

Summit Scientific

4653 Table Mountain Drive, Golden, Colorado 80403

303.277.9310

February 18, 2019

Heather Shideman

Axis Exploration LLC

2234 117th Ave Ste. 106

Greeley, CO 80634

RE: BWSE/GWA_Houlihan_4_64_22A

Enclosed are the results of analyses for samples received by Summit Scientific on 02/04/19 16:10. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A handwritten signature in black ink on a light blue background. The signature is written in a cursive style and reads "Muri Premer".

Muri Premer For Ben Shrewsbury

Laboratory Manager



Axis Exploration LLC
2234 117th Ave Ste. 106
Greeley CO, 80634

Project: BWSE/GWA_Houlihan_4_64_22A

Project Number: AFE #221706 Code 961.15

Project Manager: Heather Shideman

Reported:
02/18/19 14:03

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
BW_Hansen_136017_SWNW_23_4S_64W	1902021-01	Water	02/04/19 12:00	02/04/19 16:10

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Summit Scientific

S₂

1902021

4653 Table Mountain Drive ♦ Golden, Colorado 80403

303-277-9310 ♦ 303-374-5933

Page 1 of 1

Client:	Axis Exploration, LLC (AXIS)	Report to:	Apex Companies, LLC	Project Manager:	Heather Shideman
Address:	2234 117th Ave, Ste 106	E-Mail:	Rochelle.Carlisle@apexcos.com, Heather.Shideman@apexcos.com		
City/State/Zip:	Greeley, CO 80634	cc:	bford@extractionog.com		
Phone:	(970) 576-3446	Project Name:	BWSE/GWA_Houlihan_4_64_22A		
Sampler Name:	David Stack	Project No.:	AFE # 221706; Code: 961.15	Facility ID	755926

ID	Field ID / Point of Collection	Date Sampled	Time Sampled	# of containers	Preservative				Matrix				Analysis Requested								Special Instructions													
					HCl	HNO ₃	None	Other (Specify)	Groundwater	Soil	Air-Canister Serial #	Other (Specify)	COGCC 609 minus Isotopes																					
1	BW_Hansen_136017	2/4/19	12:00	1					X					X	X	X								Sample Frequency: 1SUB										
	SWNW_23_4S_64W																																	
	Temperature, field:	12.25	°C																															
	pH, field:	7.64	s.u.																															
	Conductivity, field:	390.5	uS/cm																															
	ORP, field:	-180.9	mV																															
	Dissolved Oxygen, field:	0.05	mg/L																															
	Turbidity, field:	1.69	NTU																															
Relinquished by: David Stack					Date/Time: 2/4/19 16:10					Received by: [Signature]					Date/Time: 2-4-19 1610					Turn Around Time (Check)					Notes:									
																				Same Day _____ 72 hours _____					24 hours _____ Standard <u>X</u>					48 hours _____				
Relinquished by:					Date/Time:					Received by:					Date/Time:					Sample Integrity:					Temperature Upon Receipt: 11.2					Intact: <u>Yes</u> No				

Sample Receipt Checklist

S2 Work Order 1902021

Client: Axis Exploration / APEX Client Project ID: BWSE/GWA-Hawthorn-4-64-22A

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

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

Temp (°C)	<u>11.2</u>
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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.	<input checked="" type="checkbox"/>	<input 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"/>	
If custody seals are present, are they intact ⁽¹⁾ ?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Are samples with holding times due within 48 hours sample due within 48 hours present?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Is a chain-of-custody (COC) form present and filled out completely ⁽¹⁾ ?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	preserve & count of bottles
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 w/ date and time recorded ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
For volatiles in water – is there headspace 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 (excluding cooling) ⁽¹⁾ ? Note the type of preservative in the Comments column – HCl, H2SO4, NaOH, HNO3, ect	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	HCl, H2SO4
If samples are acid preserved for metals, is the pH ≤ 2 ⁽¹⁾ ? Record the pH in Comments.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
If dissolved metals are requested, were samples field filtered?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Additional Comments (if any):				

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

W
Custodian Printed Name or Initials

[Signature]
Signature of Custodian

2.4.19 1655
Date/Time



Axis Exploration LLC
2234 117th Ave Ste. 106
Greeley CO, 80634

Project: BWSE/GWA_Houlihan_4_64_22A
Project Number: AFE #221706 Code 961.15
Project Manager: Heather Shideman

