



STATE OF
COLORADO

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M1997054 Parkdale Quarry 112 (c) Permit Amendment - Water Quality Consultant's Report - Part 2 of 2

1 message

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Tue, Jul 13, 2021 at 1:50 PM

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Parkdale Hydrogeologic Assessment_April 2020 - Part 2.pdf

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APPENDIX B ANALYTICAL REPORTS

Martin Marietta Parkdale Quarry: Depth to Water

Well	Elevation (feet)	Stickup (feet)	Static Depth to Water (feet btoc)					
			12/7/2018	12/11/2018	5/14/2019	8/29/2019	11/19/2019	2/28/2020
MW-01	6250.09	2.65	103.63	104.13	123.99	127.71	129.4	131.6
MW-03	6073.2	2.55	47.52	47.55	38.38	49.19	49.9	53.64
MW-10	6268.74	2.82	11.19	9.76	10.17	18.69	14.28	12.49

Martin Marietta Parkdale Quarry: Field Water Quality

	Date	Temperature	DO	Specific Conductance	pH	ORP	Turbidity
Well	Units	Deg C	mg/L	µS/ms		ReL.	NTU
MW-01	12/11/2018	14.68	4.37	587	7.71	127	743
	5/14/2019	20.26	3.98	475	7.16	127	920
MW-03	12/11/2018	16.4	0.95	480	7.65	88.5	> 1000
	5/13/2019	17.0	6.41	379	7.12	70	821
	8/28/2019	18.0	1.18	411	7.13	9	24.2
	11/19/2019	17.3	0.9	461	7.62	30.5	10.2
	2/26/2020	16.9	0.66	448	7.62	44.6	--
MW-10	12/12/2018	13.43	4.2	602	7.55	48.7	> 1000
	5/13/2019	12.86	5.05	480	6.64	110	478
	8/28/2019	14.71	4.87	617	6.91	64	330
	11/19/2019	14.3	5.91	735	6.89	98.9	28.5

Martin Marietta Parkdale Quarry: Water Quality

Parameter	Unit	Colorado Regulatory Standards			MW-01		MW-03			MW-10		
		Domestic Water Supply	Aquatic Life: Acute	Aquatic Life: Chronic	12/11/2018	5/14/2019	12/11/2018	5/13/2019	8/28/2019	12/12/2018	5/13/2019	8/28/2019
Alkalinity, Total as CaCO ₃	mg/L		--	--	190	188	176	168	--	253	228	--
Chloride	mg/L	250	--	--	8	7.5	11.6	9.9	--	8	7.5	--
Nitrogen, Nitrate	mg/L	10	--	--	5.7	6.5	1.9	2.6	--	0.12	0.087	--
Phosphorus, Total	mg/L		--	--	0.28	0.31	0.98	0.41	--	3.1	0.81	--
Solids, Total Dissolved	mg/L	500	--	--	406	417	338	318	--	437	420	--
Sulfate	mg/L	250	--	--	99	95.8	63.2	55.7	--	86.3	85.9	--
Aluminum	µg/L		8838*	1262*	< 100	< 100	< 100	< 100	--	< 100	< 100	--
Antimony	µg/L	6	--	--	< 0.80	< 0.80	< 0.80	< 0.80	--	< 0.80	< 0.80	--
Arsenic	µg/L	10	340	150	< 0.40	0.4	0.59	0.43	--	0.42	0.4	--
Barium	µg/L	1000	--	--	18.3	20.7	31.4	18.9	--	39.1	34	--
Cadmium	µg/L	5	5*	0.72*	< 0.20	< 0.20	< 0.20	< 0.20	--	< 0.20	< 0.20	--
Calcium	µg/L	--	--	--	67600	75800	50200	48100	--	81400	76400	--
Chromium	µg/L	50	16*	11*	< 4.0	< 4.0	< 4.0	< 4.0	--	< 4.0	< 4.0	--
Cobalt a	µg/L	--	--	--	< 2.0	< 1.0 ^a	< 0.40	< 0.40	--	< 2.0	< 2.0 a	--
Copper	µg/L	200	26*	16*	< 4.0	< 4.0	< 4.0	< 4.0	--	8.4	5.2	--
Iron	µg/L	300			179	122	139	82.2	--	221	140	--
Lead	µg/L	50	136*	5.3*	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	--
Magnesium	µg/L	--	--	--	15800	15100	11400	10600	--	16500	14800	--
Manganese	µg/L	50	3761*	2078*	5	2.9	9.8	12.8	--	24.1	5	--
Molybdenum	µg/L	210	300		40	18.8	141	155	--	38.3	7.3	--
Nickel	µg/L	100	842*	94*	5.2	< 4.0	< 4.0	11.2	--	10.2	< 4.0	--
Potassium	µg/L	--	--	--	2900	3030	2360	2130	--	2550	1640	--
Selenium	µg/L	50	18.4	4.6	2.9	3.8	3.2	2.2	--	1.2	1.2	--
Silicon	µg/L	--	--	--	7660	7640	9950	10700	--	13000	13200	--
Sodium	µg/L	--	--	--	23700	23100	30700	28200	--	22600	20000	--
Uranium	µg/L	30	5157*	3221*	17.3	13.7	21.2	19.7	16.7	38.2	16.7	12.6
Zinc	µg/L	5000	301*	228*	< 20	< 20	< 20	< 20	--	< 20	< 20	--

Notes:

* Aquatic life formulas based on mean hardness of 200 mg/L CaCO₃

Bold Red Font = Exceeds Domestic Water Supply Regulations

Source:

Colorado Department of Public Health and Environment Water Quality Control Commission

Regulation No. 31 - The Basic Standards and Methodologies for Surface Water

https://www.colorado.gov/pacific/sites/default/files/31_2018%2801%29.pdf

Martin Marietta Parkdale Quarry: Radionuclides

		Gross Alpha	Gross Beta	Radium 226	Radium 228	Uranium 234	Uranium 235	Uranium 238
Domestic Water Supply Standard		15	4 mrems per year (50 pCi/L screening)	5 (226 and 228 combined)	5 (226 and 228 combined)	30	30	30
	Units	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L	pCi/L
MW-01	12/11/2018	19	22	1	1.5	16	0.07	9.06
	5/14/2019	18	28	1.2	2.7	19	0	6.45
MW-03	12/11/2018	47	71	2.3	2.2	21	1.2	9.99
	5/13/2019	47	65	1.3	9.7	17	-0.27	7.28
	8/28/2019	38	14	0.6	1.9	20.8	0.505	7.66
	11/19/2019	38.8	17.5	0.15	1.32	21.6	0.475	8.53
MW-10	12/12/2018	120	200	4.4	3.1	25	0.96	17.2
	5/13/2019	25	34	1.4	2.6	11	-0.64	7.44
	8/28/2019	31	20	2.6	2.6	10.1	0.277	5.95
	11/19/2019	18	7.25	0.569	1.32	9.88	0.219	4.53

Notes:

* Aquatic life formulas based on mean hardness of 200 mg/L CaCO₃

Bold Red Font = Exceeds Domestic Water Supply Regulations

Source:

Colorado Department of Public Health and Environment Water Quality Control Commission

Regulation No. 31 - The Basic Standards and Methodologies for Surface Water

https://www.colorado.gov/pacific/sites/default/files/31_2018%2801%29.pdf

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

ERM-West, Inc.

Parkdale Quarry GW

0488586

SGS Job Number: DA11888

Sampling Dates: 12/11/18 - 12/12/18

Report to:

ERM-West, Inc.
555 17th Street Suite #1700
Denver, CO 80111
zack.walker@erm.com; Paul.Mehring@erm.com

ATTN: Zach Walker

Total number of pages in report: 35



Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.



Scott Heideman
Laboratory Director

Client Service contact: Carissa Cumine 303-425-6021

Certifications: CO (CO00049), ID (CO00049), NE (NE-OS-06-04), ND (R-027), NJ (CO007), OK (D9942)
UT (NELAP CO00049), LA (LA150028), TX (T104704511), WY (8TMS-L)

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Test results relate only to samples analyzed.

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Sample Summary

ERM-West, Inc.

Job No: DA11888

Parkdale Quarry GW
Project No: 0488586

Sample Number	Collected Date	Time By	Received	Matrix Code	Type	Client Sample ID
DA11888-1	12/11/18	11:28 PM	12/12/18	AQ	Ground Water	WELL 1:PARKDALE
DA11888-1F	12/11/18	11:28 PM	12/12/18	AQ	Groundwater Filtered	WELL 1:PARKDALE
DA11888-3	12/11/18	15:35 PM	12/12/18	AQ	Ground Water	WELL 3:PARKDALE
DA11888-3F	12/11/18	15:35 PM	12/12/18	AQ	Groundwater Filtered	WELL 3:PARKDALE
DA11888-5	12/12/18	10:52 PM	12/12/18	AQ	Ground Water	WELL 10:PARKDALE
DA11888-5F	12/12/18	10:52 PM	12/12/18	AQ	Groundwater Filtered	WELL 10:PARKDALE

CASE NARRATIVE / CONFORMANCE SUMMARY

2

Client: ERM-West, Inc.

Job No DA11888

Site: Parkdale Quarry GW

Report Date 12/27/2018 2:49:25 P

On 12/12/2018, 3 sample(s), 0 Trip Blank(s), and 0 Field Blank(s) were received at SGS North America Inc. (SGS) at a temperature of 1.1 °C. The samples were intact and properly preserved, unless noted below. An SGS Job Number of DA11888 was assigned to the project. The lab sample ID, client sample ID, and date of sample collection are detailed in the report's Results Summary.

Specified quality control criteria were achieved for this job except as noted below. For more information, please refer to the analytical results and QC summary pages.

Metals Analysis By Method EPA 200.7

Matrix: AQ

Batch ID: MP26974

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA11917-1MS, DA11917-1MSD were used as the QC samples for the metals analysis.
- MP26974-MB1 for Silicon: All sample results >10x method blank concentration.

Metals Analysis By Method EPA 200.8

Matrix: AQ

Batch ID: MP26981

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA11951-1MS, DA11951-1MSD were used as the QC samples for the metals analysis.
- DA11888-1F and -5F for Cobalt: Elevated detection limit due to dilution required for possible matrix interference.

General Chemistry By Method EPA 365.1

Matrix: AQ

Batch ID: GP24264

- All samples were prepared and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA11888-3DUP, DA11936-1MS were used as the QC samples for the Phosphorus, Total analysis.

General Chemistry By Method EPA300.0/SW846 9056A

Matrix: AQ

Batch ID: GP24222

- All samples were prepared and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA11837-2MS, DA11837-2MSD were used as the QC samples for the Chloride, Nitrogen, Nitrate, Sulfate, Chloride analysis.

General Chemistry By Method SM 2320B-2011

Matrix: AQ

Batch ID: GN45605

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA11828-2MS, DA11828-2MSD, DA11850-1DUP were used as the QC samples for the Alkalinity, Total as CaCO3 analysis.

Thursday, December 27, 2018

Page 1 of 2

General Chemistry By Method SM 2540C-2011

Matrix: AQ

Batch ID: GN45505

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA11816-1DUP were used as the QC samples for the Solids, Total Dissolved analysis.

SGS certifies that data reported for samples received, listed on the associated custody chain or analytical task order, were produced to specifications meeting SGS's Quality System precision, accuracy and completeness objectives except as noted.

Estimated non-standard method measurement uncertainty data is available on request, based on quality control bias and implicit for standard methods. Acceptable uncertainty requires tested parameter quality control data to meet method criteria.

SGS is not responsible for data quality assumptions if partial reports are used and recommends that this report be used in its entirety. This report is authorized by SGS indicated via signature on the report cover.

Summary of Hits

Job Number: DA11888
Account: ERM-West, Inc.
Project: Parkdale Quarry GW
Collected: 12/11/18 thru 12/12/18



Lab Sample ID Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
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DA11888-1 WELL 1:PARKDALE

Alkalinity, Total as CaCO3	190	5.0			mg/l	SM 2320B-2011
Chloride	8.0	2.5			mg/l	EPA300.0/SW846 9056A
Nitrogen, Nitrate	5.7	0.25			mg/l	EPA300.0/SW846 9056A
Phosphorus, Total	0.28	0.010			mg/l	EPA 365.1
Solids, Total Dissolved	406	10			mg/l	SM 2540C-2011
Sulfate	99.0	2.5			mg/l	EPA300.0/SW846 9056A

DA11888-1F WELL 1:PARKDALE

Barium	18.3	4.0			ug/l	EPA 200.8
Calcium	67600	800			ug/l	EPA 200.8
Iron	179	20			ug/l	EPA 200.8
Magnesium	15800	200			ug/l	EPA 200.8
Manganese	5.0	2.0			ug/l	EPA 200.8
Molybdenum	40.0	2.0			ug/l	EPA 200.8
Nickel	5.2	4.0			ug/l	EPA 200.8
Potassium	2900	400			ug/l	EPA 200.8
Selenium	2.9	0.80			ug/l	EPA 200.8
Silicon	7660	1000			ug/l	EPA 200.7
Sodium	23700	1000			ug/l	EPA 200.8
Uranium	17.3	0.40			ug/l	EPA 200.8

DA11888-3 WELL 3:PARKDALE

Alkalinity, Total as CaCO3	176	5.0			mg/l	SM 2320B-2011
Chloride	11.6	2.5			mg/l	EPA300.0/SW846 9056A
Nitrogen, Nitrate	1.9	0.050			mg/l	EPA300.0/SW846 9056A
Phosphorus, Total	0.98	0.010			mg/l	EPA 365.1
Solids, Total Dissolved	338	10			mg/l	SM 2540C-2011
Sulfate	63.2	2.5			mg/l	EPA300.0/SW846 9056A

DA11888-3F WELL 3:PARKDALE

Arsenic	0.59	0.40			ug/l	EPA 200.8
Barium	31.4	4.0			ug/l	EPA 200.8
Calcium	50200	800			ug/l	EPA 200.8
Iron	139	20			ug/l	EPA 200.8
Magnesium	11400	200			ug/l	EPA 200.8
Manganese	9.8	2.0			ug/l	EPA 200.8
Molybdenum	141	2.0			ug/l	EPA 200.8
Potassium	2360	400			ug/l	EPA 200.8
Selenium	3.2	0.80			ug/l	EPA 200.8
Silicon	9950	50			ug/l	EPA 200.7

Summary of Hits

Page 2 of 2

Job Number: DA11888
Account: ERM-West, Inc.
Project: Parkdale Quarry GW
Collected: 12/11/18 thru 12/12/18



Lab Sample ID Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
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Sodium		30700	1000		ug/l	EPA 200.8
Uranium		21.2	0.40		ug/l	EPA 200.8

DA11888-5 WELL 10:PARKDALE

Alkalinity, Total as CaCO3	253	5.0		mg/l	SM 2320B-2011
Chloride	8.0	2.5		mg/l	EPA300.0/SW846 9056A
Nitrogen, Nitrate	0.12	0.050		mg/l	EPA300.0/SW846 9056A
Phosphorus, Total	3.1	0.10		mg/l	EPA 365.1
Solids, Total Dissolved	437	10		mg/l	SM 2540C-2011
Sulfate	86.3	2.5		mg/l	EPA300.0/SW846 9056A

DA11888-5F WELL 10:PARKDALE

Arsenic	0.42	0.40		ug/l	EPA 200.8
Barium	39.1	4.0		ug/l	EPA 200.8
Calcium	81400	800		ug/l	EPA 200.8
Copper	8.4	4.0		ug/l	EPA 200.8
Iron	221	20		ug/l	EPA 200.8
Magnesium	16500	200		ug/l	EPA 200.8
Manganese	24.1	2.0		ug/l	EPA 200.8
Molybdenum	38.3	2.0		ug/l	EPA 200.8
Nickel	10.2	4.0		ug/l	EPA 200.8
Potassium	2550	400		ug/l	EPA 200.8
Selenium	1.2	0.80		ug/l	EPA 200.8
Silicon	13000	50		ug/l	EPA 200.7
Sodium	22600	1000		ug/l	EPA 200.8
Uranium	38.2	0.40		ug/l	EPA 200.8



Wheat Ridge, CO

Section 4

4

Sample Results

Report of Analysis

Report of Analysis

Client Sample ID: WELL 1:PARKDALE
Lab Sample ID: DA11888-1
Matrix: AQ - Ground Water
Project: Parkdale Quarry GW

Date Sampled: 12/11/18
Date Received: 12/12/18
Percent Solids: n/a

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Alkalinity, Total as CaCO3	190	5.0	mg/l	1	12/24/18 10:00	PV	SM 2320B-2011
Chloride	8.0	2.5	mg/l	5	12/13/18 09:37	MA	EPA300.0/SW846 9056A
Nitrogen, Nitrate	5.7	0.25	mg/l	25	12/13/18 10:16	MA	EPA300.0/SW846 9056A
Phosphorus, Total	0.28	0.010	mg/l	1	12/19/18 16:13	AM	EPA 365.1
Solids, Total Dissolved	406	10	mg/l	1	12/17/18	JD	SM 2540C-2011
Sulfate	99.0	2.5	mg/l	5	12/13/18 09:37	MA	EPA300.0/SW846 9056A

RL = Reporting Limit

4.1
4

Report of Analysis

Client Sample ID:	WELL 1:PARKDALE	Date Sampled:	12/11/18
Lab Sample ID:	DA11888-1F	Date Received:	12/12/18
Matrix:	AQ - Groundwater Filtered	Percent Solids:	n/a
Project:	Parkdale Quarry GW		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Aluminum	< 100	100	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Antimony	< 0.80	0.80	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ¹	EPA 200.8 ⁶
Arsenic	< 0.40	0.40	ug/l	2	12/18/18	12/24/18 JM	EPA 200.8 ⁴	EPA 200.8 ⁶
Barium	18.3	4.0	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Cadmium	< 0.20	0.20	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Calcium	67600	800	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Chromium	< 4.0	4.0	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Cobalt ^a	< 2.0	2.0	ug/l	10	12/18/18	12/24/18 JM	EPA 200.8 ⁴	EPA 200.8 ⁶
Copper	< 4.0	4.0	ug/l	2	12/18/18	12/24/18 JM	EPA 200.8 ⁴	EPA 200.8 ⁶
Iron	179	20	ug/l	2	12/18/18	12/24/18 JM	EPA 200.8 ⁴	EPA 200.8 ⁶
Lead	< 1.0	1.0	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Magnesium	15800	200	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Manganese	5.0	2.0	ug/l	2	12/18/18	12/24/18 JM	EPA 200.8 ⁴	EPA 200.8 ⁶
Molybdenum	40.0	2.0	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Nickel	5.2	4.0	ug/l	2	12/18/18	12/24/18 JM	EPA 200.8 ⁴	EPA 200.8 ⁶
Potassium	2900	400	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Selenium	2.9	0.80	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Silicon	7660	1000	ug/l	20	12/14/18	12/21/18 JR	EPA 200.7 ²	EPA 200.7 ⁵
Sodium	23700	1000	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Uranium	17.3	0.40	ug/l	2	12/18/18	12/24/18 JM	EPA 200.8 ⁴	EPA 200.8 ⁶
Zinc	< 20	20	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶

(1) Instrument QC Batch: MA10823

(2) Instrument QC Batch: MA10829

(3) Instrument QC Batch: MA10831

(4) Instrument QC Batch: MA10837

(5) Prep QC Batch: MP26974

(6) Prep QC Batch: MP26981

(a) Elevated detection limit due to dilution required for possible matrix interference.

RL = Reporting Limit

Report of Analysis

Client Sample ID: WELL 3:PARKDALE
Lab Sample ID: DA11888-3
Matrix: AQ - Ground Water
Project: Parkdale Quarry GW

Date Sampled: 12/11/18
Date Received: 12/12/18
Percent Solids: n/a

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Alkalinity, Total as CaCO3	176	5.0	mg/l	1	12/24/18 10:00	PV	SM 2320B-2011
Chloride	11.6	2.5	mg/l	5	12/13/18 09:50	MA	EPA300.0/SW846 9056A
Nitrogen, Nitrate	1.9	0.050	mg/l	5	12/13/18 09:50	MA	EPA300.0/SW846 9056A
Phosphorus, Total	0.98	0.010	mg/l	1	12/19/18 16:14	AM	EPA 365.1
Solids, Total Dissolved	338	10	mg/l	1	12/17/18	JD	SM 2540C-2011
Sulfate	63.2	2.5	mg/l	5	12/13/18 09:50	MA	EPA300.0/SW846 9056A

RL = Reporting Limit

4.3
4

Report of Analysis

Client Sample ID:	WELL 3:PARKDALE	Date Sampled:	12/11/18
Lab Sample ID:	DA11888-3F	Date Received:	12/12/18
Matrix:	AQ - Groundwater Filtered	Percent Solids:	n/a
Project:	Parkdale Quarry GW		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Aluminum	< 100	100	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Antimony	< 0.80	0.80	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ¹	EPA 200.8 ⁶
Arsenic	0.59	0.40	ug/l	2	12/18/18	12/24/18 JM	EPA 200.8 ⁴	EPA 200.8 ⁶
Barium	31.4	4.0	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Cadmium	< 0.20	0.20	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Calcium	50200	800	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Chromium	< 4.0	4.0	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Cobalt	< 0.40	0.40	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Copper	< 4.0	4.0	ug/l	2	12/18/18	12/24/18 JM	EPA 200.8 ⁴	EPA 200.8 ⁶
Iron	139	20	ug/l	2	12/18/18	12/24/18 JM	EPA 200.8 ⁴	EPA 200.8 ⁶
Lead	< 1.0	1.0	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Magnesium	11400	200	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Manganese	9.8	2.0	ug/l	2	12/18/18	12/24/18 JM	EPA 200.8 ⁴	EPA 200.8 ⁶
Molybdenum	141	2.0	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Nickel	< 4.0	4.0	ug/l	2	12/18/18	12/24/18 JM	EPA 200.8 ⁴	EPA 200.8 ⁶
Potassium	2360	400	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Selenium	3.2	0.80	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Silicon	9950	50	ug/l	1	12/14/18	12/21/18 JR	EPA 200.7 ²	EPA 200.7 ⁵
Sodium	30700	1000	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Uranium	21.2	0.40	ug/l	2	12/18/18	12/24/18 JM	EPA 200.8 ⁴	EPA 200.8 ⁶
Zinc	< 20	20	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶

(1) Instrument QC Batch: MA10823

(2) Instrument QC Batch: MA10829

(3) Instrument QC Batch: MA10831

(4) Instrument QC Batch: MA10837

(5) Prep QC Batch: MP26974

(6) Prep QC Batch: MP26981

RL = Reporting Limit

Report of Analysis

Client Sample ID: WELL 10:PARKDALE
Lab Sample ID: DA11888-5
Matrix: AQ - Ground Water
Project: Parkdale Quarry GW

Date Sampled: 12/12/18
Date Received: 12/12/18
Percent Solids: n/a

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Alkalinity, Total as CaCO3	253	5.0	mg/l	1	12/24/18 10:00	PV	SM 2320B-2011
Chloride	8.0	2.5	mg/l	5	12/13/18 10:03	MA	EPA300.0/SW846 9056A
Nitrogen, Nitrate	0.12	0.050	mg/l	5	12/13/18 10:03	MA	EPA300.0/SW846 9056A
Phosphorus, Total	3.1	0.10	mg/l	10	12/19/18 16:48	AM	EPA 365.1
Solids, Total Dissolved	437	10	mg/l	1	12/17/18	JD	SM 2540C-2011
Sulfate	86.3	2.5	mg/l	5	12/13/18 10:03	MA	EPA300.0/SW846 9056A

RL = Reporting Limit

4.5
4

Report of Analysis

Client Sample ID:	WELL 10:PARKDALE	Date Sampled:	12/12/18
Lab Sample ID:	DA11888-5F	Date Received:	12/12/18
Matrix:	AQ - Groundwater Filtered	Percent Solids:	n/a
Project:	Parkdale Quarry GW		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Aluminum	< 100	100	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Antimony	< 0.80	0.80	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ¹	EPA 200.8 ⁶
Arsenic	0.42	0.40	ug/l	2	12/18/18	12/24/18 JM	EPA 200.8 ⁴	EPA 200.8 ⁶
Barium	39.1	4.0	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Cadmium	< 0.20	0.20	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Calcium	81400	800	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Chromium	< 4.0	4.0	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Cobalt ^a	< 2.0	2.0	ug/l	10	12/18/18	12/24/18 JM	EPA 200.8 ⁴	EPA 200.8 ⁶
Copper	8.4	4.0	ug/l	2	12/18/18	12/24/18 JM	EPA 200.8 ⁴	EPA 200.8 ⁶
Iron	221	20	ug/l	2	12/18/18	12/24/18 JM	EPA 200.8 ⁴	EPA 200.8 ⁶
Lead	< 1.0	1.0	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Magnesium	16500	200	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Manganese	24.1	2.0	ug/l	2	12/18/18	12/24/18 JM	EPA 200.8 ⁴	EPA 200.8 ⁶
Molybdenum	38.3	2.0	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Nickel	10.2	4.0	ug/l	2	12/18/18	12/24/18 JM	EPA 200.8 ⁴	EPA 200.8 ⁶
Potassium	2550	400	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Selenium	1.2	0.80	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Silicon	13000	50	ug/l	1	12/14/18	12/21/18 JR	EPA 200.7 ²	EPA 200.7 ⁵
Sodium	22600	1000	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶
Uranium	38.2	0.40	ug/l	2	12/18/18	12/24/18 JM	EPA 200.8 ⁴	EPA 200.8 ⁶
Zinc	< 20	20	ug/l	2	12/18/18	12/21/18 JM	EPA 200.8 ³	EPA 200.8 ⁶

(1) Instrument QC Batch: MA10823

(2) Instrument QC Batch: MA10829

(3) Instrument QC Batch: MA10831

(4) Instrument QC Batch: MA10837

(5) Prep QC Batch: MP26974

(6) Prep QC Batch: MP26981

(a) Elevated detection limit due to dilution required for possible matrix interference.

RL = Reporting Limit

Misc. Forms

5

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

CHAIN OF CUSTODY

Page ____ of ____

4036 Youngfield Street, Wheat Ridge, CO 80033
TEL: 303-425-6021 FAX: 303-425-6854
www.accutest.com

Bottle Order Control #	FED-EX Tracking #
SGS Quote #	SGS Job # DA11888

Client / Reporting Information		Project Information		Requested Analysis (see TEST CODE sheet)										Matrix Codes			
Company: ERM-West, Inc.	Project Name: Parkdale Quarry GW	Alkalinity (sm 1320B-2011) Dissolved Metals LF (EPA 200.8) SO₄, NO₃, O₃, C-HL (EPA 200.9) TDS (sm 4500-PE-2011) Total PO₄ (sm 4500-E-2011) Isotopic Uranium Gross Alpha/Beta (EPA 909) Radium-226 Radium-228										DW - Drinking Water GW - Ground Water WW - Water SW - Surface Water SO - Soil SL - Sludge SED - Sediment OI - Oil LIQ - Other Liquid AIR - Air SOL - Other Solid WP - Wipe FB - Field Blank EB - Equipment Blank RB - Rinse Blank TB - Trip Blank					
Street: 555 17th St, #1700	Street:																
City, State: Denver, CO	City, State:																
Project Contact: Zach Walker	Project #: 0488586																
Phone: 303-741-5050	Client Purchase Order #:																
Email: zach.walker@erm.com	Street Address: @erm.com																
Sampler(s) Name(s): Z. Walker, P. Mehring	Project Manager: Becky Moore																
Collection		Number of preserved Bottles										LAB USE ONLY					
Field ID / Point of Collection	Date	Time	Sampled by	Matrix	# of bottles	NONE	HCl	HNO ₃	H ₂ SO ₄	DI Water	MEOH	ENCORE	NuS200	NuS200			
Well 1: Parkdale	12/11/18	11:28	PM	GW	12	5		6	1								01
Well 1: Parkdale Dup	12/11/18	11:28			12	5		6	1								02
Well 3: Parkdale	12/11/18	15:35			12	5		6	1								03
Well 3: Parkdale Dup	12/11/18	15:36			12	5		6	1								04
Well 10: Parkdale	12/12/18	10:52			12	5		6	1								05
Well 30: Parkdale Dup	12/12/18	10:52	↓	↓	12	5		6	1								06
Turnaround Time (Business days)		Data Deliverable Information										Comments / Special Instructions					
☒ Std. 10 Business Days ☐ 5 Day RUSH ☐ 3 Day Emergency ☐ 2 Day Emergency ☐ 1 Day Emergency		Special Reporting Instructions ☐ Report in PPB ☐ Report in PPM ☐ Report MDLs		☐ Commercial "A" (Level 1, Results Only) ☒ Commercial "B" (Level 2, Results + QC Summary) ☐ COMMBN (Results/QC/Narrative) ☐ COMMBN+ (Results/QC/Narrative (+ chromatograms)) ☐ REDT2 ☐ FULT1 ☐ EDD Format													
Emergency & Rush T/A data available VIA LabLink. RUSH TAT approval needed.																	
Sample Custody must be documented below each time samples change possession, including courier delivery.																	
Relinquished By: 1	Date/Time: 12/12/18 17:05	Received By: 1	Date/Time: 12/12/18 17:05	Relinquished By: 2	Date/Time: 12/12/18 17:05	Received By: 2	Date/Time: 12/12/18 17:05	Relinquished By: 3	Date/Time: 12/12/18 17:05	Received By: 3	Date/Time: 12/12/18 17:05	Relinquished By: 4	Date/Time: 12/12/18 17:05	Received By: 4	Date/Time: 12/12/18 17:05	Received By: 4	
Custody Seal #	Intact ☒ Not Intact ☐ Absent ☐	Preserved where applicable ☒	Cooler Temp. °C: 1.1	Therm. ID: 718C	On Ice ☒	Form MSQA 064-01, RV 6/19/17 http://www.sgs.com/terms-and-conditions											

DA11888: Chain of Custody

Page 1 of 2

SGS Accutest Sample Receipt Summary

Job Number: DA11888

Client: ERM

Project: PARKDALE

Date / Time Received: 12/12/2018 5:05:00 PM

Delivery Method:

Airbill #'s: HD

Cooler Temps (Initial/Adjusted): #1: (1.1/1.1):

Cooler Security

Y or N

Y or N

- | | | | | | |
|---------------------------|-------------------------------------|--------------------------|-----------------------|-------------------------------------|--------------------------|
| 1. Custody Seals Present: | ☒ | ☐ | 3. COC Present: | ☒ | ☐ |
| 2. Custody Seals Intact: | ☒ | ☐ | 4. Smpl Dates/Time OK | ☒ | ☐ |

Cooler Temperature

Y or N

- | | | |
|------------------------------|-------------------------------------|--------------------------|
| 1. Temp criteria achieved: | ☒ | ☐ |
| 2. Cooler temp verification: | Bar Therm; | |
| 3. Cooler media: | Ice (Bag) | |
| 4. No. Coolers: | 1 | |

Quality Control Preservation

Y or N N/A

- | | | | |
|---------------------------------|-------------------------------------|--------------------------|-------------------------------------|
| 1. Trip Blank present / cooler: | ☐ | ☐ | ☒ |
| 2. Trip Blank listed on COC: | ☐ | ☐ | ☒ |
| 3. Samples preserved properly: | ☒ | ☐ | |
| 4. VOCs headspace free: | ☐ | ☐ | ☒ |

Sample Integrity - Documentation

Y or N

- | | | |
|--|-------------------------------------|--------------------------|
| 1. Sample labels present on bottles: | ☒ | ☐ |
| 2. Container labeling complete: | ☒ | ☐ |
| 3. Sample container label / COC agree: | ☒ | ☐ |

Sample Integrity - Condition

Y or N

- | | | |
|----------------------------------|-------------------------------------|--------------------------|
| 1. Sample recvd within HT: | ☒ | ☐ |
| 2. All containers accounted for: | ☒ | ☐ |
| 3. Condition of sample: | Intact | |

Sample Integrity - Instructions

Y or N N/A

- | | | | |
|---|-------------------------------------|-------------------------------------|-------------------------------------|
| 1. Analysis requested is clear: | ☒ | ☐ | |
| 2. Bottles received for unspecified tests | ☐ | ☒ | |
| 3. Sufficient volume recvd for analysis: | ☒ | ☐ | |
| 4. Compositing instructions clear: | ☐ | ☐ | ☒ |
| 5. Filtering instructions clear: | ☐ | ☐ | ☒ |

Comments

DA11888: Chain of Custody

Page 2 of 2

Metals Analysis

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Matrix Spike and Duplicate Summaries
- Blank Spike and Lab Control Sample Summaries
- Serial Dilution Summaries

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: DA11888
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP26974
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 12/14/18

Metal	RL	IDL	MDL	MB raw	final
Aluminum	100	46	46		
Antimony	30	14	8.7		
Arsenic	25	22	12		
Barium	10	.3	.2		
Beryllium	10	1	1.6		
Boron	50	3.3	3.7		
Cadmium	10	1.9	.6		
Calcium	400	6.6	22		
Chromium	10	1.1	1		
Cobalt	5.0	2.7	1.2		
Copper	10	4.6	2.9		
Iron	10	8.9	6.9		
Lead	50	13	9.1		
Lithium	5.0	.6	1		
Magnesium	200	50	39		
Manganese	5.0	.5	.4		
Molybdenum	10	8.5	3.6		
Nickel	30	6.2	2.1		
Phosphorus	100	91	47		
Potassium	1000	84	61		
Selenium	50	30	15		
Silicon	50	41	6.2	52.7	* (a)
Silver	30	.6	.9		
Sodium	400	13	14		
Strontium	5.0	.1	.3		
Thallium	10	17	9.1		
Tin	50	41	25		
Titanium	10	.5	2.5		
Uranium	50	3.9	4.4		
Vanadium	10	.9	.6		
Zinc	30	9	3.5		

Associated samples MP26974: DA11888-1F, DA11888-3F, DA11888-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: DA11888
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP26974
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 12/14/18

Metal	RL	IDL	MDL	MB raw	final
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(anr) Analyte not requested

(a) All sample results >10x method blank concentration.

