/26/01 Time Received by:

*** = Required Field** Total Number of Containers:

Method of Shipment: Greyhound
Waybill No.: 113419869772
Received for Lab by: Date Time
Shipped by:
Shipment Condition:
Cooler opened by: Date Time

You will be paid directly by our client: ☐
Company Name:
Address:
Contact: Postal Code:
Phone: Fax:

FOR LABORATORY USE ONLY
Sample State at Receipt: ☐ Ambient ☐ Cold ☐ Frozen ☐ N/A Comments
Temperature ____ °C Shelf Number ____

CHAIN OF CUSTODY RECORD

CANTEST

90280

4606 Canada Way
Burnaby, B.C.
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cantest@cantest.com

Client Name: Hemmera Envirochem — V6Z 2K5

Page 1 of 2

Street Address (including suite number):* Suite 350, 1190 Hornby St — City: Vancouver

Telephone:* 604 669-0424 — Fax: 604 669-0430 — E-Mail Address (Required for "AutoEmail" Reports): bwarg@hemmera.com

Contact Name:* Brenda Warg / Philip Lowery — Sampler's Name: Brenda Warg

Project Name: Brooks Brook — Project Number: 316-003.04 — Quotation Number: — P.O. Number 316-003.04

RESULTS REQUESTED BY:*

Regular

Day Month Year

(Surcharges May Apply)

Special Instructions: ☐ AutoFax ☐ AutoEmail ☐ Return Cooler ☐ Ship Sampling Containers (please specify below)

FOR LABORATORY USE ONLY

Please circle options as appropriate → WATER / SOIL

Group Number / Laboratory Number	Sample Identification*	Date Sampled (M/D/Y)	Sample Type	PH	Conductivity	TSS	TDS	Alkalinity (total / spec.)	BOD	COD	Coliform Bacteria Fecal/Total	F Cl SO_4 No_3	Nitrite (No_2)	Nitrate and Nitrite	Oil & Grease (Total / HC)	PCP (Tri, Tetra and Penta)	PCP (Mono and Di)	BETX	VPH	VOC	PAH	EPH (not PAH corrected)	LEPH/HEPH (PAH corrected)	PCB	HOLD - DO NOT ANALYZE	Number of Containers
	MW01-03 SA2	09/25/01	SOIL																						X	1
	MW01-03 SA3																								X	1
	MW01-03 SA4																								X	1
	MW01-04 SA1																								X	1
	MW01-04 SA2																								X	1
	MW01-04 SA3																								X	1
	MW01-04 SA4																								X	1
	MW01-05 SA1																								X	1
	MW01-05 SA2																								X	1
	MW01-05 SA3																								X	1

Relinquished by:	Date	Time	Received by:
	09/26/01		

* = Required Field — Total Number of Containers:

Method of Shipment:	Waybill No.:	Received for Lab by:	Date	Time
Greyhound	1134198697 2			
Shipped by:	Shipment Condition:	Cooler opened by:	Date	Time

You will be paid directly by our client: ☐

Company Name:

Address:

Contact: — Postal Code:

Phone: — Fax:

FOR LABORATORY USE ONLY

Sample State at Receipt: ☐ Ambient ☐ Cold ☐ Frozen ☐ N/A Comments:

Temperature: °C Shelf Number:

WHITE: FOLLOWS REPORT YELLOW: LAB COPY PINK: CLIENT COPY/GENERAL INFORMATION

CHAIN OF CUSTODY RECORD

CANTEST

4606 Canada Way
Burnaby, B.C.
V5G 1K5

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Fax: 604.731.2386
Toll Free: 800.665.8566

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90281

Client Name: Hemmera Envirochem | Postal Code: V6Z 2K5

Street Address (including suite number): Suite 350, 1190 Hornby St. | City: Vancouver

Telephone: 604 669-0424 | Fax: 604 669-0430 | E-Mail Address (Required for "AutoEmail" Reports): bwong@hemmera.com

Contact Name: Brenda Wong / Phillip Lowery | Sampler's Name: Brenda Wong

Project Name: Brooks Brook | Project Number: 316-003 04 | Quotation Number: | P.O. Number 316-003.04

