

**BARONS FORMER GAS STATION
REMEDATION PROJECT**

**214 Main Street
Barons, AB**

**PHASE II ENVIRONMENTAL SITE
ASSESSMENT
SOIL & GROUNDWATER SAMPLING REPORT**

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

October 25, 2014

Job File #: 07-186

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

Attention: Marie

**Re: PHASE II ESA – SOIL & GROUNDWATER SAMPLING AT FORMER GAS STATION
214 Main Street, Barons, AB**

Dear Marie

As per your request, Hasegawa Engineering has conducted phase II site investigation activities at the Barons former gas station site located at 214 Main Street, Lots 28 – 35 Block 6 Plan 2605X, Barons, Alberta. The investigation activities include gauging and sampling of existing groundwater wells at the site, and installation of 3 new groundwater wells. This report contains groundwater results as well as soil sampling results conducted during the installation of new groundwater wells at the subject property.

The purpose of these activities is to delineate the extent of known impacted subsoil and groundwater along the north side of Main Street and determine if the subsoil at the subject property is impacted as well.

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/dd
Attachments

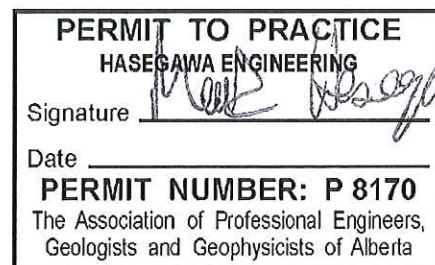


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1. INTRODUCTION

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 proposed to conduct gauging and sampling of the existing groundwater wells at the site to establish current subsurface conditions. In addition, it was proposed to install 3 new groundwater wells at the site based on the results of the groundwater analysis. The intent of the new wells is to better delineate the extent of the impacted subsoil and determine if remaining impacted subsoil is limited to offsite areas south of the property.

1.1. SCOPE OF WORK

The specific activities included in this Phase 2 Environmental Assessment include:

- Gauge and sample existing groundwater wells at the subject property and submit water samples for hydrocarbon analysis to an accredited laboratory.
- Site visitation and determining of suitable locations for drilling of 3 – 6" diameter soil borings to a max depth of 30' each, to be completed as groundwater monitoring wells at the Subject Property;
- Sampling soil from the auger flight at 5'-0" intervals during drilling to determine soil characteristics, and take readings using an OVM, to determine potential impact from petroleum operations;
- Completion of the wells to suitable depth to penetrate water table
- Submission of 1 soil sample from each soil boring, as a minimum, to an accredited laboratory for hydrocarbon analysis;
- 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-10, 11, and 15, were gauged on August 20, 2014. MW-10 is located inside the building and is currently inaccessible and MW-11 and 15 were damaged and could not be gauged. New wells MW-21 – 23 were gauged on Oct. 2, 2014. Groundwater potentiometric surface data is shown in Table 1 below, and on Figure 2 in Appendix A.

Table 1: Groundwater Potentiometric Surface Data

MONITORING WELL	Depth To Water (mBGL)	Total Depth (m)	Casing Elev. (m)	Groundwater Elev. (m)
MW-1	2.13	7.61	99.82	97.69
MW-3	2.98	5.40	99.07	96.09
MW-4	1.56	6.89	98.88	97.32
MW-5	1.58	5.71	99.31	97.73
MW-9	2.23	5.74	99.90	97.67
MW-13	1.29	4.48	98.95	97.66
MW-14	1.27	4.39	99.03	97.76
MW-16	1.54	4.55	99.41	97.87
MW-17	1.48	4.46	99.46	97.98
MW-18	1.44	5.76	99.06	97.62
MW-19	1.46	4.25	99.14	97.68
MW-20	1.52	5.77	98.75	97.23
MW-21	1.33	6.10	99.69	98.36
MW-22	2.26	6.08	99.62	97.36
MW-23	2.52	6.05	99.65	97.13

mBGL= meters Below Ground Level

As can be seen on Figure 2, the groundwater gradient is split and flows both north and southwest. MW-21 shows the highest elevation of 98.36m while MW-3 shows the lowest elevation of 96.09m. The drastic difference in groundwater elevation at MW-3 and MW-21 from adjacent wells is inconsistent with previous results and cannot be explained without further site investigation.

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.

Select groundwater wells surrounding the known impacted area 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. Water samples from monitoring wells MW-3, 4, and 13 contained free product and therefore were not submitted to the lab for analysis. 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	0.005	0.024	0.0024	0.3	2.2	1.1
MW-1	0.103	0.002	0.017	<0.001	<0.2	<0.2
MW-5	0.011	<0.001	0.006	<0.001	0.9	2.6
MW-9	<0.001	<0.001	<0.001	<0.001	<0.2	<0.2
MW-11	0.001	<0.001	0.002	0.009	<0.2	<0.2
MW-14	<0.001	<0.001	<0.001	<0.001	<0.2	<0.2
MW-16	<0.001	<0.001	<0.001	<0.001	<0.2	<0.2
MW-20	<0.001	<0.001	<0.001	<0.001	<0.2	<0.2

- Exceeds Alberta Tier 1 Groundwater Remediation Guidelines

NG - No Guideline

The water quality of the samples shown in Table 2 meets Alberta Environment Guidelines for Residential/Parkland sites, with the exception of monitoring wells MW-1, and 5. MW-1 exceeded allowable levels for Benzene and Ethylbenzene, while MW-5 exceeded for Benzene only.