6.1.1

6

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA11888
 Account: ERMC0GV - ERM-West, Inc.
 Project: Parkdale Quarry GW

QC Batch ID: MP26974
 Matrix Type: AQUEOUS

Methods: EPA 200.7
 Units: ug/l

Prep Date: 12/14/18

Metal	DA11917-1 Original MS	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium	anr			
Chromium	anr			
Cobalt				
Copper	anr			
Iron	anr			
Lead	anr			
Lithium				
Magnesium	anr			
Manganese	anr			
Molybdenum	anr			
Nickel	anr			
Phosphorus	anr			
Potassium	anr			
Selenium				
Silicon	185	1300	1000	130.0 70-130
Silver				
Sodium	anr			
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc	anr			

Associated samples MP26974: DA11888-1F, DA11888-3F, DA11888-5F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA11888
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

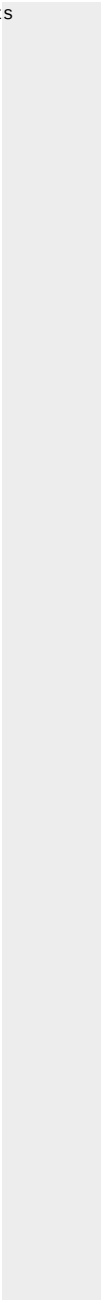
QC Batch ID: MP26974
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 12/14/18

Metal	DA11917-1 Original MS	Spike lot ICPALL2 % Rec	QC Limits
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(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested



6.1.2
6

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA11888
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP26974
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 12/14/18

Metal	DA11917-1 Original MSD	SpikeLot ICPALL2	% Rec	MSD RPD	QC Limit
Aluminum					
Antimony					
Arsenic					
Barium					
Beryllium					
Boron					
Cadmium					
Calcium	anr				
Chromium	anr				
Cobalt					
Copper	anr				
Iron	anr				
Lead	anr				
Lithium					
Magnesium	anr				
Manganese	anr				
Molybdenum	anr				
Nickel	anr				
Phosphorus	anr				
Potassium	anr				
Selenium					
Silicon	185	1280	1000	109.5	1.6
Silver					20
Sodium	anr				
Strontium					
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc	anr				

Associated samples MP26974: DA11888-1F, DA11888-3F, DA11888-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA11888
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

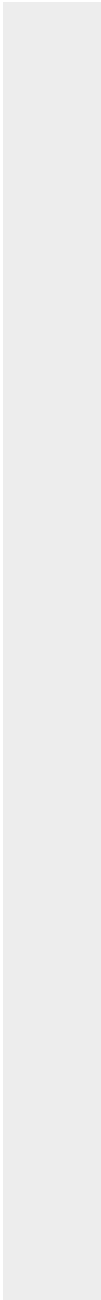
QC Batch ID: MP26974
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 12/14/18

Metal	DA11917-1 Original MSD	SpikeLot ICPALL2 % Rec	MSD RPD	QC Limit
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(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested



6.1.2
6

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: DA11888
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP26974
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 12/14/18

Metal	BSP Result	SpikeLot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium	anr			
Chromium	anr			
Cobalt				
Copper	anr			
Iron	anr			
Lead	anr			
Lithium				
Magnesium	anr			
Manganese	anr			
Molybdenum	anr			
Nickel	anr			
Phosphorus	anr			
Potassium	anr			
Selenium				
Silicon	1090	1000	109.0	85-115
Silver				
Sodium	anr			
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc	anr			

Associated samples MP26974: DA11888-1F, DA11888-3F, DA11888-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: DA11888
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

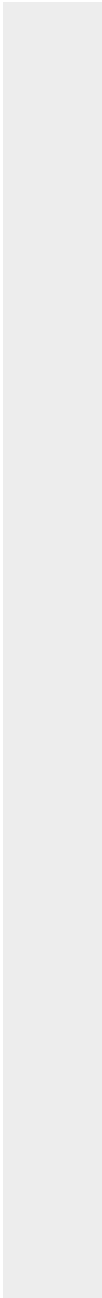
QC Batch ID: MP26974
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 12/14/18

Metal	BSP Result	Spike lot ICPALL2	% Rec	QC Limits
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(anr) Analyte not requested



6.1.3
6

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: DA11888
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP26981
Matrix Type: AQUEOUS

Methods: EPA 200.8
Units: ug/l

Prep Date: 12/18/18

Metal	RL	IDL	MDL	MB raw	final
Aluminum	50	1.1	2	4.6	<50
Antimony	0.40	.0022	.011	0.0070	<0.40
Arsenic	0.20	.017	.044	-0.0050	<0.20
Barium	2.0	.016	.079	0.039	<2.0
Beryllium	0.20	.016	.069		
Boron	40	.49	2.1		
Cadmium	0.10	.036	.042	0.045	<0.10
Calcium	400	5.6	12	-1.7	<400
Chromium	2.0	.053	.053	-0.45	<2.0
Cobalt	0.20	.0049	.015	-0.0010	<0.20
Copper	2.0	.06	.13	0.043	<2.0
Iron	10	3.5	4.6	1.4	<10
Lead	0.50	.0079	.008	-0.0010	<0.50
Magnesium	100	1.3	1.3	9.2	<100
Manganese	1.0	.12	.13	0.23	<1.0
Molybdenum	1.0	.049	.029	0.0	<1.0
Nickel	2.0	.0088	.027	0.013	<2.0
Phosphorus	60	2.6	4.3		
Potassium	200	2.9	2.9	-17	<200
Selenium	0.40	.06	.21	-0.076	<0.40
Silver	0.10	.0019	.008		
Sodium	500	4.9	4.9	13.9	<500
Strontium	20	.01	.015		
Thallium	0.20	.0024	.005		
Tin	10	.063	1.3		
Titanium	2.0	.059	.092		
Uranium	0.20	.0017	.002	0.0070	<0.20
Vanadium	1.0	.037	.2		
Zinc	10	.21	.96	1.2	<10

Associated samples MP26981: DA11888-1F, DA11888-3F, DA11888-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA11888
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP26981
Matrix Type: AQUEOUS

Methods: EPA 200.8
Units: ug/l

Prep Date: 12/18/18

Metal	DA11951-1 Original MS		SpikeLot ICPALL2	% Rec	QC Limits
Aluminum	12.1	1010	1000	99.8	70-130
Antimony	0.18	108	100	107.8	70-130
Arsenic	0.12	209	200	104.4	70-130
Barium	24.2	400	400	94.4	70-130
Beryllium					
Boron					
Cadmium	0.0	99.5	100	99.5	70-130
Calcium	15900	20200	5000	96.0	70-130
Chromium	0.0	101	100	101.0	70-130
Cobalt	0.0	95.7	100	95.7	70-130
Copper	0.43	106	100	105.6	70-130
Iron	47.2	1080	1000	103.3	70-130
Lead	0.12	213	200	106.4	70-130
Magnesium	2110	6900	5000	95.8	70-130
Manganese	6.0	113	100	107.0	70-130
Molybdenum	3.2	107	100	103.8	70-130
Nickel	0.56	106	100	105.4	70-130
Phosphorus					
Potassium	464	5210	5000	94.9	70-130
Selenium	0.0	191	200	95.5	70-130
Silver	anr				
Sodium	1670	6160	5000	93.6	70-130
Strontium					
Thallium					
Tin					
Titanium					
Uranium	1.7	217	200	107.7	70-130
Vanadium					
Zinc	4.3	95.2	100	90.9	70-130

Associated samples MP26981: DA11888-1F, DA11888-3F, DA11888-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA11888
 Account: ERMC0GV - ERM-West, Inc.
 Project: Parkdale Quarry GW

QC Batch ID: MP26981
 Matrix Type: AQUEOUS

Methods: EPA 200.8
 Units: ug/l

Prep Date: 12/18/18

Metal	DA11951-1 Original MSD		Spike lot ICPALL2	% Rec	MSD RPD	QC Limit
Aluminum	12.1	988	1000	97.6	2.2	20
Antimony	0.18	106	100	105.8	1.9	20
Arsenic	0.12	209	200	104.4	0.0	20
Barium	24.2	393	400	92.6	1.8	20
Beryllium						
Boron						
Cadmium	0.0	98.5	100	98.5	1.0	20
Calcium	15900	19700	5000	86.0	2.5	20
Chromium	0.0	98.0	100	98.0	3.0	20
Cobalt	0.0	93.0	100	93.0	2.9	20
Copper	0.43	105	100	104.6	0.9	20
Iron	47.2	1080	1000	103.3	0.0	20
Lead	0.12	207	200	103.4	2.9	20
Magnesium	2110	6770	5000	93.2	1.9	20
Manganese	6.0	113	100	107.0	0.0	20
Molybdenum	3.2	105	100	101.8	1.9	20
Nickel	0.56	108	100	107.4	1.9	20
Phosphorus						
Potassium	464	5180	5000	94.3	0.6	20
Selenium	0.0	189	200	94.5	1.1	20
Silver	anr					
Sodium	1670	6080	5000	92.0	1.3	20
Strontium						
Thallium						
Tin						
Titanium						
Uranium	1.7	215	200	106.7	0.9	20
Vanadium						
Zinc	4.3	92.9	100	88.6	2.4	20

Associated samples MP26981: DA11888-1F, DA11888-3F, DA11888-5F

Results < IDL are shown as zero for calculation purposes

(*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

(anr) Analyte not requested

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: DA11888
 Account: ERMC0GV - ERM-West, Inc.
 Project: Parkdale Quarry GW

QC Batch ID: MP26981
 Matrix Type: AQUEOUS

Methods: EPA 200.8
 Units: ug/l

Prep Date: 12/18/18

Metal	BSP Result	Spike lot ICPALL2	% Rec	QC Limits
Aluminum	1010	1000	101.0	85-115
Antimony	107	100	107.0	85-115
Arsenic	208	200	104.0	85-115
Barium	377	400	94.3	85-115
Beryllium				
Boron				
Cadmium	99.4	100	99.4	85-115
Calcium	4990	5000	99.8	85-115
Chromium	101	100	101.0	85-115
Cobalt	95.9	100	95.9	85-115
Copper	104	100	104.0	85-115
Iron	1030	1000	103.0	85-115
Lead	212	200	106.0	85-115
Magnesium	4850	5000	97.0	85-115
Manganese	106	100	106.0	85-115
Molybdenum	103	100	103.0	85-115
Nickel	106	100	106.0	85-115
Phosphorus				
Potassium	4780	5000	95.6	85-115
Selenium	191	200	95.5	85-115
Silver	anr			
Sodium	4820	5000	96.4	85-115
Strontium				
Thallium				
Tin				
Titanium				
Uranium	214	200	107.0	85-115
Vanadium				
Zinc	92.0	100	92.0	85-115

Associated samples MP26981: DA11888-1F, DA11888-3F, DA11888-5F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (anr) Analyte not requested

General Chemistry

QC Data Summaries

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Includes the following where applicable:

- Method Blank and Blank Spike Summaries
- Duplicate Summaries
- Matrix Spike Summaries

METHOD BLANK AND SPIKE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: DA11888
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

Analyte	Batch ID	RL	MB Result	Units	Spike Amount	BSP Result	BSP %Recov	QC Limits
Alkalinity, Total as CaCO3	GN45605	5.0	2.3	mg/l	100	97.5	97.5	90-110%
Alkalinity, Total as CaCO3	GN45605	5.0	2.1	mg/l	100	97.4	97.4	90-110%
Bromide	GP24222/GN45485	0.050	0.0	mg/l	0.5	0.545	109.0	90-110%
Chloride	GP24222/GN45485	0.50	0.0	mg/l	5	5.47	109.4	90-110%
Fluoride	GP24222/GN45485	0.10	0.0	mg/l	1	1.09	109.0	90-110%
Nitrogen, Nitrate	GP24222/GN45485	0.010	0.0	mg/l	0.1	0.109	109.0	90-110%
Nitrogen, Nitrite	GP24222/GN45485	0.0040	0.0	mg/l	0.05	0.0508	101.6	90-110%
Phosphorus, Total	GP24264/GN45556	0.010	0.00	mg/l	0.2	0.187	93.5	90-110%
Phosphorus, Total	GP24264/GN45556	0.010	0.00	mg/l	0.2	0.194	97.0	90-110%
Solids, Total Dissolved	GN45505	10	0.0	mg/l				
Solids, Total Dissolved	GN45505	10	0.0	mg/l	400	396	99.0	90-110%
Sulfate	GP24222/GN45485	0.50	0.0	mg/l	5	5.42	108.4	90-110%

Associated Samples:

Batch GN45505: DA11888-1, DA11888-3, DA11888-5

Batch GN45605: DA11888-1, DA11888-3, DA11888-5

Batch GP24222: DA11888-1, DA11888-3, DA11888-5

Batch GP24264: DA11888-1, DA11888-3, DA11888-5

(*) Outside of QC limits

7.1
7

DUPLICATE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: DA11888
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

Analyte	Batch ID	QC Sample	Units	Original Result	DUP Result	RPD	QC Limits
Alkalinity, Total as CaCO3	GN45605	DA11850-1	mg/l	208	211	1.4	0-20%
Phosphorus, Total	GP24264/GN45556	DA11888-3	mg/l	0.98	0.967	1.0	0-20%
Solids, Total Dissolved	GN45505	DA11816-1	mg/l	438	447	2.0	0-5%

Associated Samples:

Batch GN45505: DA11888-1, DA11888-3, DA11888-5

Batch GN45605: DA11888-1, DA11888-3, DA11888-5

Batch GP24264: DA11888-1, DA11888-3, DA11888-5

(*) Outside of QC limits

MATRIX SPIKE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: DA11888
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MS Result	%Rec	QC Limits
Alkalinity, Total as CaCO3	GN45605	DA11828-2	mg/l	39.5	100	137	97.7	80-120%
Bromide	GP24222/GN45485	DA11837-2	mg/l	0.0	25	24.5	98.0	80-120%
Chloride	GP24222/GN45485	DA11837-2	mg/l	74.7	250	319	97.7	80-120%
Fluoride	GP24222/GN45485	DA11837-2	mg/l	0.0	50	49.9	99.8	80-120%
Nitrogen, Nitrate	GP24222/GN45485	DA11837-2	mg/l	2.8	5	7.6	96.0	80-120%
Nitrogen, Nitrite	GP24222/GN45485	DA11837-2	mg/l	1.2	2.5	3.8	104.0	80-120%
Phosphorus, Total	GP24264/GN45556	DA11936-1	mg/l	0.050	0.2	0.247	98.5	90-110%
Sulfate	GP24222/GN45485	DA11837-2	mg/l	37.0	250	275	95.2	80-120%

Associated Samples:

Batch GN45605: DA11888-1, DA11888-3, DA11888-5

Batch GP24222: DA11888-1, DA11888-3, DA11888-5

Batch GP24264: DA11888-1, DA11888-3, DA11888-5

(*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

7.3

7

MATRIX SPIKE DUPLICATE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: DA11888
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MSD Result	RPD	QC Limit
Alkalinity, Total as CaCO3	GN45605	DA11828-2	mg/l	39.5	100	134	2.2	20%
Bromide	GP24222/GN45485	DA11837-2	mg/l	0.0	25	25.9	5.6	20%
Chloride	GP24222/GN45485	DA11837-2	mg/l	74.7	250	334	4.6	20%
Fluoride	GP24222/GN45485	DA11837-2	mg/l	0.0	50	53.1	6.2	20%
Nitrogen, Nitrate	GP24222/GN45485	DA11837-2	mg/l	2.8	5	8.0	5.1	20%
Nitrogen, Nitrite	GP24222/GN45485	DA11837-2	mg/l	1.2	2.5	3.7	2.7	20%
Sulfate	GP24222/GN45485	DA11837-2	mg/l	37.0	250	300	8.7	20%

Associated Samples:

Batch GN45605: DA11888-1, DA11888-3, DA11888-5

Batch GP24222: DA11888-1, DA11888-3, DA11888-5

(*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

7.4

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The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

ERM-West, Inc.

Parkdale Quarry GW

0488586

SGS Job Number: DA11888X

Sampling Date: 12/11/18

Report to:

ERM-West, Inc.
555 17th Street Suite #1700
Denver, CO 80111
zack.walker@erm.com; Paul.Mehring@erm.com

ATTN: Zach Walker

Total number of pages in report: **26**



Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.



Scott Heideman
Laboratory Director

Client Service contact: Carissa Cumine 303-425-6021

Certifications: CO (CO00049), ID (CO00049), NE (NE-OS-06-04), ND (R-027), NJ (CO007), OK (D9942)
UT (NELAP CO00049), LA (LA150028), TX (T104704511), WY (8TMS-L)

This report shall not be reproduced, except in its entirety, without the written approval of SGS.
Test results relate only to samples analyzed.

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Sample Summary

ERM-West, Inc.

Job No: DA11888X

Parkdale Quarry GW
Project No: 0488586

Sample Number	Collected Date	Time By	Received	Matrix Code	Type	Client Sample ID
DA11888-1X	12/11/18	11:28 PM	12/12/18	AQ	Ground Water	WELL 1:PARKDALE
DA11888-3X	12/11/18	15:35 PM	12/12/18	AQ	Ground Water	WELL 3:PARKDALE
DA11888-5X	12/11/18	10:52 PM	12/12/18	AQ	Ground Water	WELL 10:PARKDALE



Wheat Ridge, CO

2

Section 2

Subcontract Lab Data

Report of Analysis

December 31, 2018

2

Report to:

Scott Heideman
SGS Accutest
4036 Youngfield Street
Wheat Ridge, CO 80033

Bill to:

Scott Heideman
SGS Accutest
4036 Youngfield Street
Wheat Ridge, CO 80033

cc: Janel Mulholland, Elizabeth Sutcliffe, Elizabeth Bolstad

Project ID:

ACZ Project ID: L48880

Scott Heideman:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on December 14, 2018. This project has been assigned to ACZ's project number, L48880. Please reference this number in all future inquiries.

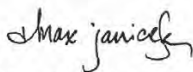
All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L48880. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after January 30, 2019. If the samples are determined to be hazardous, additional charges apply for disposal (typically \$11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.



Max Janicek has reviewed and
approved this report.



SGS Accutest

Project ID:

Sample ID: DA11888X1

ACZ Sample ID: **L48880-01**

Date Sampled: 12/14/18 11:28

Date Received: 12/14/18

Sample Matrix: Groundwater

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Residue, Total (TS) @ 105C	SM2540B	1	930			mg/L	10	20	12/20/18 15:16	kja

Arizona license number: AZ0102

SGS Accutest

Project ID:

Sample ID: DA11888X3

ACZ Sample ID: **L48880-02**

Date Sampled: 12/14/18 15:35

Date Received: 12/14/18

Sample Matrix: Groundwater

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Residue, Total (TS) @ 105C	SM2540B	1	1410			mg/L	10	20	12/20/18 15:17	kja

Arizona license number: AZ0102

SGS Accutest

Project ID:

Sample ID: DA11888X5

ACZ Sample ID: **L48880-03**

Date Sampled: 12/14/18 10:52

Date Received: 12/14/18

Sample Matrix: Groundwater

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Residue, Total (TS) @ 105C	SM2540B	2	4320			mg/L	20	40	12/20/18 15:17	kja

Arizona license number: AZ0102



Report Header Explanations

<i>Batch</i>	A distinct set of samples analyzed at a specific time
<i>Found</i>	Value of the QC Type of interest
<i>Limit</i>	Upper limit for RPD, in %.
<i>Lower</i>	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
<i>MDL</i>	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations.
<i>PCN/SCN</i>	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
<i>PQL</i>	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
<i>QC</i>	True Value of the Control Sample or the amount added to the Spike
<i>Rec</i>	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
<i>RPD</i>	Relative Percent Difference, calculation used for Duplicate QC Types
<i>Upper</i>	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
<i>Sample</i>	Value of the Sample of interest

QC Sample Types

<i>AS</i>	Analytical Spike (Post Digestion)	<i>LCSWD</i>	Laboratory Control Sample - Water Duplicate
<i>ASD</i>	Analytical Spike (Post Digestion) Duplicate	<i>LFB</i>	Laboratory Fortified Blank
<i>CCB</i>	Continuing Calibration Blank	<i>LFM</i>	Laboratory Fortified Matrix
<i>CCV</i>	Continuing Calibration Verification standard	<i>LFMD</i>	Laboratory Fortified Matrix Duplicate
<i>DUP</i>	Sample Duplicate	<i>LRB</i>	Laboratory Reagent Blank
<i>ICB</i>	Initial Calibration Blank	<i>MS</i>	Matrix Spike
<i>ICV</i>	Initial Calibration Verification standard	<i>MSD</i>	Matrix Spike Duplicate
<i>ICSAB</i>	Inter-element Correction Standard - A plus B solutions	<i>PBS</i>	Prep Blank - Soil
<i>LCSS</i>	Laboratory Control Sample - Soil	<i>PBW</i>	Prep Blank - Water
<i>LCSSD</i>	Laboratory Control Sample - Soil Duplicate	<i>PQV</i>	Practical Quantitation Verification standard
<i>LCSW</i>	Laboratory Control Sample - Water	<i>SDL</i>	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

- (1) EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
- (2) EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
- (3) EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
- (4) EPA SW-846. Test Methods for Evaluating Solid Waste.
- (5) Standard Methods for the Examination of Water and Wastewater.

Comments

- (1) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
- (2) Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
- (3) Animal matrices for Inorganic analyses are reported on an "as received" basis.
- (4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
- (5) If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click:

<http://www.acz.com/public/extqualist.pdf>

REP001.03.15.02

L48880-1812311506

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SGS Accutest

ACZ Project ID: **L48880**

NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.

Residue, Total (TS) @ 105C

SM2540B

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG463204													
WG463204PBW	PBW	12/20/18 15:15				U	mg/L		-20	20			
WG463204LCSW	LCSW	12/20/18 15:15	PCN57521	420		410	mg/L	98	80	120			
L48902-02DUP	DUP	12/20/18 15:20			1760	1760	mg/L				0	10	

SGS Accutest

ACZ Project ID: **L48880**

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
--------	---------	-----------	--------	------	-------------

No extended qualifiers associated with this analysis

SGS Accutest

Project ID:

Sample ID: DA11888X1

Locator:

ACZ Sample ID: **L48880-01**

Date Sampled: 12/14/18 11:28

Date Received: 12/14/18

Sample Matrix: Groundwater

Gross Alpha & Beta, total
M900.0

Prep Method:

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Gross Alpha	12/27/18 0:00		19	5.5	9.6	pCi/L		slm
Gross Beta	12/27/18 0:00		22	4.1	7.8	pCi/L		slm

Radium 226
M903.1

Prep Method:

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Radium 226	12/27/18 0:05		1	0.2	0.35	pCi/L	*	slm

Radium 228
M904.0

Prep Method:

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Radium 228	12/28/18 12:46		1.5	1.3	1.3	pCi/L		amk

Uranium, Isotopic
Eichrom ACW03

Prep Method:

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Uranium 234	12/26/18 0:02		16	4.6	4.7	pCi/L	*	djc
Uranium 235	12/26/18 0:02		0.07	1.4	1.9	pCi/L	*	djc
Uranium 238	12/26/18 0:02		9.06	3.7	3.5	pCi/L	*	djc

Arizona license number: **AZ0102**

SGS Accutest

Project ID:

Sample ID: DA11888X3

Locator:

ACZ Sample ID: **L48880-02**

Date Sampled: 12/14/18 15:35

Date Received: 12/14/18

Sample Matrix: Groundwater

Gross Alpha & Beta, total
M900.0

Prep Method:

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Gross Alpha	12/27/18 0:00		47	11	15	pCi/L		slm
Gross Beta	12/27/18 0:00		71	9.3	16	pCi/L		slm

Radium 226
M903.1

Prep Method:

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Radium 226	12/27/18 0:07		2.3	0.33	0.34	pCi/L	*	slm

Radium 228
M904.0

Prep Method:

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Radium 228	12/28/18 12:46		2.2	1.3	1.3	pCi/L		amk

Uranium, Isotopic
Eichrom ACW03

Prep Method:

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Uranium 234	12/26/18 0:04		21	5.2	3	pCi/L	*	djc
Uranium 235	12/26/18 0:04		1.2	1.9	5.2	pCi/L	*	djc
Uranium 238	12/26/18 0:04		9.99	3.8	2.7	pCi/L	*	djc

Arizona license number: AZ0102

SGS Accutest

Project ID:

Sample ID: DA11888X5

Locator:

ACZ Sample ID: **L48880-03**

Date Sampled: 12/14/18 10:52

Date Received: 12/14/18

Sample Matrix: Groundwater

Gross Alpha & Beta, total
M900.0

Prep Method:

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Gross Alpha	12/27/18 0:00		120	31	58	pCi/L		slm
Gross Beta	12/27/18 0:00		200	26	74	pCi/L		slm

Radium 226
M903.1

Prep Method:

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Radium 226	12/27/18 0:08		4.4	0.46	0.33	pCi/L	*	slm

Radium 228
M904.0

Prep Method:

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Radium 228	12/28/18 12:46		3.1	1.4	1.3	pCi/L		amk

Uranium, Isotopic
Eichrom ACW03

Prep Method:

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Uranium 234	12/26/18 0:05		25	5	1.9	pCi/L	*	djc
Uranium 235	12/26/18 0:05		0.96	1.3	2.3	pCi/L	*	djc
Uranium 238	12/26/18 0:05		17.2	4.1	2.8	pCi/L	*	djc

Arizona license number: **AZ0102**

Report Header Explanations

<i>Batch</i>	A distinct set of samples analyzed at a specific time
<i>Error(+/-)</i>	Calculated sample specific uncertainty
<i>Found</i>	Value of the QC Type of interest
<i>Limit</i>	Upper limit for RPD, in %.
<i>LCL</i>	Lower Control Limit, in % (except for LCSS, mg/Kg)
<i>LLD</i>	Calculated sample specific Lower Limit of Detection
<i>PCN/SCN</i>	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
<i>PQL</i>	Practical Quantitation Limit
<i>QC</i>	True Value of the Control Sample or the amount added to the Spike
<i>Rec</i>	Amount of the true value or spike added recovered, in % (except for LCSS, mg/Kg)
<i>RER</i>	Relative Error Ratio, calculation used for Dup. QC taking into account the error factor.
<i>RPD</i>	Relative Percent Difference, calculation used for Duplicate QC Types
<i>UCL</i>	Upper Control Limit, in % (except for LCSS, mg/Kg)
<i>Sample</i>	Value of the Sample of interest

QC Sample Types

<i>DUP</i>	Sample Duplicate	<i>MS/MSD</i>	Matrix Spike/Matrix Spike Duplicate
<i>LCSS</i>	Laboratory Control Sample - Soil	<i>PBS</i>	Prep Blank - Soil
<i>LCSW</i>	Laboratory Control Sample - Water	<i>PBW</i>	Prep Blank - Water

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Matrix Spikes	Determines sample matrix interferences, if any.

ACZ Qualifiers (Qual)

H	Analysis exceeded method hold time.
---	-------------------------------------

Method Prefix Reference

M	EPA methodology, including those under SDWA, CWA, and RCRA
SM	Standard Methods for the Examination of Water and Wastewater.
D	ASTM
RP	DOE
ESM	DOE/ESM

Comments

- (1) Solid matrices are reported on a dry weight basis.
- (2) Preparation method: "Method" indicates preparation defined in analytical method.
- (3) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
- (4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.

For a complete list of ACZ's Extended Qualifiers, please click:

<http://www.acz.com/public/extquallist.pdf>

REP003.09.12.01

SGS Accutest

ACZ Project ID: **L48880**

NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.

Alpha

M900.0

Units: pCi/L

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Error	LLD	Found	Error	LLD	Rec%	Lower	Upper	RPD/RER	Limit	Qual
WG463585																
L48894-02DUP	DUP-RER	12/27/18			1.3	2.2	9	3.2	2.8	9				0.53	2	
L48894-03MS	MS	12/27/18	PCN57385	100	0.83	1.1	4	110	8.9	4	109	67	144			
WG463100LCSWA	LCSW	12/27/18	PCN57385	66.67				77	5.9	0.83	116	67	144			
WG463100PBW	PBW	12/27/18						-2	0.45	0.81			1.62			
L48864-01DUP	DUP-RER	12/27/18			3.6	2.1	1.7	7	2.8	1.8				0.97	2	

Beta

M900.0

Units: pCi/L

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Error	LLD	Found	Error	LLD	Rec%	Lower	Upper	RPD/RER	Limit	Qual
WG463585																
WG463100LCSWB	LCSW	12/27/18	PCN56196	66.67				68	4.3	1.9	102	82	122			
WG463100PBW	PBW	12/27/18						-1.9	1.4	1.7			3.4			
L48894-05MS	MS	12/27/18	PCN56196	100	6.9	3	6.9	100	6.8	12	93	82	122			
L48894-02DUP	DUP-RER	12/27/18			2.8	2.8	7.1	5.3	3	7.1				0.61	2	
L48864-01DUP	DUP-RER	12/27/18			4	2	1.9	3.3	2	1.9				0.25	2	

Radium 226

M903.1

Units: pCi/L

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Error	LLD	Found	Error	LLD	Rec%	Lower	Upper	RPD/RER	Limit	Qual
WG463571																
WG463076PBW	PBW	12/27/18						.09	0.09	0.28			0.56			
WG463076LCSW	LCSW	12/27/18	PCN57865	20				19	0.55	0.16	95	43	148			
L48885-01DUP	DUP-RER	12/27/18			0.18	0.06	0.09	.09	0.09	0.06				0.83	2	
L48894-04DUP	DUP-RER	12/27/18			0.04	0.09	0.09	.16	0.07	0.1				1.05	2	
L48885-02MS	MS	12/27/18	PCN57865	20	0.15	0.09	0.11	20	0.55	0.17	99	43	148			

L48880-1812311506

SGS Accutest

ACZ Project ID: **L48880**

NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.

Radium 228

M904.0

Units: pCi/L

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Error	LLD	Found	Error	LLD	Rec%	Lower	Upper	RPD/RER	Limit	Qual
WG463689																
WG462911LCSW	LCSW	12/28/18	PCN57186	9.58				8.7	1	0.71	91	47	123			
WG462911PBW	PBW	12/28/18						1.1	0.65	0.62			1.24			
L48868-01DUP	DUP-RER	12/28/18			0.75	0.65	0.65	.42	1.6	1.7				0.19	2	
L48894-07DUP	DUP-RER	12/28/18			0.6	0.69	0.7	.2	0.7	0.72				0.41	2	
L48868-01MS	MS	12/28/18	PCN57186	9.58	0.75	0.65	0.65	8.7	1.1	0.81	83	47	123			

Uranium 234

Eichrom ACW03

Units: pCi/L

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Error	LLD	Found	Error	LLD	Rec%	Lower	Upper	RPD/RER	Limit	Qual
WG463498																
WG463263PBW	PBW	12/26/18						.03	0.47	0.84			1.68			
WG463263LCSW	LCSW	12/26/18	RC180718-10	98				98	7.9	1	100	77	122			
L48885-01DUP	DUP-RER	12/26/18			4.4	1.4	1.1	6	1.7	0.8				0.73	2	
L48894-05DUP	DUP-RER	12/26/18			2.4	1.1	0.78	3	1.4	2.4				0.34	2	
L48886-01MS	MS	12/26/18	RC180718-10	98	1	0.88	0.79	96	8	5.3	97	77	122			

Uranium 235

Eichrom ACW03

Units: pCi/L

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Error	LLD	Found	Error	LLD	Rec%	Lower	Upper	RPD/RER	Limit	Qual
WG463498																
WG463263PBW	PBW	12/26/18						-.1	0.34	0.56			1.12			
WG463263LCSW	LCSW	12/26/18	RC180718-10	4.48				3.4	1.5	0.42	76	42	136			
L48885-01DUP	DUP-RER	12/26/18			-0.22	0.53	0.77	.77	0.57	1.3				1.27	2	
L48894-05DUP	DUP-RER	12/26/18			0.11	0.23	0.31	-.18	0.37	0.74				0.67	2	
L48886-01MS	MS	12/26/18	RC180718-10	4.48	0.33	0.37	1.2	3.2	1.7	2.7	64	42	136			

L48880-1812311506

SGS Accutest

ACZ Project ID: **L48880**

NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.

Uranium 238

Eichrom ACW03

Units: pCi/L

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Error	LLD	Found	Error	LLD	Rec%	Lower	Upper	RPD/RER	Limit	Qual
WG463498																
WG463263PBW	PBW	12/26/18						.1	0.34	0.63			1.26			
WG463263LCSW	LCSW	12/26/18	RC180718-10	97.5				102	8	0.42	105	87	124			
L48885-01DUP	DUP-RER	12/26/18			3.22	1.3	0.76	5.01	1.5	1.3				0.9	2	
L48894-05DUP	DUP-RER	12/26/18			3.17	1.3	0.31	2.81	1.3	1.4				0.2	2	
L48886-01MS	MS	12/26/18	RC180718-10	97.5	0.87	0.67	1.3	107	8.5	5.8	109	87	124			

L48880-1812311506

SGS Accutest

ACZ Project ID: **L48880**

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L48880-01	WG463571	Radium 226	M903.1	DD	Sample required dilution due to matrix color or odor.
	WG463498	Uranium 234	Eichrom ACW03	D1	Sample required dilution due to matrix.
		Uranium 235	Eichrom ACW03	D1	Sample required dilution due to matrix.
		Uranium 238	Eichrom ACW03	D1	Sample required dilution due to matrix.
L48880-02	WG463571	Radium 226	M903.1	DD	Sample required dilution due to matrix color or odor.
	WG463498	Uranium 234	Eichrom ACW03	D1	Sample required dilution due to matrix.
		Uranium 235	Eichrom ACW03	D1	Sample required dilution due to matrix.
		Uranium 238	Eichrom ACW03	D1	Sample required dilution due to matrix.
L48880-03	WG463571	Radium 226	M903.1	DD	Sample required dilution due to matrix color or odor.
	WG463498	Uranium 234	Eichrom ACW03	D1	Sample required dilution due to matrix.
		Uranium 235	Eichrom ACW03	D1	Sample required dilution due to matrix.
		Uranium 238	Eichrom ACW03	D1	Sample required dilution due to matrix.

SGS Accutest

ACZ Project ID: **L48880**

Radiochemistry

The following parameters are not offered for certification or are not covered by AZ certificate #AZ0102.

Uranium 234	Eichrom ACW03
Uranium 235	Eichrom ACW03
Uranium 238	Eichrom ACW03

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Uranium 234	Eichrom ACW03
Uranium 235	Eichrom ACW03
Uranium 238	Eichrom ACW03

SGS Accutest

ACZ Project ID: L48880

Date Received: 12/14/2018 13:57

Received By:

Date Printed: 12/17/2018

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?	☐	☐	☒
2) Is the Chain of Custody form or other directive shipping papers present?	☒	☐	☐
3) Does this project require special handling procedures such as CLP protocol?	☐	☒	☐
4) Are any samples NRC licensable material?	☐	☐	☒
5) If samples are received past hold time, proceed with requested short hold time analyses?	☒	☐	☐
6) Is the Chain of Custody form complete and accurate?	☒	☐	☐
7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples?	☐	☒	☐

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	☒	☐	☐
9) Are all labels on containers and are they intact and legible?	☒	☐	☐
10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time?	☒	☐	☐
11) For preserved bottle types, was the pH checked and within limits? ¹	☒	☐	☐
12) Is there sufficient sample volume to perform all requested work?	☒	☐	☐
13) Is the custody seal intact on all containers?	☐	☐	☒
14) Are samples that require zero headspace acceptable?	☐	☐	☒
15) Are all sample containers appropriate for analytical requirements?	☒	☐	☐
16) Is there an Hg-1631 trip blank present?	☐	☐	☒
17) Is there a VOA trip blank present?	☐	☐	☒
18) Were all samples received within hold time?	☒	☐	☐

NA indicates Not Applicable

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp (°C)	Temp Criteria (°C)	Rad (µR/Hr)	Custody Seal Intact?
NA29696	2.4	<=6.0	15	Yes

Was ice present in the shipment container(s)?

Yes - Wet ice was present in the shipment container(s).

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

SGS Accutest

ACZ Project ID: L48880

Date Received: 12/14/2018 13:57

Received By:

Date Printed: 12/17/2018

¹ The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na₂S₂O₃ preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).




CHAIN OF CUSTODY
 SGS North America Inc. - Wheat Ridge
 4036 Youngfield Street, Wheat Ridge, CO 80033
 TEL: 303-425-6021 FAX: 303-425-6854
www.sgs.com/ehsusa

L48880-1812311506

		SGS North America Inc. - Wheat Ridge 4036 Youngfield Street, Wheat Ridge, CO 80033 TEL: 303-425-6021 FAX: 303-425-6854 www.sgs.com/ehsusa		FED-EX Tracking # Bottle Order Control #	
SGS Quote #		SGS Job #		DA11888X	
Client / Reporting Information		Project Information		Requested Analysis (see TEST CODE sheet)	
Company Name: SGS North America Inc.		Project Name: DA11888X		Matrix Codes	
Street Address 4036 Youngfield Street		Street		DW - Drinking Water GW - Ground Water WW - Water SW - Surface Water SO - Soil SL- Sludge SED-Sediment OI - Oil LIQ - Other Liquid AIR - Air SOL - Other Solid WP - Wipe FB-Field Blank EB-Equipment Blank RB- Rinse Blank TB-Trip Blank	
City State Zip Wheat Ridge, CO 80033		City State Billing Information (If different from Report to) Company Name			
Project Contact E-mail jeremy.dechant@sgs.com		Project #			
Phone # 303-425-6021		Fax #			
Sampler(s) Name(s) PM		Project Manager			
Field ID / Point of Collection		Collection		Number of preserved Bottles	
MEOH/DI Vial #		Date Time		Sampled by Matrix # of bottles	
1X DA11888X		12/11/18 11:28:00 AM PM AQ		HCl NaOH HNO3 H2SO4 NONE DI Water MECH ENCORE	
3X DA11888X		12/11/18 3:35:00 PM PM AQ			
5X DA11888X		12/11/18 10:52:00 AM PM AQ			
Turnaround Time (Business days)		Data Deliverable Information		Comments / Special Instructions	
Approved By (SGS PM): / Date:		Commercial "A" (Level 1) State Forms Commercial "B" (Level 2) EDD Format REDT1 (Level 3) Other FULT1 (Level 4) Commercial "C" X CC			
Standard 10 Day (business) 5 Business Days RUSH 3 Business Days RUSH 2 Business Days RUSH 1 Business Day EMERGENCY X other 42		Commercial "A" = Results Only Commercial "B" = Results + QC Summary Commercial "C" = Results + QC Summary + Partial Raw data			
Emergency & Rush T/A data available via Lablink. Approval needed for RUSH/Emergency TAT		Sample Custody must be documented below each time samples change possession, including courier delivery.		http://www.sgs.com/en/terms-and-conditions	
Relinquished by Sampler: 1		Received By: 1		Relinquished By: 2	
Date Time: 12/13/19		Date Time: 12/14/18 13:57		Date Time:	
Relinquished by Sampler: 3		Received By: 3		Relinquished By: 4	
Date Time:		Date Time:		Date Time:	
Relinquished by: 5		Received By: 5		Custody Seal #	
Date Time:		Date Time:		Intact Not Intact Preserved where applicable Therm. ID: On Ice Cooler Temp.	

