



**Barons Gas Station Remediation Project
Barons, AB**

2008 Installation and Sampling of 3 New Groundwater Wells



Environmental
Agricultural
Structural
Civil
Municipal

PREPARED FOR:
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February 10, 2009

Marie Elizabeth Read
P.O. Box 267
Irma, AB T0B 2H0

Job # 07-186

Dear Marie:

Re: Installation and Sampling of 3 New Groundwater Wells at the Former Gas Station in Barons, AB

As per your request, Hasegawa Engineering has installed 3 new groundwater wells at the service station located in Barons, Alberta. One new well was installed south of the gas station where Main Street meets the subject property. The other new wells were installed on the south side of Main Street directly south of the gas station (refer to Figure 1 for well locations).

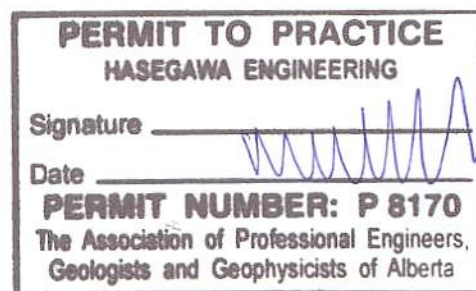
Soil samples were analyzed onsite during drilling using an OVM (Organic Vapor Meter) to screen for hydrocarbons. In addition, one soil sample from each new well was submitted to Bodycote Labs for analysis of contaminants. Groundwater samples were taken from each well at a later date and submitted to Bodycote for analysis as well. The test results are enclosed in the following report.

We trust that the enclosed information meets your requirements. Please feel free to contact me at 403-328-2686 if you have any questions or comments regarding these results.

Sincerely,



Mark Hasegawa P. Eng.
Hasegawa Engineering
Consulting Professional Engineers



PERMIT TO PRACTICE	
HASEGAWA ENGINEERING	
_____ Signature	
_____ Date	
PERMIT NUMBER: P 8170	
The Association of Professional Engineers Geologists and Geophysicists of Alberta	

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1.0 INTRODUCTION

1.1 *Project Background*

The Barons gas station site is located on Main Street in Barons, Alberta. Soil and groundwater contamination at the site were first discovered in 1993. Subsequently site investigation activities were conducted and revealed soil and groundwater was impacted by petroleum hydrocarbons. Site remediation was also conducted at this location. In August of 1996 soil beneath the pumps was removed and a soil vapor extractor system was installed. In May of 2003 soil east of the building was removed and land-farmed.

Site investigation was also conducted subsequent to remedial activities. Free product was detected in MW-2 in the Dec. 2001 groundwater sampling event. MW-2 was destroyed during the soil remediation in 2003, therefore no groundwater samples could be obtained from MW-2 in the 2007 sampling event. Free product was present in MW-3 in the 2007 and 2008, groundwater sampling events. MW-2 was formerly located just north of the sidewalk approximately 8 meters northeast of MW-3. MW-3 is located to the south of the fuel dispensers located at the gas station. Although previously two groundwater wells located south of Main Street showed no impact south of MW-3, those wells have been since been destroyed. Previous sampling events showed the groundwater flow direction to be to the south; therefore it was advised that three new groundwater wells be installed south of the former gas station to delineate off-site contamination plume. This property shall herein after be referred to as the "Subject Property".

1.2 *Scope of Work*

The specific activities included in this assessment included:

- Drilling and installation of 3 new groundwater wells to the south of the subject property.
- Sampling of soil during drilling of wells and readings taken from soil using an OVM (Organic Vapor Meter) to determine hydrocarbon content.
- Submission of one soil sample from each well corresponding to the highest OVM reading for that well (3 samples total).
- Gauging of the 3 new wells to establish water table elevations, purging of each well to allow recharging of fresh groundwater, sampling of groundwater from each well
- Submission of 3 soil samples and 3 groundwater samples for analysis for BTEX, F1, F2, F3, and F4.
- Complete summary report, which includes results, maps, conclusions and recommendations for future work

1.3 *Study Objectives*

The primary objective of this project was to provide the owner or owners, with verification of whether or not there has been additional off-site impact to soil or groundwater.

