Western Water & Land, Inc.

May 2, 2023

Ms. Amy Yeldell
Environmental Protection Specialist
Colorado Division of Reclamation, Mining and Safety
1313 Sherman Street, Room 215
Denver, CO 80203

Mr. Scott Hall
Realty Specialist
U.S. Bureau of Land Management, GJFO
2815 H Road
Grand Junction, CO 81506

RE: Logan Wash Mine Retort Water Pipeline Release Report (Permit No. M-1977-424)

Dear Ms. Yeldell and Mr. Hall:

Western Water & Land, Inc. (WWL), as agent for Occidental Oil Shale, Inc., has prepared this report to describe the events associated with a discovered release from the Logan Wash Mine (Permit No. M-1977-424) retort pipeline on the morning of April 14th, 2023.

Background

Mine water at Logan Wash Mine originates as deep percolation of meteoric precipitation through the upper Parachute Creek Member of the Green River Formation. Some of this groundwater percolates through natural fractures and into the modified in-situ retorts within the mine. Retorting involved the combustion and high-temperature heating of oil shale in large rubblized areas. Percolation of groundwater through the retorts is captured in sumps and piped from the mine. The retore water is conveyed approximately 5 miles to an Evaporation Pond by way of a buried 4- to 6-inch polyvinyl chloride (PVC) pipe. The retort pipe is located underneath or immediately adjacent to Logan Wash Road at a depth of 6 to 7 feet below ground surface The pipe can be accessed by a number of vaults with cast iron manhole covers located in or adjacent to the road. In recent years, the discharge rate of the retort water has been approximately 2.2 gallons per minute (gpm).

Findings

WWL was conducting standard monitoring tasks at the mine facilities on April 13th, 2023 when it was found that no retort water was entering and passing through the Lower Manhole, near the Evaporation Pond. However, flow was observed at the Upper Manhole closer to the mine site. This observation indicated that there was a break or plug in the pipeline within the four-mile segment of the pipeline between the two manholes.

743 Horizon Court Suite 330, Grand Junction, CO 81506
Phone: (970) 242-0170 Fax: (970) 242-0270

A commercial vacuum and pot-holing contractor was available to mobilize to the site on the same afternoon. The goal was to locate and access individual manholes along the pipeline progressively working upstream of the Lower Manhole in an effort to identify the plugged or broken section. One manhole (MH #7) was located quickly using pot-holing methods on Logan Wash Road near the intersection with Evaporation Pond Access Road; no flow was present at this manhole. Working up the pipeline, MH #8 was not found, and a large wash-out scour on the road prevented the vacuum truck from proceeding further up the pipeline alignment.

The retort pipeline was not shut-in overnight for the following reasons: 1) Logan Wash Road is currently snowed-in and the mine is not reachable by vehicle; 2) hiking into the mine would take several hours, 3) shutting in the mine retort water normally involves confined space procedures; and 4) shutting-in the retort pipeline presents an additional risk of an underground release. Such an event would require reopening the plugged portal, ventilating the mine, and addressing safe mine entry issues to investigate and remedy the situation. WWL arranged for a mini-excavator contractor to be on site the next morning, April 14th, to assist in locating pipeline manholes located further up the road.

The morning of Friday, April 14th saw moderate to heavy wet snowfall and sleet. Upon arrival at the site, WWL immediately inspected the large wash-out scour on Logan Wash Road. The scouring exposed the retort pipeline at its buried depth of approximately seven feet below the grade of the road. The retort pipeline was broken with complete displacement in one location and fractures in two other locations. It appeared that a large snow melt runoff event had flooded Logan Wash which then flooded onto Logan Wash Road causing deep erosion in the northern bar ditch. This water apparently began to scour toward the center of Logan Wash Road causing the large observed washout. It appeared that sloughing from the side of the washout fell on the side and top of the pipeline, causing it to break. Figure 1 shows the location of the release.

Retort water from the broken pipeline was flowing at an estimated rate of 2.2 gpm (measured the previous day at the Upper Manhole) into the scour and mixing with natural runoff (approximately 20 gpm). About 70 feet downstream of the pipeline break, the flow in the scour merged with flow in Logan Wash. Flow in Logan Wash was estimated at no more than 0.5 cubic feet per second (cfs) or approximately 224 gpm.

By phone message, WWL notified Mr. Scott Hall of the U.S. Bureau of Land Management (BLM) of the release at approximately 10:30 am and also by phone message, WWL notified the Colorado Division of Reclamation, Mining and Safety (DRMS) of the pipeline release at 10:36 am. Unfortunately, it was later determined that the call to Scott Hall, did not go through to him. However, DRMS had communicated the release to the BLM.

The excavator operator was instructed to remove sloughed soils on top of the broken pipe and prepare the area for pipeline repair. The pipeline was repaired and the water release was stopped at approximately 2:00 pm. To protect the pipeline from another break from sloughing material, the scour and pipeline was backfilled with approximately 3 feet of native soil and sediment materials from the road and runoff sediment deposits adjacent to the scour. This did not completely fill the scour; over three feet of vertical face remained. Safety cones were placed at the entrance to the washout to warn oncoming vehicles of the hazard.

Prior to partially backfilling the exposed pipeline, three samples were collected at the release site: two soil/sediment samples and one water sample of the released retort water. Soil and sediment sample "Release Channel" was collected approximately 40 feet downstream of the pipeline break and within the scour channel. Soil and sediment sample "Logan Wash Channel" was collected approximately 100

feet upstream of the confluence with the scour channel in the main Logan Wash channel to serve as a background sediment sample. Both sediment samples consisted of a composite of approximately 6 subsamples collected immediately adjacent to and within the active flowing channel. The water sample "Retort Pipe 41423" was collected directly from the broken retort pipeline. Figure 2 shows the locations of the collected samples.

Photographs of the release site, pipeline repair, and the interim backfilled scour are shown in Attachment A.

Laboratory Analysis and Results

Site samples associated with the release were collected on a Friday, April 14th. To maintain sample preservation, WWL refrigerated the samples over the weekend and shipped them to Pace Laboratories in Mount Juliet, Tennessee on Monday, April 17th, 2023. A three-day turn-around was requested. Requested analytes included Total Petroleum Hydrocarbons (TPH, i.e., DRO and GRO), for both the soil/sediment and water samples, and the additional analytes for the retort water sample of alkalinity, alkalinity bicarbonate, alkalinity carbonate, total phosphorus, dissolved metals of arsenic, boron, calcium, iron, magnesium, potassium, selenium, and sodium; anions chloride, bromide, nitrate, nitrite, and sulfate; the volatile organic compounds (VOCs) benzene, toluene, ethylbenzene, and total xylenes (BTEX), pH, and specific conductance.

Preliminary results of the laboratory analysis were provided by Pace Laboratories on Friday, April 21st. However, the results indicated a suspected error in the wet chemistry analysis of alkalinity and pH. WWL requested that these parameters be reanalyzed. To support reanalysis, WWL shipped overnight on Monday, April 23rd, an additional sample volume that had been collected, refrigerated and saved on April 14th. WWL requested an extended metals analyses for this extra sample volume. On Friday April 28th, Pace submitted the results of the reanalysis of the initial submittal, as well as the results of the extended metals analysis from the additional sample.

Table 1 summarizes the preliminary and subsequent analytical results for sample Retort Pipe 41423, and Table 2 summarizes preliminary results for soil/sediment samples Release Channel and Logan Wash Channel. The complete laboratory analytical report for the soil analysis is in Attachment B.

The analytical results shown in Table 1 show that concentrations of the constituents of boron, molybdenum, and selenium exceeded one or more state water quality standards. The concentration of boron in retort water is within the historical range of biannual sampling results; boron concentrations are relatively high in groundwater in the Piceance Basin, especially in the Green River Formation. The selenium concentration of 6.77 µg/L is also somewhat typical of retort water, whereas the second result of 16.4 µg/L is uncharacteristically above most concentrations in historical data. No historical data for molybdenum concentration in retort water is available. It is likely these elements attenuated in concentration by dilution when mixing with stormwater runoff in Logan Wash and by adsorption to sediment downstream of the retort pipeline release. Note that six background soil samples collected between 5 to 7 and 8 to 10 feet below ground surface in 2018 to support soil sampling under the Evaporation Pond liner showed a selenium concentration ranging from 5.2 to 16 mg/Kg (dry).

Table 2 shows that the TPH parameters tested in both the background (Logan Wash Channel) and the release-site sample (Release Channel) differed in the concentration of DRO, showing 3.49 and 8.75 mg/L, respectively. However, the concentration of GRO was virtually the same between the two samples at 0.376 mg/Kg in the Logan Wash Channel and 0.380 mg/Kg in the Release Channel. The total TPH was well below the typical threshold level of 500 mg/Kg proposed by the Colorado Division of Oil and Public Safety (DOPS).

Recommendations

On the basis of the analytical results of soil and retort water samples collected at the release location, WWL does not recommend remediation of the affected soils as TPH concentrations in the soils are well below the DOPS threshold limit, and potential metals contamination was likely minimal and within background soil concentrations for some metals.

The BLM visited the release site on Monday, April 17th, and the DRMS conducted an inspection of the site on April 21st.