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SGS

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DA11888X

5

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

CHAIN OF CUSTODY

Page ____ of ____

4036 Youngfield Street, Wheat Ridge, CO 80033
 TEL: 303-425-6021 FAX: 303-425-6854
 www.accutest.com

Bottle Order Control #	FED-EX Tracking #
SGS Quote #	SGS Job # DA11888

Client / Reporting Information		Project Information		Requested Analysis (see TEST CODE sheet)										Matrix Codes				
Company: ERM-West, Inc.	Project Name: Parkdale Quarry GW	Alkalinity (sm 1320B-2011) Dissolved Metals LF (EPA 200.8) SO₄, NO₃, O₃, C-HL (EPA 200.9) TDS (sm 4500-PE-2011) Total P04 (sm 4500-P-2011) Isotopic Uranium Gross Alpha/Beta (EPA 200.7) Radium-226 Radium-228										DW - Drinking Water GW - Ground Water WW - Water SW - Surface Water SO - Soil SL - Sludge SED - Sediment OI - Oil LIQ - Other Liquid AIR - Air SOL - Other Solid WP - Wipe FB - Field Blank EB - Equipment Blank RB - Rinse Blank TB - Trip Blank						
Street: 555 17th St, #1700	Street:																	
City, State: Denver, CO	City, State:																	
Project Contact: Zach Walker	Project #: 0488586																	
Phone: 303-741-5050	Client Purchase Order #:																	
Email: zach.walker@erm.com	Street Address: @erm.com																	
Sampler(s) Name(s): Z. Walker, P. Mehring	Project Manager: Becky Moore																	
Collection		Number of preserved Bottles										LAB USE ONLY						
Field ID / Point of Collection	Date	Time	Sampled by	Matrix	# of bottles	NONE	HCl	HNO ₃	H ₂ SO ₄	DI Water	MEOH	ENCORE	NaOH/NaCl	Na ₂ SO ₄				
Well 1: Parkdale	12/11/18	11:28	PM	GW	12	5		6	1									
Well 1: Parkdale Dup	12/11/18	11:28			12	5		6	1									
Well 3: Parkdale	12/11/18	15:35			12	5		6	1									
Well 3: Parkdale Dup	12/11/18	15:36			12	5		6	1									
Well 10: Parkdale	12/12/18	10:52			12	5		6	1									
Well 30: Parkdale Dup	12/12/18	10:52	↓	↓	12	5		6	1									
Turnaround Time (Business days)		Data Deliverable Information										Comments / Special Instructions						
☒ Std. 10 Business Days ☐ 5 Day RUSH ☐ 3 Day Emergency ☐ 2 Day Emergency ☐ 1 Day Emergency		☐ Commercial "A" (Level 1, Results Only) ☒ Commercial "B" (Level 2, Results + QC Summary) ☐ COMMBN (Results/QC/Narrative) ☐ COMMBN+ (Results/QC/Narrative (+ chromatograms)) ☐ REDT2 ☐ FULT1										☐ EDD Format						
Emergency & Rush T/A data available VIA LabLink. RUSH TAT approval needed.																		
Sample Custody must be documented below each time samples change possession, including courier delivery.																		
Relinquished By: 1	Date/Time: 12/12/18 1705	Received By: 1	Date/Time: 12/12/18 1705	Relinquished By: 2	Date/Time: 12/12/18 1705	Received By: 2	Date/Time: 12/12/18 1705	Relinquished By: 3	Date/Time: 12/12/18 1705	Received By: 3	Date/Time: 12/12/18 1705	Relinquished By: 4	Date/Time: 12/12/18 1705	Received By: 4	Date/Time: 12/12/18 1705			
Custody Seal #	Intact ☒ Not Intact ☐ Absent ☐	Preserved where applicable ☒	Cooler Temp. °C: 1.1	Therm. ID: 718C	On Ice ☒	Form MSQA 064-01, RV 6/19/17 http://www.sgs.com/terms-and-conditions												

DA11888X: Chain of Custody

Page 1 of 2

SGS Accutest Sample Receipt Summary

Job Number: DA11888

Client: ERM

Project: PARKDALE

Date / Time Received: 12/12/2018 5:05:00 PM

Delivery Method:

Airbill #'s: HD

Cooler Temps (Initial/Adjusted): #1: (1.1/1.1):

Cooler Security

Y or N

Y or N

- | | | | | | |
|---------------------------|-------------------------------------|--------------------------|-----------------------|-------------------------------------|--------------------------|
| 1. Custody Seals Present: | ☒ | ☐ | 3. COC Present: | ☒ | ☐ |
| 2. Custody Seals Intact: | ☒ | ☐ | 4. Smpl Dates/Time OK | ☒ | ☐ |

Cooler Temperature

Y or N

- | | | |
|------------------------------|-------------------------------------|--------------------------|
| 1. Temp criteria achieved: | ☒ | ☐ |
| 2. Cooler temp verification: | Bar Therm; | |
| 3. Cooler media: | Ice (Bag) | |
| 4. No. Coolers: | 1 | |

Quality Control Preservation

Y or N

N/A

- | | | | |
|---------------------------------|-------------------------------------|--------------------------|-------------------------------------|
| 1. Trip Blank present / cooler: | ☐ | ☐ | ☒ |
| 2. Trip Blank listed on COC: | ☐ | ☐ | ☒ |
| 3. Samples preserved properly: | ☒ | ☐ | |
| 4. VOCs headspace free: | ☐ | ☐ | ☒ |

Sample Integrity - Documentation

Y or N

- | | | |
|--|-------------------------------------|--------------------------|
| 1. Sample labels present on bottles: | ☒ | ☐ |
| 2. Container labeling complete: | ☒ | ☐ |
| 3. Sample container label / COC agree: | ☒ | ☐ |

Sample Integrity - Condition

Y or N

- | | | |
|----------------------------------|-------------------------------------|--------------------------|
| 1. Sample recvd within HT: | ☒ | ☐ |
| 2. All containers accounted for: | ☒ | ☐ |
| 3. Condition of sample: | Intact | |

Sample Integrity - Instructions

Y or N N/A

- | | | | |
|---|-------------------------------------|-------------------------------------|-------------------------------------|
| 1. Analysis requested is clear: | ☒ | ☐ | |
| 2. Bottles received for unspecified tests | ☐ | ☒ | |
| 3. Sufficient volume recvd for analysis: | ☒ | ☐ | |
| 4. Compositing instructions clear: | ☐ | ☐ | ☒ |
| 5. Filtering instructions clear: | ☐ | ☐ | ☒ |

Comments

DA11888X: Chain of Custody

Page 2 of 2

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

ERM-West, Inc.

Parkdale Quarry GW

Proj# 0488586

SGS Job Number: DA15855

Sampling Dates: 05/13/19 - 05/14/19

Report to:

ERM-West, Inc.
555 17th Street Suite #1700
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Total number of pages in report: 35



Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.



Scott Heideman
Laboratory Director

Client Service contact: Carissa Cumine 303-425-6021

Certifications: CO (CO00049), ID (CO00049), NE (NE-OS-06-04), ND (R-027), NJ (CO007), OK (D9942)
UT (NELAP CO00049), LA (LA150028), TX (T104704511), WY (8TMS-L)

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Test results relate only to samples analyzed.

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Sample Summary

ERM-West, Inc.

Job No: DA15855

Parkdale Quarry GW
Project No: Proj# 0488586

Sample Number	Collected Date	Time By	Received	Matrix Code	Type	Client Sample ID
DA15855-1	05/14/19	13:00 ZW	05/15/19	AQ	Ground Water	WELL 1
DA15855-1F	05/14/19	13:00 ZW	05/15/19	AQ	Groundwater Filtered	WELL 1
DA15855-3	05/13/19	13:20 ZW	05/15/19	AQ	Ground Water	WELL 3 PARKDALE
DA15855-3F	05/13/19	13:20 ZW	05/15/19	AQ	Groundwater Filtered	WELL 3 PARKDALE
DA15855-5	05/13/19	16:30 ZW	05/15/19	AQ	Ground Water	WELL 10
DA15855-5F	05/13/19	16:30 ZW	05/15/19	AQ	Groundwater Filtered	WELL 10

CASE NARRATIVE / CONFORMANCE SUMMARY

2

Client: ERM-West, Inc.

Job No DA15855

Site: Parkdale Quarry GW

Report Date 6/3/2019 5:54:09 PM

On 05/15/2019, 3 sample(s), 0 Trip Blank(s), and 0 Field Blank(s) were received at SGS North America Inc. (SGS) at a temperature of 2.2 °C. The samples were intact and properly preserved, unless noted below. An SGS Job Number of DA15855 was assigned to the project. The lab sample ID, client sample ID, and date of sample collection are detailed in the report's Results Summary.

Specified quality control criteria were achieved for this job except as noted below. For more information, please refer to the analytical results and QC summary pages.

Metals Analysis By Method EPA 200.7

Matrix: AQ

Batch ID: MP28042

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA15903-1FMS, DA15903-1FMSD were used as the QC samples for the metals analysis.
- MP28042-MB1 for Silicon: All sample results >10x method blank concentration.

Metals Analysis By Method EPA 200.8

Matrix: AQ

Batch ID: MP28044

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA15925-1AMS, DA15925-1AMSD were used as the QC samples for the metals analysis.
- The matrix spike (MS) recovery(s) of Sodium are outside control limits. Spike amount low relative to the sample amount. Refer to lab control or spike blank for recovery information.
- DA15855-1F and -5F for Cobalt: Elevated detection limit due to dilution required for possible matrix interference.
- MP28044-MB1 for Iron: All sample results < RL or > 10x MB concentration.

General Chemistry By Method EPA 365.1

Matrix: AQ

Batch ID: GP25206

- All samples were prepared and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA16059-1MS, DA15986-1DUP were used as the QC samples for the Phosphorus, Total analysis.
- The duplicate RPD(s) for Phosphorus, Total are outside control limits for sample GP25206-D1. RPD acceptable due to low duplicate and sample concentrations.

General Chemistry By Method EPA300.0/SW846 9056A

Matrix: AQ

Batch ID: GP25118

- All samples were prepared and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA15856-3MS, DA15856-3MSD were used as the QC samples for the Chloride, Nitrogen, Nitrate, Sulfate, Chloride analysis.

Monday, June 03, 2019

Page 1 of 2

General Chemistry By Method SM 2320B-2011

Matrix: AQ**Batch ID:** GN47063

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA15692-4MS, DA15692-4MSD, DA16000-1DUP were used as the QC samples for the Alkalinity, Total as CaCO₃ analysis.

General Chemistry By Method SM 2540C-2011

Matrix: AQ**Batch ID:** GN46967

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA15829-1DUP were used as the QC samples for the Solids, Total Dissolved analysis.

SGS certifies that data reported for samples received, listed on the associated custody chain or analytical task order, were produced to specifications meeting SGS's Quality System precision, accuracy and completeness objectives except as noted.

Estimated non-standard method measurement uncertainty data is available on request, based on quality control bias and implicit for standard methods. Acceptable uncertainty requires tested parameter quality control data to meet method criteria.

SGS is not responsible for data quality assumptions if partial reports are used and recommends that this report be used in its entirety. This report is authorized by SGS indicated via signature on the report cover.

Summary of Hits

Page 1 of 2

Job Number: DA15855
Account: ERM-West, Inc.
Project: Parkdale Quarry GW
Collected: 05/13/19 thru 05/14/19

Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
---------------	------------------	-----------------	----	-----	-------	--------

DA15855-1 WELL 1

Alkalinity, Total as CaCO ₃	188	5.0			mg/l	SM 2320B-2011
Chloride	7.5	5.0			mg/l	EPA300.0/SW846 9056A
Nitrogen, Nitrate	6.5	0.25			mg/l	EPA300.0/SW846 9056A
Phosphorus, Total	0.31	0.010			mg/l	EPA 365.1
Solids, Total Dissolved	417	10			mg/l	SM 2540C-2011
Sulfate	95.8	5.0			mg/l	EPA300.0/SW846 9056A

DA15855-1F WELL 1

Arsenic	0.40	0.40			ug/l	EPA 200.8
Barium	20.7	4.0			ug/l	EPA 200.8
Calcium	75800	800			ug/l	EPA 200.8
Iron	122	20			ug/l	EPA 200.8
Magnesium	15100	200			ug/l	EPA 200.8
Manganese	2.9	2.0			ug/l	EPA 200.8
Molybdenum	18.8	2.0			ug/l	EPA 200.8
Potassium	3030	400			ug/l	EPA 200.8
Selenium	3.8	0.80			ug/l	EPA 200.8
Silicon	7640	50			ug/l	EPA 200.7
Sodium	23100	1000			ug/l	EPA 200.8
Uranium	13.7	0.40			ug/l	EPA 200.8

DA15855-3 WELL 3 PARKDALE

Alkalinity, Total as CaCO ₃	168	5.0			mg/l	SM 2320B-2011
Chloride	9.9	2.5			mg/l	EPA300.0/SW846 9056A
Nitrogen, Nitrate	2.6	0.25			mg/l	EPA300.0/SW846 9056A
Phosphorus, Total	0.41	0.010			mg/l	EPA 365.1
Solids, Total Dissolved	318	10			mg/l	SM 2540C-2011
Sulfate	55.7	2.5			mg/l	EPA300.0/SW846 9056A

DA15855-3F WELL 3 PARKDALE

Arsenic	0.43	0.40			ug/l	EPA 200.8
Barium	18.9	4.0			ug/l	EPA 200.8
Calcium	48100	800			ug/l	EPA 200.8
Iron	82.2	20			ug/l	EPA 200.8
Magnesium	10600	200			ug/l	EPA 200.8
Manganese	12.8	2.0			ug/l	EPA 200.8
Molybdenum	155	2.0			ug/l	EPA 200.8
Nickel	11.2	4.0			ug/l	EPA 200.8
Potassium	2130	400			ug/l	EPA 200.8
Selenium	2.2	0.80			ug/l	EPA 200.8

Summary of Hits

Page 2 of 2

Job Number: DA15855
Account: ERM-West, Inc.
Project: Parkdale Quarry GW
Collected: 05/13/19 thru 05/14/19



Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
Analyte						
Silicon		10700	50		ug/l	EPA 200.7
Sodium		28200	1000		ug/l	EPA 200.8
Uranium		19.7	0.40		ug/l	EPA 200.8

DA15855-5 WELL 10

Alkalinity, Total as CaCO3	228	5.0		mg/l	SM 2320B-2011
Chloride	7.5	2.5		mg/l	EPA300.0/SW846 9056A
Nitrogen, Nitrate	0.087	0.050		mg/l	EPA300.0/SW846 9056A
Phosphorus, Total	0.81	0.010		mg/l	EPA 365.1
Solids, Total Dissolved	420	10		mg/l	SM 2540C-2011
Sulfate	85.9	2.5		mg/l	EPA300.0/SW846 9056A

DA15855-5F WELL 10

Arsenic	0.40	0.40		ug/l	EPA 200.8
Barium	34.0	4.0		ug/l	EPA 200.8
Calcium	76400	800		ug/l	EPA 200.8
Copper	5.2	4.0		ug/l	EPA 200.8
Iron	140	20		ug/l	EPA 200.8
Magnesium	14800	200		ug/l	EPA 200.8
Manganese	5.0	2.0		ug/l	EPA 200.8
Molybdenum	7.3	2.0		ug/l	EPA 200.8
Potassium	1640	400		ug/l	EPA 200.8
Selenium	1.2	0.80		ug/l	EPA 200.8
Silicon	13200	50		ug/l	EPA 200.7
Sodium	20000	1000		ug/l	EPA 200.8
Uranium	16.7	0.40		ug/l	EPA 200.8



Wheat Ridge, CO

Section 4

4

Sample Results

Report of Analysis

Report of Analysis

Client Sample ID: WELL 1
Lab Sample ID: DA15855-1
Matrix: AQ - Ground Water
Project: Parkdale Quarry GW

Date Sampled: 05/14/19
Date Received: 05/15/19
Percent Solids: n/a

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Alkalinity, Total as CaCO3	188	5.0	mg/l	1	05/23/19 10:00	PV	SM 2320B-2011
Chloride	7.5	5.0	mg/l	10	05/15/19 11:45	JB	EPA300.0/SW846 9056A
Nitrogen, Nitrate	6.5	0.25	mg/l	25	05/15/19 12:51	JB	EPA300.0/SW846 9056A
Phosphorus, Total	0.31	0.010	mg/l	1	05/24/19 15:37	AM	EPA 365.1
Solids, Total Dissolved	417	10	mg/l	1	05/16/19	SK	SM 2540C-2011
Sulfate	95.8	5.0	mg/l	10	05/15/19 11:45	JB	EPA300.0/SW846 9056A

RL = Reporting Limit

4.1
4

Report of Analysis

Client Sample ID:	WELL 1	Date Sampled:	05/14/19
Lab Sample ID:	DA15855-1F	Date Received:	05/15/19
Matrix:	AQ - Groundwater Filtered	Percent Solids:	n/a
Project:	Parkdale Quarry GW		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Aluminum	< 100	100	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Antimony	< 0.80	0.80	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Arsenic	0.40	0.40	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Barium	20.7	4.0	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Cadmium	< 0.20	0.20	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Calcium	75800	800	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Chromium	< 4.0	4.0	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Cobalt ^a	< 1.0	1.0	ug/l	5	05/16/19	05/17/19	EP	EPA 200.8 ³
Copper	< 4.0	4.0	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Iron	122	20	ug/l	2	05/16/19	05/17/19	EP	EPA 200.8 ³
Lead	< 1.0	1.0	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Magnesium	15100	200	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Manganese	2.9	2.0	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Molybdenum	18.8	2.0	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Nickel	< 4.0	4.0	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Potassium	3030	400	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Selenium	3.8	0.80	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Silicon	7640	50	ug/l	1	05/17/19	05/18/19	JR	EPA 200.7 ⁴
Sodium	23100	1000	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Uranium	13.7	0.40	ug/l	2	05/16/19	05/17/19	EP	EPA 200.8 ²
Zinc	< 20	20	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹

(1) Instrument QC Batch: MA11394

(2) Instrument QC Batch: MA11398

(3) Instrument QC Batch: MA11401

(4) Instrument QC Batch: MA11404

(5) Prep QC Batch: MP28042

(6) Prep QC Batch: MP28044

(a) Elevated detection limit due to dilution required for possible matrix interference.

RL = Reporting Limit

Report of Analysis

Client Sample ID: WELL 3 PARKDALE
Lab Sample ID: DA15855-3
Matrix: AQ - Ground Water
Project: Parkdale Quarry GW

Date Sampled: 05/13/19
Date Received: 05/15/19
Percent Solids: n/a

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Alkalinity, Total as CaCO3	168	5.0	mg/l	1	05/23/19 10:00	PV	SM 2320B-2011
Chloride	9.9	2.5	mg/l	5	05/15/19 11:58	JB	EPA300.0/SW846 9056A
Nitrogen, Nitrate	2.6	0.25	mg/l	25	05/15/19 13:04	JB	EPA300.0/SW846 9056A
Phosphorus, Total	0.41	0.010	mg/l	1	05/24/19 15:38	AM	EPA 365.1
Solids, Total Dissolved	318	10	mg/l	1	05/16/19	SK	SM 2540C-2011
Sulfate	55.7	2.5	mg/l	5	05/15/19 11:58	JB	EPA300.0/SW846 9056A

RL = Reporting Limit

4.3
4

Report of Analysis

Client Sample ID:	WELL 3 PARKDALE	Date Sampled:	05/13/19
Lab Sample ID:	DA15855-3F	Date Received:	05/15/19
Matrix:	AQ - Groundwater Filtered	Percent Solids:	n/a
Project:	Parkdale Quarry GW		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Aluminum	< 100	100	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Antimony	< 0.80	0.80	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Arsenic	0.43	0.40	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Barium	18.9	4.0	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Cadmium	< 0.20	0.20	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Calcium	48100	800	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Chromium	< 4.0	4.0	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Cobalt	< 0.40	0.40	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Copper	< 4.0	4.0	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Iron	82.2	20	ug/l	2	05/16/19	05/17/19	EP	EPA 200.8 ³
Lead	< 1.0	1.0	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Magnesium	10600	200	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Manganese	12.8	2.0	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Molybdenum	155	2.0	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Nickel	11.2	4.0	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Potassium	2130	400	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Selenium	2.2	0.80	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Silicon	10700	50	ug/l	1	05/17/19	05/18/19	JR	EPA 200.7 ⁴
Sodium	28200	1000	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Uranium	19.7	0.40	ug/l	2	05/16/19	05/17/19	EP	EPA 200.8 ²
Zinc	< 20	20	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹

(1) Instrument QC Batch: MA11394

(2) Instrument QC Batch: MA11398

(3) Instrument QC Batch: MA11401

(4) Instrument QC Batch: MA11404

(5) Prep QC Batch: MP28042

(6) Prep QC Batch: MP28044

RL = Reporting Limit

Report of Analysis

Client Sample ID: WELL 10
Lab Sample ID: DA15855-5
Matrix: AQ - Ground Water
Project: Parkdale Quarry GW

Date Sampled: 05/13/19
Date Received: 05/15/19
Percent Solids: n/a

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Alkalinity, Total as CaCO3	228	5.0	mg/l	1	05/23/19 10:00	PV	SM 2320B-2011
Chloride	7.5	2.5	mg/l	5	05/15/19 12:38	JB	EPA300.0/SW846 9056A
Nitrogen, Nitrate	0.087	0.050	mg/l	5	05/15/19 12:38	JB	EPA300.0/SW846 9056A
Phosphorus, Total	0.81	0.010	mg/l	1	05/24/19 15:40	AM	EPA 365.1
Solids, Total Dissolved	420	10	mg/l	1	05/16/19	SK	SM 2540C-2011
Sulfate	85.9	2.5	mg/l	5	05/15/19 12:38	JB	EPA300.0/SW846 9056A

RL = Reporting Limit

4.5
4

Report of Analysis

Client Sample ID:	WELL 10	Date Sampled:	05/13/19
Lab Sample ID:	DA15855-5F	Date Received:	05/15/19
Matrix:	AQ - Groundwater Filtered	Percent Solids:	n/a
Project:	Parkdale Quarry GW		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Aluminum	< 100	100	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Antimony	< 0.80	0.80	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Arsenic	0.40	0.40	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Barium	34.0	4.0	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Cadmium	< 0.20	0.20	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Calcium	76400	800	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Chromium	< 4.0	4.0	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Cobalt ^a	< 2.0	2.0	ug/l	10	05/16/19	05/17/19	EP	EPA 200.8 ³
Copper	5.2	4.0	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Iron	140	20	ug/l	2	05/16/19	05/17/19	EP	EPA 200.8 ³
Lead	< 1.0	1.0	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Magnesium	14800	200	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Manganese	5.0	2.0	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Molybdenum	7.3	2.0	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Nickel	< 4.0	4.0	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Potassium	1640	400	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Selenium	1.2	0.80	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Silicon	13200	50	ug/l	1	05/17/19	05/18/19	JR	EPA 200.7 ⁴
Sodium	20000	1000	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹
Uranium	16.7	0.40	ug/l	2	05/16/19	05/17/19	EP	EPA 200.8 ²
Zinc	< 20	20	ug/l	2	05/16/19	05/16/19	EP	EPA 200.8 ¹

(1) Instrument QC Batch: MA11394

(2) Instrument QC Batch: MA11398

(3) Instrument QC Batch: MA11401

(4) Instrument QC Batch: MA11404

(5) Prep QC Batch: MP28042

(6) Prep QC Batch: MP28044

(a) Elevated detection limit due to dilution required for possible matrix interference.

RL = Reporting Limit



Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

CHAIN OF CUSTODY

Page ____ of ____

4036 Youngfield Street, Wheat Ridge, CO 80033
TEL: 303-425-6021 FAX: 303-425-6854
www.accutest.com

[illegible]

5.1 5

DA15855: Chain of Custody

Page 1 of 2

SGS Accutest Sample Receipt Summary

Job Number: DA15855

Client: ERM

Project: PARKDALE

Date / Time Received: 5/15/2019 8:05:00 AM

Delivery Method:

Airbill #'s: HD

Cooler Temps (Initial/Adjusted): #1: (2.2/2.2):

Cooler Security

Y or N

Y or N

- | | | | | | |
|---------------------------|-------------------------------------|--------------------------|-----------------------|-------------------------------------|--------------------------|
| 1. Custody Seals Present: | ☒ | ☐ | 3. COC Present: | ☒ | ☐ |
| 2. Custody Seals Intact: | ☒ | ☐ | 4. Smpl Dates/Time OK | ☒ | ☐ |

Cooler Temperature

Y or N

- | | | |
|------------------------------|-------------------------------------|--------------------------|
| 1. Temp criteria achieved: | ☒ | ☐ |
| 2. Cooler temp verification: | Bar Therm; | |
| 3. Cooler media: | Ice (Bag) | |
| 4. No. Coolers: | 1 | |

Quality Control Preservation

Y or N

N/A

- | | | | |
|---------------------------------|-------------------------------------|--------------------------|-------------------------------------|
| 1. Trip Blank present / cooler: | ☐ | ☐ | ☒ |
| 2. Trip Blank listed on COC: | ☐ | ☐ | ☒ |
| 3. Samples preserved properly: | ☒ | ☐ | |
| 4. VOCs headspace free: | ☐ | ☐ | ☒ |

Sample Integrity - Documentation

Y or N

- | | | |
|--|-------------------------------------|--------------------------|
| 1. Sample labels present on bottles: | ☒ | ☐ |
| 2. Container labeling complete: | ☒ | ☐ |
| 3. Sample container label / COC agree: | ☒ | ☐ |

Sample Integrity - Condition

Y or N

- | | | |
|----------------------------------|-------------------------------------|--------------------------|
| 1. Sample recvd within HT: | ☒ | ☐ |
| 2. All containers accounted for: | ☒ | ☐ |
| 3. Condition of sample: | Intact | |

Sample Integrity - Instructions

Y or N N/A

- | | | | |
|---|-------------------------------------|-------------------------------------|-------------------------------------|
| 1. Analysis requested is clear: | ☒ | ☐ | |
| 2. Bottles received for unspecified tests | ☐ | ☒ | |
| 3. Sufficient volume recvd for analysis: | ☒ | ☐ | |
| 4. Compositing instructions clear: | ☐ | ☐ | ☒ |
| 5. Filtering instructions clear: | ☐ | ☐ | ☒ |

Comments

DA15855: Chain of Custody

Page 2 of 2

Metals Analysis

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Matrix Spike and Duplicate Summaries
- Blank Spike and Lab Control Sample Summaries
- Serial Dilution Summaries

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: DA15855
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP28042
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 05/17/19

Metal	RL	IDL	MDL	MB raw	final
Aluminum	100	46	30		
Antimony	30	14	10		
Arsenic	25	22	7		
Barium	10	.3	2		
Beryllium	10	1	1.3		
Boron	50	3.3	7.4		
Cadmium	10	1.9	1.6		
Calcium	400	6.6	53		
Chromium	10	1.1	1.7		
Cobalt	5.0	2.7	2.3		
Copper	10	4.6	2.3		
Iron	10	8.9	3.1		
Lead	50	13	6.3		
Lithium	5.0	.6	4		
Magnesium	200	50	31		
Manganese	5.0	.5	1.1		
Molybdenum	10	8.5	4.3		
Nickel	30	6.2	6.1		
Phosphorus	100	91	24		
Potassium	1000	84	250		
Selenium	50	30	21		
Silicon	50	41	45	48.9	* (a)
Silver	30	.6	4		
Sodium	400	13	51		
Strontium	5.0	.1	.6		
Thallium	10	17	7.5		
Tin	60	41	51		
Titanium	10	.5	1.9		
Uranium	50	3.9	8.5		
Vanadium	10	.9	.7		
Zinc	30	9	3.8		

Associated samples MP28042: DA15855-1F, DA15855-3F, DA15855-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: DA15855
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP28042
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 05/17/19

Metal	RL	IDL	MDL	MB raw	final
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(anr) Analyte not requested

(a) All sample results >10x method blank concentration.

6.1.1

6

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA15855
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP28042
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 05/17/19

Metal	DA15903-1F Original MS	SpikeLot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron	anr			
Cadmium				
Calcium	anr			
Chromium				
Cobalt				
Copper				
Iron	anr			
Lead				
Lithium				
Magnesium	anr			
Manganese	anr			
Molybdenum				
Nickel				
Phosphorus				
Potassium	anr			
Selenium				
Silicon	27000	27700	1000	70.0 70-130
Silver				
Sodium	anr			
Strontium	anr			
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP28042: DA15855-1F, DA15855-3F, DA15855-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA15855
 Account: ERMCOGV - ERM-West, Inc.
 Project: Parkdale Quarry GW

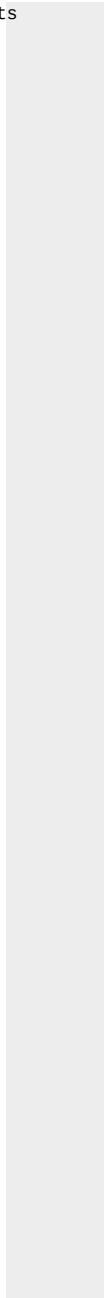
QC Batch ID: MP28042
 Matrix Type: AQUEOUS

Methods: EPA 200.7
 Units: ug/l

Prep Date: 05/17/19

Metal	DA15903-1F Original MS	Spike lot ICPALL2 % Rec	QC Limits
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(N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested



MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA15855
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP28042
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 05/17/19

Metal	DA15903-1F Original MSD	SpikeLot ICPALL2	% Rec	MSD RPD	QC Limit
Aluminum					
Antimony					
Arsenic					
Barium					
Beryllium					
Boron	anr				
Cadmium					
Calcium	anr				
Chromium					
Cobalt					
Copper					
Iron	anr				
Lead					
Lithium					
Magnesium	anr				
Manganese	anr				
Molybdenum					
Nickel					
Phosphorus					
Potassium	anr				
Selenium					
Silicon	27000	27600	1000	60.0 (a) 0.4	20
Silver					
Sodium	anr				
Strontium	anr				
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc					

Associated samples MP28042: DA15855-1F, DA15855-3F, DA15855-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA15855
 Account: ERMCOGV - ERM-West, Inc.
 Project: Parkdale Quarry GW

QC Batch ID: MP28042
 Matrix Type: AQUEOUS

Methods: EPA 200.7
 Units: ug/l

Prep Date: 05/17/19

Metal	DA15903-1F Original MSD	SpikeLot ICPALL2 % Rec	MSD RPD	QC Limit
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(N) Matrix Spike Rec. outside of QC limits

(anr) Analyte not requested

(a) Spike amount low relative to the sample amount. Refer to lab control or spike blank for recovery information.

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: DA15855
 Account: ERMC0GV - ERM-West, Inc.
 Project: Parkdale Quarry GW

QC Batch ID: MP28042
 Matrix Type: AQUEOUS

Methods: EPA 200.7
 Units: ug/l

Prep Date: 05/17/19

Metal	BSP Result	SpikeLot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron	anr			
Cadmium				
Calcium	anr			
Chromium				
Cobalt				
Copper				
Iron	anr			
Lead				
Lithium				
Magnesium	anr			
Manganese	anr			
Molybdenum				
Nickel				
Phosphorus				
Potassium	anr			
Selenium				
Silicon	1070	1000	107.0	85-115
Silver				
Sodium	anr			
Strontium	anr			
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP28042: DA15855-1F, DA15855-3F, DA15855-5F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: DA15855
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

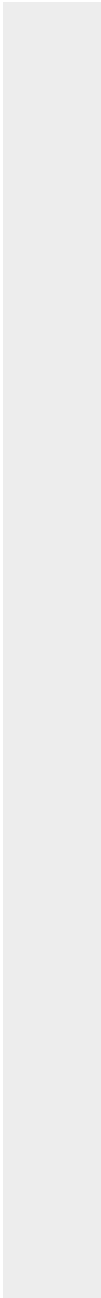
QC Batch ID: MP28042
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 05/17/19

Metal	BSP Result	Spike lot ICPALL2	% Rec	QC Limits
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(anr) Analyte not requested



6.1.3
6

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: DA15855
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP28044
Matrix Type: AQUEOUS

Methods: EPA 200.8
Units: ug/l

Prep Date: 05/16/19

Metal	RL	IDL	MDL	MB raw	final
Aluminum	50	1.1	2	5.2	<50
Antimony	0.40	.0022	.011	0.0060	<0.40
Arsenic	0.20	.017	.044	0.0060	<0.20
Barium	2.0	.016	.079	0.073	<2.0
Beryllium	0.20	.016	.069		
Boron	40	.49	2.1		
Cadmium	0.10	.036	.042	-0.032	<0.10
Calcium	400	5.6	12	29.0	<400
Chromium	2.0	.053	.053	0.16	<2.0
Cobalt	0.20	.0049	.015	0.0030	<0.20
Copper	2.0	.06	.13	0.089	<2.0
Iron	10	3.5	4.6	5.3	* (a)
Lead	0.50	.0079	.008	0.041	<0.50
Magnesium	100	1.3	1.3	7.9	<100
Manganese	1.0	.12	.13	0.12	<1.0
Molybdenum	1.0	.049	.029	0.011	<1.0
Nickel	2.0	.0088	.027	0.029	<2.0
Phosphorus	60	2.6	4.3		
Potassium	200	2.9	2.9	2.3	<200
Selenium	0.40	.06	.21	-0.052	<0.40
Silver	0.10	.0019	.008		
Sodium	500	4.9	4.9	21.2	<500
Strontium	20	.01	.015		
Thallium	0.20	.0024	.005		
Tin	10	.063	1.3		
Titanium	2.0	.059	.092		
Uranium	0.20	.0017	.002	0.073	<0.20
Vanadium	1.0	.037	.2		
Zinc	10	.21	.96	2.0	<10

Associated samples MP28044: DA15855-1F, DA15855-3F, DA15855-5F

Results < IDL are shown as zero for calculation purposes

(*) Outside of QC limits

(anr) Analyte not requested

(a) All sample results < RL or > 10x MB concentration.

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA15855
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP28044
Matrix Type: AQUEOUS

Methods: EPA 200.8
Units: ug/l

Prep Date: 05/16/19

Metal	DA15925-1A Original MS		Spike lot ICPALL2	% Rec	QC Limits
Aluminum	476	2180	2000	85.2	70-130
Antimony	0.86	195	100	97.0	70-130
Arsenic	1.8	379	400	94.3	70-130
Barium	108	892	800	98.0	70-130
Beryllium					
Boron					
Cadmium	0.21	196	200	97.9	70-130
Calcium	111000	106000	10000	74.0	70-130
Chromium	25.5	216	200	95.3	70-130
Cobalt	0.0	187	200	93.5	70-130
Copper	63.3	239	200	87.9	70-130
Iron	976	2900	2000	96.2	70-130
Lead	1.8	399	400	99.3	70-130
Magnesium	45800	53500	10000	77.0	70-130
Manganese	123	310	200	93.5	70-130
Molybdenum	12.3	218	200	102.9	70-130
Nickel	13.4	193	200	89.8	70-130
Phosphorus					
Potassium	18100	27400	10000	93.0	70-130
Selenium	3.2	357	400	88.5	70-130
Silver					
Sodium	256000	262000	10000	-20.0(a)	70-130
Strontium					
Thallium					
Tin					
Titanium					
Uranium	12.8	461	400	112.1	70-130
Vanadium					
Zinc	131	293	200	81.0	70-130

Associated samples MP28044: DA15855-1F, DA15855-3F, DA15855-5F

Results < IDL are shown as zero for calculation purposes

(*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

(anr) Analyte not requested

(a) Spike amount low relative to the sample amount. Refer to lab control or spike blank for recovery information.

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA15855
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP28044
Matrix Type: AQUEOUS

Methods: EPA 200.8
Units: ug/l

Prep Date: 05/16/19

Metal	DA15925-1A Original MSD		Spike lot ICPALL2	% Rec	MSD RPD	QC Limit
Aluminum	476	2160	2000	84.2	0.9	20
Antimony	0.86	198	100	98.6	1.5	20
Arsenic	1.8	372	400	92.6	1.9	20
Barium	108	919	800	101.4	3.0	20
Beryllium						
Boron						
Cadmium	0.21	198	200	98.9	1.0	20
Calcium	111000	105000	10000	64.0 (a)	1.4	20
Chromium	25.5	214	200	94.3	0.9	20
Cobalt	0.0	191	200	95.5	2.1	20
Copper	63.3	243	200	89.9	1.7	20
Iron	976	2750	2000	88.7	5.3	20
Lead	1.8	403	400	100.3	1.0	20
Magnesium	45800	53000	10000	72.0	0.9	20
Manganese	123	309	200	93.0	0.3	20
Molybdenum	12.3	221	200	104.4	1.4	20
Nickel	13.4	195	200	90.8	1.0	20
Phosphorus						
Potassium	18100	27100	10000	90.0	1.1	20
Selenium	3.2	355	400	88.0	0.6	20
Silver						
Sodium	256000	266000	10000	20.0 (a)	1.5	20
Strontium						
Thallium						
Tin						
Titanium						
Uranium	12.8	455	400	110.6	1.6	20
Vanadium						
Zinc	131	291	200	80.0	0.7	20

Associated samples MP28044: DA15855-1F, DA15855-3F, DA15855-5F

Results < IDL are shown as zero for calculation purposes

(*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

(anr) Analyte not requested

(a) Spike amount low relative to the sample amount. Refer to lab control or spike blank for recovery information.

