



PDC Energy, Inc.
Fourth Quarter 2015 Groundwater Monitoring Summary

January 27, 2016

Cottonwood #1 Tank Battery
NESE Section 13 T6N R66W
Weld County, API # 05-123-11801
Spill Tracking # 2315752
Remediation # 9319

This groundwater summary has been prepared by Tasman Geosciences, Inc. for the Cottonwood #1 tank battery. On December 17, 2015 groundwater sampling was conducted at the seven monitoring well locations at the site. Groundwater samples were submitted for laboratory analysis of benzene, toluene, ethylbenzene, and total xylenes (BTEX) by USEPA Method 8260B. Analytical results are summarized in Table 1 and the laboratory report is included as Attachment A. Sample locations and corresponding analytical results are illustrated on Figure 1. Fourth quarter 2015 analytical results indicate that benzene concentrations are above applicable COGCC Table 910-1 standards in well BH02. BTEX concentrations are below COGCC regulatory standards in the remaining six sample locations.

Tasman initiated enhanced fluid recovery (EFR) and air sparge (AS) events on site during the fourth quarter 2012. A summary of the EFR/AS operational data is provided in Table 2. Mobile EFR/AS events will continue as the selected remediation strategy for the site through the first quarter 2016.

Historical sampling results for naphthalene and gasoline range organics (GRO) are presented in Table 3. Analysis of these constituents was discontinued following the third quarter 2012, as they are not regulated in the COGCC 900 Series.

First quarter 2016 groundwater sampling will be conducted during March 2016.

TABLE 1
COTTONWOOD #1 TANK BATTERY
SURFACE WATER AND GROUNDWATER ANALYTICAL RESULTS SUMMARY TABLE

Sample ID	Date Sampled	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	Depth to Water ⁽²⁾ (feet)
COGCC Table 910-1 Groundwater Standard (µg/L) ⁽¹⁾		5	560	700	1,400	
SW01	8/20/2012	<1.0	<1.0	<1.0	<1.0	NM
GW01	8/21/2012	3,000	1.7	320	1,900	~ 14
BH01	9/24/2012	160	<1.0	40	<1.0	16.31
BH01	12/20/2012	5.0	<1.0	<1.0	6.8	16.13
BH01	3/18/2013	<1.0	<1.0	<1.0	<1.0	16.58
BH01	6/20/2013	<1.0	<1.0	<1.0	<1.0	11.16
BH01	9/25/2013	<1.0	<1.0	<1.0	<1.0	13.61
BH01	12/30/2013	1.8	<1.0	<1.0	<1.0	14.38
BH01	3/28/2014	<1.0	<1.0	<1.0	<1.0	14.03
BH01	6/24/2014	<1.0	<1.0	<1.0	<1.0	11.79
BH01	9/24/2014	<1.0	<1.0	<1.0	<1.0	12.48
BH01	12/17/2014	<1.0	<1.0	<1.0	<1.0	13.16
BH01	3/26/2015	<1.0	<1.0	<1.0	<1.0	12.60
BH01	6/16/2015	<1.0	<1.0	<1.0	<1.0	11.33
BH01	9/28/2015	<1.0	<1.0	<1.0	<1.0	11.31
BH01	12/17/2015	3.8	<1.0	<1.0	<1.0	11.99
BH02	9/24/2012	1,300	<1.0	190	1,100	18.42
BH02	12/20/2012	24	<1.0	3.9	8.1	17.35
BH02	3/18/2013	18	<1.0	<1.0	<1.0	17.80
BH02	6/20/2013	15	<1.0	<1.0	<1.0	12.58
BH02	9/25/2013	8.6	<1.0	<1.0	<1.0	14.68
BH02	12/30/2013	16	<1.0	<1.0	<1.0	15.44
BH02	3/28/2014	<1.0	<1.0	<1.0	<1.0	15.15
BH02	6/24/2014	14	<1.0	1.6	<1.0	12.94
BH02	9/24/2014	59	<1.0	2.5	2.7	13.28
BH02	12/17/2014	29	<1.0	<1.0	<1.0	14.19
BH02	3/26/2015	47	<1.0	2.5	<1.0	13.65
BH02	6/16/2015	35	<1.0	<1.0	<1.0	12.55
BH02	9/28/2015	80	<1.0	2.2	<1.0	12.27
BH02	12/17/2015	9.5	<1.0	<1.0	<1.0	13.01
BH03	9/24/2012	350	<1.0	120	300	18.28
BH03	12/20/2012	15	<1.0	6.7	7.9	17.04