2.0 METHODOLOGY

2.1 *Soil Sampling and Analysis*

On December 29, 2008, a solid stem auger rig was used to advance the proposed soil borings. Bedrock was reached at approximately 12 to 13 feet in each well; therefore all three wells were completed to 15 foot depths. At each 5 foot interval, a soil sample was taken directly from the auger flight and visually examined to determine soil type, moisture content, color, and the presence of odor. In addition, two soil samples were taken at each 5 foot interval, one sample was stored in a Ziploc bag and labeled while a corresponding sample was placed in a 500 ml jar and stored on ice in a cooler. The samples stored in the Ziploc bags were allowed to equilibrate for 10 minutes and then were tested using an OVM (Organic Vapor Meter) to quantify hydrocarbon content. The soil jar sample from each well corresponding to the highest OVM reading was identified and submitted to Bodycote Labs for analysis. The results of the field analysis are presented in Table 1.

2.2 *Groundwater Sampling and Gauging*

Prior to sampling, all wells were gauged to determine the depth to water. Each well was then purged of at least two well bore volumes or until the well went dry. Samples were then collected using a hand bailer and stored on ice. The bailer was decontaminated before sampling subsequent wells. All samples were then preserved at 4 degrees C and sent to Bodycote Labs on January 20, 2009, for analysis.

2.3 *Assessment Criteria*

Results obtained from Bodycote Labs for the submitted samples of soil and groundwater were evaluated to ensure validity by:

- Reviewing all data provided by the lab to ensure correct methodologies were utilized and laboratory errors had not occurred;

- Comparing concentrations of each indicator parameter to the corresponding Permissible Exposure Limits; and
- Determining whether any concentration that exceeds the exposure limits was not the result of unrelated events.

3.0 SOIL RESULTS

3.1 General

All soil samples submitted for laboratory analysis were tested for BTEX (Benzene, Toluene, Ethylbenzene, and Total Xylenes), F1, F2, F3, and F4. The results of this analysis are included in this section.

3.2 Soil Analytical Results

Soil samples were obtained during drilling of the groundwater wells on Dec 29, 2008. The soil analytical results are shown in Table 1 below. Results are compared against the AENV Commercial Guidelines for fine grained soils.

Table 1: Soil Analytical Results

SAMPLE LOCATION	Benzene (mg/L)	Toluene (mg/L)	Ethylbenzene (mg/L)	Xylenes (mg/L)	F1 (Mg/L)	F2 (Mg/L)	F2 (Mg/L)	F2 (Mg/L)
Commercial Guidelines	9	450	690	1,500	660	1,500	2,500	6,600
MW-13	1.18	0.089	1.55	17.9	191	937	340	<20
MW-14	<0.004	<0.005	<0.010	0.02	<4	25	<30	<20
MW-15	<0.004	<0.005	<0.010	0.02	<4	26	<30	<20
Detection limit	<0.004	<0.005	<0.010	0.02	<4	26	<30	<20

 - Exceeds Alberta Environment risk management guidelines for petroleum storage tank sites

As seen in Table 1, the results of soil analysis are below allowable Commercial Guidelines for fine-grained soils. Commercial guidelines for generic hydrocarbon criteria, for fine-grained soil, were obtained from AENV Risk Management Guidelines for Petroleum Storage Tank Sites.

4.0 GROUNDWATER RESULTS

4.1 General

All groundwater samples submitted for laboratory analysis were tested for BTEX (Benzene, Toluene, Ethylbenzene, and Total Xylenes), F1, F2, F3, and F4.