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: DA15855
 Account: ERMC0GV - ERM-West, Inc.
 Project: Parkdale Quarry GW

QC Batch ID: MP28044
 Matrix Type: AQUEOUS

Methods: EPA 200.8
 Units: ug/l

Prep Date: 05/16/19

Metal	BSP Result	SpikeLot ICPALL2	% Rec	QC Limits
Aluminum	925	1000	92.5	85-115
Antimony	103	100	103.0	85-115
Arsenic	204	200	102.0	85-115
Barium	394	400	98.5	85-115
Beryllium				
Boron				
Cadmium	104	100	104.0	85-115
Calcium	5130	5000	102.6	85-115
Chromium	102	100	102.0	85-115
Cobalt	102	100	102.0	85-115
Copper	99.7	100	99.7	85-115
Iron	996	1000	99.6	85-115
Lead	203	200	101.5	85-115
Magnesium	5040	5000	100.8	85-115
Manganese	103	100	103.0	85-115
Molybdenum	100	100	100.0	85-115
Nickel	99.1	100	99.1	85-115
Phosphorus				
Potassium	5120	5000	102.4	85-115
Selenium	201	200	100.5	85-115
Silver				
Sodium	5040	5000	100.8	85-115
Strontium				
Thallium				
Tin				
Titanium				
Uranium	205	200	102.5	85-115
Vanadium				
Zinc	99.5	100	99.5	85-115

Associated samples MP28044: DA15855-1F, DA15855-3F, DA15855-5F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (anr) Analyte not requested

General Chemistry

QC Data Summaries

7

Includes the following where applicable:

- Method Blank and Blank Spike Summaries
- Duplicate Summaries
- Matrix Spike Summaries

METHOD BLANK AND SPIKE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: DA15855
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

Analyte	Batch ID	RL	MB Result	Units	Spike Amount	BSP Result	BSP %Recov	QC Limits
Alkalinity, Total as CaCO ₃	GN47063	5.0	2.2	mg/l	100	101	100.5	90-110%
Bromide	GP25118/GN46966	0.050	0.0	mg/l	0.5	0.516	103.2	90-110%
Chloride	GP25118/GN46966	0.50	0.0	mg/l	5	5.29	105.8	90-110%
Fluoride	GP25118/GN46966	0.10	0.0	mg/l	1	1.05	105.0	90-110%
Nitrogen, Nitrate	GP25118/GN46966	0.010	0.0	mg/l	0.1	0.102	102.0	90-110%
Nitrogen, Nitrite	GP25118/GN46966	0.0040	0.0	mg/l	0.05	0.0505	101.0	90-110%
Phosphorus, Total	GP25206/GN47082	0.010	0.00	mg/l	0.2	0.190	95.0	90-110%
Phosphorus, Total	GP25206/GN47082	0.010	0.00	mg/l	0.2	0.188	94.0	90-110%
Solids, Total Dissolved	GN46967	10	0.0	mg/l	400	401	100.3	90-110%
Sulfate	GP25118/GN46966	0.50	0.0	mg/l	5	5.13	102.6	90-110%

Associated Samples:

Batch GN46967: DA15855-1, DA15855-3, DA15855-5

Batch GN47063: DA15855-1, DA15855-3, DA15855-5

Batch GP25118: DA15855-1, DA15855-3, DA15855-5

Batch GP25206: DA15855-1, DA15855-3, DA15855-5

(*) Outside of QC limits

7.1

7

DUPLICATE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: DA15855
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

Analyte	Batch ID	QC Sample	Units	Original Result	DUP Result	RPD	QC Limits
Alkalinity, Total as CaCO ₃	GN47063	DA16000-1	mg/l	604	607	0.5	0-20%
Phosphorus, Total	GP25206/GN47082	DA15986-1	mg/l	0.017	0.0210	21.1(a)	0-20%
Solids, Total Dissolved	GN46967	DA15829-1	mg/l	1950	1940	0.5	0-5%

Associated Samples:

Batch GN46967: DA15855-1, DA15855-3, DA15855-5

Batch GN47063: DA15855-1, DA15855-3, DA15855-5

Batch GP25206: DA15855-1, DA15855-3, DA15855-5

(*) Outside of QC limits

(a) RPD acceptable due to low duplicate and sample concentrations.

MATRIX SPIKE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: DA15855
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MS Result	%Rec	QC Limits
Alkalinity, Total as CaCO3	GN47063	DA15692-4	mg/l	64.3	100	162	97.9	80-120%
Bromide	GP25118/GN46966	DA15856-3	mg/l	0.0	0.5	0.51	102.0	80-120%
Chloride	GP25118/GN46966	DA15856-3	mg/l	0.58	5	5.7	102.4	80-120%
Fluoride	GP25118/GN46966	DA15856-3	mg/l	0.074	1	1.1	102.6	80-120%
Nitrogen, Nitrate	GP25118/GN46966	DA15856-3	mg/l	0.028	0.1	0.13	102.0	80-120%
Nitrogen, Nitrite	GP25118/GN46966	DA15856-3	mg/l	0.0	0.05	0.051	102.0	80-120%
Phosphorus, Total	GP25206/GN47082	DA16059-1	mg/l	0.094	0.2	0.289	97.5	90-110%
Sulfate	GP25118/GN46966	DA15856-3	mg/l	1.8	5	6.8	100.0	80-120%

Associated Samples:

Batch GN47063: DA15855-1, DA15855-3, DA15855-5

Batch GP25118: DA15855-1, DA15855-3, DA15855-5

Batch GP25206: DA15855-1, DA15855-3, DA15855-5

(*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

7.3

7

MATRIX SPIKE DUPLICATE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: DA15855
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MSD Result	RPD	QC Limit
Alkalinity, Total as CaCO3	GN47063	DA15692-4	mg/l	64.3	100	160	1.1	20%
Bromide	GP25118/GN46966	DA15856-3	mg/l	0.0	0.5	0.51	0.0	20%
Chloride	GP25118/GN46966	DA15856-3	mg/l	0.58	5	5.7	0.0	20%
Fluoride	GP25118/GN46966	DA15856-3	mg/l	0.074	1	1.1	0.0	20%
Nitrogen, Nitrate	GP25118/GN46966	DA15856-3	mg/l	0.028	0.1	0.13	0.0	20%
Nitrogen, Nitrite	GP25118/GN46966	DA15856-3	mg/l	0.0	0.05	0.051	0.0	20%
Sulfate	GP25118/GN46966	DA15856-3	mg/l	1.8	5	6.8	0.0	20%

Associated Samples:

Batch GN47063: DA15855-1, DA15855-3, DA15855-5

Batch GP25118: DA15855-1, DA15855-3, DA15855-5

(*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

7.4

7

June 12, 2019

Report to:

Scott Heideman
SGS Accutest
4036 Youngfield Street
Wheat Ridge, CO 80033

Bill to:

Scott Heideman
SGS Accutest
4036 Youngfield Street
Wheat Ridge, CO 80033

cc: Scott Heideman, Janel Mulholland, Elizabeth Sutcliffe

Project ID:

ACZ Project ID: L51823

Scott Heideman:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on May 16, 2019. This project has been assigned to ACZ's project number, L51823. Please reference this number in all future inquiries.

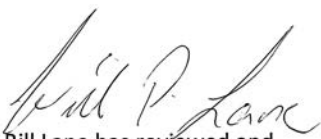
All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L51823. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after July 12, 2019. If the samples are determined to be hazardous, additional charges apply for disposal (typically \$11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.



Bill Lane has reviewed and
approved this report



SGS Accutest

Project ID:

Sample ID: DA15855-1X

ACZ Sample ID: **L51823-01**

Date Sampled: 05/14/19 13:00

Date Received: 05/16/19

Sample Matrix: Waste Water

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Residue, Total (TS) @ 105C	SM2540B	1	1110			mg/L	20	40	05/20/19 20:02	nmc

Arizona license number: AZ0102

SGS Accutest

Project ID:

Sample ID: DA15855-3X

ACZ Sample ID: **L51823-02**

Date Sampled: 05/14/19 13:20

Date Received: 05/16/19

Sample Matrix: Waste Water

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Residue, Total (TS) @ 105C	SM2540B	1	1300			mg/L	20	40	05/20/19 20:04	nmc

Arizona license number: AZ0102

SGS Accutest

Project ID:

Sample ID: DA15855-5X

ACZ Sample ID: **L51823-03**

Date Sampled: 05/14/19 16:30

Date Received: 05/16/19

Sample Matrix: Waste Water

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Residue, Total (TS) @ 105C	SM2540B	1	1140			mg/L	20	40	05/20/19 20:05	nmc

Arizona license number: AZ0102


Report Header Explanations

<i>Batch</i>	A distinct set of samples analyzed at a specific time
<i>Found</i>	Value of the QC Type of interest
<i>Limit</i>	Upper limit for RPD, in %.
<i>Lower</i>	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
<i>MDL</i>	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations.
<i>PCN/SCN</i>	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
<i>PQL</i>	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
<i>QC</i>	True Value of the Control Sample or the amount added to the Spike
<i>Rec</i>	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
<i>RPD</i>	Relative Percent Difference, calculation used for Duplicate QC Types
<i>Upper</i>	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
<i>Sample</i>	Value of the Sample of interest

QC Sample Types

<i>AS</i>	Analytical Spike (Post Digestion)	<i>LCSWD</i>	Laboratory Control Sample - Water Duplicate
<i>ASD</i>	Analytical Spike (Post Digestion) Duplicate	<i>LFB</i>	Laboratory Fortified Blank
<i>CCB</i>	Continuing Calibration Blank	<i>LFM</i>	Laboratory Fortified Matrix
<i>CCV</i>	Continuing Calibration Verification standard	<i>LFMD</i>	Laboratory Fortified Matrix Duplicate
<i>DUP</i>	Sample Duplicate	<i>LRB</i>	Laboratory Reagent Blank
<i>ICB</i>	Initial Calibration Blank	<i>MS</i>	Matrix Spike
<i>ICV</i>	Initial Calibration Verification standard	<i>MSD</i>	Matrix Spike Duplicate
<i>ICSAB</i>	Inter-element Correction Standard - A plus B solutions	<i>PBS</i>	Prep Blank - Soil
<i>LCSS</i>	Laboratory Control Sample - Soil	<i>PBW</i>	Prep Blank - Water
<i>LCSSD</i>	Laboratory Control Sample - Soil Duplicate	<i>PQV</i>	Practical Quantitation Verification standard
<i>LCSW</i>	Laboratory Control Sample - Water	<i>SDL</i>	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

<i>B</i>	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
<i>H</i>	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
<i>L</i>	Target analyte response was below the laboratory defined negative threshold.
<i>U</i>	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

- (1) EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
- (2) EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
- (3) EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
- (4) EPA SW-846. Test Methods for Evaluating Solid Waste.
- (5) Standard Methods for the Examination of Water and Wastewater.

Comments

- (1) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
- (2) Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
- (3) Animal matrices for Inorganic analyses are reported on an "as received" basis.
- (4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
- (5) If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click:

<https://aczk.com/wp-content/uploads/2019/04/Ext-Qual-List.pdf>

SGS AccutestACZ Project ID: **L51823**

NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.

Residue, Total (TS) @ 105C

SM2540B

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG472736													
WG472736PBW	PBW	05/20/19 20:00				22	mg/L		-40	40			
WG472736LCSW	LCSW	05/20/19 20:01	PCN58852	1100		1100	mg/L	100	80	120			
L51908-01DUP	DUP	05/20/19 20:16			234	216	mg/L				8	10	

SGS Accutest

ACZ Project ID: **L51823**

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
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No extended qualifiers associated with this analysis

SGS Accutest

Project ID:

Sample ID: DA15855-1X

Locator:

ACZ Sample ID: **L51823-01**

Date Sampled: 05/14/19 13:00

Date Received: 05/16/19

Sample Matrix: Waste Water

Gross Alpha & Beta

Prep Method:

M900.0

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Gross Alpha	06/03/19 0:00		18	5.7	11	pCi/L		amk
Gross Beta	06/03/19 0:00		28	4.8	7.3	pCi/L		amk

Radium 226

Prep Method:

M903.1

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Radium 226	06/10/19 0:17		1.2	0.26	0.19	pCi/L	*	djc

Radium 228, total

Prep Method:

M904.0

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Radium 228, total	06/10/19 13:46		2.7	2.8	2.8	pCi/L	*	amk

Uranium, Isotopic Total

Prep Method:

Eichrom ACW03

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Uranium 234, total	05/30/19 0:21		19	4.6	2.6	pCi/L	*	jlg
Uranium 235, total	05/30/19 0:21		0.0	1.1	4.6	pCi/L	*	jlg
Uranium 238, total	05/30/19 0:21		6.45	2.9	2.4	pCi/L	*	jlg

SGS Accutest

Project ID:

Sample ID: DA15855-3X

Locator:

ACZ Sample ID: **L51823-02**

Date Sampled: 05/14/19 13:20

Date Received: 05/16/19

Sample Matrix: Waste Water

Gross Alpha & Beta

Prep Method:

M900.0

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Gross Alpha	06/03/19 0:00		47	11	18	pCi/L		amk
Gross Beta	06/03/19 0:00		65	8.2	14	pCi/L		amk

Radium 226

Prep Method:

M903.1

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Radium 226	06/10/19 0:18		1.3	0.31	0.27	pCi/L	*	djc

Radium 228, total

Prep Method:

M904.0

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Radium 228, total	06/04/19 16:35		9.7	1.6	1.2	pCi/L	*	amk

Uranium, Isotopic Total

Prep Method:

Eichrom ACW03

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Uranium 234, total	05/30/19 0:23		17	4	1.9	pCi/L	*	jlg
Uranium 235, total	05/30/19 0:23		-0.27	1.5	2.3	pCi/L	*	jlg
Uranium 238, total	05/30/19 0:23		7.28	3	2.8	pCi/L	*	jlg

SGS Accutest

Project ID:

Sample ID: DA15855-5X

Locator:

ACZ Sample ID: **L51823-03**

Date Sampled: 05/14/19 16:30

Date Received: 05/16/19

Sample Matrix: Waste Water

Gross Alpha & Beta

Prep Method:

M900.0

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Gross Alpha	06/03/19 0:00		25	7.7	15	pCi/L		amk
Gross Beta	06/03/19 0:00		34	6.5	14	pCi/L		amk

Radium 226

Prep Method:

M903.1

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Radium 226	06/10/19 0:20		1.4	0.22	0.18	pCi/L	*	djc

Radium 228, total

Prep Method:

M904.0

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Radium 228, total	06/04/19 16:35		2.6	0.79	0.71	pCi/L		amk

Uranium, Isotopic Total

Prep Method:

Eichrom ACW03

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Uranium 234, total	05/30/19 0:24		11	3.2	2	pCi/L	*	jlg
Uranium 235, total	05/30/19 0:24		-0.64	0.93	1.5	pCi/L	*	jlg
Uranium 238, total	05/30/19 0:24		7.44	2.7	1.5	pCi/L	*	jlg

Report Header Explanations

<i>Batch</i>	A distinct set of samples analyzed at a specific time
<i>Error(+/-)</i>	Calculated sample specific uncertainty
<i>Found</i>	Value of the QC Type of interest
<i>Limit</i>	Upper limit for RPD, in %.
<i>LCL</i>	Lower Control Limit, in % (except for LCSS, mg/Kg)
<i>LLD</i>	Calculated sample specific Lower Limit of Detection
<i>PCN/SCN</i>	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
<i>PQL</i>	Practical Quantitation Limit
<i>QC</i>	True Value of the Control Sample or the amount added to the Spike
<i>Rec</i>	Amount of the true value or spike added recovered, in % (except for LCSS, mg/Kg)
<i>RER</i>	Relative Error Ratio, calculation used for Dup. QC taking into account the error factor.
<i>RPD</i>	Relative Percent Difference, calculation used for Duplicate QC Types
<i>UCL</i>	Upper Control Limit, in % (except for LCSS, mg/Kg)
<i>Sample</i>	Value of the Sample of interest

QC Sample Types

<i>DUP</i>	Sample Duplicate	<i>MS/MSD</i>	Matrix Spike/Matrix Spike Duplicate
<i>LCSS</i>	Laboratory Control Sample - Soil	<i>PBS</i>	Prep Blank - Soil
<i>LCSW</i>	Laboratory Control Sample - Water	<i>PBW</i>	Prep Blank - Water

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Matrix Spikes	Determines sample matrix interferences, if any.

ACZ Qualifiers (Qual)

H	Analysis exceeded method hold time.
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Method Prefix Reference

M	EPA methodology, including those under SDWA, CWA, and RCRA
SM	Standard Methods for the Examination of Water and Wastewater.
D	ASTM
RP	DOE
ESM	DOE/ESM

Comments

- (1) Solid matrices are reported on a dry weight basis.
- (2) Preparation method: "Method" indicates preparation defined in analytical method.
- (3) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
- (4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.

For a complete list of ACZ's Extended Qualifiers, please click:

<https://aczk.com/wp-content/uploads/2019/04/Ext-Qual-List.pdf>

SGS Accutest

ACZ Project ID: **L51823**

NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.

Alpha												Units: pCi/L				
M900.0																
ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Error	LLD	Found	Error	LLD	Rec%	Lower	Upper	RPD/RER	Limit	Qual
WG473687																
L51810-02MSA	MS	06/03/19	PCN57385	100	8.4	3.2	5.4	120	12	7.4	112	67	144			
L51851-01DUP	DUP-RER	06/03/19			2	2	5.7	1.7	1.9	5.6				0.11	2	
WG473104LCSWA	LCSW	06/03/19	PCN57385	100				110	8.8	1.3	110	67	144			
WG473104PBW	PBW	06/03/19						-.18	0.51	0.85			1.7			
L51810-01DUP	DUP-RER	06/03/19			13	3.8	12	9.6	3.4	13				0.67	2	

Beta												Units: pCi/L				
M900.0																
ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Error	LLD	Found	Error	LLD	Rec%	Lower	Upper	RPD/RER	Limit	Qual
WG473687																
L51810-01DUP	DUP-RER	06/03/19			7.2	3	8.4	3.6	2.8	8.5				0.88	2	
L51810-04MSB	MS	06/03/19	RC190312-11	98.52	5.6	3	7.5	120	7	7.5	116	82	122			
L51851-01DUP	DUP-RER	06/03/19			3.2	2.7	4.2	2.6	2.7	4.2				0.16	2	
WG473104LCSWB	LCSW	06/03/19	RC190312-11	98.52				100	6.3	2.5	102	82	122			
WG473104PBW	PBW	06/03/19						.44	1.8	1.9			3.8			

Radium 226												Units: pCi/L				
M903.1																
ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Error	LLD	Found	Error	LLD	Rec%	Lower	Upper	RPD/RER	Limit	Qual
WG474372																
WG473228PBW	PBW	06/10/19						.03	0.06	0.1			0.2			
WG473228LCSW	LCSW	06/10/19	PCN57865	20				22	0.56	0.1	110	43	148			
L51810-05DUP	DUP-RER	06/10/19			0.19	0.1	0.12	.02	0.06	0.16				1.45	2	
L52006-01DUP	DUP-RER	06/10/19			0.33	0.08	0.26	.26	0.16	0.38				0.39	2	N1A
L51810-06MS	MS	06/10/19	PCN57865	20	0.25	0.08	0.1	19	0.51	0.07	94	43	148			

SGS Accutest

ACZ Project ID: **L51823**

NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.

Radium 228, total

M904.0

Units: pCi/L

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Error	LLD	Found	Error	LLD	Rec%	Lower	Upper	RPD/RER	Limit	Qual
WG473778																
WG473070PBW	PBW	06/04/19						-.04	0.31	0.33			0.66			
WG473070LCSW	LCSW	06/04/19	PCN57186	9.09				8.1	0.97	0.69	89	47	123			
L51804-01DUP	DUP-RER	06/04/19			-0.54	0.7	0.76	.13	0.6	0.63				0.73	2	
L51810-02MS	MS	06/04/19	PCN57186	9.09	0.14	0.7	0.72	8.5	0.91	0.61	92	47	123			
L51820-05DUP	DUP-RER	06/04/19			4.2	0.87	0.72	4.1	0.83	0.69				0.08	2	
WG474248																
WG473822PBW	PBW	06/10/19						.18	0.63	0.65			1.3			
WG473822LCSW	LCSW	06/10/19	PCN57186	9.07				7.7	1	0.76	85	47	123			
L52006-02MS	MS	06/10/19	PCN57186	9.07	0.49	0.95	0.98	10	1.2	0.9	105	47	123			
L51953-01DUP	DUP-RER	06/10/19			0.82	0.81	0.81	.61	0.82	0.83				0.18	2	
L51953-02DUP	DUP-RER	06/10/19			0.05	0.83	0.87	-.39	0.9	0.97				0.36	2	

Uranium 234

Eichrom ACW03

Units: pCi/L

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Error	LLD	Found	Error	LLD	Rec%	Lower	Upper	RPD/RER	Limit	Qual
WG473418																
WG472816PBW	PBW	05/30/19						1.8	1.2	0.93			1.86			
WG472816LCSW	LCSW	05/30/19	RC190424-10	98				89	6.5	0.78	91	77	122			
L51743-02DUP	DUP-RER	05/30/19			15	2.5	1.6	16	2.4	0.74				0.29	2	
L51851-01DUP	DUP-RPD	05/30/19			1.8	0.94	0.71	9.1	2.2	2.2				134	20	
L51851-01DUP	DUP-RER	05/30/19			1.8	0.94	0.71	9.1	2.2	2.2				3.05	2	RM
L51749-01MS	MS	05/30/19	RC190424-10	98	2	1.1	0.94	110	7.2	1.4	110	77	122			

SGS Accutest

ACZ Project ID: **L51823**

NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.

Uranium 235

Eichrom ACW03

Units: pCi/L

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Error	LLD	Found	Error	LLD	Rec%	Lower	Upper	RPD/RER	Limit	Qual
WG473418																
WG472816PBW	PBW	05/30/19						0	0.3	0.61			1.22			
WG472816LCSW	LCSW	05/30/19	RC190424-10	4.48				3.6	1.3	0.31	80	42	136			
L51743-02DUP	DUP-RER	05/30/19			0.31	0.45	0.66	.56	0.5	0.49				0.37	2	
L51851-01DUP	DUP-RER	05/30/19			0	0.38	1.1	0	0.82	1.1				0	2	
L51749-01MS	MS	05/30/19	RC190424-10	4.48	-0.13	0.74	1.1	2.5	1.2	1.2	59	42	136			

Uranium 238

Eichrom ACW03

Units: pCi/L

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Error	LLD	Found	Error	LLD	Rec%	Lower	Upper	RPD/RER	Limit	Qual
WG473418																
WG472816PBW	PBW	05/30/19						.66	0.61	0.7			1.4			
WG472816LCSW	LCSW	05/30/19	RC190424-10	97.5				95.2	6.7	0.31	98	87	124			
L51743-02DUP	DUP-RER	05/30/19			5.31	1.7	1.2	7.56	1.6	0.56				0.96	2	
L51851-01DUP	DUP-RPD	05/30/19			1.55	0.89	1.1	10	2.4	2.1				146	20	
L51851-01DUP	DUP-RER	05/30/19			1.55	0.89	1.1	10	2.4	2.1				3.3	2	RM
L51749-01MS	MS	05/30/19	RC190424-10	97.5	0.62	0.91	1.4	106	7.2	0.73	108	87	124			

SGS Accutest

ACZ Project ID: **L51823**

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION	
L51823-01	WG474372	Radium 226	M903.1	D1	Sample required dilution due to matrix.	
			M903.1	N1	See Case Narrative.	
			M903.1	N1A	See Case Narrative.	
	WG474248	Radium 228, total	M904.0	D1	Sample required dilution due to matrix.	
	WG473418	Uranium 234, total	Eichrom ACW03	DF	Sample required dilution due to high sediment.	
			Eichrom ACW03	RM	For a water matrix, the duplicate precision assessment (RPD or RER) exceeded the control limit. High sediment, turbidity, or presence of an immiscible liquid attributed to non-homogeneity of the sample.	
		Uranium 235, total	Eichrom ACW03	DF	Sample required dilution due to high sediment.	
		Uranium 238, total	Eichrom ACW03	DF	Sample required dilution due to high sediment.	
		Eichrom ACW03	RM	For a water matrix, the duplicate precision assessment (RPD or RER) exceeded the control limit. High sediment, turbidity, or presence of an immiscible liquid attributed to non-homogeneity of the sample.		
	L51823-02	WG474372	Radium 226	M903.1	D1	Sample required dilution due to matrix.
				M903.1	N1A	See Case Narrative.
M904.0				D1	Sample required dilution due to matrix.	
WG473778		Radium 228, total	M904.0	D1	Sample required dilution due to matrix.	
WG473418		Uranium 234, total	Eichrom ACW03	DF	Sample required dilution due to high sediment.	
			Eichrom ACW03	RM	For a water matrix, the duplicate precision assessment (RPD or RER) exceeded the control limit. High sediment, turbidity, or presence of an immiscible liquid attributed to non-homogeneity of the sample.	
		Uranium 235, total	Eichrom ACW03	DF	Sample required dilution due to high sediment.	
		Uranium 238, total	Eichrom ACW03	DF	Sample required dilution due to high sediment.	
		Eichrom ACW03	RM	For a water matrix, the duplicate precision assessment (RPD or RER) exceeded the control limit. High sediment, turbidity, or presence of an immiscible liquid attributed to non-homogeneity of the sample.		
L51823-03		WG474372	Radium 226	M903.1	D1	Sample required dilution due to matrix.
				M903.1	N1A	See Case Narrative.
	WG473418	Uranium 234, total	Eichrom ACW03	DF	Sample required dilution due to high sediment.	
			Eichrom ACW03	RM	For a water matrix, the duplicate precision assessment (RPD or RER) exceeded the control limit. High sediment, turbidity, or presence of an immiscible liquid attributed to non-homogeneity of the sample.	
		Uranium 235, total	Eichrom ACW03	DF	Sample required dilution due to high sediment.	
	Uranium 238, total	Eichrom ACW03	DF	Sample required dilution due to high sediment.		
	Eichrom ACW03	RM	For a water matrix, the duplicate precision assessment (RPD or RER) exceeded the control limit. High sediment, turbidity, or presence of an immiscible liquid attributed to non-homogeneity of the sample.			

SGS Accutest

ACZ Project ID: **L51823**

Radiochemistry

The following parameters are not offered for certification or are not covered by AZ certificate #AZ0102.

Uranium 234, total	Eichrom ACW03
Uranium 235, total	Eichrom ACW03
Uranium 238, total	Eichrom ACW03

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.

Uranium 234, total	Eichrom ACW03
Uranium 235, total	Eichrom ACW03
Uranium 238, total	Eichrom ACW03

SGS Accutest

ACZ Project ID: L51823

Date Received: 05/16/2019 11:22

Received By:

Date Printed: 5/17/2019

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?	☐	☐	☒
2) Is the Chain of Custody form or other directive shipping papers present?	☒	☐	☐
3) Does this project require special handling procedures such as CLP protocol?	☐	☒	☐
4) Are any samples NRC licensable material?	☐	☐	☒
5) If samples are received past hold time, proceed with requested short hold time analyses?	☒	☐	☐
6) Is the Chain of Custody form complete and accurate?	☒	☐	☐
7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples?	☐	☒	☐

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	☒	☐	☐
9) Are all labels on containers and are they intact and legible?	☒	☐	☐
10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time?	☒	☐	☐
11) For preserved bottle types, was the pH checked and within limits? ¹	☒	☐	☐
12) Is there sufficient sample volume to perform all requested work?	☒	☐	☐
13) Is the custody seal intact on all containers?	☐	☐	☒
14) Are samples that require zero headspace acceptable?	☐	☐	☒
15) Are all sample containers appropriate for analytical requirements?	☒	☐	☐
16) Is there an Hg-1631 trip blank present?	☐	☐	☒
17) Is there a VOA trip blank present?	☐	☐	☒
18) Were all samples received within hold time?	☒	☐	☐

NA indicates Not Applicable

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp (°C)	Temp Criteria (°C)	Rad (µR/Hr)	Custody Seal Intact?
NA30572	3.5	<=6.0	15	Yes

Was ice present in the shipment container(s)?

Yes - Wet ice was present in the shipment container(s).

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

SGS Accutest

ACZ Project ID: L51823

Date Received: 05/16/2019 11:22

Received By:

Date Printed: 5/17/2019

¹ The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na₂S₂O₃ preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

ERM-West, Inc.

Parkdale Quarry GW

Proj# 0488586

SGS Job Number: DA19189X

Sampling Date: 08/28/19

Report to:

ERM-West, Inc.
555 17th Street Suite #1700
Denver, CO 80111
zack.walter@erm.com

ATTN: Zack Walter

Total number of pages in report: **29**



Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.



Scott Heideman
Laboratory Director

Client Service contact: Carissa Cumine 303-425-6021

Certifications: CO (CO00049), NE (NE-OS-06-04), ND (R-027), UT (NELAP CO00049)
LA (LA150028), TX (T104704511), WY (8TMS-L)

This report shall not be reproduced, except in its entirety, without the written approval of SGS.
Test results relate only to samples analyzed.

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Sample Summary

ERM-West, Inc.

Job No: DA19189X

Parkdale Quarry GW
Project No: Proj# 0488586

Sample Number	Collected Date	Time By	Received	Matrix Code	Type	Client Sample ID
DA19189-1X	08/28/19	15:00	ZW/JM	09/04/19	AQ Ground Water	WELL #3
DA19189-3X	08/28/19	19:10	ZW/JM	09/04/19	AQ Ground Water	WELL #10



Wheat Ridge, CO

Section 2

Subcontract Lab Data

Report of Analysis

ANALYTICAL REPORT

Eurofins TestAmerica, St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

Laboratory Job ID: 160-35580-1
Laboratory Sample Delivery Group: DA19189X
Client Project/Site: DA19189X

For:
SGS North America Inc
4036 Youngfield Street
Wheat Ridge, Colorado 80033

Attn: Elizabeth Sutcliffe

Elizabeth M. Hoerchler

Authorized for release by:
10/17/2019 10:58:51 AM

Elizabeth Hoerchler, Project Manager I
(314)298-8566
elizabeth.hoerchler@testamericainc.com

LINKS

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results through
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Have a Question?

**Ask
The
Expert**

Visit us at:
www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Case Narrative

Client: SGS North America Inc
Project/Site: DA19189X

Job ID: 160-35580-1
SDG: DA19189X

Job ID: 160-35580-1

Laboratory: Eurofins TestAmerica, St. Louis

Narrative

CASE NARRATIVE

Client: SGS North America Inc

Project: DA19189X

Report Number: 160-35580-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Eurofins TestAmerica, St. Louis attests to the validity of the laboratory data generated by Eurofins TestAmerica facilities reported herein. All analyses performed by Eurofins TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. Eurofins TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client.

Any minimum detectable concentration (MDC), critical value (DLC), or Safe Drinking Water Act detection limit (SDWA DL) is sample-specific unless otherwise stated elsewhere in this narrative.

Radiochemistry sample results are reported with the count date/time applied as the Activity Reference Date.

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt.

Manual Integrations were performed only when necessary and are in compliance with the laboratory's standard operating procedure. Detailed information can be found in the raw data section of the level IV report.

This laboratory report is confidential and is intended for the sole use of Eurofins TestAmerica and its client.

RECEIPT

The samples were received on 09/10/2019; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 3.0° C.

ISOTOPIC URANIUM (ALPHA SPECTROMETRY)

Case Narrative

Client: SGS North America Inc
Project/Site: DA19189X

Job ID: 160-35580-1
SDG: DA19189X

Job ID: 160-35580-1 (Continued)

Laboratory: Eurofins TestAmerica, St. Louis (Continued)

Samples DA19189-1X (160-35580-1) and DA19189-3X (160-35580-2) were analyzed for Isotopic Uranium (Alpha Spectrometry) in accordance with DOE. The samples were prepared on 09/27/2019 and analyzed on 10/10/2019.

Insufficient sample volume was available to perform a sample duplicate for the following samples: DA19189-1X (160-35580-1) and DA19189-3X (160-35580-2). A laboratory control sample/laboratory control sample duplicate (LCS/LCSD) were prepared instead to demonstrate batch precision.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

[illegible]

Page 5 of 14

03 0558 0083 Chain of Custody

<http://www.sgs.com/en/terms-and-conditions>

Sample Custody must be documented below each time samples change possession, including courier delivery

Relinquished by Sample:	Date Time: 9/2/00	Received By: 1 TASTU 9/10/15 09130	Relinquished By: 2	Date Time:	Received By: 2
3	Date Time:	Received By: 3	Relinquished By: 4	Date Time:	Received By: 4
Relinquished by:	Date Time:	Received By: 5	Custody Seal # ☐ Intact ☐ Not Intact	Preserved where applicable ☐ Therm. ID:	On Ice ☐ Cooler Temp.



CHAIN-OF CUSTODY

SGS North America Inc. - Wheat Ridge
4036 Youngfield Street, Wheat Ridge, CO 80033
TEL: 303-425-6021, FAX: 303-425-6854
www.sgs.com/ehsausa

Page 1 of 1

Send Report and Invoice to:

Elizabeth.Sutcliffe@sgs.com; Carissa.Cumine@sgs.com;
Janel.Mulholland@sgs.com; Elizabeth.Bolstad@sgs.com;
Scott.Heideman@sgs.com; Larisa.Dimarco@sgs.com

Phone # 303-425-6021		Fax #		Client Purchase Order #		City		State		Zip																	
Sampler(s) Name(s) ZW/JM		Phone		Project Manager		Attention:																					
SGS Sample #	Field ID / Point of Collection	MECH/DI Mat #	Date	Time	Sampled by	Matrix	# of bottles	HCl	NH3	PHOS	ASCO3	NO3	DI Water	MECH	ENDURE	ISOTOPIC URANIUM	Requested Analysis (see TEST CODE sheet)										Matrix Codes
1X	DA19189		8/28/19	3:00:00 PM	ZW/JM	AQ												DW - Drinking Water GW - Ground Water WW - Water SW - Surface Water SG - Soil SL - Sludge SED - Sediment OI - Oil LIQ - Other Liquid AIR - Air SOL - Other Solid WP - Wipe FB - Field Blank EB - Equipment Blank RB - Rinse Blank TB - Trip Blank									
3X	DA19189		8/28/19	7:10:00 PM	ZW/JM	AQ																					
Turnaround Time (Business days)																		LAB USE ONLY									
☐ Standard 10 Day (business) ☐ 5 Business Days RUSH ☐ 3 Business Days RUSH ☐ 2 Business Days RUSH ☐ 1 Business Day EMERGENCY ☒ other Due 10/16/2019 Emergency & Rush TAT data available via Lablink Approval needed for RUSH/Emergency TAT		Approved By (SGS PM): / Date:				☐ Commercial "A" (Level 1) ☐ Commercial "B" (Level 2) ☐ REDT1 (Level 3) ☐ FULT1 (Level 4) ☐ Commercial "C"		☐ State Forms ☐ EDD Format ☐ Other ☒ CL				Comments / Special Instructions															
Sample Custody must be documented below each time samples change possession, including courier delivery.																		http://www.sgs.com/en/terms-and-conditions									
Relinquished by Sampler:		Date/Time:		Received By:		Date/Time:		Relinquished By:		Date/Time:		Received By:															
1		10/25/19		12 M.C. 092619 0930				2				2															
Relinquished by Sampler:		Date/Time:		Received By:		Date/Time:		Relinquished By:		Date/Time:		Received By:															
3				3				4				4															
Relinquished by:		Date/Time:		Received By:		Date/Time:		Custody Seal #		☐ Intact ☐ Not Intact		Preserved where applicable ☐ Therm. ID:		On Ice ☐ Cooler Temp.													

