

PDC Energy, Inc.
Third Quarter 2019 Groundwater Monitoring Summary

July 31, 2019

Rotharmel 1; 22-33; 33A Tank Battery
NWNE Section 33 T7N R66W
Remediation # 12529

This groundwater monitoring summary has been prepared by Tasman Geosciences, Inc. for the Rotharmel 1; 22-33; 33A tank battery. On July 10, 2019, groundwater monitoring was conducted at all five monitoring well locations (BH01 – BH05). Five groundwater samples were submitted to Summit Scientific Laboratory for analysis of benzene, toluene, ethylbenzene, and total xylenes (BTEX) by USEPA Method 8260B.

Third quarter 2019 analytical results indicated that BTEX concentrations were below the applicable COGCC Table 910-1 standards in all five monitoring well locations.

Monitored natural attenuation (MNA) was selected as the remediation strategy for this site during the second quarter 2019 and will remain the selected remediation strategy for the fourth quarter 2019.

Fourth quarter 2019 groundwater sampling will be conducted during October 2019. Sample locations and corresponding analytical results are illustrated on Figure 1. Groundwater elevation data is illustrated on Figure 2. Groundwater analytical results are summarized in Table 1. The laboratory analytical report is included in Attachment A.



BH03		
Compound (µg/L)	4/8/2019	7/10/2019
Benzene	<1.0	<1.0
Toluene	<1.0	<1.0
Ethylbenzene	<1.0	<1.0
Total Xylenes	<2.0	<2.0
Depth to Water (ft. bgs)	5.07	3.88

BH02		
Compound (µg/L)	4/8/2019	7/10/2019
Benzene	<1.0	<1.0
Toluene	<1.0	<1.0
Ethylbenzene	<1.0	<1.0
Total Xylenes	<2.0	<2.0
Depth to Water (ft. bgs)	5.25	4.24

BH01		
Compound (µg/L)	4/8/2019	7/10/2019
Benzene	<1.0	<1.0
Toluene	<1.0	<1.0
Ethylbenzene	<1.0	<1.0
Total Xylenes	<2.0	<2.0
Depth to Water (ft. bgs)	5.83	4.73

BH05		
Compound (µg/L)	4/8/2019	7/10/2019
Benzene	<1.0	<1.0
Toluene	<1.0	<1.0
Ethylbenzene	<1.0	<1.0
Total Xylenes	<2.0	<2.0
Depth to Water (ft. bgs)	4.90	3.97

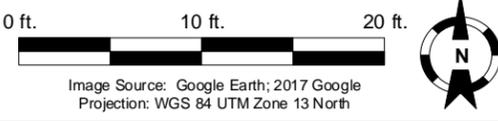
BH04		
Compound (µg/L)	4/8/2019	7/10/2019
Benzene	<1.0	<1.0
Toluene	<1.0	<1.0
Ethylbenzene	<1.0	<1.0
Total Xylenes	<2.0	<2.0
Depth to Water (ft. bgs)	4.79	3.47

Legend

- Excavation Extent (Collected via Trimble GPS)
- Monitoring Well Location (Collected via Trimble GPS)
- Excavation Groundwater Sample Location
- Groundwater Flow Direction (3Q19)

Notes

All locations are approximate unless otherwise noted.
 Surface drainage direction is estimated based on topography and is not related to regional topography.
 GPS – Global Positioning System
 µg/L – Micrograms per liter
 ft. bgs – Feet below ground surface