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Sample ID	Date Sampled	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	Depth to Water ⁽²⁾ (feet)
COGCC Table 910-1 Groundwater Standard (µg/L) ⁽¹⁾		5	560	700	1,400	
BH03	3/18/2013	14	<1.0	1.5	<1.0	17.46
BH03	6/20/2013	11	<1.0	2.1	<1.0	12.01
BH03	9/25/2013	39	<1.0	16	<1.0	14.26
BH03	12/30/2013	48	<1.0	3.6	<1.0	15.02
BH03	3/28/2014	<1.0	<1.0	<1.0	<1.0	14.79
BH03	6/24/2014	13	<1.0	1.2	<1.0	12.43
BH03	9/24/2014	45	<1.0	1.8	3.0	12.91
BH03	12/17/2014	<1.0	<1.0	<1.0	<1.0	13.72
BH03	3/26/2015	8.0	<1.0	<1.0	<1.0	13.24
BH03	6/16/2015	19	<1.0	<1.0	<1.0	12.03
BH03	9/28/2015	7.7	<1.0	<1.0	<1.0	11.82
BH03	12/17/2015	2.0	<1.0	<1.0	<1.0	12.61
BH04	9/24/2012	150	<1.0	96	400	16.58
BH04	12/20/2012	38	<1.0	40	170	13.95
BH04	3/18/2013	2.6	<1.0	<1.0	<1.0	14.38
BH04	6/20/2013	1.3	<1.0	5.4	19	8.70
BH04	9/25/2013	1.5	<1.0	2.5	<1.0	11.32
BH04	12/30/2013	<1.0	<1.0	<1.0	<1.0	12.12
BH04	3/28/2014	<1.0	<1.0	<1.0	<1.0	11.80
BH04	6/24/2014	<1.0	<1.0	2.2	<1.0	9.43
BH04	9/24/2014	<1.0	<1.0	1.2	3.1	10.22
BH04	12/17/2014	<1.0	<1.0	<1.0	<1.0	10.96
BH04	3/26/2015	<1.0	<1.0	<1.0	<1.0	10.40
BH04	6/16/2015	1.8	<1.0	3.8	<1.0	9.09
BH04	9/28/2015	<1.0	<1.0	<1.0	<1.0	9.07
BH04	12/17/2015	<1.0	<1.0	<1.0	<1.0	9.81
BH05	9/24/2012	<1.0	<1.0	<1.0	<1.0	15.42
BH05	12/20/2012	<1.0	<1.0	<1.0	<1.0	16.86
BH05	3/18/2013	<1.0	<1.0	<1.0	<1.0	17.31
BH05	6/20/2013	<1.0	<1.0	<1.0	<1.0	11.42
BH05	9/25/2013	<1.0	<1.0	<1.0	<1.0	14.02
BH05	12/30/2013	<1.0	<1.0	<1.0	<1.0	14.80

