



May 12, 2016

Mr. Charlie Jensen  
Encana Oil & Gas (USA) Inc.  
143 Diamond Ave  
Parachute, CO 81635

**Re: West Divide Creek April 2016 Seep Status – Remediation #1815**

Dear Mr. Jensen:

Rule Engineering (Rule) prepared this report to present the results of the quarterly monitoring and modification sampling associated with the West Divide Creek Seep for Encana Oil and Gas (USA) Inc. The COGCC approved modification to the remediation system and sampling plan and recommendations for the gas seep associated with Colorado Oil and Gas Conservation Commission (COGCC) Remediation #1815 pursuant to the Schwartz 2-15B well Order No. 1V-276. Figure 1 provides a map of monitoring station locations for this site.

**April 2016 Quarterly Monitoring  
Groundwater**

On April 13, 2016, Rule was tasked to sample 7 groundwater monitoring wells (MW-2, 4, 8, 12, 17, 20, 22) as part of the quarterly monitoring program. Prior to sample collection, static water levels were measured at the wells to within 0.01 feet (ft) from the top of the north side of the PVC casing using an electronic water level meter. Prior to collection of the groundwater sample, each well was purged of three casing volumes of water using disposable bailers. Field parameters were obtained during sample collection which included temperature, specific conductance, dissolved oxygen, and oxygen reduction potential (ORP) with an YSI® water quality meter. Groundwater field measurement results are provided in Table 1.

All groundwater samples were immediately placed on ice after sample collection and shipped under chain-of-custody to ESC for laboratory analysis. Samples were received in good condition within appropriate temperatures by ESC. Quarterly samples were analyzed for benzene, toluene, ethylbenzene, xylene (BTEX) and methane, method-RSK175.

A summary of the groundwater analytical results is presented in Tables 2 and 3.

**Remediation System**

On August 11, 12, and 13, 2014 the remediation system was decommissioned. All of the system wells, piping, equipment in the shed, and monitoring equipment were removed from the property per an approved Sundry Notice from COGCC.

In November 2013, fifteen (15) monitoring wells, which are not on the current sampling plan, were plugged and abandoned per an approved Sundry notice by COGCC. The wells that were plugged and abandoned were monitoring wells MW-1, 6, 7, 9, 11, 13,

14, 15, 16, 18, 19, 21, 24, 25, 26. Access was denied by the property owner for the abandonment of MW-23 and MW-27.

## **Results**

### ***Site Hydrology***

During the April 2016 monitoring period, groundwater elevation varied from 5946.22 feet above mean seal level (AMSL) at MW-12 to 5962.78 feet at MW-20. Figure 2 illustrates the potentiometric surface for the site during this quarter. An average groundwater gradient was determined to be 0.021 with a groundwater flow to the northeast/north consistent with the drainage system of West Divide Creek within the seep area.

### ***April 2016 Analytical Results***

Groundwater analytical results indicate that monitoring stations MW-2, and MW-4 had dissolved benzene concentrations above COGCC Table 910-1 standards. Benzene concentrations of 0.0379 mg/L in MW-2, and 0.0105 mg/L in MW-4, and were detected during the April 2016 sampling event. Dissolved toluene and ethylbenzene concentrations were below detection levels in all wells. A dissolved xylene concentration was detected in monitoring well MW-2 with a value of 0.00928 mg/L. Figure 3 illustrates dissolved BTEX and dissolved methane results for the April 2016 sampling event.

Below is a summary of monitoring stations that are in the current sampling plan that had been impacted by the seep:

- MW-2: Dissolved benzene concentrations remain above the groundwater standard (Figure 3). MW-2 is up gradient of the treatment area, but dissolved benzene concentrations have declined over time. The concentration during the April 2016 sampling event was 0.0379 mg/L which is consistent with previous data.
- MW-4: Dissolved benzene concentrations were above the groundwater standard (Figure 3) during this monitoring event. MW-4 is up gradient of the treatment area, but the dissolved benzene concentration has declined over time. The concentration was below the detection limit for four consecutive quarters before the October 2015. The benzene concentration during the April 2016 sampling event was 0.0105 mg/L.
- MW-8: Dissolved benzene concentration declined to non-detect level before the system was installed (Figure 3) and has remained below the groundwater standard since July 2005.
- MW-12: Dissolved benzene concentration declined dramatically before the system was installed in 2005 (Figure 3) and has remained below the groundwater standard since March 2007. MW-12 is up gradient of the treatment area.
- MW-17: Dissolved benzene concentration declined before the system start up. Dissolved benzene concentrations were not detected in the groundwater (Figure 3) during this monitoring event. Benzene concentrations had been below the detection level for four quarters prior to the October 2015 sampling event and were not detected in the first two sampling events for 2016.

A summary of the historical BTEX and methane concentrations is provided in the electronic attachment (Appendix B).

#### **Divide Creek Remediation Analysis**

As described in previous West Divide Creek Seep Status Reports, the overall decline in dissolved benzene concentrations are attributed to a reduction in the mass flux of hydrocarbons from the seep. The natural processes of dilution, degradation, dispersion, and volatilization under the current site conditions provide remediation through natural attenuation (RNA), resulting in the observed decline in concentrations. Based on the extensive monitoring conducted to date, the groundwater plume is stable and/or diminishing, and demonstrates no potential for migration towards downgradient groundwater receptors (ie. water wells), without immediate detection within the existing monitoring well network.

Since the Remediation system was shut-off, the concentrations of groundwater constituents have continued to decline or remain below the groundwater standard in all wells that are monitored. We suggest continuing the current remediation plan through RNA. Seven (7) groundwater monitoring wells (MW-2, 4, 8, 12, 17, 20, 22) will continue to be sampled as part of the quarterly monitoring program

Rule Engineering appreciates the opportunity to provide services to Encana. If you have any questions please contact me at 970-244-8500.

