



August 22, 2019

Scott Bientendorf and Vickie Foster
16150 Geneva Ct.
Brighton, CO 80602

RE: BASELINE GROUNDWATER QUALITY TESTING RESULTS

Dear Mr. & Ms. Bientendorf and Foster,

Aquionix, Inc. has been retained by PetroShare Corporation (PetroShare) to conduct a baseline groundwater quality evaluation in conjunction with oil and gas development activities. This activity is required under Rules 609 of the Colorado Oil and Gas Conservation Commission's (COGCC) Rules and Regulations for the groundwater baseline sampling and monitoring program.

The purpose of this letter is to provide you with a copy of the groundwater quality test results collected on July 11, 2019 at the water well in the table below:

Permit #	Receipt #	Latitude (Permit)	Longitude (Permit)	Sample Location Information (Field)	Sample I.D.
44657-F	0371623	39.988647	-104.866785	Spigot inside Cistern	44657-F Bientendorf

Please find enclosed field documentation and a copy of the test results conduct by Origins Laboratory (Origins), Denver, CO. The results were also released to the COGCC for their review and use, which may include posting to publicly available databases.

If you have any questions or concerns, please contact Scott Legg at 303-289-7520. Thank you for your cooperation with this matter.

Sincerely,

A handwritten signature in black ink that reads "Scott R. Legg". The signature is written in a cursive, flowing style.

Scott Legg
Environmental Engineer IV

Enclosures:

- Field Documentation (Field Sampling Data Sheets & Calibration Forms)
- Origins Test Results: Y907186-01
- Origins Test Results: Y907186 (Gas Composition)



General

PetroShare Corp.
9635 Maroon Circle
Englewood, CO 80112

Contact: Meghan Grimes
Project Name: Brighton Lakes

Purpose of Sampling: 1 Year Subsequent baseline sampling for water source 44657-F.

Quality Control

As a standard quality control practice, sample containers, tubing, and filters are new, sealed, and unopened until the time of collection. Any non-disposable sampling equipment is thoroughly cleaned and rinsed in accordance with Rule 609 Colorado Oil and Gas Conservation Commission (COGCC) Model Sampling and Analysis Plan. This precludes the use of any equipment that may contain trace amounts of pollutant. Each sample is labeled prior to, or at the time of, sampling on a self-adhesive label with waterproof ink. As a minimum, the sample number, name of collector, date and time of collection, and sample preservative are included on the label.

Samples are immediately stored on ice to begin the cooling process to the COGCC recommended storage temperature of 4°C during collection and transit to the laboratory.

Summary of Samples Taken

Sample Identification Number: 44657-F Bientendorf

Sample Date: 07/11/2019

Sample Time: 15:16

Type/Description of Sample:

Groundwater baseline sample collected at a domestic well (Latitude: 39.9884, Longitude: -104.86662) in Brighton, CO. Water well 44657-F is verified to be within ½ mile to the surface hole location of the Shook 3-1-67 wellpad.

Method of Preservation:

Samples were preserved in accordance with COGCC Rule 609 Table 5.1 *Sample Preservation and Handling*.

Analysis Requested:

Analysis requested in accordance with COGCC Rule 609 Table 7-1 *Analytical Parameters*.

Authorization:



Scott Legg

08/22/2019

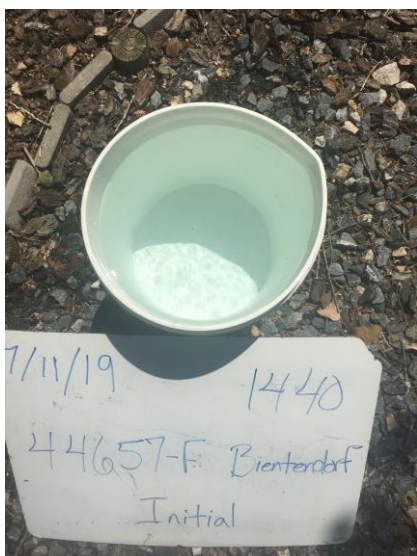
Date



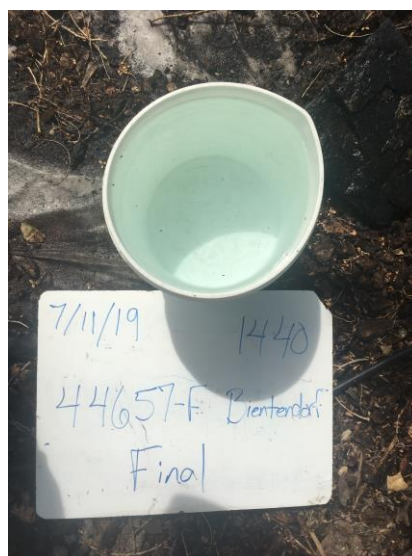
Photograph 1
44657-F Bientendorf
Sample Location



Photograph 2
44657-F Bientendorf
Wellhead



Photograph 3
44657-F Bientendorf
Initial Water Quality



Photograph 4
44657-F Bientendorf
Final Water Quality

Field Sampling Data Sheet

COGCC Facility ID: 755381
Site Address: 16150 Geneva Ct
Site Contact: Scott Bientendorf
Phone #: 303-483-5157
Date of Sample: 7/11/2019
Sample Type (baseline, post-drill, complaint): Baseline - 1st Subsequent
Oil & Gas Well API Number: See attached

Property Owner Name: Scott Bientendorf
Property Owner Phone Number: 303-483-5157
Property Owner Mailing Address: 16150 Geneva Ct
Brighton CO 80602

Individuals Present (Who was on-site during the sampling event?)

Scott Bientendorf
Richard Arnold

Water Well Information from Permit Records

Permit No.: 44657-F
Receipt No.: 0371623
Total Depth (ft.): 1040
Static Water Level (ft.): 638
Yield (GPM): 12.6
Well Diameter (in.): 6

Water Well Information Onsite

GPS Location (field): 39.9824, -104.866662
GPS Location (post-processed): Same
Water well casing height (in.): ~24
Ground Elevation (ft.): 5072' How determined: GPS
Approximate distance to the Oil & Gas well pad: 2175
%LEL at wellhead (if measured): N/A
%CH₄ at wellhead (if measured): N/A
Weather conditions: 95°N, sunny
Photo(s) Taken? Y N
Handed Out Landowner Introduction Letter? Y N
Handed Out FAQ Sheet? Y N
Handed Out "How Well Do You Know Your Water Well" Pamphlet? Y N

Where was the Sample Taken? Outside Cistern
(Outside Tap, Well House, Kitchen Tap, Spring, Seep, etc.)