Reported:
02/18/19 14:03

BW_Hansen_136017_SWNW_23_4S_64W
1902021-01 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: **02/04/19 12:00**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	ND	0.0010	mg/L	1	1902054	02/07/19	02/09/19	EPA 8260B	
Toluene	ND	0.0010	"	"	"	"	"	"	
Ethylbenzene	ND	0.0010	"	"	"	"	"	"	
m,p-Xylene	ND	0.0020	"	"	"	"	"	"	
o-Xylene	ND	0.0010	"	"	"	"	"	"	
Xylenes (total)	ND	0.0020	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	ND	0.050	"	"	"	"	"	"	

Date Sampled: **02/04/19 12:00**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		103 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		95.3 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		102 %	21-167		"	"	"	"	

Extractable Petroleum Hydrocarbons by 8015

Date Sampled: **02/04/19 12:00**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
C10-C28 (DRO)	ND	0.100	mg/L	1	1902118	02/08/19	02/08/19	EPA 8015M	

Date Sampled: **02/04/19 12:00**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: o-Terphenyl		51.6 %	44.8-129		"	"	"	"	

Dissolved Gases by RSK-175 mod

Date Sampled: **02/04/19 12:00**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
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BW_Hansen_136017_SWNW_23_4S_64W
1902021-01 (Water)

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Dissolved Gases by RSK-175 mod

Methane	5.2	1.0	mg/kg	100	1902090	02/06/19	02/07/19	RSK-175 mod
Ethane	ND	0.010	"	1	"	"	"	"
Propane	ND	0.010	"	"	"	"	"	"

Date Sampled: **02/04/19 12:00**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: Ethene		53.3 %	70-130		"	"	"	"	S-04

Dissolved Metals by EPA Method 200.8

Date Sampled: **02/04/19 12:00**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Calcium	26.2	0.0500	mg/L	1	1902055	02/05/19	02/05/19	EPA 200.8	
Iron	0.199	0.0100	"	"	"	"	"	"	
Magnesium	2.59	0.0500	"	"	"	"	"	"	
Manganese	0.0160	0.00100	"	"	"	"	"	"	
Potassium	4.36	0.0500	"	"	"	"	"	"	
Sodium	101	0.0500	"	"	"	"	"	"	
Barium	0.195	0.00100	"	"	"	"	"	"	
Boron	0.0710	0.0100	"	"	"	"	"	"	
Selenium	ND	0.00100	"	"	"	"	"	"	
Strontium	0.598	0.0100	"	"	"	"	"	"	

Anions by EPA Method 300.0

Date Sampled: **02/04/19 12:00**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Bromide	0.263	0.200	mg/L	1	1902047	02/05/19	02/05/19	EPA 300.0	
Chloride	16.2	5.00	"	50	"	"	"	"	
Fluoride	0.783	0.200	"	1	"	"	"	"	
Sulfate	4.76	0.300	"	"	"	"	"	"	
Nitrate as N	ND	0.100	"	"	"	"	"	"	
Nitrite as N	ND	0.100	"	"	"	"	"	"	
Nitrate/Nitrite as N	ND	0.200	"	"	"	"	"	"	

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BW_Hansen_136017_SWNW_23_4S_64W
1902021-01 (Water)

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Anions by EPA Method 300.0

Physical Parameters by APHA/ASTM/EPA Methods

Date Sampled: **02/04/19 12:00**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Total Alkalinity	270	10.0	mg/L as CaCO ₃	1	1902122	02/08/19	02/11/19	SM2320-B	
Carbonate	ND	10.0	"	"	"	"	"	"	
Bicarbonate	270	10.0	"	"	"	"	"	"	

Conventional Chemistry Parameters by APHA/EPA Methods

Date Sampled: **02/04/19 12:00**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Phosphorus - Total	ND	0.0500	mg/L	1	1902128	02/08/19	02/11/19	SM4500-P-E	

Specific Conductance by SM2510B

Date Sampled: **02/04/19 12:00**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Specific Conductance (EC)	550	1.00	umhos/cm	1	1902073	02/06/19	02/06/19	SM2510B	