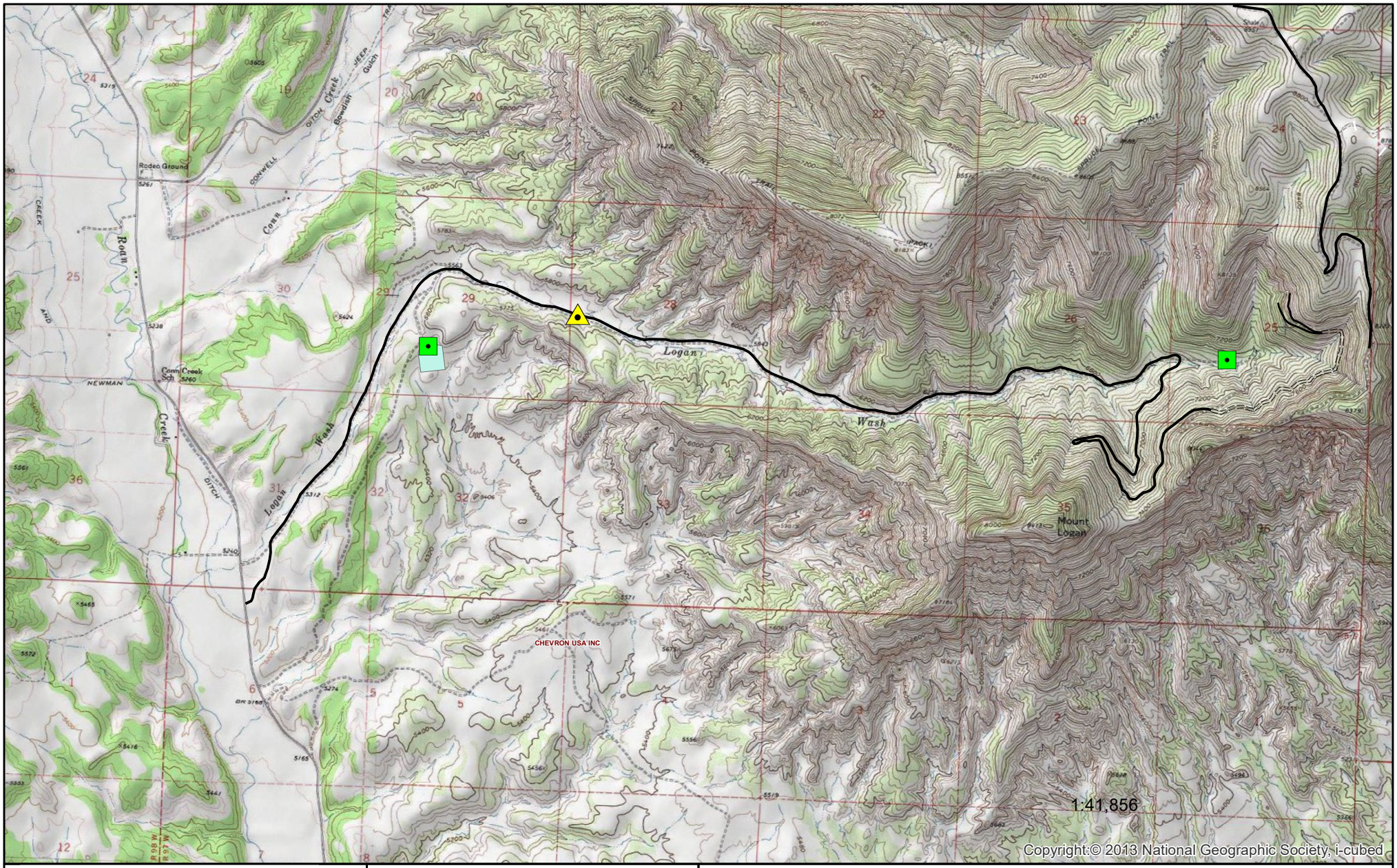
If you wish to conduct further mutual inspections of the spill site or have questions, please contact me at (970) 242-0170.

Sincerely,

Bruce D. Smith
WESTERN WATER & LAND, INC.

cc: David Anderson, Sr. Project Manager, Glenn Springs Holdings, Inc.

Attachments



Legend

- Release Point
- Upper and Lower Manhole
- Evaporation Pond
- Logan Wash Road

Garfield County, Colorado

Figure 1. Logan Wash Mine Retort Pipeline Release

Western Water & Land, Inc.

0 0.5 1 2 Miles

N

Legend

- Soil Sample Location
- Release Water Sample Location
- Logan Wash Road

Garfield County, Colorado

Figure 2. Logan Wash Mine Retort Pipeline Release Sample Locations

Western Water & Land, Inc.

0 75 150 300 Feet

N

Table 1. Logan Wash Mine Retort Water Spill Sample Analytical Results April 14, 2023

		Retort Pipe 41423						Colorado Regulation # 37 Water Quality Standards For Roan Creek Segment 14c[1]			
Parameters	**Units**	**Result 4/19/23[2]**	**Result 4/26/23[3]**	**Qualifier**	**MDL**	**RL**	**Dilution Factor**	**Units**	**Acute**	**Chronic**	**Basis**
General Chemistry											
Alkalinity	µg/L	U	363000		8450	20000	1				
Alkalinity, Bicarbonate	µg/L	U	363000		8450	20000	1				
Alkalinity, Carbonate	µg/L	U	U	U	8450	20000	1				
Bromide	µg/L	36400	36400	J	35300	100000	100				
Chloride	µg/L	141000	141000		37900	100000	100	µg/L		250000	
Sulfate	µg/L	5160000	5160000		59400	500000	100	µg/L			WS
Nitrate (as N)	µg/L	4870	4870	J, T8	4800	10000	100	µg/L	10000		
Nitrite (as N)	µg/L	U	U	T8	4200	10000	100	µg/L		50	
pH	s.u.	2.21	8.09	T8			1	s.u.	6.5-9.0		
Phosphorus, total	µg/L	42.2	42.2	J	35.5	100	1	µg/L		170	
Total Dissolved Solids	µg/L	9960000				200000	1				
Specific Conducatance	µmhos/cm	9260	9260			10	1				
Metals											
Arsenic	µg/L	33.2	39.8		4.4	10	5/1	µg/L	340	20T	
Arsenic(T)	µg/L		28.2		4.4	10					
Boron	µg/L	13200			96.3	300	10	µg/L	750		
Cadmium	µg/L		1.1	J	0.479	2	1	µg/L	5.68	1.82	TVS
Cadmium(T)	µg/L		U		0.479	2	1	µg/L	5		
Calcium	µg/L	60800			468	5000	5				
Chromium III	µg/L		U		1.4	10	1	µg/L	1567	204	TVS
Chromium VI	µg/L		U	T8	3	10	1	µg/L	16	11	
Copper	µg/L		U		3.68	10		µg/L	43	25.7	TVS
Iron	µg/L	U	34.8	BJ	18	100	1	µg/L		1000000	WS
Iron(T)	µg/L		53.3	J	18	100	1	µg/L		1000	
Lead	µg/L		U		2.99	6	1	µg/L	240	9.4	TVS
Lead(T)	µg/L		U		2.99	6	1	µg/L	50		TVS
Manganese	µg/L		20.3		0.934	10	1	µg/L	4506	2489	WS/TVS
Mercury(T)	µg/L		U		0.1	0.2	1	µg/L		0.01	TVS
Molybdenum(T)	µg/L		1910		1.16	5	1	µg/L		150	
Potassium	µg/L	1010000			540	10000	5				
Nickel	µg/L		U		1.61	10	1	µg/L	1332	148	TVS
Nickel(T)	µg/L		U		1.61	10	1	µg/L		100	TVS
Selenium	µg/L	6.77J	16.4		1.5/7.35	10	5/1	µg/L	18.4	4.6	
Silver	µg/L		U		1.54	5	1	µg/L	17	0.63	TVS
Sodium	µg/L	1380000			1880	10000	5				
Uranium	µg/L		3.79	J	0.07	20	1	µg/L	9375	5856	TVS
Zinc	µg/L		U		6.52	50	1	µg/L	492	373	TVS
Volatile Organic Compounds - BTEX								**Human Health-Based Water Supply**			
Benzene	µg/L	U	U		0.0941	1	1	µg/L	2.3 to 5M		
Ethylbenzene	µg/L	U	U		0.137	1	1	µg/L	700M		
Toluene	µg/L	U	U		0.278	1	1	µg/L	560 to 1000M		
Xylenes, Total	µg/L	U	U		0.174	3	1	µg/L	1400 to10000M		
Total Petroleum Hydrocarbons											
DRO (C10-C28)	µg/L	2810	2810		24.7	100	1				
GRO (C6-C10)	µg/L	U	U		157	500	5				

Trip Blank Results

Benzene	µg/L	U		0.0941	100	1
Ethylbenzene	µg/L	U		0.137	100	1
Toluene	µg/L	U		0.278	100	1
Xylenes, Total	µg/L	U		0.174	100	1
Total Petroleum Hydrocarbons						
GRO (C6-C10)	µg/L	U		31.4	100	1

[1] Colorado Department of Public Health and Environment Water Quality Control Commission

[2] Initial analysis conducted on 4/18-19/23. Suspect results for pH and alkalinity resulted in reanalysis on 4/26/23 which also included additional metals as shown. A reanalysis of pH and alkalinity on 4/25-26/23 showed a pH of 7.78 and Total and Bicarbonate Alkalinty of 340000 µg/L.

[3] Additional saved sample volume was analyzed for metals listed in CDPHE Colorado Regulation # 37 Water Quality Standards For Roan Creek Segment 14c

U = undetected

J = The identification of the analyte is acceptable; the reported value is an estimate.