Groundwater Potentiometric Surface

MW-13, MW-14, and MW-15, were gauged at the site on January 20, 2009, to determine the potentiometric surface elevation. Groundwater potentiometric surface data is shown in Table 2 below as well as in Figure 1 in Appendix A. The resulting groundwater gradient is toward the south which is consistent with previous groundwater potentiometric surface data.

Table 2: Groundwater Potentiometric Surface Data

MONITORING WELL	DTW (m)	TD (m)
MW – 13	3.10	4.50
MW – 14	3.11	4.39
MW – 15	2.86	4.40

DTW= Depth To Water (measured from ground level)

TD= Total Depth

4.2 Groundwater Analytical Results

The results of the sample analysis are included in Table 3 below.

Table 3: Groundwater Quality Data

SAMPLE LOCATION	Benzene (mg/L)	Toluene (mg/L)	Ethylbenzene (mg/L)	Xylenes (mg/L)	F (C6-C10) (mg/L)	F2 (C10-C16) (mg/L)
Commercial Guidelines	16	342	NG	NG	24	18
MW-13	3.42	0.215	0.164	2.05	16.8	340
MW-14	<0.001	<0.001	<0.001	0.021	<0.2	0.2
MW-15	<0.001	<0.001	<0.001	0.002	<0.2	<0.1

 - Exceeds Alberta Environment risk management guidelines for petroleum storage tank sites

The water quality of all the samples taken is within Alberta Environment Guidelines with the exception of F2 in MW-13. A sheen of petroleum product was visible when groundwater was obtained from Monitoring well MW-13. A strong gasoline odor was present as well.

The complete groundwater analytical results from Norwest labs are included in Appendix B.

5.0 CONCLUSION

Three new groundwater wells were installed south of the subject property on December 29, 2008. Soil samples were obtained during the installation of the new wells and submitted for analysis. The results of the soil sampling and analysis indicate that all three samples meet Alberta Environments guidelines for fine grained soil.

Groundwater gauging and sampling of the new wells occurred on January 20, 2009. The wells were gauged to determine groundwater depth and flow direction. One groundwater sample from each well was submitted for analysis. The results of the groundwater analysis show that all groundwater samples meet Alberta Environment guidelines with the exception of petroleum hydrocarbon fraction F2 in MW-13. These results are consistent with previous sampling events where free product was present in Monitoring well MW-3 which is located a few meters west of MW-13. The groundwater samples from MW-14 and MW-15 located offsite to the south of Main Street show no impact from the free product present in MW-13.

6.0 RECOMMENDATIONS

It is recommended that one additional well be advanced, southeast of MW-13, to confirm plume delineation. In addition, it is proposed that all remaining groundwater wells at the site be gauged, sampled, and analyzed for BTEX & F1 & F2. In addition Hasegawa Engineering proposes that each well be analyzed for parameters that determine the potential for natural attenuation of any remaining contaminants. For a proposed sampling & analysis schedule, refer to Table 4.