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160-35580 Chain of Custody

SGS

10/17/2019

4

2

Login Sample Receipt Checklist

Client: SGS North America Inc

Job Number: 160-35580-1

SDG Number: DA19189X

Login Number: 35580

List Number: 1

Creator: Press, Nicholas B

List Source: Eurofins TestAmerica, St. Louis

Question	Answer	Comment
Radioactivity wasn't checked or is $\leq$ background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: SGS North America Inc
Project/Site: DA19189X

Job ID: 160-35580-1
SDG: DA19189X

Qualifiers

Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RLL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Eurofins TestAmerica, St. Louis

Method Summary

Client: SGS North America Inc
Project/Site: DA19189X

Job ID: 160-35580-1
SDG: DA19189X

Method	Method Description	Protocol	Laboratory
HASL-300	Isotopic Uranium (Alpha Spectroscopy)	HASL	TAL SL
ExtChrom	Preparation, Extraction Chromatography Resin Actinide Separation	None	TAL SL

Protocol References:

HASL = Health And Safety Laboratory

None = None

Laboratory References:

TAL SL = Eurofins TestAmerica, St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Eurofins TestAmerica, St. Louis

Sample Summary

Client: SGS North America Inc
Project/Site: DA19189X

Job ID: 160-35580-1
SDG: DA19189X

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Asset ID
160-35580-1	DA19189-1X	Water	08/28/19 15:00	09/10/19 09:30	
160-35580-2	DA19189-3X	Water	08/28/19 19:10	09/10/19 09:30	

Eurofins TestAmerica, St. Louis

Client Sample Results

Client: SGS North America Inc
Project/Site: DA19189X

Job ID: 160-35580-1
SDG: DA19189X

Client Sample ID: DA19189-1X

Lab Sample ID: 160-35580-1

Date Collected: 08/28/19 15:00

Matrix: Water

Date Received: 09/10/19 09:30

Method: HASL-300 - Isotopic Uranium (Alpha Spectroscopy)										
Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert. (2σ+/-)	Uncert. (2σ+/-)						
Uranium-233/234	20.8		1.42	2.25	1.00	0.208	pCi/L	09/27/19 15:34	10/10/19 11:20	1
Uranium-235/236	0.505		0.248	0.252	1.00	0.137	pCi/L	09/27/19 15:34	10/10/19 11:20	1
Uranium-238	7.66		0.860	1.07	1.00	0.110	pCi/L	09/27/19 15:34	10/10/19 11:20	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	84.9		30 - 110					09/27/19 15:34	10/10/19 11:20	1

Client Sample ID: DA19189-3X

Lab Sample ID: 160-35580-2

Date Collected: 08/28/19 19:10

Matrix: Water

Date Received: 09/10/19 09:30

Method: HASL-300 - Isotopic Uranium (Alpha Spectroscopy)										
Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert. (2σ+/-)	Uncert. (2σ+/-)						
Uranium-233/234	10.1		0.979	1.30	1.00	0.153	pCi/L	09/27/19 15:34	10/10/19 11:20	1
Uranium-235/236	0.277		0.187	0.188	1.00	0.167	pCi/L	09/27/19 15:34	10/10/19 11:20	1
Uranium-238	5.95		0.750	0.901	1.00	0.134	pCi/L	09/27/19 15:34	10/10/19 11:20	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	95.6		30 - 110					09/27/19 15:34	10/10/19 11:20	1

Eurofins TestAmerica, St. Louis

QC Sample Results

Client: SGS North America Inc
Project/Site: DA19189X

Job ID: 160-35580-1
SDG: DA19189X

Method: HASL-300 - Isotopic Uranium (Alpha Spectroscopy)

Lab Sample ID: MB 160-444492/1-A

Matrix: Water

Analysis Batch: 445842

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 444492

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.04278	U	0.0818	0.0818	1.00	0.155	pCi/L	09/27/19 15:34	10/10/19 11:20	1
Uranium-235/236	0.0000	U	0.0106	0.0106	1.00	0.0852	pCi/L	09/27/19 15:34	10/10/19 11:20	1
Uranium-238	0.01565	U	0.0682	0.0683	1.00	0.162	pCi/L	09/27/19 15:34	10/10/19 11:20	1

Tracer	MB %Yield	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
Uranium-232	93.1		30 - 110	09/27/19 15:34	10/10/19 11:20	1

Lab Sample ID: LCS 160-444492/2-A

Matrix: Water

Analysis Batch: 445843

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 444492

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Uranium-233/234	12.7	13.06		1.59	1.00	0.171	pCi/L	103	75 - 125
Uranium-238	13.0	13.90		1.66	1.00	0.153	pCi/L	107	75 - 125

Tracer	LCS %Yield	LCS Qualifier	Limits
Uranium-232	90.0		30 - 110

Lab Sample ID: LCSD 160-444492/3-A

Matrix: Water

Analysis Batch: 445844

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA

Prep Batch: 444492

Analyte	Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Uranium-233/234	12.7	12.19		1.49	1.00	0.154	pCi/L	96	75 - 125	0.28	1
Uranium-238	13.0	12.51		1.51	1.00	0.135	pCi/L	96	75 - 125	0.44	1

Tracer	LCSD %Yield	LCSD Qualifier	Limits
Uranium-232	90.1		30 - 110

Eurofins TestAmerica, St. Louis

QC Association Summary

Client: SGS North America Inc
Project/Site: DA19189X

Job ID: 160-35580-1
SDG: DA19189X

Rad

Prep Batch: 444492

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-35580-1	DA19189-1X	Total/NA	Water	ExtChrom	
160-35580-2	DA19189-3X	Total/NA	Water	ExtChrom	
MB 160-444492/1-A	Method Blank	Total/NA	Water	ExtChrom	
LCS 160-444492/2-A	Lab Control Sample	Total/NA	Water	ExtChrom	
LCSD 160-444492/3-A	Lab Control Sample Dup	Total/NA	Water	ExtChrom	

Eurofins TestAmerica, St. Louis

Tracer/Carrier Summary

Client: SGS North America Inc
Project/Site: DA19189X

Job ID: 160-35580-1
SDG: DA19189X

Method: HASL-300 - Isotopic Uranium (Alpha Spectroscopy)

Matrix: Water

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)	
Lab Sample ID	Client Sample ID	uranium-23 (30-110)	
160-35580-1	DA19189-1X	84.9	
160-35580-2	DA19189-3X	95.6	
LCS 160-444492/2-A	Lab Control Sample	90.0	
LCSD 160-444492/3-A	Lab Control Sample Dup	90.1	
MB 160-444492/1-A	Method Blank	93.1	
Tracer/Carrier Legend			
Uranium-232 = Uranium-232			

Eurofins TestAmerica, St. Louis



Hazen Research, Inc.
4601 Indiana Street
Golden, CO 80403 USA
Tel: (303) 279-4501
Fax: (303) 278-1528

Lab Control ID: 19M02756
Received: Sep 06, 2019
Reported: Oct 23, 2019
Purchase Order No.
DA19189X

Customer ID: 00151Z
Account ID: Z05205

Scott Heideman
SGS North America
4036 Youngfield Street
Wheat Ridge, CO 80033-3862

ANALYTICAL REPORT

*Report may only be copied in its entirety.
Results reported herein relate only to discrete samples
submitted by the client. Hazen Research, Inc. does not warrant
that the results are representative of anything other than the
samples that were received in the laboratory*

By: 
Jessica Axen
Analytical Laboratories Director



Hazen Research, Inc.
4601 Indiana Street
Golden, CO 80403 USA
Tel: (303) 279-4501
Fax: (303) 278-1528

Lab Control ID: 19M02756
Received: Sep 06, 2019
Reported: Oct 23, 2019
Purchase Order No.
DA19189X

Customer ID: 00151Z
Account ID: Z05205
ANALYTICAL REPORT

Scott Heideman
SGS North America

Lab Sample ID			19M02756-001					
Customer Sample ID			DA19189-1X					
			sampled on 08/28/19 @ 1500 by ZW/JM					
			Precision* Detection			Analysis		
Parameter	Units	Code	Result	+/-	Limit	Method	Date / Time	Analyst
Gross Alpha	pCi/L	T	38	7	0.1	SM 7110 B	9/23/19 @ 0750	AN
Gross Beta	pCi/L	T	14	3	3.8	SM 7110 B	9/23/19 @ 0750	AN
Radium-226	pCi/L	T	0.6	0.3	0.2	SM 7500-Ra B	10/9/19 @ 0846	SA/SS
Radium-228	pCi/L	T	1.9	0.8	0.3	EPA Ra-05	10/14/19 @ 0854	JR
Total Solids	mg/L	T	H 340	-	10	EPA 160.3	9/9/19	TL

H - Sample received outside of 7 day hold time for total solids.

Certification ID's: CO/EPA CO00008; CT PH-0152; KS E-10265; NJ CO008; NYSELAP (NELAC Certified) 11417; RI LAO00284; WI 998376610, TX T104704256-15-6

*Variability of the radioactive decay process (counting error) at the 95% confidence level, 1.96 sigma.

Codes: (T) = Total (D) = Dissolved (S) = Suspended (R) = Total Residual (AR) = As Received < = Less Than

TBD - To Be Determined - Waiting for further analysis.

[^] Due to the large amount of total or dissolved solids in the sample, reduced aliquots were used for the gross alpha and beta analysis.



Hazen Research, Inc.
4601 Indiana Street
Golden, CO 80403 USA
Tel: (303) 279-4501
Fax: (303) 278-1528

Lab Control ID: 19M02756
Received: Sep 06, 2019
Reported: Oct 23, 2019
Purchase Order No.
DA19189X

Customer ID: 00151Z
Account ID: Z05205
ANALYTICAL REPORT

Scott Heideman
SGS North America

Lab Sample ID			19M02756-002					
Customer Sample ID			DA19189-3X					
			sampled on 08/28/19 @ 1910 by ZW/JM					
Parameter	Units	Code	Precision* Detection			Method	Analysis Date / Time	Analyst
			Result	+/-	Limit			
Gross Alpha	pCi/L	T	^ 31	11	0.1	SM 7110 B	9/23/19 @ 0753	AN
Gross Beta	pCi/L	T	^ 20	6	6.5	SM 7110 B	9/23/19 @ 0753	AN
Radium-226	pCi/L	T	2.6	0.6	0.2	SM 7500-Ra B	10/9/19 @ 1142	SA/SS
Radium-228	pCi/L	T	2.9	0.8	0.2	EPA Ra-05	10/14/19 @ 0859	JR
Total Solids	mg/L	T	H 814	-	10	EPA 160.3	9/9/19	TL

H - Sample received outside of 7 day hold time for total solids.

Certification ID's: CO/EPA CO00008; CT PH-0152; KS E-10265; NJ CO008; NYSELAP (NELAC Certified) 11417;
RI LAO00284; WI 998376610, TX T104704256-15-6

*Variability of the radioactive decay process (counting error) at the 95% confidence level, 1.96 sigma.

Codes: (T) = Total (D) = Dissolved (S) = Suspended (R) = Total Residual (AR) = As Received < = Less Than

TBD - To Be Determined - Waiting for further analysis.

^A Due to the large amount of total or dissolved solids in the sample, reduced aliquots were used for the gross alpha and beta analysis.

HAZEN RESEARCH, INC.
RADIOCHEMISTRY LABORATORY

Date: 09/23/2019

Batch QC Summary Form

Analyte: Gross Alpha

Control Standard/LFB: ID: C-11 pCi/mL: 57.4 (use 1 diluted)

Spike Solution: ID: C-11 pCi/mL: 57.4 (use 1 mL)

Spike Recovery Calculation: Sample: Tap*

$$\text{Calculation: } \frac{(52.4) (1.000) - (0.1) (0.200)}{57.4} \times 100 = 91\%$$

Batch QC Evaluation:

Parameter	Criteria	Pass	Fail	N/A
Control Std./LFB	+/- 30 %	x		
Spike Recovery	70 - 130 %	x		
Blank	< or = 3 x Uncertainty	x		
Duplicate 1	95% confidence interval overlap	x		
Duplicate 2 *	95% confidence interval overlap	x		

* Required for batch size greater than 10 samples.

Conclusions:

 x Batch QC Passes**
 Batch QC Fails
 Batch QC Passes, with exceptions**:

Reruns Required: _____

Narrative:

**All QC data provided in this section of the report met the acceptance criteria specified in the analytical methods and procedures. State Maximum Contamination Levels (MCLs) are not evaluated in this report.

Batch Listing by Lab Control Number:

<u>19M02858</u>	<u>19M02772</u>
<u>19M02863</u>	<u>19M02777</u>
<u>19M02716</u>	<u>19M02781</u>
<u>19M02719</u>	<u>19M02782</u>
<u>19M02866</u>	<u>19M02788</u>
<u>19M02867</u>	_____
<u>19M02840</u>	_____
<u>19M02756</u>	_____
<u>19M02757</u>	_____
<u>19M02758</u>	_____

Evaluator:

Lynnea Rockwell _____

Date 09/24/2019

page 4 of 8

HAZEN RESEARCH, INC.
RADIOCHEMISTRY LABORATORY

Date: 09/23/2019

Batch QC Summary Form

Analyte: Gross Beta

Control Standard/LFB: ID: C-11 pCi/mL: 44 (use 1 diluted)

Spike Solution: ID: C-11 pCi/mL: 44 (use 1 mL)

Spike Recovery Calculation: Sample: Tap*

$$\text{Calculation: } \frac{(37.7) - (1.000)}{44} \times 100 = 86\%$$

Batch QC Evaluation:

Parameter	Criteria	Pass	Fail	N/A
Control Std./LFB	+/- 20 %	x		
Spike Recovery	80 - 120 %	x		
Blank	< or = 3 x Uncertainty	x		
Duplicate 1	95% confidence interval overlap	x		
Duplicate 2 *	95% confidence interval overlap	x		

* Required for batch size greater than 10 samples.

Conclusions:

 x Batch QC Passes**
 Batch QC Fails
 Batch QC Passes, with exceptions**:

Reruns Required: _____

Narrative: _____

**All QC data provided in this section of the report met the acceptance criteria specified in the analytical methods and procedures. State Maximum Contamination Levels (MCLs) are not evaluated in this report.

Batch Listing by Lab Control Number:

19M02858	19M02772
19M02863	19M02777
19M02716	19M02781
19M02719	19M02782
19M02866	19M02788
19M02867	_____
19M02840	_____
19M02756	_____
19M02757	_____
19M02758	_____

Evaluator:

Hymen Rodwell _____

09/24/2019

Date

page 5 of 8

**HAZEN RESEARCH, INC.
RADIOCHEMISTRY LABORATORY**

Date: 10/09/2019

Batch QC Summary Form

Analyte: Radium-226

Control Standard/LFB: ID: NBL-6A pCi/mL: 23 (use 2 diluted)Spike Solution: ID: NBL-6A pCi/mL: 23 (use 2 mL)Spike Recovery Calculation: Sample: 19M02754-001b

Calculation: $\frac{(45.5) - (1.000) - (0.3) - (0.970)}{46} \times 100 = 98\%$

Batch QC Evaluation:

Parameter	Criteria	Pass	Fail	N/A
Control Std./LFB	+/- 20 %	x		
Spike Recovery	80 - 120 %	x		
Blank	< or = 3 x Uncertainty	x		
Duplicate 1	95% confidence interval overlap	x		
Duplicate 2 *	95% confidence interval overlap			x

* Required for batch size greater than 10 samples.

Conclusions:

 x Batch QC Passes**
 Batch QC Fails
 Batch QC Passes, with exceptions**:

Reruns Required: _____

Narrative: _____

**All QC data provided in this section of the report met the acceptance criteria specified in the analytical methods and procedures. State Maximum Contamination Levels (MCLs) are not evaluated in this report.

Batch Listing by Lab Control Number:

19M02754	_____
19M02755	_____
19M02757	_____
19M02756	_____
19M02758	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Evaluator:


10/11/2019

Date

page 6 of 8

**HAZEN RESEARCH, INC.
RADIOCHEMISTRY LABORATORY**

Date: 10/14/2019

Batch QC Summary Form

Analyte: Radium-228

Control Standard/LFB: ID: NBL7A pCi/mL: 13.2 (use 10 diluted)

Spike Solution: ID: NBL7A pCi/mL: 13.2 (use 10 mL)

Spike Recovery Calculation: Sample: 19M02806-001d

$$\text{Calculation: } \frac{(137.4) (1.000) - (2.2) (1.000)}{132} \times 100 = 102\%$$

Batch QC Evaluation:

Parameter	Criteria	Pass	Fail	N/A
Control Std./LFB	+/- 20 %	x		
Spike Recovery	80 - 120 %	x		
Blank	< or = 3 x Uncertainty	x		
Duplicate 1	95% confidence interval overlap	x		
Duplicate 2 *	95% confidence interval overlap			x

* Required for batch size greater than 10 samples.

Conclusions:

 x Batch QC Passes**
 Batch QC Fails
 Batch QC Passes, with exceptions**:

Reruns Required: _____

Narrative:

**All QC data provided in this section of the report met the acceptance criteria specified in the analytical methods and procedures. State Maximum Contamination Levels (MCLs) are not evaluated in this report.

Batch Listing by Lab Control Number:

19M02976	_____
19M03041	_____
19M02756	_____
19M02777	_____
19M02806	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Evaluator:

Alan Blair _____

10/21/2019

Date

page 7 of 8

CHAIN OF CUSTODY

SGS North America Inc. - Wheat Ridge
4038 Youngfield Street, Wheat Ridge, CO 80033
TEL: 303-425-6021 FAX: 303-425-6854
www.sgs.com/ehsusa

Page 1 of 1

[illegible]

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

SGS North America Inc. - Wheat Ridge
4036 Youngfield Street, Wheat Ridge, CO 80033
TEL: 303-425-6021 FAX: 303-425-6854
www.sgs.com/ehsusa

Bottle Order Control #		FED-EX Tracking #	
SGS Quote #		SGS Job # DA19189	
Requested Analysis (see TEST CODE sheet)			Matrix Codes
Dissolved Uranium	Isotopic Uranium	Gross Alpha / Beta Total	DW - Drinking Water
			GW - Ground Water
			WW - Water
			SW - Surface Water
			SO - Soil
			SL- Sludge
			SED-Sediment
			OI - Oil
			LIQ - Other Liquid
			AIR - Air
			SOL - Other Solid
			WP - Wipe
			FB - Field Blank
			EB-Equipment Blank
			RB - Rinse Blank
			TB - Trip Blank
			LAB USE ONLY
x	x	x	01
hold			02
x	x	x	03
hold			04
			SL-9M
			<i>[Signature]</i>
Comments / Special Instructions			
including courier delivery.			
Date/Time:		Received By:	
		2	
Date/Time:		Received By:	
		4	
Therm. ID:	On Ice ☒		
7080	http://www.sgs.com/en/terms-and-conditions		

3.1

DA19189X: Chain of Custody

Page 1 of 2

SGS Accutest Sample Receipt Summary

Job Number: DA19189

Client: ERM WEST INC.

Project: PARKDALE QUARRY GW

Date / Time Received: 9/4/2019 12:00:00 PM

Delivery Method:

Airbill #'s: hd

Cooler Temps (Initial/Adjusted): 0

Cooler Security

Y or N

Y or N

- | | | | | | |
|---------------------------|-------------------------------------|--------------------------|-----------------------|-------------------------------------|--------------------------|
| 1. Custody Seals Present: | ☒ | ☐ | 3. COC Present: | ☒ | ☐ |
| 2. Custody Seals Intact: | ☒ | ☐ | 4. Smpl Dates/Time OK | ☒ | ☐ |

Cooler Temperature

Y or N

- | | | |
|------------------------------|-------------------------------------|--------------------------|
| 1. Temp criteria achieved: | ☒ | ☐ |
| 2. Cooler temp verification: | ; | |
| 3. Cooler media: | Ice (Bag) | |
| 4. No. Coolers: | 1 | |

Quality Control Preservation

Y or N N/A

- | | | | |
|---------------------------------|-------------------------------------|--------------------------|-------------------------------------|
| 1. Trip Blank present / cooler: | ☐ | ☐ | ☒ |
| 2. Trip Blank listed on COC: | ☐ | ☐ | ☒ |
| 3. Samples preserved properly: | ☒ | ☐ | |
| 4. VOCs headspace free: | ☐ | ☐ | ☒ |

Sample Integrity - Documentation

Y or N

- | | | |
|--|-------------------------------------|--------------------------|
| 1. Sample labels present on bottles: | ☒ | ☐ |
| 2. Container labeling complete: | ☒ | ☐ |
| 3. Sample container label / COC agree: | ☒ | ☐ |

Sample Integrity - Condition

Y or N

- | | | |
|----------------------------------|-------------------------------------|--------------------------|
| 1. Sample recvd within HT: | ☒ | ☐ |
| 2. All containers accounted for: | ☒ | ☐ |
| 3. Condition of sample: | Intact | |

Sample Integrity - Instructions

Y or N N/A

- | | | | |
|---|-------------------------------------|-------------------------------------|-------------------------------------|
| 1. Analysis requested is clear: | ☒ | ☐ | |
| 2. Bottles received for unspecified tests | ☐ | ☒ | |
| 3. Sufficient volume recvd for analysis: | ☒ | ☐ | |
| 4. Compositing instructions clear: | ☐ | ☐ | ☒ |
| 5. Filtering instructions clear: | ☐ | ☐ | ☒ |

Comments

DA19189X: Chain of Custody

Page 2 of 2

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

ERM-West, Inc.

Parkdale Quarry GW

Proj# 0488586

SGS Job Number: DA19189

Sampling Date: 08/28/19



Report to:

ERM-West, Inc.
555 17th Street Suite #1700
Denver, CO 80111
zack.walter@erm.com

ATTN: Zack Walter

Total number of pages in report: **16**



Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Scott Heideman
Laboratory Director

Client Service contact: Carissa Cumine 303-425-6021

Certifications: CO (CO00049), NE (NE-OS-06-04), ND (R-027), UT (NELAP CO00049)
LA (LA150028), TX (T104704511), WY (8TMS-L)

This report shall not be reproduced, except in its entirety, without the written approval of SGS.
Test results relate only to samples analyzed.

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Sample Summary

ERM-West, Inc.

Job No: DA19189

Parkdale Quarry GW
Project No: Proj# 0488586

Sample Number	Collected Date	Time By	Received	Matrix Code	Type	Client Sample ID
DA19189-1F	08/28/19	15:00	ZW/JM	09/04/19	AQ Groundwater Filtered	WELL #3
DA19189-3F	08/28/19	19:10	ZW/JM	09/04/19	AQ Groundwater Filtered	WELL #10

CASE NARRATIVE / CONFORMANCE SUMMARY

Client: ERM-West, Inc.

Job No DA19189

Site: Parkdale Quarry GW

Report Date 9/12/2019 3:49:42 PM

On 09/04/2019, 2 sample(s), 0 Trip Blank(s), and 0 Field Blank(s) were received at SGS North America Inc. (SGS) at a temperature of 4.9 °C. The samples were intact and properly preserved, unless noted below. An SGS Job Number of DA19189 was assigned to the project. The lab sample ID, client sample ID, and date of sample collection are detailed in the report's Results Summary.

Specified quality control criteria were achieved for this job except as noted below. For more information, please refer to the analytical results and QC summary pages.

Metals Analysis By Method EPA 200.8

Matrix: AQ

Batch ID: MP28923

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA19081-1AMS, DA19081-1AMSD were used as the QC samples for the metals analysis.
- MP28923-MB1 for Uranium: All sample results < RL or > 10x CCB concentration.

SGS certifies that data reported for samples received, listed on the associated custody chain or analytical task order, were produced to specifications meeting SGS's Quality System precision, accuracy and completeness objectives except as noted.

Estimated non-standard method measurement uncertainty data is available on request, based on quality control bias and implicit for standard methods. Acceptable uncertainty requires tested parameter quality control data to meet method criteria.

SGS is not responsible for data quality assumptions if partial reports are used and recommends that this report be used in its entirety. This report is authorized by SGS indicated via signature on the report cover.

Thursday, September 12, 2019

Page 1 of 1

Summary of Hits

Job Number: DA19189
Account: ERM-West, Inc.
Project: Parkdale Quarry GW
Collected: 08/28/19



Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
DA19189-1F	WELL #3					
Uranium		16.7	0.40		ug/l	EPA 200.8
DA19189-3F	WELL #10					
Uranium		12.6	0.40		ug/l	EPA 200.8



Wheat Ridge, CO

Section 4

4

Sample Results

Report of Analysis

Report of Analysis

Client Sample ID:	WELL #3	Date Sampled:	08/28/19
Lab Sample ID:	DA19189-1F	Date Received:	09/04/19
Matrix:	AQ - Groundwater Filtered	Percent Solids:	n/a
Project:	Parkdale Quarry GW		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Uranium	16.7	0.40	ug/l	2	09/09/19	09/10/19 CG	EPA 200.8 ¹	EPA 200.8 ²

(1) Instrument QC Batch: MA11780
(2) Prep QC Batch: MP28923

RL = Reporting Limit

Report of Analysis

Client Sample ID:	WELL #10	Date Sampled:	08/28/19
Lab Sample ID:	DA19189-3F	Date Received:	09/04/19
Matrix:	AQ - Groundwater Filtered	Percent Solids:	n/a
Project:	Parkdale Quarry GW		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Uranium	12.6	0.40	ug/l	2	09/09/19	09/10/19 CG	EPA 200.8 ¹	EPA 200.8 ²

(1) Instrument QC Batch: MA11780
(2) Prep QC Batch: MP28923

RL = Reporting Limit

4.2
4

Misc. Forms

5

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

SGS North America Inc. - Wheat Ridge
4036 Youngfield Street, Wheat Ridge, CO 80033
TEL: 303-425-6021 FAX: 303-425-6854
www.sgs.com/ehsusa

[illegible]

DA19189: Chain of Custody

Page 1 of 2

5.1

SGS Accutest Sample Receipt Summary

Job Number: DA19189

Client: ERM WEST INC.

Project: PARKDALE QUARRY GW

Date / Time Received: 9/4/2019 12:00:00 PM

Delivery Method:

Airbill #'s: hd

Cooler Temps (Initial/Adjusted): 0

Cooler Security

Y or N

Y or N

- | | | | | | |
|---------------------------|-------------------------------------|--------------------------|-----------------------|-------------------------------------|--------------------------|
| 1. Custody Seals Present: | ☒ | ☐ | 3. COC Present: | ☒ | ☐ |
| 2. Custody Seals Intact: | ☒ | ☐ | 4. Smpl Dates/Time OK | ☒ | ☐ |

Cooler Temperature

Y or N

- | | | |
|------------------------------|-------------------------------------|--------------------------|
| 1. Temp criteria achieved: | ☒ | ☐ |
| 2. Cooler temp verification: | ; | |
| 3. Cooler media: | Ice (Bag) | |
| 4. No. Coolers: | 1 | |

Quality Control Preservation

Y or N

N/A

- | | | | |
|---------------------------------|-------------------------------------|--------------------------|-------------------------------------|
| 1. Trip Blank present / cooler: | ☐ | ☐ | ☒ |
| 2. Trip Blank listed on COC: | ☐ | ☐ | ☒ |
| 3. Samples preserved properly: | ☒ | ☐ | |
| 4. VOCs headspace free: | ☐ | ☐ | ☒ |

Sample Integrity - Documentation

Y or N

- | | | |
|--|-------------------------------------|--------------------------|
| 1. Sample labels present on bottles: | ☒ | ☐ |
| 2. Container labeling complete: | ☒ | ☐ |
| 3. Sample container label / COC agree: | ☒ | ☐ |

Sample Integrity - Condition

Y or N

- | | | |
|----------------------------------|-------------------------------------|--------------------------|
| 1. Sample recvd within HT: | ☒ | ☐ |
| 2. All containers accounted for: | ☒ | ☐ |
| 3. Condition of sample: | Intact | |

Sample Integrity - Instructions

Y or N N/A

- | | | | |
|---|-------------------------------------|-------------------------------------|-------------------------------------|
| 1. Analysis requested is clear: | ☒ | ☐ | |
| 2. Bottles received for unspecified tests | ☐ | ☒ | |
| 3. Sufficient volume recvd for analysis: | ☒ | ☐ | |
| 4. Compositing instructions clear: | ☐ | ☐ | ☒ |
| 5. Filtering instructions clear: | ☐ | ☐ | ☒ |

Comments

DA19189: Chain of Custody

Page 2 of 2

Metals Analysis

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Matrix Spike and Duplicate Summaries
- Blank Spike and Lab Control Sample Summaries
- Serial Dilution Summaries

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: DA19189
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP28923
Matrix Type: AQUEOUS

Methods: EPA 200.8
Units: ug/l

Prep Date: 09/09/19

Metal	RL	IDL	MDL	MB raw	final
Aluminum	50	1.1	2		
Antimony	0.40	.0022	.011		
Arsenic	0.20	.017	.044		
Barium	2.0	.016	.079		
Beryllium	0.20	.016	.069		
Boron	40	.49	2.1		
Cadmium	0.10	.036	.042		
Calcium	400	5.6	12		
Chromium	2.0	.053	.053		
Cobalt	0.20	.0049	.015		
Copper	2.0	.06	.13		
Iron	10	3.5	4.6		
Lead	0.50	.0079	.008		
Magnesium	100	1.3	1.3		
Manganese	1.0	.12	.13		
Molybdenum	1.0	.049	.029		
Nickel	2.0	.0088	.027		
Phosphorus	60	2.6	4.3		
Potassium	200	2.9	2.9		
Selenium	0.40	.06	.21		
Silver	0.10	.0019	.008		
Sodium	500	4.9	4.9		
Strontium	20	.01	.015		
Thallium	0.20	.0024	.005		
Tin	10	.063	1.3		
Titanium	2.0	.059	.092		
Uranium	0.20	.0017	.002	0.13	* (a)
Vanadium	1.0	.037	.2		
Zinc	10	.21	.96		

Associated samples MP28923: DA19189-1F, DA19189-3F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested
(a) All sample results < RL or > 10x CCB concentration.

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA19189
 Account: ERMC0GV - ERM-West, Inc.
 Project: Parkdale Quarry GW

QC Batch ID: MP28923
 Matrix Type: AQUEOUS

Methods: EPA 200.8
 Units: ug/l

Prep Date: 09/09/19

Metal	DA19081-1A Original MS	SpikeLot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic	anr			
Barium				
Beryllium				
Boron				
Cadmium				
Calcium				
Chromium	anr			
Cobalt				
Copper				
Iron				
Lead				
Magnesium				
Manganese				
Molybdenum	anr			
Nickel				
Phosphorus				
Potassium				
Selenium				
Silver				
Sodium				
Strontium				
Thallium				
Tin				
Titanium				
Uranium	2.4	212	200	104.5 70-130
Vanadium				
Zinc				

Associated samples MP28923: DA19189-1F, DA19189-3F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA19189
Account: ERMC0GV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP28923
Matrix Type: AQUEOUS

Methods: EPA 200.8
Units: ug/l

Prep Date: 09/09/19

Metal	DA19081-1A Original	MSD	SpikeLot ICPALL2	% Rec	MSD RPD	QC Limit
Aluminum						
Antimony						
Arsenic	anr					
Barium						
Beryllium						
Boron						
Cadmium						
Calcium						
Chromium	anr					
Cobalt						
Copper						
Iron						
Lead						
Magnesium						
Manganese						
Molybdenum	anr					
Nickel						
Phosphorus						
Potassium						
Selenium						
Silver						
Sodium						
Strontium						
Thallium						
Tin						
Titanium						
Uranium	2.4	209	200	103.0	1.4	20
Vanadium						
Zinc						

Associated samples MP28923: DA19189-1F, DA19189-3F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: DA19189
 Account: ERMC0GV - ERM-West, Inc.
 Project: Parkdale Quarry GW

QC Batch ID: MP28923
 Matrix Type: AQUEOUS

Methods: EPA 200.8
 Units: ug/l

Prep Date: 09/09/19

Metal	BSP Result	SpikeLot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic	anr			
Barium				
Beryllium				
Boron				
Cadmium				
Calcium				
Chromium	anr			
Cobalt				
Copper				
Iron				
Lead				
Magnesium				
Manganese				
Molybdenum	anr			
Nickel				
Phosphorus				
Potassium				
Selenium				
Silver				
Sodium				
Strontium				
Thallium				
Tin				
Titanium				
Uranium	225	200	112.5	85-115
Vanadium				
Zinc				

Associated samples MP28923: DA19189-1F, DA19189-3F

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (anr) Analyte not requested

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

ERM-West, Inc.

Parkdale Quarry GW

0488586

SGS Job Number: DA22132X

Sampling Date: 11/19/19

Report to:

ERM-West, Inc.
555 17th Street Suite #1700
Denver, CO 80111
becky.moore@erm.com

ATTN: Becky Moores

Total number of pages in report: 24



Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.



Scott Heideman
Laboratory Director

Client Service contact: Carissa Cumine 303-425-6021

Certifications: CO (CO00049), NE (NE-OS-06-04), ND (R-027), UT (NELAP CO00049)
LA (LA150028), TX (T104704511), WY (8TMS-L)

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Test results relate only to samples analyzed.



January 30, 2020

Zack Walter
ERM-West, Inc.
555 17th Street, Suite #1700
Denver, CO 80111

Subject: Report Reissue for SGS Job: DADA22132x

Dear Zack:

We are reissuing your report with the revised sub-laboratory report. This includes the Gross Beta results. Please accept our apologies for any inconvenience this may have caused.

Any questions or concerns should be directed to the undersigned at 303-425-6021.

Sincerely,

Scott Heideman
Laboratory Director

SGS IS THE WORLD'S LEADING INSPECTION, VERIFICATION, TESTING AND CERTIFICATION COMPANY.

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Sample Summary

ERM-West, Inc.

Job No: DA22132X

Parkdale Quarry GW
Project No: 0488586

Sample Number	Collected Date	Time By	Received	Matrix Code	Type	Client Sample ID
DA22132-1X	11/19/19	09:50	ZW	11/20/19	AQ Water	WELL 3
DA22132-2X	11/19/19	12:55	ZW	11/20/19	AQ Water	WELL 10



Wheat Ridge, CO

2

Section 2

Subcontract Lab Data

Report of Analysis

ANALYTICAL REPORT

Eurofins TestAmerica, St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

Laboratory Job ID: 160-36489-1
Laboratory Sample Delivery Group: DA22132X
Client Project/Site: DA22132X
Revision: 2

For:
SGS North America Inc
4036 Youngfield Street
Wheat Ridge, Colorado 80033

Attn: Elizabeth Sutcliffe

Elizabeth M. Hoerchler

Authorized for release by:
1/28/2020 4:13:25 PM

Elizabeth Hoerchler, Project Manager I
(314)298-8566
elizabeth.hoerchler@testamericainc.com

LINKS

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? **Ask
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Expert**

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www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Case Narrative

Client: SGS North America Inc
Project/Site: DA22132X

Job ID: 160-36489-1
SDG: DA22132X

Job ID: 160-36489-1

Laboratory: Eurofins TestAmerica, St. Louis

Narrative

CASE NARRATIVE

Client: SGS North America Inc

Project: DA22132X

Report Number: 160-36489-1 - Revision 1 to include gross beta in the 900.0 method.

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Eurofins TestAmerica, St. Louis attests to the validity of the laboratory data generated by Eurofins TestAmerica facilities reported herein. All analyses performed by Eurofins TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. Eurofins TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

Any minimum detectable concentration (MDC), critical value (DLC), or Safe Drinking Water Act detection limit (SDWA DL) is sample-specific unless otherwise stated elsewhere in this narrative.

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt.

Radiochemistry sample results are reported with the count date/time applied as the Activity Reference Date.

This laboratory report is confidential and is intended for the sole use of Eurofins TestAmerica and its client.

Revision 1- Updated project description per the COC

RECEIPT

The samples were received on 11/22/2019; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 0.0 C. Per client instruction, gross alpha only was analyzed by method 900.0 without total solids.

GROSS ALPHA/BETA RADIOACTIVITY

Samples DA22132X-1X (160-36489-1) and DA22132X-2X (160-36489-2) were analyzed for Gross Alpha and Gross Beta Radioactivity in

Case Narrative

Client: SGS North America Inc
Project/Site: DA22132X

Job ID: 160-36489-1
SDG: DA22132X

Job ID: 160-36489-1 (Continued)

Laboratory: Eurofins TestAmerica, St. Louis (Continued)

accordance with USEPA Method 900.0. The samples were prepared on 11/27/2019 and analyzed on 12/06/2019.

The gross alpha and gross beta detection goals were not met for the following samples due to a reduction of the sample size attributed to high residual mass: DA22132X-1X (160-36489-1), DA22132X-2X (160-36489-2). Analytical results are reported with the detection limit achieved.

The Method Blank (MB) exhibited a negative gross alpha result greater in magnitude than the 3 sigma TPU. This occurrence was evaluated and determined to be random in nature. Sporadic occurrences such as this are statistically expected. No further action is required. (MB 160-452151/1-A)

The following samples had additional volume added to reach target mass and efficiency: DA22132X-1X (160-36489-1) and DA22132X-2X (160-36489-2). The total sample volume is reflected in the initial amount field.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

RADIUM-226 (GFPC)

Samples DA22132X-1X (160-36489-1) and DA22132X-2X (160-36489-2) were analyzed for Radium-226 (GFPC) in accordance with EPA Method 903.0. The samples were prepared on 11/27/2019 and analyzed on 12/23/2019.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

RADIUM-228 (GFPC)

Samples DA22132X-1X (160-36489-1) and DA22132X-2X (160-36489-2) were analyzed for Radium-228 (GFPC) in accordance with EPA 904. The samples were prepared on 11/27/2019 and analyzed on 12/06/2019.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

ISOTOPIC URANIUM (ALPHA SPECTROMETRY)

Samples DA22132X-1X (160-36489-1) and DA22132X-2X (160-36489-2) were analyzed for Isotopic Uranium (Alpha Spectrometry) in accordance with DOE. The samples were prepared on 11/27/2019 and analyzed on 12/11/2019.

The tracer resolution (FWHM= 108 keV) was greater than 100 keV. The analyte peaks were resolvable within the appropriate region(s) of interest, and no interferent peaks were seen. The laboratory does not believe this excursion adversely affects the data. (LCS 160-452281/2-A)

Insufficient volume was available to perform a sample duplicate for the following samples: DA22132X-1X (160-36489-1) and DA22132X-2X (160-36489-2). A laboratory control sample/ laboratory control sample duplicate (LCS/LCSD) were prepared instead to demonstrate batch precision. The following samples were also cloudy with sediment.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.