RESULTS REQUESTED BY:* regular

Day Month Year

(Surcharges May Apply)

Special Instructions: ☐ AutoFax ☐ AutoEmail ☐ Return Cooler ☐ Ship Sampling Containers (please specify below)

FOR LABORATORY USE ONLY

Please circle options as appropriate →

Group Number / Laboratory Number	Sample Identification*	Date Sampled (M/D/Y)	Sample Type	Metals (WATER) DISS	Metals (SOIL) TOT	PH	Conductivity	TSS	TDS	Alkalinity (total / spec.)	BOD	COD	Coliform Bacteria Fecal/Total	F Cl SO_4 No_3	Nitrite (No_2)	Nitrate and Nitrite	Oil & Grease (Total / HC)	PCP (Tri, Tetra and Penta)	PCP (Mono and Di)	BETX	VPH	VOC	PAH	EPH (not PAH corrected)	LEPH/HEPH (PAH corrected)	PCB	HOLD - DO NOT ANALYZE	Number of Containers
	MW01-05 SA4	09/25/01	SOIL																								X	1
	MW01-05 SA5	"																									X	1
	DUP 1	"																									X	1
	MW01-06 SA1	9/26/01																									X	1
	MW01-06 SA2	"																									X	1
	MW01-06 SA3	"																									X	1
	MW01-06 SA4	"																									X	1
	MW01-07 SA1	"																									X	1
	MW01-07 SA2	"																									X	1
	MW01-07 SA3	"																									X	1

Relinquished by:	Date: 09/26/01	Time	Received by:	* = Required Field	Total Number of Containers:
Method of Shipment: Greyhound	Waybill No.: 113419869 72	Received for Lab by:	Date	Time	You will be paid directly by our client: ☐
Shipped by:	Shipment Condition:	Cooler opened by:	Date	Time	Company Name:
					Address:
					Contact: / Postal Code:
					Phone: / Fax:

FOR LABORATORY USE ONLY

Sample State at Receipt: ☐ Ambient ☐ Cold ☐ Frozen ☐ N/A Comments:

Temperature ____°C Shelf Number ____

WHITE: FOLLOWS REPORT YELLOW: LAB COPY PINK: CLIENT COPY/GENERAL INFORMATION

CHAIN OF CUSTODY RECORD

CANTEST

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Toll Free: 800.665.8566

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90284

Client Name:* Hemmera Envirochem | Postal Code: V6Z 2K5

Street Address (including suite number):* Suite 350, 1190 Hornby St | City: Vancouver

Telephone:* 604 669-0424 | Fax: 604 669-0430 | E-Mail Address (Required for "AutoEmail" Reports): bwong@hemmera.com

Contact Name:* Brenda Wong / Philip Lowery | Sampler's Name: Brenda Wong

Project Name: Brooks Brook | Project Number: 316-003.04 | Quotation Number: | P.O. Number 316-003.04

RESULTS REQUESTED BY:* regular

Day Month Year

(Surcharges May Apply)

Special Instructions: ☐ AutoFax ☐ AutoEmail ☐ Return Cooler ☐ Ship Sampling Containers (please specify below)

FOR LABORATORY USE ONLY

Please circle options as appropriate → WATER / SOIL

Group Number / Laboratory Number	Sample Identification*	Date Sampled (M / D / Y)	Sample Type	PH	Conductivity	TSS	TDS	Alkalinity (total / spec.)	BOD	COD	Coliform Bacteria Fecal/Total	F Cl SO_4 No_3	Nitrite (No_2)	Nitrate and Nitrite	Oil & Grease (Total / HC)	PCP (Tri, Tetra and Penta)	PCP (Mono and Di)	BETX	VPH	VOC	PAH	EPH (not PAH corrected)	LEPH/HEPH (PAH corrected)	PCB	HOLD - DO NOT ANALYZE	Number of Containers
	MW01-07 SA4	09/26/01	SOIL																						X	1
	MW01-07 SA5	"																							X	1
	DUP 2	"																							X	1
	DUP 3	"																							X	1
	MW01-08 SA1	"																							X	1
	MW01-08 SA2	"																							X	1
	MW01-08 SA3	"																							X	1
	MW01-08 SA4	"																							X	1
	DUP 4	"																							X	1

