



## SAFETY CODES COUNCIL

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File #

May 17, 2002

Central Region  
Alberta Environment  
3<sup>rd</sup> Floor Provincial Building  
4920 – 51 Street  
Red Deer, AB T4N 6K8



### RE: Phase II Environmental Site Assessment Reports

Dear Larry Williams:

Enclosed are the Phase II Environmental Site Assessment reports for the following sites, which were funded by the Underground Tank Remediation Program.

- Site #2336 - Poyser's Auto Service, Lougheed
- Site #4957 – Sylvan Lake Co-op, Sylvan Lake
- Site #2132 – New Way Petroleum Service, New Norway
- Site #6143 – Bentley Shell, Bentley
- Site #9234 – Former Service Station, Delburne
- Site #1738 – Ken Bulat Pontiac Buick GMC, Killam
- Site #9232 – Congcar Services Ltd., Rimbey
- Site #5720 – Alsike General Store, Alsike

We welcome any comments that you may wish to make.

Yours truly,

*Karen Clarke*

Karen Clarke  
Technical Coordinator

Enc.

1947





February 15, 2002

Harold Blize  
Alsike General Store  
Highway 20 and Highway 39 (Junction)  
Alsike, Alberta  
T0C 0C0

Phone (780) 775-2187  
Fax. (780) 333-4792

Dear Mr Blize

**Re: Phase II Hydrocarbon Environmental Site Assessment (ESA) of Underground Petroleum Storage Tank Sites in Alberta - Site # 5720**

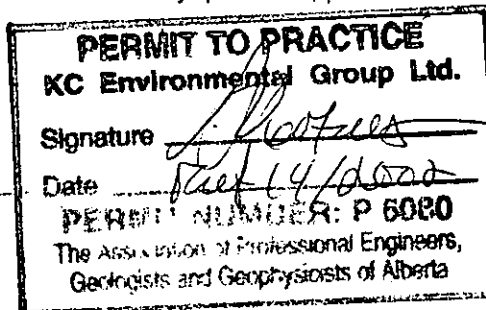
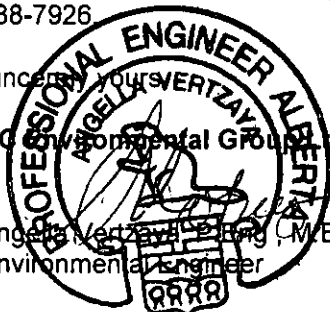
KC Environmental Group Ltd. (KC) conducted borehole drilling and analysis, of soil and groundwater for site # 5720 located on Highway 20 and Highway 39 (Junction), Alsike, Alberta, to assess petroleum hydrocarbons and lead, at potentially high risk areas of the site (underground storage tanks, piping and dispenser island) due to past and present land use.

The results of the soil analysis showed that the petroleum contaminants have migrated towards the soil, when compared to the Generic Hydrocarbon and Lead Criteria for Coarse-Grained Soil (Commercial Land Use) for the petroleum hydrocarbon fractions (F1, F2, F3 and F4), and the Generic Hydrocarbon Criteria for the Groundwater Ingestion Pathway (Coarse Grained Soil) for the BTEX levels, defined by Alberta Environment's Risk Management Guidelines for Petroleum Storage Tank Sites (October, 2001). Moreover, the results of the groundwater analysis showed that the petroleum contaminants have also migrated towards the groundwater system, when compared to the Generic Hydrocarbon Criteria for the Groundwater Ingestion Pathway (for Groundwater). The contaminated area was identified approximately on the west side of the property where the two underground gasoline storage tanks and the distribution island are located. As contamination is above the appropriate risk management criteria, remediation is recommended for the subject site. The total cost for remediation is estimated to range from \$84,000 + Tax to \$96,000 + Tax, depending on the results of the leak tests for the underground storage tanks and the results of further delineation of the contamination area.

Should you wish to discuss this information or have any questions, please contact me at (780) 488-7926

Sincerely yours,  
KC Environmental Group Ltd.

Angela Vertzava, P.Eng., M.Eng.  
Environmental Engineer



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Prepared for

Harold Blize  
Race Trac Alsike  
Highway 20 and Highway 39 (Junction)  
Alsike, Alberta



Phase II Hydrocarbon Environmental Site  
Assessment (ESA) of Underground Petroleum  
Storage Tank Site in Alberta

Site: #5720 – Alsike General Store

Located at: Highway 20 and Highway 39  
(Junction), Alsike, Alberta

SUBMITTED BY

KC Environmental Group Ltd.  
February 15, 2002

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Environmental Consultant

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February 15, 2002

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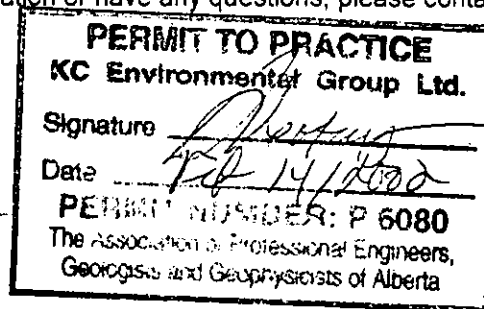
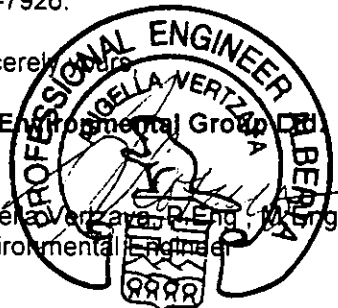
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The results of the soil analysis showed that the petroleum contaminants have migrated towards the soil, when compared to the Generic Hydrocarbon and Lead Criteria for Coarse-Grained Soil (Commercial Land Use) for the petroleum hydrocarbon fractions (F1, F2, F3 and F4), and the Generic Hydrocarbon Criteria for the Groundwater Ingestion Pathway (Coarse Grained Soil) for the BTEX levels, defined by Alberta Environment's Risk Management Guidelines for Petroleum Storage Tank Sites (October, 2001) Moreover, the results of the groundwater analysis showed that the petroleum contaminants have also migrated towards the groundwater system, when compared to the Generic Hydrocarbon Criteria for the Groundwater Ingestion Pathway (for Groundwater) The contaminated area was identified approximately on the west side of the property where the two underground gasoline storage tanks and the distribution island are located. As contamination is above the appropriate risk management criteria, remediation is recommended for the subject site The total cost for remediation is estimated to range from \$84,000 + Tax to \$96,000 + Tax, depending on the results of the leak tests for the underground storage tanks and the results of further delineation of the contamination area.

Should you wish to discuss this information or have any questions, please contact me at (780) 488-7926.

Sincerely,

KC Environmental Group Ltd.  
Angela Vartzava, P.Eng. - Writing  
Environmental Engineer



Head Office 780.488.7926  
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Fax. 780.452.8284



## EXECUTIVE SUMMARY

KC Environmental Group Ltd. (KC) conducted borehole drilling and analysis, of soil and groundwater for site # 5720 located at Highway 20 and Highway 39 (Junction) Alsike, Alberta, to assess petroleum hydrocarbons and lead, at potentially high risk areas of the site (underground storage tanks, piping and dispenser island) due to past and present land use.

Soil samples at all sampling locations were tested for BTEX (Benzene, Toluene, Ethylbenzene and Xylenes), Petroleum Fractions (F1, F2, F3 and F4) and lead. Water sample was tested for BTEX and petroleum fractions: F1 and F2. The Phase II Environmental Site Assessment program consisted of eight boreholes and three groundwater-monitoring wells.

The results of the soil analysis showed that the petroleum contaminants have migrated towards the soil, when compared to the Generic Hydrocarbon and Lead Criteria for Coarse-Grained Soil (Commercial Land Use) for the petroleum hydrocarbon fractions (F1, F2, F3 and F4), and the Generic Hydrocarbon Criteria for the Groundwater Ingestion Pathway (Coarse Grained Soil) or the BTEX levels, defined by Alberta Environment's Risk Management Guidelines for Petroleum Storage Tank Sites (October, 2001). Moreover, the results of the groundwater analysis showed that the petroleum contaminants have also migrated towards the groundwater system, when compared to the Generic Hydrocarbon Criteria for the Groundwater Ingestion Pathway (for Groundwater). The contaminated area was identified approximately in the west side of the property where the two underground gasoline storage tanks and the distribution island are located. As contamination is above the appropriate risk management criteria, remediation is recommended for the subject site. The total cost for remediation is estimated to range from \$86,400 + Tax to \$98,400 + Tax, depending on the results of the leak tests for the underground storage tanks and the results of further delineation of the contamination area.

The following are the conclusions and recommendations:

1. A leak test should be done to check whether there is petroleum hydrocarbon leakage from the underground storage tanks.
2. If leak test confirms that there is no leakage from the 3 underground storage tanks, the contaminated soil will be removed and the total volume of soil excavated is estimated to be 400 m<sup>3</sup> (area around the underground storage tanks and the dispenser island on the west side of the property). The total volume of soil excavated depends on further delineation of contamination. It is estimated that the depth to which the soil should be excavated is 4.5 metres.
3. If leak test shows that the tanks and/or piping have leakage, the corresponding tanks should be removed. It is recommended that the soil be transported to the closest





Sturgeon Landfill or to Cleanit Greenit Composting Facility in West Edmonton for disposal.