CHAIN OF CUSTODY

SGS North America Inc. - Wheat Ridge
4036 Youngfield Street, Wheat Ridge, CO 80033
TEL: 303-425-6021 FAX: 303-425-6854
www.sgs.com/ehsusa

Page 1 of 1

Send Report and Invoice to:

Elizabeth.Sutcliffe@sgs.com; Carissa.Cumine@sgs.com;
Janel.Mulholland@sgs.com; Elizabeth.Bolstad@sgs.com;
Scott.Heideman@sgs.com; Larisa.Dimarco@sgs.com

Phone # 303-425-6021		Fax #	Client Purchase Order #		FED-EX Tracking #		Bottle Order Control #				
Sampler(s) Name(s) ZW		Phone	Project Manager		SGS Quote #		SGS Job # DA22132X				
Project Information					Requested Analysis (see TEST CODE sheet)				Matrix Codes		
arkdale Quarry GW									DW - Drinking Water GW - Ground Water WW - Water SW - Surface Water SO - Soil SL - Sludge SED - Sediment OI - Oil LIQ - Other Liquid AIR - Air SOL - Other Solid WP - Wipe FB - Field Blank EB - Equipment Blank RB - Rinse Blank TB - Trip Blank		
Billing Information (if different from Report to)											
Company Name											
Street Address											
City					State		Zip				
Attention											
Field ID / Point of Collection		MEQH/OI Vial #	Date	Time	Sampled by	Matrix	# of bottles	Isotopic Uranium	Radium 226/228	Gross alpha/Beta + total solids	LAB USE ONLY
1X	DA22132X		11/19/19	9:50:00 AM	ZW	AQ		X	X	X	
2X	DA22132X		11/19/19	12:55:00 PM	ZW	AQ		X	X	X	
Turnaround Time (Business days) Approved By (SGS PM): / Date: ☐ Standard 10 Day (business) ☐ 5 Business Days RUSH ☐ 3 Business Days RUSH ☐ 2 Business Days RUSH ☐ 1 Business Day EMERGENCY ☒ other STD TAT Emergency & Rush T/A data available via Lablink Approval needed for RUSH/Emergency TAT Data Deliverable Information ☐ Commercial "A" (Level 1) ☐ Commercial "B" (Level 2) ☐ REDT1 (Level 3) ☐ FULT1 (Level 4) ☐ Commercial "C" ☐ State Forms ☐ EDD Format ☐ Other Commercial "A" = Results Only Commercial "B" = Results + QC Summary Commercial "C" = Results + QC Summary + Partial Raw data Comments / Special Instructions http://www.sgs.com/en/terms-and-conditions											
Sample Custody must be documented below each time samples change possession, including courier delivery.											
Relinquished by Sampler:		Date Time:	Received By:		Date Time:		Relinquished By:		Date Time:		Received By:
1		11/21/19	1		11/21/19 09:00		2				2
Relinquished by Sampler:		Date Time:	Received By:		Date Time:		Relinquished By:		Date Time:		Received By:
3			3				4				4
Relinquished by:		Date Time:	Received By:		Date Time:		Custody Seal #		Preserved where applicable		On Ice
5			5						☐ Intact ☐ Not intact		☐ Therm. ID ☐ Cooler Temp.



160-36499 Chain of Custody

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1/28/2020 (Rev. 2)

SGS

Login Sample Receipt Checklist

Client: SGS North America Inc

Job Number: 160-36489-1

SDG Number: DA22132X

Login Number: 36489

List Number: 1

Creator: Press, Nicholas B

List Source: Eurofins TestAmerica, St. Louis

Question	Answer	Comment
Radioactivity wasn't checked or is $\leq$ background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: SGS North America Inc
Project/Site: DA22132X

Job ID: 160-36489-1
SDG: DA22132X

Qualifiers

Rad

Qualifier	Qualifier Description
G	The Sample MDC is greater than the requested RL.
U	Result is less than the sample detection limit.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
□	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Eurofins TestAmerica, St. Louis

Method Summary

Client: SGS North America Inc
Project/Site: DA22132X

Job ID: 160-36489-1
SDG: DA22132X

Method	Method Description	Protocol	Laboratory
900.0	Gross Alpha and Gross Beta Radioactivity	EPA	TAL SL
903.0	Radium-226 (GFPC)	EPA	TAL SL
904.0	Radium-228 (GFPC)	EPA	TAL SL
HASL-300	Isotopic Uranium (Alpha Spectroscopy)	HASL	TAL SL
Evaporation	Preparation, Evaporation	None	TAL SL
ExtChrom	Preparation, Extraction Chromatography Resin Actinide Separation	None	TAL SL
PrecSep_0	Preparation, Precipitate Separation	None	TAL SL
PrecSep-21	Preparation, Precipitate Separation (21-Day In-Growth)	None	TAL SL

Protocol References:

EPA = US Environmental Protection Agency
HASL = Health And Safety Laboratory
None = None

Laboratory References:

TAL SL = Eurofins TestAmerica, St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Eurofins TestAmerica, St. Louis

Sample Summary

Client: SGS North America Inc
Project/Site: DA22132X

Job ID: 160-36489-1
SDG: DA22132X

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Asset ID
160-36489-1	DA22132X-1X	Water	11/19/19 09:50	11/22/19 09:00	
160-36489-2	DA22132X-2X	Water	11/19/19 12:55	11/22/19 09:00	

Eurofins TestAmerica, St. Louis

Client Sample Results

Client: SGS North America Inc
Project/Site: DA22132X

Job ID: 160-36489-1
SDG: DA22132X

Client Sample ID: DA22132X-1X

Lab Sample ID: 160-36489-1

Date Collected: 11/19/19 09:50

Matrix: Water

Date Received: 11/22/19 09:00

Method: 900.0 - Gross Alpha and Gross Beta Radioactivity

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	38.8	G	5.87	7.35	3.00	3.86	pCi/L	11/27/19 07:27	12/06/19 07:00	1
Gross Beta	17.5		1.96	2.63	4.00	1.70	pCi/L	11/27/19 07:27	12/06/19 07:00	1

Method: 903.0 - Radium-226 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.150		0.0955	0.0964	1.00	0.136	pCi/L	11/27/19 09:12	12/23/19 09:52	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	84.3		40 - 110					11/27/19 09:12	12/23/19 09:52	1

Method: 904.0 - Radium-228 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-228	1.32		0.367	0.386	1.00	0.469	pCi/L	11/27/19 09:32	12/06/19 12:56	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	84.3		40 - 110					11/27/19 09:32	12/06/19 12:56	1
Y Carrier	83.7		40 - 110					11/27/19 09:32	12/06/19 12:56	1

Method: HASL-300 - Isotopic Uranium (Alpha Spectroscopy)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	21.6		1.30	2.23	1.00	0.161	pCi/L	11/27/19 12:50	12/11/19 23:21	1
Uranium-235/236	0.475		0.219	0.222	1.00	0.136	pCi/L	11/27/19 12:50	12/11/19 23:21	1
Uranium-238	8.53		0.817	1.09	1.00	0.121	pCi/L	11/27/19 12:50	12/11/19 23:21	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	81.7		30 - 110					11/27/19 12:50	12/11/19 23:21	1

Client Sample ID: DA22132X-2X

Lab Sample ID: 160-36489-2

Date Collected: 11/19/19 12:55

Matrix: Water

Date Received: 11/22/19 09:00

Method: 900.0 - Gross Alpha and Gross Beta Radioactivity

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	18.0	G	6.07	6.41	3.00	7.18	pCi/L	11/27/19 07:27	12/06/19 07:00	1
Gross Beta	7.25		1.87	2.00	4.00	2.18	pCi/L	11/27/19 07:27	12/06/19 07:00	1

Method: 903.0 - Radium-226 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.569		0.130	0.140	1.00	0.102	pCi/L	11/27/19 09:12	12/23/19 09:53	1

Eurofins TestAmerica, St. Louis

Client Sample Results

Client: SGS North America Inc
Project/Site: DA22132X

Job ID: 160-36489-1
SDG: DA22132X

Client Sample ID: DA22132X-2X

Lab Sample ID: 160-36489-2

Date Collected: 11/19/19 12:55

Matrix: Water

Date Received: 11/22/19 09:00

Carrier	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Ba Carrier	93.5		40 - 110	11/27/19 09:12	12/23/19 09:53	1

Method: 904.0 - Radium-228 (GFPC)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-228	1.32		0.351	0.371	1.00	0.452	pCi/L	11/27/19 09:32	12/06/19 12:56	1
Carrier	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	93.5		40 - 110					11/27/19 09:32	12/06/19 12:56	1
Y Carrier	86.4		40 - 110					11/27/19 09:32	12/06/19 12:56	1

Method: HASL-300 - Isotopic Uranium (Alpha Spectroscopy)

Analyte	Result	Qualifier	Count	Total	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
			Uncert.	Uncert.						
			(2σ+/-)	(2σ+/-)						
Uranium-233/234	9.88		0.845	1.18	1.00	0.0541	pCi/L	11/27/19 12:50	12/11/19 23:21	1
Uranium-235/236	0.219		0.142	0.144	1.00	0.109	pCi/L	11/27/19 12:50	12/11/19 23:21	1
Uranium-238	4.53		0.572	0.687	1.00	0.101	pCi/L	11/27/19 12:50	12/11/19 23:21	1
Tracer	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	75.6		30 - 110					11/27/19 12:50	12/11/19 23:21	

Eurofins TestAmerica, St. Louis

QC Sample Results

Client: SGS North America Inc
Project/Site: DA22132X

Job ID: 160-36489-1
SDG: DA22132X

Method: 900.0 - Gross Alpha and Gross Beta Radioactivity

Lab Sample ID: MB 160-452151/1-A
Matrix: Water
Analysis Batch: 453308

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 452151

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Gross Alpha	-1.045	U	0.404	0.421	3.00	1.26	pCi/L	11/27/19 07:27	12/06/19 06:57	1
Gross Beta	0.6730	U	0.557	0.561	4.00	0.886	pCi/L	11/27/19 07:27	12/06/19 06:57	1

Lab Sample ID: LCS 160-452151/2-A
Matrix: Water
Analysis Batch: 453308

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 452151

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Gross Alpha	49.6	50.41		7.64	3.00	2.43	pCi/L	102	75 - 125

Lab Sample ID: LCSB 160-452151/3-A
Matrix: Water
Analysis Batch: 453308

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 452151

Analyte	Spike Added	LCSB Result	LCSB Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Gross Beta	85.2	88.59		9.40	4.00	1.13	pCi/L	104	75 - 125

Method: 903.0 - Radium-226 (GFPC)

Lab Sample ID: MB 160-452212/20-A
Matrix: Water
Analysis Batch: 454939

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 452212

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	-0.01737	U	0.0472	0.0473	1.00	0.104	pCi/L	11/27/19 09:12	12/23/19 11:47	1
Carrier	MB %Yield	MB Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	91.0		40 - 110					11/27/19 09:12	12/23/19 11:47	1

Lab Sample ID: LCS 160-452212/1-A
Matrix: Water
Analysis Batch: 455038

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 452212

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Radium-226	11.3	10.63		1.09	1.00	0.112	pCi/L	94	75 - 125
Carrier	LCS %Yield	LCS Qualifier	Limits						
Ba Carrier	96.0		40 - 110						

Eurofins TestAmerica, St. Louis

QC Sample Results

Client: SGS North America Inc
Project/Site: DA22132X

Job ID: 160-36489-1
SDG: DA22132X

Method: 903.0 - Radium-226 (GFPC) (Continued)

Lab Sample ID: 160-36489-1 DU

Matrix: Water

Analysis Batch: 454939

Client Sample ID: DA22132X-1X

Prep Type: Total/NA

Prep Batch: 452212

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Radium-226	0.150		0.3859		0.133	1.00	0.121	pCi/L	1.03	1
Carrier										
	%Yield	Qualifier	Limits							
Ba Carrier	65.1		40 - 110							

Method: 904.0 - Radium-228 (GFPC)

Lab Sample ID: MB 160-452214/20-A

Matrix: Water

Analysis Batch: 453332

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 452214

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-228	0.1447	U	0.267	0.268	1.00	0.454	pCi/L	11/27/19 09:32	12/06/19 12:56	1
Carrier										
	%Yield	Qualifier	Limits					Prepared	Analyzed	Dil Fac
Ba Carrier	91.0		40 - 110					11/27/19 09:32	12/06/19 12:56	1
Y Carrier	83.4		40 - 110					11/27/19 09:32	12/06/19 12:56	1

Lab Sample ID: LCS 160-452214/17-A Lab Control Sample

Matrix: Water

Analysis Batch: 453313

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 452214

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Radium-228	9.33	9.918		1.14	1.00	0.407	pCi/L	106	75 - 125
Carrier									
	%Yield	Qualifier	Limits						
Ba Carrier	96.0		40 - 110						
Y Carrier	84.9		40 - 110						

Lab Sample ID: 160-36489-1 DU

Matrix: Water

Analysis Batch: 453332

Client Sample ID: DA22132X-1X

Prep Type: Total/NA

Prep Batch: 452214

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Radium-228	1.32		1.131		0.437	1.00	0.593	pCi/L	0.23	1
Carrier										
	%Yield	Qualifier	Limits							
Ba Carrier	65.1		40 - 110							
Y Carrier	87.9		40 - 110							

Eurofins TestAmerica, St. Louis

QC Sample Results

Client: SGS North America Inc
Project/Site: DA22132X

Job ID: 160-36489-1
SDG: DA22132X

Method: HASL-300 - Isotopic Uranium (Alpha Spectroscopy)

Lab Sample ID: MB 160-452281/1-A
Matrix: Water
Analysis Batch: 454013

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 452281

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	-0.04295	U	0.0668	0.0669	1.00	0.202	pCi/L	11/27/19 12:50	12/11/19 23:21	1
Uranium-235/236	-0.04157	U	0.0314	0.0316	1.00	0.187	pCi/L	11/27/19 12:50	12/11/19 23:21	1
Uranium-238	0.0000	U	0.0738	0.0738	1.00	0.179	pCi/L	11/27/19 12:50	12/11/19 23:21	1
Tracer	MB %Yield	MB Qualifier	Limits					Prepared	Analyzed	Dil Fac
Uranium-232	75.4		30 - 110					11/27/19 12:50	12/11/19 23:21	1

Lab Sample ID: LCS 160-452281/2-A
Matrix: Water
Analysis Batch: 454017

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 452281

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Uranium-233/234	12.7	13.81		1.66	1.00	0.230	pCi/L	108	75 - 125
Uranium-238	13.0	12.26		1.52	1.00	0.207	pCi/L	94	75 - 125
Tracer	LCS %Yield	LCS Qualifier	Limits						
Uranium-232	66.1		30 - 110						

Lab Sample ID: LCSD 160-452281/3-A
Matrix: Water
Analysis Batch: 454019

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 452281

Analyte	Spike Added	LCSD Result	LCSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Uranium-233/234	12.7	12.85		1.55	1.00	0.385	pCi/L	101	75 - 125	0.30	1
Uranium-238	13.0	14.67		1.71	1.00	0.307	pCi/L	113	75 - 125	0.75	1
Tracer	LCSD %Yield	LCSD Qualifier	Limits								
Uranium-232	71.4		30 - 110								

Eurofins TestAmerica, St. Louis

QC Association Summary

Client: SGS North America Inc
Project/Site: DA22132X

Job ID: 160-36489-1
SDG: DA22132X

Rad

Prep Batch: 452151

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-36489-1	DA22132X-1X	Total/NA	Water	Evaporation	
160-36489-2	DA22132X-2X	Total/NA	Water	Evaporation	
MB 160-452151/1-A	Method Blank	Total/NA	Water	Evaporation	
LCS 160-452151/2-A	Lab Control Sample	Total/NA	Water	Evaporation	
LCSB 160-452151/3-A	Lab Control Sample	Total/NA	Water	Evaporation	

Prep Batch: 452212

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-36489-1	DA22132X-1X	Total/NA	Water	PrecSep-21	
160-36489-2	DA22132X-2X	Total/NA	Water	PrecSep-21	
MB 160-452212/20-A	Method Blank	Total/NA	Water	PrecSep-21	
LCS 160-452212/1-A	Lab Control Sample	Total/NA	Water	PrecSep-21	
160-36489-1 DU	DA22132X-1X	Total/NA	Water	PrecSep-21	

Prep Batch: 452214

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-36489-1	DA22132X-1X	Total/NA	Water	PrecSep_0	
160-36489-2	DA22132X-2X	Total/NA	Water	PrecSep_0	
MB 160-452214/20-A	Method Blank	Total/NA	Water	PrecSep_0	
LCS 160-452214/1-A	Lab Control Sample	Total/NA	Water	PrecSep_0	
160-36489-1 DU	DA22132X-1X	Total/NA	Water	PrecSep_0	

Prep Batch: 452281

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-36489-1	DA22132X-1X	Total/NA	Water	ExtChrom	
160-36489-2	DA22132X-2X	Total/NA	Water	ExtChrom	
MB 160-452281/1-A	Method Blank	Total/NA	Water	ExtChrom	
LCS 160-452281/2-A	Lab Control Sample	Total/NA	Water	ExtChrom	
LCSD 160-452281/3-A	Lab Control Sample Dup	Total/NA	Water	ExtChrom	

Eurofins TestAmerica, St. Louis

Tracer/Carrier Summary

Client: SGS North America Inc
Project/Site: DA22132X

Job ID: 160-36489-1
SDG: DA22132X

Method: 903.0 - Radium-226 (GFPC)

Matrix: Water

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)	
Lab Sample ID	Client Sample ID	Ba Carrier (40-110)	
160-36489-1	DA22132X-1X	84.3	
160-36489-1 DU	DA22132X-1X	65.1	
160-36489-2	DA22132X-2X	93.5	
LCS 160-452212/1-A	Lab Control Sample	96.0	
MB 160-452212/20-A	Method Blank	91.0	
Tracer/Carrier Legend			
Ba Carrier = Ba Carrier			

Method: 904.0 - Radium-228 (GFPC)

Matrix: Water

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)	
Lab Sample ID	Client Sample ID	Ba Carrier (40-110)	Y Carrier (40-110)
160-36489-1	DA22132X-1X	84.3	83.7
160-36489-1 DU	DA22132X-1X	65.1	87.9
160-36489-2	DA22132X-2X	93.5	86.4
LCS 160-452214/1-A	Lab Control Sample	96.0	84.9
MB 160-452214/20-A	Method Blank	91.0	83.4
Tracer/Carrier Legend			
Ba Carrier = Ba Carrier			
Y Carrier = Y Carrier			

Method: HASL-300 - Isotopic Uranium (Alpha Spectroscopy)

Matrix: Water

Prep Type: Total/NA

		Percent Yield (Acceptance Limits)	
Lab Sample ID	Client Sample ID	uranium-232 (30-110)	
160-36489-1	DA22132X-1X	81.7	
160-36489-2	DA22132X-2X	75.6	
LCS 160-452281/2-A	Lab Control Sample	66.1	
LCSD 160-452281/3-A	Lab Control Sample Dup	71.4	
MB 160-452281/1-A	Method Blank	75.4	
Tracer/Carrier Legend			
Uranium-232 = Uranium-232			

Eurofins TestAmerica, St. Louis

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

SGS North America Inc. - Wheat Ridge
4036 Youngfield Street, Wheat Ridge, CO 80033
TEL: 303-425-6021 FAX: 303-425-6854
www.sgs.com/ehsusa

Bottle Order Control #	FED-EX Tracking #
SGS Quote #	SGS Job # <i>PA22132</i>

[illegible]

FHA-OAC-0027-00 FORM Wheat Ridge, CO 80095-3000 Page 1 of 1

DA22132X: Chain of Custody

Page 1 of 2

SGS Accutest Sample Receipt Summary

Job Number: DA22132

Client: ERM WEST INC

Project: PARKDALE QUARRY GW

Date / Time Received: 11/20/2019 2:15:00 PM

Delivery Method:

Airbill #'s: hd

Cooler Temps (Initial/Adjusted): 0

Cooler Security

Y or N

Y or N

- | | | | | | |
|---------------------------|-------------------------------------|--------------------------|-----------------------|-------------------------------------|--------------------------|
| 1. Custody Seals Present: | ☒ | ☐ | 3. COC Present: | ☒ | ☐ |
| 2. Custody Seals Intact: | ☒ | ☐ | 4. Smpl Dates/Time OK | ☒ | ☐ |

Cooler Temperature

Y or N

- | | | |
|------------------------------|-------------------------------------|--------------------------|
| 1. Temp criteria achieved: | ☒ | ☐ |
| 2. Cooler temp verification: | ; | |
| 3. Cooler media: | Ice (Bag) | |
| 4. No. Coolers: | 1 | |

Quality Control Preservation

Y or N

N/A

- | | | | |
|---------------------------------|-------------------------------------|--------------------------|-------------------------------------|
| 1. Trip Blank present / cooler: | ☐ | ☐ | ☒ |
| 2. Trip Blank listed on COC: | ☐ | ☐ | ☒ |
| 3. Samples preserved properly: | ☒ | ☐ | |
| 4. VOCs headspace free: | ☐ | ☐ | ☒ |

Sample Integrity - Documentation

Y or N

- | | | |
|--|-------------------------------------|--------------------------|
| 1. Sample labels present on bottles: | ☒ | ☐ |
| 2. Container labeling complete: | ☒ | ☐ |
| 3. Sample container label / COC agree: | ☒ | ☐ |

Sample Integrity - Condition

Y or N

- | | | |
|----------------------------------|-------------------------------------|--------------------------|
| 1. Sample recvd within HT: | ☒ | ☐ |
| 2. All containers accounted for: | ☒ | ☐ |
| 3. Condition of sample: | Intact | |

Sample Integrity - Instructions

Y or N N/A

- | | | | |
|---|-------------------------------------|-------------------------------------|-------------------------------------|
| 1. Analysis requested is clear: | ☒ | ☐ | |
| 2. Bottles received for unspecified tests | ☐ | ☒ | |
| 3. Sufficient volume recvd for analysis: | ☒ | ☐ | |
| 4. Compositing instructions clear: | ☐ | ☐ | ☒ |
| 5. Filtering instructions clear: | ☐ | ☐ | ☒ |

Comments

DA22132X: Chain of Custody

Page 2 of 2

APPENDIX C PUMPING TEST ANALYSES

Martin Marietta Parkdale Quarry Field Investigation.
Pumping Tests Conducted December 2018

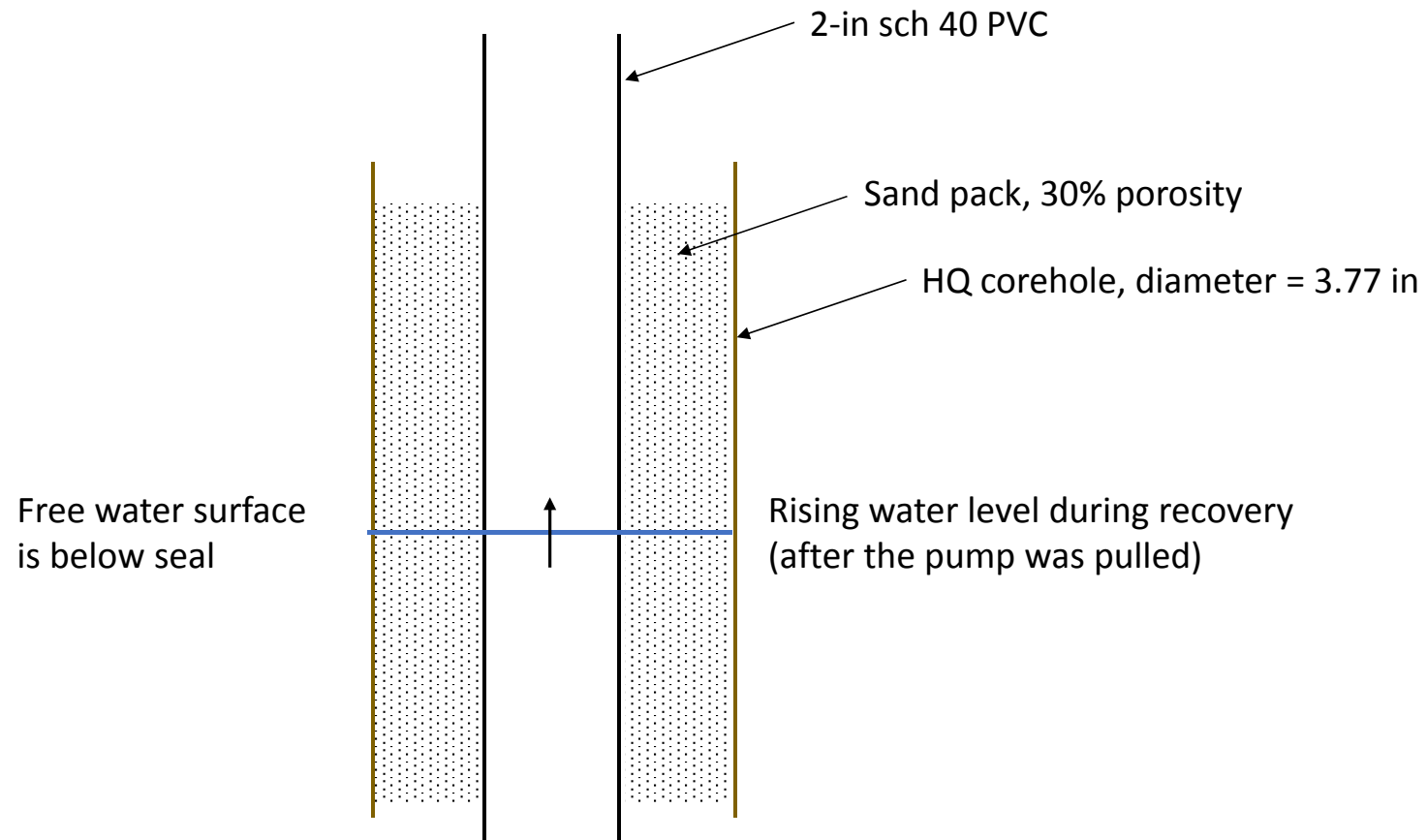
Well 1	Saturated thickness = 134.87 ft			Mean for Well	
	T (ft ² /day)	K (ft/day)		K (ft/day)	K (cm/sec)
Theis Recovery Analysis (Aqtesolv)	0.289	0.00215	Incomplete Recovery	0.00192	6.77E-07
Hvorslev Analysis 1	0.228	0.00169			
Hvorslev Analysis 2	0.00916	0.000068	Late response; unrealistically low; value not used		

Well 3	Saturated thickness = 201.45 ft			Mean for Well	
	T (ft ² /day)	K (ft/day)		K (ft/day)	K (cm/sec)
Theis Recovery Analysis	0.298	0.00148		0.00268	9.45E-07
Hvorslev Analysis	0.781	0.00388			
Steady-State Analysis	0.812	0.00403			

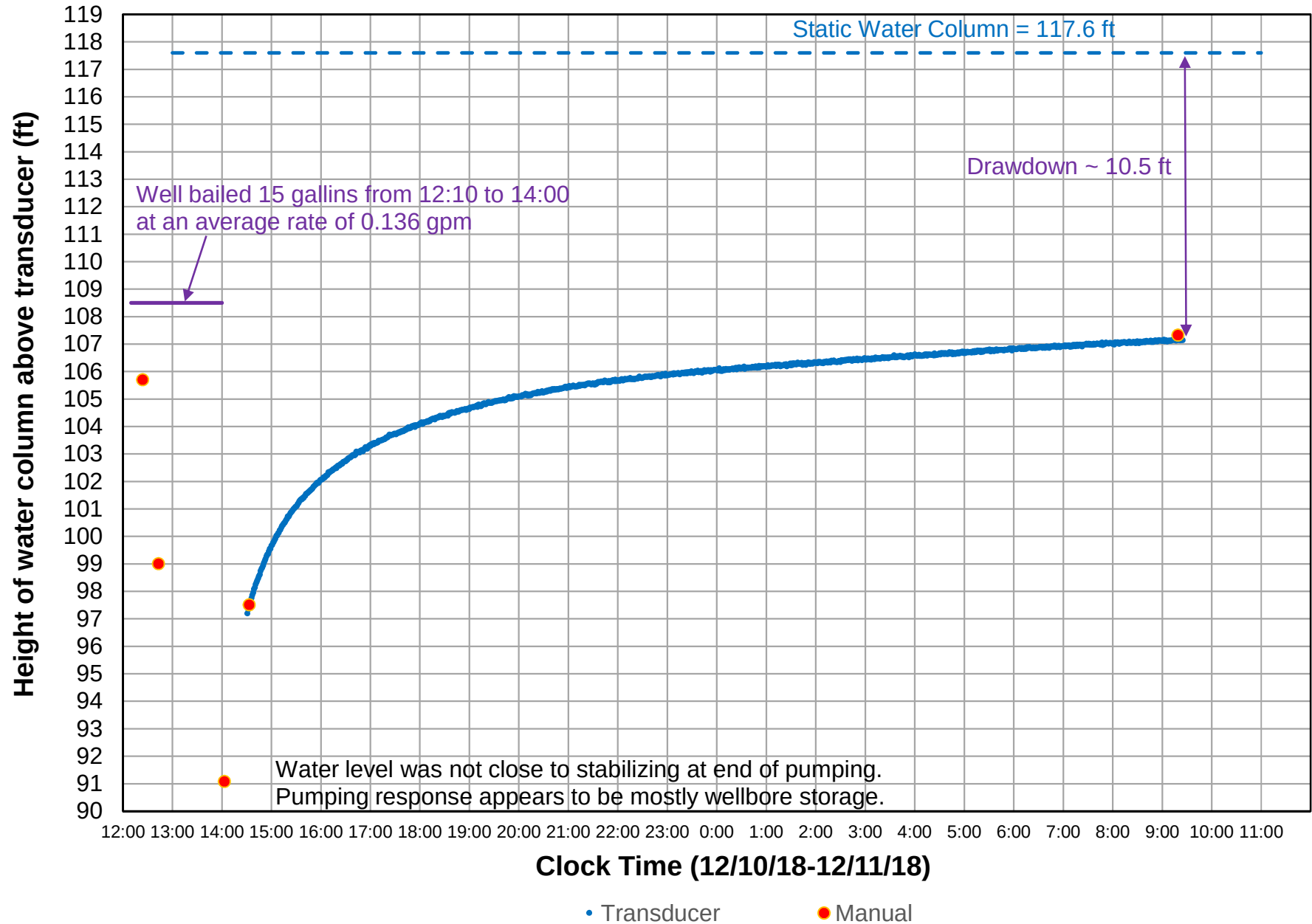
Well 10	Saturated thickness = 241.24 ft			Mean for Well	
	T (ft ² /day)	K (ft/day)		K (ft/day)	K (cm/sec)
Theis Recovery Analysis			Recovery not monitored	0.00650	2.29E-06
Hvorslev Analysis			Recovery not monitored		
Steady-State Analysis Q1 = 0.65 gpm	2.25	0.00933			
Steady-State Analysis Q2 = 0.39 gpm	1.76	0.00730			
Steady-State Analysis Q3 = 0.012 gpm	2.13	0.00883			
Cooper-Jacob Analysis (Aqtesolv)	0.830	0.00344			
Birsoy-Summers (1980) Analysis	0.865	0.00359			

Best Estimate Bulk K (average of three well values) 0.00370 1.30E-06

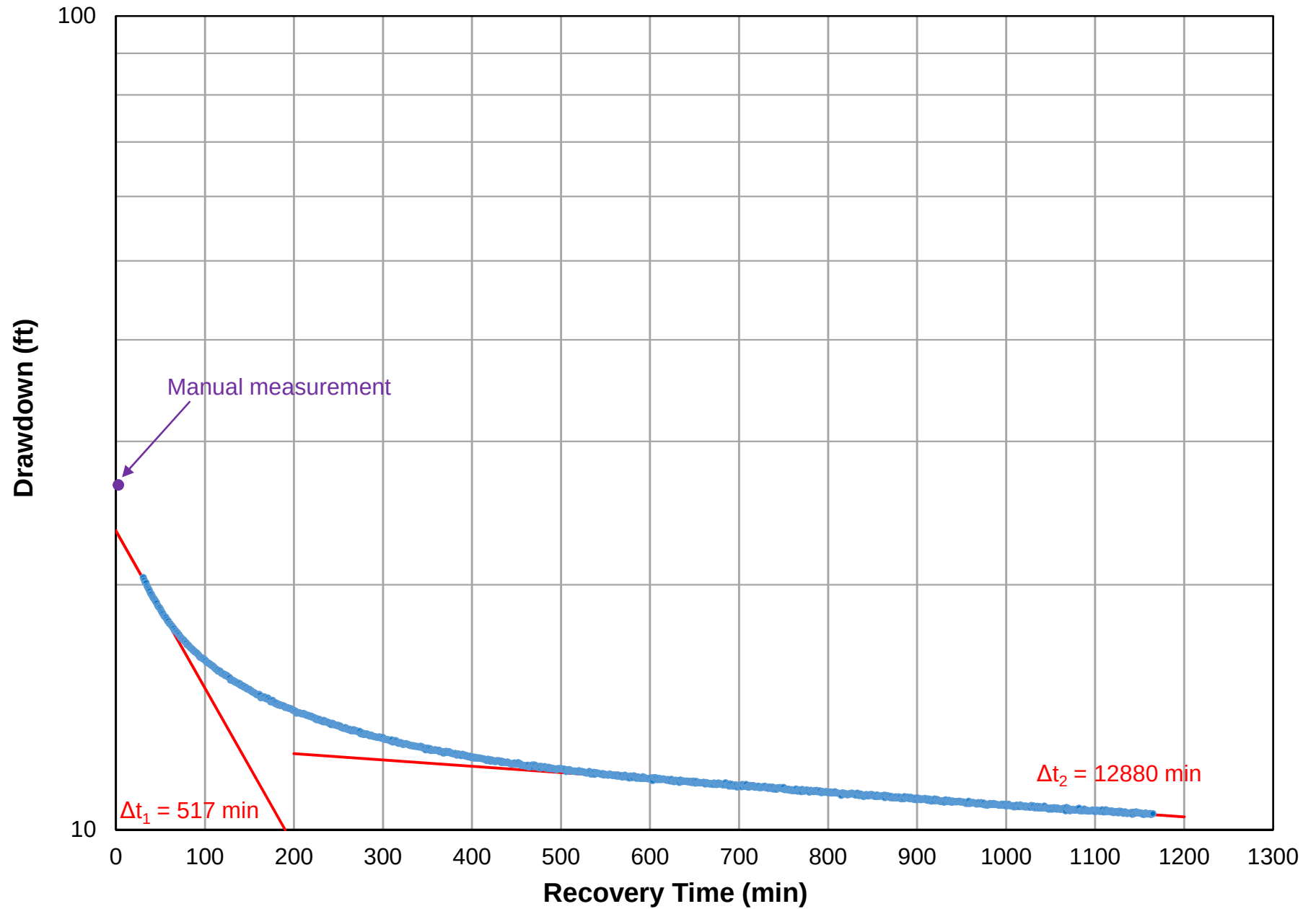
Well Recovery



Well 1 - Hydrograph



Well 1 - Hvorslev Plot



Well 1 Analyses

Theis Recovery Analysis

Analysis not feasible. Pumping and recovery response dominated by wellbore storage.
Recovery far from complete (10.5 ft of residual drawdown after 1160 minutes of recovery).

