

**BARONS FORMER GAS STATION
REMEDATION PROJECT**

**214 Main Street
Barons, AB**

**2015 Annual Groundwater
Monitoring Report**



**PREPARED FOR
Marie Read
P.O. Box 267
Irma, AB
T0B 2H0**

April 16, 2015

Job File #: 15-500

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

Attention: Marie

Re: 2015 ANNUAL GROUNDWATER SAMPLING REPORT
Location: Former Barons Gas Station - 214 Main Street, Barons, AB

Dear Marie

As per approval by the Tank Site Remediation Program, and on behalf the property owner Marie Read, Hasegawa Engineering has conducted the annual 2015 Groundwater Monitoring at the Barons former gas station site located at 214 Main Street, Lots 28 – 35 Block 6 Plan 2605X, Barons, Alberta. The monitoring activities include gauging and sampling of existing groundwater wells at the subject property and submission of the groundwater samples for laboratory analysis. This report contains groundwater gauging and sampling results complete with maps and figures detailing the results.

We trust that the enclosed information meets your requirements. Please do not hesitate to contact us if you have any questions.

Yours truly,



Mark Hasegawa, P. Eng
HASEGAWA ENGINEERING
Consulting Professional Engineers

MAH/mo
Attachments

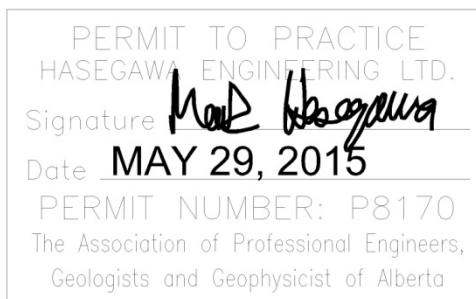


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1. INTRODUCTION

The Barons former gas station site is located at 214 Main Street (Plan 2605X, Block 6, Lot 28 to 33, 34, & 35), in Barons, Alberta (refer to Figure 1 for site map). 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. In August of 1996 soil beneath the pumps was removed and a soil vapor extractor system was installed. Site investigation activities were conducted subsequent to remedial activities and free product was detected in MW-2 in the Dec. 2001 groundwater sampling event. In May of 2003, impacted soils located southeast of the building were removed and land-farmed.

Since 2003, there have been multiple new wells installed at the former gas station site along the south side of the property along Main Street to further delineate the extent of remaining impacted soils at the subject property. Historical potentiometric surface data shows the groundwater flow direction to be to the south and southwest, thus, groundwater wells were installed on the south side of Main Street, directly south of the subject property to monitor offsite subsurface conditions. Soil and groundwater sampling activities at the subject property since 2003 have shown that the area of impacted soil seems to be limited to the south edge of the property, along the north side of Main Street, around monitoring wells MW-3, 4, and 13 (refer to figure 2 for well locations).

In September of 2014, at the request of the Marie Read (owner of subject property), Hasegawa Engineering installed 3 new wells to the north of well MW-3 to more accurately delineate the extents of the impacted subsoil. The results showed that there is impacted subsoil which extends primarily from the area surrounding MW-3 and directly to the north onto the former gas station property.

Due to site remediation not being a viable option for the property owner, it was determined that the site continue to be monitored on an annual basis under the current Risk Management Plan. The results of the 2015 site monitoring activities are contained in the following report.

1.1. SCOPE OF WORK

The specific activities included in this groundwater monitoring event include:

- Gauge existing wells at the subject property to determine potentiometric surface elevations
- Sample existing groundwater wells at the subject property and submit water samples for hydrocarbon analysis to an accredited laboratory.
- Complete summary report, which includes results, maps, conclusions and recommendations for future work;

2. METHODOLOGY

2.1. GROUNDWATER GAUGING & POTENTIOMETRIC SURFACE

The existing groundwater wells at the subject property, with the exception of MW-4, 10, 15, and 20 were gauged on March 31, 2015. MW-10 is located inside the building and is currently inaccessible, while MW-4, 15, and 20 were damaged and could not be gauged.

The road box casing for MW-11 was damaged and inaccessible during the 2014 groundwater sampling event and as a result there is no data for this well for that year. However, MW-14 was able to be unblocked during the 2015 monitoring event and was gauged and sampled. 2015 groundwater potentiometric surface data is shown in Table 1 below, and on Figure 1 in Appendix A (the 2014 potentiometric surface data is shown for comparison).