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Sample ID	Date Sampled	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	Depth to Water ⁽²⁾ (feet)
COGCC Table 910-1 Groundwater Standard (µg/L) ⁽¹⁾		5	560	700	1,400	
BH05	3/28/2014	<1.0	<1.0	<1.0	<1.0	14.45
BH05	6/24/2014	<1.0	<1.0	<1.0	<1.0	12.00
BH05	9/24/2014	<1.0	<1.0	<1.0	<1.0	12.93
BH05	12/17/2014	<1.0	<1.0	<1.0	<1.0	13.69
BH05	3/26/2015	<1.0	<1.0	<1.0	<1.0	13.30
BH05	6/16/2015	<1.0	<1.0	<1.0	<1.0	11.96
BH05	9/28/2015	<1.0	<1.0	<1.0	<1.0	11.98
BH05	12/17/2015	<1.0	<1.0	<1.0	<1.0	12.73
BH06	9/24/2012	6.7	18	7.5	50	15.35
BH06	12/20/2012	<1.0	<1.0	<1.0	<1.0	16.79
BH06	3/18/2013	3.6	1.2	<1.0	<1.0	14.74
BH06	6/20/2013	<1.0	<1.0	<1.0	<1.0	11.72
BH06	9/25/2013	1.9	<1.0	<1.0	<1.0	14.05
BH06	12/30/2013	<1.0	<1.0	<1.0	<1.0	15.12
BH06	3/28/2014	<1.0	<1.0	<1.0	<1.0	14.78
BH06	6/24/2014	<1.0	<1.0	<1.0	<1.0	12.52
BH06	9/24/2014	<1.0	<1.0	<1.0	<1.0	13.26
BH06	12/17/2014	<1.0	<1.0	<1.0	<1.0	13.94
BH06	3/26/2015	<1.0	<1.0	<1.0	<1.0	13.45
BH06	6/16/2015	<1.0	<1.0	<1.0	<1.0	12.28
BH06	9/28/2015	<1.0	<1.0	<1.0	<1.0	12.09
BH06	12/17/2015	<1.0	<1.0	<1.0	<1.0	12.78
BH07	9/24/2012	<1.0	<1.0	<1.0	<1.0	16.86
BH07	12/20/2012	<1.0	<1.0	<1.0	<1.0	18.32
BH07	3/18/2013	<1.0	<1.0	<1.0	<1.0	18.77
BH07	6/20/2013	1.6	<1.0	<1.0	<1.0	13.70
BH07	9/25/2013	<1.0	<1.0	<1.0	<1.0	15.95
BH07	12/30/2013	<1.0	<1.0	<1.0	<1.0	16.68
BH07	3/28/2014	<1.0	<1.0	<1.0	<1.0	16.39
BH07	6/24/2014	<1.0	<1.0	<1.0	<1.0	14.30
BH07	9/24/2014	<1.0	<1.0	<1.0	<1.0	14.84
BH07	12/17/2014	<1.0	<1.0	<1.0	<1.0	15.46

TABLE 1
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Sample ID	Date Sampled	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	Depth to Water ⁽²⁾ (feet)
COGCC Table 910-1 Groundwater Standard (µg/L) ⁽¹⁾		5	560	700	1,400	
BH07	3/26/2015	<1.0	1.2	<1.0	<1.0	14.93
BH07	6/16/2015	<1.0	<1.0	<1.0	<1.0	13.71
BH07	9/28/2015	<1.0	<1.0	<1.0	<1.0	13.38
BH07	12/17/2015	<1.0	<1.0	<1.0	<1.0	14.03

Notes:

1. Groundwater standards referenced from 2 CCR 404-1, Table 910-1, effective January 30, 2015.

COGCC = Colorado Oil and Gas Conservation Commission

2. Depth to water measured from top of well casing or ground surface for monitoring well samples and excavation samples, respectively.

µg/L = Micrograms per liter

(<) = Analytical result is less than the indicated laboratory reporting limit.

NM = Not measured

BOLD = Analytical result is in exceedance of COGCC groundwater standards.