T8 = Sample received past to or past holding time expiration.

WS = Water supply

D = Dissolved

T = Total

M = Drinking water maximum contaminant level

Regulation 31 and 37. 5 CCR 1002 -31 and 5 CCR 1002-37

https://www.coloradosos.gov/CCR/GenerateRulePdf.do?ruleVersionId=9874&fileName=5%20CCR%201002-31

Orange highlight = constituenent concentration exceeds a state standard

Table 2. Preliminary Logan Wash Mine Retort Water Spill Soil Sample Analytical Results April 14, 2023

		Sample ID									
		Release Channel					Logan Wash Channel				
Parameters	**Units**	**Result 4/19/23**	**Qualifier**	**MDL**	**RL**	**Dilution Factor**	**Result 4/19/23**	**Qualifier**	**MDL**	**RL**	**Dilution Factor**
Petroleum Products											
DRO (C10-C28)	mg/Kg	8.75		0.937	4.87	1	3.49	J	0.907	4.72	1
GRO (C6-C10)	mg/Kg	0.38		0.0264	0.122	1	0.443		0.0256	0.118	1

J = The identification of the analyte is acceptable; the reported value is an estimate.

ATTACHMENT A

PHOTOGRAPHS

Photo 1. Washout on Logan Wash Road.

Photo 2. Washout on Logan Wash Road showing exposed Retort Pipeline

Photo 3. Washout on Logan Wash Road showing exposed Retort Pipeline

Photo 4. Washout on Logan Wash Road showing soil excavation near exposed Retort Pipeline.

Photo 5. Building soil ramp into washout.

Photo 6. Exposed broken Retort Pipe in bottom of washout.

Photo 7. Repaired Retort Pipeline.

Photo 8. Backfilling over repaired Retort Pipeline

Photo 9. Interim backfilling complete at washout.

Photo 10. Upstream view of Logan Wash; washout is to right.

Photo 11. Washout tributary to Logan Wash.

Photo 12. Downstream of confluence of washout tributary (left) to Logan Wash.

Photo 13. View looking upstream in Logan Wash channel plugged by sediment debris at crossing of Logan Wash Road.

Photo 14. Plugged culverts at crossing of Logan Wash Road and Logan Wash.

Photo 15. Scoured bar ditch on north side of Logan Wash Road that resulted in large eroded washout.

Photo 16. Final regraded washout location.

ATTACHMENT B

LABORATORY REPORTS

Note: the Preliminary report from Pace showing undetected alkalinity and a pH of 2.2 for the Retort Pipe 41423 sample was reissued by Pace after correct analysis was performed; the original report is no longer available.

ANALYTICAL REPORT

April 28, 2023

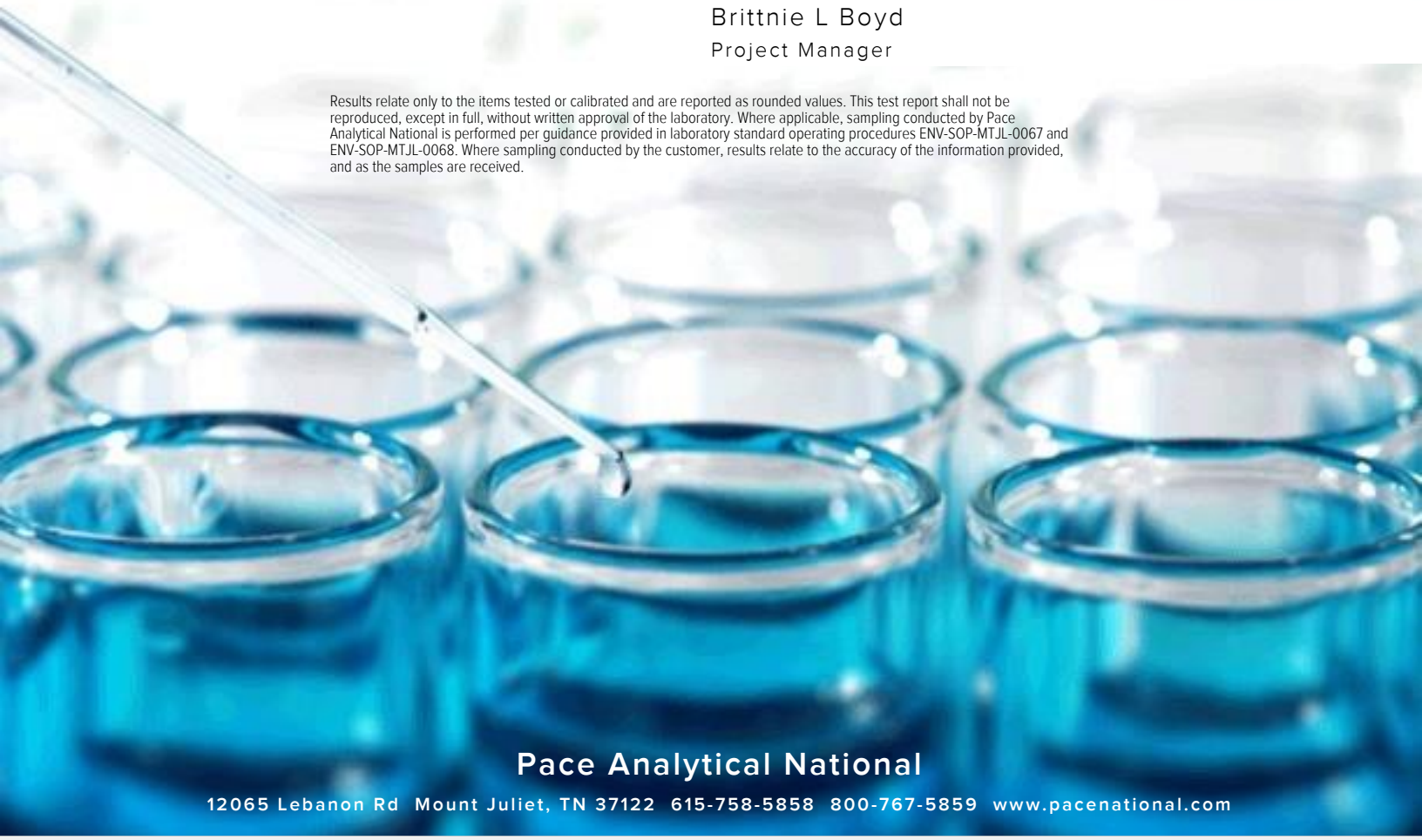
GHD-Houston, TX-Glenn Springs Holdings

Sample Delivery Group:	L1606161
Samples Received:	04/18/2023
Project Number:	14266DM
Description:	Logan Wash Mine
Site:	LOGAN WASH RETORT PIPELINE
Report To:	Sheri Finn;Bruce Smith 2055 Niagara Falls Blvd. #3 Niagara Falls, NY 14034

Entire Report Reviewed By:

Brittnie L Boyd
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

TABLE OF CONTENTS

LOGAN WASH CHANNEL L1606161-01 Solid

Collected by: Bruce Smith | Collected date/time: 04/14/23 00:00 | Received date/time: 04/18/23 09:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG2044473	1	04/19/23 07:38	04/19/23 07:54	CMK	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 8015D/GRO	WG2044255	1	04/18/23 16:51	04/19/23 12:28	NCC	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method 8015	WG2044023	1	04/18/23 15:55	04/18/23 21:33	KAP	Mt. Juliet, TN

RELEASE CHANNEL L1606161-02 Solid

Collected by: Bruce Smith | Collected date/time: 04/14/23 00:00 | Received date/time: 04/18/23 09:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG2044473	1	04/19/23 07:38	04/19/23 07:54	CMK	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 8015D/GRO	WG2044255	1	04/18/23 16:51	04/19/23 12:50	NCC	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method 8015	WG2044023	1	04/18/23 15:55	04/19/23 02:06	KAP	Mt. Juliet, TN

RETORT PIPE 41423 L1606161-03 GW

Collected by: Bruce Smith | Collected date/time: 04/14/23 13:30 | Received date/time: 04/18/23 09:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Microbiology by Method BART	WG2044095	1	04/28/23 08:25	04/28/23 08:25	TMP	Mt. Juliet, TN
Gravimetric Analysis by Method 2540 C-2011	WG2044865	1	04/19/23 20:22	04/20/23 00:53	ARD	Mt. Juliet, TN
Wet Chemistry by Method 2320 B-2011	WG2048264	1	04/26/23 10:37	04/26/23 10:37	ARD	Mt. Juliet, TN
Wet Chemistry by Method 365.4	WG2045036	1	04/19/23 09:38	04/19/23 17:22	UNP	Mt. Juliet, TN
Wet Chemistry by Method 9040C	WG2048489	1	04/25/23 18:44	04/25/23 18:44	KAD	Mt. Juliet, TN
Wet Chemistry by Method 9050A	WG2041510	1	04/19/23 17:33	04/19/23 17:33	NTG	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG2045531	100	04/21/23 02:01	04/21/23 02:01	GEB	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG2045324	10	04/20/23 18:48	04/20/23 23:13	LD	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG2045324	5	04/20/23 18:48	04/21/23 00:10	JPD	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 8015D/GRO	WG2044664	5	04/19/23 15:41	04/19/23 15:41	KSD	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG2044188	1	04/18/23 18:16	04/18/23 18:16	ACG	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method 3511/8015	WG2043578	1	04/18/23 20:36	04/19/23 15:24	TJD	Mt. Juliet, TN

TRIP BLANK L1606161-04 GW

Collected by: Bruce Smith | Collected date/time: 04/14/23 00:00 | Received date/time: 04/18/23 09:30

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC) by Method 8015D/GRO	WG2044316	1	04/19/23 02:30	04/19/23 02:30	ACG	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG2044188	1	04/18/23 17:33	04/18/23 17:33	ACG	Mt. Juliet, TN

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Brittnie L Boyd
Project Manager

Project Narrative

The following reactions were observed on one or more samples within this SDG.