Relinquished by: [signature] | Date: 09/26/01 | Time | Received by:

* = Required Field | Total Number of Containers:

Method of Shipment: courier hand | Waybill No.: 1134198672 | Received for Lab by: | Date | Time

Shipped by: | Shipment Condition: | Cooler opened by: | Date | Time

You will be paid directly by our client: ☐

Company Name:

Address:

Contact: | Postal Code:

Phone: | Fax:

FOR LABORATORY USE ONLY

Sample State at Receipt: ☐ Ambient ☐ Cold ☐ Frozen ☐ NA | Comments:

Temperature: °C | Shelf Number:

WHITE: FOLLOWS REPORT YELLOW: LAB COPY PINK: CLIENT COPY/GENERAL INFORMATION

CHAIN OF CUSTODY RECORD

CANTEST

90282

4606 Canada Way
Burnaby, B.C.
V5G 1K5

Tel: 604.734.7276
Fax: 604.731.2386
Toll Free: 800.665.8566

www.cantest.com
cantest@cantest.com

Client Name: Hemmera Envirochem V6Z 2K5

Street Address (including suite number):* Suite 350, 1190 Hornby St | City: Vancouver

Telephone:* 604 669-0424 | Fax: 604 669-0430 | E-Mail Address (Required for "AutoEmail" Reports): bwong@hemmera.com

Contact Name:* Brenda Wong / Philip Lowery | Sampler's Name: Brenda Wong / Philip Lowery

Project Name: Brooks Brook | Project Number: 316-003.04 | Quotation Number: | P.O. Number 316-003.04

RESULTS REQUESTED BY:* regular (Day / Month / Year)

(Surcharges May Apply)

Special Instructions: ☐ AutoFax ☐ AutoEmail ☐ Return Cooler ☐ Ship Sampling Containers (please specify below)

FOR LABORATORY USE ONLY

Please circle options as appropriate → WATER / SOIL

Group Number / Laboratory Number	Sample Identification*	Date Sampled (M / D / Y)	Sample Type	PH	Conductivity	TSS	TDS	Alkalinity (total / spec.)	BOD	COD	Coliform Bacteria Fecal/Total	F Cl SO_4 No_3	Nitrite (No_2)	Nitrate and Nitrite	Oil & Grease (Total / HC)	PCP (Tri, Tetra and Penta)	PCP (Mono and Di)	BETX	VPH	VOC	PAH	EPH (not PAH corrected)	LEPH/HEPH (PAH corrected)	PCB	HOLD - DO NOT ANALYZE	Number of Containers
	SED-UP	9/24/01	SOIL																						X	1
	SED-ADJ	"																							X	1
	SED-DN	"																							X	1
	SURFACE1	"																							X	1
	SURFACE2	"																							X	1
	SURFACE3	"																							X	1
																									X	1

Relinquished by: [signature] | Date 09/26/01 | Time | Received by:

* = Required Field | Total Number of Containers:

Method of Shipment: Greyhound | Waybill No.: 113419 86972 | Received for Lab by: | Date | Time

Shipped by: | Shipment Condition: | Cooler opened by: | Date | Time

You will be paid directly by our client: ☐

Company Name:

Address:

Contact: | Postal Code:

Phone: | Fax:

FOR LABORATORY USE ONLY

Sample State at Receipt: ☐ Ambient ☐ Cold ☐ Frozen ☐ N/A Comments:

Temperature: ____ °C Shelf Number ____

WHITE: FOLLOWS REPORT YELLOW: LAB COPY PINK: CLIENT COPY/GENERAL INFORMATION

APPENDIX C

RISING HEAD TEST RESULTS

RISING HEAD PERMEABILITY TEST

BH No	**H98-23**
Date	9/27/2001
Dia. Of Well, D (m):	0.0508
Depth of Well (m):	3.143
Area of Well, A (m2)	0.00202709
Test Length, L (m):	1.483
Depth of resting Water Level (m):	1.66
Depth to Induced Level (m):	2.28
Ho = Differential Head at Start of Test	0.62
Ht = Differential Head at Time of Test:	0.21
Hf = Differential Head at End of Test:	0.01