Hvorslev Analysis 1

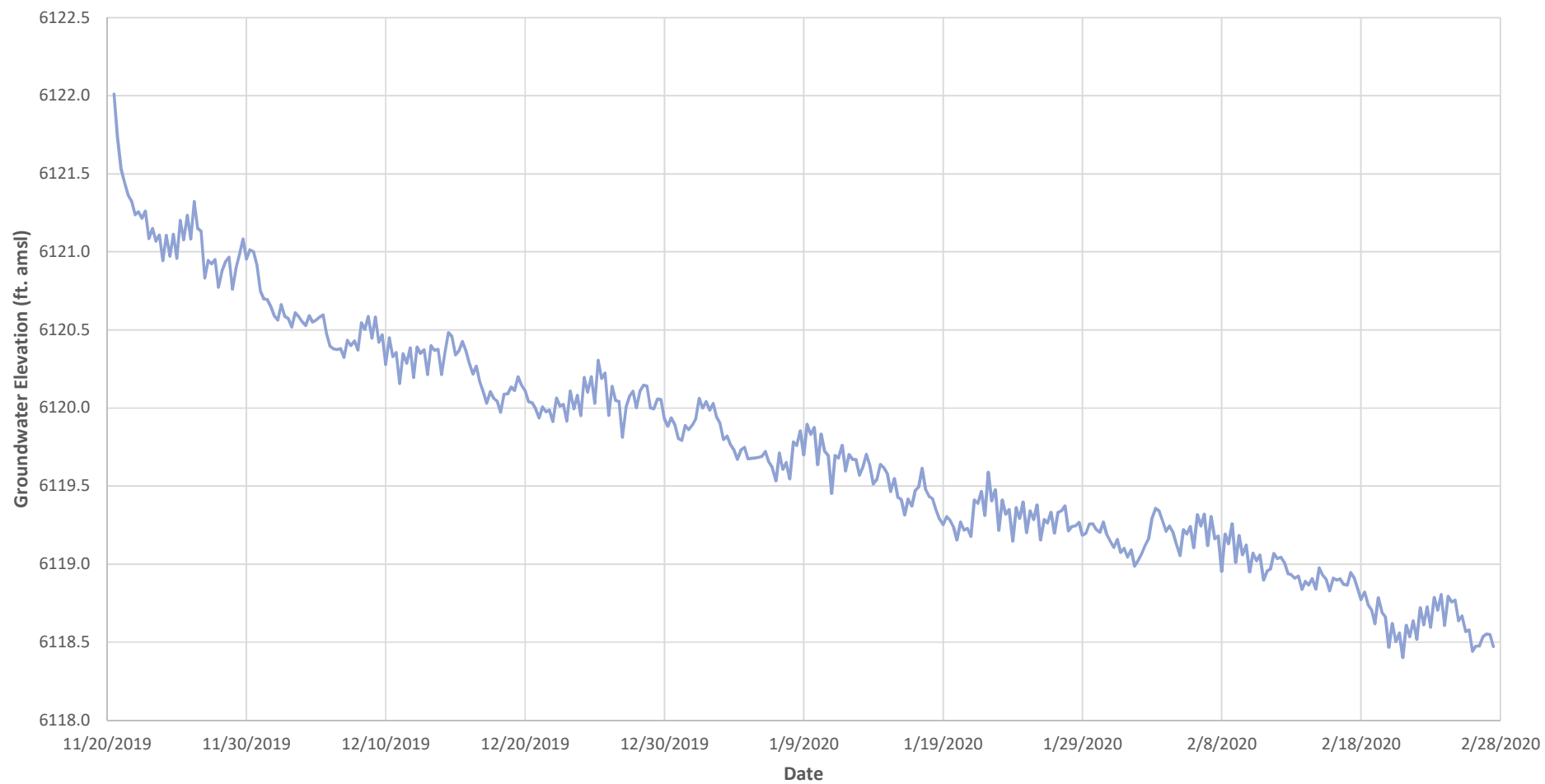
$d_c := 2 \cdot \text{in}$	Riser pipe diameter (2-in sch 40 PVC)	
$d_b := 3.77 \cdot \text{in}$	Borehole diameter (<i>assume HQ corehole</i>)	
$n := 0.3$	Sand pack specific yield	
$A := \frac{\pi}{4} \cdot d_c^2 + \frac{\pi}{4} \cdot n \cdot (d_b^2 - d_c^2)$	Casing - sand pack void area	$A = 5.548 \cdot \text{in}^2$
$F := 5.8$	Hvorslev shape factor (index value)	
$\Delta t_1 := 517 \cdot \text{min}$	Time for one log cycle change in drawdown (early response)	
$T_1 := \frac{2.303 \cdot A \cdot F}{2 \cdot \pi \cdot \Delta t_1}$	Computed transmissivity	$T_1 = 0.228 \cdot \frac{\text{ft}^2}{\text{day}}$

Hvorslev Analysis 2

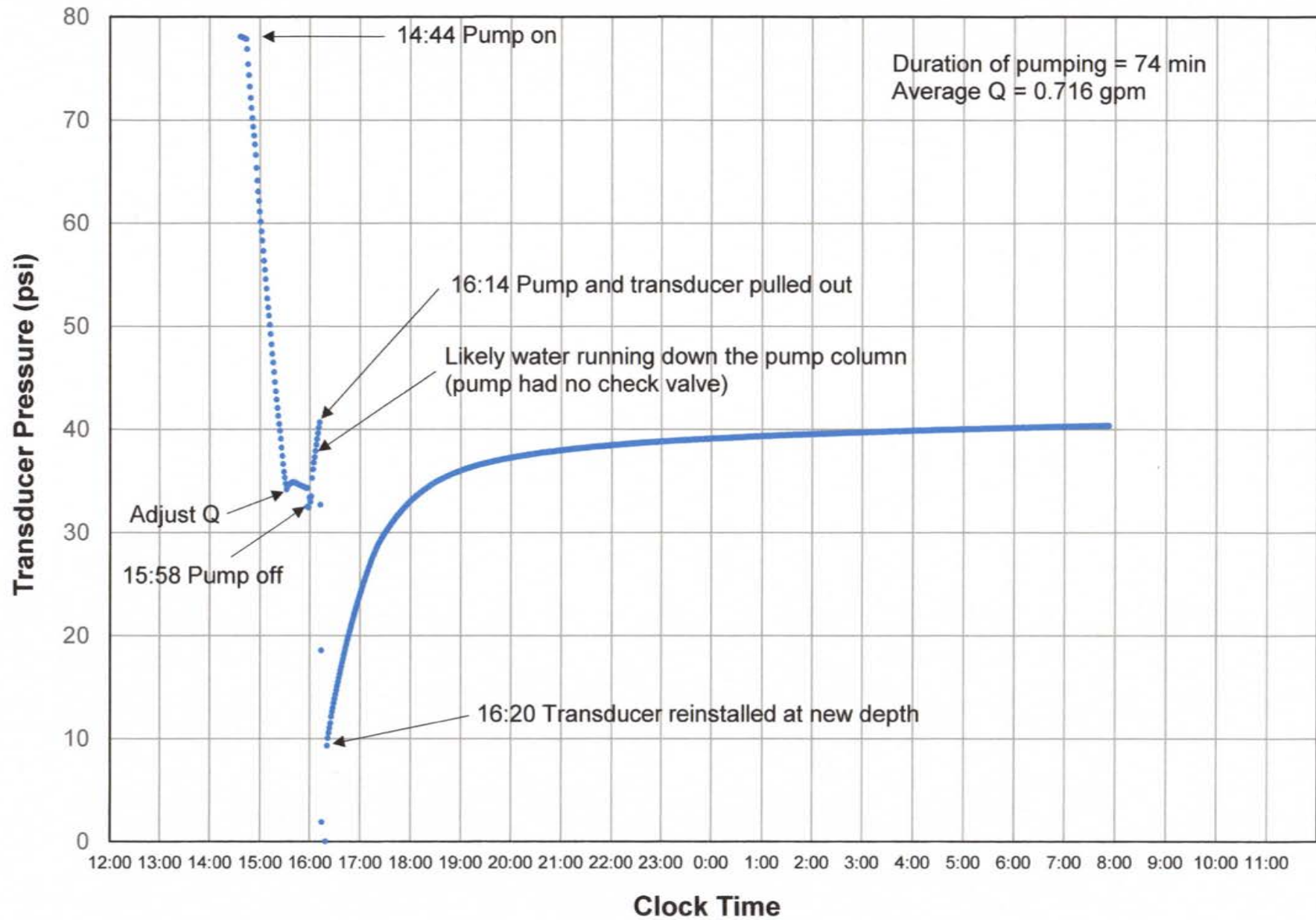
$\Delta t_2 := 12880 \cdot \text{min}$	Time for one log cycle change in drawdown (late response)	
$T_2 := \frac{2.303 \cdot A \cdot F}{2 \cdot \pi \cdot \Delta t_2}$	Computed transmissivity	$T_2 = 0.00916 \cdot \frac{\text{ft}^2}{\text{day}}$

This T seems unrealistically low

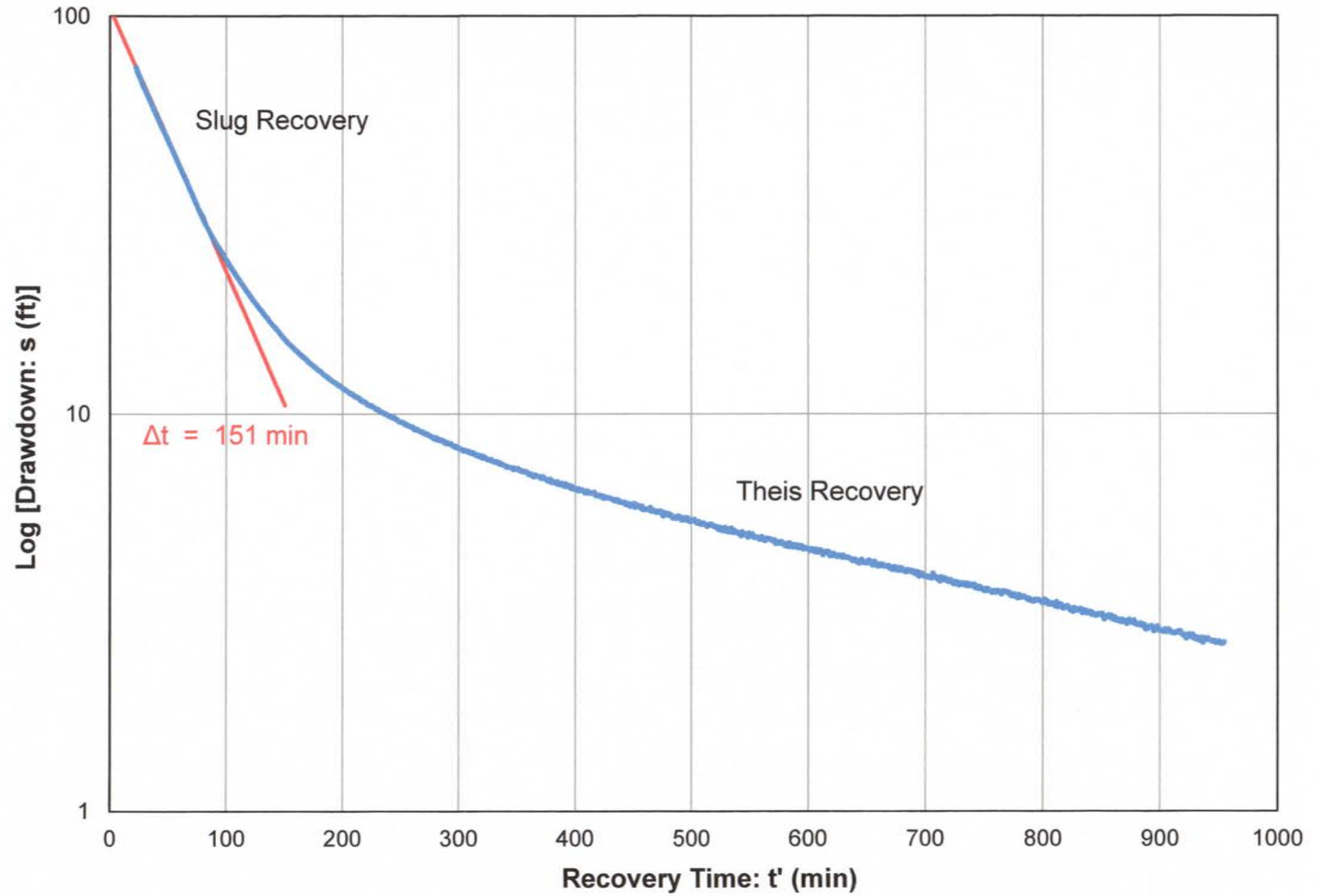
Well 1 Groundwater Elevation Transducer Results



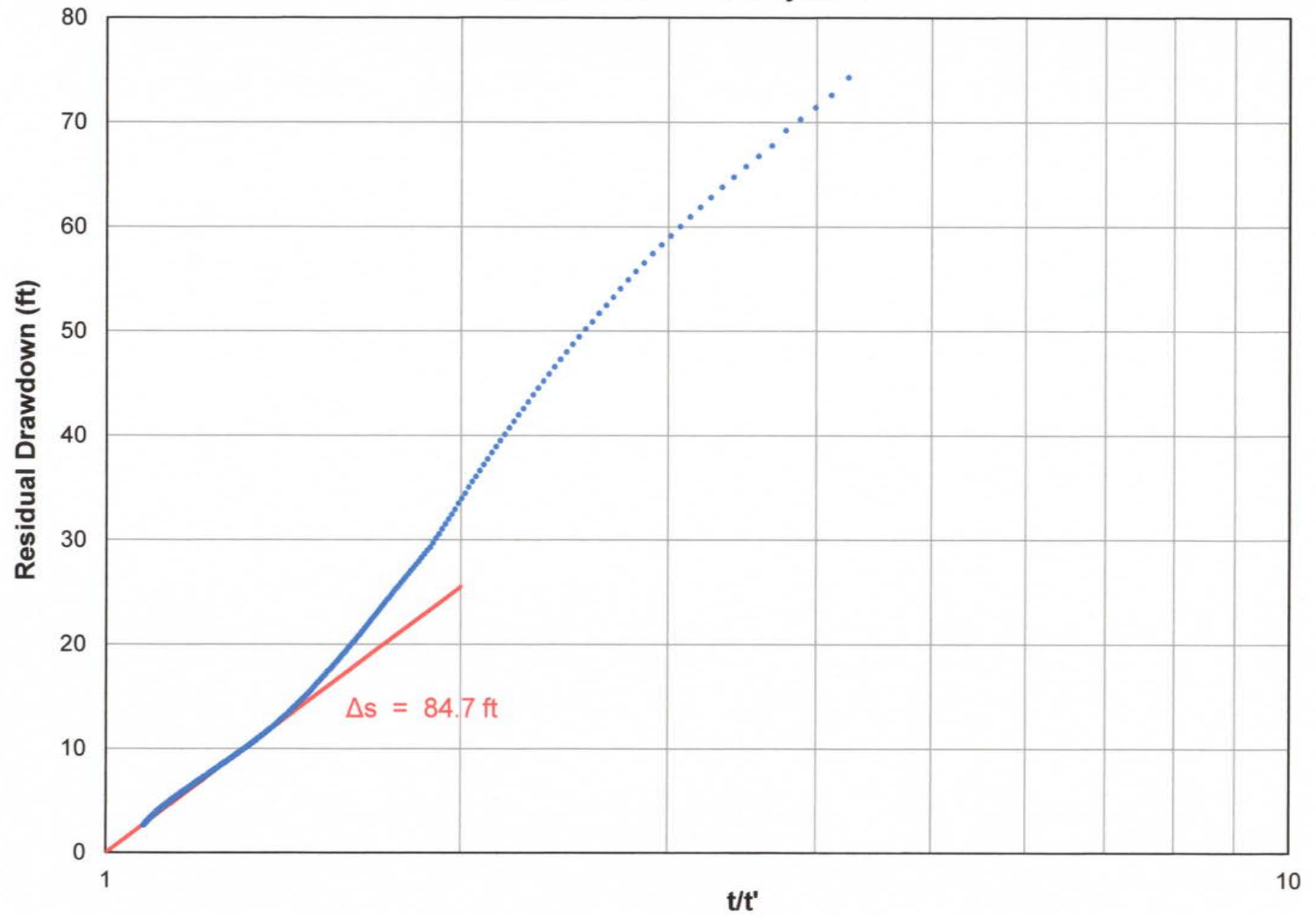
Well 3 - Pressure Hydrograph



Well 3 - Hvorslev Plot



Well 3 - Theis Recovery Plot



Well 3 Analyses

Theis Recovery Analysis

$Q_1 := \frac{53 \text{ gal}}{74 \cdot \text{min}}$	Average flow rate during pumping period	$Q_1 = 0.716 \cdot \text{gpm}$
$\Delta s := 84.7 \cdot \text{ft}$	Change in drawdown per log cycle on t/t' plot	
$T_1 := \frac{2.303 \cdot Q_1}{4 \cdot \pi \cdot \Delta s}$	Computed transmissivity	$T_1 = 0.298 \cdot \frac{\text{ft}^2}{\text{day}}$

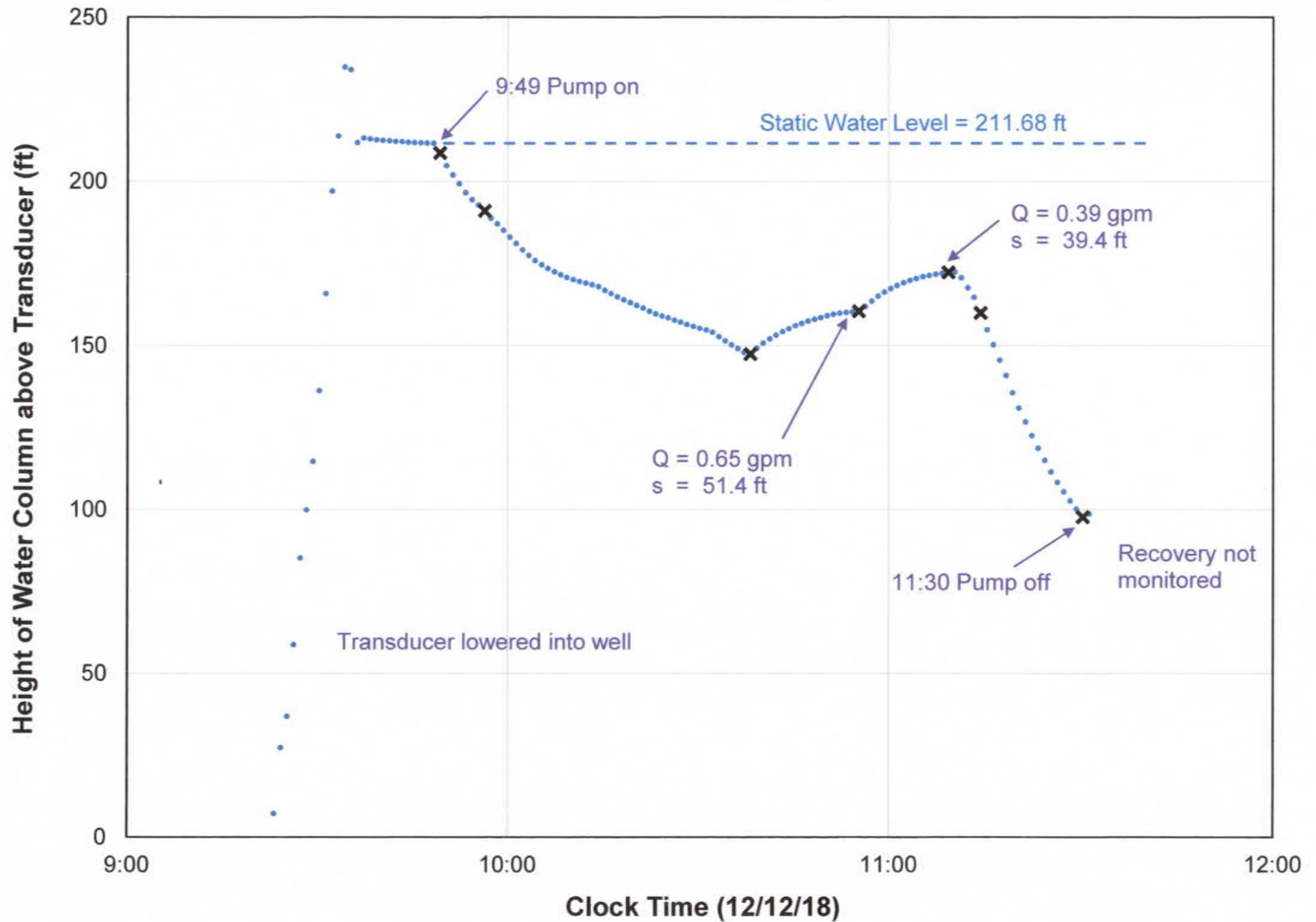
Hvorslev Analysis

$d_c := 2 \cdot \text{in}$	Riser pipe diameter (2-in sch 40 PVC)	
$d_b := 3.77 \cdot \text{in}$	Borehole diameter (<i>assume HQ corehole</i>)	
$n := 0.3$	Sand pack specific yield	
$A_v := \frac{\pi}{4} \cdot d_c^2 + \frac{\pi}{4} \cdot n \cdot (d_b^2 - d_c^2)$	Casing - sand pack void area	$A = 5.548 \cdot \text{in}^2$
$F_w := 5.8$	Hvorslev shape factor (index value)	
$\Delta t := 151 \cdot \text{min}$	Time for one log cycle change in drawdown	
$T_2 := \frac{2.303 \cdot A \cdot F}{2 \cdot \pi \cdot \Delta t}$	Computed transmissivity	$T_2 = 0.781 \cdot \frac{\text{ft}^2}{\text{day}}$

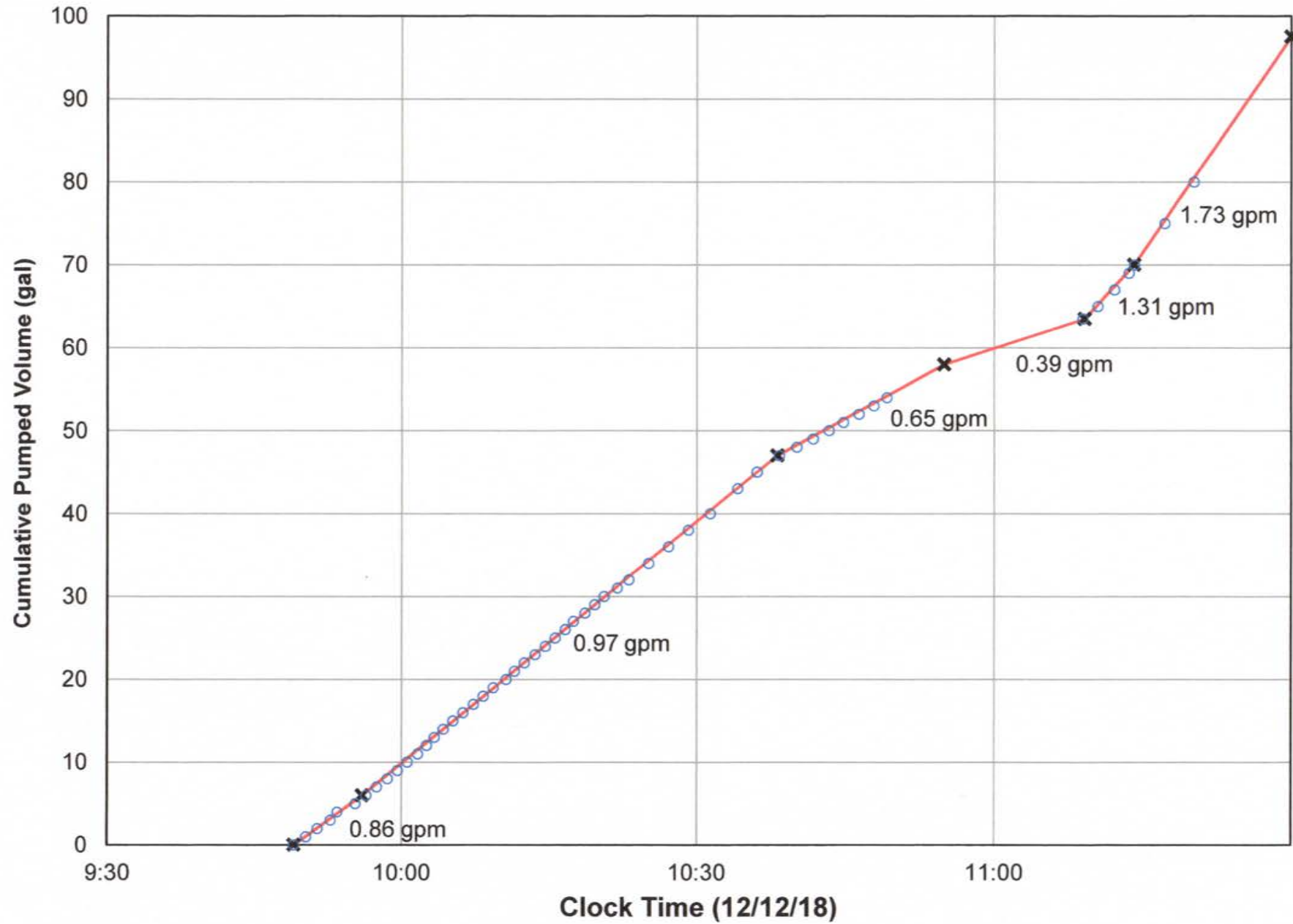
Steady-state Analysis

$Q_3 := 0.456 \cdot \text{gpm}$	Flow rate at end of pumping period	
$s_s := (77.98 - 34.74) \cdot 2.308 \cdot \text{ft}$	Approximately stabilized drawdown at end of pumping period	$s = 99.798 \cdot \text{ft}$
$T_3 := \frac{Q_3 \cdot F}{2 \cdot \pi \cdot s}$	Computed transmissivity	$T_3 = 0.812 \cdot \frac{\text{ft}^2}{\text{day}}$

Well 10 - Hydrograph



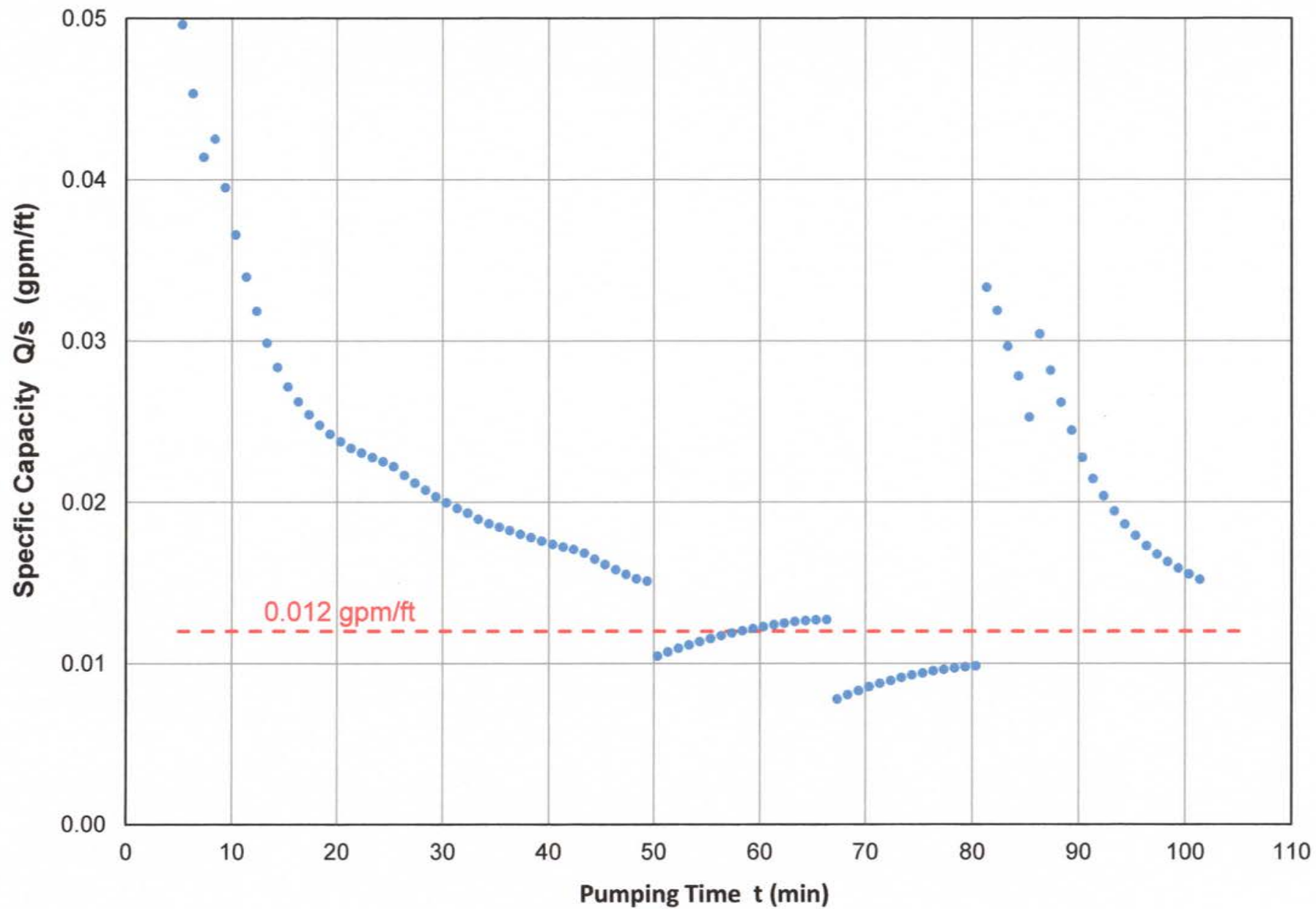
Well 10 - Flow Chart



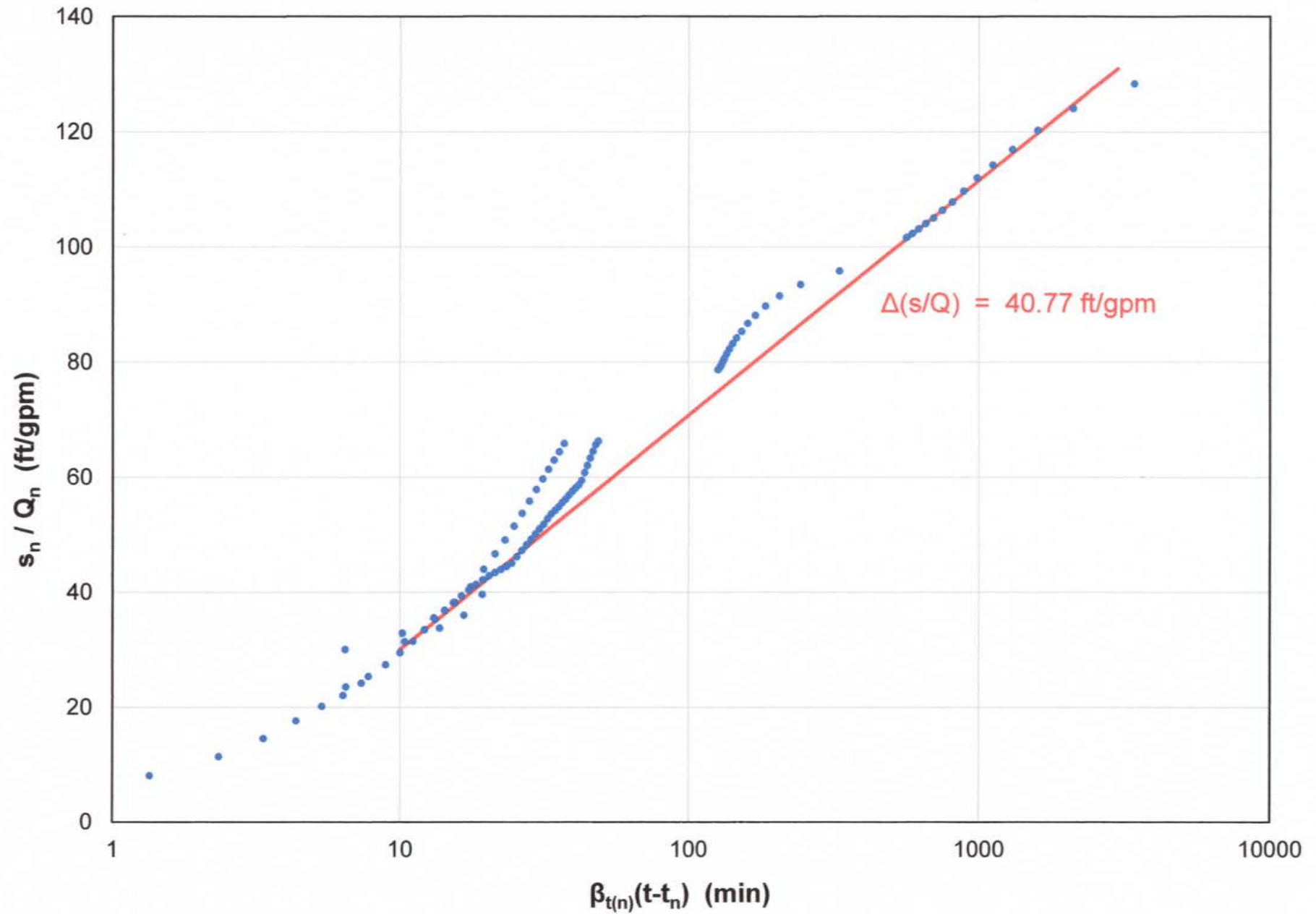
Flow Rate Schedule

Clock Time	Vol (gal)	Q (gpm)	Step	Notes
9:49:00	0			Pump on
9:56:00	6	0.86	step 1	
10:38:10	47	0.97	step 2	
10:55:00	58	0.65	step 3	
11:09:10	63.5	0.39	step 4	
11:14:08	70	1.31	step 5	
11:30:00	97.5	1.73	step 6	Pump off

Well 10 - Specific Capacity Plot



Well 10 - Birsoy-Summers Plot (Variable Flow Rate Analysis)



Well 10 Analyses

Cooper-Jacob Analysis

Not likely to work due to flow rate variations during the pumping period.
Can attempt to analyse in Aqtesolve using the Birsoy-Summers (1980) variable flow rate solution.