Sincerely,

**Rule Engineering, LLC**

Christopher Bak  
Scientist/Project Manager

cc: Alex Fischer-COGCC  
Brett Middleton-Encana  
Russ Knight-Rule  
Pepi Langegger

## Tables

**Table 3. 1/13/15 - 4/13/16 Methane Groundwater Concentrations.**

Monitoring Station	Sample ID	Lab ID	Sample Date	Methane (mg/L)			
				RDL	MDL	Value	Qual
MW-2	MW-2-011315	L743311-01	1/13/2015	0.01	0.0021	7.2	
MW-4	MW-4-011315	L743311-02	1/13/2015	0.01	0.0021	1.0	
MW-8	MW-8-011315	L743311-03	1/13/2015	0.01	0.0021	0.1	
MW-12	NS	NS	1/13/2015	0.01	0.0021	NS	
MW-17	MW-17-011315	L743311-04	1/13/2015	0.01	0.0021	0.17	
MW-20	MW-20-011315	L743311-05	1/13/2015	0.01	0.0021	<0.010	
MW-22	MW-22-011315	L743311-06	1/13/2015	0.01	0.0021	<0.010	
MW-2	MW-2-041415	L759403-01	4/14/2015	0.05	0.01	0.36	
MW-4	MW-4-041415	L759403-02	4/14/2015	0.05	0.01	0.41	
MW-8	MW-8-041415	L759403-03	4/14/2015	0.01	0.0021	0.042	
MW-12	MW-12-041415	L759403-04	4/14/2015	0.01	0.0021	0.13	
MW-17	MW-17-041415	L759403-05	4/14/2015	0.01	0.0021	0.016	
MW-20	MW-20-041415	L759403-06	4/14/2015	0.01	0.0021	<0.010	
MW-22	MW-22-041415	L759403-07	4/14/2015	0.01	0.0021	<0.010	
MW-2	MW-2-071515	L777357-01	7/15/2015	0.4	0.0021	12	
MW-4	MW-4-071515	L777357-02	7/15/2015	0.04	0.0021	0.94	
MW-8	MW-8-071515	L777357-03	7/15/2015	0.01	0.0021	0.02	
MW-12	MW-12-071515	L777357-04	7/15/2015	0.04	0.0021	1	
MW-17	MW-17-071515	L777357-05	7/15/2015	0.01	0.0021	0.014	
MW-20	MW-20-071515	L777357-06	7/15/2015	0.01	0.0021	<0.010	
MW-22	MW-22-071515	L777357-07	7/15/2015	0.01	0.0021	<0.010	
MW-2	MW-2-101415	L794742-01	10/14/2015	0.25	0.0021	13.7	
MW-4	MW-4-101415	L794742-02	10/14/2015	0.25	0.0021	12.2	
MW-8	MW-8-101415	L794742-03	10/14/2015	0.01	0.0021	0.11	
MW-12	MW-12-101415	L794742-04	10/14/2015	0.01	0.0021	0.485	
MW-17	MW-17-101415	L794742-05	10/14/2015	0.1	0.0021	3.08	
MW-20	MW-20-101415	L794742-06	10/14/2015	0.01	0.0021	<0.010	
MW-22	MW-22-101415	L794742-07	10/14/2015	0.01	0.0021	0.0141	
MW-2	MW-2-012716	L814354-01	1/27/2016	0.4	0.0021	12.9	
MW-4	MW-4-012716	L814354-02	1/27/2016	0.4	0.0021	12.5	
MW-8	MW-8-012716	L814354-03	1/27/2016	0.05	0.0021	0.147	
MW-12	NS	NS	1/27/2016	0.01	0.0021	NS	
MW-17	MW-17-012716	L814354-04	1/27/2016	0.05	0.0021	0.901	
MW-20	MW-20-012716	L814354-05	1/27/2016	0.01	0.0021	<0.010	
MW-22	MW-22-012716	L814354-06	1/27/2016	0.01	0.0021	<0.010	
MW-2	MW-2-041316	L829611-01	4/13/2016	0.25	0.0021	15	
MW-4	MW-4-041316	L829611-02	4/13/2016	0.25	0.0021	13.2	
MW-8	MW-8-041316	L829611-03	4/13/2016	0.01	0.0021	0.0821	
MW-12	MW-12-041316	L829611-04	4/13/2016	0.04	0.0021	1.08	
MW-17	MW-17-041316	L829611-05	4/13/2016	0.01	0.0021	0.433	
MW-20	MW-20-041316	L829611-06	4/13/2016	0.01	0.0021	<0.010	
MW-22	MW-22-041316	L829611-07	4/13/2016	0.01	0.0021	<0.010	

Note: No Methane Standard for Groundwater in COGCC Table 910-1

Table 2. 10/13/15 - 4/13/16 West Divide Creek BTEX Groundwater Concentrations

Monitoring Station	Sample ID	Lab ID	Sample Date	Benzene (mg/L)				Toluene (mg/L)				Ethylbenzene (mg/L)				Total Xylenes (mg/L)			
				RDL	MDL	Value	Qual	RDL	MDL	Value	Qual	RDL	MDL	Value	Qual	RDL	MDL	Value	Qual
MW-2	MW-2-011315	L743311-01	1/13/2015	0.001	0.00033	0.03		0.005	0.00078	ND		0.001	0.00038	ND		0.003	0.0011	0.0072	
MW-4	MW-4-011315	L743311-02	1/13/2015	0.001	0.00033	ND		0.005	0.00078	ND		0.001	0.00038	ND		0.003	0.0011	ND	
MW-8	MW-8-011315	L743311-03	1/13/2015	0.001	0.00033	ND		0.005	0.00078	ND		0.001	0.00038	ND		0.003	0.0011	ND	
MW-12	NS	NS	1/13/2015	0.001	0.00033	NS		0.005	0.00078	NS		0.001	0.00038	NS		0.003	0.0011	NS	
MW-17	MW-17-011315	L743311-04	1/13/2015	0.001	0.00033	ND		0.005	0.00078	ND		0.001	0.00038	ND		0.003	0.0011	ND	
MW-20	MW-20-011315	L743311-05	1/13/2015	0.001	0.00033	ND		0.005	0.00078	ND		0.001	0.00038	ND		0.003	0.0011	ND	
MW-22	MW-22-011315	L743311-06	1/13/2015	0.001	0.00033	ND		0.005	0.00078	ND		0.001	0.00038	ND		0.003	0.0011	ND	
MW-2	MW-2-041415	L759403-01	4/14/2015	0.001	0.0003	0.36		0.005	0.0008	ND		0.0001	0.0004	ND		0.003	0.0011	0.004	
MW-4	MW-4-041415	L759403-02	4/14/2015	0.001	0.0003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-8	MW-8-041415	L759403-03	4/14/2015	0.001	0.0003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-12	MW-12-041415	L759403-04	4/14/2015	0.001	0.0003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-17	MW-17-041415	L759403-05	4/14/2015	0.001	0.0003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-20	MW-20-041415	L759403-06	4/14/2015	0.001	0.0003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-22	MW-22-041415	L759403-07	4/14/2015	0.001	0.0003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-2	MW-2-071515	L777357-01	7/15/2015	0.001	0.0003	0.054		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	0.015	
MW-4	MW-4-071515	L777357-02	7/15/2015	0.001	0.0003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-8	MW-8-071515	L777357-03	7/15/2015	0.001	0.0003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-12	MW-12-071515	L777357-04	7/15/2015	0.001	0.0003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-17	MW-17-071515	L777357-05	7/15/2015	0.001	0.0003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-20	MW-20-071515	L777357-06	7/15/2015	0.001	0.0003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-22	MW-22-071515	L777357-07	7/15/2015	0.001	0.0003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-2	MW-2-101415	L794742-01	10/14/2015	0.001	0.0003	0.0703		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	0.0162	
MW-4	MW-4-101415	L794742-02	10/14/2015	0.001	0.0003	0.0292		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	0.0109	
MW-8	MW-8-101415	L794742-03	10/14/2015	0.001	0.0003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-12	MW-12-101415	L794742-04	10/14/2015	0.001	0.0003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-17	MW-17-101415	L794742-05	10/14/2015	0.001	0.0003	0.00953		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-20	MW-20-101415	L794742-06	10/14/2015	0.001	0.0003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-22	MW-22-101415	L794742-07	10/14/2015	0.001	0.0003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-2	MW-2-012716	L814254-01	1/27/2016	0.001	0.0003	0.0363		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	0.0075	
MW-4	MW-4-012716	L814254-02	1/27/2016	0.001	0.0003	0.0178		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	0.00416	
MW-8	MW-8-012716	L814254-03	1/27/2016	0.001	0.0003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-12	NS	NS	1/27/2016	0.001	0.0003	NS		0.005	0.0008	NS		0.001	0.0004	NS		0.003	0.0011	NS	
MW-17	MW-17-012716	L814254-04	1/27/2016	0.001	0.0003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-20	MW-20-012716	L814254-05	1/27/2016	0.001	0.0003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-22	MW-22-012716	L814254-06	1/27/2016	0.001	0.0003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-2	MW-2-041316	L829611-01	4/13/2016	0.001	0.003	0.0379		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	0.00928	
MW-4	MW-4-041316	L829611-02	4/13/2016	0.001	0.003	0.0105		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-8	MW-8-041316	L829611-03	4/13/2016	0.001	0.003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-12	MW-12-041316	L829611-04	4/13/2016	0.001	0.003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-17	MW-17-041316	L829611-05	4/13/2016	0.001	0.003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-20	MW-20-041316	L829611-06	4/13/2016	0.001	0.003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	
MW-22	MW-22-041316	L829611-07	4/13/2016	0.001	0.003	ND		0.005	0.0008	ND		0.001	0.0004	ND		0.003	0.0011	ND	