Note: All depths from Ground Level

SHAPE FACTOR

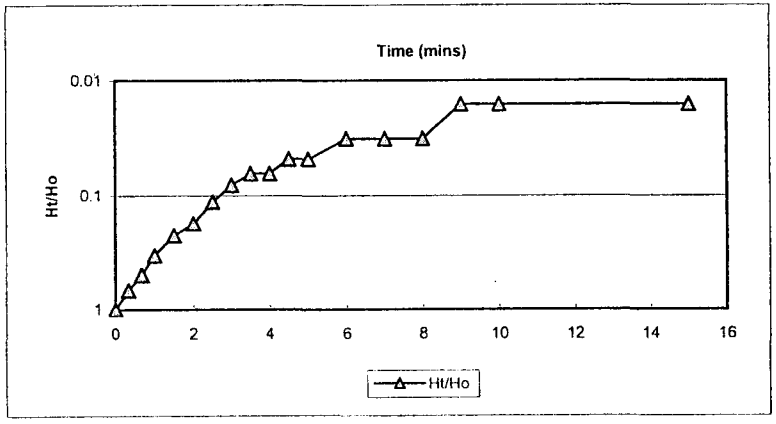
F = value for cylindrical filter zone in isotropic stratum.

$$F = \frac{2 \times 3.142 \times L}{\ln [(L/D) + \text{sq rt}\{1+(L/D)2\}]}$$

2.29120544

Variable Head Test

T = Basic Time Lag (sec)	60
when Ht/Ho = 0.37	
K (m/sec) = A/FT	**1.4745E-05**



Time, T (mins)	Depth at Time T (m	Ht	Ht/Ho
0	2.28	0.62	1
0.33	2.08	0.42	0.677419355
0.67	1.97	0.31	0.5
1	1.87	0.21	0.338709677
1.5	1.8	0.14	0.225806452
2	1.77	0.11	0.177419355
2.5	1.73	0.07	0.112903226
3	1.71	0.05	0.080645161
3.5	1.7	0.04	0.064516129
4	1.7	0.04	0.064516129
4.5	1.69	0.03	0.048387097
5	1.69	0.03	0.048387097
6	1.68	0.02	0.032258065
7	1.68	0.02	0.032258065
8	1.68	0.02	0.032258065
9	1.67	0.01	0.016129032
10	1.67	0.01	0.016129032
15	1.67	0.01	0.016129032

RISING HEAD PERMEABILITY TEST

BH No	**H97-15**
Date	9/25/2001
Dia. Of Well, D (m):	0.0508
Depth of Well (m):	4.42
Area of Well, A (m2)	0.00202709
Test Length, L (m):	2.516
Depth of resting Water Level (m):	1.904
Depth to Induced Level (m):	3.55
Ho = Differential Head at Start of Test	1.646
Ht = Differential Head at Time of Test:	2.53
Hf = Differential Head at End of Test:	4.4

Note: All depths from Ground Level

SHAPE FACTOR

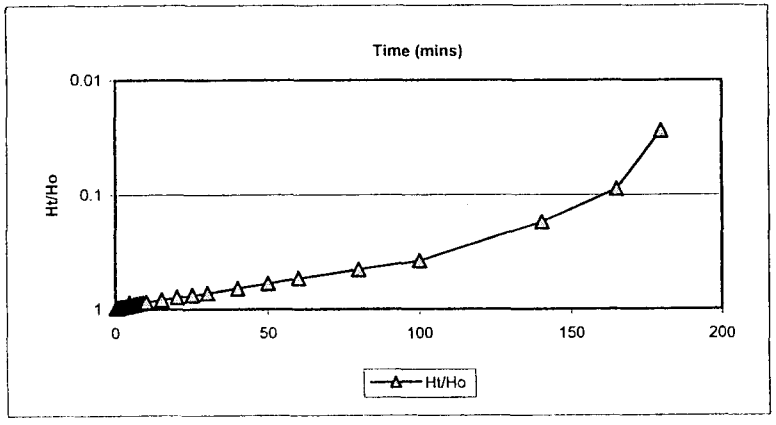
F = value for cylindrical filter zone in isotropic stratum.