BR Brown Ring
FO Foam
GC Green Cloudy
BB Blackened Base
BT Blackening around Ball
SR Slime Ring around Ball

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	84.8		1	04/19/2023 07:54	WG2044473

Volatile Organic Compounds (GC) by Method 8015D/GRO

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
TPH (GC/FID) Low Fraction	0.443		0.0256	0.118	1	04/19/2023 12:28	WG2044255
(S) a,a,a-Trifluorotoluene(FID)	*92.9*			*77.0-120*		*04/19/2023 12:28*	WG2044255

Semi-Volatile Organic Compounds (GC) by Method 8015

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
TPH (GC/FID) High Fraction	3.49	J	0.907	4.72	1	04/18/2023 21:33	WG2044023
(S) o-Terphenyl	*65.5*			*18.0-148*		*04/18/2023 21:33*	WG2044023

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	82.1		1	04/19/2023 07:54	WG2044473

Volatile Organic Compounds (GC) by Method 8015D/GRO

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
TPH (GC/FID) Low Fraction	0.380		0.0264	0.122	1	04/19/2023 12:50	WG2044255
(S) a,a,a-Trifluorotoluene(FID)	*92.8*			*77.0-120*		*04/19/2023 12:50*	WG2044255

Semi-Volatile Organic Compounds (GC) by Method 8015

Analyte	Result (dry)	Qualifier	MDL (dry)	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg	mg/kg		date / time	
TPH (GC/FID) High Fraction	8.75		0.937	4.87	1	04/19/2023 02:06	WG2044023
(S) o-Terphenyl	*92.5*			*18.0-148*		*04/19/2023 02:06*	WG2044023

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Microbiology by Method BART

Analyte	Result	Qualifier	Dilution	Analysis date / time	Batch
Iron Related Bacteria	Present		1	04/28/2023 08:25	WG2044095
Slime Forming Bacteria	Present		1	04/28/2023 08:25	WG2044095
Sulfate Reducing Bacteria	Present		1	04/28/2023 08:25	WG2044095

Sample Narrative:

L1606161-03 WG2044095: IRB Approximate Population=35,000 CFU/mL. Reactions=FO/BR/GC.
L1606161-03 WG2044095: SLYM Approximate Population=500 CFU/mL. Reactions=SR.
L1606161-03 WG2044095: SRB Approximate Population=115,000 CFU/mL. Reactions=BT/BB.

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result ug/l	Qualifier	RDL ug/l	Dilution	Analysis date / time	Batch
Dissolved Solids	9960000		200000	1	04/20/2023 00:53	WG2044865

Wet Chemistry by Method 2320 B-2011

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Alkalinity	340000		8450	20000	1	04/26/2023 10:37	WG2048264
Alkalinity,Bicarbonate	340000		8450	20000	1	04/26/2023 10:37	WG2048264
Alkalinity,Carbonate	U		8450	20000	1	04/26/2023 10:37	WG2048264

Sample Narrative:

L1606161-03 WG2048264: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 365.4

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Phosphorus,Total	42.2	J	35.0	100	1	04/19/2023 17:22	WG2045036

Wet Chemistry by Method 9040C

Analyte	Result su	Qualifier	Dilution	Analysis date / time	Batch
pH	7.78	T8	1	04/25/2023 18:44	WG2048489

Sample Narrative:

L1606161-03 WG2048489: 7.78 at 19.4C

Wet Chemistry by Method 9050A

Analyte	Result umhos/cm	Qualifier	RDL umhos/cm	Dilution	Analysis date / time	Batch
Specific Conductance	9260		10.0	1	04/19/2023 17:33	WG2041510

Sample Narrative:

L1606161-03 WG2041510: at 25C

Wet Chemistry by Method 9056A

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Bromide	36400	J	35300	100000	100	04/21/2023 02:01	WG2045531
Chloride	141000		37900	100000	100	04/21/2023 02:01	WG2045531
Nitrate	4870	J T8	4800	10000	100	04/21/2023 02:01	WG2045531
Nitrite	U	T8	4200	10000	100	04/21/2023 02:01	WG2045531
Sulfate	5160000		59400	500000	100	04/21/2023 02:01	WG2045531

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Arsenic,Dissolved	33.2		0.900	10.0	5	04/21/2023 00:10	WG2045324
Boron,Dissolved	13200		96.3	300	10	04/20/2023 23:13	WG2045324
Calcium,Dissolved	60800		468	5000	5	04/21/2023 00:10	WG2045324
Iron,Dissolved	U		140	500	5	04/21/2023 00:10	WG2045324
Magnesium,Dissolved	46800		368	5000	5	04/21/2023 00:10	WG2045324
Potassium,Dissolved	1010000		540	10000	5	04/21/2023 00:10	WG2045324
Selenium,Dissolved	6.77	J	1.50	10.0	5	04/21/2023 00:10	WG2045324
Sodium,Dissolved	1380000		1880	10000	5	04/21/2023 00:10	WG2045324

Volatile Organic Compounds (GC) by Method 8015D/GRO

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
TPH (GC/FID) Low Fraction	U		157	500	5	04/19/2023 15:41	WG2044664
(S) a,a,a-Trifluorotoluene(FID)	*114*			*78.0-120*		*04/19/2023 15:41*	WG2044664

Sample Narrative:

L1606161-03 WG2044664: Lowest possible dilution due to sample foaming.

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Benzene	U		0.0941	1.00	1	04/18/2023 18:16	WG2044188
Toluene	U		0.278	1.00	1	04/18/2023 18:16	WG2044188
Ethylbenzene	U		0.137	1.00	1	04/18/2023 18:16	WG2044188
Total Xylenes	U		0.174	3.00	1	04/18/2023 18:16	WG2044188
(S) Toluene-d8	*103*			*80.0-120*		*04/18/2023 18:16*	WG2044188
(S) 4-Bromofluorobenzene	*95.6*			*77.0-126*		*04/18/2023 18:16*	WG2044188
(S) 1,2-Dichloroethane-d4	*114*			*70.0-130*		*04/18/2023 18:16*	WG2044188

Semi-Volatile Organic Compounds (GC) by Method 3511/8015

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
TPH (GC/FID) High Fraction	2810		24.7	100	1	04/19/2023 15:24	WG2043578
(S) o-Terphenyl	*123*			*31.0-160*		*04/19/2023 15:24*	WG2043578

Volatile Organic Compounds (GC) by Method 8015D/GRO

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
TPH (GC/FID) Low Fraction	U		31.4	100	1	04/19/2023 02:30	WG2044316
(S) a,a,a-Trifluorotoluene(FID)	*117*			*78.0-120*		*04/19/2023 02:30*	WG2044316

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Benzene	U		0.0941	1.00	1	04/18/2023 17:33	WG2044188
Toluene	U		0.278	1.00	1	04/18/2023 17:33	WG2044188
Ethylbenzene	U		0.137	1.00	1	04/18/2023 17:33	WG2044188
Total Xylenes	U		0.174	3.00	1	04/18/2023 17:33	WG2044188
(S) Toluene-d8	*103*			*80.0-120*		*04/18/2023 17:33*	WG2044188
(S) 4-Bromofluorobenzene	*92.8*			*77.0-126*		*04/18/2023 17:33*	WG2044188
(S) 1,2-Dichloroethane-d4	*114*			*70.0-130*		*04/18/2023 17:33*	WG2044188

Method Blank (MB)

(MB) R3915897-1 04/20/23 00:53

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Dissolved Solids	U		10000	10000

L1605291-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1605291-03 04/20/23 00:53 • (DUP) R3915897-3 04/20/23 00:53

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Dissolved Solids	894000	962000	1	7.33	J3	5

L1605291-04 Original Sample (OS) • Duplicate (DUP)

(OS) L1605291-04 04/20/23 00:53 • (DUP) R3915897-4 04/20/23 00:53

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Dissolved Solids	744000	659000	1	12.2	J3	5

Laboratory Control Sample (LCS)

(LCS) R3915897-2 04/20/23 00:53

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Dissolved Solids	8800000	8440000	95.9	77.3-123	

Method Blank (MB)

(MB) R3915253-1 04/19/23 07:54

Analyte	MB Result %	MB Qualifier	MB MDL %	MB RDL %
Total Solids	0.00100			

L1606226-17 Original Sample (OS) • Duplicate (DUP)

(OS) L1606226-17 04/19/23 07:54 • (DUP) R3915253-3 04/19/23 07:54

Analyte	Original Result %	DUP Result %	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Total Solids	81.7	80.6	1	1.38		10

Laboratory Control Sample (LCS)

(LCS) R3915253-2 04/19/23 07:54

Analyte	Spike Amount %	LCS Result %	LCS Rec. %	Rec. Limits %	LCS Qualifier
Total Solids	50.0	50.0	100	85.0-115	