Total Dissolved Solids by SM2540C

Date Sampled: **02/04/19 12:00**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Total Dissolved Solids	272	10.0	mg/L	1	1902072	02/06/19	02/06/19	SM2540C	

pH by SM4500

Date Sampled: **02/04/19 12:00**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
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BW_Hansen_136017_SWNW_23_4S_64W
1902021-01 (Water)

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pH by SM4500

pH	7.90	1.00	pH Units	1	1902046	02/04/19	02/04/19	SM4500-H+ B
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Biological Activity Reaction Test

Date Sampled: **02/04/19 12:00**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Iron Related Bacteria	2200	25.0	CFU/ml	1	1902061	02/05/19	02/18/19	BART	
Sulfate Reducing Bacteria	ND	200	"	"	"	"	"	"	
Slime Forming Bacteria	ND	500	"	"	"	"	"	"	

Field Data

Date Sampled: **02/04/19 12:00**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Specific Conductance (EC)	390.5		uS/cm	1	1902040	02/04/19	02/04/19	Field Method	
Temperature	12.25		Degrees C	"	"	"	"	"	
Oxidation/Reduction Potential	-180.9		mv	"	"	"	"	"	
Dissolved Oxygen	0.05		mg/L	"	"	"	"	"	
Turbidity	1.69		NTU	"	"	"	"	"	
pH	7.64		SU	"	"	"	"	"	

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Reported:
02/18/19 14:03

Volatile Organic Compounds by EPA Method 8260B - Quality Control

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

Batch 1902054 - EPA 5030 Water MS

Blank (1902054-BLK1)

Prepared: 02/07/19 Analyzed: 02/08/19

Benzene	ND	0.0010	mg/L							
Toluene	ND	0.0010	"							
Ethylbenzene	ND	0.0010	"							
m,p-Xylene	ND	0.0020	"							
o-Xylene	ND	0.0010	"							
Xylenes (total)	ND	0.0020	"							
Gasoline Range Hydrocarbons	ND	0.050	"							
Surrogate: 1,2-Dichloroethane-d4	0.0126		"	0.0133		94.6	23-173			
Surrogate: Toluene-d8	0.0128		"	0.0133		95.9	20-170			
Surrogate: 4-Bromofluorobenzene	0.0133		"	0.0133		99.9	21-167			

LCS (1902054-BS1)

Prepared: 02/07/19 Analyzed: 02/08/19

Benzene	0.0290	0.0010	mg/L	0.0333		86.9	51-132			
Toluene	0.0282	0.0010	"	0.0333		84.5	51-138			
Ethylbenzene	0.0343	0.0010	"	0.0333		103	58-146			
m,p-Xylene	0.0573	0.0020	"	0.0667		85.9	57-144			
o-Xylene	0.0298	0.0010	"	0.0333		89.4	53-146			
Surrogate: 1,2-Dichloroethane-d4	0.0127		"	0.0133		95.6	23-173			
Surrogate: Toluene-d8	0.0128		"	0.0133		95.9	20-170			
Surrogate: 4-Bromofluorobenzene	0.0131		"	0.0133		98.6	21-167			

Matrix Spike (1902054-MS1)

Source: 1902027-01

Prepared: 02/07/19 Analyzed: 02/08/19

Benzene	0.0291	0.0010	mg/L	0.0333	ND	87.2	34-141			
Toluene	0.0284	0.0010	"	0.0333	ND	85.3	27-151			
Ethylbenzene	0.0347	0.0010	"	0.0333	ND	104	29-160			
m,p-Xylene	0.0574	0.0020	"	0.0667	ND	86.1	20-166			
o-Xylene	0.0303	0.0010	"	0.0333	ND	90.8	33-159			
Surrogate: 1,2-Dichloroethane-d4	0.0129		"	0.0133		96.8	23-173			
Surrogate: Toluene-d8	0.0129		"	0.0133		96.6	20-170			
Surrogate: 4-Bromofluorobenzene	0.0139		"	0.0133		104	21-167			

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Project Number: AFE #221706 Code 961.15

Project Manager: Heather Shideman

Reported:
02/18/19 14:03

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 1902054 - EPA 5030 Water MS