$$F = \frac{2 \times 3.142 \times L}{\ln[(L/D) + \text{sq rt}\{1+(L/D)2\}]}$$

3.44023206

Variable Head Test

T = Basic Time Lag (sec)	6000
when Ht/Ho = 0.37	
K (m/sec) = A/FT	**9.8205E-08**



Time, T (mins)	Depth at Time T (m	Ht	Ht/Ho
0	3.55	1.646	1
0.75	3.51	1.606	0.975698663
1.25	3.5	1.596	0.969623329
1.75	3.48	1.576	0.957472661
2.5	3.47	1.566	0.951397327
3	3.64	1.736	1.054678007
3.5	3.46	1.556	0.945321993
4	3.44	1.536	0.933171324
4.5	3.343	1.439	0.874240583
5	3.42	1.516	0.921020656
6	3.4	1.496	0.908869988
7	3.38	1.476	0.89671932
8	3.36	1.456	0.884568651
9	3.35	1.446	0.878493317
10	3.33	1.426	0.866342649
15	3.27	1.366	0.829890644
20	3.2	1.296	0.787363305
25	3.15	1.246	0.756986634
30	3.1	1.196	0.726609964
40	2.99	1.086	0.659781288
50	2.89	0.986	0.599027947
60	2.79	0.886	0.538274605
80	2.65	0.746	0.453219927
100	2.53	0.626	0.380315917
140	2.19	0.286	0.173754557
165	2.05	0.146	0.088699878
180	1.95	0.046	0.027946537

APPENDIX D

SOIL VAPOUR SURVEY RESULTS

TABLE D1: SOIL VAPOUR SURVEY DETAILS				
Sample Location	Location	Depth of rod below grade (m)	Length of Screened Section (m)	Air pump operating time (min)
SV#1	Vicinity of H98-18 and H97-16	0.4	0.25	348
SV#2	Vicinity of H98-20	0.45	0.25	321
SV#3 (background)	West of H98-25	0.45	0.25	227
SV#4	Vicinity of MW01-02	0.45	0.25	44

TABLE D2: SOIL VAPOUR RESULTS (ug)					
Sample Location	Benzene	Toluene	Ethylbenzene	Xylenes	Total Hydrocarbons
SV#1	<0.5	2.7	1.7	1.8	24.5
SV#2	<0.5	4.1	<0.5	1.8	33.6
SV#3	<0.5	3.0	<0.5	0.6	45.6
SV#4	<0.5	<0.5	<0.5	<0.5	<5

TABLE D3: TOTAL HYDROCARBON CONCENTRATION CALCULATION				
Sample Location	Time Operated (min)	Flow Rate (l/min)	Total Hydrocarbons (ug)	Concentration (ug/L)
SV#1	348	0.2065	24.5	0.341
SV#2	321	0.2065	33.6	0.507
SV#3 (background)	227	0.2065	45.6	0.973
SV#4	44	0.2065	<5	<0.55

TABLE D4: BTEX CONCENTRATIONS IN SOIL VAPOUR (ug/L or mg/m^3)				
	Benzene	Toluene	Ethylbenzene	Xylenes
SV#1	<0.007	0.038	0.024	0.025
SV#2	<0.008	0.062	<0.008	0.027
SV#3 (background)	<0.01	0.065	<0.01	0.013
SV#4	<0.055	<0.055	<0.055	<0.055
Yukon WCB 8-hour exposure	32	375	435	435