4. **For soil, the site should be remediated to the Generic Hydrocarbon and Lead Criteria for Coarse-Grained Soil (Commercial Land Use) for the petroleum hydrocarbon fractions (F1, F2, F3 and F4), and the Generic Hydrocarbon Criteria for the Groundwater Ingestion Pathway (Coarse-Grained Soil) for the BTEX levels, defined in the Alberta Environment's Risk Management Guidelines for Petroleum Storage Tank Sites (October, 2001).**
5. **For groundwater, the site should be remediated to the Generic Hydrocarbon Criteria for the Groundwater Ingestion Pathway (Coarse-Grained Soil), defined in the Alberta Environment's Risk Management Guidelines for Petroleum Storage Tank Sites (October, 2001).**
6. **In conclusion, as contamination is above the appropriate risk management criteria, remediation is recommended for the subject site.**

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## 1.0 INTRODUCTION AND SCOPE

Alberta Municipal Affairs is responsible for implementing the Alberta Government's Underground Petroleum Storage Tank Site Remediation Program. To implement the Environmental Site Assessment (ESA) phase of this program, KC Environmental Group Ltd. (KC), of 15619 - 112 Ave, Edmonton, (780) 488-7926 (Tel) and (780) 452-8284 (fax) was retained to conduct borehole drilling and groundwater monitoring well installation. KC is a fully qualified and insured environmental engineering firm.

Site # 5720 (Race Trac - Alsike) is located at Highway 20 and Highway 39 (Junction), Alsike, Alberta. Site # 5720 is a gas service station owned by Mr Harold Blize. The owner and contact person for this site is Mr. Harold Blize at (780) 775-2187.

The scope of this report includes:

Any modifications made to the method outlined in the Terms of Reference set out by the Alberta Remediation Program were approved by Municipal Affairs before being carried out. A summary of the work conducted at Site # 5720 include.

- Located all utilities prior to drilling, Alberta First call issued ticket number 246872,
- Drilled 8 boreholes using a truck rear mounted with a 6 inches solid stem to cover most of the potentially high risk contamination areas and conducted field vapor screening of soil samples from all boreholes. The boreholes were drilled and field-tested at 2.5 ft (0.75 m) intervals.
- Completed 3 boreholes as monitoring wells to the design specified in Alberta Environment's Risk Management Guidelines for Petroleum Storage Tank Sites (October, 2001)
- Four soil samples and one groundwater water sample were submitted for detailed laboratory analysis. Soil and water samples were collected from the areas of highest petroleum contamination.
- Analyzed soil samples for BTEX (Benzene, Toluene, Ethylbenzene, Xylenes), Petroleum Hydrocarbon Fractions F1, F2, F3 and F4, as well as lead. Conducted grain size analysis on one soil sample.
- Documented presence of free product on the water table, and analyzed water samples for BTEX (Benzene, Toluene, Ethylbenzene, Xylenes), Petroleum Hydrocarbon Fractions F1 and F2.
- Reported the analytical results conforming to relevant sections of the Risk Management Guidelines for Petroleum Storage Tank Sites (October, 2001)





- A site sensitivity analysis (land use assessment and potential exposure pathways) was conducted for site # 5720 to determine the required Risk Management Criteria applicable to the Petroleum Hydrocarbon Fractions, BTEX, and lead levels at the subject site.

## 2.0 BACKGROUND

The subject site is a gas service station owned by Mr. Harold Blize. According to Mr Blize, the site had been a service station since 1947. There was a leak test done for the underground petroleum storage tanks on May 1, 1998. The results of the leak test showed that there was no leakage from any of the three underground petroleum storage tanks then.

### Existence of Potable Groundwater Wells

Mr. Harold Blize said that there are two potable groundwater wells on the subject site, one located underneath the Race Trac building (west side of the property) and the other one located on the east end of the property.

### Three Underground and One Aboveground Storage Petroleum Storage Tanks in Use

Currently there are three underground petroleum storage tanks (two 27,300 Litres and one 36,400 Litres) and one aboveground propane storage tank (1000 Imperial Gallons, 4500 Litres) in use. The age of the four storage tanks is approximately 12 years old. The relative positions of the three petroleum storage tanks are shown on the site sketch (Appendix A).

**Table1: A Summary of Information for the Petroleum Storage Tanks**

	Volume (litres)	Content	Status
2 underground steel storage tanks	27,300	gasoline/diesel fuel	Currently in use
1 underground steel storage tank	36,400	gasoline	Currently in use
1 aboveground storage tank	45,000	propane	Currently in use



### 3.0 SITE DESCRIPTION

Site # 5720 is located in a rural area, at the junction of Highway 20 and Highway 39, and is zoned as highway commercial. The current uses of the subject site and immediately adjacent areas and their receptor sensitivities as well as the potential exposure pathways are outlined as below. There are three underground petroleum storage tanks (one 36,400 litres and two 27,300 litres), as well as an aboveground propane storage tank.

The general store and the two underground gasoline storage tanks with the dispenser island are located on the west half of the property. The diesel underground storage tank with the dispenser island is located on the east half of the property. Approximately 70 m east of the general store are the denture clinic, Teddy Bear's Restaurant and a trailer, followed by a service centre located about 150 m from the general store. Further east about 200 m from the general store is an oilfield and industrial supplier (Monarch Supply Apex Distribution).

#### Adjacent land uses

North: Immediately north of the subject site is wooded area, followed by a farm field.

South: Immediately south of the subject site is a ditch located within 30 m in distance, followed by Highway 39 and then a cultivated farm field.

East: Immediately east of the subject site is wooded area, followed by a farmhouse located about 200 m from the subject site.

West: Immediately west of the subject site is a wooded area.

### 4.0 SITE ASSESSMENT

The following are the laboratory results and the findings for site # 5720 located at Highway 20 and Highway 39 (Junction) Alsike, Alberta.

#### 4.1 Soil Analysis

##### 4.1.1 Particle Size and Texture

Four soil samples were collected and sent for laboratory analysis on January 7, 2002. The sieve laboratory analysis for the representative soil sample collected from borehole 2 at the depth of 4.5 m reported that the soil had 89.3% of







particles having size greater than 75 microns. The soil sample is classified as a coarse-grained soil according to the Alberta Environment's Risk Management Guidelines for Petroleum Storage Tank Sites (October, 2001).

#### 4.1.2 Field Hydrocarbon Vapor Screening

The soil sample field screening logs comprise Appendix C. Approximate locations of the boreholes are also identified on the site sketch, Appendix A. The soil samples were screened by Photoionization detector (PID). The PID readings ranged from 5.8 ppm to 780.0 ppm. Soil samples from borehole 2 had odor indication of petroleum hydrocarbons.

#### 4.1.3 Laboratory Investigations

The laboratory results of the soil samples collected from the subject site on January 7<sup>th</sup> are included in Appendix B. Soil samples were sent to the laboratory for analysis for BTEX (benzene, toluene, ethylbenzene, and xylenes), Petroleum Hydrocarbons Fractions: F1 (C6-C10), F2 (C10-C16), F3 (C16-C34) and F4 (C34-C50), and lead. The test results were compared to the more stringent values (the lower numerical values for each chemical parameter) between the two Criteria. Generic Hydrocarbon and Lead Criteria for Coarse-Grained Soil (Commercial Land Use) for the petroleum fractions (F1, F2, F3 and F4) and the Generic Hydrocarbon Criteria for the Groundwater Ingestion Pathway (Coarse-Grained Soil) for BTEX, defined in the Alberta Environment's Risk Management Guidelines for Petroleum Storage Tank Sites (October, 2001). The soil criteria were chosen based on the Site Sensitivity Analysis (Land Use Assessment and the Potential Exposure Pathway) in section 5. The test results and the criteria used are listed in the following Table 2.



**Table 2: Comparison of Soil Analysis Results to the Generic Hydrocarbon and Lead Criteria for Coarse-Grained Soil (Commercial Land Use) and the Generic Hydrocarbon Criteria for the Groundwater Ingestion Pathway (Coarse-Grained Soil) defined in the Alberta Environment's Risk Management Guidelines for Petroleum Storage Tank Sites (October, 2001).**

Sample	Soil Criteria For Commercial Land Use	Soil Criteria for Groundwater Ingestion Pathway				
Borehole and Sampling Depth			Borehole# 1 at 7.5 m	Borehole# 2 at 4.50 m	Borehole #4 at 3.75 m	Borehole#6 at 6 m
PID readings (ppm)			291 0	780 0	372	209
Benzene	0.55	0.13	<0.005	0.019	<0.005	<0.005
Toluene	71	1.6	<0.005	0.207	0.016	<0.005
Ethyl-Benzene	200	0.36	<0.005	<b>1.10</b>	<0.005	<0.005
Xylenes	130	49	<0.005	10.9	0.074	<0.005
F1 (C6-C10)	310	3700	<0.05	<b>745</b>	1.63	<0.05
F2 (C10-C16)	760	5100	<10	80	<10	<10
F3 (C16-C34)	1,700	NA	20	30	<10	10
F4 (C34-C50)	3,300	NA	<10	<10	<10	<10
Lead	260	NA	11.4	8.3	5.3	6.1

Note: All values in (mg/kg or µg/g) ppm unless otherwise noted  
Levels that exceed either of the criteria are in bold text. NA = not applicable

Based upon the laboratory results, all 4 soil samples did not exceed the criteria for lead level defined in the Generic Hydrocarbon and Lead Criteria for Coarse-Grained Soil (Commercial Land Use) and have petroleum fraction F4 below the



laboratory detection limit. The soil samples from boreholes 1 and 6 have non-detectable BTEX, F1, F2 and F4.

The soil sample from borehole 2 has levels of ethylbenzene and petroleum hydrocarbon fraction F1 above the Generic Hydrocarbon and Lead Criteria for Coarse-Grained Soil (Commercial Land Use). The finding was consistent with the petroleum hydrocarbon odor detected in the soil samples from borehole 2.