Matrix Spike Dup (1902054-MSD1)	Source: 1902027-01			Prepared: 02/07/19 Analyzed: 02/08/19						
Benzene	0.0293	0.0010	mg/L	0.0333	ND	87.8	34-141	0.651	32	
Toluene	0.0291	0.0010	"	0.0333	ND	87.4	27-151	2.43	25	
Ethylbenzene	0.0347	0.0010	"	0.0333	ND	104	29-160	0.173	50	
m,p-Xylene	0.0580	0.0020	"	0.0667	ND	87.0	20-166	0.953	36	
o-Xylene	0.0304	0.0010	"	0.0333	ND	91.1	33-159	0.330	26	
Surrogate: 1,2-Dichloroethane-d4	0.0145		"	0.0133		109	23-173			
Surrogate: Toluene-d8	0.0130		"	0.0133		97.6	20-170			
Surrogate: 4-Bromofluorobenzene	0.0141		"	0.0133		106	21-167			

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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 1902118 - EPA 3520B

Blank (1902118-BLK1)

Prepared & Analyzed: 02/08/19

C10-C28 (DRO) ND 0.100 mg/L

Surrogate: o-Terphenyl 0.0138 " 0.0250 55.3 44.8-129

LCS (1902118-BS1)

Prepared & Analyzed: 02/08/19

C10-C28 (DRO) 0.823 0.100 mg/L 1.00 82.3 70-130

Surrogate: o-Terphenyl 0.0157 " 0.0250 62.7 44.8-129

Matrix Spike (1902118-MS1)

Source: 1902021-01

Prepared & Analyzed: 02/08/19

C10-C28 (DRO) 0.950 0.100 mg/L 1.00 ND 95.0 10-159

Surrogate: o-Terphenyl 0.0203 " 0.0250 81.0 44.8-129

Matrix Spike Dup (1902118-MSD1)

Source: 1902021-01

Prepared & Analyzed: 02/08/19

C10-C28 (DRO) 0.895 0.100 mg/L 1.00 ND 89.5 10-159 6.04 20

Surrogate: o-Terphenyl 0.0208 " 0.0250 83.1 44.8-129

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Dissolved Gases by RSK-175 mod - Quality Control

Summit Scientific

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

Batch 1902090 - GC

Blank (1902090-BLK1)

Prepared: 02/06/19 Analyzed: 02/07/19

Methane	ND	0.010	mg/kg							
Ethane	ND	0.010	"							
Propane	ND	0.010	"							
Surrogate: Ethene	0.0324		"	0.0364		89.0	70-130			

LCS (1902090-BS1)

Prepared: 02/06/19 Analyzed: 02/07/19

Methane	0.041	0.010	mg/kg	0.0428		96.1	70-130			
Ethane	0.071	0.010	"	0.0798		88.6	70-130			
Propane	0.098	0.010	"	0.139		70.5	70-130			
Surrogate: Ethene	0.0659		"	0.0728		90.5	70-130			

Duplicate (1902090-DUP1)

Source: 1902021-01

Prepared: 02/06/19 Analyzed: 02/07/19

Methane	5.1	1.0	mg/kg		5.2			1.03	30	
Ethane	0.0055	0.010	"		0.0060			8.70	30	
Propane	ND	0.010	"		ND				30	
Surrogate: Ethene	0.0194		"	0.0364		53.3	70-130			S-04

Matrix Spike (1902090-MS1)

Source: 1902021-01

Prepared: 02/06/19 Analyzed: 02/07/19

QM-07

Methane	5.6	1.0	mg/kg	0.0428	5.2	NR	70-130			
Ethane	0.070	0.010	"	0.0798	0.0060	79.7	70-130			
Propane	0.088	0.010	"	0.139	ND	63.4	70-130			
Surrogate: Ethene	0.0590		"	0.0728		81.0	70-130			

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Dissolved Metals by EPA Method 200.8 - Quality Control
Summit Scientific

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

Batch 1902055 - EPA 200.8

Blank (1902055-BLK1)

Prepared & Analyzed: 02/05/19

Calcium	ND	0.0500	mg/L
Iron	ND	0.0100	"
Magnesium	ND	0.0500	"
Manganese	ND	0.00100	"
Potassium	ND	0.0500	"
Sodium	ND	0.0500	"
Barium	ND	0.00100	"
Boron	ND	0.0100	"
Selenium	ND	0.00100	"
Strontium	ND	0.0100	"

