Summit Scientific

4653 Table Mountain Drive, Golden, Colorado 80403

303.277.9310

February 11, 2021

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

RE: DWR Permit #137465
Work Order #2102134

Enclosed are the results of analyses for samples received by Summit Scientific on 02/09/21 17:44. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Paul Shrewsbury
President

S2

PDC Energy 1775 Sherman St. STE. 3000 Denver CO, 80203	Project: DWR Permit #137465 Project Number: AFE #EX-000335 Project Manager: Karen Olson	**Reported:** 02/11/21 08:15

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
EFF-020921-1102	2102134-01	Water	02/09/21 11:02	02/09/21 17:44
INF-020921-1137	2102134-02	Water	02/09/21 11:37	02/09/21 17:44

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.

2102134

Summit Scientific

S_2

4653 Table Mountain Drive ♦ Golden, Colorado 80403
303-277-9310

Client:	PDC Energy / Tasman Geosciences	Project Manager:	Karen Olson
Address:	6855 W. 119th Ave.	E-Mail:	Karen.Olson@pdce.com; chamlin@tasman-geo.com
City/State/Zip:	Broomfield / CO / 80020		
Phone:	303-487-1228	Project Name:	DWR Permit # 137465
Sampler Name:	Brock Nelson	Project Number:	AFE # EX-000335

					Preservative				Matrix				Analysis Requested								Special Instructions
ID	Sample Description	Date Sampled	Time Sampled	# of containers	HCl	HNO3	None	Other ___	Water	Soil	Air-Canister #	Other ___	RSK-175 (Dissolved Gases)		D26 Gas Composition	D26 Methane (carbon	D26 Methane (Hydrogen				4th Container for INF-020921 sample is IsoFlask (F09WN)
1	EFF-020921-1102	2/9/21	1102	3			X		X				X								
2	INF-020921-1137	2/9/21	1137	4			X		X				X		X	X	X				
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					

Relinquished by:	Date/Time:	Received by:	Date/Time:
[signature]	2/9/21 13:10	Tasman Locker box	2/9/21 13:10
Tasman Locker Box	02/09/2021 1730	[signature]	02/09/2021 1730
Relinquished by:	Date/Time:	Received by:	Date/Time:

Turn Around Time (Check)

Same Day	___	72 hours	___
24 hours	X	Standard	___
48 hours	___		

Sample Integrity:

Temperature Upon Receipt: 4.9

Samples Intact: (Yes) No

Notes:

Please provide data in PDF and COGCC EDD formats.

COGCC Facility No.: 765500

Sample Receipt Checklist

S2 Work Order 2102134

Client: PBC/JACKMAN Client Project ID: DWR PERMIT #137465

Shipped Via: H.D./P.U./FedEx/UPS/USPS/Other_____ Airbill #: _____

[ ] [X] [ ] [ ] [ ]

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

Temp (°C)	4.9

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.	X			
Were all samples received intact [(1)]?	X			
Was adequate sample volume provided [(1)]?	X			
If custody seals are present, are they intact [(1)]?			X	
Are samples with holding times due within 48 hours sample due within 48 hours present?	X			
Is a chain-of-custody (COC) form present and filled out completely [(1)]?	X			
Does the COC agree with the number and type of sample bottles received [(1)]?	X			
Do the sample IDs on the bottle labels match the COC [(1)]?	X			
Is the COC properly relinquished by the client w/ date and time recorded [(1)]?	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)** [(1)]? 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[(1)]? Record the pH in Comments.			X	
If dissolved metals are requested, were samples field filtered?			X	
Additional Comments (if any):				

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

TC — **Custodian Printed Name or Initials**

Signature of Custodian

02/09/2021 — **Date/Time**

PDC Energy 1775 Sherman St. STE. 3000 Denver CO, 80203	Project: DWR Permit #137465 Project Number: AFE #EX-000335 Project Manager: Karen Olson	**Reported:** 02/11/21 08:15

EFF-020921-1102

2102134-01 (Water)

Summit Scientific

Dissolved Gases by RSK-175

Date Sampled: **02/09/21 11:02**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Methane	**3.6**	1.0	mg/L	100	BEB0138	02/09/21	02/10/21	RSK-175 mod	
Ethane	**3.4**	1.0	"	"	"	"	"	"	
Propane	**2.0**	1.0	"	"	"	"	"	"	

Date Sampled: **02/09/21 11:02**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: Ethene		*96.7 %*	*70-130*		"	"	"	"	

PDC Energy 1775 Sherman St. STE. 3000 Denver CO, 80203	Project: DWR Permit #137465 Project Number: AFE #EX-000335 Project Manager: Karen Olson	**Reported:** 02/11/21 08:15

INF-020921-1137

2102134-02 (Water)

Summit Scientific

Dissolved Gases by RSK-175

Date Sampled: **02/09/21 11:37**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Methane	**13**	1.0	mg/L	100	BEB0138	02/09/21	02/10/21	RSK-175 mod	
Ethane	**6.9**	1.0	"	"	"	"	"	"	
Propane	**4.3**	0.10	"	10	"	"	"	"	

Date Sampled: **02/09/21 11:37**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: Ethene		*85.2 %*	*70-130*		"	"	"	"	