The above laboratory analysis indicated that the area around the two underground gasoline storage tanks and the dispenser island on the west side of the property should be remediated to the Generic Hydrocarbon and Lead Criteria for Coarse-Grained Soil (Commercial Land Use) for the petroleum hydrocarbon fractions (F1, F2, F3 and F4), and the Generic Hydrocarbon Criteria for the Groundwater Ingestion Pathway (Coarse-Grained Soil) for the BTEX levels, defined in the Alberta Environment's Risk Management Guidelines for Petroleum Storage Tank Sites (October, 2001).

The contaminated materials removed from the area should be taken to an approved handling facility, such as the Sturgeon Landfill or to Cleanit Greenit Composting Facility in west Edmonton. It is estimated that the depth to which the soil should be excavated is 4.5 m and that the total volume of excavated soil should be approximately 400 m<sup>3</sup>. The extent of contamination is required to be confirmed by further delineation. Leak tests should be conducted to ensure that there is no leakage from the three underground storage tanks and piping.

#### 4.2 Groundwater Analysis

Three groundwater-monitoring wells were installed at boreholes 2, 3, and 8 on January 7, 2002. The wells were purged on January 9, 2002, and the depth to water in the three groundwater-monitoring wells ranged from 2.21 m to 3.89 m below the ground surface. The groundwater sample from well 2 was collected on January 10, 2002 and was submitted for laboratory analysis. The groundwater sample from borehole 2 had strong visual and odor signs of petroleum. The water sample was sent to the laboratory for analysis of BTEX (benzene, toluene, ethylbenzene, and xylenes), as well as petroleum fractions F1 and F2.

The laboratory results of the water sample collected are included in Appendix B and the groundwater elevations are tabulated in Appendix C. The estimated groundwater flow direction is to the north-east based on the measured water table elevations within the three groundwater wells. The test results were compared to the Generic Hydrocarbon Criteria for Groundwater Ingestion Pathway defined in the Alberta Environment's Risk Management Guidelines for Petroleum Storage Tank Sites (October, 2001) and listed in the following Table 3.



**Table 3: Comparison of Laboratory Analysis Results to the Generic Hydrocarbon Criteria for Groundwater Ingestion Pathway Defined in the Alberta Environment's Risk Management Guidelines for Petroleum Storage Tank Sites (October, 2001)**

	<b>Benzene</b>	<b>Toluene</b>	<b>Ethyl-Benzene</b>	<b>Xylene</b>	<b>F1</b>	<b>F2</b>	<b>Lead</b>
<b>Groundwater criteria</b>	0.005	0.024	0.0024	0.3	5	2	N/A
<b>Groundwater sample (well # 2)</b>	<b>0.028</b>	<b>0.102</b>	<b>0.180</b>	<b>2.12</b>	<b>15.9</b>	<b>41.0</b>	0.06

All values in (mg/L) unless otherwise noted. Levels that exceed criteria are in bold text.  
NA = not applicable

Based upon the laboratory results, the ground water sample has concentrations of BTEX and the petroleum hydrocarbon fractions F1 and F2 all above the Generic Hydrocarbon Criteria for Groundwater Ingestion Pathway (Groundwater), the petroleum contaminants have migrated towards the groundwater system. The potential contaminant migration plume route from the underground storage tanks is predicated to be primarily in the direction of north east due to the influence of the groundwater flow.

## 5.0 SITE SENSITIVITY ASSESSMENT

Site # 5720 is located in a rural area, at the junction of Highway 20 and Highway 39, and is zoned as highway commercial. The current uses of the subject site and immediately adjacent areas and their receptor sensitivities as well as the potential exposure pathways are outlined as below.

### 5.1 Site Conditions

From the drilling logs, site # 5720 appears to be situated on a bed of silty clay with a mixture of cobbles and sand to a depth of approximately 7.5 m, which was the extent of the drilling. The soil stratigraphy is generally a layer of silty clay and silty sand.

The depth to water within the monitoring wells ranged from 2.21 m to 3.89 m below the ground surface. Stratigraphic details are provided in the Borehole Logs comprising Appendix C.

### 5.2 Contaminant Evaluation

There were detectable levels of BTEX and petroleum hydrocarbon fractions: F1, F2, F3 and F4 for some of the soil samples.



The water sample had levels of BTEX as well as F1 and F2 above the detection limits of the laboratory.

### 5.3 Land Use Assessment - Surrounding Land Use and Receptors

#### Commercial buildings on site:

- The commercial buildings. Teddy Bear's Restaurant and the trailer, the denture clinic, and the service centre would be most affected by the contamination due to its proximity.

#### Outdoor north, east and west of the subject site:

- Immediately north, east and west of the subject site is wooded area.

#### Outdoor south of the subject site:

- Immediately south of the subject site is a ditch located within 30 m in distance, followed by Highway 39 and then a cultivated farm field.

Since the subject site is zoned as commercial use and surrounded by wooded area, the land use is considered as commercial use.

### 5.4 Exposure Pathways

#### 5.4.1 Human Pathway

##### Soil Ingestion and Soil Dermal Contact

This pathway is not considered, as incidental soil ingestion and soil dermal contact is unlikely for a commercial area.

##### Inhalation of Indoor Air

The sale building on the subject site would be most affected by the contamination due to its proximity. Even though there are overhead (aboveground) power lines on the subject site, the potential impact from inhalation of vapors from soil and groundwater is considered high, as there are underground piping for groundwater.

##### Groundwater Ingestion Pathway

There are two potable groundwater wells on site. One of them is located underneath the general store (west end of the property) and the other one is on the east end of the property. The potential contaminant migration plume route from the underground storage tanks is predicated to be primarily in the direction of north east due to the influence of the groundwater flow. The groundwater ingestion pathway is therefore considered.



## 5.4.2 Ecological Pathway

### Plant/Invertebrate Soil Contact

As the gas station is surrounded by field, the exposure of terrestrial organisms (plant and invertebrate) to contaminants is considered.

### Aquatic Life

There is no surface water body within 300 m from the subject site, the potential risk to the freshwater aquatic life from the contaminants of the subject site is not considered. There is a river located more than 3 km to the east. As the surface water body is located more than 300 m from the subject site, the potential risk to the freshwater aquatic life from contaminants from the subject site is not considered.

Therefore, the potential pathways are primarily through inhalation of vapor from soil and groundwater, as well as through groundwater ingestion.

Based on the above land use assessment and the potential exposure pathways assessment, the remediation criteria considered for the soil are the Generic Hydrocarbon and Lead Criteria for Coarse-Grained Soil (Commercial Land Use) and the Generic Hydrocarbon Criteria for Groundwater Ingestion Pathway (Coarse-Grained Soil); the remediation criteria for the groundwater is the Generic Hydrocarbon Criteria for Groundwater (Coarse-Grained Soil) and the Generic Hydrocarbon Criteria for Groundwater Ingestion Pathway (Groundwater).

For any contamination encountered at this site, the more stringent values (the lower numerical values for each chemical parameter) between the Criteria should be chosen. **Therefore, the remediation criteria for the soil of the subject site are the Generic Hydrocarbon and Lead Criteria for Coarse-Grained Soil (Commercial Land Use) for the petroleum hydrocarbon fractions (F1, F2, F3 and F4), and the Generic Hydrocarbon Criteria for the Groundwater Ingestion Pathway (Coarse-Grained Soil) for the BTEX levels, defined in the Alberta Environment's Risk Management Guidelines for Petroleum Storage Tank Sites (October, 2001); the remediation criteria for the groundwater is the Generic Hydrocarbon Criteria for Groundwater Ingestion Pathway (Groundwater).**

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

The following recommendations were developed for the subject property and are based on the results of the Phase II Environmental Site Assessment at site # 5720 located at Highway 20 and Highway 39 (Junction), Alsike, Alberta:

The following are the conclusions and recommendations:

- 1 A leak test should be done to check whether there is petroleum hydrocarbon leakage from the underground storage tanks



2. If leak test confirms that there is no leakage from the 3 underground storage tanks, the contaminated soil will be removed and the total volume of soil excavated is estimated to be 400 m<sup>3</sup> (area around the underground storage tanks and the dispenser island on the west side of the property). The total volume of soil excavated depends on further delineation of contamination. It is estimated that the depth to which the soil should be excavated is 4.5 metres.
3. If leak test shows that the tanks and/or piping have leakage, the corresponding tanks should be removed. It is recommended that the soil be transported to the closest Sturgeon Landfill or to Cleanit Greenit Composting Facility in West Edmonton for disposal.
4. **For soil, the site should be remediated to the Generic Hydrocarbon and Lead Criteria for Coarse-Grained Soil (Commercial Land Use) for the petroleum hydrocarbon fractions (F1, F2, F3 and F4), and the Generic Hydrocarbon Criteria for the Groundwater Ingestion Pathway (Coarse-Grained Soil) for the BTEX levels, defined in the Alberta Environment's Risk Management Guidelines for Petroleum Storage Tank Sites (October, 2001).**
5. **For groundwater, the site should be remediated to the Generic Hydrocarbon Criteria for the Groundwater Ingestion Pathway (Groundwater) defined in the Alberta Environment's Risk Management Guidelines for Petroleum Storage Tank Sites (October, 2001).**
6. In conclusion, as contamination is above the appropriate risk management criteria, remediation is recommended for the subject site.





## 7.0 COST ESTIMATE OF REMEDIATION

The total cost for remediation is estimated to range \$86,400 + Tax to \$98,400 + Tax, depending on the results of the leak tests. The following table is the cost estimated for each of the components.