Free product was present in monitoring wells MW-3, 4, and 13 in the 2014 sampling event which is consistent with previous sampling events. These results seem to indicate that the area of impacted soils is limited to the area around monitoring wells MW-3, 4, and 13.

As a result, it was decided to install 2 – 3 new wells to the north of monitoring wells MW-3 and 13 as close as possible to the property line to further delineate the extent of the impacted soils.

3. SOIL RESULTS

3.1. WELL BORE INSTALLATION AND SAMPLING PROCEDURE

Representatives from Hasegawa Engineering met the contractors from Chilako Drilling at the Subject Property at 9:00am on September 23, 2014. Suitable well locations were determined and drilling commenced at 9:30am (see Figure 1 for soil boring/monitoring well locations).

Drilling was performed using a solid stem auger rig and sampling was carried out in 5'-0" intervals to observe the characteristics and properties of the soil. A soil sample from each 5'-0" interval was placed in a plastic bag and sealed, while a duplicate sample was placed in an approved 250ml jar complete with a plastic Teflon lid, with zero headspace. Following a period of 15-20 minutes the sample in the bag was tested with an Organic Vapor Meter (OVM) to measure the quality of the soil removed from the bore hole. Readings were observed and recorded for reference and comparison to AENV guidelines.

The soil borings were advanced until the water table was penetrated and then completed as groundwater monitoring wells. Each well consists of solid 2" PVC casing with 10' of slotted pipe screen which is installed in the upper water bearing zone of the soil boring to allow groundwater to infiltrate the well. Backfilling around the pipe was completed with sand as a filter pack, and bentonite chips as a seal. Each well was finished flush with ground level, with a steel road box cap. Complete well installation logs are provided in Appendix B.

Only one well was completed on Sept. 23, 2014, due to the fact that there is an overhead power line located in the desired location for the new wells. As a result, Fortis was contacted and permission was obtained to drill closer to the overhead line with a smaller drill rig. Chilako Drilling

returned to the subject property on Sept. 29, 2014, and an additional two wells were installed just north of the existing sidewalk along the north side of Main Street (refer to Figure 1 for well locations). In addition, Chilako Drilling repaired the surface mounted road boxes on monitoring wells MW-3 and MW-13 which were damaged.

3.2. ASSESSMENT CRITERIA

Results obtained from Exova Laboratories for the submitted soil samples are 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.

3.3. ONSITE SOIL ANALYSIS

The subject property is completely covered in gravel with the exception of the concrete apron with the abandoned pump islands directly to the south of the existing building. Soil boring TH-21 (MW-21) was advanced 2 meters directly east of the existing concrete apron, aligned with abandoned fuel dispensers. Soil boring TH-22 (MW-22) was advanced along the north side of the sidewalk to the east of the concrete apron and soil boring TH-23 (MW-23) was advanced 4 meters directly east of soil boring TH-22 (refer to Figure 1 for soil boring locations).

Soil samples were collected at 5'-0" intervals from the auger flights during well installation to determine soil characteristics and possible impact from petroleum related operations on site. An OVM (Organic Vapor Meter) was used to measure hydrocarbon content in the sampled soil. The observed values are found in Table 3.

Table 3: Soil Sampling Results

DEPTH	PPM Measured		
	TH-21	TH-22	TH-23
0-5'	0	45	75
5'-10'	0	200	330
10'-15'	15	50	95
15'-20'	75	70	105
20'-25'	0	N/A	N/A

PPM – Parts Per Million

N/A - Not applicable (SB2 & SB3 completed at 20')

The results in Table 3 show that soil borings TH-22 & 23 (which are located closest to MW – 3 & 13) had the highest readings on the OVM and there was a strong gasoline/petroleum odor emanating from the soil samples taken. Grey staining of the subsoil was visible as well.

3.4. SOIL ANALYTICAL RESULTS

Fine grained soils criteria were selected due to the soil type observed at the site. The soil criteria applicable to this site are shown in Table 4 below.

Table 4: Alberta Tier 1 Soil Remediation Guidelines

Constituent	Residential/Parkland Guidelines
Benzene (mg/kg)	0.046
Toluene (mg/kg)	0.52
EthylBenzene (mg/kg)	0.11
Xylene (mg/kg)	15
Fraction F1 (mg/kg)	210
Fraction F2 (mg/kg)	150

Soil samples were taken at each five foot interval during the advancement of each soil boring and placed in a 250ml jar. The soil sample from each soil boring with the highest corresponding reading was submitted to Exova labs for hydrocarbon analysis for a total of 3 samples. This analysis includes testing for, Benzene, Toluene, Ethylbenzene, and Total Xylenes. The results of the laboratory analysis are found in Table 5 below.