Method Blank (MB)

(MB) R3917654-2 04/26/23 10:33

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Alkalinity	U		8450	20000
Alkalinity,Bicarbonate	U		8450	20000
Alkalinity,Carbonate	U		8450	20000

Sample Narrative:

BLANK: Endpoint pH 4.5

L1607242-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1607242-01 04/26/23 11:03 • (DUP) R3917654-3 04/26/23 11:08

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	314000	320000	1	1.91		20
Alkalinity,Bicarbonate	314000	320000	1	1.91		20
Alkalinity,Carbonate	U	U	1	0.000		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

L1606771-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1606771-01 04/26/23 12:32 • (DUP) R3917654-4 04/26/23 12:37

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	294000	291000	1	1.02		20
Alkalinity,Bicarbonate	294000	291000	1	1.02		20
Alkalinity,Carbonate	U	U	1	0.000		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

Laboratory Control Sample (LCS)

(LCS) R3917654-1 04/26/23 10:10

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Alkalinity	100000	100000	100	90.0-110	

Sample Narrative:

LCS: Endpoint pH 4.5

Method Blank (MB)

(MB) R3915109-1 04/19/23 17:13

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Phosphorus,Total	U		35.0	100

L1606179-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1606179-01 04/19/23 17:33 • (DUP) R3915109-6 04/19/23 17:34

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Phosphorus,Total	1710	1720	1	0.583		20

L1606035-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1606035-01 04/19/23 17:38 • (DUP) R3915109-7 04/19/23 17:39

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Phosphorus,Total	5800	6100	2	5.04		20

Laboratory Control Sample (LCS)

(LCS) R3915109-2 04/19/23 17:15

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Phosphorus,Total	4660	4260	91.4	83.2-116	

L1606165-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1606165-01 04/19/23 17:24 • (MS) R3915109-4 04/19/23 17:25 • (MSD) R3915109-5 04/19/23 17:29

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Phosphorus,Total	2500	47.3	2350	2390	92.1	93.7	1	90.0-110			1.69	20

L1606161-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1606161-03 04/25/23 18:44 • (DUP) R3917227-2 04/25/23 18:44

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	su	su		%		%
pH	7.78	7.82	1	0.513		1

Sample Narrative:

OS: 7.78 at 19.4C

DUP: 7.82 at 20C

L1608738-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1608738-01 04/25/23 18:44 • (DUP) R3917227-3 04/25/23 18:44

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	su	su		%		%
pH	10.9	10.9	1	0.368		1

Sample Narrative:

OS: 10.85 at 20C

DUP: 10.89 at 18.9C

Laboratory Control Sample (LCS)

(LCS) R3917227-1 04/25/23 18:44

Analyte	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
	su	su	%	%	
pH	10.0	9.99	99.9	99.0-101	

Sample Narrative:

LCS: 9.99 at 18.9C

Method Blank (MB)

(MB) R3915106-1 04/19/23 17:33

Analyte	MB Result umhos/cm	MB Qualifier	MB MDL umhos/cm	MB RDL umhos/cm
Specific Conductance	U		10.0	10.0

Sample Narrative:
BLANK: at 25C

L1604826-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1604826-01 04/19/23 17:33 • (DUP) R3915106-3 04/19/23 17:33

Analyte	Original Result umhos/cm	DUP Result umhos/cm	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Specific Conductance	7470	7480	1	0.134		20

Sample Narrative:
OS: at 25C
DUP: at 25C

L1605126-05 Original Sample (OS) • Duplicate (DUP)

(OS) L1605126-05 04/19/23 17:33 • (DUP) R3915106-4 04/19/23 17:33

Analyte	Original Result umhos/cm	DUP Result umhos/cm	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Specific Conductance	341	340	1	0.294		20

Sample Narrative:
OS: at 25C
DUP: at 25C

Laboratory Control Sample (LCS)

(LCS) R3915106-2 04/19/23 17:33

Analyte	Spike Amount umhos/cm	LCS Result umhos/cm	LCS Rec. %	Rec. Limits %	LCS Qualifier
Specific Conductance	1120	1170	104	85.0-115	

Sample Narrative:
LCS: at 25C

Method Blank (MB)

(MB) R3915959-1 04/20/23 21:02

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Bromide	U		353	1000
Chloride	U		379	1000
Nitrate	U		48.0	100
Nitrite	U		42.0	100
Sulfate	U		594	5000

L1604765-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1604765-01 04/20/23 21:27 • (DUP) R3915959-3 04/20/23 21:39

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Bromide	366	366	1	0.0820	J	15
Chloride	13600	13600	1	0.204		15
Nitrate	392	387	1	1.23		15
Nitrite	U	U	1	0.000		15
Sulfate	34600	34600	1	0.000867		15

L1606583-08 Original Sample (OS) • Duplicate (DUP)

(OS) L1606583-08 04/21/23 03:40 • (DUP) R3915959-6 04/21/23 03:53

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Bromide	379	378	1	0.159	J	15
Chloride	14200	14300	1	0.562		15
Nitrate	7620	7650	1	0.456		15
Nitrite	U	U	1	0.000		15
Sulfate	39000	39100	1	0.190		15

Laboratory Control Sample (LCS)

(LCS) R3915959-2 04/20/23 21:14

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Bromide	40000	39800	99.5	80.0-120	
Chloride	40000	39700	99.2	80.0-120	
Nitrate	8000	7840	98.0	80.0-120	
Nitrite	8000	8140	102	80.0-120	

Laboratory Control Sample (LCS)

(LCS) R3915959-2 04/20/23 21:14

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Sulfate	40000	39800	99.5	80.0-120	

L1604765-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1604765-01 04/20/23 21:27 • (MS) R3915959-4 04/20/23 21:52 • (MSD) R3915959-5 04/20/23 22:04

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Bromide	50000	366	50500	50600	100	101	1	80.0-120			0.194	15
Chloride	50000	13600	62600	62700	98.0	98.1	1	80.0-120			0.0904	15
Nitrate	5000	392	5500	5520	102	103	1	80.0-120			0.412	15
Nitrite	5000	U	5160	5170	103	103	1	80.0-120			0.151	15
Sulfate	50000	34600	83100	83200	97.0	97.3	1	80.0-120			0.172	15

L1606583-08 Original Sample (OS) • Matrix Spike (MS)

(OS) L1606583-08 04/21/23 03:40 • (MS) R3915959-7 04/21/23 04:30

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Bromide	50000	379	50800	101	1	80.0-120	
Chloride	50000	14200	63200	98.0	1	80.0-120	
Nitrate	5000	7620	12800	104	1	80.0-120	
Nitrite	5000	U	5130	103	1	80.0-120	
Sulfate	50000	39000	87600	97.2	1	80.0-120	

Method Blank (MB)

(MB) R3915648-1 04/20/23 22:31

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Arsenic,Dissolved	U		0.180	2.00
Calcium,Dissolved	U		93.6	1000
Iron,Dissolved	29.1	J	28.1	100
Magnesium,Dissolved	U		73.5	1000
Potassium,Dissolved	U		108	2000
Selenium,Dissolved	U		0.300	2.00
Sodium,Dissolved	U		376	2000

Method Blank (MB)

(MB) R3915649-1 04/20/23 22:42

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Boron,Dissolved	U		9.63	30.0

Laboratory Control Sample (LCS)

(LCS) R3915648-2 04/20/23 22:34

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Arsenic,Dissolved	50.0	46.7	93.3	80.0-120	
Calcium,Dissolved	5000	4700	94.0	80.0-120	
Iron,Dissolved	5000	4820	96.4	80.0-120	
Magnesium,Dissolved	5000	4630	92.6	80.0-120	
Potassium,Dissolved	5000	5170	103	80.0-120	
Selenium,Dissolved	50.0	50.1	100	80.0-120	
Sodium,Dissolved	5000	4820	96.5	80.0-120	

Laboratory Control Sample (LCS)

(LCS) R3915649-2 04/20/23 22:45

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Boron,Dissolved	50.0	46.5	92.9	80.0-120	

L1606789-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1606789-01 04/20/23 22:39 • (MS) R3915648-4 04/20/23 22:45 • (MSD) R3915648-5 04/20/23 22:48

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Arsenic,Dissolved	50.0	U	48.0	46.4	96.1	92.7	1	75.0-125			3.58	20
Calcium,Dissolved	5000	26800	31200	30800	88.9	79.7	1	75.0-125			1.47	20
Iron,Dissolved	5000	U	4890	4700	97.8	94.1	1	75.0-125			3.86	20
Magnesium,Dissolved	5000	15100	19700	19700	91.7	91.6	1	75.0-125			0.0323	20
Potassium,Dissolved	5000	6680	11400	11400	94.1	94.5	1	75.0-125			0.192	20
Selenium,Dissolved	50.0	U	51.2	50.4	102	101	1	75.0-125			1.39	20
Sodium,Dissolved	5000	137000	143000	142000	129	104	1	75.0-125	V		0.871	20

L1606789-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1606789-01 04/20/23 22:51 • (MS) R3915649-4 04/20/23 22:58 • (MSD) R3915649-5 04/20/23 23:01

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Boron,Dissolved	50.0	1070	1130	1150	118	169	1	75.0-125		V	2.24	20

Method Blank (MB)

(MB) R3914782-2 04/19/23 00:02

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
TPH (GC/FID) Low Fraction	U		0.0217	0.100
(S) a,a,a-Trifluorotoluene(FID)	*96.6*			*77.0-120*