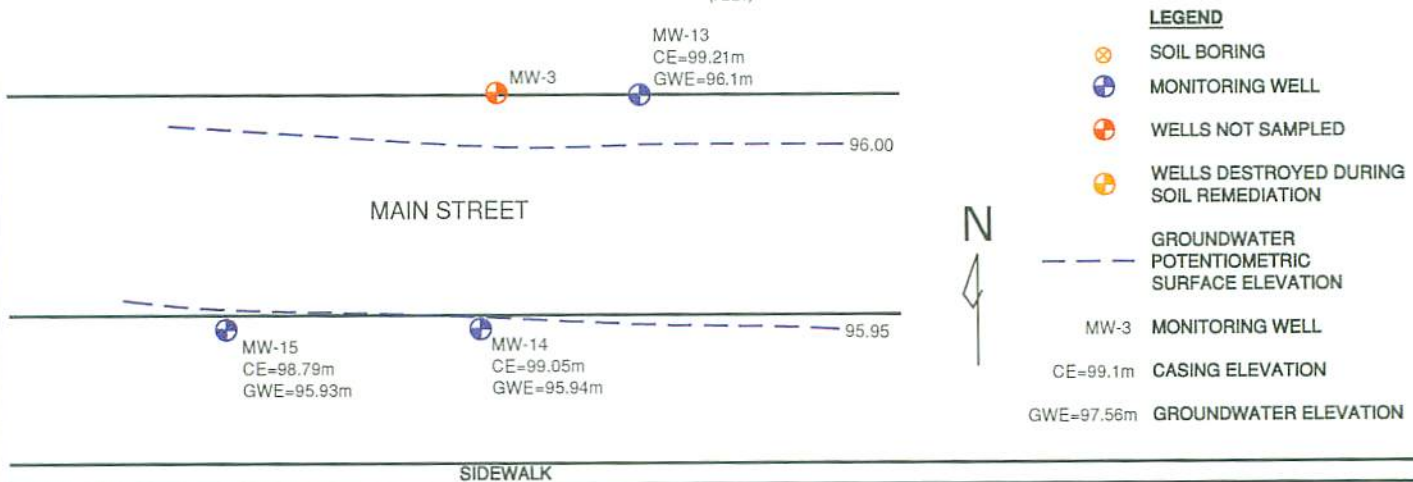
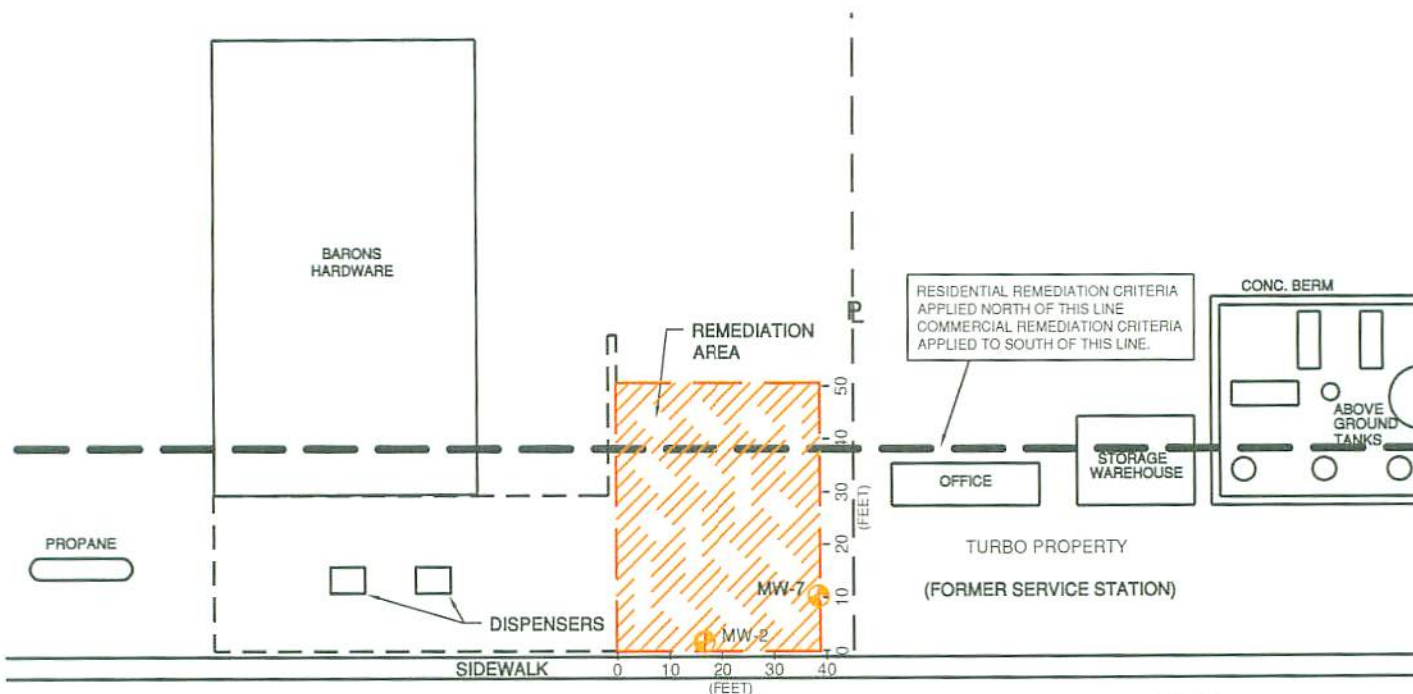
Table 4