Table 5: Soil Analytical Results

SAMPLE LOCATION	DEPTH (ftBGL)	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl benzene (mg/kg)	Total Xylenes (mg/kg)	Fraction F1 (C6-C10) (mg/kg)	Fraction F2 (C10-C16) (mg/kg)
Commercial Guidelines		0.046	0.52	0.11	15	210	150
TH-21	15-20	0.007	<0.02	<0.010	<0.03	11	292
TH-22	5-10	2.30	0.02	9.49	2.84	346	331
TH-23	5-10	5.32	0.68	66.9	129	6170	5970
Detection Limit		0.005	0.02	0.010	0.03	10	10

 - Exceeds Alberta Tier 1 Soil & Groundwater Remediation Guidelines

ftBGL - feet Below Ground Level

Commercial Guidelines - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (December 2010)

Results for TH-21 meet Alberta Tier 1 soil requirements for the parameters shown in Table 5 with the exception of Fraction F2. Results for TH-22 exceed all parameters shown with the exception of toluene and total xylenes, while the results for TH-23 exceed all parameters shown in Table 5. Complete soil analytical results from Exova labs are included in Appendix C.

4. CONCLUSION

The key results of this Phase 2 Environmental Site Assessment are as follows:

- Groundwater potentiometric surface elevations are consistent with previous sampling events with the exception of MW-3 which was significantly lower than adjacent wells and MW-21 which was significantly higher than adjacent wells.
- Groundwater quality results are consistent with previous sampling events.
- Water samples from monitoring wells MW-3, 4, & 13 showed the presence of free product.

- Three new boreholes were advanced at the subject property in September of 2014, just to the north of monitoring wells MW-3, 4, & 13, and each was completed as a groundwater monitoring well.
- Soil samples taken during the advancement of soil borings TH-21 – 23 showed evidence of hydrocarbon impact in the form of a visible grey sheen, strong gasoline odor, and high OVM readings taken onsite.
- Analytical results for tested soil samples taken during soil boring advancement show that there is still impacted subsoil on the south side of the subject property where remediation activities have previously taken place.

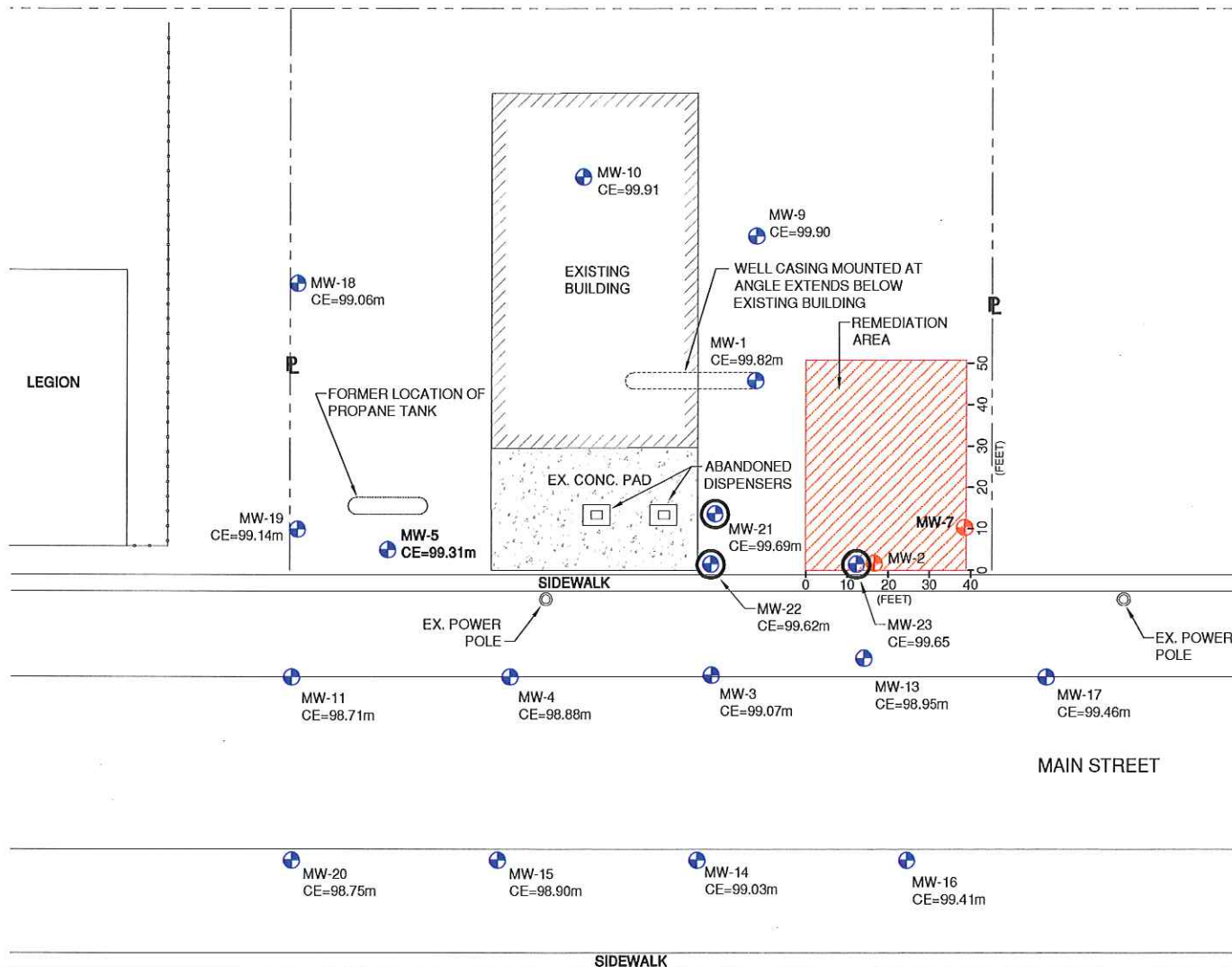
5. STATEMENT OF LIMITATIONS

This report is based on data collected and compiled by Hasegawa Engineering during the Phase 2 ESA 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 & Figures

RESIDENTIAL
PROPERTIES



SITE PLAN -
SCALE: 1:500

LEGEND

- SOIL BORING
- MONITORING WELL
- MONITORING WELLS INSTALLED SEPT. 2014
- WELLS DESTROYED DURING SOIL REMEDIATION

MW-3 MONITORING WELL I.D.

CE=99.1m CASING ELEVATION



330, 3120, 32ND ST. S.
LETHBRIDGE, AB T1K 7B4
PH: 403-328-2686
FX: 403-328-2728
EMAIL: office@hasegawa.ca

- 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 or omissions to be 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.

DRAWN

MDO

SCALE

1:500

SHEET NO.

FIGURE 1

PROJECT NO.

07-186

CLIENT

MARIE READ

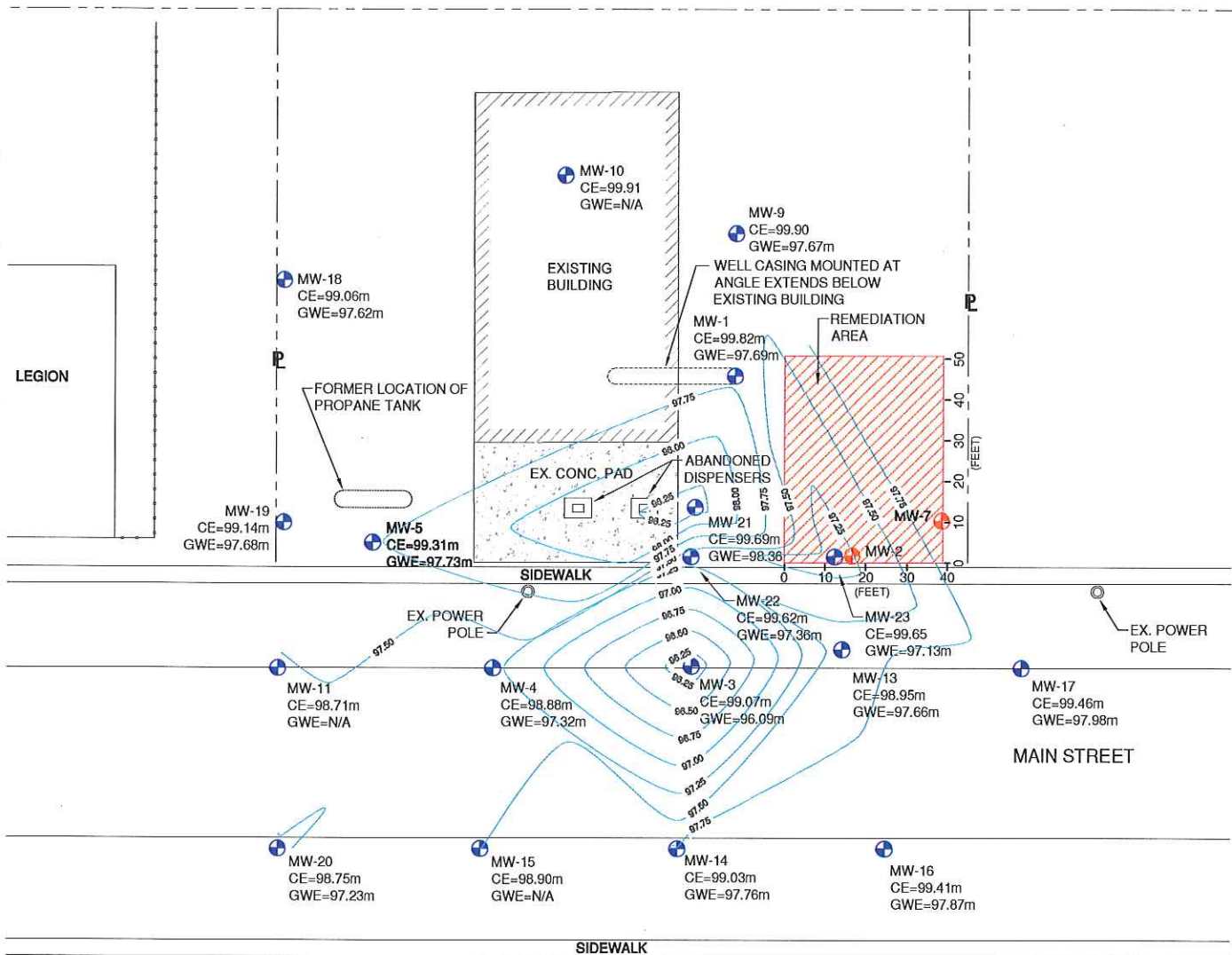
PROJECT TITLE

BARONS FORMER GAS STATION

DATE DRAWN

OCT. 25, 2014

RESIDENTIAL
PROPERTIES



○ SITE PLAN - POTENTIOMETRIC SURFACE MAP
SCALE: 1:500

- LEGEND**
- ⊗ SOIL BORING
 - ⊕ MONITORING WELL
 - ⊕ WELLS DESTROYED DURING SOIL REMEDIATION
 - GROUNDWATER POTENTIOMETRIC SURFACE ELEVATION
 - MW-3 MONITORING WELL I.D.
 - CE=99.1m CASING ELEVATION
 - GWE=97.56m GROUNDWATER ELEVATION



330, 3120, 32ND ST. S.
LETHBRIDGE, AB T1K 7B4
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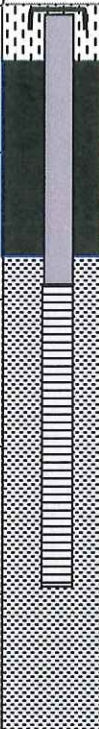
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- All construction shall be in accordance with the latest code, may it be construction, mechanical, etc. code.

CLIENT	MDO	SCALE	1:500	SHEET NO	FIGURE 2	PROJECT NO	07-186
CLIENT	MARIE READ	PROJECT TITLE	BARONS FORMER GAS STATION	DATE DRAFT	OCT. 25, 2014		

Appendix B

Monitoring Well Completion Details

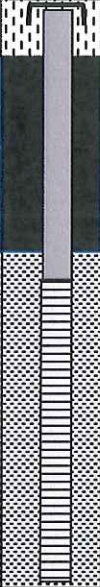
PROJECT: BARONS FORMER GAS STATION				BOREHOLE #: TH-21			
JOB #: 07-186				DRILL RIG: C-72			
LOCATION: 214 MAIN STREET, BARONS, AB				GROUND ELEVATION: 99.69			
CLIENT: MARIE READ				COMPLETION DATE: SEPT. 23, 2014			
NOTES:				WEATHER CONDITIONS: OVERCAST 13°C			
CASING TYPE:  2" DIA. SOLID PVC  2" DIA SLOTTED PVC SCREEN  FLUSH MOUNT ROAD BOX							
BACKFILL:  SAND  DRILL CUTTINGS  BENTONITE SEAL							

Depth (ft)	Soil Description	Sample Type	Sample No.	Combustible Soil Vapors (ppm)	Well Details
0-5'	0-1.5' GRAVELLY-SAND, DARK BROWN, NON-PLASTIC, DRY, NO ODOR			0	
	1.5'-5' CLAY (SOME SAND), DARK BROWN/GREY, PLASTIC, DRY, NO ODOR				
5'-10'	ROCKS/GRAVEL, SANDY CLAY, DARK BROWN, NON-PLASTIC, WET @ 7', NO ODOR			0	
10'-15'	10-13' ROCKS/GRAVEL, SANDY CLAY, DARKBROWN, NON-PLASTIC, WET, NO ODOR			15	
	13-15' SANDY CLAY, DARK BROWN, PLASTIC, WET, NO ODOR				
15'-20'	SANDY CLAY, DARK BROWN, PLASTIC, DRY, STRONG GASOLINE ODOR,			75	
20'-25'	CLAYEY-SAND, LIGHT BROWN, NON-PLASTIC, DRY, STRONG GASOLINE ODOR			0	
25'-30'					
30'-35'					
35'-40'					
40'-45'					

 HASEGAWA CONSULTING PROFESSIONAL ENGINEERS	SLOUGH: 5'	COMPLETION DEPTH (FT): 20
	DEPTH TO GROUNDWATER: 7'	CHECKED BY:
	LOGGED BY: MDO	PAGE:

COMMENTS: SOIL BORING KEPT SLOUGHING IN SO THE WELL WAS COMPLETED TO 20' BELOW GRADE.

PROJECT: BARONS FORMER GAS STATION				BOREHOLE #: TH-22			
JOB #: 07-186				DRILL RIG: B-31			
LOCATION: 214 MAIN STREET, BARONS, AB				GROUND ELEVATION: 99.62m			
CLIENT: MARIE READ				COMPLETION DATE: SEPT. 29, 2014			
NOTES:				WEATHER CONDITIONS: PAR. CLOUDY 15°C			
CASING TYPE:  2" DIA. SOLID PVC  2" DIA SLOTTED PVC SCREEN  FLUSH MOUNT ROAD BOX							
BACKFILL:  SAND  DRILL CUTTINGS  BENTONITE SEAL							

Depth (ft)	Soil Description	Sample Type	Sample No.	Combustible Soil Vapors (ppm)	Well Details
0-5'	0-3' SANDY-CLAY W/ SOME GRAVEL, DARK BROWN, PLASTIC, MOIST, SOME ODOR 3-5' SANDY CLAY, DARK BROWN/GREY, MOIST, STRONG GASOLINE ODOR,			45	
5'-10'	SANDY CLAY, DARK BROWN, PLASTIC, MOIST/WET, STRONG GASOLINE ODOR, GREY STAINING			200	
10'-15'	SANDY CLAY, DARK BROWN, PLASTIC, WET, STRONG GASOLINE ODOR, GREY STAINING			50	
15'-20'	SANDY CLAY, DARK BROWN, PLASTIC, MOIST, STRONG GASOLINE ODOR, GREY STAINING			70	
20'-25'					
25'-30'					
30'-35'					
35'-40'					
40'-45'					

 HASEGAWA CONSULTING PROFESSIONAL ENGINEERS	SLOUGH:	COMPLETION DEPTH (FT): 20
	DEPTH TO GROUNDWATER: 8'	CHECKED BY:
	LOGGED BY: MDO	PAGE:

COMMENTS:

PROJECT: BARONS FORMER GAS STATION				BOREHOLE #: TH-23			
JOB #: 07-186				DRILL RIG: B-31			
LOCATION: 214 MAIN STREET, BARONS, AB				GROUND ELEVATION: 99.65m			
CLIENT: MARIE READ				COMPLETION DATE: SEPT. 29, 2014			
NOTES:				WEATHER CONDITIONS: PAR. CLOUDY 15°C			
CASING TYPE:  2" DIA. SOLID PVC  2" DIA SLOTTED PVC SCREEN  FLUSH MOUNT ROAD BOX							
BACKFILL:  SAND  DRILL CUTTINGS  BENTONITE SEAL							

Depth (ft)	Soil Description	Sample Type	Sample No.	Combustible Soil Vapors (ppm)	Well Details
0-1'	SANDY CLAY, BROWN, DRY, PLASTIC, SOME GASOLINE ODOR				
1-3'	SANDY CLAY, BROWN, MOIST, PLASTIC, SOME GASOLINE ODOR			75	
3-5'	SANDY CLAY, BROWN, WET, PLASTIC, SOME GASOLINE ODOR GREY STAINING @ 4				
5'-10'	SANDY CLAY, BROWN, WET, PLASTIC, STRONG GASOLINE ODOR GREY STAINING			330	
10'-15'	SANDY CLAY, BROWN, MOIST, PLASTIC, STRONG GASOLINE ODOR GREY STAINING			95	
15'-17'	SANDY CLAY, BROWN, SLIGHT MOISTURE, PLASTIC, STRONG GASOLINE ODOR, GREY STAINING			105	
20'-25'					
25'-30'					
30'-35'					
35'-40'					
40'-45'					

 HASEGAWA CONSULTING PROFESSIONAL ENGINEERS	SLOUGH:	COMPLETION DEPTH (FT): 20
	DEPTH TO GROUNDWATER: 8'	CHECKED BY:
	LOGGED BY: MDO	PAGE:

COMMENTS:

Appendix C

Soil & Groundwater Analytical Results

Groundwater Analytical Results

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

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

Lot ID: **1021496**
 Control Number: C0038411
 Date Received: Aug 21, 2014
 Date Reported: Aug 24, 2014
 Report Number: 1941895

	Reference Number	1021496-1	1021496-2	1021496-3	
	Sample Date	Aug 20, 2014	Aug 20, 2014	Aug 20, 2014	
	Sample Time	NA	NA	NA	
	Sample Location				
	Sample Description	Barons / MW5 / 14.9C	Barons / MW11 / 14.9C	Barons / MW14 / 14.9C	
	Matrix	Water	Water	Water	
Analyte	Units	Results	Results	Results	Nominal Detection Limit
Mono-Aromatic Hydrocarbons - Water					
Benzene	mg/L	0.011	0.001	<0.001	0.001
Toluene	mg/L	<0.001	<0.001	<0.001	0.001
Ethylbenzene	mg/L	0.006	0.002	<0.001	0.001
Total Xylenes (m,p,o)	mg/L	<0.001	0.009	<0.001	0.001
Volatile Petroleum Hydrocarbons - Water					
F1 -BTEX	mg/L	0.9	<0.2	<0.2	0.2
F1 C6-C10	mg/L	0.9	<0.2	<0.2	0.2
F2 C10-C16	mg/L	2.6	4.5	<0.2	0.2
Extractable Petroleum Hydrocarbons - Water					
F3 C16-C34	mg/L	0.9	2.7	<0.1	0.1
F4 C34-C50	mg/L	<0.1	<0.1	<0.1	0.1
F4HTGC C34-C50+	mg/L	<0.1	<0.1	<0.1	0.1



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

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

Lot ID: **1021496**
 Control Number: C0038411
 Date Received: Aug 21, 2014
 Date Reported: Aug 24, 2014
 Report Number: 1941895

		Reference Number	1021496-4	1021496-5
		Sample Date	Aug 20, 2014	Aug 20, 2014
		Sample Time	NA	NA
		Sample Location		
		Sample Description	Barons / MW16 /	Barons / MW20 /
		Matrix	14.9C Water	14.9C Water
Analyte	Units	Results	Results	Results
Nominal Detection Limit				
Mono-Aromatic Hydrocarbons - Water				
Benzene	mg/L	<0.001	<0.001	0.001
Toluene	mg/L	<0.001	<0.001	0.001
Ethylbenzene	mg/L	<0.001	<0.001	0.001
Total Xylenes (m,p,o)	mg/L	<0.001	<0.001	0.001
Volatile Petroleum Hydrocarbons - Water				
F1 -BTEX	mg/L	<0.2	<0.2	0.2
F1 C6-C10	mg/L	<0.2	<0.2	0.2
F2 C10-C16	mg/L	<0.2	<0.2	0.2
Extractable Petroleum Hydrocarbons - Water				
F3 C16-C34	mg/L	<0.1	0.2	0.1
F4 C34-C50	mg/L	<0.1	0.2	0.1
F4HTGC C34-C50+	mg/L	<0.1	0.3	0.1

Approved by: 
 Randy Neumann, BSc
 Vice President

Methodology and Notes

Bill To:	Hasegawa Engineering	Project:		Lot ID:	1021496
Report To:	Hasegawa Engineering	ID:		Control Number:	C0038411
	330, 3120 - 32 Street S	Name:	Barons	Date Received:	Aug 21, 2014
	Lethbridge, AB, Canada	Location:		Date Reported:	Aug 24, 2014
	T1K 7B4	LSD:		Report Number:	1941895
Attn:	Mike Oler	P.O.:			
Sampled By:	Mike Oler	Acct code:			
Company:	Hasegawa				

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	21-Aug-14	Exova Calgary
TEH-CCME - Water	EPA/CCME	* Separatory Funnel Liquid-liquid Extraction/CCME, EPA 3510/CCME	21-Aug-14	Exova Calgary
* Reference Method Modified				

References

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



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:

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

Lot ID: **1024259**
 Control Number: C0038033
 Date Received: Sep 4, 2014
 Date Reported: Sep 9, 2014
 Report Number: 1945457

	Reference Number	1024259-1	1024259-2		
	Sample Date	Sep 02, 2014	Sep 02, 2014		
	Sample Time	NA	NA		
	Sample Location				
	Sample Description	Barons / MW1 / 12.1°C Water	Barons / MW9 / 12.1°C Water		
	Matrix				
Analyte	Units	Results	Results	Results	Nominal Detection Limit
Mono-Aromatic Hydrocarbons - Water					
Benzene	mg/L	0.103	<0.001		0.001
Toluene	mg/L	0.002	<0.001		0.001
Ethylbenzene	mg/L	0.017	<0.001		0.001
Total Xylenes (m,p,o)	mg/L	<0.001	<0.001		0.001
Volatile Petroleum Hydrocarbons - Water					
F1 -BTEX	mg/L	<0.2	<0.2		0.2
F1 C6-C10	mg/L	<0.2	<0.2		0.2
F2 C10-C16	mg/L	<0.2	<0.2		0.2
Extractable Petroleum Hydrocarbons - Water					
F3 C16-C34	mg/L	0.2	<0.1		0.1
F3+ C34+	mg/L	<0.1	<0.1		0.1

Approved by:

Michael Yohemas, BSc
 Laboratory Operations Manager

Data have been validated by Analytical Quality Control and Exova's Integrated Data Validation System (IDVS).
 Generation and distribution of the report, and approval by the digitized signature above, are performed through a secure and controlled automatic process.

Methodology and Notes

Bill To: Hasegawa Engineering	Project:	Lot ID: 1024259
Report To: Hasegawa Engineering	ID:	Control Number: C0038033
330, 3120 - 32 Street S	Name: Barons	Date Received: Sep 4, 2014
Lethbridge, AB, Canada	Location:	Date Reported: Sep 9, 2014
T1K 7B4	LSD:	Report Number: 1945457
Attn: Mike Oler	P.O.:	
Sampled By: Mike Oler	Acct code:	
Company:		

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	06-Sep-14	Exova Calgary
TEH-CCME - Water	EPA/CCME	* Separatory Funnel Liquid-liquid Extraction/CCME, EPA 3510/CCME	05-Sep-14	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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Soil Analytical Results

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

Project:
 ID:
 Name: Barons
 Location: Barons, AB
 LSD:
 P.O.: 07-186
 Acct code:

Lot ID: **1029983**
 Control Number:
 Date Received: Oct 1, 2014
 Date Reported: Oct 4, 2014
 Report Number: 1953204

		Reference Number	1029983-1	1029983-2	1029983-3	
		Sample Date	Sep 23, 2014	Sep 29, 2014	Sep 29, 2014	
		Sample Time	NA	NA	NA	
		Sample Location	21 TH-1 / 10.1C	TH-22 / 10.1C	TH-23 / 10.1C	
		Sample Description				
		Matrix	Soil	Soil	Soil	
Analyte	Units	Results	Results	Results	Nominal Detection Limit	
Mono-Aromatic Hydrocarbons - Soil						
Extraction Date	Volatiles	1-Oct-14	1-Oct-14	1-Oct-14		
Benzene	Dry Weight	mg/kg 0.007	2.30	5.32	0.005	
Toluene	Dry Weight	mg/kg <0.02	0.02	0.68	0.02	
Ethylbenzene	Dry Weight	mg/kg <0.010	9.49	66.9	0.010	
Total Xylenes (m,p,o)	Dry Weight	mg/kg <0.03	2.84	129	0.03	
Volatile Petroleum Hydrocarbons - Soil						
Extraction Date	Volatiles	1-Oct-14	1-Oct-14	1-Oct-14		
F1 C6-C10	Dry Weight	mg/kg 11	346	6170	10	
F1 -BTX	Dry Weight	mg/kg 11	331	5970	10	
Extractable Petroleum Hydrocarbons - Soil						
Extraction Date	Total Extractables	1-Oct-14	1-Oct-14	1-Oct-14		
F2c C10-C16	Dry Weight	mg/kg 292	1300	6110	50	
F3c C16-C34	Dry Weight	mg/kg 137	487	2690	50	
F4c C34-C50	Dry Weight	mg/kg <100	<100	<100	100	
F4HTGCc C34-C50+	Dry Weight	mg/kg <100	<100	<100	100	
% C50+	%	<5	<5	<5		
Silica Gel Cleanup						
Silica Gel Cleanup		Done	Done	Done		
Soil % Moisture						
Moisture	Soil % Moisture	% by weight 14.10	27.10	20.90		

Approved by:



Michael Yohemas, BSc
 Laboratory Operations Manager

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Methodology and Notes

Bill To: Hasegawa Engineering	Project:	Lot ID: 1029983
Report To: Hasegawa Engineering	ID:	Control Number:
330, 3120 - 32 Street S	Name: Barons	Date Received: Oct 1, 2014
Lethbridge, AB, Canada	Location: Barons, AB	Date Reported: Oct 4, 2014
T1K 7B4	LSD:	Report Number: 1953204
Attn: Mike Oler	P.O.: 07-186	
Sampled By: Mike Oler	Acct code:	
Company: Hasegawa		

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	01-Oct-14	Exova Calgary
BTEX-CCME - Soil	US EPA	* Volatile Organic Compounds in Various Sample Matrices Using Equilibrium Headspace Analysis/Gas Chromatography Mass Spectrometry, 5021/8260	01-Oct-14	Exova Calgary
TEH-CCME-Soil (Shake)	CCME	* Reference Method for Canada-Wide Standard for PHC in Soil, CWS PHCS TIER 1	01-Oct-14	Exova Calgary

** Reference Method Modified*

References

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

Comments:

- Analysis was performed on sample 1 that exceeded the recommended holding time for BTEX and F1 analysis.

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Analytical Report

Bill To: Hasegawa Engineering	Project:	Lot ID: 1029983
Report To: Hasegawa Engineering	ID:	Control Number:
330, 3120 - 32 Street S	Name: Barons	Date Received: Oct 1, 2014
Lethbridge, AB, Canada	Location: Barons, AB	Date Reported: Oct 4, 2014
T1K 7B4	LSD:	Report Number: 1953204
Attn: Mike Oler	P.O.: 07-186	
Sampled By: Mike Oler	Acct code:	
Company: Hasegawa		

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 Exova.
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 performed for fractions F2, F3, F4.
5. F1-BTEX: BTEX has been subtracted from the F1 fraction.
6. If analyzed, 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. Exova does not routinely 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 F4HTGC are reported, F4HTGC is the final 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 30% of the average RF for nC₁₀+nC₁₆+nC₃₄
 - linearity is within 15% for each of the calibrated carbon ranges
11. Batch data for analytical quality control are available on request.
12. Extraction and analysis holding times were met: See Notes and Methodology for nonconformances (if applicable).

Approved by:

Michael Yohemas, BSc
Laboratory Operations Manager

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