



**PDC Energy, Inc.**  
**Third Quarter 2012 Groundwater Monitoring Summary**

October 16, 2012

Cottonwood #1 Tank Battery  
NESE Section 13 T6N R66W  
Weld County, API # 05-123-11801

This groundwater summary has been prepared by Tasman Geosciences, LLC for the Cottonwood #1 tank battery. Seven temporary monitoring wells were installed on September 18, 2012, for groundwater monitoring and remediation purposes. On September 24, 2012, groundwater sampling was conducted at seven monitoring well locations. Groundwater samples were submitted for laboratory analysis of BTEX constituents using USEPA Method 8260B. Analytical results are summarized in Table 1 below and a complete lab report is included as Attachment A. Sample locations and corresponding analytical results are illustrated on Figure 2. Third quarter analytical results indicate that BTEX concentrations are in exceedance of the COGCC regulatory standards in monitoring wells BH01 through BH04 and BH06. Ethylbenzene and total xylenes concentrations were also elevated in these five wells. Petroleum hydrocarbon concentrations were below laboratory detection limits in the two boundary wells to the south (BH05) and to the north (BH07).

Tasman will initiate enhanced fluid recovery (EFR) and air sparging (AS) in October 2012 and will continue bi-weekly events through January 2013. Chemical oxidation injections are tentatively scheduled in March of 2013, if needed.

Fourth quarter 2012 groundwater sampling will be conducted during December 2012.

**TABLE 1**  
**COTTONWOOD #1**  
**GROUNDWATER ANALYTICAL RESULTS SUMMARY TABLE**

Sample ID	Date Sampled	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)	Depth to Water (feet)
GW01	8/21/2012	<b>3,000</b>	1.7	320	<b>1,900</b>	NM
BH01	9/24/2012	<b>160</b>	<1.0	40	<1.0	16.31
BH02	9/24/2012	<b>1,300</b>	<1.0	190	1,100	18.42
BH03	9/24/2012	<b>350</b>	<1.0	120	300	18.28
BH04	9/24/2012	<b>150</b>	<1.0	96	400	16.58
BH05	9/24/2012	<1.0	<1.0	<1.0	<1.0	15.42
BH06	9/24/2012	<b>6.7</b>	18	7.5	50	15.35
BH07	9/24/2012	<1.0	<1.0	<1.0	<1.0	16.86
<b>COGCC standards for Groundwater (ug/L) <sup>(1)</sup></b>		<b>5</b>	<b>560</b>	<b>700</b>	<b>1,400</b>	

Notes:

1). The environmental cleanup standards for groundwater that are applicable to this site are the Colorado Oil and Gas Conservation Commission (COGCC) standards for contaminants in groundwater according to Table 910-1 of the COGCC 900 Series Rule for E&P Waste Management.

**Bold** red values indicate an exceedance of the COGCC soil standards for the Site.

ug/L= Micrograms per liter.    NM - Not Measured



Surface  
Drainage

BH06	
Compound (ug/L)	9/24/2012
Benzene	6.7
Toluene	18
Ethylbenzene	7.5
Total Xylenes	50

Separator Secondary  
Containment

BH07	
Compound (ug/L)	9/24/2012
Benzene	<1.0
Toluene	<1.0
Ethylbenzene	<1.0
Total Xylenes	<1.0

BH-07 ⊕

BH01	
Compound (ug/L)	9/24/2012
Benzene	160
Toluene	<1.0
Ethylbenzene	40
Total Xylenes	<1.0

Native  
Vegetation

BH-06 ⊕

Private Land

BH-01 ⊕

BH02	
Compound (ug/L)	9/24/2012
Benzene	1,300
Toluene	<1.0
Ethylbenzene	190
Total Xylenes	1,100

BH-02 ⊕

100 bbl  
PW Tank

300 bbl  
Condensate Tank

300 bbl  
Condensate Tank

BH04	
Compound (ug/L)	9/24/2012
Benzene	150
Toluene	<1.0
Ethylbenzene	96
Total Xylenes	400

Irrigation Canal

Flow

BH-04 ⊕

BH05	
Compound (ug/L)	9/24/2012
Benzene	<1.0
Toluene	<1.0
Ethylbenzene	<1.0
Total Xylenes	<1.0