APPENDIX E

PHOTOGRAPHS

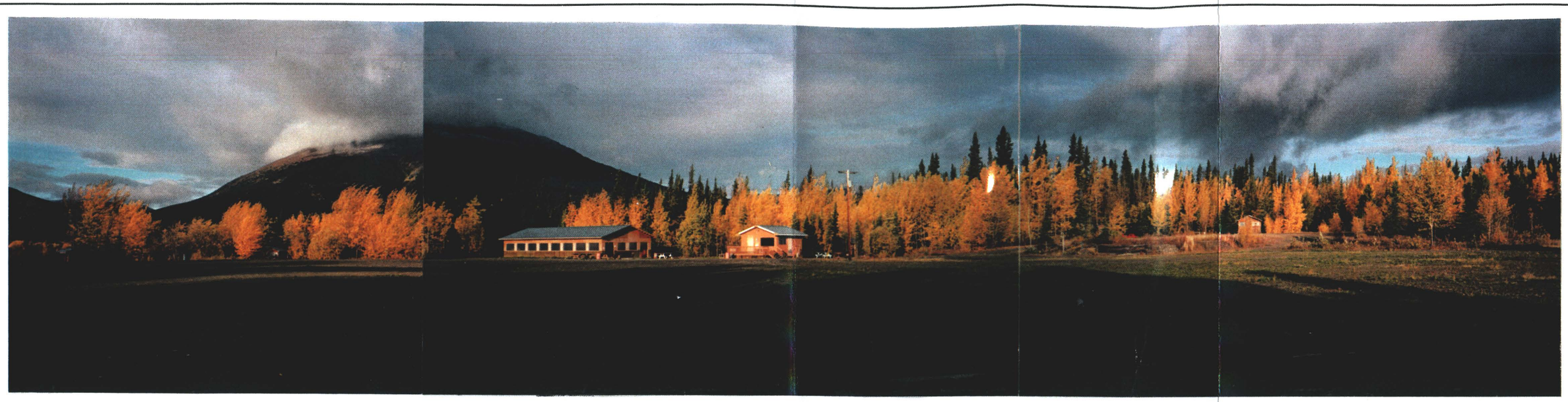


PHOTO 1: View looking west towards main site area.

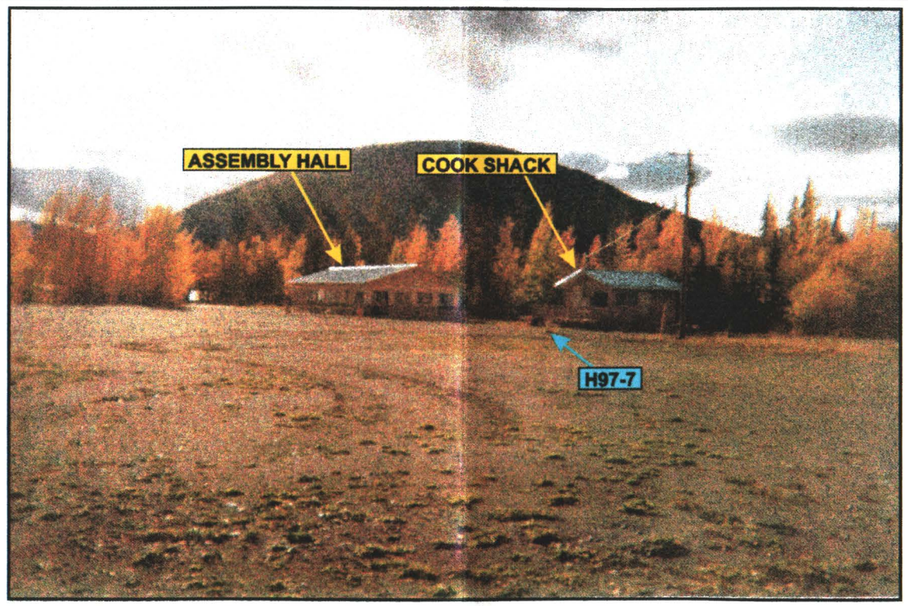


PHOTO 2: View of assembly hall, cook shack and monitoring well H97-7. (Foundation K Area)

File: 316-003.04
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Site: Brooks Brook, Alaska Highway, YT

HEMMERA ENVIROCHEM INC.

