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

2007 Groundwater Monitoring Report



PREPARED FOR:
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PREPARED BY:
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Environmental
Structural
Civil
Industrial
Municipal

HASEGAWA ENGINEERING

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October 19, 2007

Job #: 07-186

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

Dear Marie:

**Re: Groundwater monitoring at former Barons Gas Station
Barons, AB**

As per your request, Hasegawa Engineering has collected ground water samples from monitoring wells 1,3,4,5,9, and 11, located at and around the gas station property. Refer to Figure 1 for well locations. Samples were submitted to Bodycote Labs for analysis and contamination testing. 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
MAH/cms

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2.0 METHODOLOGY

2.1 *Groundwater Sampling and Gauging*

Samples were obtained from Monitoring wells MW-1, 3-5, 9, and 11. A sample was not obtained from MW-6 because the well could not be located with a pin finder. MW-10 was not sampled because it is located inside the building and access was not available. MW-2 and MW-7 were destroyed during the soil remediation event in 2003, therefore no groundwater samples could be taken. Prior to sampling, all wells were gauged to determine the depth to water. Each well was developed and then purged of at least two well bore volumes or until the well went dry. Samples were then collected using a submersible pump and stored on ice. The pump was decontaminated before sampling subsequent wells and a new hose was used for each well.

All samples were then preserved at 4 degrees C and sent to Bodycote Labs on July 27, 2007 for analysis.

2.2 *Assessment Criteria*

Results obtained from Bodycote Labs for the submitted samples of 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 GROUNDWATER RESULTS

3.1 General

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

3.2 Groundwater Potentiometric Surface

MW-1, 3-5, 9, and 11, were gauged at the site on July 27, 2007 to determine the potentiometric surface elevation. Groundwater potentiometric surface data is shown in Table 1 below as well as in Figure 1 in Appendix A.

Table 1: Groundwater Potentiometric Surface Data

MONITORING WELL	DTW (m)	TD (m)	DTP (m)
MW - 1	2.16	5.4	N/A
MW - 3	1.54	4.02	Sheen
MW - 4	1.62	4.07	N/A
MW - 5	2.28	5.70	N/A
MW - 9	2.52	5.71	N/A
MW - 11	1.69	7.1	N/A

NA=Not Available

NS=Not Sampled

DTW= Depth To Water

TD= Total Depth

MW-1 was completed on a 45 degree angle therefore the Depth To Water and Total Depth measurements were calculated and are consistent with the other monitoring wells. A sheen of product was observed in MW-3. The groundwater flow direction is towards the southwest which is consistent with previous results.

3.3 Groundwater Analytical Results

The results of the sample analysis are included in Table 2 below. Monitoring wells MW-1 and MW-9 are classified as Residential. Monitoring wells MW3-5, and 11 are classified as Commercial. This delineation in regulatory levels is due to the proximity of the site to residential lots.

Table 2: Groundwater Quality Data

SAMPLE LOCATION	Benzene (mg/L)	Toluene (mg/L)	Ethylbenzene (mg/L)	Xylenes (mg/L)	F1 (Mg/L)	F2 (Mg/L)
Commercial Guidelines	16	342	NG	NG	24	18
MW-3	2.32	0.455	1.90	14.3	94.4	1640
MW-4	2.94	<0.1	<0.1	2.93	<20	39.9
MW-5	0.609	<0.1	<0.1	0.267	<20	24.2
MW-11	<0.001	<0.001	<0.001	<0.001	<0.2	2.6
Residential Guidelines	3.5	228	NG	163	9	11
MW-1	<0.001	<0.001	<0.001	<0.001	<0.2	0.3
MW-9	<0.001	<0.001	<0.001	0.002	<0.2	0.2

Exceeds Alberta Environment risk management guidelines for petroleum storage tank sites

NG – No Guideline required for this pathway; limited by solubility

The water quality of all the samples taken is within Alberta Environment Guidelines with the exception of MW-3. Levels for F1 and F2, in MW-3, exceed Alberta Environment Guidelines. Petroleum product was visible when groundwater was obtained from Monitoring well MW-3. A strong gasoline odor was present as well.