Laboratory Control Sample (LCS)

(LCS) R3914782-1 04/18/23 22:28

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCS Rec. %	Rec. Limits %	LCS Qualifier
TPH (GC/FID) Low Fraction	5.50	5.82	106	72.0-127	
(S) a,a,a-Trifluorotoluene(FID)			*105*	*77.0-120*	

Method Blank (MB)

(MB) R3914762-2 04/18/23 23:41

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
TPH (GC/FID) Low Fraction	U		31.4	100
(S) a,a,a-Trifluorotoluene(FID)	*115*			*78.0-120*

Laboratory Control Sample (LCS)

(LCS) R3914762-1 04/18/23 22:55

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
TPH (GC/FID) Low Fraction	5500	5740	104	72.0-127	
(S) a,a,a-Trifluorotoluene(FID)			*113*	*78.0-120*	

Method Blank (MB)

(MB) R3915212-2 04/19/23 14:01

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
TPH (GC/FID) Low Fraction	U		31.4	100
(S) a,a,a-Trifluorotoluene(FID)	*117*			*78.0-120*

Laboratory Control Sample (LCS)

(LCS) R3915212-1 04/19/23 12:46

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
TPH (GC/FID) Low Fraction	5500	6160	112	72.0-127	
(S) a,a,a-Trifluorotoluene(FID)			*113*	*78.0-120*	

Method Blank (MB)

(MB) R3914742-3 04/18/23 15:20

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Benzene	U		0.0941	1.00
Toluene	U		0.278	1.00
Ethylbenzene	U		0.137	1.00
Xylenes, Total	U		0.174	3.00
(S) Toluene-d8	*101*			*80.0-120*
(S) 4-Bromofluorobenzene	*92.4*			*77.0-126*
(S) 1,2-Dichloroethane-d4	*118*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3914742-1 04/18/23 14:17 • (LCSD) R3914742-2 04/18/23 14:38

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Benzene	5.00	5.20	5.04	104	101	70.0-123			3.12	20
Toluene	5.00	4.73	4.49	94.6	89.8	79.0-120			5.21	20
Ethylbenzene	5.00	4.20	4.11	84.0	82.2	79.0-123			2.17	20
Xylenes, Total	15.0	12.7	12.3	84.7	82.0	79.0-123			3.20	20
(S) Toluene-d8				*98.4*	*97.2*	*80.0-120*				
(S) 4-Bromofluorobenzene				*95.7*	*94.9*	*77.0-126*				
(S) 1,2-Dichloroethane-d4				*112*	*110*	*70.0-130*				

Method Blank (MB)

(MB) R3914841-1 04/19/23 06:17

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
TPH (GC/FID) High Fraction	34.3	J	24.7	100
(S) o-Terphenyl	*132*			*31.0-160*

Laboratory Control Sample (LCS)

(LCS) R3914841-2 04/19/23 06:39

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
TPH (GC/FID) High Fraction	1500	1800	120	50.0-150	
(S) o-Terphenyl			*112*	*31.0-160*	

L1605921-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1605921-04 04/20/23 15:34 • (MS) R3915192-1 04/20/23 15:55 • (MSD) R3915192-2 04/20/23 16:17

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
TPH (GC/FID) High Fraction	1430	U	18700	27300	1310	1910	10	50.0-150	J5	J3 J5	37.4	20
(S) o-Terphenyl					*149*	*135*		*31.0-160*				

Sample Narrative:

OS: Dilution and surrogate failure due to matrix interference.

Method Blank (MB)

(MB) R3914661-1 04/18/23 20:28

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
TPH (GC/FID) High Fraction	U		0.769	4.00
(S) o-Terphenyl	*66.7*			*18.0-148*

Laboratory Control Sample (LCS)

(LCS) R3914661-2 04/18/23 20:41

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCS Rec. %	Rec. Limits %	LCS Qualifier
TPH (GC/FID) High Fraction	50.0	37.1	74.2	50.0-150	
(S) o-Terphenyl			*91.0*	*18.0-148*	

L1606140-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1606140-01 04/19/23 01:27 • (MS) R3914661-3 04/19/23 01:40 • (MSD) R3914661-4 04/19/23 01:53

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
TPH (GC/FID) High Fraction	50.0	4.54	40.4	42.0	71.7	74.9	1	50.0-150			3.88	20
(S) o-Terphenyl					*59.9*	*72.7*		*18.0-148*				

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

(dry)	Results are reported based on the dry weight of the sample. [this will only be present on a dry report basis for soils].
MDL	Method Detection Limit.
MDL (dry)	Method Detection Limit.
RDL	Reported Detection Limit.
RDL (dry)	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
J	The identification of the analyte is acceptable; the reported value is an estimate.
J3	The associated batch QC was outside the established quality control range for precision.
J5	The sample matrix interfered with the ability to make any accurate determination; spike value is high.
T8	Sample(s) received past/too close to holding time expiration.
V	The sample concentration is too high to evaluate accurate spike recoveries.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Billing Information:
Western Water & Land
743 Horizon Court, Suite 330
Grand Junction, CO 81506

Pres Chk

Analysis / Container / Preservative

Chain of Custody Page ___ of ___

Pace Analytical®
National Center for Testing & Innovation

12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

Report to: Bruce Smith

Email To: bsmith@westernwaterandland.com

Project Description: Logan Wash Retort Pipeline

City/State Collected: DeBeque, CO

Phone: 970-242-0170
Fax:

Client Project #

Lab Project # GHDGSH-14266DM

L # L1606161

B103

Table #

Acct# GSH

Template:

Prelogin:

TSR:

PB:

Shipped Via:

Collected by (print): Bruce Smith

Site/Facility ID # Logan Wash Retort Pipeline

P.O. #

Collected by (signature): Bruce Smith

Immediately Packed on Ice N ___ Y X

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
X Three Day

Quote #

Date Results Needed: Apr 21, 2023

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	TPH - GRO	TPH - DRO	BTEX	Dissolved Metals (Lab filter)	Phosphorus	General (pH, alk, TDS, Cond., NO2, NO3, anions)	BART				Remarks	Sample # (lab only)
Logan Wash Channel	Comp	SS	6in	4/14/23	No Time	2	X	X										-01
Release Channel	Comp	SS	6in	4/14/23	No Time	2	X	X										-02
Retort Pipe 41423	Grab	OT	surface	4/14/23	1330	12	X	X	X	X	X	X	X					-03
Trip Blank						2	X	X	X									-04

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:
Retort Pipe 41423 source is oil shale mine effluent water. Samples were collected on 3/14/23 and stored at 8 degree celcius before shipping on 4/17/23

pH _____ Temp _____
Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier __ _____

Tracking # 3471 4334 0698

Sample Receipt Checklist

COC Seal Present/Intact:	NP	Y N
COC Signed/Accurate:		Y N
Bottles arrive intact:		Y N
Correct bottles used:		Y N
Sufficient volume sent:		Y N
If Applicable		
VOA Zero Headspace:		Y N
Preservation Correct/Checked:		Y N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No HCL / MeoH TBR	If preservation required by Login: Date/Time
[signature]	4/17/23	5:30pm			
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: USLV °C 1.7+0=1.7 Bottles Received: 16	
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature) [signature] 10	Date: 4.18.23 Time: 9:30	Hold: Condition: NCF / OK

4/18-NCF-L1606161 GHDGSH

R5

Time estimate: oh **Time spent:** oh

Members

Hailey Melson (responsible) BB Brittnie Boyd

Due on *21 April 2023 8:00 AM* for target *Done*

- [x] Login Clarification needed
- [ ] Chain of custody is incomplete
- [ ] Please specify Metals requested
- [ ] Please specify TCLP requested
- [ ] Received additional samples not listed on COC
- [ ] Sample IDs on containers do not match IDs on COC
- [ ] Client did not "X" analysis
- [ ] Chain of Custody is missing
- [ ] If no COC: Received by:_____
- [ ] If no COC: Date/Time:_____
- [ ] If no COC: Temp./Cont.Rec./pH:_____
- [ ] If no COC: Carrier:_____
- [ ] If no COC: Tracking #:_____
- [ ] Client informed by call
- [ ] Client informed by Email
- [ ] Client informed by Voicemail
- [ ] Date/Time:_____
- [ ] PM initials:_____
- [ ] Client Contact:_____

Comments

Hailey Melson *18 April 2023 11:25 AM*

1) What Dissolved metals?
2) Are any other anions needed other than the ones listed out on the COC?
3) What Phosphorous needs to be logged?
4)Nitrate, Nitrite received out of hold.