Job description	Detailed information	Total cost
1 Leak test for the tanks and the piping	\$600 /tank for 3 tanks and \$200/piping for estimated 3 piping	\$ 2400
2 no leakage from the tanks and piping - Excavation of contaminated soil, backfill and disposal of contaminated soil - Landfill	\$ 100/ cubic meter for excavation, backfill and disposal \$ 40 per ton for landfilling/composting	\$56,000 (for 400 m <sup>3</sup> of soil)
3. leakage from the tanks and piping - Removal of tanks - Excavation of contaminated soil, backfill and disposal of contaminated soil	\$ 100/ cubic meter for excavation, backfill and disposal \$ 40 per ton for landfilling \$ 4000 per removal of tank	\$68,000 (for 400 m <sup>3</sup> of soil)
4 Laboratory tests and Instrument rental	\$ 6000	\$6000
5. For all of the above, on site - engineering cost (includes analysis and report writing)	\$ 7,000	\$7,000
6 Further delineation of contamination	\$15,000	\$15,000
<b>Total cost</b>		<b>(a) no leakage - \$86,400</b> <b>(b) leakage - \$98,400</b>

Note (a) These costs are budgetary numbers and may change when the actual work is begun and unforeseen issues arise. (b) Costs do not include applicable taxes. (c) Costs do not include remedial measures for groundwater, presuming that groundwater will be remediated after the source of contamination (contaminated soil and possibly leaked tanks /piping ) are removed.



## 8.0 METHODOLOGY

The following is a summary of the general methodology followed for Environmental Site Assessments conducted for Alberta Government's Underground Petroleum Storage Tank Site Remediation Program. Changes made are stated in the Introduction of this report (section 1.0)

### 8.1 Consultation with Client

Work is on a "grant recipient" approved basis. Grant recipients are to notify KC Environmental that work under the Alberta Government Underground Petroleum Storage Tank Site Remediation Program is requested. They are to advise KC Environmental on the particular scope of the work including location and depth factors as well as any unique conditions on the site that might assist in fully defining the methodology. Depending on the conditions of the work site the following methodology may be modified.

### 8.2 Boreholes and Soil Samples

All utilities in the area will be located.

- Eight boreholes will be drilled using a truck-mounted auger rig equipped with solid stem or hollow stem augers as drilling conditions dictate. The boreholes will be drilled to a depth below any observed hydrocarbon contamination, or one meter below the lowest tank invert, whichever is lower. The first boreholes will be drilled in the area of least expected contamination to reduce contamination of sampling equipment between boreholes.
- Soil samples will be collected off the auger flight at 0.75m intervals. At the sampling depth, the outer surface of the core will be removed to ensure that a clean sample is obtained.
- Samples will be collected using sterile hand tools which will be washed between each sample taken and rinsed with distilled water. Surgical gloves will be worn during the procedure and changed between samples.
- Soil samples will be grab samples collected off the auger flight. At each sampling depth, two samples will be taken and placed in separate Ziploc bags. One sample will be kept at room temperature until it reaches approximately 20°C, at which time it will be tested with a Photoionization detector (PID) to determine the presence or absence of hydrocarbon contamination. As is standard practice, the instrument will be calibrated with 99.6 ppm of isobutylene to record the maximum level of contamination detected. PID analysis is used to conduct the field vapour screening as specified in the Terms of Reference.



- Soil samples with high PID readings will be transferred from the duplicate unopened Ziploc bags to EPA certified glass jars and kept at or below 4°C until taken to the laboratory for analysis, or the decision is made to discard the sample. Four soil samples will be selected from the areas of highest petroleum contamination for laboratory testing
- As boreholes are being drilled, soil samples collected will be observed and described according to the Unified Soil Classification System. Lithology logs will be prepared for each borehole.
- Samples will be submitted to a CAEAL (Canadian Association for Environmental Analytical Laboratories) and SCC (Standards Council of Canada) accredited laboratory and will be received in accordance with the chain of custody documentation. The samples will not exceed the recommended holding times thus preserving sample integrity. One of the quality control procedures performed by the laboratory with each batch of samples involves the "spiking" of a sample replicate with a known concentration of analyte. The percent recovery of the spike is then determined by subtracting the analyte concentration of an unspiked sample replicate from that of the spiked replicate. If the spike recovery is within acceptable limits, matrix interference is deemed to be negligible and analytical results are accepted. This is standard laboratory practice.
- The laboratory disposes of the water samples down the drain and of the soil samples at an approved landfill. This is standard laboratory practice and is acceptable according to the City of Edmonton Sewers Use By-Law as well as solid waste disposal guidelines.
- Soil samples will be disposed of at the sampling location or in an approved landfill. This is standard laboratory practice, and is acceptable according to the sewer bylaw as well as solid waste disposal guidelines.

### 8.3 Monitoring Wells and Water Sampling

1. Monitoring wells will be installed in 3 of the 8 boreholes described above. The monitoring wells will consist of a 51mm diameter PVC pipe with 2mm slots. The annulus between the wall of the hole and the slotted pipe will be filled with Sil 7 frac sand to form a sand filter. The remainder of the fill will consist of 9.5mm granular bentonite chips up to the ground surface. The well will be capped with a locking cap, and the keys to each well held by the consultant
2. A Waterra foot-valve and Waterra tubing will be installed in each groundwater monitoring well. The Waterra tubing is used to sample each well, and is a



dedicated unit, thereby reducing the chance of cross-contamination being introduced with the sampling of many wells.

3. One groundwater sample will be collected directly from the Waterra tubing into the containers provided by the laboratory for each analysis. Wells will be purged approximately 24 hours prior to obtaining the water samples. The sample will be held at or below 4 °C until it is taken to the laboratory for analysis

#### **8.4 Analysis of Collected Soil and Groundwater Samples**

Four soil samples and one groundwater sample will be submitted to a CAEAL approved laboratory for testing. These samples will be collected from the areas of highest petroleum contamination.

The tests requested for the soil samples are:

- a) BTEX (Benzene, Toluene, Ethylbenzene, Xylenes),
- b) Petroleum Hydrocarbon Fractions F1(C6 -C10), F2 (C10-C16), F3(C16-C34) and F4(C34-C50),
- c) Lead,
- d) Grain size analysis on one soil sample.

The tests requested for the water samples are:

- a) BTEX (Benzene, Toluene, Ethylbenzene, Xylenes),
- b) Petroleum Hydrocarbon Fractions F1(C6 -C10), F2 (C10-C16),
- c) Document the presence of free product on the water table.

## **9.0 PROJECT LIMITATIONS**

### **9.1 Sampling Limitations**

A limited number of samples were submitted for laboratory testing and only for components as determined by the Alberta Remediation program. Laboratory analysis is limited in that it only provides quantifiable data about specific samples tested and compounds tested for, and may not necessarily reflect the entire site. Interpretations are based on a limited number of laboratory results and the error in this must be recognized. Laboratory results were used to validate field data and to obtain a more accurate reading of hydrocarbon contamination levels.



## 9.2 Project Limitations

This project will be completed to the best of the consultant's abilities and in accordance to the APEGGA Code of Ethics. The report will be based on the information reviewed to the extent that the information will be available and to the extent considered reasonable within the allocated project time frame and project budget. KC Environmental Group Ltd. and the environmental consultants who prepare this report will not accept any liability for contamination that may be found later on the subject site and is not identified in this environmental report.

This report will be specifically for the use of the client and for the purpose agreed upon by the client and the consultant. One copy of the report will be maintained in the consultant's files as required by APEGGA.



**APPENDIX A**

**SITE SKETCH, AND LOCATIONS OF  
BOREHOLES AND GROUNDWATER  
MONITORING WELLS**



**APPENDIX B**

**LABORATORY RESULTS**





## Certificate of Analysis

**CLIENT NAME:** KC ENVIRONMENTAL

**AGAT WORK ORDER:** 02E001844

**ATTENTION:** Margaret Marra

### Petroleum Hydrocarbons in Water

<b>SAMPLE TYPE:</b>	Water	<b>DATE SAMPLED:</b>	Jan 10, 2002
<b>SAMPLE ID:</b>	319224	<b>DATE RECEIVED:</b>	Jan 11, 2002
<b>SAMPLE DESCRIPTION:</b>	#2 Groundwater @ 13:15'	<b>DATE REPORTED:</b>	Jan 21, 2002

PARAMETER	RESULTS	UNITS	M.D.L.	DATE ANALYZED	INITIALS	DATE PREPARED
C>6 - C10	15.9	mg/L	0.01	Jan 17, 2002	CL	Jan 17, 2002
C>10 - C16	41.0	mg/L	0.1	Jan 17, 2002	NY	Jan 17, 2002
Total C>6 - C50	56.9	mg/L	0.1			

**COMMENTS:**

M.D.L. - Method Detection Limit  
 Hydrocarbon fractions are determined by integrating all area counts from the end of the first n-alkane peak in the fraction, to the end of the last n-alkane peak in the fraction.  
 The C>5 - C10 fraction is calculated using the toluene response factor  
 The C>10 - C16 fraction is calculated using the average response factor for n-C10  
 N/A. Not Available  
 N/A. Not Applicable  
 Sample arrived at laboratory with air (headspace) included in sample container.

**Certified By:**



## Certificate of Analysis

**CLIENT NAME:** KC ENVIRONMENTAL

**AGAT WORK ORDER:** 02E001844

**ATTENTION:** Margaret Marra

### BTEX Analysis - Water

<b>SAMPLE TYPE:</b>	Water	<b>DATE SAMPLED:</b>	Jan 10, 2002
<b>SAMPLE ID:</b>	319224	<b>DATE RECEIVED:</b>	Jan 11, 2002
<b>SAMPLE DESCRIPTION:</b>	#2 Groundwater @ 13:15	<b>DATE REPORTED:</b>	Jan 21, 2002

PARAMETER	RESULTS	UNITS	M.D.L.	DATE ANALYZED	INITIALS	DATE PREPARED
Benzene	0.028	mg/L	0.001	Jan 17, 2002	CL	Jan 17, 2002
Toluene	0.102	mg/L	0.001	Jan 17, 2002	CL	Jan 17, 2002
Ethylbenzene	0.180	mg/L	0.001	Jan 17, 2002	CL	Jan 17, 2002
Xylenes	2.12	mg/L	0.001	Jan 17, 2002	CL	Jan 17, 2002

**COMMENTS:**

M.D.L. - Method Detection Limit  
 Toluene-d8 surrogate recovery: 120%  
 Sample arrived at laboratory with air (headspace) included in sample container.