TABLE 2
COTTONWOOD #1 TANK BATTERY
EFR / AS OPERATIONAL SUMMARY TABLE

Date	EFR Wells	Total EFR/AS Duration (hours)	Approximate Gallons Extracted	AS Wells	Air Injection Pressure (psi)
Fourth Quarter 2012					
11/2/2012	BH01, BH02, BH03, BH04	6.75	13.8	BH01, BH02, BH03, BH04	8
11/14/2012		6	110		8
12/12/2012		6	400		8
Quarterly Totals		18.75	523.8		-
First Quarter 2013					
1/4/2013	BH01, BH02, BH03, BH04	6.5	185	BH01, BH02, BH03, BH04	10
1/18/2013		6.25	272		10
2/2/2013		6	278		10
2/15/2013		7	180		9
3/5/2013		6.75	364		10
3/22/2013		4	90		10
Quarterly Totals		36.5	1369		-
Second Quarter 2013					
4/3/2013	BH01, BH02, BH03, BH04	5	275	BH01, BH02, BH03, BH04	10
4/19/2013		6.5	373		10
5/13/2013		6	385		10
5/23/2013		6	151		10
6/6/2013		6	387		10
6/17/2013		5	300		10
Quarterly Totals		34.5	1871		-
Third Quarter 2013					
7/16/2013	BH01, BH02, BH03, BH04, BH07	6	340	BH01, BH02, BH03, BH04, BH07	10
7/30/2013		6	320		10
8/13/2013		6	294		10
8/30/2013		5.5	182		10
9/12/2013		5.5	180		10
9/27/2013		6	80		10
Quarterly Totals		35	1396		-
Fourth Quarter 2013					
10/10/2013	BH01, BH02, BH03, BH04, BH06, BH07	6	132	BH01, BH02, BH03, BH04, BH06, BH07	10
10/22/2013		6	159		11
11/12/2013		6	115		10
11/25/2013		6	65		10
12/13/2013		6	60		10
Quarterly Totals		30	531		-

TABLE 2
COTTONWOOD #1 TANK BATTERY
EFR / AS OPERATIONAL SUMMARY TABLE

Date	EFR Wells	Total EFR/AS Duration (hours)	Approximate Gallons Extracted	AS Wells	Air Injection Pressure (psi)
First Quarter 2014					
1/3/2014	BH01, BH02, BH03, BH04	6	10	BH01, BH02, BH03, BH04	10
1/17/2014		6	240		10
2/17/2014		6	180		10
3/5/2014		5.25	270		10
3/14/2014		6	300		10
Quarterly Totals		29.25	1000		
Second Quarter 2014					
4/3/2014	BH01, BH02, BH03, BH04	6	120	BH01, BH02, BH03, BH04	10
4/18/2014		6	360		20
5/7/2014		6	225		10
5/22/2014		6	400		20
6/7/2014		6	200		10
6/20/2014		6	300		20
Quarterly Totals		36	1605		
Third Quarter 2014					
7/10/2014	BH02, BH03	6	250	BH02, BH03	10
7/25/2014		6	220		10
8/16/2014		6	120		10
9/8/2014		6	450		20
9/19/2014		6	150		20
Quarterly Totals		30	1190		
Fourth Quarter 2014					
10/8/2014	BH02, BH03	6	100	BH02, BH03	20
10/25/2014		6	260		20
11/7/2014		6	112		20
12/2/2014		6	250		20
12/15/2014		6	270		20
Quarterly Totals		30	992		
First Quarter 2015					
1/5/2015	BH02, BH03	6	0	BH02, BH03	20
1/16/2015		6	315		20
2/7/2015		6	410		20
3/2/2015		6	0		20
3/19/2015		6	0		20
Quarterly Totals		30	725		