Condition of the Well, Spring or Seep (Wellhead sealed? Does the ground slope away from the well?, Visible contamination of spring/seep?, etc.):

Good condition

Sample Collection Field Sheet

Sample ID: 44657-F - Bientendorf

Associated Well Information:

API Number:	05-001-09968	Operator Name:	PETROSHARE CORPORATION # 10454	Well Name:	Shook # 3-10-1CDH
Well Status:	PR			Location:	NWSE 3 1S67W
API Number:	05-001-09969	Operator Name:	PETROSHARE CORPORATION # 10454	Well Name:	Shook # 3-10-3CDH
Well Status:	PR			Location:	NWSE 3 1S67W
API Number:	05-001-09970	Operator Name:	PETROSHARE CORPORATION # 10454	Well Name:	Shook # 3-10-1NBH
Well Status:	PR			Location:	NWSE 3 1S67W
API Number:	05-001-09971	Operator Name:	PETROSHARE CORPORATION # 10454	Well Name:	Shook # 3-10-2NBH
Well Status:	PR			Location:	NWSE 3 1S67W
API Number:	05-001-09972	Operator Name:	PETROSHARE CORPORATION # 10454	Well Name:	Shook # 3-10-2NAH
Well Status:	PR			Location:	NWSE 3 1S67W
API Number:	05-001-09973	Operator Name:	PETROSHARE CORPORATION # 10454	Well Name:	Shook # 3-10-2CDH
Well Status:	PR			Location:	NWSE 3 1S67W
API Number:	05-001-09974	Operator Name:	PETROSHARE CORPORATION # 10454	Well Name:	Shook # 3-10-4CDH
Well Status:	PR			Location:	NWSE 3 1S67W
API Number:	05-001-09975	Operator Name:	PETROSHARE CORPORATION # 10454	Well Name:	Shook # 3-10-1NCH
Well Status:	PR			Location:	NWSE 3 1S67W
API Number:	05-001-09976	Operator Name:	PETROSHARE CORPORATION # 10454	Well Name:	Shook # 3-10-4NBH
Well Status:	PR			Location:	NWSE 3 1S67W
API Number:	05-001-09977	Operator Name:	PETROSHARE CORPORATION # 10454	Well Name:	Shook # 3-10-3NBH
Well Status:	PR			Location:	NWSE 3 1S67W
API Number:	05-001-09978	Operator Name:	PETROSHARE CORPORATION # 10454	Well Name:	Shook # 3-10-1NAH
Well Status:	PR			Location:	NWSE 3 1S67W
API Number:	05-001-09979	Operator Name:	PETROSHARE CORPORATION # 10454	Well Name:	Shook # 3-10-5CDH
Well Status:	PR			Location:	NWSE 3 1S67W
API Number:	05-001-09980	Operator Name:	PETROSHARE CORPORATION # 10454	Well Name:	Shook # 3-10-2NCH
Well Status:	PR			Location:	NWSE 3 1S67W
API Number:	05-001-09981	Operator Name:	PETROSHARE CORPORATION # 10454	Well Name:	Shook # 3-10-6CDH
Well Status:	PR			Location:	NWSE 3 1S67W

Landowner Comments on Water Quality: 13 concerns

Time	Purge Vol. (gal)	pH	Conductivity	Temp	Color/Appearance /Sediment	Odor	Bubbles/Effervescence?
1506	220	8.90	1049	23.2	clear, no sediment	None	No bubbles
1511	275	8.88	1065	23.2	↓	↓	↓
1516	330	8.86	1071	23.2	↓	↓	↓

ADDITIONAL INFORMATION: Samples collected ~~before~~ after
chloride filter bypass.

Sampler's Name Scott Weger Company: Aguronix, Inc
(Print)
Sampler's Signature Scott Weger Date: 7/11/19

Sample Collection Field Sheet

Sample ID: 44657-F Bientendorf

Groundwater Monitoring Well Purging/Sampling Information

Purge Start Time: 1446 Purge End Time: 1516

Purge Rate (gpm): 11 Total Purge Volume (gal): 330

Final Field Parameters	pH (s.u.)	Temp (°C)	Sp. Cond. (µS/cm)	ORP (mV)	DO (mg/L)	Turbidity (ntu)
	8.9	23.2	1071	97.3	0.55	0.74

Water Quality Field Parameters

Time	Volume Removed (gal)	pH (s.u.)	Temp (°C)	Sp. Cond. (µS/cm)	ORP (mV)	DO (mg/L)	Turbidity (ntu)	Bubbles or Effervescence?
1446	Initial	8.87	18.6	1059	177.6	0.71	1.11	Slight Bubbles, no odor
1451	55	8.88	21.2	1012	116.1	0.66	1.34	"
1456	110	8.92	22.4	996	101.7	0.57	0.58	"
1501	165	8.89	23.0	1038	95.7	0.45	0.44	bubbles cleared, no odor
1506	220	8.90	23.2	1049	99.9	0.55	0.59	"
1511	275	8.88	23.2	1065	98.4	0.52	0.48	"
1516	330	8.86	23.2	1071	97.3	0.55	0.74	"

Notes: Measure field parameters every 5 minutes.

Minimum of 6 parameter measurements required.

Stabilization is demonstrated by a variance of no more than +/- 10% for temperature, turbidity (if >10 NTU), DO (if >0.5 mg/L) and specific conductance; +/- 10 mV for ORP; and +/- 0.2 s.u. for pH.

Comments: Clear H₂O, no odor

Sample Collection Field Sheet

Sample ID: 44657-F - Bientendorf

Aquionix™, Inc.