**Certified By:**



### Certificate of Analysis

CLIENT NAME: KC ENVIRONMENTAL

AGAT WORK ORDER: 02E001844

ATTENTION: Margaret Marra

#### CCME Inorganic Parameters

<b>SAMPLE TYPE:</b>	Water	<b>DATE SAMPLED:</b>	Jan 10, 2002
<b>SAMPLE ID:</b>	319224	<b>DATE RECEIVED:</b>	Jan 11, 2002
<b>SAMPLE DESCRIPTION:</b>	#2 Groundwater @ 13.15	<b>DATE REPORTED:</b>	Jan 21, 2002

PARAMETER	RESULTS	UNITS	M.D.L.	DATE ANALYZED	INITIALS	DATE PREPARED
Lead	0.06	mg/L	0.01	Jan 18, 2002	IG	Jan 17, 2002

**COMMENTS:**

M.D.L. - Method Detection Limit

Certified By:



## Certificate of Analysis

**CLIENT NAME:** KC ENVIRONMENTAL

**AGAT WORK ORDER:** 02E001694

**ATTENTION:** Margaret Marra

### Petroleum Hydrocarbons in Soil

<b>SAMPLE TYPE:</b>	Soil	<b>DATE SAMPLED:</b>	Jan 07, 2002
<b>SAMPLE ID:</b>	319155	<b>DATE RECEIVED:</b>	Jan 10, 2002
<b>SAMPLE DESCRIPTION:</b>	Borehole #1 @ 7.50 M 10:00	<b>DATE REPORTED:</b>	Jan 21, 2002

PARAMETER	RESULTS	UNITS	M.D.L.	DATE ANALYZED	INITIALS	DATE PREPARED
Benzene	<0.005	mg/kg	0.005	Jan 16, 2002	WG	Jan 14, 2002
Toluene	<0.005	mg/kg	0.005	Jan 16, 2002	WG	Jan 14, 2002
Ethylbenzene	<0.005	mg/kg	0.005	Jan 16, 2002	WG	Jan 14, 2002
Xylenes	<0.005	mg/kg	0.005	Jan 16, 2002	WG	Jan 14, 2002
C6 - C10 (Fraction 1)	<0.05	mg/kg	0.05	Jan 16, 2002	WG	Jan 14, 2002
C10 - C16 (Fraction 2)	<10	mg/kg	10	Jan 16, 2002	NY	Jan 14, 2002
C16 - C34 (Fraction 3)	20	mg/kg	10	Jan 16, 2002	NY	Jan 14, 2002
C34 - C50 (Fraction 4)	<10	mg/kg	10	Jan 16, 2002	NY	Jan 14, 2002
Total C6 - C50	20	mg/kg	10			
Gravimetric Heavy Hydrocarbons	N/A	mg/kg	1000			

**COMMENTS:**

M.D.L. - Method Detection Limit  
 Sample Percent Moisture: 20%  
 Results are based on the dry weight of the sample  
 The C6 - C10 fraction is calculated using the o-xylene response factor  
 The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.  
 Gravimetric Heavy Hydrocarbons are not included in the Total C6-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.  
 Fraction 1 results have NOT been corrected for BTEX contributions  
 N/A. Not Applicable

*Certified By:*



## Certificate of Analysis

**CLIENT NAME:** KC ENVIRONMENTAL

**AGAT WORK ORDER:** 02E001694

**ATTENTION:** Margaret Marra

### Petroleum Hydrocarbons in Soil

<b>SAMPLE TYPE:</b> Soil		<b>DATE SAMPLED:</b> Jan 07, 2002				
<b>SAMPLE ID:</b> 319156		<b>DATE RECEIVED:</b> Jan 10, 2002				
<b>SAMPLE DESCRIPTION:</b> Borehole #2 @ 4.50 M 11:00		<b>DATE REPORTED:</b> Jan 21, 2002				
PARAMETER	RESULTS	UNITS	M.D.L.	DATE ANALYZED	INITIALS	DATE PREPARED
Benzene	0.019	mg/kg	0.005	Jan 16, 2002	WG	Jan 14, 2002
Toluene	0.207	mg/kg	0.005	Jan 16, 2002	WG	Jan 14, 2002
Ethylbenzene	1.10	mg/kg	0.005	Jan 16, 2002	WG	Jan 14, 2002
Xylenes	10.9	mg/kg	0.005	Jan 16, 2002	WG	Jan 14, 2002
C6 - C10 (Fraction 1)	745	mg/kg	0.05	Jan 16, 2002	WG	Jan 14, 2002
C10 - C16 (Fraction 2)	80	mg/kg	10	Jan 16, 2002	NY	Jan 14, 2002
C16 - C34 (Fraction 3)	30	mg/kg	10	Jan 16, 2002	NY	Jan 14, 2002
C34 - C50 (Fraction 4)	<10	mg/kg	10	Jan 16, 2002	NY	Jan 14, 2002
Total C6 - C50	855	mg/kg	10			
Gravimetric Heavy Hydrocarbons	N/A	mg/kg	1000			

**COMMENTS:**

M.D.L. - Method Detection Limit  
 Sample Percent Moisture: 16%  
 Results are based on the dry weight of the sample  
 The C6 - C10 fraction is calculated using the o-xylene response factor  
 The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.  
 Gravimetric Heavy Hydrocarbons are not included in the Total C6-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.  
 Fraction 1 results have NOT been corrected for BTEX contributions  
 N/A. Not Applicable

**Certified By:**



## Certificate of Analysis

**CLIENT NAME:** KC ENVIRONMENTAL

**AGAT WORK ORDER:** 02E001694

**ATTENTION:** Margaret Marra

### Petroleum Hydrocarbons in Soil

<b>SAMPLE TYPE:</b>	Soil	<b>DATE SAMPLED:</b>	Jan 07, 2002
<b>SAMPLE ID:</b>	319157.	<b>DATE RECEIVED:</b>	Jan 10, 2002
<b>SAMPLE DESCRIPTION:</b>	Borehole #4 @ 3.75 M 13:00	<b>DATE REPORTED:</b>	Jan 21, 2002

PARAMETER	RESULTS	UNITS	M.D.L.	DATE ANALYZED	INITIALS	DATE PREPARED
Benzene	<0.005	mg/kg	0.005	Jan 16, 2002	WG	Jan 14, 2002
Toluene	0.016	mg/kg	0.005	Jan 16, 2002	WG	Jan 14, 2002
Ethylbenzene	<0.005	mg/kg	0.005	Jan 16, 2002	WG	Jan 14, 2002
Xylenes	0.074	mg/kg	0.005	Jan 16, 2002	WG	Jan 14, 2002
C6 - C10 (Fraction 1)	1.63	mg/kg	0.05	Jan 16, 2002	WG	Jan 14, 2002
C10 - C16 (Fraction 2)	<10	mg/kg	10	Jan 16, 2002	NY	Jan 14, 2002
C16 - C34 (Fraction 3)	<10	mg/kg	10	Jan 16, 2002	NY	Jan 14, 2002
C34 - C50 (Fraction 4)	<10	mg/kg	10	Jan 16, 2002	NY	Jan 14, 2002
Total C6 - C50	<10	mg/kg	10			
Gravimetric Heavy Hydrocarbons	N/A	mg/kg	1000			

**COMMENTS:**

M.D.L. - Method Detection Limit  
 Sample Percent Moisture: 18%  
 Results are based on the dry weight of the sample  
 The C6 - C10 fraction is calculated using the o-xylene response factor  
 The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34  
 Gravimetric Heavy Hydrocarbons are not included in the Total C6-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present  
 Fraction 1 results have NOT been corrected for BTEX contributions  
 N/A. Not Applicable

*Certified By:*



## Certificate of Analysis

**CLIENT NAME:** KC ENVIRONMENTAL

**AGAT WORK ORDER:** 02E001694

**ATTENTION:** Margaret Marra

### Petroleum Hydrocarbons in Soil

<b>SAMPLE TYPE:</b>	Soil	<b>DATE SAMPLED:</b>	Jan 07, 2002
<b>SAMPLE ID:</b>	319158	<b>DATE RECEIVED:</b>	Jan 10, 2002
<b>SAMPLE DESCRIPTION:</b>	Borehole #8 @ 6.00 M 15:00	<b>DATE REPORTED:</b>	Jan 21, 2002

PARAMETER	RESULTS	UNITS	M.D.L.	DATE ANALYZED	INITIALS	DATE PREPARED
Benzene	<0.005	mg/kg	0.005	Jan 16, 2002	WG	Jan 14, 2002
Toluene	<0.005	mg/kg	0.005	Jan 16, 2002	WG	Jan 14, 2002
Ethylbenzene	<0.005	mg/kg	0.005	Jan 16, 2002	WG	Jan 14, 2002
Xylenes	<0.005	mg/kg	0.005	Jan 16, 2002	WG	Jan 14, 2002
C6 - C10 (Fraction 1)	<0.05	mg/kg	0.05	Jan 16, 2002	WG	Jan 14, 2002
C10 - C16 (Fraction 2)	<10	mg/kg	10	Jan 16, 2002	NY	Jan 14, 2002
C16 - C34 (Fraction 3)	10	mg/kg	10	Jan 16, 2002	NY	Jan 14, 2002
C34 - C50 (Fraction 4)	<10	mg/kg	10	Jan 16, 2002	NY	Jan 14, 2002
Total C6 - C50	10	mg/kg	10			
Gravimetric Heavy Hydrocarbons	N/A	mg/kg	1000			

