

December 6, 2017

Karen Shanahan Olson  
Senior EHS Manager  
PDC Energy, Inc.  
1775 Sherman Street, Suite 3000  
Denver, CO 80203

**RE: Produced Water Vessel Closure Report  
Dillard 32, 42-20 Tank Battery  
Facility ID #: 305873  
SENE S20 T7N R64W  
Blanket Remediation #: 9440**

Dear Mrs. Olson,

On behalf of PDC Energy, Inc. (PDC), Tasman Geosciences, Inc. (Tasman) has prepared this Produced Water Vessel Closure Report (Report) to document environmental sampling activities performed at the above-referenced site. This Report is being submitted under the Form 27 Management Plan for Closure of Produced Water Vessels, which has been assigned Blanket Remediation #9440 by the Colorado Oil and Gas Conservation Commission (COGCC).

A summary of excavation and environmental sampling activities is provided below.

#### **Site Assessment Activities**

On November 30, 2017, confirmation sampling activities were conducted following the removal of the partially buried produced water vessel. Soil encountered in the excavation was field screened for volatile organic compound (VOC) concentrations in soil using a photoionization detector (PID). One soil sample (SS01) was collected below the former vessel location at approximately 5 feet below ground surface (bgs). The sample was submitted to Summit Scientific Laboratories in Golden, Colorado for analysis of benzene, toluene, ethylbenzene, and total xylenes (BTEX), naphthalene, and total petroleum hydrocarbons (TPH) – gasoline range organics (GRO) by United States Environmental Protection Agency (USEPA) Method 8260B, TPH – diesel range organics (DRO) by USEPA Method 8015, pH, and electrical conductivity (EC).

Analytical results indicated that organic compound concentrations were in compliance with COGCC Table 910-1 soil standards. EC was in exceedance of regulatory standards, however no further soil removal is required as the sample was collected below the COGCC designated root zone.

The excavation extent and soil sample location are illustrated on Figure 1. Soil analytical data is summarized in Table 1 and the laboratory analytical report is included as Attachment A.

## Conclusions

Based on the soil analytical data described herein, petroleum hydrocarbon impacts in exceedance of regulatory standards were not encountered during the removal of the produced water vessel. Consequently, no further site investigation is recommended at this time. The facility was decommissioned following site assessment activities.

Please contact me at (720) 409-8791 if you have questions regarding this report.

Sincerely,

Tasman Geosciences, Inc.



Christine Hamlin  
Program Manager

## Enclosures:

Figure 1 – Excavation Site Map

Table 1 – Soil Analytical Results Summary Table

Attachment A – Laboratory Analytical Report



DATE:	December 6, 2017
DESIGNED BY:	C. Hamlin
DRAWN BY:	C. Armbruster



**TASMAN**  
GEOSCIENCES

**Tasman Geosciences, Inc.**  
6899 Pecos Street – Unit C  
Denver, CO 80221

**PDC Energy, Inc. – DJ Basin**  
**Dillard 32, 42-20 Tank Battery**  
SENE, Section 20, Township 7 North, Range 64 West  
Weld County, Colorado

EXCAVATION SITE MAP

FIGURE  
1

TABLE 1  
DILLARD 32, 42-20 TANK BATTERY  
SOIL ANALYTICAL RESULTS SUMMARY TABLE

Sample ID	Date Sampled	Depth (feet bgs)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)	Naphthalene (mg/kg)	TPH <sup>(2)</sup> (mg/kg)	pH (units)	EC (mmhos/cm)
COGCC standards for soil (mg/kg) <sup>(1)</sup>			0.17	85	100	175	23	500	6-9	<4
SS01 @ 5'	11/30/2017	5'	<0.0020	<0.0050	<0.0050	<0.010	<0.010	<50	8.58	<b>4.10</b>

**Notes:**  
1. Standards for soil are taken from 2 CCR 404-1, Table 910-1, effective January 30, 2015.  
2. TPH - Total volatile and extractable petroleum hydrocarbons. Value calculated by adding GRO and DRO concentrations.  
COGCC = Colorado Oil and Gas Conservation Commission  
(<) = Analytical result is less than the indicated laboratory reporting limit.  
GRO = Total volatile petroleum hydrocarbons - gasoline range organics  
DRO = Total extractable petroleum hydrocarbons - diesel range organics  
mg/kg = Milligrams per kilogram  
bgs = Below ground surface  
EC = Electrical conductivity  
mmhos/cm = millimhos per centimeter  
**BOLD** = Analytical result is in exceedance of COGCC soil standards.

**ATTACHMENT A**

# Summit Scientific

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741 Corporate Circle – Suite I ♦ Golden, Colorado 80401

303.277.9310 - laboratory ♦ 303.277.9531 - fax

December 05, 2017

Mark Longhurst  
PDC Energy  
1775 Sherman St. STE. 3000  
Denver, CO 80203  
RE: Dillard 32, 42-20

Enclosed are the results of analyses for samples received by Summit Scientific on 11/30/17 13:45. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A handwritten signature in black ink, appearing to be 'P. Shrewsbury', written in a cursive style.

Paul Shrewsbury For Ben Shrewsbury  
Laboratory Manager



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

Project: Dillard 32, 42-20  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
12/05/17 10:33

### ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
SS01@5'	1711385-01	Soil	11/30/17 11:48	11/30/17 13:45

Summit Scientific

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

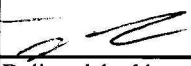

*The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.*

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

Page 1 of 1

Client: PDC  
Address: \_\_\_\_\_  
City/State/Zip: \_\_\_\_\_  
Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
Sampler Name: Tyler Blessisng

Project Manager: Mark Longhurst  
E-Mail: Mark.Longhurst@pdce.com  
Project Name: Dillard 32, 42-20  
Project Number: \_\_\_\_\_

Sample Description	Date Sampled	Time Sampled	Number of Containers	Preservative				Matrix			Analyze For:								Special Instructions				
				HCl	HNO <sub>3</sub>	None	Other (Specify)	Groundwater	Soil	Air - Canister Serial #	Other (Specify)	GBTEXN (8260)	DRO (TPH)	EC	pH								
SS01 @ 5'	11/30/2017	11:48	1			X			X				X	X	X	X							
Relinquished by: 		Date/Time: 11/30/17 13:45		Received by: 		Date/Time: 11-30-17 13:45		Turn Around Time (Check)								Notes:							
								Same Day <input type="checkbox"/> 72 Hours <input type="checkbox"/> 24 Hours <input type="checkbox"/> Standard <input checked="" type="checkbox"/> 48 Hours <input type="checkbox"/>															
Relinquished by:		Date/Time:		Received by:		Date/Time:		Sample Integrity:															
								Temperature Upon Receipt: 3.1															
Relinquished by:		Date/Time:		Received in Lab by:		Date/Time:		Intact: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>															

1711385

## Sample Receipt Checklist

S2 Work Order: \_\_\_\_\_

Client: PDC Client Project ID: Pillard 32, 42-20Shipped Via: P.U.  
(UPS, FedEx, Hand Delivered, Pick-up, etc.)

Airbill #: \_\_\_\_\_

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

Cooler ID					
Temp (°C)	3.1				

Thermometer ID: 61857155-K

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

Additional Comments (if any):

<sup>(1)</sup> If NO, then contact the client before proceeding with analysis and note in case narrative.Muri P.  
Custodian Printed NameMA 11-30-17  
Signature or Initials of Custodian18:00  
Date/Time



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

Project: Dillard 32, 42-20  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
12/05/17 10:33

**SS01@5'**  
**1711385-01 (Soil)**

**Summit Scientific**

**Extractable Petroleum Hydrocarbons by 8015**

Date Sampled: 11/30/17 11:48									
Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
C10-C28 (DRO)	ND	50	mg/kg	1	1712002	12/01/17	12/03/17	8015M	

Date Sampled: 11/30/17 11:48									
Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: o-Terphenyl		93.9 %	30-150		"	"	"	"	

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

Date Sampled: 11/30/17 11:48									
Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Naphthalene	ND	0.010	mg/kg	1	1712003	12/01/17	12/02/17	EPA 8260B	
Benzene	ND	0.0020	"	"	"	"	"	"	
Toluene	ND	0.0050	"	"	"	"	"	"	
Ethylbenzene	ND	0.0050	"	"	"	"	"	"	
Xylenes (total)	ND	0.010	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	ND	0.50	"	"	"	"	"	"	

Date Sampled: 11/30/17 11:48									
Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		125 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		109 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		106 %	21-167		"	"	"	"	

**Physical Parameters by APHA/ASTM/EPA Methods**

Date Sampled: 11/30/17 11:48									
Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
pH	8.58	0.100	pH Units	1	1712034	12/04/17	12/04/17	EPA 9045	

Summit Scientific

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

Project: Dillard 32, 42-20  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
12/05/17 10:33

**SS01@5'**  
**1711385-01 (Soil)**

**Summit Scientific**

**Physical Parameters by APHA/ASTM/EPA Methods**

**Specific Conductance by EPA120.1**

Date Sampled: **11/30/17 11:48**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Specific Conductance (EC)	<b>4.10</b>	0.0100	mmhos/cm	1	1712035	12/04/17	12/04/17	EPA 120.1	

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

Project: Dillard 32, 42-20  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
12/05/17 10:33

**Extractable Petroleum Hydrocarbons by 8015 - Quality Control**  
**Summit Scientific**

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

**Batch 1712002 - EPA 3550A**

**Blank (1712002-BLK1)**

Prepared: 12/01/17 Analyzed: 12/02/17

C10-C28 (DRO) ND 50 mg/kg

Surrogate: o-Terphenyl 12.2 " 12.5 97.2 30-150

**LCS (1712002-BS1)**

Prepared: 12/01/17 Analyzed: 12/02/17

C10-C28 (DRO) 547 50 mg/kg 499 110 73-134

Surrogate: o-Terphenyl 14.7 " 12.5 118 30-150

**Matrix Spike (1712002-MS1)**

**Source: 1711379-02**

Prepared: 12/01/17 Analyzed: 12/02/17

C10-C28 (DRO) 466 50 mg/kg 499 34.6 86.5 50-148

Surrogate: o-Terphenyl 11.9 " 12.5 95.2 30-150

**Matrix Spike Dup (1712002-MSD1)**

**Source: 1711379-02**

Prepared: 12/01/17 Analyzed: 12/02/17

C10-C28 (DRO) 525 50 mg/kg 499 34.6 98.2 50-148 11.8 20

Surrogate: o-Terphenyl 12.6 " 12.5 100 30-150

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

Project: Dillard 32, 42-20  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
12/05/17 10:33

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

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

**Batch 1712003 - EPA 5030 Soil MS**

**Blank (1712003-BLK1)**

Prepared & Analyzed: 12/01/17

Naphthalene	ND	0.010	mg/kg							
Benzene	ND	0.0020	"							
Toluene	ND	0.0050	"							
Ethylbenzene	ND	0.0050	"							
Xylenes (total)	ND	0.010	"							
Gasoline Range Hydrocarbons	ND	0.50	"							
<i>Surrogate: 1,2-Dichloroethane-d4</i>	<i>0.0500</i>		<i>"</i>	<i>0.0400</i>		<i>125</i>	<i>23-173</i>			
<i>Surrogate: Toluene-d8</i>	<i>0.0431</i>		<i>"</i>	<i>0.0400</i>		<i>108</i>	<i>20-170</i>			
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>0.0418</i>		<i>"</i>	<i>0.0400</i>		<i>104</i>	<i>21-167</i>			

**LCS (1712003-BS1)**

Prepared & Analyzed: 12/01/17

Naphthalene	ND	0.010	mg/kg				66-138			
Benzene	0.119	0.0020	"	0.100		119	58-130			
Toluene	0.112	0.0050	"	0.100		112	61-134			
Ethylbenzene	0.110	0.0050	"	0.0992		111	74-139			
m,p-Xylene	0.212	0.010	"	0.200		106	73-137			
o-Xylene	0.105	0.0050	"	0.0980		107	73-141			
Xylenes (total)	0.317	0.010	"				0-200			
Gasoline Range Hydrocarbons	3.92	0.50	"				30-150			
<i>Surrogate: 1,2-Dichloroethane-d4</i>	<i>0.0489</i>		<i>"</i>	<i>0.0400</i>		<i>122</i>	<i>23-173</i>			
<i>Surrogate: Toluene-d8</i>	<i>0.0436</i>		<i>"</i>	<i>0.0400</i>		<i>109</i>	<i>20-170</i>			
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>0.0400</i>		<i>"</i>	<i>0.0400</i>		<i>100</i>	<i>21-167</i>			

**Matrix Spike (1712003-MS1)**

Source: 1711379-02

Prepared & Analyzed: 12/01/17

Naphthalene	ND	0.010	mg/kg		ND		10-158			
Benzene	0.119	0.0020	"	0.100	ND	119	30-131			
Toluene	0.111	0.0050	"	0.100	ND	111	30-134			
Ethylbenzene	0.106	0.0050	"	0.0992	ND	107	22-153			
m,p-Xylene	0.202	0.010	"	0.200	ND	101	10-159			
o-Xylene	0.101	0.0050	"	0.0980	ND	103	31-151			
Xylenes (total)	0.302	0.010	"		ND		30-160			
Gasoline Range Hydrocarbons	3.85	0.50	"		ND		30-160			
<i>Surrogate: 1,2-Dichloroethane-d4</i>	<i>0.0519</i>		<i>"</i>	<i>0.0400</i>		<i>130</i>	<i>23-173</i>			
<i>Surrogate: Toluene-d8</i>	<i>0.0435</i>		<i>"</i>	<i>0.0400</i>		<i>109</i>	<i>20-170</i>			
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>0.0404</i>		<i>"</i>	<i>0.0400</i>		<i>101</i>	<i>21-167</i>			

Summit Scientific

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

Project: Dillard 32, 42-20  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
12/05/17 10:33

**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 1712003 - EPA 5030 Soil MS**

Matrix Spike Dup (1712003-MSD1)			Source: 1711379-02		Prepared & Analyzed: 12/01/17					
Naphthalene	ND	0.010	mg/kg		ND		10-158		42	
Benzene	0.117	0.0020	"	0.100	ND	117	30-131	1.71	34	
Toluene	0.110	0.0050	"	0.100	ND	110	30-134	0.894	30	
Ethylbenzene	0.104	0.0050	"	0.0992	ND	105	22-153	2.01	24	
m,p-Xylene	0.199	0.010	"	0.200	ND	99.9	10-159	1.09	68	
o-Xylene	0.0991	0.0050	"	0.0980	ND	101	31-151	1.68	38	
Xylenes (total)	0.298	0.010	"		ND		30-160	1.29	30	
Gasoline Range Hydrocarbons	3.79	0.50	"		ND		30-160	1.45	30	
Surrogate: 1,2-Dichloroethane-d4	0.0514		"	0.0400		128	23-173			
Surrogate: Toluene-d8	0.0436		"	0.0400		109	20-170			
Surrogate: 4-Bromofluorobenzene	0.0413		"	0.0400		103	21-167			

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

Project: Dillard 32, 42-20  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
12/05/17 10:33

**Physical Parameters by APHA/ASTM/EPA Methods - Quality Control**  
**Summit Scientific**

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

**Batch 1712034 - General Preparation**

**LCS (1712034-BS1)**

Prepared & Analyzed: 12/04/17

pH	9.27	0.100	pH Units	9.16	101	95-105
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PDC Energy  
1775 Sherman St. STE. 3000  
Denver CO, 80203

Project: Dillard 32, 42-20  
Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
12/05/17 10:33

**Specific Conductance by EPA120.1 - Quality Control**  
**Summit Scientific**

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

**Batch 1712035 - General Preparation**

**LCS (1712035-BS1)**

Prepared & Analyzed: 12/04/17

Specific Conductance (EC)	0.751	0.0100	mmhos/cm	0.750	100	90-110
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**Duplicate (1712035-DUP1)**

**Source: 1711379-02**

Prepared & Analyzed: 12/04/17

Specific Conductance (EC)	2.00	0.0100	mmhos/cm	2.38	17.5	20
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Summit Scientific

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

Project: Dillard 32, 42-20

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
12/05/17 10:33

### 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