LCS (1902055-BS1)

Prepared & Analyzed: 02/05/19

Calcium	5.74	0.0500	mg/L	5.00	115	80-120
Iron	5.39	0.0100	"	5.00	108	80-120
Magnesium	5.55	0.0500	"	5.00	111	80-120
Manganese	0.589	0.00100	"	0.500	118	80-120
Potassium	5.18	0.0500	"	5.00	104	80-120
Sodium	5.49	0.0500	"	5.00	110	80-120
Barium	0.505	0.00100	"	0.500	101	80-120
Boron	2.70	0.0100	"	2.50	108	80-120
Selenium	0.0518	0.00100	"	0.0500	104	80-120
Strontium	0.576	0.0100	"	0.500	115	80-120

Duplicate (1902055-DUP1)

Source: 1902008-01

Prepared & Analyzed: 02/05/19

Calcium	120	0.0500	mg/L	123	2.56	20
Iron	0.195	0.0100	"	0.201	2.87	20
Magnesium	46.2	0.0500	"	47.9	3.56	20
Manganese	0.0445	0.00100	"	0.0466	4.56	20
Potassium	7.00	0.0500	"	7.29	4.06	20
Sodium	134	0.0500	"	138	2.91	20
Barium	0.0937	0.00100	"	0.0965	2.91	20
Boron	0.291	0.0100	"	0.314	7.62	20
Selenium	0.00205	0.00100	"	0.00222	8.38	20
Strontium	1.44	0.0100	"	1.51	4.59	20

Summit Scientific

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Axis Exploration LLC
2234 117th Ave Ste. 106
Greeley CO, 80634

Project: BWSE/GWA_Houlihan_4_64_22A

Project Number: AFE #221706 Code 961.15

Project Manager: Heather Shideman

Reported:
02/18/19 14:03

Dissolved Metals by EPA Method 200.8 - Quality Control

Summit Scientific

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

Batch 1902055 - EPA 200.8

Matrix Spike (1902055-MS1)				Source: 1902008-01		Prepared & Analyzed: 02/05/19				
Calcium	128	0.0500	mg/L	5.00	123	102	75-125			
Iron	5.44	0.0100	"	5.00	0.201	105	75-125			
Magnesium	53.4	0.0500	"	5.00	47.9	109	75-125			
Manganese	0.609	0.00100	"	0.500	0.0466	113	75-125			
Potassium	12.1	0.0500	"	5.00	7.29	96.7	75-125			
Sodium	143	0.0500	"	5.00	138	101	75-125			
Barium	0.677	0.00100	"	0.500	0.0965	116	75-125			
Boron	2.96	0.0100	"	2.50	0.314	106	75-125			
Selenium	0.0635	0.00100	"	0.0500	0.00222	123	75-125			
Strontium	2.01	0.0100	"	0.500	1.51	99.2	75-125			

Matrix Spike Dup (1902055-MSD1)				Source: 1902008-01		Prepared & Analyzed: 02/05/19				
Calcium	128	0.0500	mg/L	5.00	123	103	75-125	0.0355	25	
Iron	5.59	0.0100	"	5.00	0.201	108	75-125	2.84	25	
Magnesium	51.7	0.0500	"	5.00	47.9	76.6	75-125	3.13	25	
Manganese	0.633	0.00100	"	0.500	0.0466	117	75-125	3.90	25	
Potassium	12.2	0.0500	"	5.00	7.29	98.7	75-125	0.843	25	
Sodium	143	0.0500	"	5.00	138	97.4	75-125	0.125	25	
Barium	0.687	0.00100	"	0.500	0.0965	118	75-125	1.40	25	
Boron	2.98	0.0100	"	2.50	0.314	107	75-125	0.833	25	
Selenium	0.0505	0.00100	"	0.0500	0.00222	96.5	75-125	22.8	25	
Strontium	2.06	0.0100	"	0.500	1.51	109	75-125	2.50	25	

Summit Scientific

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Axis Exploration LLC
2234 117th Ave Ste. 106
Greeley CO, 80634