BH-05 ⊕

BH03	
Compound (ug/L)	9/24/2012
Benzene	350
Toluene	<1.0
Ethylbenzene	120
Total Xylenes	300

BH-03 ⊕

Access Road

PROJECT  
NO:

DRAWN BY: CAW

DATE: 10/16/2012

**Facility Diagram**  
PDC Energy – DJ Basin  
Cottonwood #1  
NESE S13 T6N R66W  
Weld County, CO



5690 Webster Avenue  
Arvada CO 80002

LEGEND

- Earthen Berm
- Temporary Monitoring Well

FIGURE 2  
GROUNDWATER  
ANALYTICAL RESULTS

## **ATTACHMENT A**

# Summit Scientific

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741 Corporate Circle – Suite I ♦ Golden, Colorado 80401

303.277.9310 - laboratory ♦ 303.277.9531 - fax

October 01, 2012

Brandon Bruns  
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 09/24/12 16:30. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read "Joseph J. Egry IV". The signature is stylized with a large, sweeping initial "J" and "E".

Joseph J Egry IV For Ben Shrewsbury  
President / Laboratory Manager



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

Project: Cottonwood #1  
Project Number: [none]  
Project Manager: Brandon Bruns

**Reported:**  
10/01/12 09:24

### ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
BH01	R209180-01	Water	09/24/12 10:25	09/24/12 16:30
BH02	R209180-02	Water	09/24/12 10:30	09/24/12 16:30
BH03	R209180-03	Water	09/24/12 10:40	09/24/12 16:30
BH04	R209180-04	Water	09/24/12 10:35	09/24/12 16:30
BH05	R209180-05	Water	09/24/12 10:45	09/24/12 16:30
BH06	R209180-06	Water	09/24/12 10:50	09/24/12 16:30
BH07	R209180-07	Water	09/24/12 10:55	09/24/12 16:30

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.*





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

Project: Cottonwood #1  
Project Number: [none]  
Project Manager: Brandon Brunns

Reported:  
10/01/12 09:24

**BH01**  
**R209180-01 (Water)**

**Summit Scientific**

**Volatile Organic Compounds by EPA Method 8260B**

Date Sampled: **09/24/12 10:25**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
<b>Naphthalene</b>	<b>5.5</b>	1.0	ug/l	1	2092610	09/26/12	09/27/12	EPA 8260B	
<b>Benzene</b>	<b>160</b>	1.0	"	"	"	"	"	"	
Toluene	ND	1.0	"	"	"	"	"	"	
<b>Ethylbenzene</b>	<b>40</b>	1.0	"	"	"	"	"	"	
Xylenes (total)	ND	1.0	"	"	"	"	"	"	
<b>Gasoline Range Hydrocarbons</b>	<b>830</b>	500	"	"	"	"	"	"	

Date Sampled: **09/24/12 10:25**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		91.6 %	49.7-150		"	"	"	"	
Surrogate: Toluene-d8		105 %	51-150		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		102 %	50.1-150		"	"	"	"	

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

Project: Cottonwood #1  
Project Number: [none]  
Project Manager: Brandon Bruns

Reported:  
10/01/12 09:24

**BH02**  
**R209180-02 (Water)**

**Summit Scientific**

**Volatile Organic Compounds by EPA Method 8260B**

Date Sampled: **09/24/12 10:30**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Naphthalene	25	1.0	ug/l	1	2092610	09/26/12	09/28/12	EPA 8260B	
Benzene	1300	100	"	100	"	"	"	"	
Toluene	ND	1.0	"	1	"	"	"	"	
Ethylbenzene	190	1.0	"	"	"	"	"	"	
Xylenes (total)	1100	100	"	100	"	"	"	"	
Gasoline Range Hydrocarbons	6800	500	"	1	"	"	"	"	

Date Sampled: **09/24/12 10:30**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		90.5 %	49.7-150		"	"	"	"	
Surrogate: Toluene-d8		118 %	51-150		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		100 %	50.1-150		"	"	"	"	

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

Project: Cottonwood #1  
Project Number: [none]  
Project Manager: Brandon Bruns

Reported:  
10/01/12 09:24

**BH03**  
**R209180-03 (Water)**

**Summit Scientific**

**Volatile Organic Compounds by EPA Method 8260B**

Date Sampled: **09/24/12 10:40**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Naphthalene	13	1.0	ug/l	1	2092610	09/26/12	09/28/12	EPA 8260B	
Benzene	350	100	"	100	"	"	"	"	
Toluene	ND	1.0	"	1	"	"	"	"	
Ethylbenzene	120	1.0	"	"	"	"	"	"	
Xylenes (total)	300	1.0	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	2900	500	"	"	"	"	"	"	