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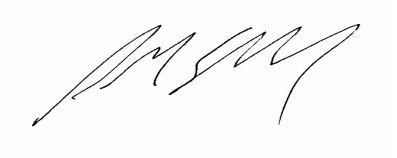

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PDC Energy	Project: DWR Permit #137465	
1775 Sherman St. STE. 3000	Project Number: AFE #EX-000335	**Reported:**
Denver CO, 80203	Project Manager: Karen Olson	02/11/21 08:15

Dissolved Gases by RSK-175 - Quality Control

Summit Scientific

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch BEB0138 - GC										
Blank (BEB0138-BLK1)				Prepared: 02/09/21 Analyzed: 02/10/21						
Methane	ND	0.010	mg/L							
Ethane	ND	0.010	"							
Propane	ND	0.010	"							
Surrogate: Ethene	*0.0429*		*"*	*0.0364*		*118*	*70-130*			
LCS (BEB0138-BS1)				Prepared: 02/09/21 Analyzed: 02/10/21						
Methane	0.032	0.010	mg/L	0.0428		73.9	70-130			
Ethane	0.090	0.010	"	0.0798		113	70-130			
Propane	0.13	0.010	"	0.139		94.7	70-130			
Surrogate: Ethene	*0.0856*		*"*	*0.0728*		*118*	*70-130*			
Duplicate (BEB0138-DUP1)	**Source: 2102134-02**			Prepared: 02/09/21 Analyzed: 02/10/21						
Methane	12	1.0	mg/L		13			9.09	30	
Ethane	5.6	1.0	"		6.9			20.6	30	
Propane	2.4	1.0	"		4.3			54.4	30	QR-03
Surrogate: Ethene	*0.0200*		*"*	*0.0364*		*54.9*	*70-130*			*S-06*
Matrix Spike (BEB0138-MS1)	**Source: 2102134-02**			Prepared: 02/09/21 Analyzed: 02/10/21						
Methane	15	1.0	mg/L	0.0428	13	NR	70-130			QM-05
Ethane	7.5	1.0	"	0.0798	6.9	727	70-130			QM-05
Propane	4.1	1.0	"	0.139	4.3	NR	70-130			QM-05
Surrogate: Ethene	*0.0600*		*"*	*0.0728*		*82.4*	*70-130*			

Dolan Integration Group
Geochemistry for Energy
11025 Dover Street Unit 800
Westminster, CO 80021
p: 303.531.2030

Hydrocarbon Gas Composition and Stable Isotopes
Data and Interpretation

Job #:	**21025283**
Lab #:	**DIG-024763**
Client:	**Summit Scientific**
Well Name:	**INF-020921-1137**

Client/Well Name: Summit Scientific / INF-020921-1137
Job #: 21025283
Lab #: DIG-024763

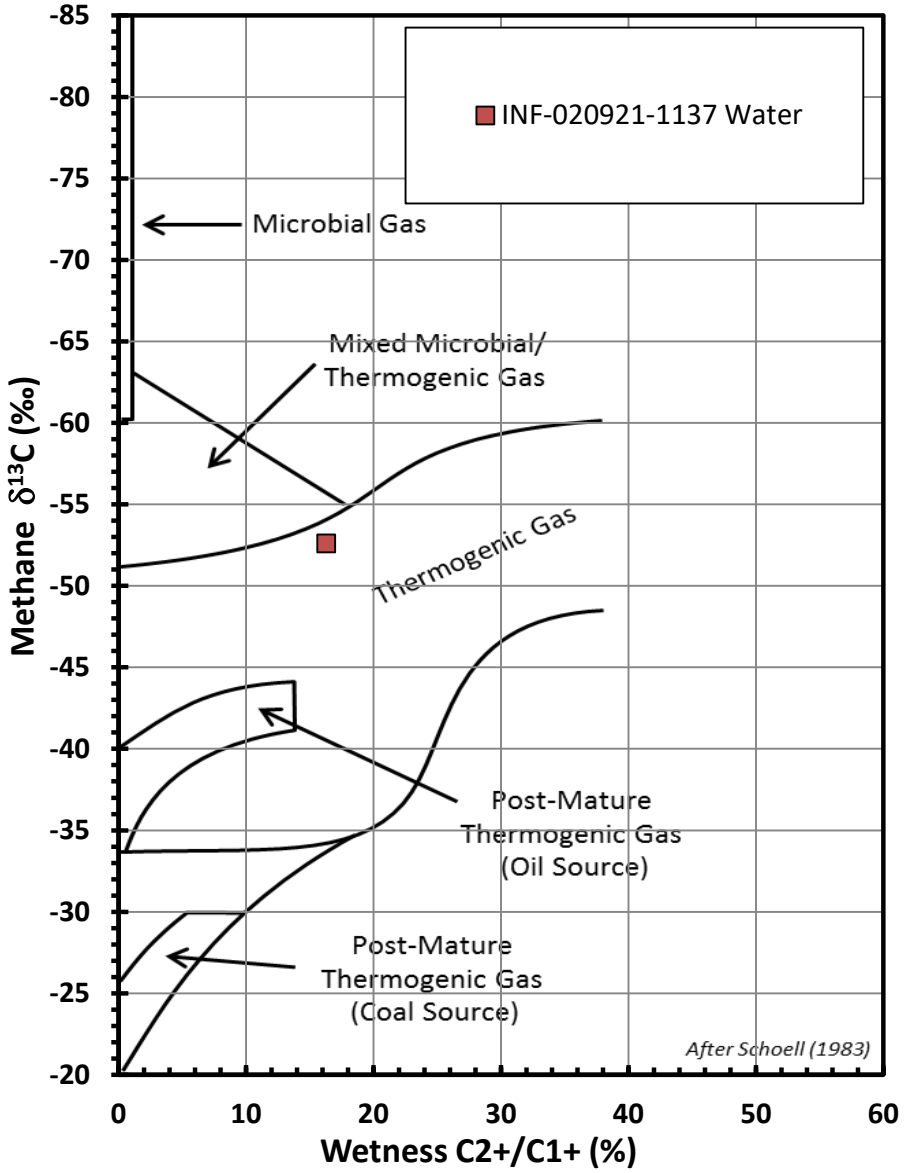
SAMPLE INFORMATION						COMPLETE GAS ANALYSIS															HYDROCARBON GAS ANALYSIS (normalized to total HC content)								BTU CONTENT*
Job Number	Lab Number	Well Name	Sample Type	Sample Date	Sample Time	GC Date	N_2 ppm	O_2 + Ar ppm	CO_2 ppm	C_1 ppm	C_2 ppm	C_3 ppm	iC_4 ppm	nC_4 ppm	iC_5 ppm	nC_5 ppm	C_6+ ppm	C_2H_6 ppm	He ppm	H_2 ppm	C_1 mol%	C_2 mol%	C_3 mol%	iC_4 mol%	nC_4 mol%	iC_5 mol%	nC_5 mol%	C_6+ mol%	Total Gas BTU/ft³
21025283	DIG-024763	INF-020921-1137 Water	Water	02/09/21	11:37	2/15/2021	269373	57879	1263	573184	75483	28312	2367	4308	545	420	177				83.7	11.02	4.13	0.35	0.63	0.08	0.06	0.03	800