Turbidity Meter Calibration Form

Client Name: Petroshare

Date: 7/10/19

Pre Sampling Time: 1431 Post Sampling Time: 1546

Performed By: Scott Heggs

Calibration Pre/Post Sampling Check

Standard	Pre Sampling Value	Post Sampling Value
Source 1 10 ntu Lot No: A8149 Expiration: Sept. 2019	ntu <u>10.2</u>	ntu <u>10.03</u>
Source 2 20 ntu Lot No: A8149 Expiration: Sept. 2019	ntu <u>20.7</u>	ntu <u>20.5</u>
Source 3 100 ntu Lot No: A8152 Expiration: Sept. 2019	ntu <u>103</u>	ntu <u>100</u>
Source 4 800 ntu Lot No: A8142 Expiration: Sept. 2019	ntu <u>796</u>	sntu <u>782</u>

*The turbidity meter was calibrated on the same day of the sample analysis using the following standards:

- CAT No. 2684901 NIST Traceable Standards

Calibration results outside of +/- 5% from the standard shall require the calibration procedure to be conducted again.

Client Name: Petroskma

Meter 1: S/N # 12C100181

Aquionix Project Number: 3710-071119

Meter 2: S/N # 15A104951

Date: 7/11/19

Pre Sampling Time: 1430 Post Sampling Time: 1545

Performed By: Scott Lutz
Calibration

The multimeter must be calibrated/verified **before and after** sample collection. In addition, the meter must be calibrated/verified for **all** field parameters that are to be measured and recorded.

Perform a three point pH calibration. Record measured value for each buffer solution after calibration has been completed. In addition, record pH mV values. After accepting a good calibration, navigate to the GLP file and check the pH Slope and Slope % of ideal. A good slope should be between 55 and 60 mVs while the ideal is 59 mV.

- A value of +50 or -50 mVs in buffer 7 does not indicate a bad sensor.
- The mV span between pH 4 and 7 and 7 and 10 mV values should be \approx 165 to 180 mV. 177 is the ideal distance.
- If the mV span between pH 4 and 7 or 7 and 10 drops below 160, clean the sensor and try to recalibrate.
- If the slope drops below 53, the sensor should be reconditioned and recalibrated.

Calibration/Standard	Pre Sampling Value	Post Sampling Value
pH 4.0 Buffer μ Lot#: P10012071701 Exp Date: 7/26/2019	S.U. 4.01	S.U. 4.00
pH 7.0 Buffer Lot#: P10020181801 Exp Date: 1/18/2020	S.U. 6.99	S.U. 7.02
pH 10.0 Buffer Lot#: P10053051701 Exp Date: 11/01/2019	S.U. 9.97	S.U. 10.02
Conductivity Standard 1413 (μS/cm) Lot#: 8GH1064 Exp Date: Aug/2019	1413	1421
ORP Standard 220 (mV) Lot#: 8GL486 Exp Date: Sep/2019	219.8	219.2
DO Water Saturated Air (100%)	99.8%	96.4%

Client: Aquionix
Address: 5545 W 51st Ave # E
Arvada CO 80002
Telephone Number: 303-289-7570
Email Address: sls@aquionix.com

Project Manager: Scott Weag
Project Name: Petroshore - Shook 1st Subsegment
Project Number: 44657-E Bientendorf
Samples Collected By: Scott Weag

Sample ID Description	Date Sampled	Time Sampled	# of Containers	Preservative			Matrix			Analysis		Sample Instructions
				Unpreserved	HCl	HNO ₃	Groundwater	Soil	Air Summa Canister #	Other	Other	
44657-E Bientendorf	7/11/19	1516	13	X		X	X	X			Rule 609 1st Subsegment	1
												2
												3
												4
												5
												6
												7
												8
												9
												10
Relinquished By: <u>[Signature]</u>	Date: <u>7/11/19</u>	Time: <u>1620</u>	Received By: <u>[Signature]</u>	Date: <u>7/11/19</u>	Time: <u>1620</u>	Turnaround Time: Same Day <input type="checkbox"/> 24 Hr <input type="checkbox"/> 48 Hr <input type="checkbox"/> 72 Hr <input type="checkbox"/> Standard <input checked="" type="checkbox"/>						
Relinquished By: <u>[Signature]</u>	Date:	Time:	Received By:	Date:	Time:							

Temp Received- 5.4 Date Results Needed

July 25, 2019

Aquionix

Scott Legg

5545 W 56th Ave, Unit E

Arvada

CO

80002

**Project Name - Petroshare - Shook 1st
Subsequent**

Project Number - 44657-F Bientendorf

Attached are your analytical results for Petroshare - Shook 1st Subsequent received by Origins Laboratory, Inc. July 11, 2019. This project is associated with Origins project number Y907186-01.

The analytical results in the following report were analyzed under the guidelines of EPA Methods. These methods are identified as follows; "SW" are defined in SW-846, "EPA" are defined in 40CFR part 136 and "SM" are defined in the most current revision of Standard Methods For the Examination of Water and Wastewater.

The analytical results apply specifically to the samples and analyses specified per the attached Chain of Custody. As such, this report shall not be reproduced except in full, without the written approval of Origin's laboratory.

Unless otherwise noted, the analytical results for all soil samples are reported on a wet weight basis. All analytical analyses were performed under NELAP guidelines unless noted by a data qualifier.

Any holding time exceedances, deviations from the method specifications or deviations from Origins Laboratory's Standard Operating Procedures are outlined in the case narrative.

Thank you for selecting Origins for your analytical needs. Please contact us with any questions concerning this report, or if we can help with anything at all.

Origins Laboratory, Inc.
303.433.1322
o-squad@oelabinc.com



Aquionix
5545 W 56th Ave, Unit E
Arvada CO 80002

Scott Legg
Project Number: 44657-F Bientendorf
Project: Petroshare - Shook 1st Subsequent

CROSS REFERENCE REPORT

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
44657-F Bientendorf	Y907186-01	Water	July 11, 2019 15:16	07/11/2019 16:20

Origins Laboratory, Inc.



Jen Pellegrini, Project Manager

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.