Project: BWSE/GWA_Houlihan_4_64_22A

Project Number: AFE #221706 Code 961.15

Project Manager: Heather Shideman

Reported:
02/18/19 14:03

Anions by EPA Method 300.0 - Quality Control

Summit Scientific

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

Batch 1902047 - General Preparation

Blank (1902047-BLK1)

Prepared & Analyzed: 02/05/19

Bromide	ND	0.200	mg/L
Chloride	ND	0.100	"
Fluoride	ND	0.200	"
Sulfate	ND	0.300	"
Nitrate as N	ND	0.100	"
Nitrite as N	ND	0.100	"
Nitrate/Nitrite as N	ND	0.200	"

LCS (1902047-BS1)

Prepared & Analyzed: 02/05/19

Bromide	10.1	0.200	mg/L	10.0	101	90-110
Chloride	3.04	0.100	"	3.00	102	90-110
Fluoride	2.17	0.200	"	2.00	109	90-110
Sulfate	16.4	0.300	"	15.0	109	90-110
Nitrate as N	3.25	0.100	"	3.00	108	90-110
Nitrite as N	3.19	0.100	"	3.00	106	90-110

Duplicate (1902047-DUP1)

Source: 1902021-01

Prepared & Analyzed: 02/05/19

Bromide	0.235	0.200	mg/L	0.263	11.2	20
Chloride	17.9	0.100	"	16.2	9.86	20
Fluoride	0.672	0.200	"	0.783	15.3	20
Sulfate	4.41	0.300	"	4.76	7.67	20
Nitrate as N	ND	0.100	"	ND		20
Nitrite as N	ND	0.100	"	ND		20
Nitrate/Nitrite as N	ND	0.200	"	ND		20

Matrix Spike (1902047-MS1)

Source: 1902021-01

Prepared & Analyzed: 02/05/19

Bromide	10.3	0.200	mg/L	10.0	0.263	100	80-120
Chloride	13.9	0.100	"	3.00	16.2	NR	80-120
Fluoride	2.80	0.200	"	2.00	0.783	101	80-120
Sulfate	21.8	0.300	"	15.0	4.76	113	80-120
Nitrate as N	2.99	0.100	"	3.00	ND	99.6	80-120
Nitrite as N	3.14	0.100	"	3.00	ND	105	80-120

QM-02

Summit Scientific

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Axis Exploration LLC
2234 117th Ave Ste. 106
Greeley CO, 80634

Project: BWSE/GWA_Houlihan_4_64_22A

Project Number: AFE #221706 Code 961.15

Project Manager: Heather Shideman

Reported:
02/18/19 14:03

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 1902122 - General Preparation

Blank (1902122-BLK1)

Prepared: 02/08/19 Analyzed: 02/11/19

Total Alkalinity	ND	10.0	mg/L as CaCO3
Carbonate	ND	10.0	"
Bicarbonate	ND	10.0	"

LCS (1902122-BS1)

Prepared: 02/08/19 Analyzed: 02/11/19

Total Alkalinity	90.0	10.0	mg/L as CaCO3	100	90.0	80-120
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Duplicate (1902122-DUP1)

Source: 1902021-01

Prepared: 02/08/19 Analyzed: 02/11/19

Total Alkalinity	270	10.0	mg/L as CaCO3	270	0.00	20
Carbonate	ND	10.0	"	ND		20
Bicarbonate	270	10.0	"	270	0.00	20

Matrix Spike (1902122-MS1)

Source: 1902021-01

Prepared: 02/08/19 Analyzed: 02/11/19

Total Alkalinity	360	10.0	mg/L as CaCO3	100	270	90.0	70-130
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Matrix Spike Dup (1902122-MSD1)

Source: 1902021-01

Prepared: 02/08/19 Analyzed: 02/11/19

Total Alkalinity	360	10.0	mg/L as CaCO3	100	270	90.0	70-130	0.00	20
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Summit Scientific

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Axis Exploration LLC
2234 117th Ave Ste. 106
Greeley CO, 80634

Project: BWSE/GWA_Houlihan_4_64_22A

Project Number: AFE #221706 Code 961.15

Project Manager: Heather Shideman

Reported:
02/18/19 14:03

Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control
Summit Scientific

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

Batch 1902128 - General Preparation

Blank (1902128-BLK1)