Value exceeds Table 910-1  
ND = Non Detect

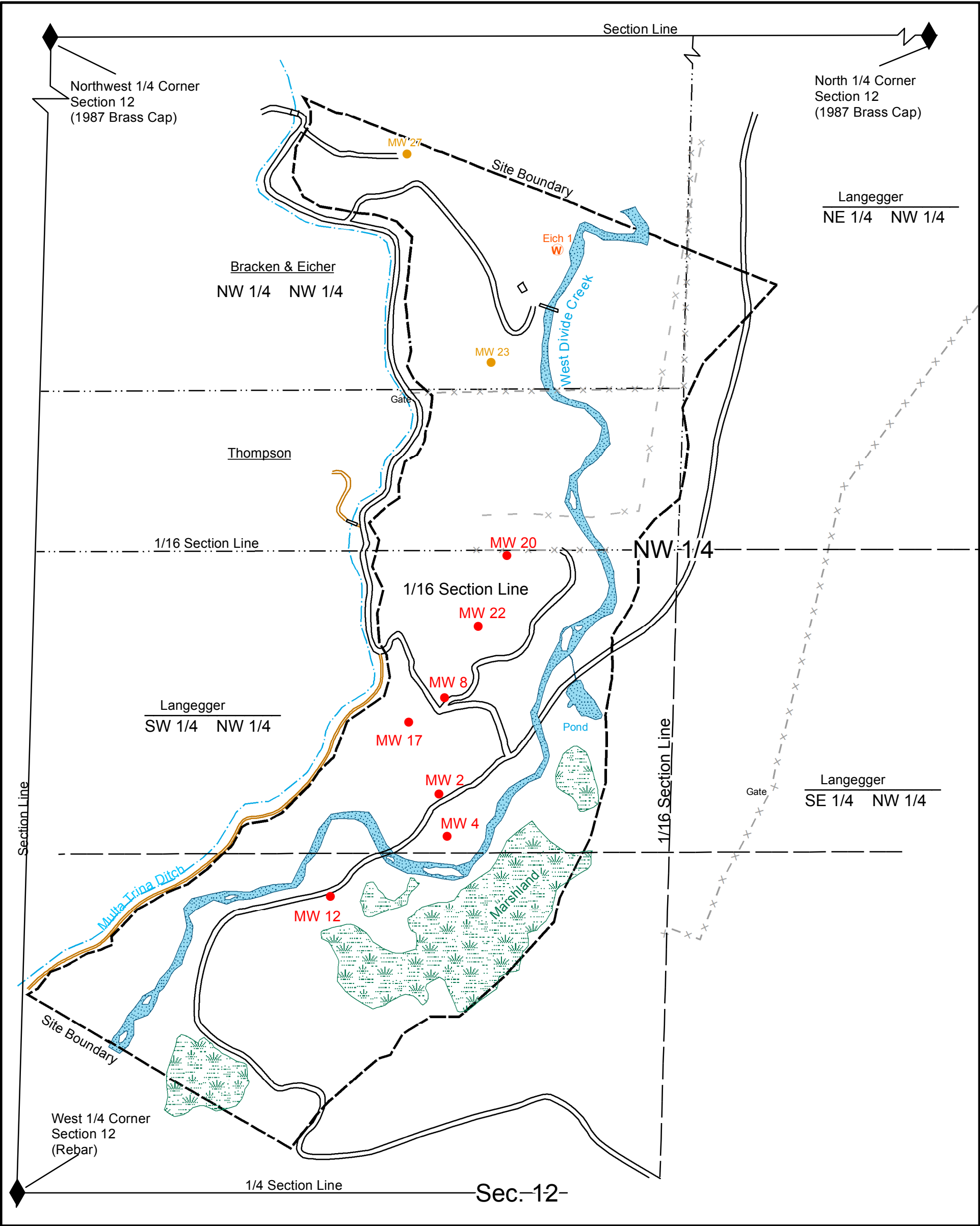
Table 1. 1/13/15 - 3/13/16 Groundwater Field Parameters