Well	BTEX	F1	F2	OXYGEN	NITRATE	SULFATE	IRON	REDOX POTENTIAL	METHANE
1	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	✓	✓	✓	✓	✓	✓	✓	✓	✓
11	✓	✓	✓	✓	✓	✓	✓	✓	✓
13	✓	✓	✓	✓	✓	✓	✓	✓	✓
14	✓	✓	✓	✓	✓	✓	✓	✓	✓
15	✓	✓	✓	✓	✓	✓	✓	✓	✓

The results of this analysis will then be reviewed to determine the potential for natural Attenuation as a renewal option at this site.

Appendix A

Maps and Figures



 Hasegawa Engineering	LETHBRIDGE OFFICE 1220 - 31 Street North Lethbridge Alberta T1H 5J8 Ph: 328-2686 Fax: 328-2728 email: hosgm@telusplanet.net	This is a copyright drawing and shall not be reproduced in any form without written permission of Engineer. Contractor to check and verify all dimensions before construction, any errors and omissions reported to Engineer immediately.	Drawing not to be used for construction until so approved. Do not scale Drawing. All construction shall be in accordance with the latest code, may it be construction, mechanical, etc. code.	
CLIENT MARIE READ	PROJECT TITLE BARONS GAS STATION REMEDIATION PROJECT	SHEET NO. FIGURE 1 - SITE MAP DATE DRAWN FEB. 10, 2009		

Appendix B

Analytical Reports

Soil Analytical Results

Analytical Report

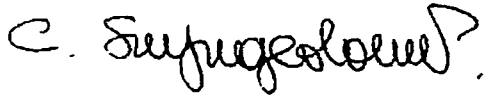
Bill To: Hasegawa Engineering
Report To: Hasegawa Engineering
1220 - 31 Street North
Lethbridge, AB, Canada
T1H 5J8
Attn: Mike Oler
Sampled By: Mike
Company: Hasegawa

Project:
ID: Barons Gas Station
Name:
Location: Barons, AB
LSD:
P.O.:
Acct code:

Lot ID: **661902**
Control Number: L-003879
Date Received: Dec 29, 2008
Date Reported: Jan 2, 2009
Report Number: 1185233

		Reference Number	661902-1	661902-2	661902-3	
		Sample Date	Dec 29, 2008	Dec 29, 2008	Dec 29, 2008	
		Sample Time	NA	NA	NA	
		Sample Location	Barons, AB	Barons, AB	Barons, AB	
		Sample Description	MWA (MW-13)	MWB (MW-14)	MWC (MW-15)	
		Matrix	Soil	Soil	Soil	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Mono-Aromatic Hydrocarbons - Soil						
Extraction Date			30-Dec-08	30-Dec-08	30-Dec-08	
Benzene	Dry Weight	mg/kg	1.18	<0.004	<0.004	0.004
Toluene	Dry Weight	mg/kg	0.089	<0.005	<0.005	0.005
Ethylbenzene	Dry Weight	mg/kg	1.55	<0.010	<0.010	0.010
Total Xylenes (m,p,o)	Dry Weight	mg/kg	17.9	0.02	0.02	0.010
Volatile Petroleum Hydrocarbons - Soil						
Extraction Date			30-Dec-08	30-Dec-08	30-Dec-08	
F1 C6-C10	Dry Weight	mg/kg	191	<4	<4	4
F1 -BTEX	Dry Weight	mg/kg	170	<4	<4	4
Extractable Petroleum Hydrocarbons - Soil						
Extraction Date			30-Dec-08	30-Dec-08	30-Dec-08	
F2c C10-C16	Dry Weight	mg/kg	937	25	26	10
F3c C16-C34	Dry Weight	mg/kg	340	<30	<30	30
F4c C34-C50	Dry Weight	mg/kg	<20	<20	<20	20
F4HTGCc C34-C50+	Dry Weight	mg/kg	<20	<20	<20	20
% C50+		%	<5	<5	<5	
Silica Gel Cleanup						
Silica Gel Cleanup			Done	Done	Done	
Soil % Moisture						
Moisture	Soil % Moisture	%	14.60	17.30	16.20	