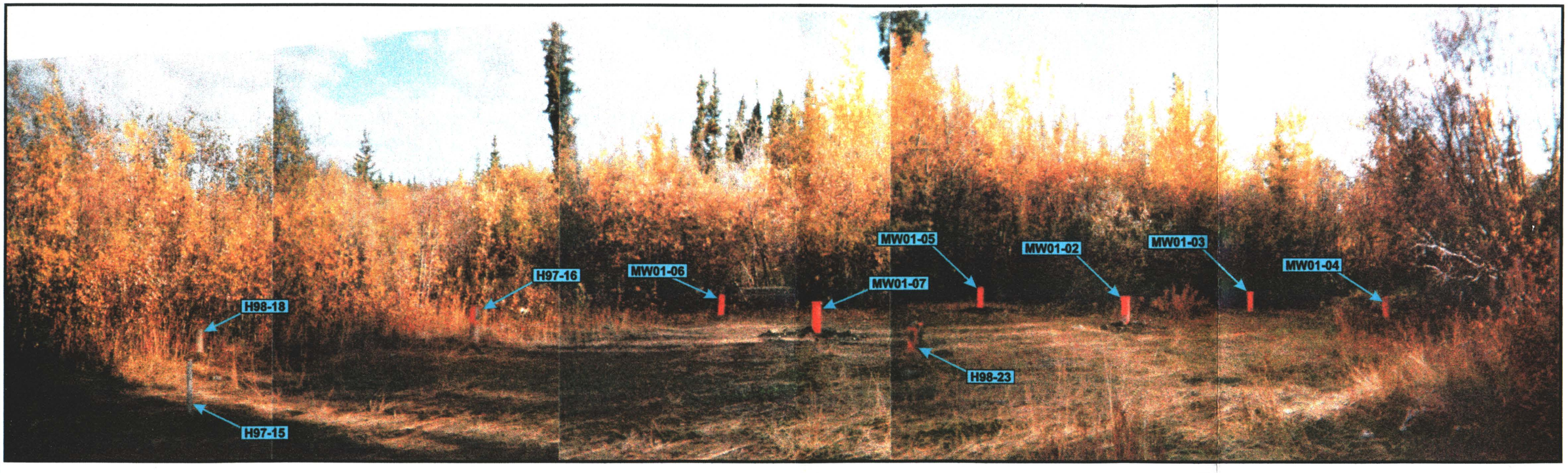

PHOTO 3: View looking southeast (Foundation AB Area).

File: 316-003.04
CLIENT:
INDIAN & NORTHERN AFFAIRS CANADA

Site: Brooks Brook, Alaska Highway, YT

HEMMERA ENVIROCHEM INC.

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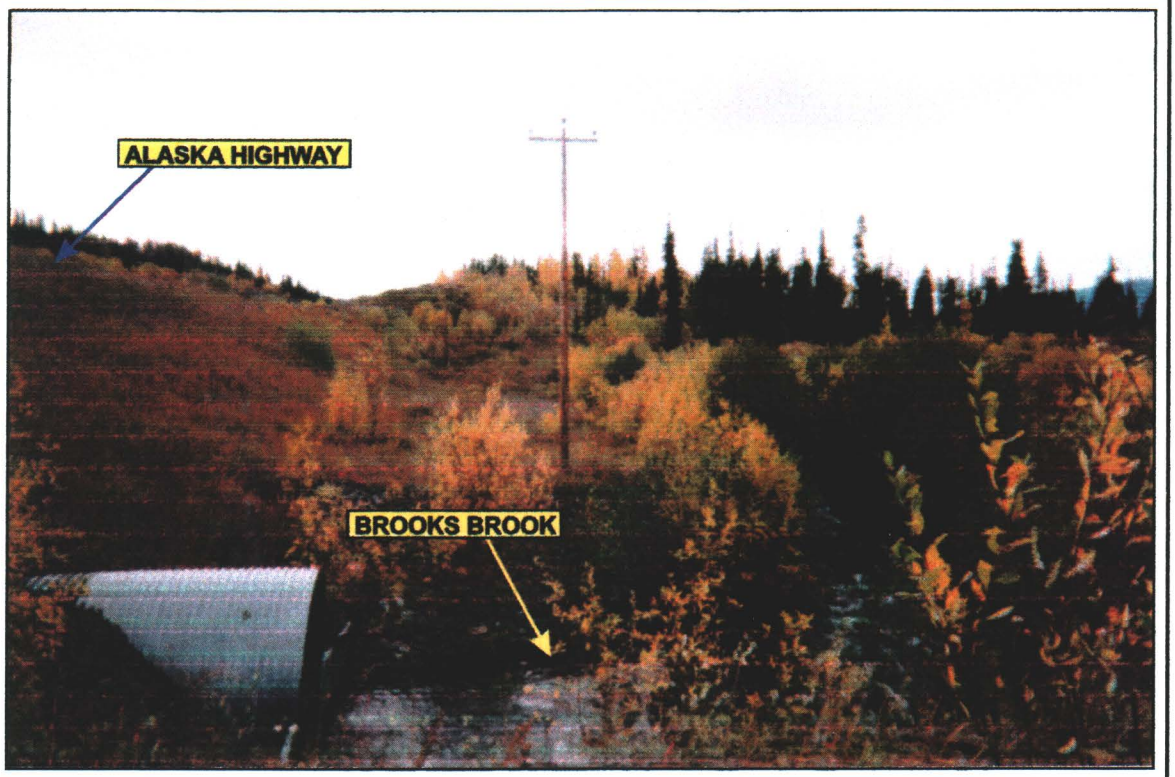