TABLE 2
COTTONWOOD #1 TANK BATTERY
EFR / AS OPERATIONAL SUMMARY TABLE

Date	EFR Wells	Total EFR/AS Duration (hours)	Approximate Gallons Extracted	AS Wells	Air Injection Pressure (psi)
Second Quarter 2015					
4/8/2015	BH02, BH03	6	0	BH02, BH03	20
4/15/2015		5.45	0		20
4/29/2015		6	320		20
5/13/2015		6	360		20
5/27/2015		6	480		20
6/10/2015		6	600		20
6/24/2015		6	480		20
Quarterly Totals		41.45	2240		
Third Quarter 2015					
7/8/2015	BH02, BH03	6	400	BH02, BH03	20
7/22/2015		6	280		20
8/5/2015		6	250		20
8/17/2015		4	375		20
9/2/2015		6	640		20
9/30/2015	BH02, BH03, EFR01, EFR02, EFR03, EFR04, EFR05, EFR06, EFR07, EFR08, EFR09, EFR10	6	800	BH02, BH03, EFR01, EFR02, EFR03, EFR04, EFR05, EFR06, EFR07, EFR08, EFR09, EFR10	20
Quarterly Totals		34	2745		
Fourth Quarter 2015					
10/15/2015	BH02, BH03, EFR01, EFR02, EFR03, EFR04, EFR05, EFR06, EFR07, EFR08, EFR09, EFR10	6	230	BH02, BH03, EFR01, EFR02, EFR03, EFR04, EFR05, EFR06, EFR07, EFR08, EFR09, EFR10	20
10/23/2015		5	552	20	
11/5/2015		6	644	BH02, BH03, EFR02, EFR03, EFR04, EFR05, EFR06, EFR07, EFR08, EFR09, EFR10	20
11/18/2015		6	480	20	
12/3/2015		6	786	BH02, BH03, EFR01, EFR02, EFR03, EFR04, EFR05, EFR06, EFR07, EFR08, EFR09, EFR10	20
12/19/2015		6	320	20	
Quarterly Totals		35	3012		

Notes:

EFR = Enhanced fluid recovery

AS = Air sparge

psi = Pounds per square inch

TABLE 3
COTTONWOOD #1 TANK BATTERY
SURFACE WATER AND GROUNDWATER ANALYTICAL RESULTS SUMMARY TABLE

Sample ID	Date Sampled	Naphthalene (µg/L)	TPH-GRO (µg/L)
CDPHE WQCC Groundwater Standard ⁽¹⁾		140	NS
SW01	8/20/2012	<1.0	<500
GW01	8/21/2012	200	32,000
BH01	9/24/2012	5.5	830
BH02	9/24/2012	25	6,800
BH03	9/24/2012	13	2,900
BH04	9/24/2012	14	3,100
BH05	9/24/2012	<1.0	<500
BH06	9/24/2012	<1.0	<500
BH07	9/24/2012	1.6	<500

Notes:

1. Groundwater standards referenced from Colorado Department of Public Health Water Quality Control Commission 5CCR 1002-41 Basic Standards for Groundwater.

TPH-GRO = Total Petroleum Hydrocarbons - Gasoline Range Organics

µg/L = Micrograms per liter

(<) = Analytical result is less than the indicated laboratory reporting limit.

NS = No Standard

BOLD = Analytical result is in exceedance of applicable groundwater standards.



Irrigation
Canal Flow

Surface
Drainage

BH06		
Compound (µg/L)	9/28/2015	12/17/2015
Benzene	<1.0	<1.0
Toluene	<1.0	<1.0
Ethylbenzene	<1.0	<1.0
Total Xylenes	<1.0	<1.0

BH01		
Compound (µg/L)	9/28/2015	12/17/2015
Benzene	<1.0	3.8
Toluene	<1.0	<1.0
Ethylbenzene	<1.0	<1.0
Total Xylenes	<1.0	<1.0

BH07		
Compound (µg/L)	9/28/2015	12/17/2015
Benzene	<1.0	<1.0
Toluene	<1.0	<1.0
Ethylbenzene	<1.0	<1.0
Total Xylenes	<1.0	<1.0

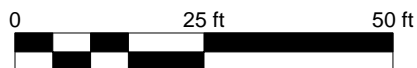
BH02		
Compound (µg/L)	9/28/2015	12/17/2015
Benzene	80	9.5
Toluene	<1.0	<1.0
Ethylbenzene	2.2	<1.0
Total Xylenes	<1.0	<1.0

BH04		
Compound (µg/L)	9/28/2015	12/17/2015
Benzene	<1.0	<1.0
Toluene	<1.0	<1.0
Ethylbenzene	<1.0	<1.0
Total Xylenes	<1.0	<1.0

BH05		
Compound (µg/L)	9/28/2015	12/17/2015
Benzene	<1.0	<1.0
Toluene	<1.0	<1.0
Ethylbenzene	<1.0	<1.0
Total Xylenes	<1.0	<1.0

BH03		
Compound (µg/L)	9/28/2015	12/17/2015
Benzene	7.7	2.0
Toluene	<1.0	<1.0
Ethylbenzene	<1.0	<1.0
Total Xylenes	<1.0	<1.0

SW01



EFR05
EFR10
EFR04
BH02
GW01
EFR06
EFR07
EFR01
EFR02
EFR08
EFR09
BH03

Note: Surface drainage direction
is estimated based on site
topography and is not related to
regional topography.