Monitoring Station	Date	DTW (ft)	Temp (°C)	SPC (mS/cm)	DO (mg/L)	TDS (mg/L)	SAL (ppt)	pH	ORP (mV)	Water Quality Observations
MW-2	1/13/2015	3.72	7.40	0.866	0.90	565.50	0.43	NR	-115.30	Light brown in color, no sheen, no effervescence, mild sulfur odor, mildly visually turbid
MW-4	1/13/2015	4.94	5.60	0.856	2.90	559.00	0.42	NR	63.70	Slightly brown in color, large rust particles present, no effervescence, no sheen, mild odor
MW-8	1/13/2015	8.00	9.70	1.108	0.71	721.60	0.55	NR	-63.00	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-12	1/13/2015	NR	NR	NR	NR	NR	NR	NR	NR	Frozen well head
MW-17	1/13/2015	5.00	7.90	1.833	0.80	1189.50	0.93	NR	-2.90	Brown in color, no sheen, no effervescence, no odor, very turbid
MW-20	1/13/2015	8.13	7.60	0.92	2.29	598.00	0.46	NR	18.30	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-22	1/13/2015	9.40	8.40	0.999	3.12	650.00	0.50	NR	7.50	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-2	4/14/2015	3.15	7.60	0.882	1.26	572.00	0.44	7.94	-137.50	Light brown in color, no sheen, no effervescence, mild sulfur odor, mildly visually turbid
MW-4	4/14/2015	4.18	11.20	0.394	3.87	252.00	0.18	7.92	6.30	Slightly brown in color, large rust particles present, no effervescence, no sheen, mild odor
MW-8	4/14/2015	7.12	9.00	1.145	1.25	741.00	0.57	7.71	-94.60	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-12	4/14/2015	1.20	6.20	1.132	4.04	34.50	0.56	7.47	-82.30	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-17	4/14/2015	3.53	7.50	1.957	1.83	1274.00	1.00	7.79	-16.70	Brown in color, no sheen, no effervescence, no odor, very turbid
MW-20	4/14/2015	7.37	6.20	1.015	1.25	663.00	0.50	NR	-92.80	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-22	4/14/2015	8.64	7.70	1.292	1.58	838.50	0.65	7.31	-3.60	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-2	7/15/2015	3.11	11.80	0.841	1.36	546.00	0.41	8.04	-106.40	Light brown in color, no sheen, no effervescence, mild sulfur odor, mildly visually turbid
MW-4	7/15/2015	4.88	10.50	1.035	3.56	1051.00	0.37	6.99	-7.80	Slightly brown in color, large rust particles present, no effervescence, no sheen, mild odor
MW-8	7/15/2015	6.45	10.02	1.452	11.80	942.50	0.73	7.58	-89.10	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-12	7/15/2015	1.61	15.20	1.032	6.35	669.50	0.51	6.94	-40.40	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-17	7/15/2015	2.39	13.80	1.161	2.02	754.00	0.58	8.14	27.30	Brown in color, no sheen, no effervescence, no odor, very turbid
MW-20	7/15/2015	6.64	10.50	0.963	1.30	624.00	0.48	7.65	26.20	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-22	7/15/2015	7.93	9.60	1.402	2.17	910.00	0.71	7.66	10.90	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-2	10/14/2015	5.80	11.60	0.810	3.84	526.50	0.40	7.91	-44.30	Light brown in color, no sheen, no effervescence, mild sulfur odor, mildly visually turbid
MW-4	10/14/2015	8.55	11.50	0.867	3.21	556.00	0.40	7.90	-54.20	Slightly brown in color, large rust particles present, no effervescence, no sheen, mild odor
MW-8	10/14/2015	9.64	12.30	1.162	3.06	754.00	0.58	7.61	-74.50	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-12	10/14/2015	1.11	11.50	0.975	9.77	975.00	0.48	7.54	-83.10	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-17	10/14/2015	7.39	11.70	1.192	3.87	773.50	0.60	7.86	-50.70	Brown in color, no sheen, no effervescence, no odor, very turbid
MW-20	10/14/2015	9.09	11.40	0.930	6.57	604.50	0.46	7.56	47.50	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-22	10/14/2015	10.55	10.60	1.017	2.89	663.00	0.51	7.63	28.50	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-2	1/21/2016	5.14	8.10	0.890	0.83	578.50	0.44	6.49	-87.60	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-4	1/21/2016	8.12	5.80	0.950	2.17	617.50	0.47	6.92	-125.00	Slightly brown in color, large rust particles present, no effervescence, no sheen, mild odor
MW-8	1/21/2016	9.01	9.20	1.173	1.82	780.00	0.69	6.17	-87.30	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-12	1/21/2016	NR	NR	NR	NR	NR	NR	NR	NR	Frozen well head
MW-17	1/21/2016	6.51	8.00	1.357	0.85	884.00	0.64	6.36	-82.50	Brown in color, no sheen, no effervescence, no odor, very turbid
MW-20	1/21/2016	8.21	6.80	0.971	6.50	630.50	0.48	6.62	-28.50	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-22	1/21/2016	9.98	7.80	1.373	5.24	890.00	0.69	6.61	-25.90	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-2	4/13/2016	4.58	7.60	0.464	3.53	299.00	0.22	6.02	-82.90	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-4	4/13/2016	7.08	8.60	0.499	4.22	323.40	0.24	6.35	-19.90	Slightly brown in color, large rust particles present, no effervescence, no sheen, mild odor
MW-8	4/13/2016	9.53	8.50	0.561	2.49	364.50	0.27	5.74	-60.50	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-12	4/13/2016	0.82	6.20	0.570	3.39	366.80	0.29	4.98	-108.60	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-17	4/13/2016	5.80	7.70	0.597	596.50	386.10	0.29	5.77	-43.90	Brown in color, no sheen, no effervescence, no odor, very turbid
MW-20	4/13/2016	7.66	6.50	0.472	2.76	305.50	0.23	6.50	19.50	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid
MW-22	4/13/2016	9.43	7.50	0.601	4.62	388.70	0.29	5.60	13.60	Light brown in color, no sheen, no effervescence, no odor, mildly visually turbid