Stephanie Coble *18 April 2023 4:15 PM*

1) Dissolved Metals are: As, B, Ca, Fe, K, Mg, Na, and Se
2) ALKBI,ALKCA, Bromide, Chloride, and Sulfate
3) PT
4) Please proceed to run Nitrate, Nitrite.
5) Please add TS to dashes -01 and -02

Hailey Melson *18 April 2023 5:19 PM*

Done

ANALYTICAL REPORT

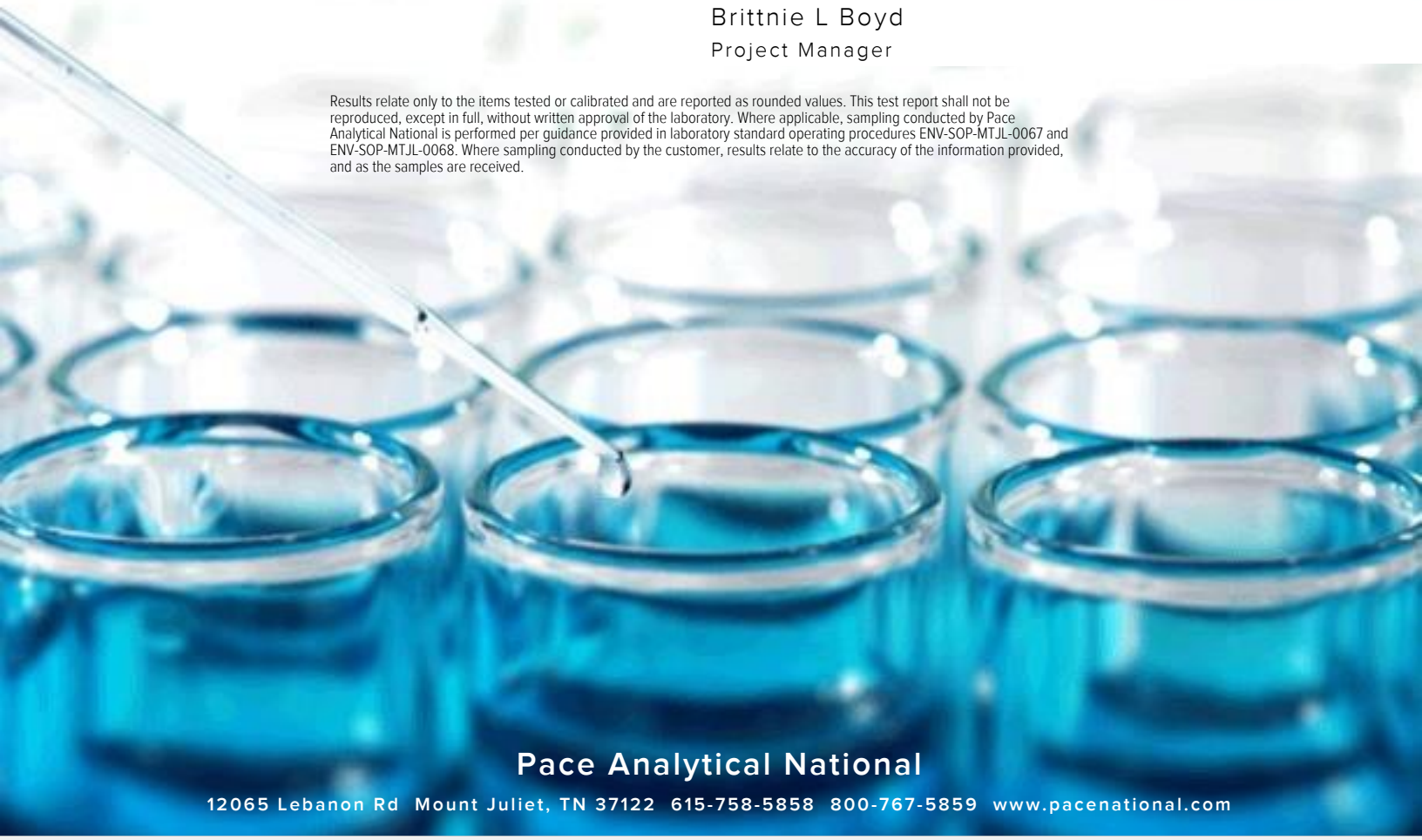
April 28, 2023

GHD-Houston, TX-Glenn Springs Holdings

Sample Delivery Group:	L1608705
Samples Received:	04/25/2023
Project Number:	14266DM
Description:	Logan Wash Mine
Site:	LOGAN WASH MINE
Report To:	Sheri Finn;Bruce Smith 2055 Niagara Falls Blvd. #3 Niagara Falls, NY 14034

Entire Report Reviewed By:

Brittnie L Boyd
Project Manager



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

TABLE OF CONTENTS

RETORT PIPE 41423 L1608705-01 GW

Collected by	Collected date/time	Received date/time
BDS	04/14/23 13:30	04/25/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Calculated Results	WG2048545	1	04/26/23 14:16	04/26/23 14:16	SPL	Mt. Juliet, TN
Wet Chemistry by Method 2320 B-2011	WG2048908	1	04/26/23 13:16	04/26/23 13:16	ARD	Mt. Juliet, TN
Wet Chemistry by Method 7196A	WG2048621	1	04/26/23 03:59	04/26/23 03:59	CRB	Mt. Juliet, TN
Wet Chemistry by Method 9040C	WG2048489	1	04/25/23 18:44	04/25/23 18:44	KAD	Mt. Juliet, TN
Mercury by Method 7470A	WG2048546	1	04/26/23 11:19	04/26/23 15:08	AKB	Mt. Juliet, TN
Metals (ICP) by Method 6010B	WG2048545	1	04/26/23 11:33	04/26/23 14:16	SPL	Mt. Juliet, TN
Metals (ICP) by Method 6010B	WG2048550	1	04/26/23 12:25	04/26/23 19:40	ZSA	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG2048813	1	04/26/23 12:02	04/26/23 14:00	JPD	Mt. Juliet, TN

CASE NARRATIVE

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Brittnie L Boyd
Project Manager

Calculated Results

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Chromium,Trivalent	U		1.40	10.0	1	04/26/2023 14:16	WG2048545

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Alkalinity	363000		8450	20000	1	04/26/2023 13:16	WG2048908
Alkalinity,Bicarbonate	363000		8450	20000	1	04/26/2023 13:16	WG2048908
Alkalinity,Carbonate	U		8450	20000	1	04/26/2023 13:16	WG2048908

Sample Narrative:

L1608705-01 WG2048908: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 7196A

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Chromium,Hexavalent	U	T8	3.00	10.0	1	04/26/2023 03:59	WG2048621

Wet Chemistry by Method 9040C

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	su			date / time	
pH	8.09	T8	1	04/25/2023 18:44	WG2048489

Sample Narrative:

L1608705-01 WG2048489: 8.09 at 18.3C

Mercury by Method 7470A

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Mercury	U		0.100	0.200	1	04/26/2023 15:08	WG2048546

Metals (ICP) by Method 6010B

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Arsenic	28.2		4.40	10.0	1	04/26/2023 14:16	WG2048545
Arsenic,Dissolved	39.8		4.40	10.0	1	04/26/2023 19:40	WG2048550
Cadmium	U		0.479	2.00	1	04/26/2023 14:16	WG2048545
Cadmium,Dissolved	1.10	J	0.479	2.00	1	04/26/2023 19:40	WG2048550
Chromium	U		1.40	10.0	1	04/26/2023 14:16	WG2048545
Copper,Dissolved	U		3.68	10.0	1	04/26/2023 19:40	WG2048550
Iron	53.3	J	18.0	100	1	04/26/2023 14:16	WG2048545
Iron,Dissolved	34.8	B J	18.0	100	1	04/26/2023 19:40	WG2048550
Lead	U		2.99	6.00	1	04/26/2023 14:16	WG2048545
Lead,Dissolved	U		2.99	6.00	1	04/26/2023 19:40	WG2048550
Manganese,Dissolved	20.3		0.934	10.0	1	04/26/2023 19:40	WG2048550
Molybdenum	1910		1.16	5.00	1	04/26/2023 14:16	WG2048545
Nickel	U		1.61	10.0	1	04/26/2023 14:16	WG2048545
Nickel,Dissolved	U		1.61	10.0	1	04/26/2023 19:40	WG2048550
Selenium,Dissolved	16.4		7.35	10.0	1	04/26/2023 19:40	WG2048550
Silver,Dissolved	U		1.54	5.00	1	04/26/2023 19:40	WG2048550
Zinc,Dissolved	U		6.52	50.0	1	04/26/2023 19:40	WG2048550

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Uranium,Dissolved	3.79	J	0.0700	20.0	1	04/26/2023 14:00	WG2048813

Method Blank (MB)

(MB) R3917627-2 04/26/23 10:35

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Alkalinity	U		8450	20000
Alkalinity,Bicarbonate	U		8450	20000
Alkalinity,Carbonate	U		8450	20000

Sample Narrative:

BLANK: Endpoint pH 4.5

L1607789-05 Original Sample (OS) • Duplicate (DUP)

(OS) L1607789-05 04/26/23 11:53 • (DUP) R3917627-3 04/26/23 11:59

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	283000	283000	1	0.0193		20
Alkalinity,Bicarbonate	283000	283000	1	0.0193		20
Alkalinity,Carbonate	U	U	1	0.000		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

L1608034-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1608034-01 04/26/23 12:24 • (DUP) R3917627-4 04/26/23 12:30

Analyte	Original Result ug/l	DUP Result ug/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	419000	423000	1	0.890		20
Alkalinity,Bicarbonate	419000	423000	1	0.890		20
Alkalinity,Carbonate	U	U	1	0.000		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

Laboratory Control Sample (LCS)

(LCS) R3917627-1 04/26/23 10:18

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Alkalinity	100000	108000	108	90.0-110	

Sample Narrative:

LCS: Endpoint pH 4.5

Method Blank (MB)

(MB) R3917317-1 04/26/23 03:57

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
	ug/l		ug/l	ug/l
Chromium,Hexavalent	U		3.00	10.0

L1608705-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1608705-01 04/26/23 03:59 • (DUP) R3917317-3 04/26/23 03:59