Aquionix
5545 W 56th Ave, Unit E
Arvada CO 80002

Scott Legg
Project Number: 44657-F Bientendorf
Project: Petroshare - Shook 1st Subsequent

www.originslaboratory.com

9907186

page | of |

Client: Aquionix
Address: 5545 W 56th Ave # E
Arvada CO 80002
Telephone Number: 303-289-7520
Email Address: slegg@aquionix.com

Project Manager: Scott Legg
Project Name: Petroshare - Shook 1st Subsequent
Project Number: 44657-F Bientendorf
Samples Collected By: Scott Legg

Sample ID Description	Date Sampled	Time Sampled	# of Containers	Preservative				Matrix			Analysis	Sample Instructions	
				Unpreserved	HCl	HNO ₃	Other	Groundwater	Soil	Air Summa Canister #			Other
44657-F Bientendorf	7/11/19	1516	13	X				X	X			Rule 609 1st Subsequent	1
													2
													3
													4
													5
													6
													7
													8
													9
													10

Relinquished By: Scott Legg Date: 7/11/19 Time: 1620
Relinquished By: Scott Legg Date: 7/11/19 Time: 1620

Received By: Scott Legg Date: 7/11/19 Time: 1620
Received By: Scott Legg Date: 7/11/19 Time: 1620

Turnaround Time: ☐ 24 Hr ☐ 48 Hr ☒ Standard

Temp Received: 5.4 Date Results Needed

1725 Elk Place | Denver, CO 80211 | Phone: 303.433.1322 | Fax: 303.265.9645

Origins Laboratory, Inc.

Jen Pellegrini

Jen Pellegrini, Project Manager

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Aquionix
5545 W 56th Ave, Unit E
Arvada CO 80002

Scott Legg
Project Number: 44657-F Bientendorf
Project: Petroshare - Shook 1st Subsequent

Origins Laboratory

F-012207-01-R1
Effective Date: 01/09/12

Sample Receipt Checklist

Origins Work Order: Y907186

Client: Aquionix

Client Project ID: Petroshare - Shook 1st

Checklist Completed by: JG

Shipped Via: HD

(UPS, FedEx, Hand Delivered, Pick-up, etc.)

Date/time completed: 7/12/2019

Airbill #: N/A

Matrix(s) Received: (Check all that apply): Soil/Solid ☒ Water ☐ Other: ☐ (Describe)

Cooler Number/Temperature: 1 / 5.4 °C 1 / 1 °C 1 / 1 °C 1 / 1 °C

Thermometer ID: T003

Requirement Description	Yes	No	N/A	Comments (if any)
If samples require cooling, was the temperature between 0°C to ≤ 8°C ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Is there ice present (document if blue ice is used)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are custody seals present on cooler? (If so, document in comments if they are signed and dated, broken or intact)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Are custody seals present on each sample container? (If so, document in comments if they are signed and dated, broken or intact)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Were all samples received intact ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was adequate sample volume provided ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are short holding time analytes or samples with HTs due within 48 hours present ⁽¹⁾ ?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Is a chain-of-custody (COC) present and filled out completely ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Does the COC agree with the number and type of sample bottles received ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Do the sample IDs on the bottle labels match the COC ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Is the COC properly relinquished by the client with date and time recorded ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
For volatiles in water — is there headspace (> ¼ inch bubble) present? If yes, contact client and note in narrative.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Are samples preserved that require preservation and was it checked ⁽¹⁾ ? (note ID of confirmation instrument used in comments) / (preservation is not confirmed for subcontracted analyses in order to insure sample integrity)/(pH <2 for samples preserved with HNO ₃ , HCL, H ₂ SO ₄) / (pH >10 for samples preserved with NaAsO ₂ •NaOH, ZnAc•NaOH)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Additional Comments (if any):				

⁽¹⁾If NO, then contact the client before proceeding with analysis and note date/time and person contacted as well as the corrective action to in the additional comments (above) and the case narrative.

Reviewed by (Project Manager) CP

Date/Time Reviewed 7/15/19

Origins Laboratory, Inc.

Jefe Pellegrini

Jen Pellegrini, Project Manager

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.

Aquionix
5545 W 56th Ave, Unit E
Arvada CO 80002

Scott Legg
Project Number: 44657-F Bientendorf
Project: Petroshare - Shook 1st Subsequent

44657-F Bientendorf
7/11/2019 3:16:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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GEL Laboratories, LLC
Y907186-01 (Water)

Alkalinity by SM 2320B

Alkalinity, Total as CaCO ₃	472	1.45	4.00	mg/L	1	1896559	07/11/2019	07/16/2019	
Bicarbonate alkalinity (CaCO ₃)	402	1.45	4.00	"	"	"	"	"	
Carbonate alkalinity (CaCO ₃)	70.4	1.45	4.00	"	"	"	"	"	

Anions by EPA 300.0

Bromide	0.701	0.067	0.200	mg/L	1	1896208	"	07/16/2019	
Chloride	64.1	0.670	2.00	"	10	"	"	"	
Fluoride	1.60	0.033	0.100	"	1	"	"	"	
Sulfate	1.68	0.133	0.400	"	"	"	"	"	

BTEX by EPA 8260D

Benzene	ND		1.00	ug/L	1	B9G1502	07/15/2019	07/15/2019	Ua
Toluene	ND		1.00	"	"	"	"	"	Ua
Ethylbenzene	ND		1.00	"	"	"	"	"	Ua
Xylenes, total	ND		1.00	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	97.5 %	70-130	"	"	"
Surrogate: Toluene-d8	103 %	70-130	"	"	"
Surrogate: 4-Bromofluorobenzene	96.3 %	70-130	"	"	"

Origins Laboratory, Inc.



Jen Pellegrini, Project Manager

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Aquionix
5545 W 56th Ave, Unit E
Arvada CO 80002

Scott Legg
Project Number: 44657-F Bientendorf
Project: Petroshare - Shook 1st Subsequent

44657-F Bientendorf
7/11/2019 3:16:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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Pace Analytical
Y907186-01 (Water)

Dissolved Gasses by RSK 175

Ethane	37.3	3.0	10	ug/L	1	11111	07/11/2019	07/15/2019	
Methane	7840	4.9	10	"	"	"	"	"	E
n-Propane	ND	4.4	20	"	"	"	"	"	

Dissolved Metals by 200.8

Calcium	1190	80.0	200	ug/L	1	1896385	07/16/2019	07/17/2019	
Magnesium	230	10.0	30.0	"	"	"	"	"	
Potassium	874	80.0	300	"	"	"	"	"	
Sodium	242000	1600	5000	"	20	"	"	"	

DRO by 8015C

Diesel Range Organics	ND	72.0	192	ug/L	1	1896320	"	07/17/2019	U
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Surrogate: o-Terphenyl	68 %	40-109	"	"	"
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GRO by 8015C

Gasoline Range Organics	ND	40	100	ug/L	1	23246	07/11/2019	07/20/2019	
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Surrogate: Bromofluorobenzene	112 %	70-130	"	"	"
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Origins Laboratory, Inc.



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Jen Pellegrini, Project Manager

Aquionix
5545 W 56th Ave, Unit E
Arvada CO 80002

Scott Legg
Project Number: 44657-F Bientendorf
Project: Petroshare - Shook 1st Subsequent

44657-F Bientendorf
7/11/2019 3:16:00PM

Analyte	Result	Min Detection Limit	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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GEL Laboratories, LLC
Y907186-01 (Water)

TDS by EPA 160.1

Total Dissolved Solids	531	3.40	14.3	mg/L	1	1896664	07/11/2019	07/17/2019
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Origins Laboratory, Inc.



Jen Pellegrini, Project Manager

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Aquionix
5545 W 56th Ave, Unit E
Arvada CO 80002

Scott Legg
Project Number: 44657-F Bientendorf
Project: Petroshare - Shook 1st Subsequent

Volatile Organic Compounds by GC/MS SW846 8260D - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B9G1502 - EPA 5030B (Water)

Blank (B9G1502-BLK1)

Prepared: 07/15/2019 Analyzed: 07/15/2019

Benzene	ND	1.00	ug/L							Ua
Toluene	ND	1.00	"							Ua
Ethylbenzene	ND	1.00	"							Ua
Xylenes, total	ND	1.00	"							Ua
Surrogate: 1,2-Dichloroethane-d4	65		"	62.5	104		70-130			
Surrogate: Toluene-d8	64		"	62.5	103		70-130			
Surrogate: 4-Bromofluorobenzene	64		"	62.5	103		70-130			

Origins Laboratory, Inc.



Jen Pellegrini, Project Manager

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Aquionix
5545 W 56th Ave, Unit E
Arvada CO 80002

Scott Legg
Project Number: 44657-F Bientendorf
Project: Petroshare - Shook 1st Subsequent

Volatile Organic Compounds by GC/MS SW846 8260D - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B9G1502 - EPA 5030B (Water)

LCS (B9G1502-BS1)

Prepared: 07/15/2019 Analyzed: 07/15/2019

Benzene	45.5	1.00	ug/L	50.0		91.0	70-130			
Toluene	46.2	1.00	"	50.0		92.5	70-130			
Ethylbenzene	45.7	1.00	"	50.0		91.3	70-130			
m,p-Xylene	91.8	2.00	"	100		91.8	70-130			
o-Xylene	45.9	1.00	"	50.0		91.7	70-130			
Surrogate: 1,2-Dichloroethane-d4	61		"	62.5		98.2	70-130			
Surrogate: Toluene-d8	64		"	62.5		102	70-130			
Surrogate: 4-Bromofluorobenzene	64		"	62.5		102	70-130			

Origins Laboratory, Inc.



Jen Pellegrini, Project Manager

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Aquionix
5545 W 56th Ave, Unit E
Arvada CO 80002

Scott Legg
Project Number: 44657-F Bientendorf
Project: Petroshare - Shook 1st Subsequent

Volatile Organic Compounds by GC/MS SW846 8260D - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B9G1502 - EPA 5030B (Water)

Matrix Spike (B9G1502-MS1)		Source: Y907202-02			Prepared: 07/15/2019 Analyzed: 07/15/2019					
Benzene	52.4	1.00	ug/L	50.0	12.9	79.0	70-130			
Toluene	43.9	1.00	"	50.0	ND	87.9	70-130			
Ethylbenzene	52.6	1.00	"	50.0	17.7	69.8	70-130			QM-07
m,p-Xylene	85.8	2.00	"	100	ND	85.8	70-130			
o-Xylene	44.9	1.00	"	50.0	0.160	89.5	70-130			
Surrogate: 1,2-Dichloroethane-d4	61		"	62.5		98.3	70-130			
Surrogate: Toluene-d8	63		"	62.5		101	70-130			
Surrogate: 4-Bromofluorobenzene	63		"	62.5		100	70-130			

Origins Laboratory, Inc.



Jen Pellegrini, Project Manager

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Aquionix
5545 W 56th Ave, Unit E
Arvada CO 80002

Scott Legg
Project Number: 44657-F Bientendorf
Project: Petroshare - Shook 1st Subsequent

Volatile Organic Compounds by GC/MS SW846 8260D - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B9G1502 - EPA 5030B (Water)

Matrix Spike Dup (B9G1502-MSD1)		Source: Y907202-02			Prepared: 07/15/2019 Analyzed: 07/15/2019					
Benzene	51.7	1.00	ug/L	50.0	12.9	77.7	70-130	1.25	20	
Toluene	43.4	1.00	"	50.0	ND	86.8	70-130	1.26	20	
Ethylbenzene	51.4	1.00	"	50.0	17.7	67.4	70-130	2.31	20	QM-07
m,p-Xylene	84.3	2.00	"	100	ND	84.3	70-130	1.74	20	
o-Xylene	44.5	1.00	"	50.0	0.160	88.6	70-130	0.918	20	
Surrogate: 1,2-Dichloroethane-d4	61		"	62.5		97.1	70-130			
Surrogate: Toluene-d8	63		"	62.5		101	70-130			
Surrogate: 4-Bromofluorobenzene	62		"	62.5		99.3	70-130			

Origins Laboratory, Inc.



Jen Pellegrini, Project Manager

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Aquionix
5545 W 56th Ave, Unit E
Arvada CO 80002

Scott Legg
Project Number: 44657-F Bientendorf
Project: Petroshare - Shook 1st Subsequent

Volatile Organic Compounds by GC/MS SW846 8260D - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Alkalinity by SM 2320B - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch 1896559 -

LCS (1204331904-BKS)

Prepared: Analyzed: 07/16/2019

Alkalinity, Total as CaCO ₃	107	4.00	mg/L	100	107	90-110
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DUP (1204331905 D)

Source: 484397002

Prepared: Analyzed: 07/16/2019

Bicarbonate alkalinity (CaCO ₃)	204	4.00	mg/L	203	0-20	0.494	20
Alkalinity, Total as CaCO ₃	204	4.00	"	203	0-20	0.494	20
Carbonate alkalinity (CaCO ₃)	ND	4.00	"	<1.45	0-20	0	20 U

DUP (1204331906 D)

Source: 484437002

Prepared: Analyzed: 07/16/2019

Carbonate alkalinity (CaCO ₃)	ND	4.00	mg/L	<1.45	0-20	0	20 U
Bicarbonate alkalinity (CaCO ₃)	255	4.00	"	258	0-20	1.17	20
Alkalinity, Total as CaCO ₃	255	4.00	"	258	0-20	1.17	20

MS (1204331907 S)

Source: 484397002

Prepared: Analyzed: 07/16/2019

Alkalinity, Total as CaCO ₃	312	4.00	mg/L	100	203	109	80-120
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MS (1204331908 S)

Source: 484437002

Prepared: Analyzed: 07/16/2019

Alkalinity, Total as CaCO ₃	362	4.00	mg/L	100	258	104	80-120
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DUP (1204331974 D)

Source: Y907186-01

Prepared: Analyzed: 07/16/2019

Bicarbonate alkalinity (CaCO ₃)	409	4.00	mg/L	402	0-20	1.73	20
Alkalinity, Total as CaCO ₃	471	4.00	"	472	0-20	0.213	20
Carbonate alkalinity (CaCO ₃)	62.3	4.00	"	70.4	0-20	12.1	20

Origins Laboratory, Inc.



Jen Pellegrini, Project Manager

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Aquionix
5545 W 56th Ave, Unit E
Arvada CO 80002

Scott Legg
Project Number: 44657-F Bientendorf
Project: Petroshare - Shook 1st Subsequent

Alkalinity by SM 2320B - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1896559 -										
MS (1204331975 S)		Source: Y907186-01			Prepared: Analyzed: 07/16/2019					
Alkalinity, Total as CaCO ₃	578	4.00	mg/L	100	472	106	80-120			
MSD (1204331976 SD)		Source: Y907186-01			Prepared: Analyzed: 07/16/2019					
Alkalinity, Total as CaCO ₃	575	4.00	mg/L	100	472	103	80-120	0.523	20	

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Aquionix
5545 W 56th Ave, Unit E
Arvada CO 80002

Scott Legg
Project Number: 44657-F Bientendorf
Project: Petroshare - Shook 1st Subsequent

Anions by EPA 300.0 - Quality Control GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1896208 -										
BLANK (1204331006-BLK)					Prepared: Analyzed: 07/15/2019					
Sulfate	ND	0.400	mg/L				-			U
Bromide	ND	0.200	"				-			U
Chloride	ND	0.200	"				-			U
Fluoride	ND	0.100	"				-			U
LCS (1204331007-BKS)					Prepared: Analyzed: 07/15/2019					
Sulfate	9.81	0.400	mg/L	10.0		98.1	90-110			
Bromide	1.29	0.200	"	1.25		103	90-110			
Chloride	4.81	0.200	"	5.00		96.1	90-110			
Fluoride	2.43	0.100	"	2.50		97.3	90-110			
DUP (1204331008 D)					Source: 482591011		Prepared: Analyzed: 07/15/2019			
Sulfate	3.40	0.400	mg/L		3.43		0-20	1.04	20	
Fluoride	0.356	0.100	"		0.362		0-20	1.53	20	
Chloride	2.64	0.200	"		2.64		0-20	0.019	20	
Bromide	ND	0.200	"		<0.067		0-20	0	20	U
PS (1204331009 S)					Source: 482591011		Prepared: Analyzed: 07/15/2019			
Sulfate	13.4	0.400	mg/L	10.0		100	90-110			
Fluoride	2.76	0.100	"	2.50		96	90-110			
Chloride	7.80	0.200	"	5.00		103	90-110			
Bromide	1.37	0.200	"	1.25		109	90-110			
DUP (1204331014 D)					Source: Y907186-01		Prepared: Analyzed: 07/16/2019			
Bromide	0.723	0.200	mg/L		0.701		0-20	3.02	20	
Chloride	64.4	2.00	"		64.1		0-20	0.447	20	
Fluoride	1.60	0.100	"		1.60		0-20	0.0751	20	
Sulfate	1.66	0.400	"		1.68		0-20	1.09	20	

Origins Laboratory, Inc.



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Aquionix
5545 W 56th Ave, Unit E
Arvada CO 80002

Scott Legg
Project Number: 44657-F Bientendorf
Project: Petroshare - Shook 1st Subsequent

Anions by EPA 300.0 - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch 1896208 -

PS (1204331015 S)

Source: Y907186-01

Prepared: Analyzed: 07/16/2019

Sulfate	11.8	0.400	mg/L	10.0		101	90-110			
Fluoride	4.21	0.100	"	2.50		104	90-110			
Chloride	123	2.00	"	5.00		118	90-110			
Bromide	2.05	0.200	"	1.25		108	90-110			

Origins Laboratory, Inc.



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Aquionix
5545 W 56th Ave, Unit E
Arvada CO 80002

Scott Legg
Project Number: 44657-F Bientendorf
Project: Petroshare - Shook 1st Subsequent

Dissolved Metals by 200.8 - Quality Control GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1896385 -										
FLTB (1204330987-BLK)					Prepared: 07/16/2019 Analyzed: 07/17/2019					
Potassium	ND	300	ug/L				-			U
Magnesium	ND	30.0	"				-			U
Sodium	ND	250	"				-			U
Calcium	ND	200	"				-			U
BLANK (1204331458-BLK)					Prepared: 07/16/2019 Analyzed: 07/17/2019					
Calcium	ND	200	ug/L				-			U
Potassium	ND	300	"				-			U
Sodium	ND	250	"				-			U
Magnesium	ND	30.0	"				-			U
LCS (1204331459-BKS)					Prepared: 07/16/2019 Analyzed: 07/17/2019					
Sodium	1870	250	ug/L	2000		93.4	85-115			
Potassium	1830	300	"	2000		91.5	85-115			
Magnesium	1840	30.0	"	2000		92.1	85-115			
Calcium	2060	200	"	2000		103	85-115			
MS (1204331460 S)					Source: Y907186-01		Prepared: 07/16/2019 Analyzed: 07/17/2019			
Calcium	3200	200	ug/L	2000	1190	100	75-125			
Sodium	239000	5000	"	2000	242000	0	75-125			
Magnesium	1950	30.0	"	2000	230	86.1	75-125			
Potassium	2640	300	"	2000	874	88.5	75-125			
MSD (1204331461 SD)					Source: Y907186-01		Prepared: 07/16/2019 Analyzed: 07/17/2019			
Calcium	3190	200	ug/L	2000	1190	99.9	75-125	0.247	20	
Sodium	245000	5000	"	2000	242000	146	75-125	2.63	20	
Magnesium	1950	30.0	"	2000	230	86.2	75-125	0.0417	20	
Potassium	2640	300	"	2000	874	88.1	75-125	0.351	20	

Origins Laboratory, Inc.



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Aquionix
5545 W 56th Ave, Unit E
Arvada CO 80002

Scott Legg
Project Number: 44657-F Bientendorf
Project: Petroshare - Shook 1st Subsequent

Dissolved Metals by 200.8 - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch 1896385 - EPA 200.2

Origins Laboratory, Inc.



Jen Pellegrini, Project Manager

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Aquionix
5545 W 56th Ave, Unit E
Arvada CO 80002

Scott Legg
Project Number: 44657-F Bientendorf
Project: Petroshare - Shook 1st Subsequent

DRO by 8015C - Quality Control GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1896320 - SW846 3535A										
BLANK (1204331282-BLK)					Prepared: 07/16/2019 Analyzed: 07/16/2019					
Diesel Range Organics	ND	204	ug/L				-			U
Surrogate: o-Terphenyl	15.7		"	20.4		77	40-109			
LCS (1204331283-BKS)					Prepared: 07/16/2019 Analyzed: 07/16/2019					
Diesel Range Organics	738	204	ug/L	1020		72	45-119			
Surrogate: o-Terphenyl	15.0		"	20.4		73	40-109			
LCSD (1204331284-BKSD)					Prepared: 07/16/2019 Analyzed: 07/16/2019					
Diesel Range Organics	788	204	ug/L	1020		77	45-119	7	27	
Surrogate: o-Terphenyl	16.1		"	20.4		79	40-109			

Origins Laboratory, Inc.



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Aquionix
5545 W 56th Ave, Unit E
Arvada CO 80002

Scott Legg
Project Number: 44657-F Bientendorf
Project: Petroshare - Shook 1st Subsequent

TDS by EPA 160.1 - Quality Control GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1896664 -										
BLANK (1204332194-BLK)					Prepared: Analyzed: 07/17/2019					
Total Dissolved Solids	ND	14.3	mg/L				-			U
LCS (1204332195-BKS)					Prepared: Analyzed: 07/17/2019					
Total Dissolved Solids	290	14.3	mg/L	300		96.7	95-105			
DUP (1204332196 D)					Source: 484384002 Prepared: Analyzed: 07/17/2019					
Total Dissolved Solids	230	14.3	mg/L		231		0-5	0.619	5	
DUP (1204332200 D)					Source: Y907186-01 Prepared: Analyzed: 07/17/2019					
Total Dissolved Solids	589	14.3	mg/L		531		0-5	10.2	5	
DUP (1204332201 D)					Source: 484523001 Prepared: Analyzed: 07/17/2019					
Total Dissolved Solids	240	14.3	mg/L		109		0-5	75.4	5	

Origins Laboratory, Inc.



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Aquionix
5545 W 56th Ave, Unit E
Arvada CO 80002

Scott Legg
Project Number: 44657-F Bientendorf
Project: Petroshare - Shook 1st Subsequent

Notes and Definitions

Ua Sample is Non-Detect.

U Result not detected above the detection limit

QM-07 The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.

E Analyte Concentration exceeded the calibration range. The reported result is estimated.

ND Analyte NOT DETECTED at or above the reporting limit

RPD Relative Percent Difference

All soil results are reported on a wet weight basis.

Origins Laboratory, Inc.



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Jen Pellegrini, Project Manager



dig
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 #: 19072497
Lab #: DIG-019579
Client: Origins Laboratory
Sample Name(s): 44657-Bientendorf

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Analytical Report



Job #: 19072497
 Lab #: DIG-019579
 Client: Origins Laboratory
 Sample Name: 44657-Bientendorf
 Date Sampled: 07/11/19
 Time Sampled: 15:16
 Sample Description: 1L Bottle
 Sampling Notes:
 Date Received: 07/17/19
 Date Analyzed: Gas Composition: 6/26/19 $\delta^{13}\text{C}$: 7/30/19 δD : 8/1/19
 Date Reported: 08/01/19
 Comments:

Measured Values:	Measured ppm	Analyte mol % ^a	HC mol %	$\delta^{13}\text{C}$ ‰ VPDB	δD ‰ VSMOW	Comments
Nitrogen (N_2)	349195	53.03	-	-	-	
Oxygen + Argon (O_2+Ar)	34298	5.21	-	-	-	
Carbon Dioxide (CO_2)	564	0.09	-	-	-	
Helium (He) ^b	na	na	-	-	-	Helium added to create headspace.
Hydrogen (H_2)	nd	nd	-	-	-	
Methane (CH_4)	274019	41.61	99.83	-71.2	-264	
Ethane (C_2H_6)	454	0.07	0.17		-	
Ethene (C_2H_4)	nd	nd	nd		-	
Propane (C_3H_8)	nd	nd	nd		-	
iso-Butane (C_4H_{10})	nd	nd	nd		-	
n-Butane (C_4H_{10})	nd	nd	nd		-	
iso-Pentane (C_5H_{12})	nd	nd	nd		-	
n-Pentane (C_5H_{12})	nd	nd	nd		-	
Hexanes + (C_6H_{14})	nd	nd	nd		-	

Calculated Values:	
Total HCs (ppm)	274473
Gas Wetness (mol % C_2+C_1+)	0.17
$\text{C}_1/(\text{C}_2+\text{C}_3)$ (mol/mol)	604

^a Analyte concentrations normalized to 100% (Mol. % is approximately equal to Vol. %)

^b Addition of helium negates the ability to detect native helium and may negate the ability to detect hydrogen.