PHOTO 4: View of Brooks Brook flowing from culvert underneath Alaska Highway.

PHOTO 5: View of Brooks Brook, looking downstream.

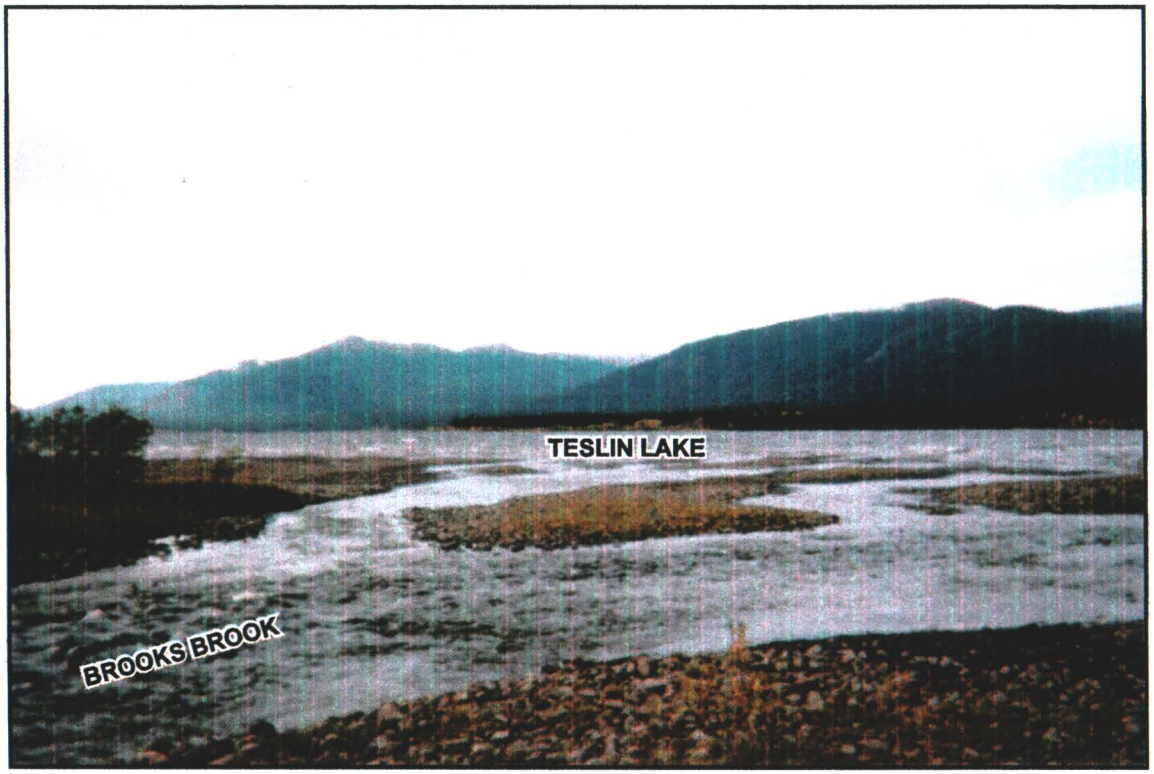

PHOTO 6: View of Brooks Brook discharging into Teslin Lake.

PHOTO 7: View of soil vapour point #4.

File: 316-003.04
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Site: Brooks Brook, Alaska Highway, YT

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