DRAWN BY: ESS

DATE: 12/23/2015

Facility Diagram
PDC Energy, Inc. – DJ Basin
Cottonwood #1 Tank Battery
NESE S13 T6N R66W
Weld County, CO

 **TASMAN** GEOSCIENCES 6899 Pecos Street, Unit C
Denver, CO 80221

LEGEND

- Excavation Extent
- Monitoring Well Location
- Remediation EFR Well Location
- Excavation Groundwater Sample
- Excavation Surface Water Sample



Point of Release

All locations are
approximate unless
otherwise noted

FIGURE 1
GROUNDWATER
ANALYTICAL
RESULTS MAP

ATTACHMENT A

Summit Scientific

741 Corporate Circle – Suite I ♦ Golden, Colorado 80401

303.277.9310 - laboratory ♦ 303.277.9531 - fax

December 23, 2015

Mark Longhurst
PDC Energy
1775 Sherman St. STE. 3000
Denver, CO 80203
RE: Cottonwood #1

Enclosed are the results of analyses for samples received by Summit Scientific on 12/17/15 17:00. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read 'P. Shrewsbury', with a stylized, cursive script.

Paul Shrewsbury
President



PDC Energy
1775 Sherman St. STE. 3000
Denver CO, 80203

Project: Cottonwood #1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
12/23/15 08:53

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
BH01	1512146-01	Water	12/17/15 11:30	12/17/15 17:00
BH02	1512146-02	Water	12/17/15 11:48	12/17/15 17:00
BH03	1512146-03	Water	12/17/15 11:57	12/17/15 17:00
BH04	1512146-04	Water	12/17/15 12:06	12/17/15 17:00
BH05	1512146-05	Water	12/17/15 12:15	12/17/15 17:00
BH06	1512146-06	Water	12/17/15 12:24	12/17/15 17:00
BH07	1512146-07	Water	12/17/15 12:30	12/17/15 17:00

Summit Scientific

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

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PDC Energy
1775 Sherman St. STE. 3000
Denver CO, 80203

Project: Cottonwood #1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
12/23/15 08:53

BH01
1512146-01 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: 12/17/15 11:30

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	3.8	1.0	ug/l	1	1512180	12/22/15	12/22/15	EPA 8260B	
Toluene	ND	1.0	"	"	"	"	"	"	
Ethylbenzene	ND	1.0	"	"	"	"	"	"	
Xylenes (total)	ND	1.0	"	"	"	"	"	"	

Date Sampled: 12/17/15 11:30

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		95.6 %	37-154		"	"	"	"	
Surrogate: Toluene-d8		93.2 %	45-149		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		89.9 %	45-146		"	"	"	"	

Summit Scientific

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PDC Energy
1775 Sherman St. STE. 3000
Denver CO, 80203

Project: Cottonwood #1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
12/23/15 08:53

BH02
1512146-02 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: 12/17/15 11:48

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	9.5	1.0	ug/l	1	1512180	12/22/15	12/22/15	EPA 8260B	
Toluene	ND	1.0	"	"	"	"	"	"	
Ethylbenzene	ND	1.0	"	"	"	"	"	"	
Xylenes (total)	ND	1.0	"	"	"	"	"	"	

Date Sampled: 12/17/15 11:48

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		94.3 %	37-154		"	"	"	"	
Surrogate: Toluene-d8		92.1 %	45-149		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		91.4 %	45-146		"	"	"	"	

Summit Scientific

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PDC Energy
1775 Sherman St. STE. 3000
Denver CO, 80203

Project: Cottonwood #1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
12/23/15 08:53

BH03
1512146-03 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: 12/17/15 11:57