Prepared: 02/08/19 Analyzed: 02/11/19

Phosphorus - Total ND 0.0500 mg/L

LCS (1902128-BS1)

Prepared: 02/08/19 Analyzed: 02/11/19

Phosphorus - Total 1.10 0.0500 mg/L 1.00 110 80-120

Duplicate (1902128-DUP1)

Source: 1902021-01

Prepared: 02/08/19 Analyzed: 02/11/19

Phosphorus - Total ND 0.0500 mg/L ND 20

Matrix Spike (1902128-MS1)

Source: 1902021-01

Prepared: 02/08/19 Analyzed: 02/11/19

Phosphorus - Total 1.11 0.0500 mg/L 1.00 ND 111 70-130

Matrix Spike Dup (1902128-MSD1)

Source: 1902021-01

Prepared: 02/08/19 Analyzed: 02/11/19

Phosphorus - Total 1.11 0.0500 mg/L 1.00 ND 111 70-130 0.00 20

Summit Scientific

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Axis Exploration LLC
2234 117th Ave Ste. 106
Greeley CO, 80634

Project: BWSE/GWA_Houlihan_4_64_22A

Project Number: AFE #221706 Code 961.15

Project Manager: Heather Shideman

Reported:
02/18/19 14:03

Specific Conductance by SM2510B - Quality Control

Summit Scientific

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

Batch 1902073 - General Preparation

Duplicate (1902073-DUP1)

Source: 1902021-01

Prepared & Analyzed: 02/06/19

Specific Conductance (EC)	558	1.00	umhos/cm	550	1.55	20
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Summit Scientific

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Axis Exploration LLC
2234 117th Ave Ste. 106
Greeley CO, 80634

Project: BWSE/GWA_Houlihan_4_64_22A

Project Number: AFE #221706 Code 961.15

Project Manager: Heather Shideman

Reported:
02/18/19 14:03

Total Dissolved Solids by SM2540C - Quality Control

Summit Scientific

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

Batch 1902072 - General Preparation

Blank (1902072-BLK1)

Prepared & Analyzed: 02/06/19

Total Dissolved Solids ND 10.0 mg/L

Duplicate (1902072-DUP1)

Source: 1902021-01

Prepared & Analyzed: 02/06/19

Total Dissolved Solids 274 10.0 mg/L 272 1.06 20

Summit Scientific

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Axis Exploration LLC
2234 117th Ave Ste. 106
Greeley CO, 80634

Project: BWSE/GWA_Houlihan_4_64_22A

Project Number: AFE #221706 Code 961.15

Project Manager: Heather Shideman

Reported:
02/18/19 14:03

pH by SM4500 - Quality Control

Summit Scientific

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

Batch 1902046 - General Preparation

LCS (1902046-BS1)

Prepared & Analyzed: 02/04/19

pH	9.25	1.00	pH Units	9.23	100	90-110
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Duplicate (1902046-DUP1)

Source: 1902021-01

Prepared & Analyzed: 02/04/19

pH	7.88	1.00	pH Units	7.90	0.253	20
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Summit Scientific

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Axis Exploration LLC
2234 117th Ave Ste. 106
Greeley CO, 80634

Project: BWSE/GWA_Houlihan_4_64_22A

Project Number: AFE #221706 Code 961.15

Project Manager: Heather Shideman

Reported:
02/18/19 14:03

Biological Activity Reaction Test - Quality Control
Summit Scientific

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

Batch 1902061 - General Preparation

Blank (1902061-BLK1)

Prepared: 02/05/19 Analyzed: 02/18/19

Iron Related Bacteria	ND	25.0	CFU/ml
Sulfate Reducing Bacteria	ND	200	"
Slime Forming Bacteria	ND	500	"

Summit Scientific

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Axis Exploration LLC
2234 117th Ave Ste. 106
Greeley CO, 80634

Project: BWSE/GWA_Houlihan_4_64_22A

Project Number: AFE #221706 Code 961.15
Project Manager: Heather Shideman

Reported:
02/18/19 14:03

Notes and Definitions

S-04	A sample matrix effect prevented complete surrogate recovery.
QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS/LCSD recovery.
QM-02	The RPD and/or percent recovery for this QC spike sample cannot be accurately calculated due to the high concentration of analyte inherent in the sample.
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