DATE:	July 31, 2019
DESIGNED BY:	C. Hamlin
DRAWN BY:	M. Dahlgren

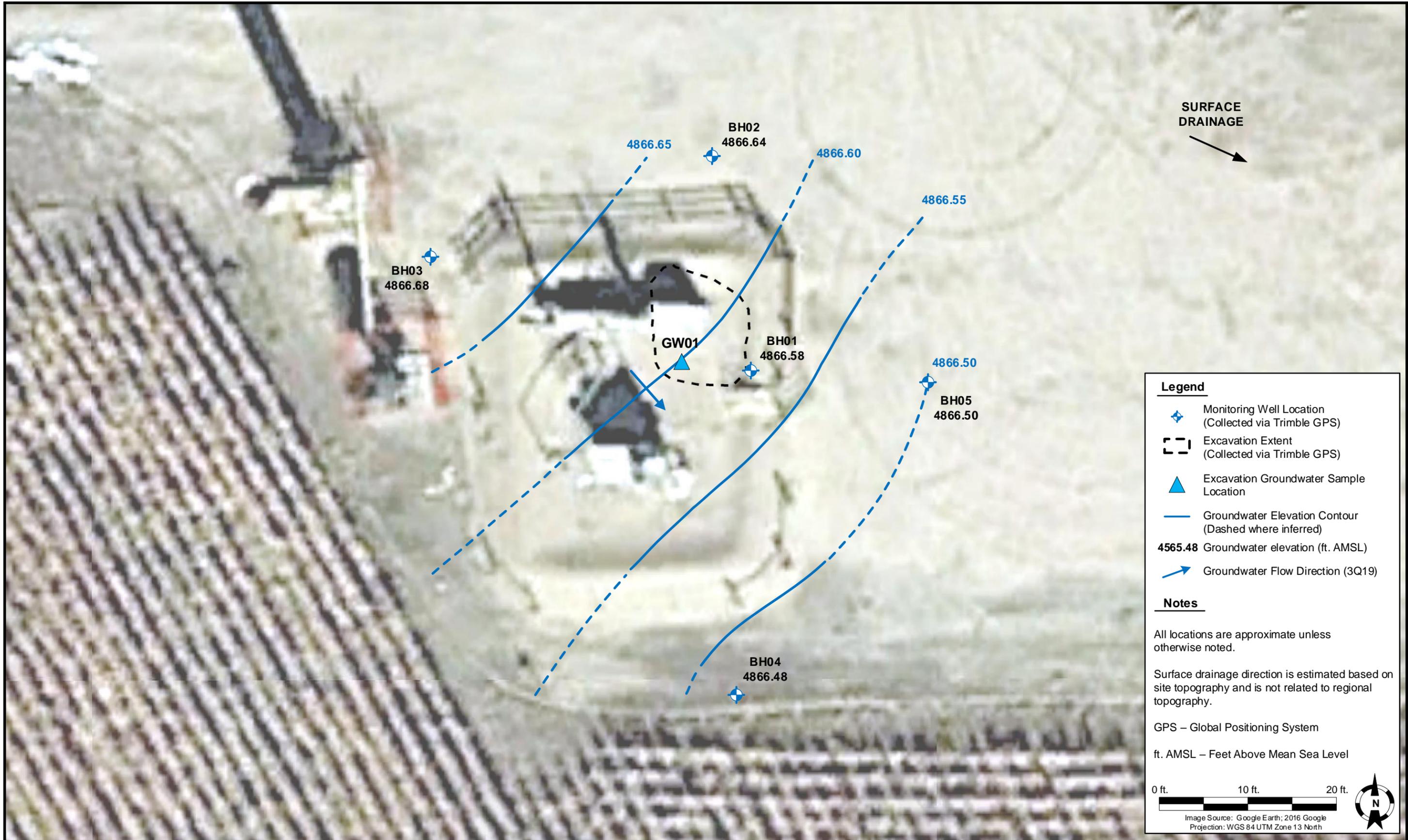


Tasman Geosciences, Inc.
 6855 W. 119th Ave
 Broomfield, CO 80020

PDC Energy, Inc. – DJ Basin
Rotharmel 1; 22-33; 33A Tank Battery
 NWNW Section 33, Township 7 North, Range 66 West
 Weld County, Colorado

GROUNDWATER
 ANALYTICAL RESULTS
 MAP

FIGURE
 1



Legend

- Monitoring Well Location (Collected via Trimble GPS)
- Excavation Extent (Collected via Trimble GPS)
- Excavation Groundwater Sample Location
- Groundwater Elevation Contour (Dashed where inferred)
- 4865.48** Groundwater elevation (ft. AMSL)
- Groundwater Flow Direction (3Q19)

Notes

All locations are approximate unless otherwise noted.

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

GPS – Global Positioning System

ft. AMSL – Feet Above Mean Sea Level

0 ft. 10 ft. 20 ft.

Image Source: Google Earth; 2016 Google
Projection: WGS 84 UTM Zone 13 North

DATE:	August 9, 2019
DESIGNED BY:	C. Hamlin
DRAWN BY:	L. Martin



TASMAN Geosciences, Inc.
6855 W. 119th Ave
Broomfield, CO 80020

PDC Energy, Inc. – DJ Basin
Rotharmel 1; 22-33; 33A Tank Battery
 NWNW, Section 33, Township 7 North, Range 66 West
 Weld County, Colorado

GROUNDWATER ELEVATION CONTOUR MAP (07/10/2019)

FIGURE 2

TABLE 1
ROTHARMEL 1; 22-33; 33A TANK BATTERY
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⁾ (ft.)	Groundwater Elevation (ft. AMSL)
COGCC Table 910-1 Groundwater Standard (µg/L) ⁽¹⁾		5	560	700	1,400		
GW01	2/5/2019	40	<1.0	<1.0	2.2	~ 8	NM
BH01	4/8/2019	<1.0	<1.0	<1.0	<2.0	5.83	4865.48
BH01	7/10/2019	<1.0	<1.0	<1.0	<2.0	4.73	4866.58
BH02	4/8/2019	<1.0	<1.0	<1.0	<2.0	5.25	4865.63
BH02	7/10/2019	<1.0	<1.0	<1.0	<2.0	4.24	4866.64
BH03	4/8/2019	<1.0	<1.0	<1.0	<2.0	5.07	4865.49
BH03	7/10/2019	<1.0	<1.0	<1.0	<2.0	3.88	4866.68
BH04	4/8/2019	<1.0	<1.0	<1.0	<2.0	4.79	4865.16
BH04	7/10/2019	<1.0	<1.0	<1.0	<2.0	3.47	4866.48
BH05	4/8/2019	<1.0	<1.0	<1.0	<2.0	4.90	4865.57
BH05	7/10/2019	<1.0	<1.0	<1.0	<2.0	3.97	4866.50

Notes:

1. Groundwater standards referenced from 2 CCR 404-1, Table 910-1, effective May 1, 2018.
 2. Groundwater measurements for excavation samples were estimated from ground surface. Depth to water measurements were collected from top of casing and adjusted using survey data and product thickness to reflect depth of water from ground surface.
- COGCC = Colorado Oil and Gas Conservation Commission
µg/L = Micrograms per liter
NM = Not measured
(<) = Analytical result is less than the indicated laboratory reporting limit.
ft. = Feet
AMSL = Above Mean Sea Level
BOLD = Analytical result is in exceedance of COGCC groundwater standards.

Attachment A

Summit Scientific

4653 Table Mountain Drive, Golden, Colorado 80403

303.277.9310

July 17, 2019

Mark Longhurst

PDC Energy

1775 Sherman St. STE. 3000

Denver, CO 80203

RE: Rotharmel 1; 22-33 , 33A

Work Order # 1907110

Enclosed are the results of analyses for samples received by Summit Scientific on 07/10/19 17:30. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A handwritten signature in black ink that reads "Muri Premer". The signature is written in a cursive style with a large initial "M" and a long, sweeping underline.

Muri Premer For Paul Shrewsbury

President



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

Project: Rotharmel 1; 22-33 , 33A

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
07/17/19 16:52

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
BH01	1907110-01	Water	07/10/19 11:33	07/10/19 17:30
BH02	1907110-02	Water	07/10/19 11:39	07/10/19 17:30
BH03	1907110-03	Water	07/10/19 11:30	07/10/19 17:30
BH04	1907110-04	Water	07/10/19 11:47	07/10/19 17:30
BH05	1907110-05	Water	07/10/19 11:45	07/10/19 17:30

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.

1907110

Summit Scientific

741 Corporate Circle Suite I ♦ Golden, Colorado 80401
303-277-9310 ♦ 303-374-5933 Fax

Page 1 of 1

Client: PDC / Tasman Geosciences
Address: 6899 Pecos St, Unit C
City/State/Zip: Denver, CO 80221
Phone: 303-487-1228 Fax:
Sampler Name: Brian G., Brandon V.

Project Manager: Mark Longhurst
E-Mail: mark.longhurst@pdce.com
Project Name: Rotharmel 1; 22-33 + 33A
Project Number: N/A

Sample Description	Date Sampled	Time Sampled	Number of Containers	Preservative				Matrix			Analyze For:				Special Instructions		
				HCl	HNO ₃	None	Other (Specify)	Groundwater	Soil	Air - Canister Serial #	Other (Specify)	BTEX - 8260					
BH01	7/10/19	1133	3	X				X				X					
BH02		1139															
BH03		1130															
BH04		1147															
BH05		1145															
Relinquished by: <u>Brandon V.</u>				Date/Time: <u>7/10/19 1500</u>	Received by: <u>Tasman Lock Box</u>				Date/Time: <u>7/10/19 1500</u>	Turn Around Time (Check)				Notes:			
Tasman Lock Box				Date/Time: <u>07/10/19 1730</u>					Date/Time: <u>07/10/19 1730</u>	Same Day <input type="checkbox"/>	72 Hours <input type="checkbox"/>	24 Hours <input type="checkbox"/>	Standard <input checked="" type="checkbox"/>				
Relinquished by:				Date/Time:	Received in Lab by:				Date/Time:	48 Hours <input type="checkbox"/>	Sample Integrity: Temperature Upon Receipt: <u>3.9</u>						
Relinquished by:				Date/Time:	Received in Lab by:				Date/Time:	Intact: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>							

Sample Receipt Checklist

S2 Work Order: 1907110

Client: PDC/TRIUMPH SCIENCES Client Project ID: ROTH ARCHAEOLOGY; 22-33 & 33A

Shipped Via: H.D. (P.U.) FedEx/UPS/USPS/Other _____ Airbill #: _____

Matrix (check all that apply): _____ Air _____ Soil/Solid X Water _____ Other: _____
(Describe)

Temp (°C)	<u>3.9</u>
-----------	------------

Thermometer ID: 61857155-K

	Yes	No	N/A	Comments (if any)
If samples require cooling, was the temperature at 4°C +/- 2°C ⁽¹⁾ ? NOTE: If samples are delivered the same day of sampling, this requirement is met provided that there is evidence that cooling has begun.	<u>X</u>			
Were all samples received intact ⁽¹⁾ ?	<u>X</u>			
Was adequate sample volume provided ⁽¹⁾ ?	<u>X</u>			
If custody seals are present, are they intact ⁽¹⁾ ?			<u>X</u>	
Are samples with holding times due within 48 hours sample due within 48 hours present?		<u>X</u>		
Is a chain-of-custody (COC) form present and filled out completely ⁽¹⁾ ?	<u>X</u>			
Does the COC agree with the number and type of sample bottles received ⁽¹⁾ ?	<u>X</u>			
Do the sample IDs on the bottle labels match the COC ⁽¹⁾ ?	<u>X</u>			
Is the COC properly relinquished by the client w/ date and time recorded ⁽¹⁾ ?	<u>X</u>			
For volatiles in water – is there headspace present? If yes, contact client and note in narrative.		<u>X</u>		
Are samples preserved that require preservation (excluding cooling) ⁽¹⁾ ? Note the type of preservative in the Comments column – HCl, H2SO4, NaOH, HNO3, ect	<u>X</u>			<u>HCl</u>
If samples are acid preserved for metals, is the pH ≤ 2 ⁽¹⁾ ? Record the pH in Comments.			<u>X</u>	
If dissolved metals are requested, were samples field filtered?			<u>X</u>	
Additional Comments (if any):				

⁽¹⁾ If NO, then contact the client before proceeding with analysis and note in case narrative.

KE
Custodian Printed Name or Initials

[Signature]
Signature of Custodian

07/10/19
Date/Time 1813



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

Project: Rotharmel 1; 22-33 , 33A

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 07/17/19 16:52

BH01
1907110-01 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: **07/10/19 11:33**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Benzene	ND	1.0		ug/l	1	1907144	07/11/19	07/12/19	EPA 8260B	
Toluene	ND	1.0		"	"	"	"	"	"	
Ethylbenzene	ND	1.0		"	"	"	"	"	"	
Xylenes (total)	ND	2.0		"	"	"	"	"	"	

Date Sampled: **07/10/19 11:33**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Surrogate: 1,2-Dichloroethane-d4		111 %		23-173		"	"	"	"	
Surrogate: Toluene-d8		95.4 %		20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		93.5 %		21-167		"	"	"	"	

Summit Scientific



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

Project: Rotharmel 1; 22-33 , 33A

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 07/17/19 16:52

BH02
1907110-02 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: **07/10/19 11:39**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Benzene	ND	1.0		ug/l	1	1907144	07/11/19	07/12/19	EPA 8260B	
Toluene	ND	1.0		"	"	"	"	"	"	
Ethylbenzene	ND	1.0		"	"	"	"	"	"	
Xylenes (total)	ND	2.0		"	"	"	"	"	"	

Date Sampled: **07/10/19 11:39**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Surrogate: 1,2-Dichloroethane-d4		109 %		23-173		"	"	"	"	
Surrogate: Toluene-d8		92.8 %		20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		90.8 %		21-167		"	"	"	"	

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

Project: Rotharmel 1; 22-33 , 33A

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 07/17/19 16:52

BH03
1907110-03 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: **07/10/19 11:30**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Benzene	ND	1.0		ug/l	1	1907144	07/11/19	07/12/19	EPA 8260B	
Toluene	ND	1.0		"	"	"	"	"	"	
Ethylbenzene	ND	1.0		"	"	"	"	"	"	
Xylenes (total)	ND	2.0		"	"	"	"	"	"	

Date Sampled: **07/10/19 11:30**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Surrogate: 1,2-Dichloroethane-d4		113 %		23-173		"	"	"	"	
Surrogate: Toluene-d8		95.0 %		20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		93.2 %		21-167		"	"	"	"	

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

Project: Rotharmel 1; 22-33 , 33A

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 07/17/19 16:52

BH04
1907110-04 (Water)

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Volatile Organic Compounds by EPA Method 8260B

Date Sampled: **07/10/19 11:47**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Benzene	ND	1.0		ug/l	1	1907144	07/11/19	07/12/19	EPA 8260B	
Toluene	ND	1.0		"	"	"	"	"	"	
Ethylbenzene	ND	1.0		"	"	"	"	"	"	
Xylenes (total)	ND	2.0		"	"	"	"	"	"	

Date Sampled: **07/10/19 11:47**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Surrogate: 1,2-Dichloroethane-d4		111 %		23-173		"	"	"	"	
Surrogate: Toluene-d8		94.6 %		20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		92.6 %		21-167		"	"	"	"	

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

Project: Rotharmel 1; 22-33 , 33A

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 07/17/19 16:52

BH05
1907110-05 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: **07/10/19 11:45**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Benzene	ND	1.0		ug/l	1	1907144	07/11/19	07/12/19	EPA 8260B	
Toluene	ND	1.0		"	"	"	"	"	"	
Ethylbenzene	ND	1.0		"	"	"	"	"	"	
Xylenes (total)	ND	2.0		"	"	"	"	"	"	

Date Sampled: **07/10/19 11:45**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Surrogate: 1,2-Dichloroethane-d4		114 %		23-173		"	"	"	"	
Surrogate: Toluene-d8		92.9 %		20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		93.7 %		21-167		"	"	"	"	

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

Project: Rotharmel 1; 22-33 , 33A

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
07/17/19 16:52

Volatile Organic Compounds by EPA Method 8260B - Quality Control

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

Batch 1907144 - EPA 5030 Water MS

Blank (1907144-BLK1)

Prepared & Analyzed: 07/11/19

Benzene	ND	1.0	ug/l							
Toluene	ND	1.0	"							
Ethylbenzene	ND	1.0	"							
Xylenes (total)	ND	2.0	"							
Surrogate: 1,2-Dichloroethane-d4	13.9		"	13.3		104		23-173		
Surrogate: Toluene-d8	12.7		"	13.3		95.5		20-170		
Surrogate: 4-Bromofluorobenzene	12.2		"	13.3		91.4		21-167		

LCS (1907144-BS1)

Prepared & Analyzed: 07/11/19

Benzene	43.6	1.0	ug/l	33.3		131		51-132		
Toluene	42.4	1.0	"	33.3		127		51-138		
Ethylbenzene	45.0	1.0	"	33.3		135		58-146		
m,p-Xylene	85.1	2.0	"	66.7		128		57-144		
o-Xylene	44.2	1.0	"	33.3		133		53-146		
Surrogate: 1,2-Dichloroethane-d4	14.0		"	13.3		105		23-173		
Surrogate: Toluene-d8	12.9		"	13.3		96.9		20-170		
Surrogate: 4-Bromofluorobenzene	12.6		"	13.3		94.1		21-167		

Matrix Spike (1907144-MS1)

Source: 1907088-01

Prepared & Analyzed: 07/11/19

Benzene	39.5	1.0	ug/l	33.3	ND	119		34-141		
Toluene	42.7	1.0	"	33.3	ND	128		27-151		
Ethylbenzene	47.1	1.0	"	33.3	ND	141		29-160		
m,p-Xylene	89.4	2.0	"	66.7	ND	134		20-166		
o-Xylene	46.4	1.0	"	33.3	ND	139		33-159		
Surrogate: 1,2-Dichloroethane-d4	13.4		"	13.3		100		23-173		
Surrogate: Toluene-d8	12.8		"	13.3		95.8		20-170		
Surrogate: 4-Bromofluorobenzene	14.3		"	13.3		107		21-167		

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

Project: Rotharmel 1; 22-33 , 33A

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 07/17/19 16:52

Volatile Organic Compounds by EPA Method 8260B - Quality Control

Summit Scientific

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

Batch 1907144 - EPA 5030 Water MS

Matrix Spike Dup (1907144-MSD1)	Source: 1907088-01			Prepared & Analyzed: 07/11/19						
Benzene	38.4	1.0	ug/l	33.3	ND	115	34-141	2.77	30	
Toluene	42.9	1.0	"	33.3	ND	129	27-151	0.397	30	
Ethylbenzene	46.6	1.0	"	33.3	ND	140	29-160	1.13	30	
m,p-Xylene	85.9	2.0	"	66.7	ND	129	20-166	3.98	30	
o-Xylene	43.7	1.0	"	33.3	ND	131	33-159	5.84	30	
<i>Surrogate: 1,2-Dichloroethane-d4</i>	<i>13.1</i>		<i>"</i>	<i>13.3</i>		<i>98.1</i>	<i>23-173</i>			
<i>Surrogate: Toluene-d8</i>	<i>12.9</i>		<i>"</i>	<i>13.3</i>		<i>96.5</i>	<i>20-170</i>			
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>13.6</i>		<i>"</i>	<i>13.3</i>		<i>102</i>	<i>21-167</i>			

Summit Scientific

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

Project: Rotharmel 1; 22-33 , 33A

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
07/17/19 16:52

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