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	2.0	1.0	ug/l	1	1512180	12/22/15	12/22/15	EPA 8260B	
Toluene	ND	1.0	"	"	"	"	"	"	
Ethylbenzene	ND	1.0	"	"	"	"	"	"	
Xylenes (total)	ND	1.0	"	"	"	"	"	"	

Date Sampled: 12/17/15 11:57

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
<i>Surrogate: 1,2-Dichloroethane-d4</i>		98.1 %	37-154		"	"	"	"	
<i>Surrogate: Toluene-d8</i>		91.1 %	45-149		"	"	"	"	
<i>Surrogate: 4-Bromofluorobenzene</i>		92.0 %	45-146		"	"	"	"	

Summit Scientific

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PDC Energy
1775 Sherman St. STE. 3000
Denver CO, 80203

Project: Cottonwood #1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
12/23/15 08:53

BH04
1512146-04 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: 12/17/15 12:06

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Benzene	ND	1.0	ug/l	1	1512180	12/22/15	12/22/15	EPA 8260B	
Toluene	ND	1.0	"	"	"	"	"	"	
Ethylbenzene	ND	1.0	"	"	"	"	"	"	
Xylenes (total)	ND	1.0	"	"	"	"	"	"	

Date Sampled: 12/17/15 12:06

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Surrogate: 1,2-Dichloroethane-d4		95.0 %	37-154		"	"	"	"	
Surrogate: Toluene-d8		91.1 %	45-149		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		91.6 %	45-146		"	"	"	"	

Summit Scientific

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PDC Energy
1775 Sherman St. STE. 3000
Denver CO, 80203

Project: Cottonwood #1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
12/23/15 08:53

BH05
1512146-05 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: 12/17/15 12:15

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Benzene	ND	1.0		ug/l	1	1512180	12/22/15	12/22/15	EPA 8260B	
Toluene	ND	1.0		"	"	"	"	"	"	
Ethylbenzene	ND	1.0		"	"	"	"	"	"	
Xylenes (total)	ND	1.0		"	"	"	"	"	"	

Date Sampled: 12/17/15 12:15

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Surrogate: 1,2-Dichloroethane-d4		94.3 %		37-154		"	"	"	"	
Surrogate: Toluene-d8		94.1 %		45-149		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		90.6 %		45-146		"	"	"	"	

Summit Scientific

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PDC Energy
1775 Sherman St. STE. 3000
Denver CO, 80203

Project: Cottonwood #1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
12/23/15 08:53

BH06
1512146-06 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: 12/17/15 12:24

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	ND	1.0	ug/l	1	1512180	12/22/15	12/22/15	EPA 8260B	
Toluene	ND	1.0	"	"	"	"	"	"	
Ethylbenzene	ND	1.0	"	"	"	"	"	"	
Xylenes (total)	ND	1.0	"	"	"	"	"	"	

Date Sampled: 12/17/15 12:24

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		94.3 %	37-154		"	"	"	"	
Surrogate: Toluene-d8		93.2 %	45-149		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		92.0 %	45-146		"	"	"	"	

Summit Scientific

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PDC Energy
1775 Sherman St. STE. 3000
Denver CO, 80203

Project: Cottonwood #1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
12/23/15 08:53

BH07
1512146-07 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: 12/17/15 12:30

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Benzene	ND	1.0	ug/l	1	1512180	12/22/15	12/22/15	EPA 8260B	
Toluene	ND	1.0	"	"	"	"	"	"	
Ethylbenzene	ND	1.0	"	"	"	"	"	"	
Xylenes (total)	ND	1.0	"	"	"	"	"	"	

Date Sampled: 12/17/15 12:30

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Surrogate: 1,2-Dichloroethane-d4		102 %	37-154		"	"	"	"	
Surrogate: Toluene-d8		92.7 %	45-149		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		96.0 %	45-146		"	"	"	"	

Summit Scientific

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PDC Energy
1775 Sherman St. STE. 3000
Denver CO, 80203

Project: Cottonwood #1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
12/23/15 08:53