SAMPLE INFORMATION						HYDROCARBON RATIOS				STABLE ISOTOPE ANALYSIS											SPECIFIC GRAVITY*	
Job Number	Lab Number	Well Name	Sample Type	Sample Date	Sample Time	Total HC ppm	Wetness % C_2 to C_5	C_1/C_2+C_3 mol/mol	Balance Ratio C_1+C_2/C_3-C_5	Mass Spec Date	$\delta^{13}C_1$ ‰ VPDB	$\delta^{13}C_2$ ‰ VPDB	$\delta^{13}C_3$ ‰ VPDB	$\delta^{13}iC_4$ ‰ VPDB	$\delta^{13}nC_4$ ‰ VPDB	$\delta^{13}iC_5$ ‰ VPDB	$\delta^{13}nC_5$ ‰ VPDB	$\delta^{13}CO_2$ ‰ VPDB	δD ‰ VSMOW	Comments	Total Gas Spec Grav	HCs only Spec Grav
21025283	DIG-024763	INF-020921-1137 Water	Water	02/09/21	11:37	684796	16.3	5.5	18.0	2/10/2021	-52.6								-270		0.771	0.665

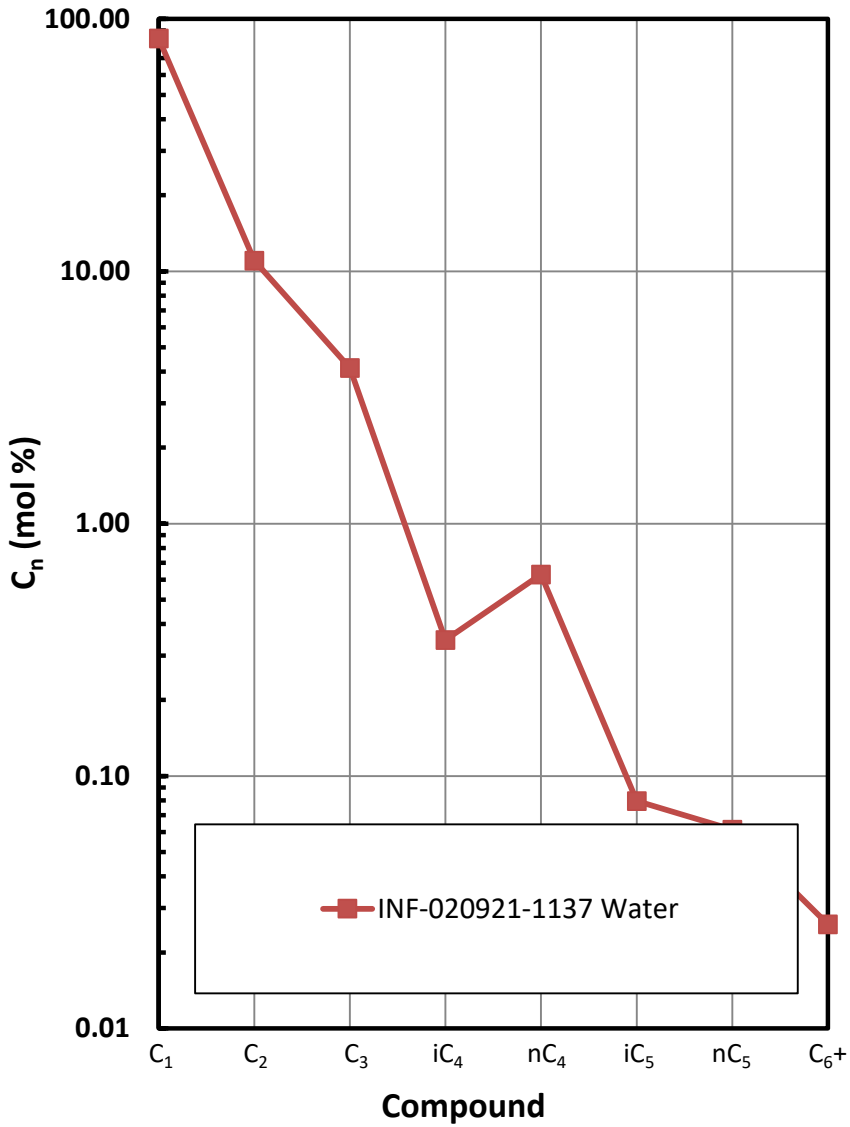
Stable isotope results based on multi-point laboratory calibration
Values in red represent low signal; interpret with caution
Precision $\delta 13C < 0.5$ ‰
Precision $\delta D < 5$ ‰
* As ideal gas, with gas concentrations normalized to 100%; caculations based on GPA 2145-09 physical constants.