**COMMENTS:**

M D L - Method Detection Limit  
 Sample Percent Moisture 17%  
 Results are based on the dry weight of the sample  
 The C6 - C10 fraction is calculated using the o-xylene response factor  
 The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34  
 Gravimetric Heavy Hydrocarbons are not included in the Total C6-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.  
 Fraction 1 results have NOT been corrected for BTEX contributions  
 N/A. Not Applicable

**Certified By:**







## Certificate of Analysis

CLIENT NAME: KC ENVIRONMENTAL

AGAT WORK ORDER: 02E001694

ATTENTION: Margaret Marra

### Soil Analysis - Lead

<b>SAMPLE TYPE:</b> Soil	<b>DATE SAMPLED:</b> Jan 07, 2002
<b>SAMPLE ID:</b> 319155	<b>DATE RECEIVED:</b> Jan 10, 2002
<b>SAMPLE DESCRIPTION:</b> Borehole #1 @ 7.50 M 10:00	<b>DATE REPORTED:</b> Jan 21, 2002

PARAMETER	RESULTS	UNITS	M.D.L.	DATE ANALYZED	INITIALS	DATE PREPARED
Lead	11.4	µg/g	0.4	Jan 21, 2002	IG	Jan 21, 2002

**COMMENTS:**

M D L - Method Detection Limit

Certified By: 

**AGAT CERTIFICATE OF ANALYSIS**

Page 1

AGAT Laboratories Calgary is accredited by the Standards Council of Canada (SCC), in co-operation with the Canadian Association for Environmental Analytical Laboratories (CAEAL), for specific tests listed in the scope of accreditation approved by the SCC.

AGAT Laboratories Calgary is accredited by the American Industrial Hygiene Association (AIHA) for specific tests.



## Certificate of Analysis

CLIENT NAME: KC ENVIRONMENTAL

AGAT WORK ORDER: 02E001694

ATTENTION: Margaret Marra

### Soil Analysis - Lead

<b>SAMPLE TYPE:</b>	Soil	<b>DATE SAMPLED:</b>	Jan 07, 2002
<b>SAMPLE ID:</b>	319156	<b>DATE RECEIVED:</b>	Jan 10, 2002
<b>SAMPLE DESCRIPTION:</b>	Borehole #2 @ 4.50 M 11:00	<b>DATE REPORTED:</b>	Jan 21, 2002

PARAMETER	RESULTS	UNITS	M.D.L.	DATE ANALYZED	INITIALS	DATE PREPARED
Lead	8.3	µg/g	0.4	Jan 21, 2002	IG	Jan 21, 2002

**COMMENTS:**

M.D.L. - Method Detection Limit

Certified By: 



## Certificate of Analysis

CLIENT NAME: KC ENVIRONMENTAL

AGAT WORK ORDER: 02E001694

ATTENTION: Margaret Marra

### Soil Analysis - Lead

<b>SAMPLE TYPE:</b>	Soil	<b>DATE SAMPLED:</b>	Jan 07, 2002
<b>SAMPLE ID:</b>	319157	<b>DATE RECEIVED:</b>	Jan 10, 2002
<b>SAMPLE DESCRIPTION:</b>	Borehole #4 @ 3.75 M 13:00	<b>DATE REPORTED:</b>	Jan 21, 2002

PARAMETER	RESULTS	UNITS	M.D.L.	DATE ANALYZED	INITIALS	DATE PREPARED
Lead	5.3	µg/g	0.4	Jan 21, 2002	KG	Jan 21, 2002

**COMMENTS:**

M.D.L. - Method Detection Limit

Certified By: 

**AGAT CERTIFICATE OF ANALYSIS**

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## Certificate of Analysis

CLIENT NAME: KC ENVIRONMENTAL

AGAT WORK ORDER: 02E001694

ATTENTION: Margaret Marra

### Soil Analysis - Lead

<b>SAMPLE TYPE:</b>	Soil	<b>DATE SAMPLED:</b>	Jan 07, 2002
<b>SAMPLE ID:</b>	319158	<b>DATE RECEIVED:</b>	Jan 10, 2002
<b>SAMPLE DESCRIPTION:</b>	Borehole #6 @ 6.00 M 15:00	<b>DATE REPORTED:</b>	Jan 21, 2002

PARAMETER	RESULTS	UNITS	M.D.L.	DATE ANALYZED	INITIALS	DATE PREPARED
Lead	6.1	µg/g	0.4	Jan 21, 2002	IG	Jan 21, 2002

**COMMENTS:**

M D L - Method Detection Limit

Certified By:

**AGAT CERTIFICATE OF ANALYSIS**

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## Certificate of Analysis

**CLIENT NAME:** KC ENVIRONMENTAL

**AGAT WORK ORDER:** 02E001694

**ATTENTION:** Margaret Marra

### Sieve Analysis - Particle Size by Sieve

<b>SAMPLE TYPE:</b>	Soil	<b>DATE SAMPLED:</b>	Jan 07, 2002
<b>SAMPLE ID:</b>	319156	<b>DATE RECEIVED:</b>	Jan 10, 2002
<b>SAMPLE DESCRIPTION:</b>	Borehole #2 @ 4.50 M 11:00	<b>DATE REPORTED:</b>	Jan 21, 2002

PARAMETER	RESULTS	UNITS	M.D.L.	DATE ANALYZED	INITIALS	DATE PREPARED
Sieve Analysis - 75 microns	89.3	%	N/A	Jan 17, 2002	AD	Jan 17, 2002
Sieve Analysis - Retaining Pan	10.7	%	N/A	Jan 17, 2002	AD	Jan 17, 2002

**COMMENTS:**

M.D.L. - Method Detection Limit

*Certified By:*

**AGAT CERTIFICATE OF ANALYSIS**

AGAT Laboratories Calgary is accredited by the Standards Council of Canada (SCC), in co-operation with the Canadian Association for Environmental Analytical Laboratories (CAEAL), for specific tests listed in the scope of accreditation approved by the SCC.

AGAT Laboratories Calgary is accredited by the American Industrial Hygiene Association (AIHA) for specific tests.

**APPENDIX C**

**SOIL LITHOLOGY, PID READINGS, AND  
MEASURED GROUNDWATER ELEVATIONS**

# DRILLER'S LOG REPORT

PROJECT 801-01-367-Site 5720		DATE	7-Jan-02
BOREHOLE	B1	LOGGED	Margaret Marra
START TIME	10:00 AM	END TIME	12:30 PM

Depth in m	Sample Number	Soil Type	TOTAL ORGANIC HYDROCARBON VAPOUR (ppm)
0			
0.75	Till B1-0.75		12.3
1.5	Till B1-1.5		
2.25	Silty till, charcoal deposits B1-2.25		52.8
3	Silty sand B1-3.00		
3.75	Wet sand B1-3.75	▼	26.6
4.5	Clay, grey brown, oxides and whites B1-4.5		20.7
5.25	Clay grey brown, oxides and whites B1-5.25		
6	Wet sand B1-6.00		12.8
6.75	Wet silty sand B1-6.75		18.8
*7.5	Wet sand some grey clay END OF DRILLING B1-7.5 *		22.2
			61.7
			48.9
			29.1

- fines (clay and silt)
- fine sand
- med sand
- coarse sand
- gravel
- cobbles

\*Sample sent to laboratory      ▼ Water Table

SOLID AUGER USED      SUNALTA DRILLING

# DRILLER'S LOG REPORT

PROJECT 801-01-367-Site 5720	DATE	7-Jan-02
BOREHOLE B2	LOGGED	Margaret Marra
START TIME 10:00 AM	END TIME	06:00 PM

Depth in m	Sample Number	Soil Type	TOTAL ORGANIC HYDROCARBON VAPOUR (ppm)
0			
0.75	Clay brown B2-0.75		22.8
1.5	Clay, brown, some charcoal B2-1.5		
2.25	Clay, some sand and charcoal B2-2.25		82.8
3	Silty brown clay B2-3.00		
3.75	Silty sand, obvious hydrocarbon odour B2-3.75		62.4
*4.5	Silty sand, obvious hydrocarbon odour END OF DRILLING B2-4.5 *	▼	42.2
			220
			780

- fines (clay and silt)
- fine sand
- med sand
- coarse sand
- gravel
- cobbles

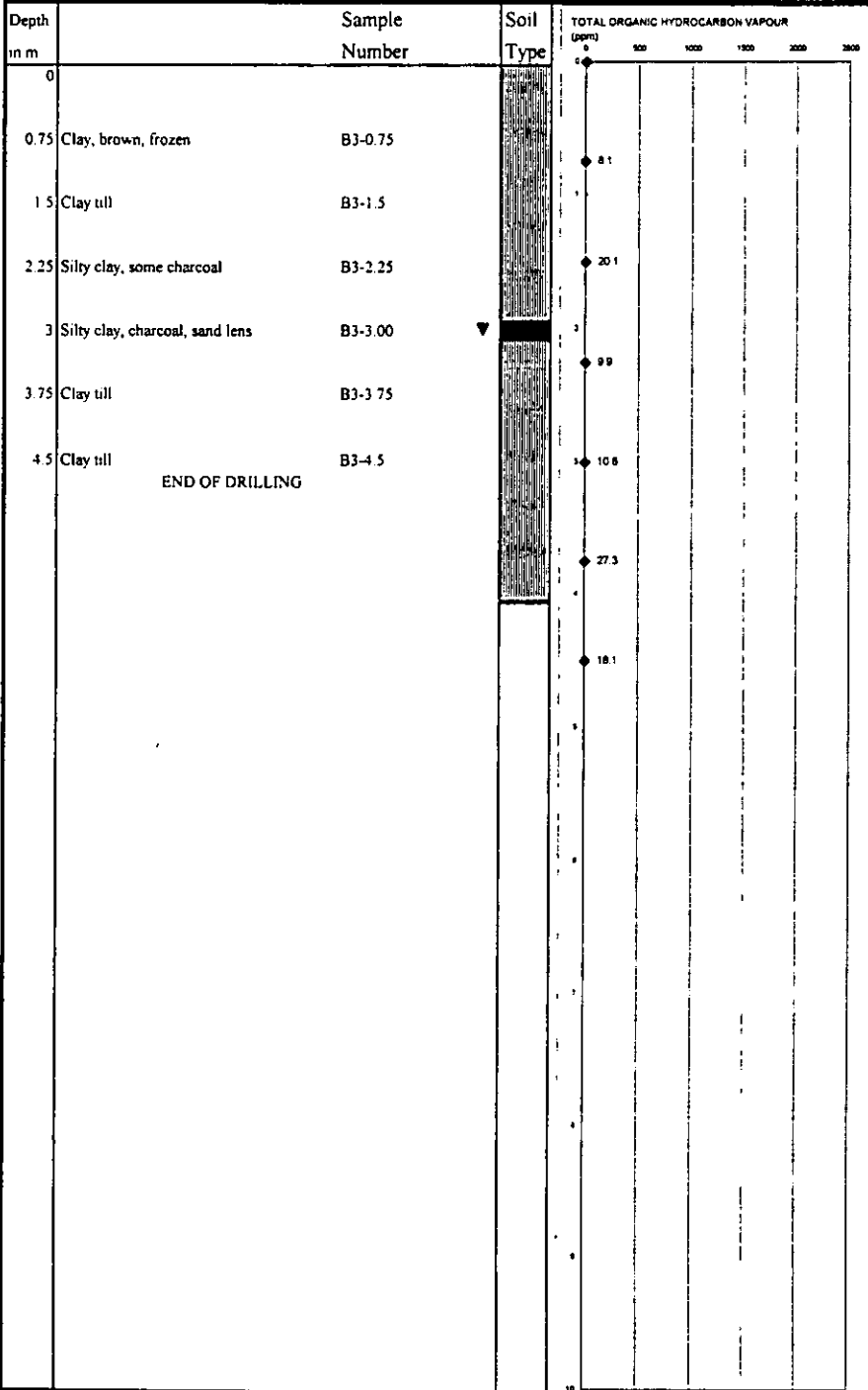
\*Sample sent to laboratory      ▼ Water Table

SOLID AUGER USED      SUNALTA DRILLING



# DRILLER'S LOG REPORT

PROJECT	801-01-367-Site 5720	DATE	7-Jan-02
BOREHOLE	B3	LOGGED	Margaret Marra
START TIME	10:00am	END TIME	06:00 PM



- fines (clay and silt)
- fine sand
- med sand
- coarse sand
- gravel
- cobbles

Sample sent to laboratory      ▼ Water Table

SOLID AUGER USED      SUNALTA DRILLING

# DRILLER'S LOG REPORT

PROJECT 801-01-367-Site 5720	DATE	January 7 2002	
BOREHOLE	B4	LOGGED	Margaret Marra
START TIME	10 00 AM	END TIME	06 00 PM

Depth (m)	Sample Number	Soil Type	TOTAL ORGANIC HYDROCARBON VAPOUR (ppm)
0			
0.75	No sample on auger due to frost	B4-0.75	
1.5	Clay, some charcoal	B4-1.5	
2.25	Wet clay, some charcoal	B4-2.25	292
3	Clay, some charcoal, whites	B4-3.00	5
*3.75	Wet silty clay, some charcoal	B4-3.75*	565
4.5	Wet silty sand, some charcoal	B4-4.5	372
5.25	Wet silty sand	B4-5.25	58
6	Wet silty sand, some clay	B4-6.00	222
6.75	Clay, grey till	B4-6.75	43
7.5	Silty clay, grey, sand lens END OF DRILLING	B4-7.5	408
			987

- fines (clay and silt)
- fine sand
- med sand
- coarse sand
- gravel
- cobbles

▼ Sample sent to laboratory      ▼ Water Table

SOLID AUGER USED      SUNALTA DRILLING

# DRILLER'S LOG REPORT

PROJECT 801-01-367-Site 5720		DATE	7-Jan-02
BOREHOLE	B5	LOGGED	Margaret Marra
START TIME	10:00 AM	END TIME	06:00 PM

Depth in m	Sample Number	Soil Type	TOTAL ORGANIC HYDROCARBON VAPOUR (ppm)
0			
0.75	Hard crumbly clay till (frozen)	B5-0.75	16
1.5	Clay till, some charcoal	B5-1.5	
2.25	Silty clay till with charcoal	B5-2.25	80.1
3	Silty clay till, brown, with charcoal	B5-3.00	79.3
3.75	Wet sand	B5-3.75	66.9
4.5	Sand with charcoal	B5-4.5	9
5.25	Wet sand	B5-5.25	108
6	Wet sand	B5-6.00	25.7
	END OF DRILLING Hole collapsing		30.3

- fines (clay and silt)
- fine sand
- med sand
- coarse sand
- gravel
- cobbles

\*Sample sent to laboratory    ▼ Water Table

SOLID AUGER USED      SUNALTA DRILLING

## DRILLER'S LOG REPORT

PROJECT 801-01-367-Site 5720	DATE	7-Jan-02	
BOREHOLE B6	LOGGED	Margaret Marra	
START TIME 10 00 AM	END TIME	06 00 PM	

Depth in m	Sample Number	Soil Type	TOTAL ORGANIC HYDROCARBON VAPOUR (ppm)
0			
0.75	B6-0.75		5.8
1.5	B6-1.5		
2.25	B6-2.25		54.9
3	B6-3.00		29.9
3.75	B6-3.75		
4.5	B6-4.5		46.8
5.25	B6-5.25		121
*6	B6-6.00*		141
	END OF DRILLING Hole collapsing		25.7
			200

- fines (clay and silt)
- fine sand
- med sand
- coarse sand
- gravel
- cobbles

\*Sample sent to laboratory      ▼ Water Table

SOLID AUGER USED

SUNALTA DRILLING

# DRILLER'S LOG REPORT

PROJECT 801-01-367-site 4385B		DATE	17-Dec-01
BOREHOLE	B7	LOGGED	Vanessa Castro
START TIME	12 45 PM	END TIME	01 30 PM

Depth in m	Sample Number	Soil Type	TOTAL ORGANIC HYDROCARBON VAPOUR (ppm)
0			
0.75	No sample, crumbly	B7-0.75	
1.5	No sample, crumbly, ground rock	B7-1.5	
2.25	Silty clay	B7-2.25	
3	Silty clay, some whites and oxides	B7-3.00	
3.75	Silty clay till, some whites	B7-3.75	85.5
4.5	Silty clay till	B7-4.5	143
5.25	Clay till, grey some oxides, some sand	B7-5.25	18.2
6	Clay till, grey	B7-6.00	18.2
6.75	Clay till, grey, sand lens	B7-6.75	18.2
7.5	Clay till, grey, sand lens END OF DRILLING	B7-7.5	9.5
	NOTE: Did not reach water table		8.4
			172
			156

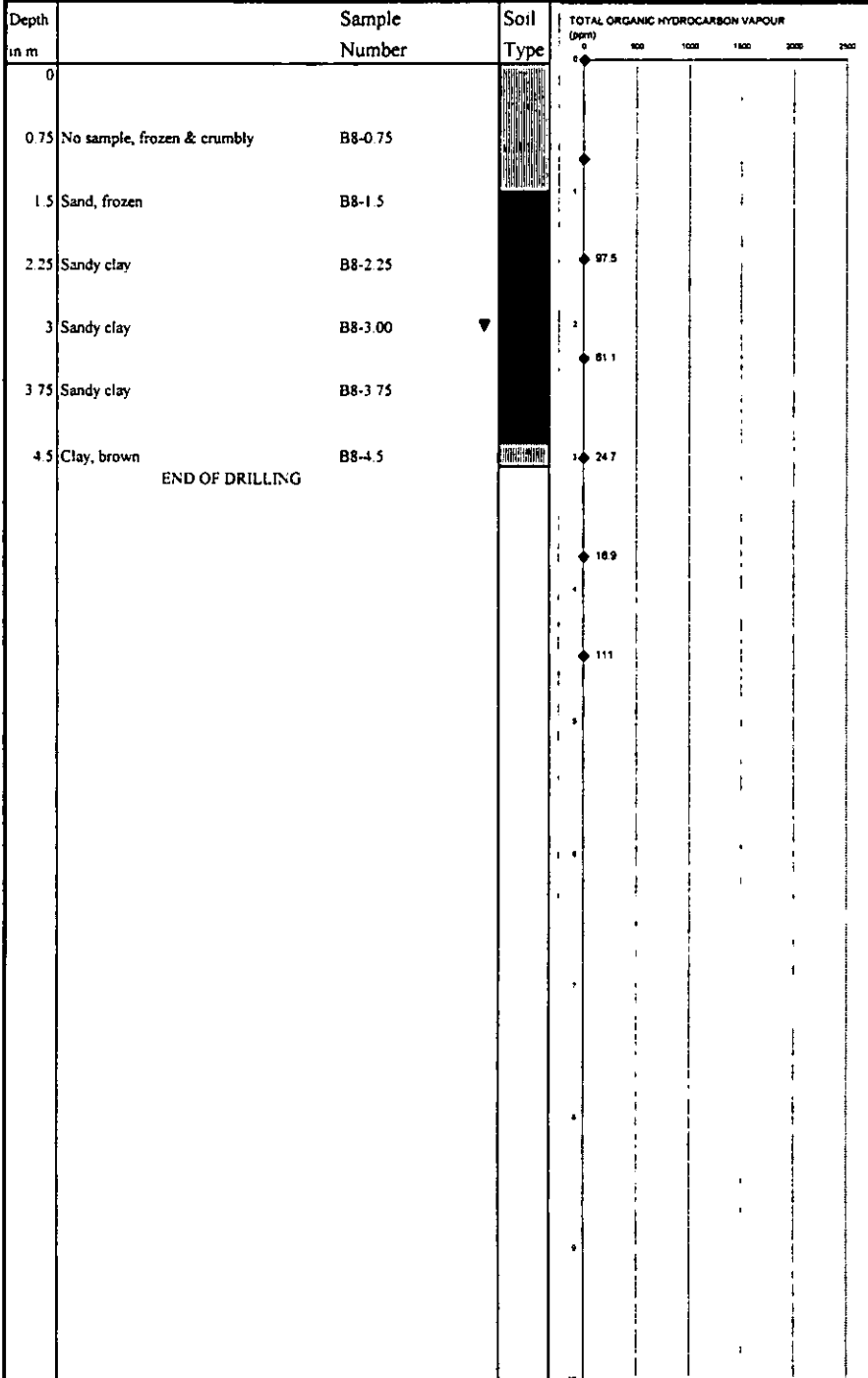
- fines (clay and silt)
- fine sand
- med sand
- coarse sand
- gravel
- cobbles

\* Sample sent to laboratory
▼ Water Table

SOLID AUGER USED
SUNALTA DRILLING

# DRILLER'S LOG REPORT

PROJECT 801-01-367-Site 5720		DATE	7-Jan-02
BOREHOLE	B8	LOGGED	Margaret Marra
START TIME	10:00am	END TIME	06 00 PM



- fines (clay and silt)
- fine sand
- med sand
- coarse sand
- gravel
- cobbles

\*Sample sent to laboratory      ▼ Water Table

SOLID AUGER USED      SUNALTA DRILLING

**Readings (ppm) - Alsike (Site 5720)**

Sample name	Location & Depth	PID Readings (ppm)
1-0.75	1, 0.75m	12.3
1-1.50	1, 1.50m	52.6
1-2.25	1, 2.25m	36.6
1-3.00	1, 3.00m	20.7
1-3.75	1, 3.75m	12.8
1-4.50	1, 4.50m	16.8
1-5.25	1, 5.25m	22.2
1-6.00	1, 6.00m	61.7
1-6.75	1, 6.75m	48.9
1-7.50	1, 7.50m	291.0
2-0.75	2, 0.75m	22.8
2-1.50	2, 1.50m	82.6
2-2.25	2, 2.25m	62.4
2-3.00	2, 3.00m	42.2
2-3.75	2, 3.75m	226.0
2-4.50	2, 4.50m	780.0
3-0.75	3, 0.75m	8.1
3-1.50	3, 1.50m	20.1
3-2.25	3, 2.25m	9.9
3-3.00	3, 3.00m	10.8
3-3.75	3, 3.75m	27.3
3-4.50	3, 4.50m	18.1
4-0.75	4, 0.75m	0 (no sample)
4-1.50	4, 1.50m	29.2
4-2.25	4, 2.25m	5.0
4-3.00	4, 3.00m	56.5
4-3.75	4, 3.75m	372.0
4-4.50	4, 4.50m	5.8
4-5.25	4, 5.25m	232.0
4-6.00	4, 6.00m	43.0
4-6.75	4, 6.75m	40.6
4-7.50	4, 7.50m	96.7
5-0.75	5, 0.75m	16.0
5-1.50	5, 1.50m	60.1
5-2.25	5, 2.25m	79.3
5-3.00	5, 3.00m	66.9
5-3.75	5, 3.75m	9.0
5-4.50	5, 4.50m	109.0
5-5.25	5, 5.25m	25.7
5-6.00	5, 6.00m	30.3

Sample name	Location & Depth	PID Readings (ppm)
6-0.75	6, 0.75m	5.8
6-1.50	6, 1.50m	54.9
6-2.25	6, 2.25m	29.9
6-3.00	6, 3.00m	46.8
6-3.75	6, 3.75m	121.0
6-4.50	6, 4.50m	141.0
6-5.25	6, 5.25m	25.7
6-6.00	6, 6.00m	209.0
7-0.75	7, 0.75m	0 (no sample)
7-1.50	7, 1.50m	0 (no sample)
7-2.25	7, 2.25m	55.5
7-3.00	7, 3.00m	143.0
7-3.75	7, 3.75m	16.2
7-4.50	7, 4.50m	18.2
7-5.25	7, 5.25m	9.5
7-6.00	7, 6.00m	8.4
7-6.75	7, 6.75m	172.0
7-7.50	7, 7.50m	156.0
8-0.75	8, 0.75m	0 (no sample)
8-1.50	8, 1.50m	97.5
8-2.25	8, 2.25m	61.1
8-3.00	8, 3.00m	24.7
8-3.75	8, 3.75m	18.9
8-4.50	8, 4.50m	111.0

**Village of Alsike  
Monitoring Well Geodetic Ground Elevations**

**January 24, 2002**

**Project "Alsike":**                    **Highway 39 Service Station (Race Trac Gas)  
Located in the Village of Alsike  
On the north side of Hwy. 39 & the  
Junction of Hwy. 20 running South**

<b><u>Identification</u></b>	<b><u>Elevation</u></b>	<b><u>Comments</u></b>	<b><u>Water Level Elevation</u></b>
Well GW # 2	806.40 m.	Steel Cover	802.53 m
Well GW # 3	806.13 m.	Steel Cover	802.60 m
Well GW # 8	802.97 m.	Steel Cover	800.76 m

**Geodetic Datum used was ASCM # 171132 with published elevation of 798.551 AMSL. AMSL means Above Mean Sea Level ( measured in metres ).**

**Differential Levelling was carried out by John Clark of DanLin Environmental Consultants Inc.. The weather was sunny, light breeze and -10<sup>0</sup>C. All Level runs were checked back to Geodetic Benchmarks.**



**APPENDIX D**

**SITE PHOTOGRAPHS**

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Photograph 1. Race Trac Gas

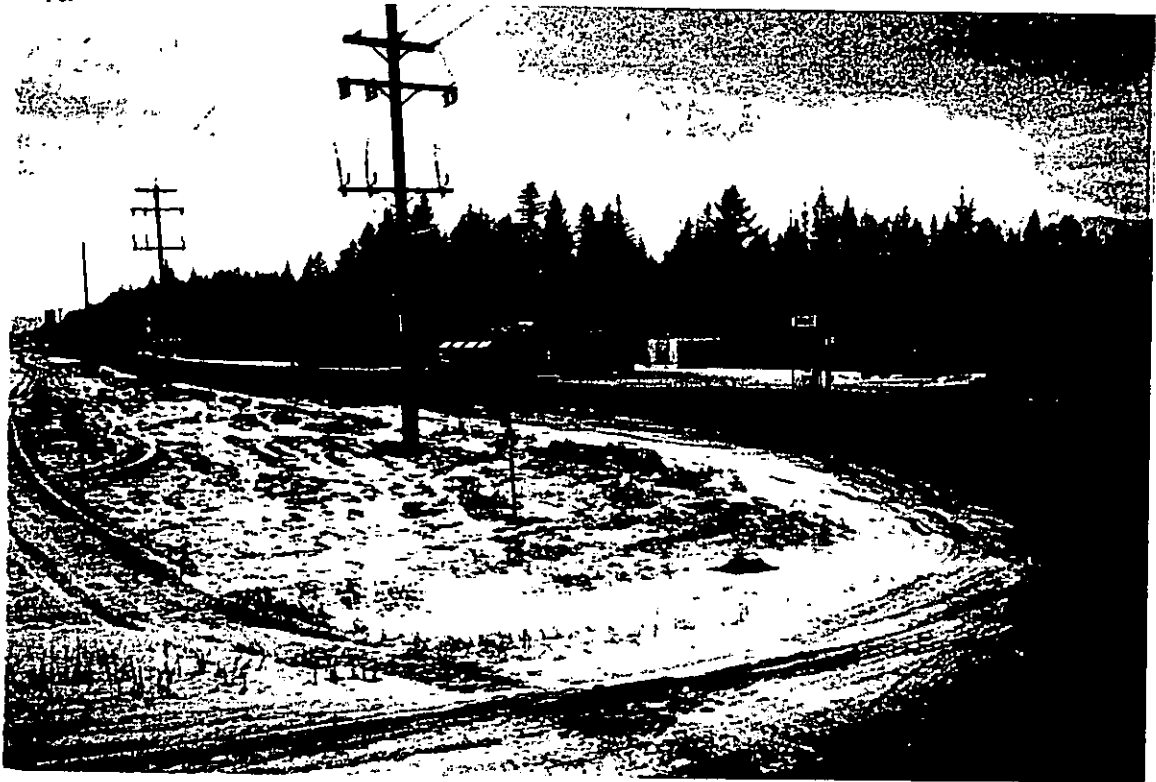


Photograph 2. View east of Race Trac Gas (Denture clinic, Teddy Bear's Restaurant, diesel fuel pump, garage, Monarch Supply and Apex Distribution)





Photograph 3 – Diesel pump to the east of Race Trac Gas



Photograph 4 Looking west from garage and diesel pump to Race Trac Gas