Date Sampled: **09/24/12 10:40**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		103 %	49.7-150		"	"	"	"	
Surrogate: Toluene-d8		121 %	51-150		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		102 %	50.1-150		"	"	"	"	

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

Project: Cottonwood #1  
Project Number: [none]  
Project Manager: Brandon Bruns

Reported:  
10/01/12 09:24

**BH04**  
**R209180-04 (Water)**

**Summit Scientific**

**Volatile Organic Compounds by EPA Method 8260B**

Date Sampled: **09/24/12 10:35**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Naphthalene	14	1.0	ug/l	1	2092610	09/26/12	09/28/12	EPA 8260B	
Benzene	150	1.0	"	"	"	"	"	"	
Toluene	ND	1.0	"	"	"	"	"	"	
Ethylbenzene	96	1.0	"	"	"	"	"	"	
Xylenes (total)	400	1.0	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	3100	500	"	"	"	"	"	"	

Date Sampled: **09/24/12 10:35**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		101 %	49.7-150		"	"	"	"	
Surrogate: Toluene-d8		116 %	51-150		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		93.7 %	50.1-150		"	"	"	"	

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

Project: Cottonwood #1  
Project Number: [none]  
Project Manager: Brandon Brunns

Reported:  
10/01/12 09:24

**BH05**  
**R209180-05 (Water)**

**Summit Scientific**

**Volatile Organic Compounds by EPA Method 8260B**

Date Sampled: **09/24/12 10:45**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Naphthalene	ND	1.0	ug/l	1	2092610	09/26/12	09/28/12	EPA 8260B	
Benzene	ND	1.0	"	"	"	"	"	"	
Toluene	ND	1.0	"	"	"	"	"	"	
Ethylbenzene	ND	1.0	"	"	"	"	"	"	
Xylenes (total)	ND	1.0	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	ND	500	"	"	"	"	"	"	

Date Sampled: **09/24/12 10:45**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Surrogate: 1,2-Dichloroethane-d4		101 %	49.7-150		"	"	"	"	
Surrogate: Toluene-d8		99.8 %	51-150		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		100 %	50.1-150		"	"	"	"	

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

Project: Cottonwood #1  
Project Number: [none]  
Project Manager: Brandon Bruns

Reported:  
10/01/12 09:24

**BH06**  
**R209180-06 (Water)**

**Summit Scientific**

**Volatile Organic Compounds by EPA Method 8260B**

Date Sampled: **09/24/12 10:50**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Naphthalene	ND	1.0		ug/l	1	2092610	09/26/12	09/28/12	EPA 8260B	
<b>Benzene</b>	<b>6.7</b>	1.0		"	"	"	"	"	"	
<b>Toluene</b>	<b>18</b>	1.0		"	"	"	"	"	"	
<b>Ethylbenzene</b>	<b>7.5</b>	1.0		"	"	"	"	"	"	
<b>Xylenes (total)</b>	<b>50</b>	1.0		"	"	"	"	"	"	
Gasoline Range Hydrocarbons	ND	500		"	"	"	"	"	"	

Date Sampled: **09/24/12 10:50**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Surrogate: 1,2-Dichloroethane-d4		95.6 %		49.7-150		"	"	"	"	
Surrogate: Toluene-d8		95.3 %		51-150		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		103 %		50.1-150		"	"	"	"	

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

Project: Cottonwood #1  
Project Number: [none]  
Project Manager: Brandon Brunns

Reported:  
10/01/12 09:24

**BH07**  
**R209180-07 (Water)**

**Summit Scientific**

**Volatile Organic Compounds by EPA Method 8260B**

Date Sampled: **09/24/12 10:55**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Naphthalene	1.6	1.0	ug/l	1	2092610	09/26/12	09/28/12	EPA 8260B	
Benzene	ND	1.0	"	"	"	"	"	"	
Toluene	ND	1.0	"	"	"	"	"	"	
Ethylbenzene	ND	1.0	"	"	"	"	"	"	
Xylenes (total)	ND	1.0	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	ND	500	"	"	"	"	"	"	