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

4.0 HISTORICAL COMPARISON

The following information is provided to compare the historical results with current results.

Groundwater

Free product was detected in MW-2 in the Dec. 2001 groundwater sampling event (refer to Table 3). MW-2 was destroyed during the soil remediation which took place in 2003, therefore no groundwater samples could be obtained in 2007. MW-2 was formerly located just north of the sidewalk approximately 8 meters northeast of MW-3. Free product was present in MW-3 in the 2007 groundwater sampling event. From these findings it appears that the groundwater flow is pushing the remaining product in a southwest direction towards the road.

Table 3: 2002 Groundwater Analytical Results

Sample Location	Date	Benzene (mg/L)	Toluene (mg/L)	Ethyl-benzene (mg/L)	Xylenes (mg/L)	F1 (mg/L)	F2 (mg/L)
MW-1*	12/19/01	15.4	3.26	1.07	11.8	85.3	4.4
MW-1*	10/19/03	1.65	.016	0.031	0.605	3.78	4.9
MW-2	12/19/01	FP	FP	FP	FP	FP	FP
MW-3	12/19/01	2.49	1.4	0.203	2.49	8.6	0.6
MW-4	12/19/01	0.516	0.083	0.001	0.581	1.97	1.2
MW-5	12/19/01	2.17	0.051	0.009	2.81	8.1	
MW-6	14/06/02	1.85	2.19	0.005	3.33	9.85	3.0
MW-7	14/06/02	6.41	9.54	0.239	8.01	42.4	3.5
MW-8*	14/06/02	0.001	<0.001	<0.005	0.004	0.05	<0.1
MW-9*	14/06/02	<0.001	<0.001	<0.001	<0.001	<0.01	<0.1
MW-10*	14/06/02	<0.001	<0.001	<0.001	<0.001	<0.01	<0.1

FP indicates concentration exceeds applicable remedial criteria

*Offsite criteria applies

FP = Free Product

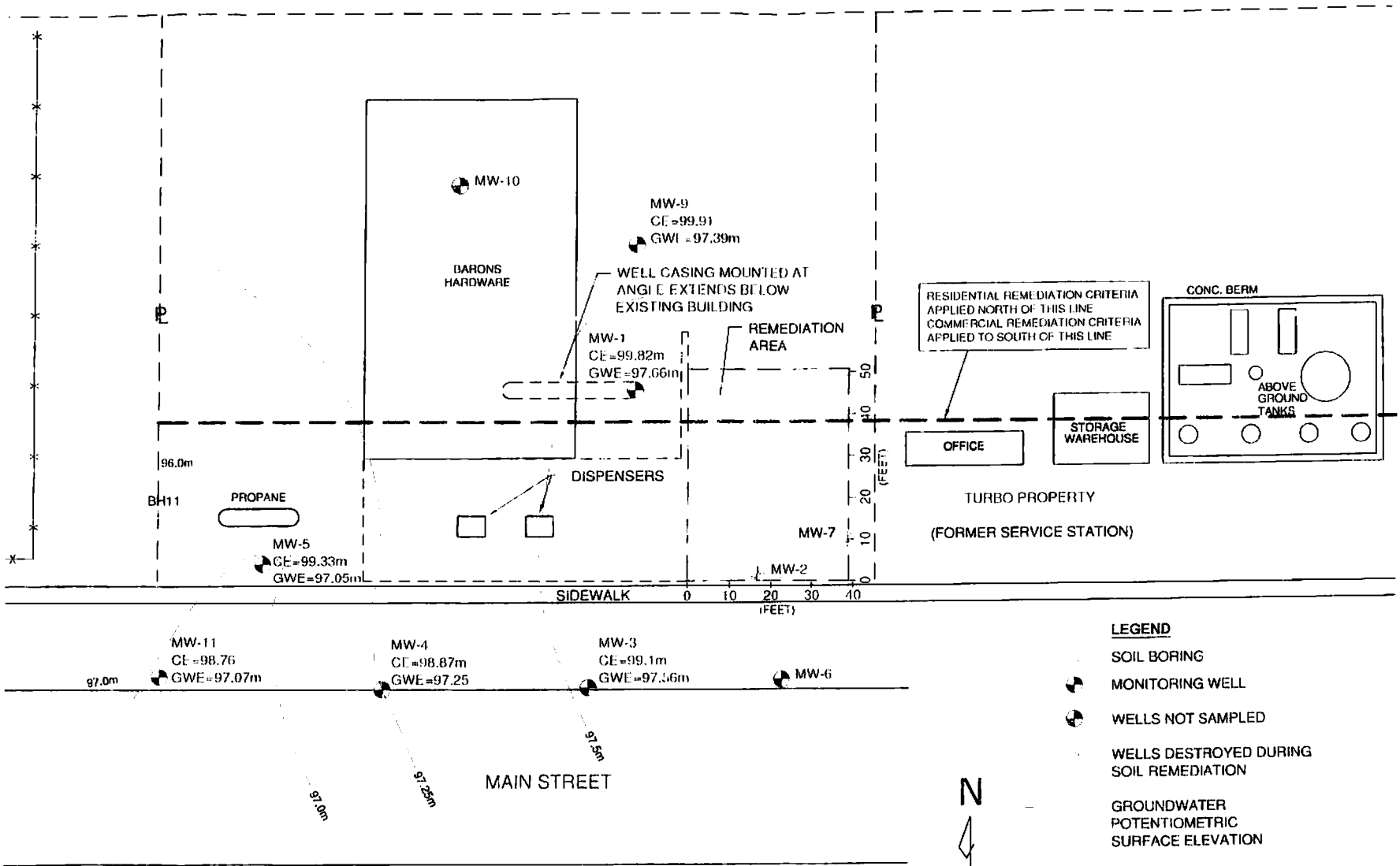
5.0 CONCLUSION

Groundwater sampling occurred at the Subject Property on July 27, 2007. Monitoring wells MW-1, 3-5, 9, and 11, were gauged to determine potentiometric elevations. Groundwater samples were taken from each well and submitted for analysis. The water quality of all the samples taken meets minimum standards as set forth by Alberta Environment Guidelines with the exception of MW-3. Levels for F1 and F2, in MW-3, exceed Alberta Environment Guidelines.

When compared to previous sampling events, results from MW-1 appear to have been reduced. Also, the only well where impact was observed was in MW-3 which is located offsite.

Appendix A

Maps and Figures



LEGEND

- SOIL BORING
- MONITORING WELL
- WELLS NOT SAMPLED
- WELLS DESTROYED DURING SOIL REMEDIATION
- GROUNDWATER POTENTIOMETRIC SURFACE ELEVATION
- MW-3 MONITORING WELL
- CE=99.1m CASING ELEVATION
- GWE=97.56m GROUNDWATER ELEVATION

Notes

This is a copyright drawing and shall not be reproduced in any form without written permission of the 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, and the latest code.

Basepoint Engineering Ltd.

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CLIENT
MARIE READ

PROJECT TITLE
BARONS HARDWARE

DRAWING TITLE
2007 GROUNDWATER SAMPLING SITE MAP

DATE
 HE
 MDO
 TREVIL
 H.E.
 OCT 18, 07

PROJECT NO.
 07186

SCALE
 NTS

FIG. 1

Appendix B

Analytical Reports

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 Oler
 Company: Hasegawa

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

Lot ID: **562651**
 Control Number:
 Date Received: Jul 27, 2007
 Date Reported: Aug 3, 2007
 Report Number: 1028789

	Reference Number	562651-4	562651-5	562651-6	
	Sample Date	Jul 27, 2007	Jul 27, 2007	Jul 27, 2007	
	Sample Location				
	Sample Description	MW3	MW9	MW1	
	Matrix	Water	Water	Water	
Analyte	Units	Results	Results	Results	Detection Limit
Mono-Aromatic Hydrocarbons - Water					
Benzene	mg/L	2.32	<0.001	<0.001	0.001
Toluene	mg/L	0.455	<0.001	<0.001	0.001
Ethylbenzene	mg/L	1.90	<0.001	<0.001	0.001
Total Xylenes (m,p,o)	mg/L	14.3	0.002	<0.001	0.001
Volatile Petroleum Hydrocarbons - Water					
F1 C6-C10	mg/L	94.4	<0.2	<0.2	0.2
F1 -BTEX	mg/L	75.4	<0.2	<0.2	0.2
Extractable Petroleum Hydrocarbons - Water					
F2 C10-C16	mg/L	1640	0.2	0.3	0.1
F3 C16-C34	mg/L	1150	<0.1	0.2	0.1
F3+ C34+	mg/L	<0.1	<0.1	<0.1	0.1

Approved by:

C. Swyngedouw

Chris Swyngedouw, PhD, PChem
 Consulting Scientist

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

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

Lot ID: **562651**
 Control Number:
 Date Received: Jul 27, 2007
 Date Reported: Aug 3, 2007
 Report Number: 1028789

	Reference Number	562651-1	562651-2	562651-3	
	Sample Date	Jul 27, 2007	Jul 27, 2007	Jul 27, 2007	
	Sample Location				
	Sample Description	MW5	MW11	MW4	
	Matrix	Water	Water	Water	
Analyte	Units	Results	Results	Results	Detection Limit
Mono-Aromatic Hydrocarbons - Water					
Benzene	mg/L	0.609	<0.001	2.94	0.001
Toluene	mg/L	<0.1	<0.001	<0.1	0.001
Ethylbenzene	mg/L	<0.1	<0.001	<0.1	0.001
Total Xylenes (m,p,o)	mg/L	0.267	<0.001	2.93	0.001
Volatile Petroleum Hydrocarbons - Water					
F1 C6-C10	mg/L	<20	<0.2	<20	0.2
F1 -BTEX	mg/L	<20	<0.2	<20	0.2
Extractable Petroleum Hydrocarbons - Water					
F2 C10-C16	mg/L	24.2	2.6	39.9	0.1
F3 C16-C34	mg/L	8.4	1.8	21.2	0.1
F3+ C34+	mg/L	0.2	<0.1	<0.1	0.1

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

Lot ID: **562651**
 Control Number:
 Date Received: Jul 27, 2007
 Date Reported: Aug 3, 2007
 Report Number: 1028789

Method of Analysis

Method Name	Reference	Method	Date Analysis Started	Location
BTEX-CCME - Water	US EPA	* US EPA method, 8260B/5035	03-Aug-07	BTG Calgary
TEH-CCME - Water	Alta. Env. Method	Hydrocarbon Soil and Water Quality Guidelines, C51260500	02-Aug-07	BTG Calgary

* Bodycote method(s) based on reference method

References

Alta. Env. Alberta Environment Method
 US EPA US Environmental Protection Agency Test Methods

Comments:

- Due to sample matrix, sample #3 was diluted for BTEX and F1 analysis. The detection limits for the detected and undetected analytes have been adjusted according to the dilution, which is 100 times higher than originally reported.
- Due to sample matrix, sample #4 was diluted for BTEX and F1 analysis. The detection limits for the detected and undetected analytes have been adjusted according to the dilution, which is 100 times higher than originally reported.
- Due to sample matrix, sample #1 was diluted for BTEX and F1 analysis. The detection limits for the detected and undetected analytes have been adjusted according to the dilution, which is 100 times higher than originally reported.

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.