Volatile Organic Compounds by EPA Method 8260B - Quality Control

Summit Scientific

Analyte	Reporting			Spike	Source		%REC		RPD	
	Result	Limit	Units	Level	Result	%REC	Limits	RPD	Limit	Notes

Batch 1512180 - EPA 5030 Water MS

Blank (1512180-BLK1)

Prepared & Analyzed: 12/21/15

Benzene	ND	1.0	ug/l							
Toluene	ND	1.0	"							
Ethylbenzene	ND	1.0	"							
Xylenes (total)	ND	1.0	"							
Surrogate: 1,2-Dichloroethane-d4	12.1		"	13.3		90.8	37-154			
Surrogate: Toluene-d8	12.3		"	13.3		92.3	45-149			
Surrogate: 4-Bromofluorobenzene	11.9		"	13.3		89.4	45-146			

LCS (1512180-BS1)

Prepared & Analyzed: 12/21/15

Benzene	33.0	1.0	ug/l	33.3		98.9	51-132			
Toluene	32.4	1.0	"	33.3		97.1	51-138			
Ethylbenzene	36.9	1.0	"	33.1		112	58-146			
m,p-Xylene	72.0	2.0	"	66.5		108	57-144			
o-Xylene	34.1	1.0	"	32.8		104	53-146			
Surrogate: 1,2-Dichloroethane-d4	12.0		"	13.3		90.4	37-154			
Surrogate: Toluene-d8	12.7		"	13.3		95.0	45-149			
Surrogate: 4-Bromofluorobenzene	12.4		"	13.3		93.1	45-146			

Matrix Spike (1512180-MS1)

Source: 1512145-01

Prepared & Analyzed: 12/21/15

Benzene	33.2	1.0	ug/l	33.3	ND	99.6	34-141			
Toluene	33.1	1.0	"	33.3	ND	99.3	27-151			
Ethylbenzene	37.9	1.0	"	33.1	ND	115	29-160			
m,p-Xylene	73.5	2.0	"	66.5	ND	110	20-166			
o-Xylene	35.2	1.0	"	32.8	ND	107	33-159			
Surrogate: 1,2-Dichloroethane-d4	12.5		"	13.3		93.9	37-154			
Surrogate: Toluene-d8	12.5		"	13.3		93.5	45-149			
Surrogate: 4-Bromofluorobenzene	12.1		"	13.3		91.1	45-146			

Summit Scientific

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Denver CO, 80203

Project: Cottonwood #1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
12/23/15 08:53

Volatile Organic Compounds by EPA Method 8260B - Quality Control
Summit Scientific

Analyte	Reporting			Spike	Source		%REC		RPD	
	Result	Limit	Units	Level	Result	%REC	Limits	RPD	Limit	Notes

Batch 1512180 - EPA 5030 Water MS

Matrix Spike Dup (1512180-MSD1)	Source: 1512145-01			Prepared & Analyzed: 12/21/15						
Benzene	32.9	1.0	ug/l	33.3	ND	98.7	34-141	0.938	32	
Toluene	32.3	1.0	"	33.3	ND	96.8	27-151	2.51	25	
Ethylbenzene	37.7	1.0	"	33.1	ND	114	29-160	0.503	50	
m,p-Xylene	74.1	2.0	"	66.5	ND	111	20-166	0.800	36	
o-Xylene	35.2	1.0	"	32.8	ND	107	33-159	0.142	26	
Surrogate: 1,2-Dichloroethane-d4	12.7		"	13.3		95.5	37-154			
Surrogate: Toluene-d8	12.5		"	13.3		93.5	45-149			
Surrogate: 4-Bromofluorobenzene	12.4		"	13.3		92.6	45-146			

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1775 Sherman St. STE. 3000
Denver CO, 80203

Project: Cottonwood #1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
12/23/15 08:53

Notes and Definitions

DET Analyte DETECTED
ND Analyte NOT DETECTED at or above the reporting limit
NR Not Reported
dry Sample results reported on a dry weight basis
RPD Relative Percent Difference

Summit Scientific

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A handwritten signature in black ink, appearing to be 'MSM'.