Table 1: Groundwater Potentiometric Surface Data

MONITORING WELL	Depth To Water (Mbgl)	Total Depth (m)	Casing Elev. (m)	2014 Groundwater Elev. (m)	2015 Groundwater Elev. (m)
MW-1	2.76	7.61	99.82	97.69	97.06
MW-3	1.67	5.40	99.07	96.09	97.40
MW-4	N/A	6.89	98.88	97.32	N/A
MW-5	1.51	5.71	99.31	97.73	97.80
MW-9	2.53	5.74	99.90	97.67	97.37
MW-11	1.19	7.12	98.74	N/A	97.55
MW-13	1.63	4.48	98.95	97.66	97.32
MW-14	1.44	4.39	99.03	97.76	97.59
MW-15	N/A	4.38	98.90	N/A	N/A
MW-16	1.60	4.55	99.41	97.87	97.81
MW-17	1.32	4.46	99.46	97.98	98.14
MW-18	1.45	5.76	99.06	97.62	97.61
MW-19	1.60	4.25	99.14	97.68	97.54
MW-20	N/A	5.77	98.75	97.23	N/A
MW-21	1.77	6.10	99.69	98.36	97.92
MW-22	2.00	6.08	99.62	97.36	97.62
MW-23	2.21	6.05	99.65	97.13	97.44

mBGL= meters Below Ground Level

N/A = Not Available

As can be seen on Figure 1, the groundwater gradient is split and flows both north and southwest which is consistent with the 2014 results. MW-17 showed the highest elevation of 98.14m while MW-1 showed the lowest elevation of 97.06m. The groundwater elevation recorded for MW-3 in 2014 was significantly lower than the historical average for this well. The water elevation in MW-3 returned to historically normal levels in 2015 after showing significantly lower elevations in the 2014 monitoring event. In addition, 2014 water elevations in MW-21 were much higher than adjacent wells MW-22 & 23, but showed lower elevations in 2015 which are more consistent with the nearby wells.

2.2. GROUNDWATER ANALYTICAL RESULTS

The subject property is commercial use with residential properties located directly to the north and private business properties to the south. Due to the surrounding land uses, the more strict Alberta Tier 1 Soil Remediation Guidelines for Residential/Parkland apply for this project.

All accessible groundwater wells on and surrounding the former gas station were sampled and the water samples submitted for laboratory for hydrocarbon analysis. This analysis includes BTEX (Benzene, Toluene, Ethylbenzene, and Total Xylenes), F1, F2, F3, and F4. The results of the sample analysis are included in Table 2 below (refer to Appendix C for complete groundwater analytical results).

Table 2: Groundwater Quality Data (Aug. 20, 2014)

SAMPLE I.D.	Benzene (mg/L)	Toluene (mg/L)	Ethylbenzene (mg/L)	Xylenes (mg/L)	F1 (C6- C10) (mg/L)	F2 (C10- C16) (mg/L)
Residential/Parkland Guidelines – fine grained soils	0.005	0.024	0.0024	0.3	2.2	1.1
MW-1	0.096	<0.0004	0.039	<0.001	0.3	1.0
MW-3	2.01	0.0031	0.578	1.16	13.4	1680
MW-5	<0.001	<0.0004	0.002	0.002	0.2	21.9
MW-9	<0.001	<0.0004	<0.001	<0.001	<0.1	<0.1
MW-11	<0.001	<0.0004	<0.001	<0.001	<0.1	0.3
MW-13	2.98	0.239	0.103	2.95	35.5	91.5
MW-14	<0.001	<0.0004	0.001	0.003	<0.1	0.2
MW-16	0.002	<0.0004	0.001	0.004	<0.1	0.3
MW-17	<0.001	<0.0004	<0.001	<0.001	<0.1	0.2
MW-18	<0.001	<0.0004	<0.001	<0.001	<0.1	0.5
MW-19	<0.001	<0.0004	<0.001	<0.001	<0.1	1.7
MW-21	0.002	0.0006	<0.001	<0.001	<0.1	1.2
MW-22	2.01	0.0004	0.451	0.051	3.3	1.4
MW-23	0.446	0.0071	0.113	0.479	6.3	613