HC= Hydrocarbons

nd = not detected

na = not analyzed

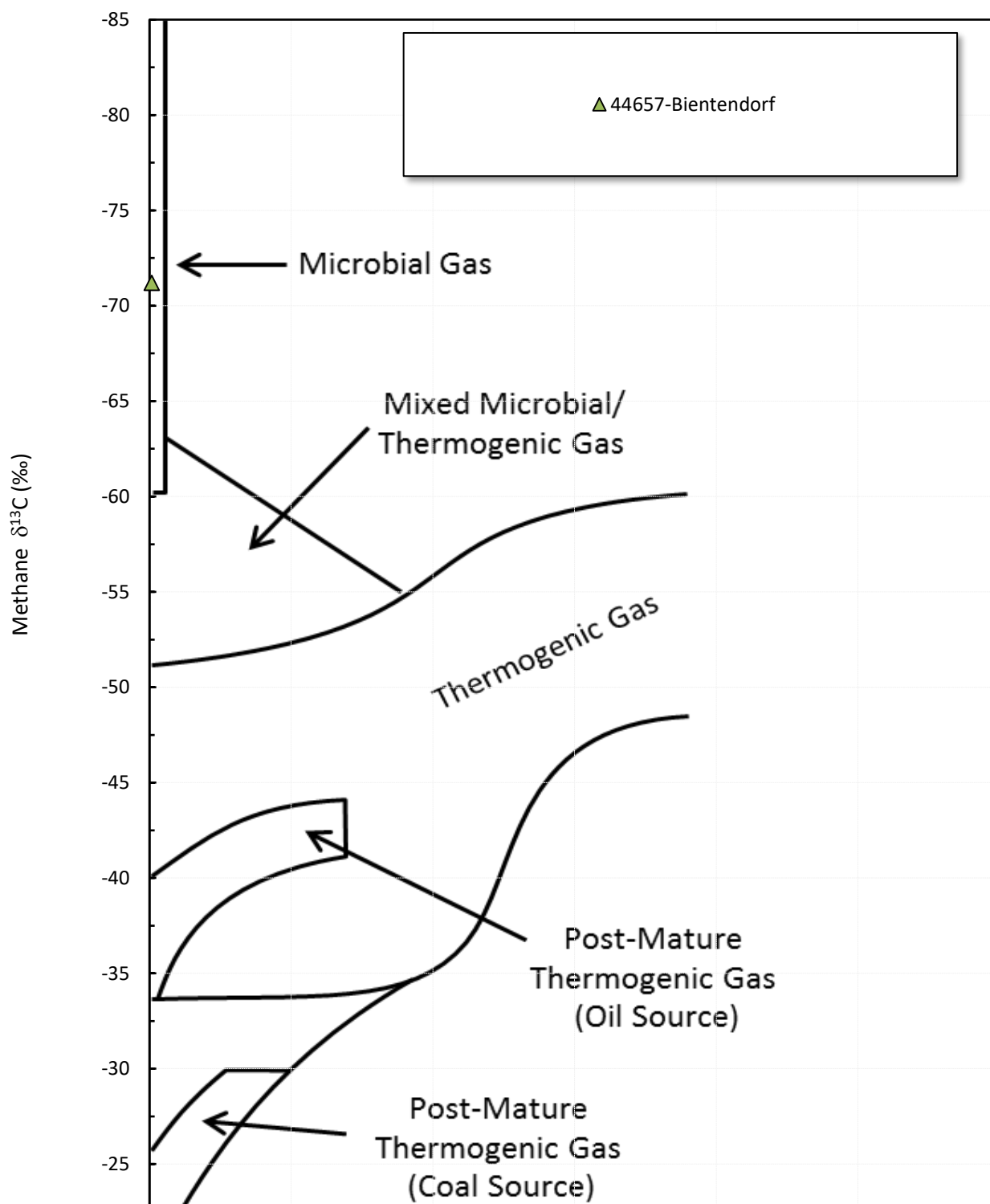
Stable isotope results based on multi-point laboratory calibration

Error $\delta^{13}\text{C}$ < 0.5 ‰

Error δD < 5.0 ‰

Stable Isotope Interpretive Plots

Methane vs Gas Wetness Genetic Classification Plot



Chain of Custody Form



JOB 19072497 DIG-019579



Geochemistry for Energy

1317 West 121st Ave
Westminster, CO 80234
p: 303.531.2030

Send Data and Invoice to:

Name: Jennifer Pellegrini
Company: Origins Laboratory
Address: 1725 W. Elk Pl
Denver, CO 80211
Phone: 303-433-1322
Fax: _____
Email: j.pellegrini@originslab.com

AFE #: _____
Report Ctr: _____
Project: 1907186
PO #: _____
Location: _____
Sampled By: _____

Sample Description

Sample Description										
Container #	Sample Identification	Date Sampled	Time							Comments
190718201	44657- Bientendorf	7/11/19	1516	X			X	X		

Chain-of-Custody Record

Signature	Company	Date	Time
Relinquished by <u>[Signature]</u>	<u>Origins</u>	<u>7/17/19</u>	<u>1230</u>
Received by <u>[Signature]</u>	<u>DEG</u>	<u>7/17/19</u>	<u>1230</u>
Relinquished by			
Received by			

*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