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	ug/l	ug/l		%		%
Chromium,Hexavalent	U	U	1	0.000		20

Laboratory Control Sample (LCS)

(LCS) R3917317-2 04/26/23 03:58

Analyte	Spike Amount	LCS Result	LCS Rec.	Rec. Limits	LCS Qualifier
	ug/l	ug/l	%	%	
Chromium,Hexavalent	500	545	109	80.0-120	

L1608705-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1608705-01 04/26/23 03:59 • (MS) R3917317-4 04/26/23 03:59 • (MSD) R3917317-5 04/26/23 03:59

Analyte	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
	ug/l	ug/l	ug/l	ug/l	%	%		%			%	%
Chromium,Hexavalent	500	U	475	462	95.0	92.4	1	85.0-115			2.77	20

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

L1606161-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1606161-03 04/25/23 18:44 • (DUP) R3917227-2 04/25/23 18:44

Analyte	Original Result su	DUP Result su	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
pH	7.78	7.82	1	0.513		1

Sample Narrative:

OS: 7.78 at 19.4C

DUP: 7.82 at 20C

L1608738-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1608738-01 04/25/23 18:44 • (DUP) R3917227-3 04/25/23 18:44

Analyte	Original Result su	DUP Result su	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
pH	10.9	10.9	1	0.368		1

Sample Narrative:

OS: 10.85 at 20C

DUP: 10.89 at 18.9C

Laboratory Control Sample (LCS)

(LCS) R3917227-1 04/25/23 18:44

Analyte	Spike Amount su	LCS Result su	LCS Rec. %	Rec. Limits %	LCS Qualifier
pH	10.0	9.99	99.9	99.0-101	

Sample Narrative:

LCS: 9.99 at 18.9C

QUALITY CONTROL SUMMARY

L1608705-01

Method Blank (MB)

(MB) R3917646-1 04/26/23 14:58

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Mercury	U		0.100	0.200

Laboratory Control Sample (LCS)

(LCS) R3917646-2 04/26/23 15:00

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Mercury	3.00	2.81	93.6	80.0-120	

L1608738-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1608738-01 04/26/23 15:02 • (MS) R3917646-3 04/26/23 15:04 • (MSD) R3917646-4 04/26/23 15:06

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Mercury	3.00	U	3.00	3.01	100	100	1	75.0-125			0.253	20

Method Blank (MB)

(MB) R3917688-1 04/26/23 14:10

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Arsenic	U		4.40	10.0
Cadmium	U		0.479	2.00
Chromium	U		1.40	10.0
Iron	U		18.0	100
Lead	U		2.99	6.00
Molybdenum	U		1.16	5.00
Nickel	U		1.61	10.0

Laboratory Control Sample (LCS)

(LCS) R3917688-2 04/26/23 14:13

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Arsenic	1000	978	97.8	80.0-120	
Cadmium	1000	1000	100	80.0-120	
Chromium	1000	978	97.8	80.0-120	
Iron	10000	10300	103	80.0-120	
Lead	1000	963	96.3	80.0-120	
Molybdenum	1000	1040	104	80.0-120	
Nickel	1000	965	96.5	80.0-120	

L1608705-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1608705-01 04/26/23 14:16 • (MS) R3917688-4 04/26/23 14:22 • (MSD) R3917688-5 04/26/23 14:24

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Arsenic	1000	28.2	1080	1090	105	106	1	75.0-125			1.27	20
Cadmium	1000	U	1050	1070	105	107	1	75.0-125			1.90	20
Chromium	1000	U	887	908	88.7	90.8	1	75.0-125			2.34	20
Iron	10000	53.3	9800	10100	97.5	100	1	75.0-125			2.59	20
Lead	1000	U	955	979	95.5	97.9	1	75.0-125			2.46	20
Molybdenum	1000	1910	2800	2820	89.1	90.3	1	75.0-125			0.441	20
Nickel	1000	U	989	1010	98.9	101	1	75.0-125			1.90	20

Method Blank (MB)

(MB) R3917802-1 04/26/23 18:19

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Arsenic,Dissolved	U		4.40	10.0
Cadmium,Dissolved	U		0.479	2.00
Copper,Dissolved	U		3.68	10.0
Iron,Dissolved	24.8	J	18.0	100
Lead,Dissolved	U		2.99	6.00
Manganese,Dissolved	U		0.934	10.0
Nickel,Dissolved	U		1.61	10.0
Selenium,Dissolved	U		7.35	10.0
Silver,Dissolved	U		1.54	5.00
Zinc,Dissolved	U		6.52	50.0

Laboratory Control Sample (LCS)

(LCS) R3917802-2 04/26/23 18:22

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Arsenic,Dissolved	1000	963	96.3	80.0-120	
Cadmium,Dissolved	1000	990	99.0	80.0-120	
Copper,Dissolved	1000	948	94.8	80.0-120	
Iron,Dissolved	10000	9650	96.5	80.0-120	
Lead,Dissolved	1000	974	97.4	80.0-120	
Manganese,Dissolved	1000	929	92.9	80.0-120	
Nickel,Dissolved	1000	978	97.8	80.0-120	
Selenium,Dissolved	1000	1010	101	80.0-120	
Silver,Dissolved	200	172	85.9	80.0-120	
Zinc,Dissolved	1000	974	97.4	80.0-120	

L1607288-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1607288-01 04/26/23 18:25 • (MS) R3917802-4 04/26/23 18:31 • (MSD) R3917802-5 04/26/23 18:34

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Arsenic,Dissolved	1000	8.02	1000	1000	99.6	99.7	1	75.0-125			0.0208	20
Cadmium,Dissolved	1000	0.959	1020	1020	102	101	1	75.0-125			0.343	20
Copper,Dissolved	1000	U	979	983	97.9	98.3	1	75.0-125			0.420	20
Iron,Dissolved	10000	U	9390	9280	93.9	92.8	1	75.0-125			1.12	20
Lead,Dissolved	1000	3.66	978	970	97.4	96.7	1	75.0-125			0.741	20
Manganese,Dissolved	1000	45.7	942	938	89.7	89.3	1	75.0-125			0.428	20
Nickel,Dissolved	1000	1.61	978	978	97.7	97.6	1	75.0-125			0.0576	20

L1607288-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1607288-01 04/26/23 18:25 • (MS) R3917802-4 04/26/23 18:31 • (MSD) R3917802-5 04/26/23 18:34

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Selenium,Dissolved	1000	U	1070	1070	107	107	1	75.0-125			0.343	20
Silver,Dissolved	200	U	180	180	89.8	90.1	1	75.0-125			0.261	20
Zinc,Dissolved	1000	U	943	947	94.3	94.7	1	75.0-125			0.416	20

Method Blank (MB)

(MB) R3917639-1 04/26/23 13:53

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Uranium,Dissolved	U		0.0700	20.0

Laboratory Control Sample (LCS)

(LCS) R3917639-2 04/26/23 13:56

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Uranium,Dissolved	50.0	49.3	98.5	80.0-120	

L1608705-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1608705-01 04/26/23 14:00 • (MS) R3917639-4 04/26/23 14:06 • (MSD) R3917639-5 04/26/23 14:09

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Uranium,Dissolved	50.0	3.79	54.5	52.3	101	97.1	1	75.0-125			4.02	20

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
B	The same analyte is found in the associated blank.
J	The identification of the analyte is acceptable; the reported value is an estimate.
T8	Sample(s) received past/too close to holding time expiration.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LA000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Billing Information:

Pres Chk

Analysis / Container / Preservative

Chain of Custody Page ___ of ___

Pace Analytical®
National Center for Testing & Innovation

12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

Report to: **Bruce Smith**

Email To: **bsmith@westernwaterandland.com**

Project Description: **Logan Wash Mine**

City/State Collected: **Grand Junction, CO**

Phone: **970-242-0170**
Fax:

Client Project # **14266**

Lab Project # **GHDGSH-14266DM**

Collected by (print): **BDS**

Site/Facility ID # **Logan Wash Mine**

P.O. #

Collected by (signature): Bruce D Smith

Immediately Packed on Ice N ___ Y X

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
X Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed: **April 26, 2023**

L # B116

Tab 46068705

Acct. ... GHDGSH

Template:

Prelogin:

TSR:

PB:

Shipped Via:

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	Diss: As, Cd, Cr III, CrVI, Cu, Fe, Pb, Mn,	Diss: Ni, Se,Ag, Ur, Zn	Total: As, Cd, CrIII, Fe, Pb, Hg, Mo, Ni	Alkalinity, total, bicarb, carbonate	pH	Remarks	Sample # (lab only)
Retort Pipe 41423	Grab	GW		4/14/23	13:30	13	X	X	X	X	X		-01

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:
Sample is NOT preserved with acid and has not been filtered.

pH _____ Temp _____

Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier __ _____

Tracking # 3974 3753 5199

Sample Receipt Checklist

COC Seal Present/Intact:	NP	Y N
COC Signed/Accurate:		Y N
Bottles arrive intact:		Y N
Correct bottles used:		Y N
Sufficient volume sent:		Y N
If Applicable		
VOA Zero Headspace:		Y N
Preservation Correct/Checked:		Y N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes (No) HCL / MeoH TBR	
Bruce D Smith	4/24/2023	1815			
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: 0.5/0.6 °C 3.9+0=3.9	Bottles Received: 3
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature) J	Date: 4.25.23	Time: 9.00

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK