

# Gas and Water Geochemistry Results from the Rays Valley Quadrangle, Utah

*by*

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**OPEN-FILE REPORT 723**  
**UTAH GEOLOGICAL SURVEY**  
*a division of*  
UTAH DEPARTMENT OF NATURAL RESOURCES  
**2020**

*Blank pages are intentional for printing purposes.*

## INTRODUCTION

This Open-File Report makes available raw analytical data from laboratory procedures completed to determine the geochemistry of gas and water samples collected during geologic investigations funded or partially supported by the Utah Geological Survey (UGS) and the U.S. Geological Survey National Cooperative Geologic Mapping Program (STATEMAP). The references listed in table 1 and figures 1 and 2 generally provide additional information such as sample location, geologic setting, and significance or interpretation of the samples in the context of the area where they were collected. Refer to Wavrek and others (2017) for the sampling protocol, analytical methods, and discussion of results. The data were prepared by Isotech Laboratories Inc., Champaign, Illinois, and TestAmerica Inc., Phoenix, Arizona, under contract to the UGS. These data are highly technical in nature and proper interpretation requires considerable training in the applicable geochemical techniques.

## DISCLAIMER

This open-file release is intended as a data repository for information gathered in support of various UGS projects. The data are presented as received from Isotech Laboratories Inc. and TestAmerica Inc. and do not necessarily conform to UGS technical, editorial, or policy standards; this should be considered by an individual or group planning to take action based on the contents of this report. The Utah Department of Natural Resources, Utah Geological Survey, makes no warranty, expressed or implied, regarding the suitability of this product for a particular use. The Utah Department of Natural Resources, Utah Geological Survey, shall not be liable under any circumstances for any direct, indirect, special, incidental, or consequential damages with respect to claims by users of this product.

The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.

## ACKNOWLEDGMENTS

Geologic mapping of the Provo 30' x 60' quadrangle was funded by the UGS and U.S. Geological Survey, National Cooperative Geologic Mapping Program (NCGMP) through USGS STATEMAP award numbers 99HQAG0138 (1999-2000), 01HQAG100 (2001-02), 02HQAG055 (2002-03), 03HQAG0096 (2003-04), 04HQAG0040 (2004-05), 05HQAG0084 (2005-06), and 06HQAG0037 (2006-07).

## REFERENCES

- Constenius, K.N., 2008, Interim geologic map of the Rays Valley quadrangle, Utah County, Utah: Utah Geological Survey Open-File Report 535, 12 p., 1 plate, scale 1:24,000, <https://doi.org/10.34191/OFR-535>.
- Constenius, K.N., Clark, D.L., King, J.K., and Ehler, J.B., 2011, Interim geologic map of the Provo 30' x 60' quadrangle, Utah, Wasatch, and Salt Lake Counties, Utah: Utah Geological Survey Open-File Report 586DM, 42 p., 2 plates, contains GIS data, scale 1:62,500, <https://doi.org/10.34191/OFR-586DM>.
- Constenius, K.N., Coogan, J.K., Clark, D.L., and King, J.K., in preparation, Geologic map of the Provo 30' x 60' quadrangle, Utah, Wasatch, and Salt Lake Counties, Utah: Utah Geological Survey Map, scale 1:62,500.
- Wavrek, D.A., Slack, M.N., and Constenius, K.N., 2017, Stinky bubbles in Diamond Fork Canyon (Utah)—a curious case of whodunit?, *in* Lund, W.R., Emerman, S.H., Wang, W., and Zanazzi, A., editors, *Geology and Resources of the Wasatch—back to front*: Utah Geological Association Publication 46, 16 p.

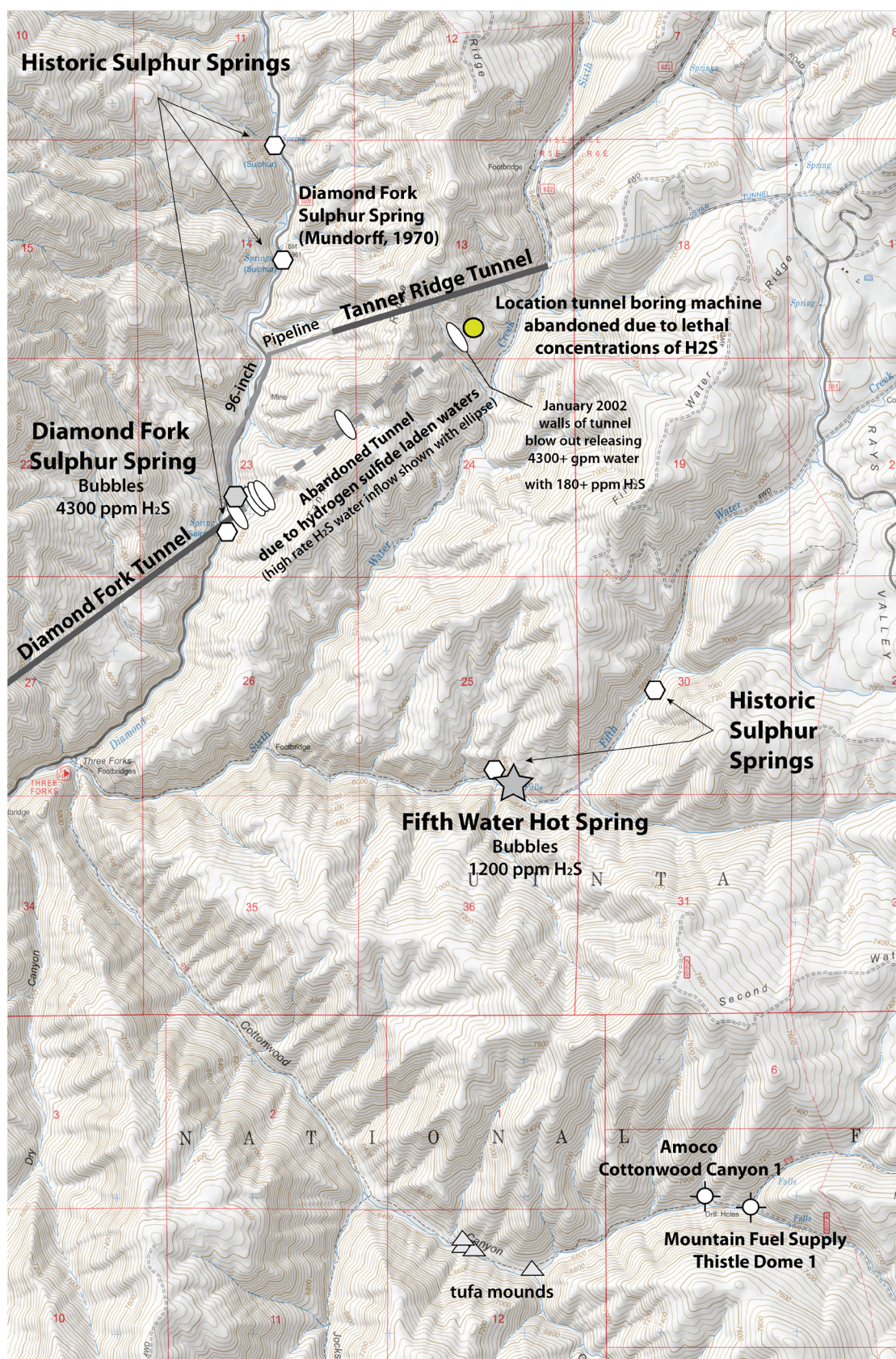
**Table 1.** Sample numbers and locations.

Sample Location	Sample Number	Sample Type	Lab	Analysis Date	7.5' quadrangle	UTM easting NAD27-12	UTM northing NAD27-12	Latitude (°N) WGS84	Longitude (°W) WGS84	Reference
Fifth water hot spring	—	gas	Isotech	8/14/2009	Rays Valley	472935	4436785	40.08276	111.31818	Constenius and others, 2011, in prep.
Diamond Fork cool spring	—	gas	Isotech	8/14/2009	Rays Valley	470947	4439088	40.10344	111.34160	Constenius and others, 2011, in prep.
Fifth water hot spring, upper pool	KNC101811-7	gas	Isotech	11/14/2011	Rays Valley	472969	4436766	40.08258	111.31778	Constenius and others, 2011, in prep.
Fifth water hot spring, upper pool	KNC101811-7	gas	Isotech	11/14/2011	Rays Valley	472969	4436766	40.08258	111.31778	Constenius and others, 2011, in prep.
Fifth water hot spring, upper pool	KNC101811-7	gas	Isotech	11/14/2011	Rays Valley	472969	4436766	40.08258	111.31778	Constenius and others, 2011, in prep.
Diamond Fork cool spring	KNC101811-8	gas	Isotech	11/14/2011	Rays Valley	470947	4439088	40.10344	111.34160	Constenius and others, 2011, in prep.
Fifth water hot spring, upper pool	KNC102612-U5H	water	Isotech	11/1/2012	Rays Valley	472969	4436766	40.08258	111.31778	Constenius and others, 2011, in prep.
Fifth water hot spring, main pool	KNC102612-PS	water	TestAmerica	11/14/2012 11/19/2012	Rays Valley	472935	4436785	40.08276	111.31818	Constenius and others, 2011, in prep.
Fifth water hot spring, upper pool	KNC102612-U5H	water	TestAmerica	11/14/2012 11/19/2012	Rays Valley	472969	4436766	40.08258	111.31778	Constenius and others, 2011, in prep.
Fifth water hot spring, main pool	KNC102612-5H	water	TestAmerica	11/14/2012 11/19/2012	Rays Valley	472935	4436785	40.08276	111.31818	Constenius and others, 2011, in prep.

**Note:**

Table 1 of Wavrek and others (2017) incorrectly lists springs and locations for gas samples KNC101811-7 and KNC101811-8 collected October 18, 2011.

Also refer to the geologic map of Constenius (2008).



**Figure 1.** Topographic map of the Diamond Fork Canyon area of the Rays Valley quadrangle and adjacent area showing the locations of springs, tunnels, hydrocarbon exploration drill holes, and tufa mounds. Section grid for scale; each section is one mile across. Figure modified from Wavrek and others (2017).



**Figure 2.** Photo montage of Fifth Water Hot Springs. **A** – View looking east-southeast of main pools of hot spring occupied by bathers. Note drapery of mineral precipitates (tufa) that extend from top to base of waterfall. The waterfall is spilling over a ledge of conglomerate in the North Horn Formation. **B** - Pools of Upper Fifth Water hot spring (above waterfall). Grant Willis of Utah Geological Survey shown for scale. **C** – Milky water of Fifth Water Creek below points of hot spring discharge. **D** – People lathered with stinky black mud encountered below the pools. Figure from Wavrek and others (2017).

## APPENDIX


[www.isotechlabs.com](http://www.isotechlabs.com)

## Isotech Gas Data

Job 11833

Project: 291.003

Isotech Lab No.	Sample Name	Location	GC Analysis Date	H <sub>2</sub> S %	He %	H <sub>2</sub> %	Ar + O <sub>2</sub> %	CO <sub>2</sub> %	N <sub>2</sub> %	CO %	C <sub>1</sub> %	C <sub>2</sub> %	C <sub>2</sub> H <sub>4</sub> %	C <sub>3</sub> %	iC <sub>4</sub> %	nC <sub>4</sub> %	iC <sub>5</sub> %	nC <sub>5</sub> %	C <sub>6</sub> + %	Specific BTU Gravity	Comments	
168949	Fifth Water	Utah County, Utah	8/14/2009	0.113	0.0026	0.0037	0.7	3.52	8	0	87.6	0.0597	0	0	0	0	0	0	0	0.626	890	
168950	Diamond Fork	Utah County, Utah	8/14/2009	0.356	0.0369	0	3.96	2.58	87.86	0	5.19	0.0136	0	0	0	0	0	0	0	0.966	55	

Chemical analysis based on standards accurate to within 2%



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# Isotech Gas Data

Job 16586

Provo 30 x 60 Quad

Cottonwood Hot Spring

Isotech Lab No.	Sample Name	Sample Date	Sample Time	GC Date	He	H <sub>2</sub>	Ar	O <sub>2</sub>	CO <sub>2</sub>	N <sub>2</sub>	CO	C <sub>1</sub>	C <sub>2</sub>	C <sub>2</sub> H <sub>4</sub>	C <sub>3</sub>	C <sub>3</sub> H <sub>6</sub>	iC <sub>4</sub>	nC <sub>4</sub>	iC <sub>5</sub>	nC <sub>5</sub>	C <sub>6</sub> +	MS Date	δ <sup>13</sup> C <sub>1</sub>	δDC <sub>1</sub>	Tritium	Std. Dev.	δD H <sub>2</sub> O	δ <sup>18</sup> O H <sub>2</sub> O	δ <sup>13</sup> C DIC	<sup>14</sup> C DIC	Std. Dev.	Specific	BTU	Helium dilution	
					%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	Date	‰	‰	TU		‰	‰	‰	pMC		Gravity		factor *
223960	KNC101811-7 (W1)	10/18/2011	18:20	11/14/2011	na	nd	0.265	0.013	6.07	8.81	nd	84.77	0.0667	nd	0.0005	nd	nd	nd	nd	nd	nd	nd	11/17/2011	-38.24	-188.9	0.73	0.14	-132.4	-17.00	-6.8	4.8	0.1	0.652	861	0.62
223961	KNC101811-7 (G1)	10/18/2011	18:15	11/14/2011	0.0059	0.0015	0.224	0.23	4.68	8.73	nd	86.06	0.0662	nd	0.0006	nd	0.0001	0.0001	nd	0.0001	nd	nd	11/17/2011	-38.95	-189.3								0.639	874	
223962	KNC101811-7 (G2)	10/18/2011	18:30	11/14/2011	0.0056	0.0018	0.169	0.006	4.96	3.58	nd	91.21	0.0707	nd	0.0006	nd	nd	0.0001	nd	nd	nd	nd	11/17/2011	-38.87	-190.3								0.618	926	
223963	KNC101811-8 (G3)	10/18/2011	19:25	11/14/2011	na	nd	1.45	0.011	5.59	86.27	nd	6.66	0.0203	nd	0.0003	nd	nd	nd	nd	nd	nd	nd	11/17/2011	-36.19	-113.5	2.27	0.16	-128.5	-16.16	-12.9			0.977	68	0.62

## Notes:

Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace.

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

nd = not detected, na = not analyzed



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## Isotech Gas Data

Job 19694

Project: Upper Fifth Water/Constenius

Company Lab No.	Isotech Lab No.	Sample Name	GC Analysis Date	H <sub>2</sub> %	Ar + O <sub>2</sub> %	CO <sub>2</sub> %	N <sub>2</sub> %	CO %	C <sub>1</sub> %	C <sub>2</sub> %	C <sub>2</sub> H <sub>4</sub> %	C <sub>3</sub> %	C <sub>3</sub> H <sub>6</sub> %	iC <sub>4</sub> %	nC <sub>4</sub> %	iC <sub>5</sub> %	nC <sub>5</sub> %	C <sub>6</sub> + %	Mass Spec Date	δ <sup>13</sup> C <sub>1</sub> ‰	Specific Gravity	BTU	Comments	
KC102612-U5H	314166	Upper Fifth Water/Constenius	11/1/2012	nd	0.24	4.92	4.17	nd	90.60	0.0638	0.0045	0.0010	nd	nd	nd	nd	nd	nd	nd	11/2/2012	-38.8	0.620	920	methane carbon isotope obtained online via GC-C-IRMS

nd = not detected, na = not analyzed

# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

4625 East Cotton Center Blvd. Ste 189, Phoenix, AZ 85040 (602) 437-3340 Fax: (602) 454-9303

## LABORATORY REPORT

Prepared For: Utah Geological Survey  
1594 W. North Temple Suite 3110  
Salt Lake City, UT 84114  
Attention: Grant Willis

Project: 314262

Sampled: 10/26/12  
Received: 11/14/12  
Revised: 11/26/12 12:44

NELAP #01109CA / AZ100001 Arizona DHS#AZ0728

*The results listed within this Laboratory Report pertain only to the samples tested in the laboratory. The analyses contained in this report were performed in accordance with the applicable certifications as noted. All soil samples are reported on a wet weight basis unless otherwise noted in the report. This Laboratory Report is confidential and is intended for the sole use of TestAmerica and its client. This report shall not be reproduced, except in full, without written permission from TestAmerica. The Chain of Custody, 1 page, is included and is an integral part of this report.*

*This entire report was reviewed and approved for release.*

## CASE NARRATIVE

### LABORATORY ID

PVK1040-01  
PVK1040-02  
PVK1040-03

### CLIENT ID

KNC102612-PS  
KNC102612-U5H  
KNC102612-5H

### MATRIX

Water  
Water  
Water

**SAMPLE RECEIPT:** Samples were received intact, at 21°C and with chain of custody documentation.

**HOLDING TIMES:** Not all holding times were met. Results were qualified where the sample analysis did not occur within method specified holding time requirements.

**PRESERVATION:** Samples requiring preservation were verified prior to sample analysis.

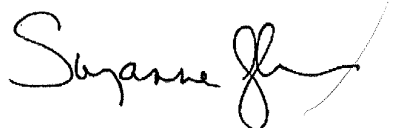
**QA/QC CRITERIA:** All analyses met method criteria, except as noted in the report with data qualifiers.

**COMMENTS:** No significant observations were made.

**SUBCONTRACTED:** No analyses were subcontracted to an outside laboratory.

**ADDITIONAL INFORMATION:** 11/26/2012: The report was revised to change the name and address of the recipient of the report and to correct the sample IDs for PVK1040-02 and PVK1040-03.

Reviewed By:



TestAmerica Phoenix

Suzanne Glass  
Project Manager

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Utah Geological Survey  
1594 W. North Temple Suite 3110  
Salt Lake City, UT 84114  
Attention: Grant Willis

Project ID: 314262

Report Number: PVK1040

Sampled: 10/26/12

Received: 11/14/12

## TOTAL METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: PVK1040-01 (KNC102612-PS - Water)								
Reporting Units: mg/l								
Calcium	EPA 200.7	12K0660	2.0	120	1	11/16/2012	11/19/2012	
Magnesium	EPA 200.7	12K0660	2.0	33	1	11/16/2012	11/19/2012	
Potassium	EPA 200.7	12K0660	2.0	11	1	11/16/2012	11/19/2012	
Silica	EPA 200.7	12K0660	0.21	17	1	11/16/2012	11/19/2012	
Sodium	EPA 200.7	12K0660	2.0	160	1	11/16/2012	11/19/2012	
Sample ID: PVK1040-02 (KNC102612-U5H - Water)								
Reporting Units: mg/l								
Calcium	EPA 200.7	12K0660	2.0	27	1	11/16/2012	11/19/2012	
Magnesium	EPA 200.7	12K0660	2.0	10	1	11/16/2012	11/19/2012	
Potassium	EPA 200.7	12K0660	2.0	7.5	1	11/16/2012	11/19/2012	
Silica	EPA 200.7	12K0660	0.21	39	1	11/16/2012	11/19/2012	
Sodium	EPA 200.7	12K0660	2.0	230	1	11/16/2012	11/19/2012	
Sample ID: PVK1040-03 (KNC102612-5H - Water)								
Reporting Units: mg/l								
Calcium	EPA 200.7	12K0660	2.0	16	1	11/16/2012	11/19/2012	
Magnesium	EPA 200.7	12K0660	2.0	3.9	1	11/16/2012	11/19/2012	
Potassium	EPA 200.7	12K0660	2.0	9.4	1	11/16/2012	11/19/2012	
Silica	EPA 200.7	12K0660	0.21	48	1	11/16/2012	11/19/2012	
Sodium	EPA 200.7	12K0660	2.0	300	1	11/16/2012	11/19/2012	

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Project Manager

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Utah Geological Survey  
1594 W. North Temple Suite 3110  
Salt Lake City, UT 84114  
Attention: Grant Willis

Project ID: 314262

Report Number: PVK1040

Sampled: 10/26/12  
Received: 11/14/12

## INORGANICS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
<b>Sample ID: PVK1040-01 (KNC102612-PS - Water)</b>								
Reporting Units: pH Units								
pH	SM 4500H+	12K0562	1.68	7.73	1	11/14/2012	11/14/2012	H5
Temperature - °C	SM 4500H+	12K0562	NA	17.5	1	11/14/2012	11/14/2012	H5
<b>Sample ID: PVK1040-02 (KNC102612-U5H - Water)</b>								
Reporting Units: pH Units								
pH	SM 4500H+	12K0562	1.68	7.86	1	11/14/2012	11/14/2012	H5
Temperature - °C	SM 4500H+	12K0562	NA	17.5	1	11/14/2012	11/14/2012	H5
<b>Sample ID: PVK1040-03 (KNC102612-5H - Water)</b>								
Reporting Units: pH Units								
pH	SM 4500H+	12K0562	1.68	7.71	1	11/14/2012	11/14/2012	H5
Temperature - °C	SM 4500H+	12K0562	NA	17.6	1	11/14/2012	11/14/2012	H5

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1594 W. North Temple Suite 3110  
Salt Lake City, UT 84114  
Attention: Grant Willis

Project ID: 314262

Report Number: PVK1040

Sampled: 10/26/12  
Received: 11/14/12

## SHORT HOLD TIME DETAIL REPORT

	Hold Time (in days)	Date/Time Sampled	Date/Time Received	Date/Time Extracted	Date/Time Analyzed
Sample ID: KNC102612-PS (PVK1040-01) - Water					
SM 4500H+	1	10/26/2012 17:00	11/14/2012 10:50	11/14/2012 21:00	11/14/2012 21:00
Sample ID: KNC102612-U5H (PVK1040-02) - Water					
SM 4500H+	1	10/26/2012 16:00	11/14/2012 10:50	11/14/2012 21:00	11/14/2012 21:00
Sample ID: KNC102612-5H (PVK1040-03) - Water					
SM 4500H+	1	10/26/2012 14:00	11/14/2012 10:50	11/14/2012 21:00	11/14/2012 21:00

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Utah Geological Survey  
1594 W. North Temple Suite 3110  
Salt Lake City, UT 84114  
Attention: Grant Willis

Project ID: 314262

Report Number: PVK1040

Sampled: 10/26/12

Received: 11/14/12

## METHOD BLANK/QC DATA

### TOTAL METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
<b>Batch: 12K0660 Extracted: 11/16/12</b>										
<b>Blank Analyzed: 11/19/2012 (12K0660-BLK1)</b>										
Calcium	ND	2.0	mg/l							
Magnesium	ND	2.0	mg/l							
Potassium	ND	2.0	mg/l							
Silica	ND	0.21	mg/l							
Sodium	ND	2.0	mg/l							
<b>LCS Analyzed: 11/19/2012 (12K0660-BS1)</b>										
Calcium	20.2	2.0	mg/l	21.0		96	85-115			
Magnesium	19.9	2.0	mg/l	21.0		95	85-115			
Potassium	18.2	2.0	mg/l	20.0		91	85-115			
Silica	9.75	0.21	mg/l	10.7		91	85-115			
Sodium	18.1	2.0	mg/l	20.0		90	85-115			
<b>LCS Dup Analyzed: 11/19/2012 (12K0660-BSD1)</b>										
Calcium	21.1	2.0	mg/l	21.0		101	85-115	4	20	
Magnesium	20.8	2.0	mg/l	21.0		99	85-115	4	20	
Potassium	19.0	2.0	mg/l	20.0		95	85-115	4	20	
Silica	10.1	0.21	mg/l	10.7		95	85-115	4	20	
Sodium	19.0	2.0	mg/l	20.0		95	85-115	5	20	
<b>Matrix Spike Analyzed: 11/19/2012 (12K0660-MS1)</b>										
					<b>Source: PVK0940-01</b>					
Calcium	63.7	2.0	mg/l	21.0	46.2	84	70-130			
Magnesium	40.4	2.0	mg/l	21.0	21.3	91	70-130			
Potassium	22.4	2.0	mg/l	20.0	3.45	95	70-130			
Silica	28.3	0.21	mg/l	10.7	19.5	82	70-130			
Sodium	221	2.0	mg/l	20.0	221	0	70-130			M3
<b>Matrix Spike Dup Analyzed: 11/19/2012 (12K0660-MSD1)</b>										
					<b>Source: PVK0940-01</b>					
Calcium	64.9	2.0	mg/l	21.0	46.2	89	70-130	2	20	
Magnesium	41.3	2.0	mg/l	21.0	21.3	95	70-130	2	20	
Potassium	22.9	2.0	mg/l	20.0	3.45	97	70-130	2	20	
Silica	28.4	0.21	mg/l	10.7	19.5	83	70-130	0.5	20	
Sodium	228	2.0	mg/l	20.0	221	36	70-130	3	20	M3

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Utah Geological Survey  
1594 W. North Temple Suite 3110  
Salt Lake City, UT 84114  
Attention: Grant Willis

Project ID: 314262

Report Number: PVK1040

Sampled: 10/26/12

Received: 11/14/12

## METHOD BLANK/QC DATA

### INORGANICS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC Limits	RPD	RPD Limit	Data Qualifiers
<b>Batch: 12K0562 Extracted: 11/14/12</b>									
<b>Duplicate Analyzed: 11/14/2012 (12K0562-DUP1)</b>									
pH	7.78	1.68	pH Units		7.78		0	10	H5
<b>Duplicate Analyzed: 11/14/2012 (12K0562-DUP2)</b>									
pH	7.26	1.68	pH Units		7.22		0.6	10	H5
<b>Reference Analyzed: 11/14/2012 (12K0562-SRM1)</b>									
pH	7.03	1.68	pH Units	7.00		100	99-101		
<b>Reference Analyzed: 11/14/2012 (12K0562-SRM2)</b>									
pH	7.04	1.68	pH Units	7.00		101	99-101		

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# TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

4625 East Cotton Center Blvd. Ste 189, Phoenix, AZ 85040 (602) 437-3340 Fax: (602) 454-9303

Utah Geological Survey  
1594 W. North Temple Suite 3110  
Salt Lake City, UT 84114  
Attention: Grant Willis

Project ID: 314262

Report Number: PVK1040

Sampled: 10/26/12  
Received: 11/14/12

## DATA QUALIFIERS AND DEFINITIONS

H5	Field parameter with a holding time of 15 minutes.
M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The associated blank spike recovery was acceptable.
ND	Analyte NOT DETECTED at or above the reporting limit or MDL, if MDL is specified.
RPD	Relative Percent Difference

TestAmerica Phoenix

Suzanne Glass  
Project Manager

*The results pertain only to the samples tested in the laboratory. This report shall not be reproduced, except in full, without written permission from TestAmerica.*

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## Certification Summary

### TestAmerica Phoenix

Method	Matrix	Nelac	Arizona
EPA 200.7	Water		X
SM 4500H+	Water		X

Nevada and NELAP provide analyte specific accreditations. Analyte specific information for TestAmerica may be obtained by contacting the laboratory or visiting our website at [www.testamericainc.com](http://www.testamericainc.com)

### TestAmerica Phoenix

Suzanne Glass  
Project Manager

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## CHAIN OF CUSTODY FORM

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