- Exceeds Alberta Tier 1 Groundwater Remediation Guidelines (Residential/Parkland)

NG - No Guideline

The results of the groundwater analysis show:

- MW-9, 11, 14, 16 – 19 meet groundwater quality standards for fine grained soils
- MW-1 exceeds allowable levels for Benzene and Ethylbenzene
- MW-3 & 23 exceed allowable levels for all parameters shown in Table 2 with the exception of Toluene.
- MW-5 exceeds allowable levels for Benzene and Fraction F2.
- MW-13 exceeds allowable levels for all parameters in Table 2.
- MW-21 exceeds allowable levels for Fraction F2.
- MW-22 exceeds allowable levels for Benzene, Ethylbenzene, and Fractions F1 & F2.

Monitoring wells MW-3 & 13 show the highest concentrations of the parameters shown in Table 2 with levels in MW-22 & 23 being the next highest of the wells sampled. This is consistent with results from previous sampling events and confirms that the area of impacted subsoil is still mainly limited to the area surrounding MW-3, 13, 22, & 23.

3. CONCLUSION

The key results of this annual groundwater sampling event are as follows:

- Groundwater potentiometric surface elevations are consistent with previous sampling events and historically overall, and show no significant upward or downward trends.
- Water levels in MW-3 & MW-21 returned to similar elevations as adjacent wells in 2015 after showing above average variances in elevation to adjacent wells in 2014.

- Water samples from monitoring wells MW-3, 13, 22, & 23 showed the highest concentrations of petroleum product contaminants.
- Groundwater quality results are consistent with previous sampling events and show no new trends or migration of subsurface contaminants
- Monitoring wells MW-4, 15, and 20 were damaged and therefore were not able to be gauged or sampled. In addition MW-11 is damaged but was able to be gauged and sampled in the 2015 monitoring event. It is recommended that these wells be repaired or replaced as necessary prior to the 2016 annual groundwater monitoring event.
- Due to observed concentrations above remediation guidelines, continued annual testing is recommended.
- Now that additional data points are available, evaluation of natural attenuation is recommended for future evaluations.

4. STATEMENT OF LIMITATIONS

This report is based on data collected and compiled by Hasegawa Engineering during the 2015 Groundwater Monitoring event of this site and is considered to reflect the conditions of the specific areas investigated. The data and information collected is representative within the dates of the work.

Appendix A

Maps and Figures

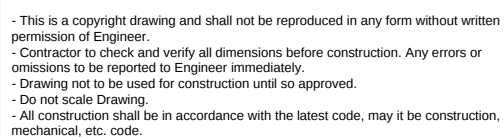
LANE



- SOIL BORING
- MONITORING WELL
- WELLS DESTROYED DURING SOIL REMEDIATION

GWE=97.56m GROUNDWATER ELEVATION

1. MW-1 WELL CASING MOUNTED AT AN ANGLE AND EXTENDS BELOW EXISTING BUILDING
2. REMEDIATION ACTIVITIES TOOK PLACE IN MAY OF 2003



DATE DRAWN APR. 16, 2015

Appendix B

Groundwater Analytical Results

Report Transmission Cover Page

Bill To: Hasegawa Engineering	Project:	Lot ID: 1062479
Report To: Hasegawa Engineering	ID:	Control Number: C0047583
330, 3120 - 32 Street S	Name: Barons	Date Received: Apr 2, 2015
Lethbridge, AB, Canada	Location:	Date Reported: Apr 9, 2015
T1K 7B4	LSD:	Report Number: 2000159
Attn: Mike Oler	P.O.:	
Sampled By: Mike Oler	Acct code:	
Company: Hasegawa Eng.		

Contact & Affiliation	Address	Delivery Commitments
Mike Oler	330, 3120 - 32 Street S	On [Lot Verification] send
Hasegawa Engineering	Lethbridge, Alberta T1K 7B4	(COA, COC) by Email - Single Report
	Phone: (403) 328-2686	On [Report Approval] send
	Fax: (403) 328-2728	(COC, Test Report) by Email - Merge Reports
	Email: mike.o@hasegawa.ca	On [Lot Approval and Final Test Report Approval] send
		(Invoice) by Email - Single Report
		On [Lot Creation] send
		(COR) by Email - Single Report

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Analytical Report

Bill To: Hasegawa Engineering
 Report To: Hasegawa Engineering
 330, 3120 - 32 Street S
 Lethbridge, AB, Canada
 T1K 7B4
 Attn: Mike Oler
 Sampled By: Mike Oler
 Company: Hasegawa Eng.

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

Lot ID: **1062479**
 Control Number: C0047583
 Date Received: Apr 2, 2015
 Date Reported: Apr 9, 2015
 Report Number: 2000159

	Reference Number	1062479-1	1062479-2	1062479-3	
	Sample Date	Mar 31, 2015	Mar 31, 2015	Mar 31, 2015	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	MW1 / Barons / 14.5°C	MW3 / Barons / 14.5°C	MW5 / Barons / 14.5°C	
	Matrix	Water	Water	Water	
Analyte	Units	Results	Results	Results	Nominal Detection Limit
Mono-Aromatic Hydrocarbons - Water					
Benzene	mg/L	0.096	2.01	<0.001	0.001
Toluene	mg/L	<0.0004	0.0031	<0.0004	0.0004
Ethylbenzene	mg/L	0.039	0.578	0.002	0.001
Total Xylenes (m,p,o)	mg/L	<0.001	1.16	0.002	0.001
Volatile Petroleum Hydrocarbons - Water					
F1 -BTEX	mg/L	0.2	9.6	0.1	0.1
F1 C6-C10	mg/L	0.3	13.4	0.2	0.1
Extractable Petroleum Hydrocarbons - Water					
F2 C10-C16	mg/L	1.0	1680	21.9	0.1
F3 C16-C34	mg/L	0.7	682	11.3	0.1
F3+ C34+	mg/L	<0.1	2.5	0.3	0.1



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Lot ID: **1062479**
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 Report Number: 2000159

	Reference Number	1062479-4	1062479-5	1062479-6	
	Sample Date	Mar 31, 2015	Mar 31, 2015	Mar 31, 2015	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	MW9 / Barons / 14.5°C	MW11 / Barons / 14.5°C	MW13 / Barons / 14.5°C	
	Matrix	Water	Water	Water	
Analyte	Units	Results	Results	Results	Nominal Detection Limit
Mono-Aromatic Hydrocarbons - Water					
Benzene	mg/L	<0.001	<0.001	2.98	0.001
Toluene	mg/L	<0.0004	<0.0004	0.239	0.0004
Ethylbenzene	mg/L	<0.001	<0.001	0.103	0.001
Total Xylenes (m,p,o)	mg/L	<0.001	<0.001	2.95	0.001
Volatile Petroleum Hydrocarbons - Water					
F1 -BTEX	mg/L	<0.1	<0.1	29.2	0.1
F1 C6-C10	mg/L	<0.1	<0.1	35.5	0.1
Extractable Petroleum Hydrocarbons - Water					
F2 C10-C16	mg/L	<0.1	0.3	91.5	0.1
F3 C16-C34	mg/L	<0.1	0.4	36.3	0.1
F3+ C34+	mg/L	<0.1	0.2	0.1	0.1



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	Reference Number	1062479-7	1062479-8	1062479-9	
	Sample Date	Mar 31, 2015	Mar 31, 2015	Mar 31, 2015	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	MW14 / Barons / 14.5°C	MW16 / Barons / 14.5°C	MW17 / Barons / 14.5°C	
	Matrix	Water	Water	Water	
Analyte	Units	Results	Results	Results	Nominal Detection Limit
Mono-Aromatic Hydrocarbons - Water					
Benzene	mg/L	<0.001	0.002	<0.001	0.001
Toluene	mg/L	<0.0004	0.0004	<0.0004	0.0004
Ethylbenzene	mg/L	0.001	0.001	<0.001	0.001
Total Xylenes (m,p,o)	mg/L	0.003	0.004	<0.001	0.001
Volatile Petroleum Hydrocarbons - Water					
F1 -BTEX	mg/L	<0.1	<0.1	<0.1	0.1
F1 C6-C10	mg/L	<0.1	<0.1	<0.1	0.1
Extractable Petroleum Hydrocarbons - Water					
F2 C10-C16	mg/L	0.2	0.3	0.2	0.1
F3 C16-C34	mg/L	0.2	0.2	0.2	0.1
F3+ C34+	mg/L	<0.1	<0.1	<0.1	0.1



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	Reference Number	1062479-10	1062479-11	1062479-12	
	Sample Date	Mar 31, 2015	Mar 31, 2015	Mar 31, 2015	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	MW18 / Barons / 14.5°C Water	MW19 / Barons / 14.5°C Water	MW21 / Barons / 14.5°C Water	
	Matrix				
Analyte	Units	Results	Results	Results	Nominal Detection Limit
Mono-Aromatic Hydrocarbons - Water					
Benzene	mg/L	<0.001	<0.001	0.002	0.001
Toluene	mg/L	<0.0004	<0.0004	0.0006	0.0004
Ethylbenzene	mg/L	<0.001	<0.001	<0.001	0.001
Total Xylenes (m,p,o)	mg/L	<0.001	<0.001	<0.001	0.001
Volatile Petroleum Hydrocarbons - Water					
F1 -BTEX	mg/L	<0.1	<0.1	<0.1	0.1
F1 C6-C10	mg/L	<0.1	<0.1	<0.1	0.1
Extractable Petroleum Hydrocarbons - Water					
F2 C10-C16	mg/L	0.5	1.7	1.2	0.1
F3 C16-C34	mg/L	0.3	0.9	0.9	0.1
F3+ C34+	mg/L	<0.1	0.1	<0.1	0.1

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 Report Number: 2000159

	Reference Number	1062479-13	1062479-14		
	Sample Date	Mar 31, 2015	Mar 31, 2015		
	Sample Time	NA	NA		
	Sample Location				
	Sample Description	MW22 / Barons / 14.5°C Water	MW23 / Barons / 14.5°C Water		
	Matrix				
Analyte	Units	Results	Results	Results	Nominal Detection Limit
Mono-Aromatic Hydrocarbons - Water					
Benzene	mg/L	2.01	0.446		0.001
Toluene	mg/L	0.0004	0.0071		0.0004
Ethylbenzene	mg/L	0.451	0.113		0.001
Total Xylenes (m,p,o)	mg/L	0.051	0.479		0.001
Volatile Petroleum Hydrocarbons - Water					
F1 -BTEX	mg/L	0.8	5.3		0.1
F1 C6-C10	mg/L	3.3	6.3		0.1
Extractable Petroleum Hydrocarbons - Water					
F2 C10-C16	mg/L	1.4	613		0.1
F3 C16-C34	mg/L	<0.1	243		0.1
F3+ C34+	mg/L	<0.1	<0.1		0.1

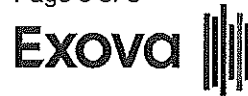
Approved by:

Anthony Neumann

Anthony Neumann, MSc
 Laboratory Operations Manager

Data have been validated by Analytical Quality Control and Exova's Integrated Data Validation System (IDVS).

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Methodology and Notes

Bill To: Hasegawa Engineering	Project:	Lot ID: 1062479
Report To: Hasegawa Engineering	ID:	Control Number: C0047583
330, 3120 - 32 Street S	Name: Barons	Date Received: Apr 2, 2015
Lethbridge, AB, Canada	Location:	Date Reported: Apr 9, 2015
T1K 7B4	LSD:	Report Number: 2000159
Attn: Mike Oler	P.O.:	
Sampled By: Mike Oler	Acct code:	
Company: Hasegawa Eng.		

Method of Analysis

Method Name	Reference	Method	Date Analysis Started	Location
BTEX-CCME - Water	US EPA	* Volatile Organic Compounds in Various Sample Matrices Using Equilibrium Headspace Analysis/Gas Chromatography Mass Spectrometry, 5021/8260	04-Apr-15	Exova Calgary
TEH-CCME - Water	EPA/CCME	* Separatory Funnel Liquid-Liquid Extraction/CCME, EPA 3510/CCME	02-Apr-15	Exova Calgary
* Reference Method Modified				

References

EPA/CCME	Environmental Protection Agency Test Methods - US/CCME
US EPA	US Environmental Protection Agency Test Methods

Comments:

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