Date Sampled: **09/24/12 10:55**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Surrogate: 1,2-Dichloroethane-d4		99.1 %	49.7-150		"	"	"	"	
Surrogate: Toluene-d8		96.7 %	51-150		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		92.1 %	50.1-150		"	"	"	"	

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

Project: Cottonwood #1  
Project Number: [none]  
Project Manager: Brandon Brunns

Reported:  
10/01/12 09:24

## 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 2092610 - EPA 5030 Water MS

##### Blank (2092610-BLK1)

Prepared: 09/26/12 Analyzed: 09/28/12

Naphthalene	ND	1.0	ug/l							
Benzene	ND	1.0	"							
Toluene	ND	1.0	"							
Ethylbenzene	ND	1.0	"							
Xylenes (total)	ND	1.0	"							
Gasoline Range Hydrocarbons	ND	500	"							
Surrogate: 1,2-Dichloroethane-d4	12.4		"	13.2		93.3	49.7-150			
Surrogate: Toluene-d8	12.4		"	13.3		93.2	51-150			
Surrogate: 4-Bromofluorobenzene	12.0		"	13.3		90.2	50.1-150			

##### LCS (2092610-BS1)

Prepared: 09/26/12 Analyzed: 09/28/12

Naphthalene	ND	1.0	ug/l				76-128			
Benzene	27.4	1.0	"	33.3		82.3	51-132			
Toluene	29.3	1.0	"	33.3		87.9	51-138			
Ethylbenzene	36.4	1.0	"	33.3		109	58-146			
m,p-Xylene	72.8	2.0	"	66.7		109	57-144			
o-Xylene	38.4	1.0	"	33.3		115	53-146			
Surrogate: 1,2-Dichloroethane-d4	12.2		"	13.2		92.3	49.7-150			
Surrogate: Toluene-d8	12.4		"	13.3		92.9	51-150			
Surrogate: 4-Bromofluorobenzene	12.5		"	13.3		93.8	50.1-150			

##### LCS Dup (2092610-BS1)

Prepared: 09/26/12 Analyzed: 09/28/12

Naphthalene	ND	1.0	ug/l				76-128		10	
Benzene	27.0	1.0	"	33.3		81.0	51-132	1.51	17	
Toluene	29.0	1.0	"	33.3		87.1	51-138	0.994	17	
Ethylbenzene	35.5	1.0	"	33.3		106	58-146	2.56	16	
m,p-Xylene	71.7	2.0	"	66.7		108	57-144	1.55	16	
o-Xylene	37.6	1.0	"	33.3		113	53-146	2.05	15	
Surrogate: 1,2-Dichloroethane-d4	11.8		"	13.2		89.4	49.7-150			
Surrogate: Toluene-d8	12.8		"	13.3		95.9	51-150			
Surrogate: 4-Bromofluorobenzene	12.2		"	13.3		91.3	50.1-150			

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

Project: Cottonwood #1  
Project Number: [none]  
Project Manager: Brandon Bruns

Reported:  
10/01/12 09:24

**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 2092610 - EPA 5030 Water MS**

Matrix Spike (2092610-MS1)		Source: R209180-06			Prepared: 09/26/12		Analyzed: 09/28/12	
Naphthalene	1.03	1.0	ug/l		ND		73-132	
Benzene	35.9	1.0	"	33.3	6.68	87.5	34-141	
Toluene	51.1	1.0	"	33.3	18.4	98.1	27-151	
Ethylbenzene	47.7	1.0	"	33.3	7.47	121	29-160	
m,p-Xylene	123	2.0	"	66.7	38.9	126	20-166	
o-Xylene	53.4	1.0	"	33.3	10.8	128	33-159	
Surrogate: 1,2-Dichloroethane-d4	12.1		"	13.2		91.3	49.7-150	
Surrogate: Toluene-d8	12.5		"	13.3		93.7	51-150	
Surrogate: 4-Bromofluorobenzene	12.9		"	13.3		96.9	50.1-150	

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

Project: Cottonwood #1  
Project Number: [none]  
Project Manager: Brandon Bruns

**Reported:**  
10/01/12 09:24

### 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

A handwritten signature in black ink, appearing to read 'Daniel A. Bruns IV'.