Notes: NR= Not recorded

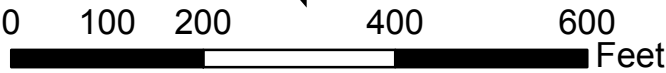
## Figures

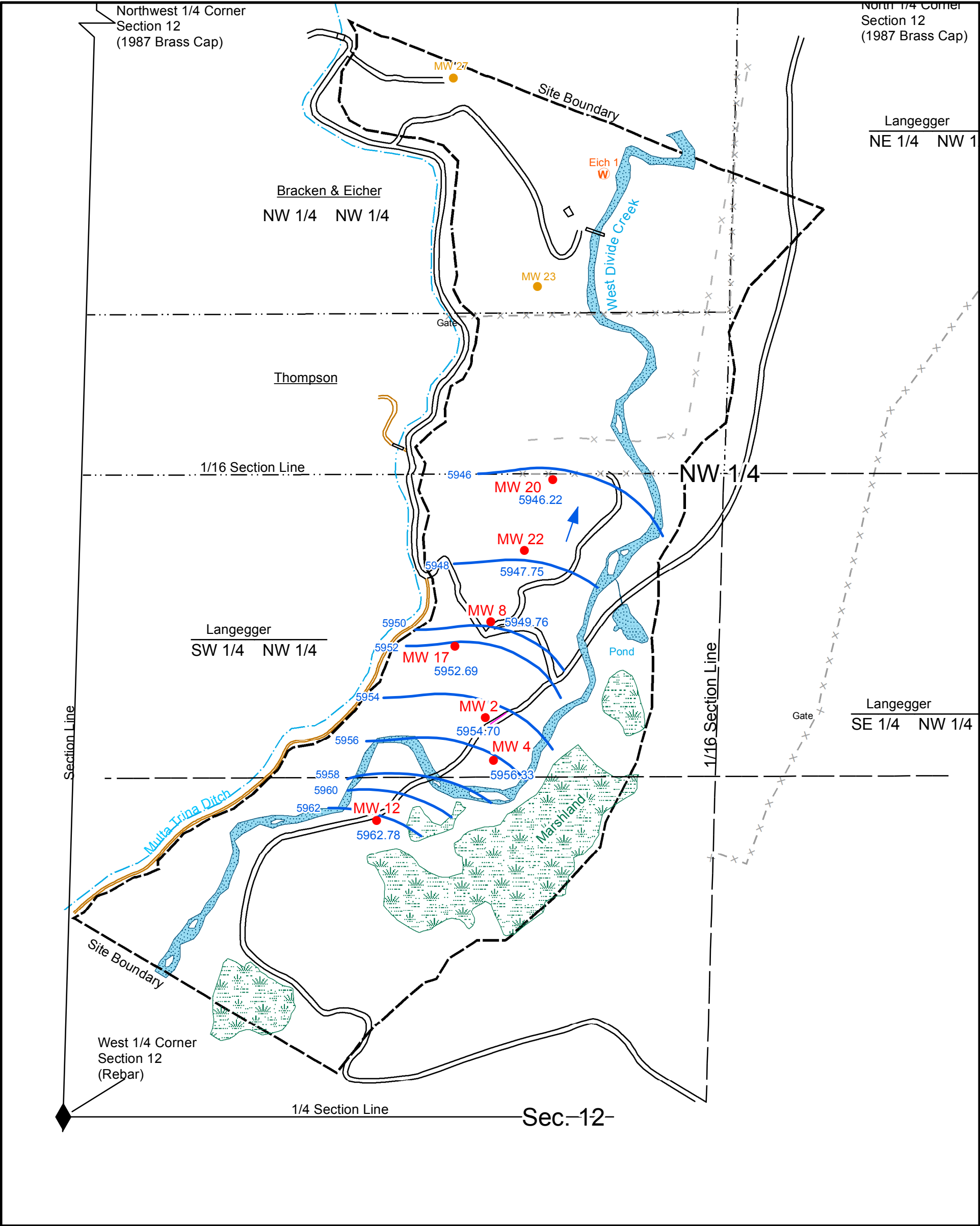




**Legend**

- Site Boundary
- Road
- .- Drainage
- x - x Fence
- x - Old Fence
- .- Property Line
- Trail
- Monitoring Well Location
- Approved Monitoring Well to P/A
- ◆ Section Corners





**Legend**

- Site Boundary
- Road
- Drainage
- Fence
- Old Fence
- Property Line
- Trail

- Monitoring Well Location
- Approved Monitoring Well to P/A
- Section Corners

**Groundwater Legend**

- 5950.0 = Groundwater Elevation Contour (Feet)
- 5950.0 = Groundwater Elevation (Feet)
- Flow Vector

**Rule Engineering, LLC**  
Solutions to Regulations for Industry

**encana**

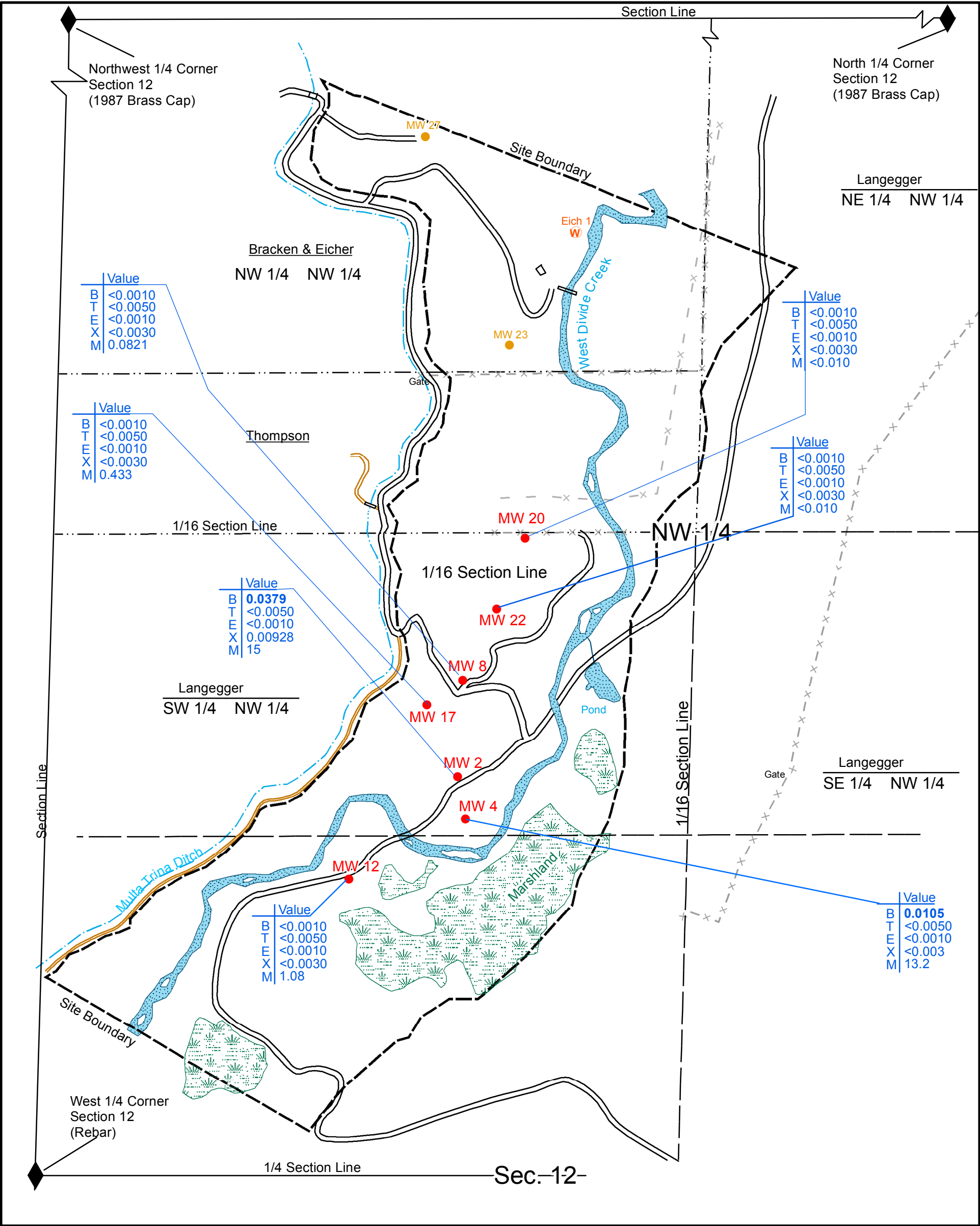
**Groundwater Elevation Map**  
April 2016

DATE: 4/25/2016

EZ

File:

Figure: 2



**Legend**

- Site Boundary
- Road
- Drainage
- Fence
- Old Fence
- Property Line
- Trail

- Monitoring Well Location
- Approved Monitoring Well to P/A
- Section Corners

Chemical Data  
B = Benzene (mg/L)  
T = Toluene (mg/L)  
E = Ethylbenzene (mg/L)  
X = Xylenes (mg/L)  
M = Total Methane (mg/L)  
NS = Not Sampled



0 100 200 400 600 Feet

# **APPENDIX A**



## EnCana Oil & Gas - Parachute, CO

Sample Delivery Group: L829611  
Samples Received: 04/14/2016  
Project Number: EDC-O1E  
Description: West Divide Creek-Quarterly  
Site: WDC  
Report To: Charles Jensen  
143 Diamond Avenue  
Parachute, CO 81635

Entire Report Reviewed By:



Jarred Willis

Technical Service Representative

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by ESC is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.



<sup>1</sup> Cp: Cover Page	1
<sup>2</sup> Tc: Table of Contents	2
<sup>3</sup> Ss: Sample Summary	3
<sup>4</sup> Cn: Case Narrative	4
<sup>5</sup> Sr: Sample Results	5
MW-2-041316   L829611-01	5
MW-4-041316   L829611-02	6
MW-8-041316   L829611-03	7
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MW-17-041316   L829611-05	9
MW-20-041316   L829611-06	10
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<sup>6</sup> Gl: Glossary of Terms	12
<sup>7</sup> Al: Accreditations & Locations	13
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<sup>1</sup> Cp
<sup>2</sup> Tc
<sup>3</sup> Ss
<sup>4</sup> Cn
<sup>5</sup> Sr
<sup>6</sup> Gl
<sup>7</sup> Al
<sup>8</sup> Sc

# SAMPLE SUMMARY

ONE LAB. NATIONWIDE.



## MW-2-041316 L829611-01 GW

Collected by  
Chris Bak

Collected date/time  
04/13/16 10:40

Received date/time  
04/14/16 09:00

<sup>1</sup> Cp

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method RSK175	WG865568	1	04/19/16 12:23	04/19/16 12:23	MBF
Volatile Organic Compounds (GC) by Method RSK175	WG865568	25	04/19/16 14:13	04/19/16 14:13	MBF
Volatile Organic Compounds (GC/MS) by Method 8260B	WG864946	1	04/18/16 09:38	04/18/16 09:38	BMB

<sup>2</sup> Tc

<sup>3</sup> Ss

## MW-4-041316 L829611-02 GW

Collected by  
Chris Bak

Collected date/time  
04/13/16 10:25

Received date/time  
04/14/16 09:00

<sup>4</sup> Cn

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method RSK175	WG865568	1	04/19/16 12:28	04/19/16 12:28	MBF
Volatile Organic Compounds (GC) by Method RSK175	WG865568	25	04/19/16 14:15	04/19/16 14:15	MBF
Volatile Organic Compounds (GC/MS) by Method 8260B	WG864946	1	04/18/16 10:00	04/18/16 10:00	BMB

<sup>5</sup> Sr

<sup>6</sup> Gl

## MW-8-041316 L829611-03 GW

Collected by  
Chris Bak

Collected date/time  
04/13/16 11:10

Received date/time  
04/14/16 09:00

<sup>7</sup> Al

<sup>8</sup> Sc

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method RSK175	WG865568	1	04/19/16 12:55	04/19/16 12:55	MBF
Volatile Organic Compounds (GC/MS) by Method 8260B	WG864946	1	04/18/16 10:22	04/18/16 10:22	BMB

## MW-12-041316 L829611-04 GW

Collected by  
Chris Bak

Collected date/time  
04/13/16 10:10

Received date/time  
04/14/16 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method RSK175	WG865568	1	04/19/16 13:08	04/19/16 13:08	MBF
Volatile Organic Compounds (GC) by Method RSK175	WG865568	4	04/19/16 14:20	04/19/16 14:20	MBF
Volatile Organic Compounds (GC/MS) by Method 8260B	WG864946	1	04/18/16 10:44	04/18/16 10:44	BMB

## MW-17-041316 L829611-05 GW

Collected by  
Chris Bak

Collected date/time  
04/13/16 10:55

Received date/time  
04/14/16 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method RSK175	WG865568	1	04/19/16 13:13	04/19/16 13:13	MBF
Volatile Organic Compounds (GC/MS) by Method 8260B	WG864946	1	04/18/16 11:07	04/18/16 11:07	BMB

## MW-20-041316 L829611-06 GW

Collected by  
Chris Bak

Collected date/time  
04/13/16 11:35

Received date/time  
04/14/16 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method RSK175	WG865568	1	04/19/16 13:52	04/19/16 13:52	MBF
Volatile Organic Compounds (GC/MS) by Method 8260B	WG864946	1	04/18/16 11:30	04/18/16 11:30	BMB