Approved by:



Chris Swyngedouw, PhD, PChem
Consulting Scientist

Methodology and Notes

Bill To: Hasegawa Engineering
Report To: Hasegawa Engineering
1220 - 31 Street North
Lethbridge, AB, Canada
T1H 5J8
Attn: Mike Oler
Sampled By: Mike
Company: Hasegawa

Project:
ID: Barons Gas Station
Name:
Location: Barons, AB
LSD:
P.O.:
Acct code:

Lot ID: **661902**
Control Number: L-003879
Date Received: Dec 29, 2008
Date Reported: Jan 2, 2009
Report Number: 1185233

Method of Analysis

Method Name	Reference	Method	Date Analysis Started	Location
BTEX-CCME - Soil	CCME	* Reference Method for Canada-Wide Standard for PHC in Soil, CWS PHCS TIER 1	30-Dec-08	BTG Calgary
BTEX-CCME - Soil	US EPA	* US EPA method, 8260B/5035	30-Dec-08	BTG Calgary
TEH-CCME-Soil (Shake)	CCME	* Reference Method for Canada-Wide Standard for PHC in Soil, CWS PHCS TIER 1	30-Dec-08	BTG Calgary

** Bodycote method(s) based on reference method*

References

CCME Canadian Council of Ministers of the Environment
US EPA US Environmental Protection Agency Test Methods

Comments:

Please direct any inquiries regarding this report to our Client Services group.

Results relate only to samples as submitted.

The test report shall not be reproduced except in full, without the written approval of the laboratory.

Petroleum Hydrocarbons in Soil

Bill To: Hasegawa Engineering
Report To: Hasegawa Engineering
1220 - 31 Street North
Lethbridge, AB, Canada
T1H 5J8
Attn: Mike Oler
Sampled By: Mike
Company: Hasegawa

Project:
ID: Barons Gas Station
Name:
Location: Barons, AB
LSD:
P.O.:
Acct code:

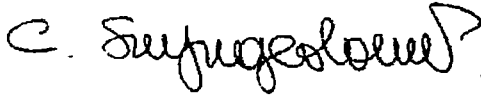
Lot ID: **661902**
Control Number: L-003879
Date Received: Dec 29, 2008
Date Reported: Jan 2, 2009
Report Number: 1185233

Petroleum Hydrocarbons in Soil

Batch Notes

1. The method used complies with the Reference Method for the Canada Wide Standards for Petroleum Hydrocarbons in Soil - Tier 1, April 2001, including Addendum 1, and is accredited for use in Bodycote Testing Group.
2. Modifications of the method: See Notes and Methodology for nonconformances (if applicable).
3. Qualifications on results: See Notes and Methodology for nonconformances (if applicable).
4. Silica gel treatment is done for fractions F2, F3, F4.
5. F1-BTEX: BTEX has been subtracted from the F1 fraction.
6. Naphthalene has been subtracted from fraction F2 and selected PAHs have been subtracted from fraction F3.
7. F4HTGC is reported when more than 5% of the total carbon envelope elutes past C₅₀.
8. Bodycote Testing Group does not report Gravimetric Heavy Hydrocarbons (F4G or F4G-sg), F4HTGC through extended range high temperature GC is reported instead.
9. When both F4(C₃₄-C₅₀) and FHTGC are reported, F4HTGC is the F4 that is to be used for interpreting the CWS.
10. Quality criteria met for the batch: Data is reported in Quality Control Section of report (if requested).
 - nC₆ and nC₁₀ response factors (RF) are within 30% of RF for toluene
 - nC₁₀, nC₁₆ and nC₃₄ RFs are within 10% of each other
 - nC₅₀ RF is within 70% of the average RF for nC₁₀+nC₁₆+nC₃₄
 - linearity is within 15%
11. Batch data for QC samples is available on request.
12. Extraction and analysis holding times were met: See Notes and Methodology for nonconformances (if applicable).

Approved by:



Chris Swyngedouw, PhD, PChem
Consulting Scientist

Groundwater Analytical Results



Analytical Report

Bill To: Hasegawa Engineering
 Report To: Hasegawa Engineering
 1220 - 31 Street North
 Lethbridge, AB, Canada
 T1H 5J8
 Attn: Mike Oler
 Sampled By:
 Company:

Project:
 ID:
 Name:
 Location:
 LSD:
 P.O.:
 Acct code:

Lot ID: 664511
 Control Number:
 Date Received: Jan 20, 2009
 Date Reported: Jan 28, 2009
 Report Number: 1188242

	Reference Number	664511-1	664511-2	664511-3	
	Sample Date	Jan 20, 2009	Jan 20, 2009	Jan 20, 2009	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	MWA (MW-13)	MWB (MW-14)	MWC (MW-15)	
	Matrix	Water	Water	Water	
Analyte	Units	Results	Results	Results	Nominal Detection Limit
Mono-Aromatic Hydrocarbons - Water					
Benzene	mg/L	3.42	<0.001	<0.001	0.001
Toluene	mg/L	0.215	<0.001	<0.001	0.001
Ethylbenzene	mg/L	0.164	<0.001	<0.001	0.001
Total Xylenes (m,p,o)	mg/L	2.05	0.021	0.002	0.001
Volatile Petroleum Hydrocarbons - Water					
F1 C6-C10	mg/L	16.8	<0.2	<0.2	0.2
F1 -BTEX	mg/L	11.0	<0.2	<0.2	0.2
Extractable Petroleum Hydrocarbons - Water					
F2 C10-C16	mg/L	340	0.2	<0.1	0.1
F3 C16-C34	mg/L	117	<0.1	0.4	0.1
F3+ C34+	mg/L	<0.1	<0.1	0.3	0.1

Approved by:

Randy Neumann, BSc
 Vice President, Environmental

Methodology and Notes

Bill To: Hasegawa Engineering
Report To: Hasegawa Engineering
1220 - 31 Street North
Lethbridge, AB, Canada
T1H 5J8
Attn: Mike Oler
Sampled By:
Company:

Project:
ID:
Name:
Location:
LSD:
P.O.:
Acct code:

Lot ID: **664511**
Control Number:
Date Received: Jan 20, 2009
Date Reported: Jan 28, 2009
Report Number: 1188242

Method of Analysis

Method Name	Reference	Method	Date Analysis Started	Location
BTEX-CCME - Water	US EPA	* US EPA method, 8260B/5035	21-Jan-09	BTG Calgary
TEH-CCME - Water	MMCA	* Petroleum Hydrocarbons in water, A108.0	21-Jan-09	BTG Calgary

* Bodycote method(s) based on reference method

References

MMCA Methods Manual for Chemical Analysis of Trace Orgs.
US EPA US Environmental Protection Agency Test Methods

Comments:

Please direct any inquiries regarding this report to our Client Services group.

Results relate only to samples as submitted.

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