INTERPRETIVE PLOTS

Methane $\delta^{13}C$ vs Wetness Genetic Classification Plot

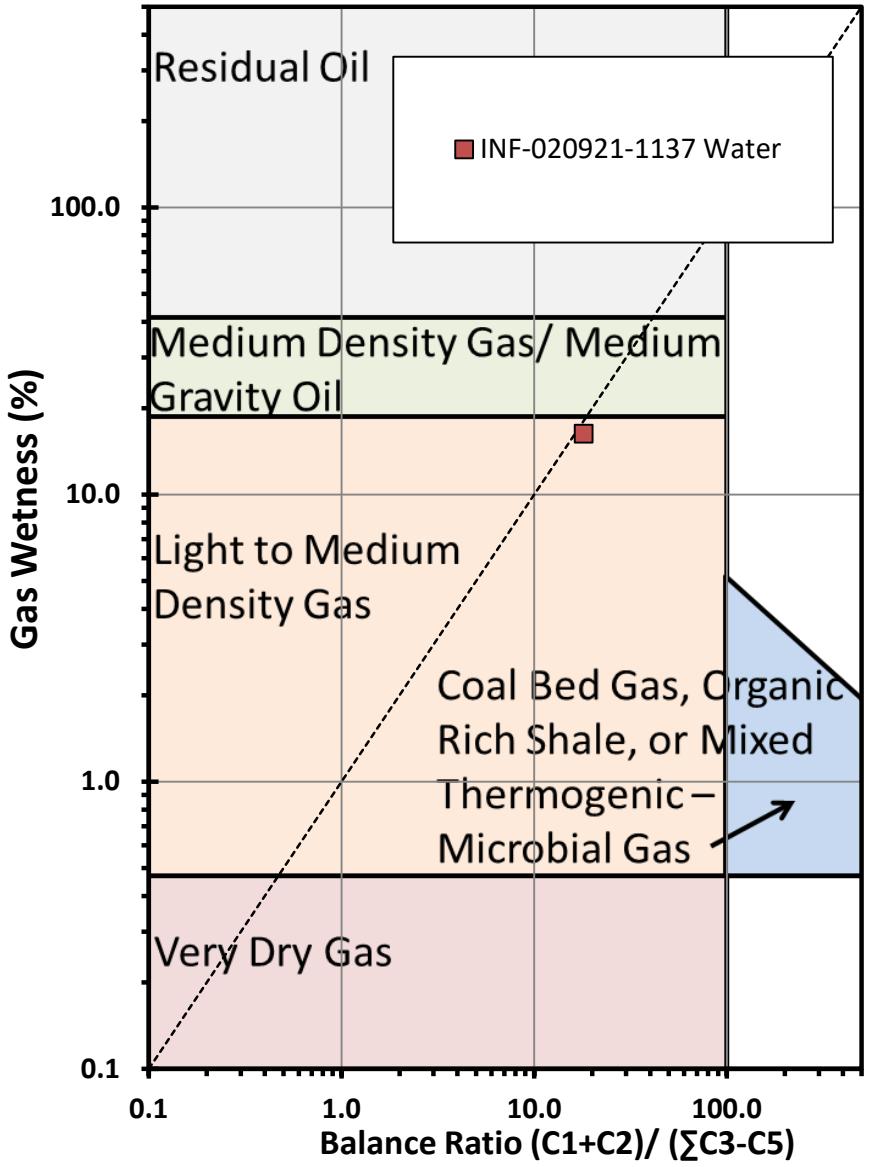


Hydrocarbon Composition Plot

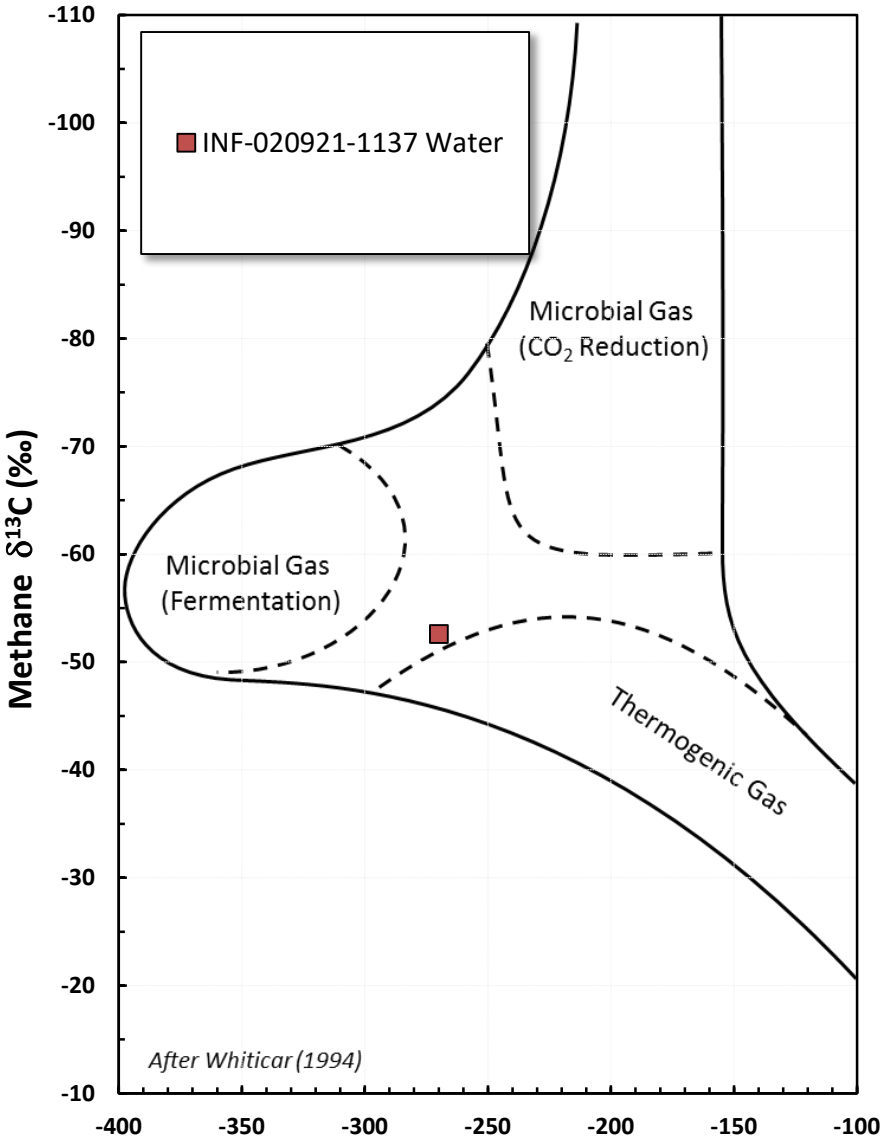


INTERPRETIVE PLOTS

Haworth Ratio Plot - Characterization of Hydrocarbon Type



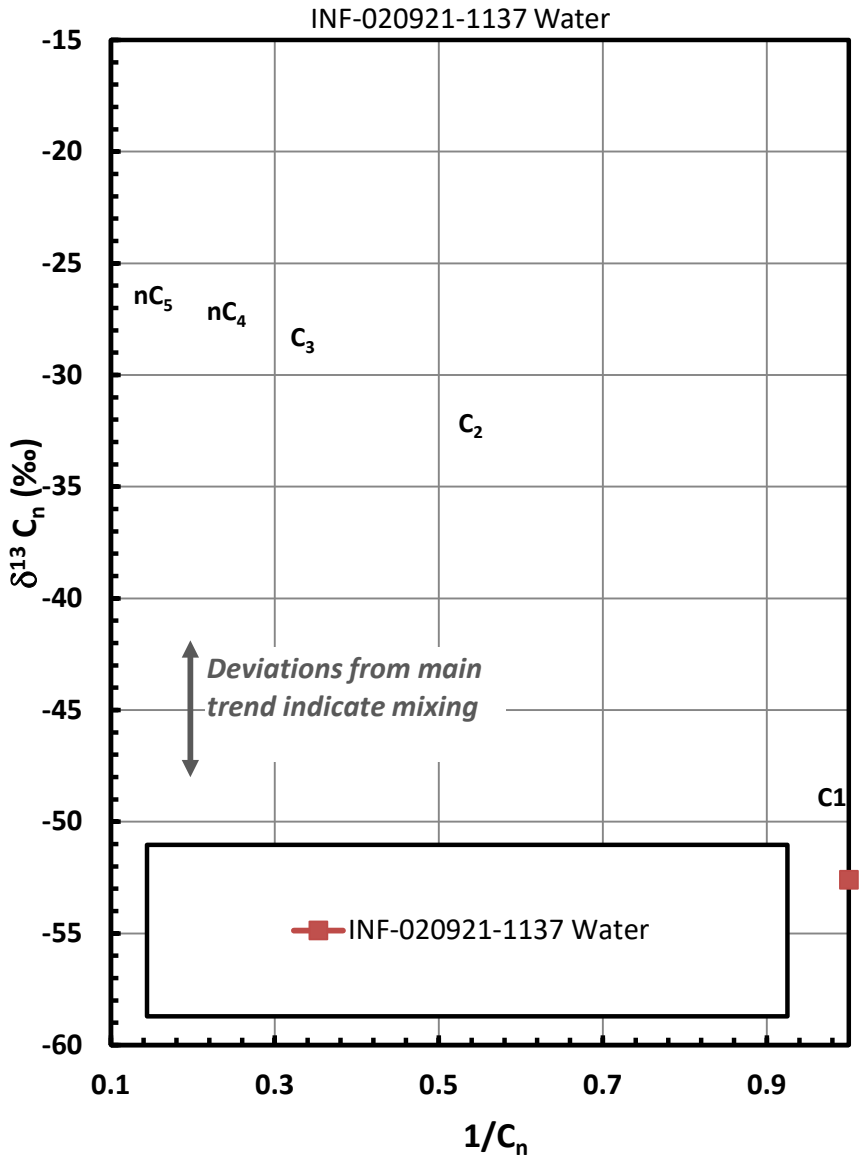
Methane δ¯¯C vs δD Genetic Classification Plot



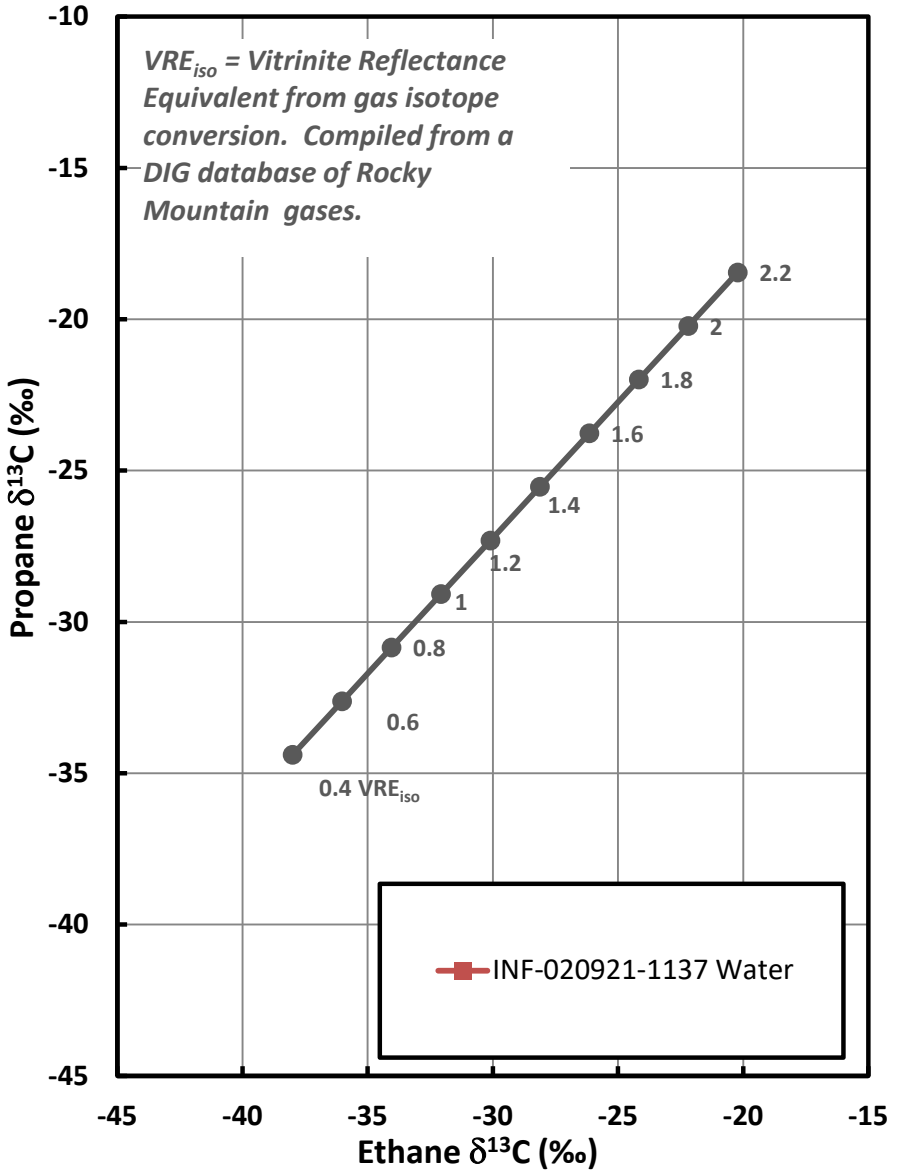
Methane δD (‰)

INTERPRETIVE PLOTS

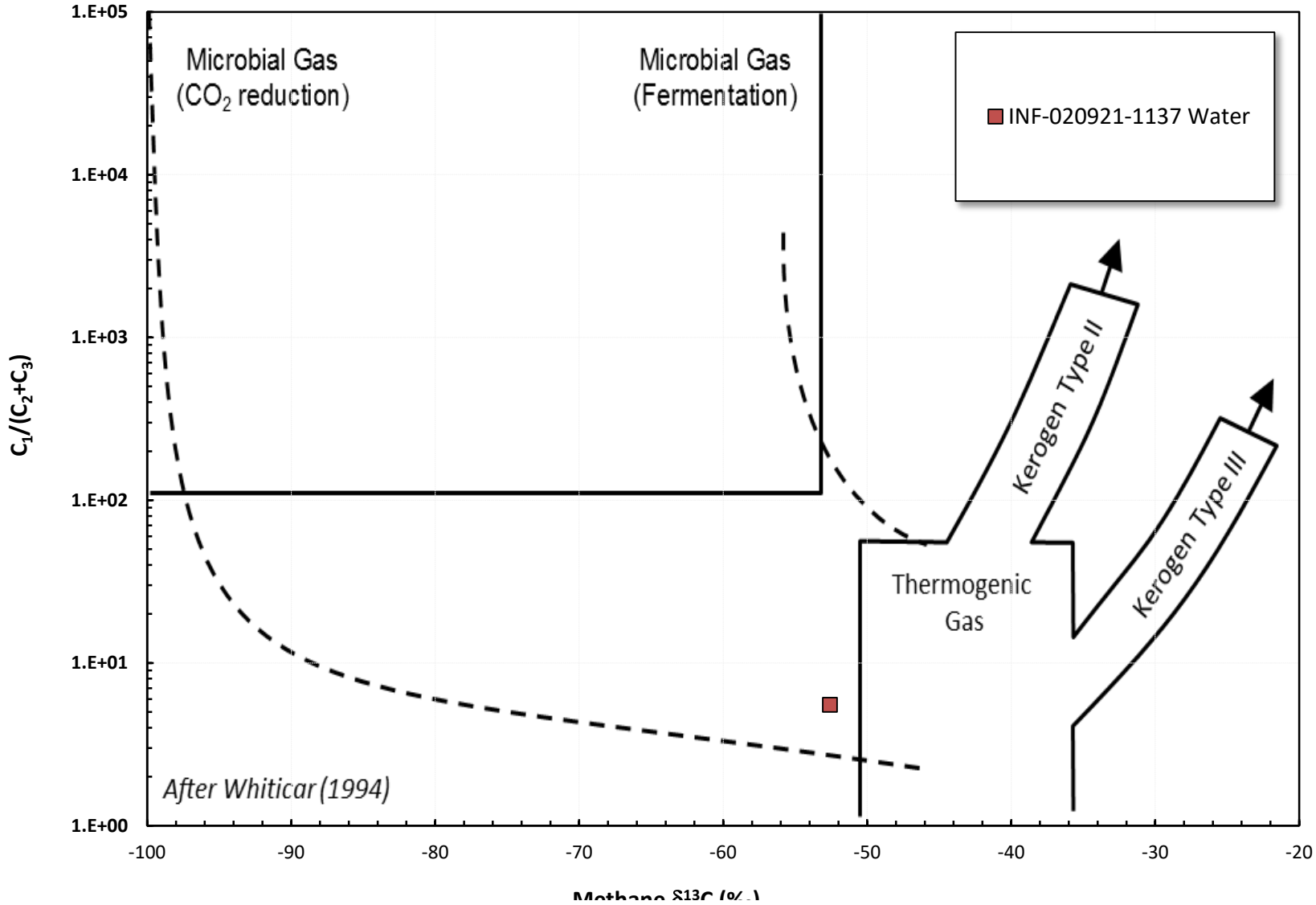
Mixing Plot



Ethane - Propane Maturity Plot



Methane $\delta^{13}C$ vs $C_1/(C_2+C_3)$ Genetic Classification Plot



Methane δ¹³C (‰)

Organization	Reporting Organization	Reporting Organization Name	Order Number	Entity Requesting Analysis	Purpose	Project													
	10206	Dolan Integration Group		Summit Scientific															
Sample	COGCC Facility No.	Sample Date and Time	API #	LAB Sample ID	Sample Type	Matrix	Comments	Project Number	Chain of Custody ID	Date Received by Lab									
		2/9/21 11:37		DIG-024763		GAS			INF-020921-1137	2/10/2021									
Batch	LabID	Lab Batch Identifier	Leach Date	Extract Date and Time	Extract Method	Start Date and Time	Conc Method	Init Vol	Final Vol	Init Vol Units	Final Vol Units	Analysis Date and Time	Report Basis	Comments	File Name	Column #			
	10206	21025283																	
Result	CAS Number	Analysis Name	Analysis Method	Analytical Method Modifier	Unit	Result Value	Qualifier	Test Type	Result Text	Data Flag	Dilution	Fraction Type	MDC	Requested MDC	Detection Limit	Instrument Detection Limit	Method Detection Limit	Comments	AnalyticalBatchID
	O2+AR	OXYGEN + ARGON	SOP		MOL %	5.71									0.005	0.005	0.005		21025283
	124-38-9	CARBON DIOXIDE	SOP		MOL %	0.13									0.005	0.005	0.005		21025283
	7727-37-9	NITROGEN (N2)	SOP		MOL %	26.58									0.005	0.005	0.005		21025283
	7440-59-7	Helium	SOP		MOL %	0.01	ND								0.005	0.005	0.005		21025283
	1333-74-0	HYDROGEN	SOP		MOL %	0.01	ND								0.005	0.005	0.005		21025283
	74-82-8	METHANE	SOP		MOL %	56.57									0.005	0.005	0.005		21025283
	74-84-0	ETHANE	SOP		MOL %	7.45									0.005	0.005	0.005		21025283
	74-85-1	ETHENE	SOP		MOL %	0.01	ND								0.005	0.005	0.005		21025283
	74-98-6	PROPANE	SOP		MOL %	2.79									0.005	0.005	0.005		21025283
	75-28-5	ISOBUTANE	SOP		MOL %	0.23									0.005	0.005	0.005		21025283
	106-97-8	N-BUTANE	SOP		MOL %	0.43									0.005	0.005	0.005		21025283
	iC5	ISOPENTANE	SOP		MOL %	0.05									0.005	0.005	0.005		21025283
	109-66-0	N-PENTANE	SOP		MOL %	0.04									0.005	0.005	0.005		21025283
	92112-69-1+	C6+ (hexanes +)	SOP		MOL %	0.02									0.005	0.005	0.005		21025283
	delta13C C1	DELTA 13C C1	SOP		per mil	-52.6													21025283
	deltaD C1	DELTA D C1	SOP		per mil	-270													21025283
	BTU	BRITISH THERMAL UNITS	SOP		BTU/cuft	800													21025283
	SpGrav	SPECIFIC GRAVITY	SOP		No Unit	0.771													21025283

JOB 21025283 DIG-024763

dig Geochemistry for Energy
Dolan Integration Group

main 303.531.2030 · info@digforenergy.com · digforenergy.com
Office and Lab 11025 Dover St · Ste 800 · Westminster, CO 80021

Send Data to:	Send Invoice to (if different):	Additional Information:
Name: Muri Premer / Paul Shrewsbury	Name: Ben Shrewsbury	AFE #:
Company: Summit Scientific	Company: Summit Scientific	Project:
Address: 4653 Table Mountain Drive	Address: 4653 Table Mountain Drive	PO #:
City, State: Golden, CO 80403	City, State: Golden, CO 80403	Location:
Phone: 303-277-9310	Phone: 303-277-9310	Sampled By:
Email: mpremer@s2scientific.com / pshrewsbury@s2scientific.com	Email: bshrewsbury@s2scientific.com	API #:

Turnaround Time**: ○ Standard (≤ 10 Business days) ○ Rush (≤ 5 Business days) ● Expedited Rush (≤ 3 Business days)

Container Number	Sample Identification	Date Sampled	Time	Sample Type*	Gas Composition	d13C of Methane (C1)	d13C of Ethane (C2)	d13C of Propane+ (C3+)	d13C of Carbon Dioxide (CO2)	dD of Methane (C1)	Whole Oil Gas Chromatography	d18O and dD Isotopes of Water	RSK 175 Dissolved Gas Quantification
	INF-020921-1137	2/9/21	11:37	Other Water	☒	☒	☐	☐	☐	☒	☐	☐	☐
				Other	☐	☐	☐	☐	☐	☐	☐	☐	☐
				Other	☐	☐	☐	☐	☐	☐	☐	☐	☐
				Other	☐	☐	☐	☐	☐	☐	☐	☐	☐
				Other	☐	☐	☐	☐	☐	☐	☐	☐	☐
				Other	☐	☐	☐	☐	☐	☐	☐	☐	☐
				Other	☐	☐	☐	☐	☐	☐	☐	☐	☐
				Other	☐	☐	☐	☐	☐	☐	☐	☐	☐
				Other	☐	☐	☐	☐	☐	☐	☐	☐	☐
				Other	☐	☐	☐	☐	☐	☐	☐	☐	☐

Chain of Custody Record

Comments: Please Reference Project Name: 2102134

Relinquished by Signature	Company	Date	Time	Received by Signature	Company	Date	Time
[signature]	Summit Scientific	02/10/2021	1351	[signature]	DIG	2-10-21	1351

*Gas composition vs RSK-175 - Gas composition is a basic analysis of the concentration (ppm) of gases within the headspace of the sample (headspace is created at the lab). RSK-175 is a specific analysis technique combined with

calculations to give the total dissolved gas of each species in the water sample (mg/L). Why one or the other? Gas composition gives us a quick, general look at relative concentrations and ratios (e.g., gas wetness). RSK-175 gives us an exact total of gas present in the sample (headspace and dissolved in the water). Questions? Give us a call at 303-531-2030.

** Rush and Expedited Rush turnaround time analysis will incur additional costs at 2x and 3x the standard turnaround time pricing.

PDC Energy 1775 Sherman St. STE. 3000 Denver CO, 80203	Project: DWR Permit #137465 Project Number: AFE #EX-000335 Project Manager: Karen Olson	**Reported:** 02/11/21 08:15

Notes and Definitions

S-06	The recovery of this surrogate is outside control limits due to sample dilution required from high analyte concentration and/or matrix interferences.
QR-03	The RPD value for the sample duplicate or MS/MSD was outside of QC acceptance limits due to matrix interference. QC batch accepted based on LCS and/or LCSD recovery and/or RPD values.
QM-05	The spike recovery was outside acceptance limits for the MS and/or MSD due to matrix interference. The associated LCS and/or LCSD were within acceptance limits, therefore the data are considered valid.
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