## MW-22-041316 L829611-07 GW

Collected by  
Chris Bak

Collected date/time  
04/13/16 11:25

Received date/time  
04/14/16 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method RSK175	WG865568	1	04/19/16 13:58	04/19/16 13:58	MBF
Volatile Organic Compounds (GC/MS) by Method 8260B	WG864946	1	04/18/16 11:51	04/18/16 11:51	BMB

ACCOUNT:

EnCana Oil & Gas - Parachute, CO

PROJECT:

EDC-O1E

SDG:

L829611

DATE/TIME:

04/20/16 11:28

PAGE:

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All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. All MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Jarred Willis  
Technical Service Representative







## Volatile Organic Compounds (GC) by Method RSK175

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Methane	15.0		0.250	25	04/19/2016 14:13	WG865568
Ethane	3.30		0.325	25	04/19/2016 14:13	WG865568
Ethene	ND		0.0130	1	04/19/2016 12:23	WG865568
Propane	0.670		0.0190	1	04/19/2016 12:23	WG865568

<sup>1</sup> Cp<sup>2</sup> Tc<sup>3</sup> Ss<sup>4</sup> Cn<sup>5</sup> Sr<sup>6</sup> Gl<sup>7</sup> Al<sup>8</sup> Sc

## Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Benzene	0.0379		0.00100	1	04/18/2016 09:38	WG864946
Toluene	ND		0.00500	1	04/18/2016 09:38	WG864946
Ethylbenzene	ND		0.00100	1	04/18/2016 09:38	WG864946
Total Xylenes	0.00928		0.00300	1	04/18/2016 09:38	WG864946
(S) Toluene-d8	99.5		90.0-115		04/18/2016 09:38	WG864946
(S) Dibromofluoromethane	102		79.0-121		04/18/2016 09:38	WG864946
(S) a,a,a-Trifluorotoluene	97.1		90.4-116		04/18/2016 09:38	WG864946
(S) 4-Bromofluorobenzene	98.2		80.1-120		04/18/2016 09:38	WG864946



## Volatile Organic Compounds (GC) by Method RSK175

Analyte	Result mg/l	<u>Qualifier</u>	RDL mg/l	Dilution	Analysis date / time	Batch
Methane	13.2		0.250	25	04/19/2016 14:15	WG865568
Ethane	2.66		0.325	25	04/19/2016 14:15	WG865568
Ethene	ND		0.0130	1	04/19/2016 12:28	WG865568
Propane	0.461		0.0190	1	04/19/2016 12:28	WG865568

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Gl

7 Al

8 Sc

## Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	<u>Qualifier</u>	RDL mg/l	Dilution	Analysis date / time	Batch
Benzene	0.0105		0.00100	1	04/18/2016 10:00	WG864946
Toluene	ND		0.00500	1	04/18/2016 10:00	WG864946
Ethylbenzene	ND		0.00100	1	04/18/2016 10:00	WG864946
Total Xylenes	ND		0.00300	1	04/18/2016 10:00	WG864946
(S) Toluene-d8	100		90.0-115		04/18/2016 10:00	WG864946
(S) Dibromofluoromethane	101		79.0-121		04/18/2016 10:00	WG864946
(S) a,a,a-Trifluorotoluene	98.2		90.4-116		04/18/2016 10:00	WG864946
(S) 4-Bromofluorobenzene	98.4		80.1-120		04/18/2016 10:00	WG864946



## Volatile Organic Compounds (GC) by Method RSK175

Analyte	Result mg/l	<u>Qualifier</u>	RDL mg/l	Dilution	Analysis date / time	Batch
Methane	0.0821		0.0100	1	04/19/2016 12:55	WG865568
Ethane	ND		0.0130	1	04/19/2016 12:55	WG865568
Ethene	ND		0.0130	1	04/19/2016 12:55	WG865568
Propane	ND		0.0190	1	04/19/2016 12:55	WG865568

<sup>1</sup> Cp<sup>2</sup> Tc<sup>3</sup> Ss<sup>4</sup> Cn<sup>5</sup> Sr<sup>6</sup> Gl<sup>7</sup> Al<sup>8</sup> Sc

## Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	<u>Qualifier</u>	RDL mg/l	Dilution	Analysis date / time	Batch
Benzene	ND		0.00100	1	04/18/2016 10:22	WG864946
Toluene	ND		0.00500	1	04/18/2016 10:22	WG864946
Ethylbenzene	ND		0.00100	1	04/18/2016 10:22	WG864946
Total Xylenes	ND		0.00300	1	04/18/2016 10:22	WG864946
(S) Toluene-d8	99.3		90.0-115		04/18/2016 10:22	WG864946
(S) Dibromofluoromethane	102		79.0-121		04/18/2016 10:22	WG864946
(S) a,a,a-Trifluorotoluene	97.8		90.4-116		04/18/2016 10:22	WG864946
(S) 4-Bromofluorobenzene	96.8		80.1-120		04/18/2016 10:22	WG864946



## Volatile Organic Compounds (GC) by Method RSK175

Analyte	Result mg/l	<u>Qualifier</u>	RDL mg/l	Dilution	Analysis date / time	Batch
Methane	1.08		0.0400	4	04/19/2016 14:20	WG865568
Ethane	ND		0.0130	1	04/19/2016 13:08	WG865568
Ethene	ND		0.0130	1	04/19/2016 13:08	WG865568
Propane	ND		0.0190	1	04/19/2016 13:08	WG865568

1  
Cp2  
Tc3  
Ss4  
Cn5  
Sr6  
Gl7  
Al8  
Sc

## Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	<u>Qualifier</u>	RDL mg/l	Dilution	Analysis date / time	Batch
Benzene	ND		0.00100	1	04/18/2016 10:44	WG864946
Toluene	ND		0.00500	1	04/18/2016 10:44	WG864946
Ethylbenzene	ND		0.00100	1	04/18/2016 10:44	WG864946
Total Xylenes	ND		0.00300	1	04/18/2016 10:44	WG864946
(S) Toluene-d8	99.0		90.0-115		04/18/2016 10:44	WG864946
(S) Dibromofluoromethane	102		79.0-121		04/18/2016 10:44	WG864946
(S) a,a,a-Trifluorotoluene	97.8		90.4-116		04/18/2016 10:44	WG864946
(S) 4-Bromofluorobenzene	95.3		80.1-120		04/18/2016 10:44	WG864946



## Volatile Organic Compounds (GC) by Method RSK175

Analyte	Result mg/l	<u>Qualifier</u>	RDL mg/l	Dilution	Analysis date / time	Batch
Methane	0.433		0.0100	1	04/19/2016 13:13	WG865568
Ethane	0.0846		0.0130	1	04/19/2016 13:13	WG865568
Ethene	ND		0.0130	1	04/19/2016 13:13	WG865568
Propane	ND		0.0190	1	04/19/2016 13:13	WG865568

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Gl

7 Al

8 Sc

## Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	<u>Qualifier</u>	RDL mg/l	Dilution	Analysis date / time	Batch
Benzene	ND		0.00100	1	04/18/2016 11:07	WG864946
Toluene	ND		0.00500	1	04/18/2016 11:07	WG864946
Ethylbenzene	ND		0.00100	1	04/18/2016 11:07	WG864946
Total Xylenes	ND		0.00300	1	04/18/2016 11:07	WG864946
(S) Toluene-d8	99.1		90.0-115		04/18/2016 11:07	WG864946
(S) Dibromofluoromethane	101		79.0-121		04/18/2016 11:07	WG864946
(S) a,a,a-Trifluorotoluene	98.0		90.4-116		04/18/2016 11:07	WG864946
(S) 4-Bromofluorobenzene	97.5		80.1-120		04/18/2016 11:07	WG864946



## Volatile Organic Compounds (GC) by Method RSK175

Analyte	Result mg/l	<u>Qualifier</u>	RDL mg/l	Dilution	Analysis date / time	Batch
Methane	ND		0.0100	1	04/19/2016 13:52	WG865568
Ethane	ND		0.0130	1	04/19/2016 13:52	WG865568
Ethene	ND		0.0130	1	04/19/2016 13:52	WG865568
Propane	ND		0.0190	1	04/19/2016 13:52	WG865568

1  
Cp2  
Tc3  
Ss4  
Cn5  
Sr6  
Gl7  
Al8  
Sc

## Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	<u>Qualifier</u>	RDL mg/l	Dilution	Analysis date / time	Batch
Benzene	ND		0.00100	1	04/18/2016 11:30	WG864946
Toluene	ND		0.00500	1	04/18/2016 11:30	WG864946
Ethylbenzene	ND		0.00100	1	04/18/2016 11:30	WG864946
Total Xylenes	ND		0.00300	1	04/18/2016 11:30	WG864946
(S) Toluene-d8	98.9		90.0-115		04/18/2016 11:30	WG864946
(S) Dibromofluoromethane	100		79.0-121		04/18/2016 11:30	WG864946
(S) a,a,a-Trifluorotoluene	97.9		90.4-116		04/18/2016 11:30	WG864946
(S) 4-Bromofluorobenzene	98.0		80.1-120		04/18/2016 11:30	WG864946



## Volatile Organic Compounds (GC) by Method RSK175

Analyte	Result mg/l	<u>Qualifier</u>	RDL mg/l	Dilution	Analysis date / time	Batch
Methane	ND		0.0100	1	04/19/2016 13:58	WG865568
Ethane	ND		0.0130	1	04/19/2016 13:58	WG865568
Ethene	ND		0.0130	1	04/19/2016 13:58	WG865568
Propane	ND		0.0190	1	04/19/2016 13:58	WG865568

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Gl

7 Al

8 Sc

## Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	<u>Qualifier</u>	RDL mg/l	Dilution	Analysis date / time	Batch
Benzene	ND		0.00100	1	04/18/2016 11:51	WG864946
Toluene	ND		0.00500	1	04/18/2016 11:51	WG864946
Ethylbenzene	ND		0.00100	1	04/18/2016 11:51	WG864946
Total Xylenes	ND		0.00300	1	04/18/2016 11:51	WG864946
(S) Toluene-d8	99.8		90.0-115		04/18/2016 11:51	WG864946
(S) Dibromofluoromethane	102		79.0-121		04/18/2016 11:51	WG864946
(S) a,a,a-Trifluorotoluene	98.4		90.4-116		04/18/2016 11:51	WG864946
(S) 4-Bromofluorobenzene	97.1		80.1-120		04/18/2016 11:51	WG864946



## Abbreviations and Definitions

SDG	Sample Delivery Group.
MDL	Method Detection Limit.
RDL	Reported Detection Limit.
ND,U	Not detected at the Reporting Limit (or MDL where applicable).
RPD	Relative Percent Difference.
(dry)	Results are reported based on the dry weight of the sample. [this will only be present on a dry report basis for soils].
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Rec.	Recovery.
SDL	Sample Detection Limit.
MQL	Method Quantitation Limit.
Unadj. MQL	Unadjusted Method Quantitation Limit.

Qualifier	Description
-----------	-------------

The remainder of this page intentionally left blank, there are no qualifiers applied to this SDG.

<sup>1</sup> Cp<sup>2</sup> Tc<sup>3</sup> Ss<sup>4</sup> Cn<sup>5</sup> Sr<sup>6</sup> Gl<sup>7</sup> Al<sup>8</sup> Sc





ESC Lab Sciences is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our "one location" design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be **YOUR LAB OF CHOICE**.

\* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

## State Accreditations

Alabama	40660	Nevada	TN-03-2002-34
Alaska	UST-080	New Hampshire	2975
Arizona	AZ0612	New Jersey–NELAP	TN002
Arkansas	88-0469	New Mexico	TN00003
California	01157CA	New York	11742
Colorado	TN00003	North Carolina	Env375
Connecticut	PH-0197	North Carolina <sup>1</sup>	DW21704
Florida	E87487	North Carolina <sup>2</sup>	41
Georgia	NELAP	North Dakota	R-140
Georgia <sup>1</sup>	923	Ohio–VAP	CL0069
Idaho	TN00003	Oklahoma	9915
Illinois	200008	Oregon	TN200002
Indiana	C-TN-01	Pennsylvania	68-02979
Iowa	364	Rhode Island	221
Kansas	E-10277	South Carolina	84004
Kentucky <sup>1</sup>	90010	South Dakota	n/a
Kentucky <sup>2</sup>	16	Tennessee <sup>14</sup>	2006
Louisiana	AI30792	Texas	T 104704245-07-TX
Maine	TN0002	Texas <sup>5</sup>	LAB0152
Maryland	324	Utah	6157585858
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	109
Minnesota	047-999-395	Washington	C1915
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA
Nebraska	NE-OS-15-05		

## Third Party & Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA	100789
A2LA – ISO 17025 <sup>5</sup>	1461.02	DOD	1461.01
Canada	1461.01	USDA	S-67674
EPA–Crypto	TN00003		

<sup>1</sup> Drinking Water <sup>2</sup> Underground Storage Tanks <sup>3</sup> Aquatic Toxicity <sup>4</sup> Chemical/Microbiological <sup>5</sup> Mold <sup>n/a</sup> Accreditation not applicable

## Our Locations

ESC Lab Sciences has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. **ESC Lab Sciences performs all testing at our central laboratory.**