Theis Recovery Analysis

Recovery not monitored

Steady-state Analysis

Approximate stabilized water level at 10:55

$Q_1 := 0.65 \cdot \text{gpm}$	Flow rate at end of pumping period	
$s_1 := 211.7 \cdot \text{ft} - 160.3 \cdot \text{ft}$	Approximately stabilized drawdown at end of step 3	$s_1 = 51.4 \cdot \text{ft}$

$F_w := 5.8$	Shape factor (index value)	
--------------	----------------------------	--

$T_1 := \frac{Q_1 \cdot F}{2 \cdot \pi \cdot s_1}$	Computed transmissivity	$T_1 = 2.25 \cdot \frac{\text{ft}^2}{\text{day}}$
--	-------------------------	---

Approximate stabilized water level at 11:09

$Q_2 := 0.39 \cdot \text{gpm}$	Flow rate at end of pumping period	
$s_2 := 211.7 \cdot \text{ft} - 172.32 \cdot \text{ft}$	Approximately stabilized drawdown at end of step 4	$s_2 = 39.4 \cdot \text{ft}$

$T_2 := \frac{Q_2 \cdot F}{2 \cdot \pi \cdot s_2}$	Computed transmissivity	$T_2 = 1.76 \cdot \frac{\text{ft}^2}{\text{day}}$
--	-------------------------	---

Projected specific capacity on plot

$SC_3 := 0.012 \cdot \frac{\text{gpm}}{\text{ft}}$	Projected specific capacity on plot	
--	-------------------------------------	--

$T_3 := \frac{F \cdot SC_3}{2 \cdot \pi}$	Computed transmissivity	$T_3 = 2.13 \cdot \frac{\text{ft}^2}{\text{day}}$
---	-------------------------	---

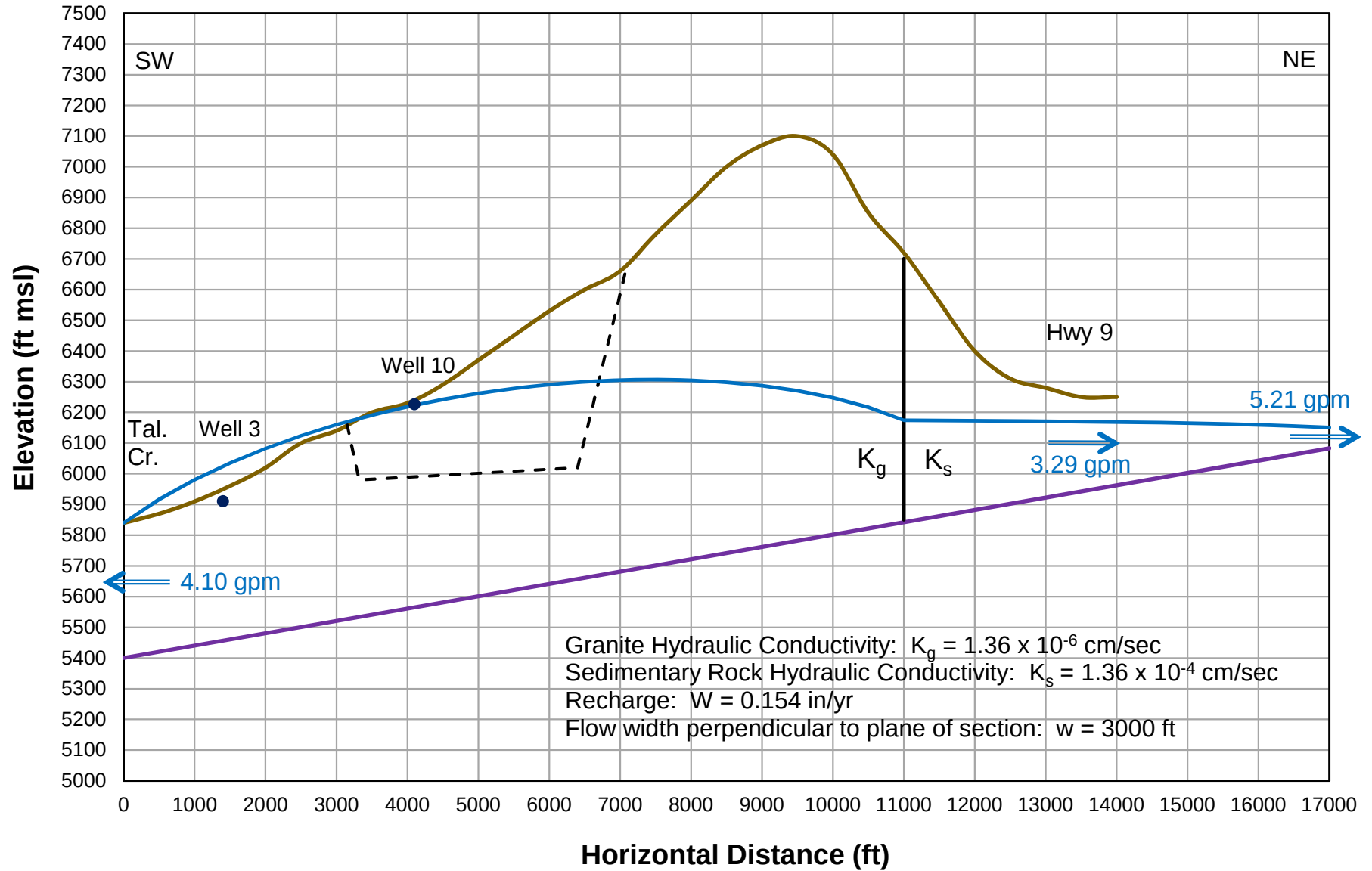
Birsoy-Summers (1980) Analysis

$\Delta sQ := 40.77 \cdot \frac{\text{ft}}{\text{gpm}}$	Change in s/Q per log cycle	
---	-----------------------------	--

$T_4 := \frac{2.303}{4 \cdot \pi \cdot \Delta sQ}$	Computed transmissivity	$T_4 = 0.865 \cdot \frac{\text{ft}^2}{\text{day}}$
--	-------------------------	--

APPENDIX D SCOPING-LEVEL HYDRAULIC CALCULATIONS

SW-NE Cross Section: Computed (Calibrated) Water-Table Profile for Pre-Mining Conditions



Sloping Aquifer With Recharge Pre-Mining (Current) Conditions

Dimensionless parameters below are in units of ft-day

Inputs

$KK_g := 1.36 \cdot 10^{-6} \cdot \frac{\text{cm}}{\text{sec}}$	Hydraulic conductivity of granite	$K_g := KK_g \cdot \text{ft}^{-1} \cdot \text{day}$	$K_g = 0.0039$
$KK_s := 100 \cdot KK_g$	Hydraulic conductivity of sedimentary rock	$K_s := KK_s \cdot \text{ft}^{-1} \cdot \text{day}$	$K_s = 0.3855$
$WW := 0.154 \cdot \frac{\text{in}}{\text{yr}}$	Recharge. Iterate on this value	$W := WW \cdot \text{ft}^{-1} \cdot \text{day}$	$W = 3.51 \times 10^{-5}$
$LL := 17000 \cdot \text{ft}$	Length of flow system (Tallahassee Ck to Hwy 9)	$L := LL \cdot \text{ft}^{-1}$	$L = 17000.0$
$ww := 3000 \cdot \text{ft}$	Flow tube unit width	$w := ww \cdot \text{ft}^{-1}$	$w = 3000.0$
$HH_0 := 5840 \cdot \text{ft}$	Head at x = 0 (Creek elevation in msl)	$H_0 := HH_0 \cdot \text{ft}^{-1}$	$H_0 = 5840.0$

$$K(x) := \begin{cases} K_g & \text{if } x \leq 11000 \\ K_s & \text{otherwise} \end{cases} \quad \text{Aquifer hydraulic conductivity function. Fault located at } x = 11,000 \text{ ft}$$

$$B(x) := 5440 + 0.0378 \cdot x \quad \text{Aquifer base elevation function} \quad B(0) = 5440.0 \quad B(L) = 6082.6$$

Calcs

$$b := 100 \cdot \text{ft} \quad s := 50 \cdot \text{ft} \quad Q_w := \frac{2 \cdot \pi \cdot KK_s \cdot b \cdot s}{6} \quad Q_w = 10.5 \cdot \text{gpm} \quad \text{Estimated flow for a well completed in sedimentary rock. This value is reasonable for a domestic well.}$$

$$Q_0 := -789 \quad \text{Flow at SW end of section. Iterate on this value} \quad QQ_0 := Q_0 \cdot \frac{\text{ft}^3}{\text{day}} \quad QQ_0 = -4.10 \cdot \text{gpm} \quad \text{Creek, Flow to SW}$$

$$Q_{hw9} := Q_0 + W \cdot w \cdot 13500 \quad \text{Flow at Highway 9} \quad QQ_{hw9} := Q_{hw9} \cdot \frac{\text{ft}^3}{\text{day}} \quad QQ_{hw9} = 3.29 \cdot \text{gpm} \quad \text{Highway 9, Flow to NE}$$

$$Q_L := Q_0 + W \cdot w \cdot L \quad \text{Flow at NE end of section} \quad QQ_L := Q_L \cdot \frac{\text{ft}^3}{\text{day}} \quad QQ_L = 5.21 \cdot \text{gpm} \quad \text{Highway 9, Flow to NE}$$

$$\text{Given} \quad \frac{d}{dx} H(x) = -\frac{\frac{Q_0}{w} + W \cdot x}{K(x) \cdot (H(x) - B(x))} \quad H(0) = H_0 \quad H := \text{Odesolve}(x, L) \quad \text{Governing ODE and BC Must be a unitless equation}$$

$$\text{SE end (Creek)} \quad x = 0 \quad H(0) = 5840.0 \quad \text{Boundary condition}$$

$$\text{Well 3} \quad x = 1400 \quad \text{Measured water level 5910} \quad H(1400) = 6024.9 \quad \text{Poor match}$$

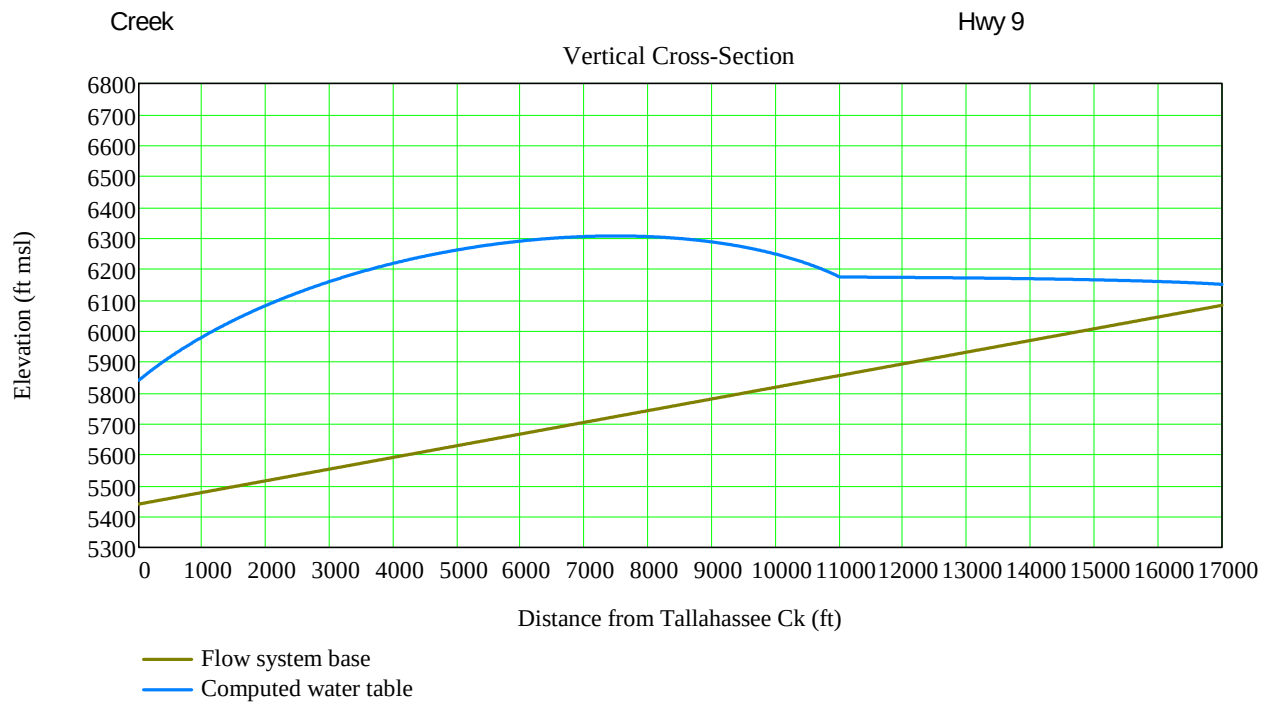
$$\text{Well 10} \quad x = 4100 \quad \text{Measured water level 6225} \quad H(4100) = 6223.6 \quad \text{Good Match}$$

$$\text{Base of high wall} \quad x = 6400 \quad H(6400) = 6298.0$$

$$\text{Highway 9} \quad x = 13500 \quad \text{Measured static water level 6170} \quad H(13500) = 6170.0 \quad \text{Iterate to match these values}$$

$$\text{NE end} \quad x = 17000 \quad H(17000) = 6150.4$$

Use this as boundary condition for post-mining analysis



Check flow rates with Darcy's law

$$Q(x) := -K(x) \cdot w \cdot (H(x) - B(x)) \cdot \frac{d}{dx} H(x) \quad \text{Darcy's law for horizontal flow with variable saturated thickness}$$

$$QQ_L := Q(0.1) \cdot \frac{\text{ft}^3}{\text{day}} \quad QQ_L = -4.089 \cdot \text{gpm} \quad \text{SW end of section (creek). Flow is to SW}$$

$$QQ_R := Q(16999.9) \cdot \frac{\text{ft}^3}{\text{day}} \quad QQ_R = 5.189 \cdot \text{gpm} \quad \text{NE end of section. Flow is to NE}$$

$$QQ_R - QQ_L = 9.28 \cdot \text{gpm} \quad \text{Total flow leaving cross-section}$$

$$LL \cdot ww \cdot WW = 9.31 \cdot \text{gpm} \quad \text{Total recharge into cross-section}$$

For steady-state, these should be equal

Discussion

This is a 1-D vertical-section groundwater hydraulic calculation. The SW-NE orientation of the section is shown on the attached map. The left (SW) side of the section is at confluence of Tallahassee Creek and Current Creek. The right (NE) side of section is NE of Hwy 9. Total horizontal length of the section is 17,000 ft. Highway 9 is located at $x = 13,500$ ft

Solution assumes horizontal flow according to the Dupuit assumption to account for variable saturated thickness. This is usually a good approximation if flow lines have slopes of less than 15 percent, which should be the case here.

The perennial stream at the left side of the section is assumed to be a fixed head boundary (elevation 5840 ft msl).

Granite hydraulic conductivity (KK_g) is 1.36×10^{-6} cm/sec. This hydraulic conductivity is based on pumping tests conducted at three wells within and near the pit area.

Sedimentary rock hydraulic conductivity (KK_s) is 1.36×10^{-4} cm/sec (100 times KK_g). This hydraulic conductivity provides an estimated well yield of about 10.5 gpm, which is reasonable for domestic wells along Highway 9.

A fault is located at $x = 11,000$ ft. Granite exists SE of the fault. Sedimentary rock exists NE of the fault. The fault does not operate as barrier or conduit to flow. Hydraulically, it provides the transition from granite to sedimentary rock.

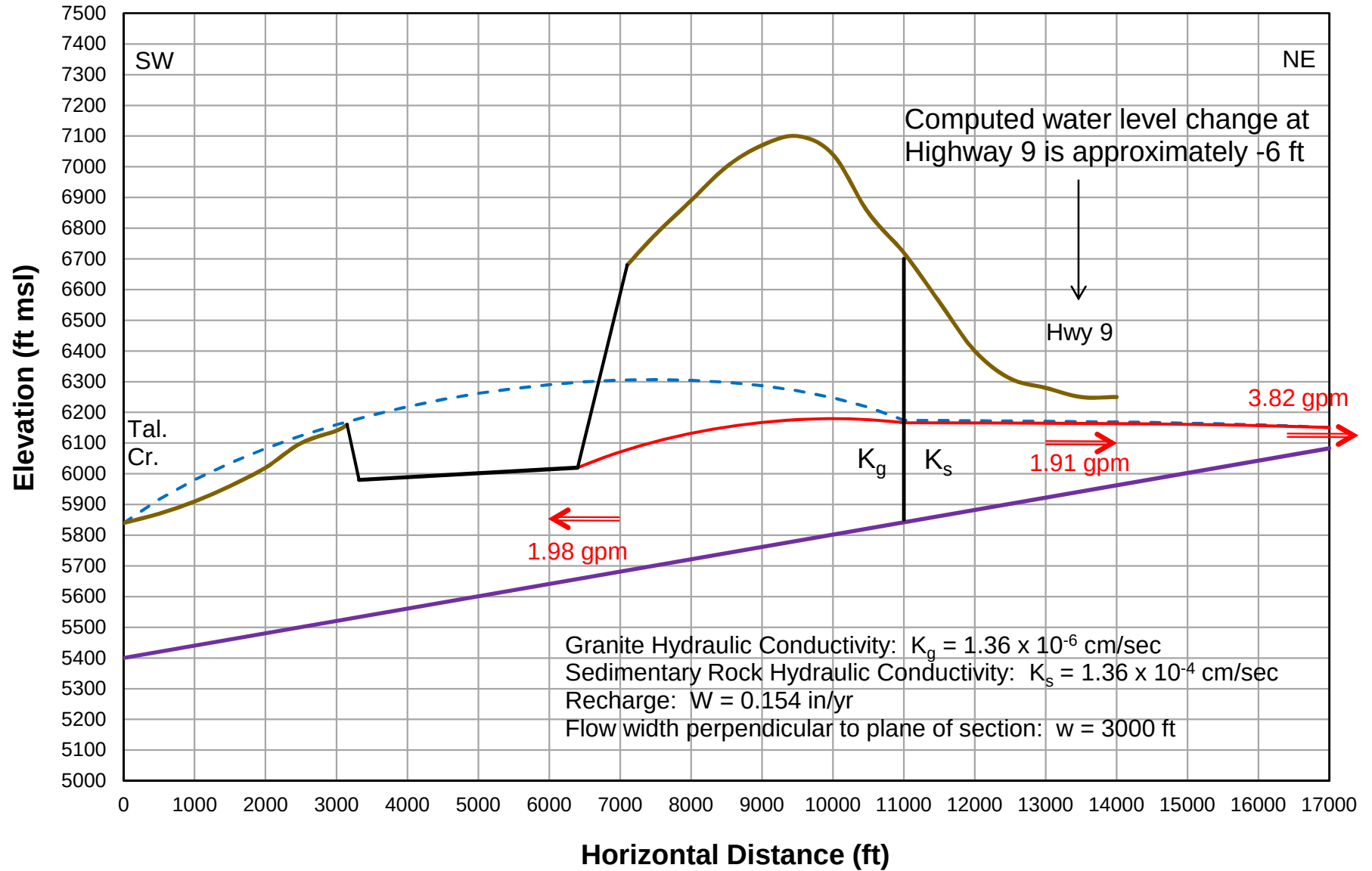
Evenly distributed recharge is 0.154 in/yr. This is a calibrated value.

Mathcad solves the inhomogeneous ordinary differential equation (ODE) using the 4th order Runge-Kutta method.

For regularly fractured hard rock, a general rule of thumb is that the hydraulic conductivity becomes very low at about 300-500 feet below ground surface due to geostatic pressures that close fractures. This effect is approximated in the solution by placing a linear sloped no-flow boundary at 400 feet below the Creek. Below highway 9, the basal no-flow boundary is about 300 feet below the top of the Niabara Formation, which is the unit that most domestic wells are completed in. The sloped no-flow boundary causes the aquifer to "pinch" to the NE, consistent with the geologic section.

The solution is "calibrated" so that the computed water-level profile (1) conforms to the water level measured in Well 10 and (2) is 80 feet below ground surface at Hwy 9 (elevation 6170 ft msl).

SW-NE Cross Section: Computed Water-Table Profile for Post-Mining Conditions



-- Pre-mining water table

— Excavated Pit

— Post-mining water table

— Base of permeable rock

— Ground surface

— Fault

Sloping Aquifer With Recharge Post-Mining Conditions with Recharge

Dimensionless
parameters below
are in units of ft-day

Inputs

$KK_g := 1.36 \cdot 10^{-6} \cdot \frac{\text{cm}}{\text{sec}}$	Hydraulic conductivity of granite	$K_g := KK_g \cdot \text{ft}^{-1} \cdot \text{day}$	$K_g = 0.0039$
$KK_s := 100 \cdot KK_g$	Hydraulic conductivity of sedimentary rock	$K_s := KK_s \cdot \text{ft}^{-1} \cdot \text{day}$	$K_s = 0.3855$
$WW := 0.154 \cdot \frac{\text{in}}{\text{yr}}$	Recharge. Value from pre-mining solution	$W := WW \cdot \text{ft}^{-1} \cdot \text{day}$	$W = 3.51 \times 10^{-5}$
$LL := 10600 \cdot \text{ft}$	Length of flow system (Pit wall to NE end of section)	$L := LL \cdot \text{ft}^{-1}$	$L = 10600.0$
$ww := 3000 \cdot \text{ft}$	Flow tube unit width	$w := ww \cdot \text{ft}^{-1}$	$w = 3000.0$
$HH_0 := 6020 \cdot \text{ft}$	Head at $x = 0$ (Pit wall base elevation msl)	$H_0 := HH_0 \cdot \text{ft}^{-1}$	$H_0 = 6020.0$

$$K(x) := \begin{cases} K_g & \text{if } x \leq 4600 \\ K_s & \text{otherwise} \end{cases} \quad \text{Aquifer hydraulic conductivity function}$$

$$B(x) := 5681.92 + 0.0378 \cdot x \quad \text{Aquifer base elevation function} \quad B(0) = 5681.9 \quad B(L) = 6082.6$$

Calcs

$$b := 100 \cdot \text{ft} \quad s_g := 50 \cdot \text{ft} \quad Q_w := \frac{2 \cdot \pi \cdot KK_s \cdot b \cdot s}{6} \quad Q_w = 10.5 \cdot \text{gpm} \quad \text{Estimated flow for a well completed in sedimentary rock. This value is reasonable for a domestic well.}$$

$$Q_0 := -381.1 \quad \text{Flow at SW end of section. Iterate on this value} \quad QQ_0 := Q_0 \cdot \frac{\text{ft}^3}{\text{day}} \quad QQ_0 = -1.98 \cdot \text{gpm} \quad \text{Pit wall, flow to SW}$$

$$Q_{hw9} := Q_0 + W \cdot w \cdot 7100 \quad \text{Highway 9 flow} \quad QQ_{hw9} := Q_{hw9} \cdot \frac{\text{ft}^3}{\text{day}} \quad QQ_{hw9} = 1.91 \cdot \text{gpm} \quad \text{Highway 9, Flow to NE}$$

$$Q_L := Q_0 + W \cdot w \cdot L \quad \text{Flow at NE end of section} \quad QQ_L := Q_L \cdot \frac{\text{ft}^3}{\text{day}} \quad QQ_L = 3.82 \cdot \text{gpm} \quad \text{NE end of section, Flow to NE}$$

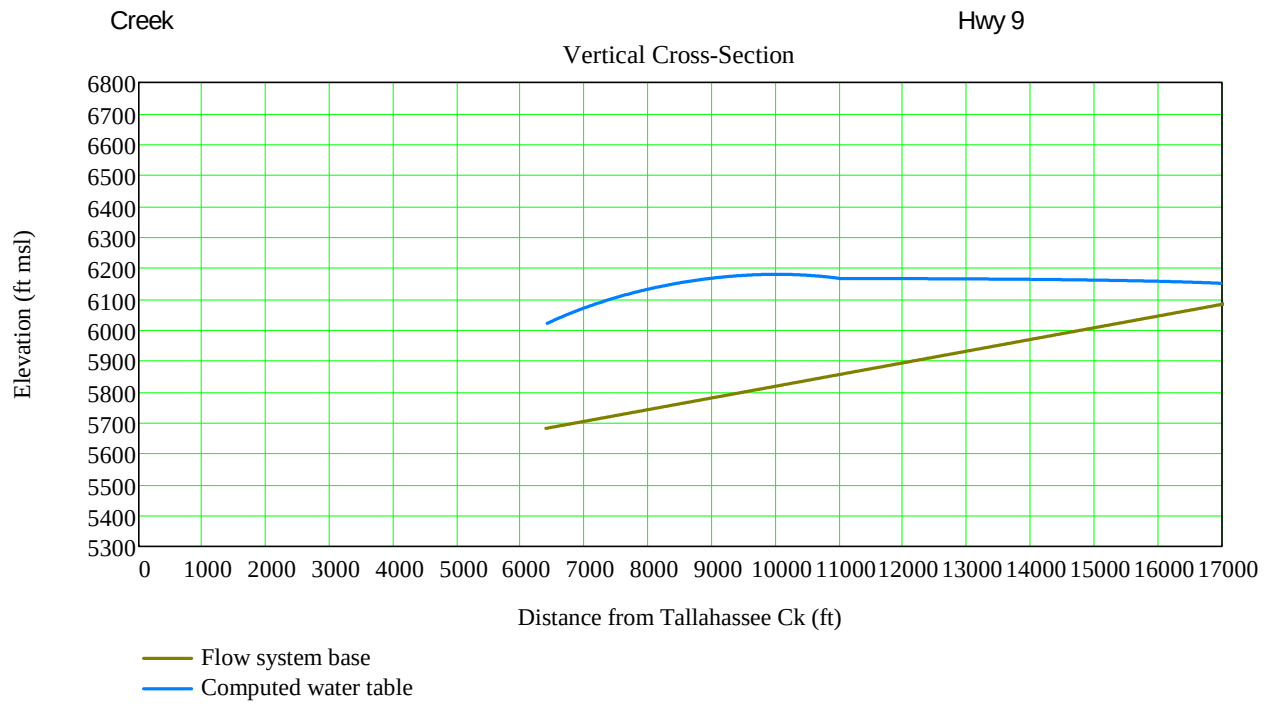
$$\text{Given} \quad \frac{d}{dx} H(x) = -\frac{\frac{Q_0}{w} + W \cdot x}{K(x) \cdot (H(x) - B(x))} \quad H(0) = H_0 \quad H := \text{Odesolve}(x, L) \quad \text{Governing ODE and BC Must be a unitless equation}$$

$$\text{Base of high wall} \quad x = 0 \cdot \text{ft} \quad H(0) = 6020.0 \quad \text{Boundary condition}$$

$$\text{Highway 9} \quad x = 7100 \quad \text{Static water level is 6170} \quad H(7100) = 6164.1 \quad \text{Water level change is -5.9 ft}$$

$$\text{NE end} \quad x = 10600 \quad \text{Target value is 6150.4} \quad H(10600) = 6150.4 \quad \text{Iterate to match these values}$$

$$X(x) := x + 6400 \quad \text{Transform } x \text{ coordinate to standard cross-section. } X = \text{distance from Tallahassee Cr.}$$



Check flow rates with Darcy's law

$$Q(x) := -K(x) \cdot w \cdot (H(x) - B(x)) \cdot \frac{d}{dx} H(x) \quad \text{Darcy's law for horizontal flow with variable saturated thickness}$$

$$QQ_L := Q(0.1) \cdot \frac{\text{ft}^3}{\text{day}} \quad QQ_L = -1.977 \cdot \text{gpm} \quad \text{SW end of section (creek). Flow is to SW}$$

$$QQ_R := Q(10599) \cdot \frac{\text{ft}^3}{\text{day}} \quad QQ_R = 3.817 \cdot \text{gpm} \quad \text{NE end of section. Flow is to NE}$$

$$QQ_R - QQ_L = 5.79 \cdot \text{gpm} \quad \text{Total flow leaving cross-section}$$

For steady-state, these should be equal

$$LL \cdot ww \cdot WW = 5.80 \cdot \text{gpm} \quad \text{Total recharge into cross-section}$$

Discussion

This is a 1-D vertical-section groundwater hydraulic calculation. The SW-NE orientation of the section is shown on the attached map. The left (SW) side of the section is at the base of the pit wall. The right (NE) side of section is NE of Hwy 9. Total horizontal length of the section is 10,600 ft. Highway 9 is located at $x = 7100$ ft

Solution assumes horizontal flow according to the Dupuit assumption to account for variable saturated thickness. This is usually a good approximation if flow lines have slopes of less than 15 percent, which should be the case here.

The SW end of the section is a fixed head boundary (elevation 6020 ft msl) that conforms with the base elevation of the pit wall

Granite hydraulic conductivity (KK_g) is 1.36×10^{-6} cm/sec. The assumed granite hydraulic conductivity is based on pumping tests conducted at three wells within and near the pit area.

Sedimentary rock hydraulic conductivity (KK_s) is 1.36×10^{-4} cm/sec (100 times KK_g). This hydraulic conductivity provides an estimated well yield of about 10.5 gpm, which is reasonable for a domestic well.

A fault is located at $x = 4600$ ft. Granite exists southeast of the fault. Sedimentary rock exists northeast of the fault. The fault does not operate as barrier or conduit to flow. Hydraulically, it provides the transition from granite to sedimentary rock.

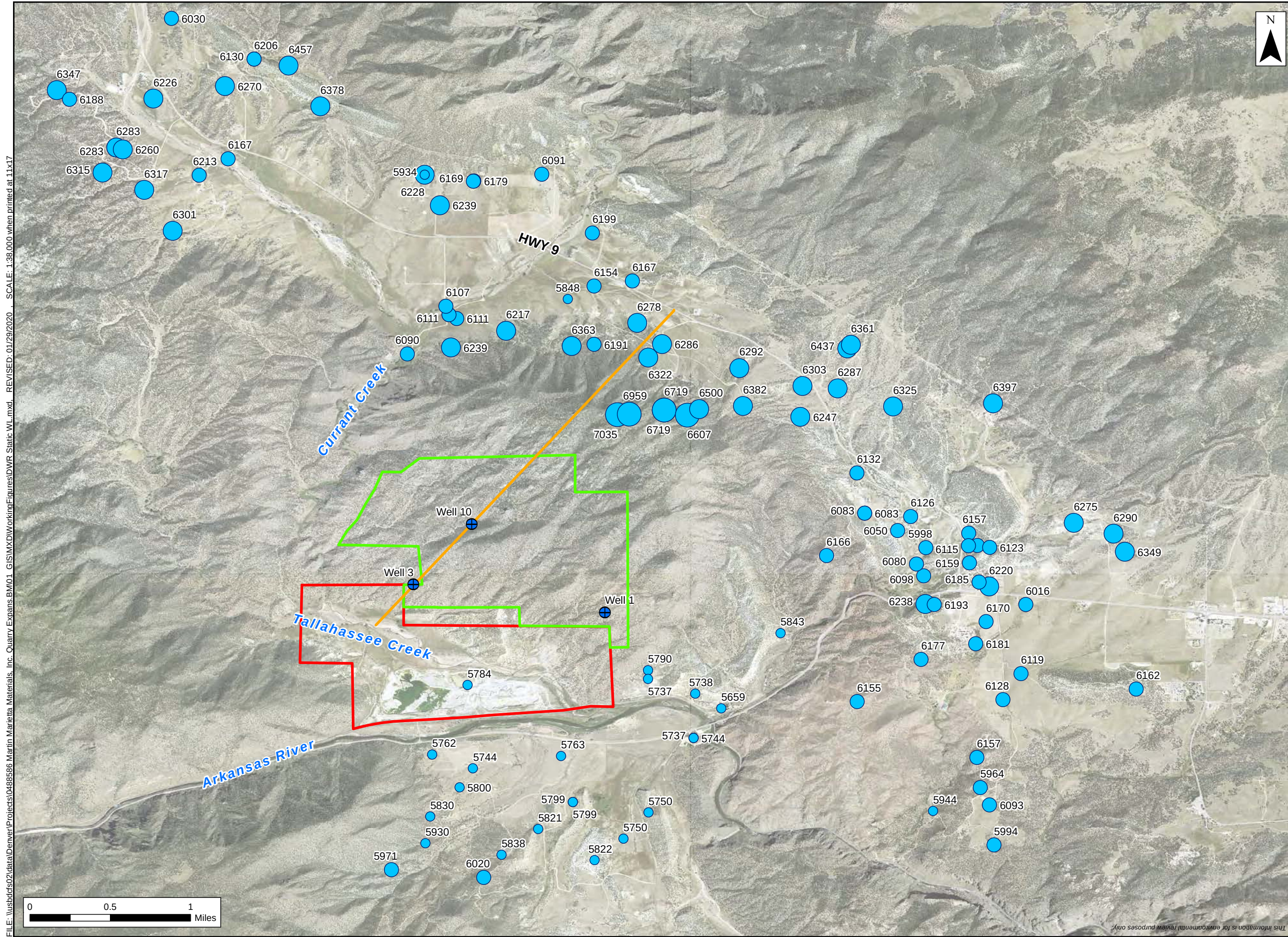
Evenly distributed recharge of 0.154 in/yr. This is a calibrated value.

Mathcad solves the inhomogeneous ordinary differential equation (ODE) using the 4th order Runge-Kutta method.

The solution is iterated so the water table elevation at the NE end of the section is 6153 ft msl. This is the computed value obtained from the pre-mining solution. This boundary is considered sufficiently far (NE) of Highway 9 as to not be affected by the pit drawdown.

After computations are completed, a coordinate transformation is used to align this section with the section used for the pre-mining analysis. The pre-mining section goes from Tallahassee Creek ($X = 0$) to the NE end of the section $X = 17,000$ ft.

FILE: \\usbdcds02\data\Denver\Projects\0488586 Martin Marietta Materials, Inc. Quarry Expans.BM01 GIS\MXD\WorkingFigures\DWR Static WL.mxd REVISED: 01/29/2020 SCALE: 1:38,000 when printed at 11x17



Legend

Mine Permit Boundary

Proposed Expansion

⊕ Monitoring Well

— Cross Section A-A'

DWR Static Water Level (ft)

- 5659.00 - 5944.00
- 5944.01 - 6213.00
- 6213.01 - 6500.00
- 6500.01 - 7035.00

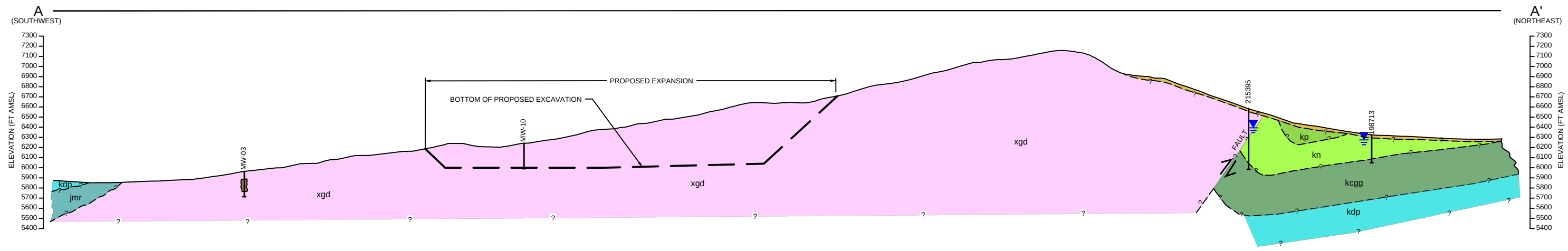
Notes:
Numbers are DWR static water levels.

DWR Static Water Levels
Parkdale Quarry Expansion
Martin Marietta
Fremont County, Colorado



This information is for environmental review purposes only.

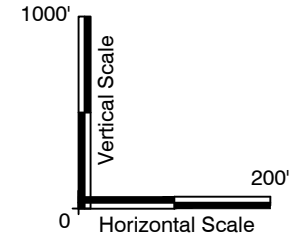
J. Estrada 4/08/2020 0488586.05 G:\DWGS\0488586 Parkdale Quarry\05\048858605-01.dwg



LEGEND

- Top Soil/Fill
- Clayey Fracture Fill
- kp - Pierre Shale
- kn - Niabara Formation
- kcgg - Carlile Shale, Greenhorn Limestone, and Graneros Shale
- kdp - Dakota Sandstone and Purgatoire Formation
- jmr - Morrison and Ralston Creek Formation
- xgd - Granodiorite

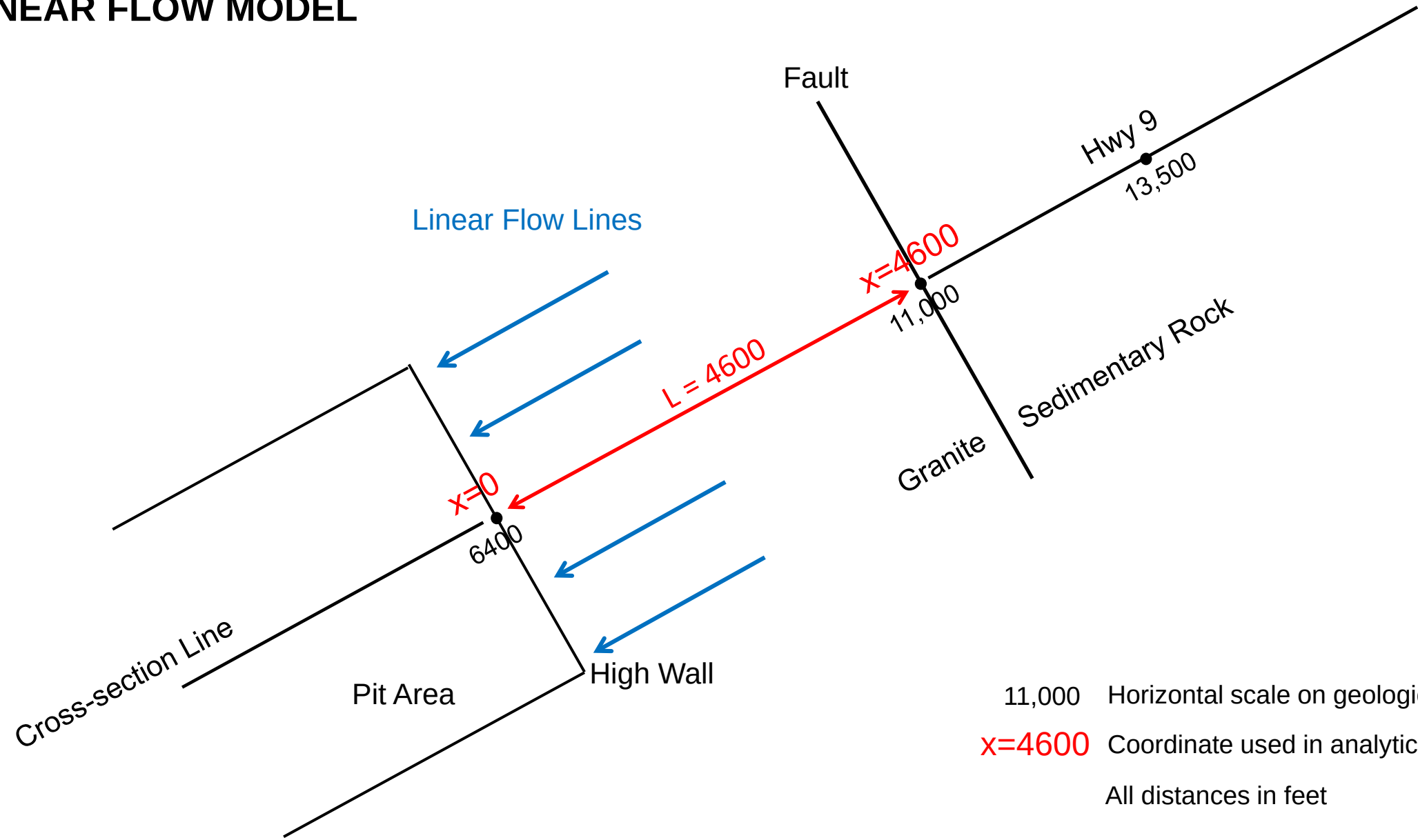
- Well
- Water Level
- Bottom of Proposed Excavation
- Fault Movement



Cross Section A-A'
Parkdale Quarry Expansion
Martin Marietta
Fremont County, Colorado

APPENDIX E DRAWDOWN AND INFLOW TRANSIENT ANALYSIS

LINEAR FLOW MODEL



Transient Linear Flow Analysis

$$K := 1.36 \cdot 10^{-6} \cdot \frac{\text{cm}}{\text{sec}}$$
$$S_y := 0.01$$
$$b := 450 \cdot \text{ft}$$
$$w := 3000 \cdot \text{ft}$$
$$s_p := 300 \cdot \text{ft}$$
$$\alpha := \frac{K \cdot b}{S_y}$$
$$s(x,t) := s_p \cdot \text{erfc}\left(\frac{x}{2 \cdot \sqrt{\alpha \cdot t}}\right)$$

Hydraulic conductivity of granite based on pumping tests

Specific yield of fractured bedrock

Thickness of bedrock "aquifer"

Width of flow tube with linear flow

Change in head (drawdown) at pit wall (x = 0)

Hydraulic diffusivity

Drawdown solution; Carslaw and Jaeger (1959; section 2.4; modified eq 3)

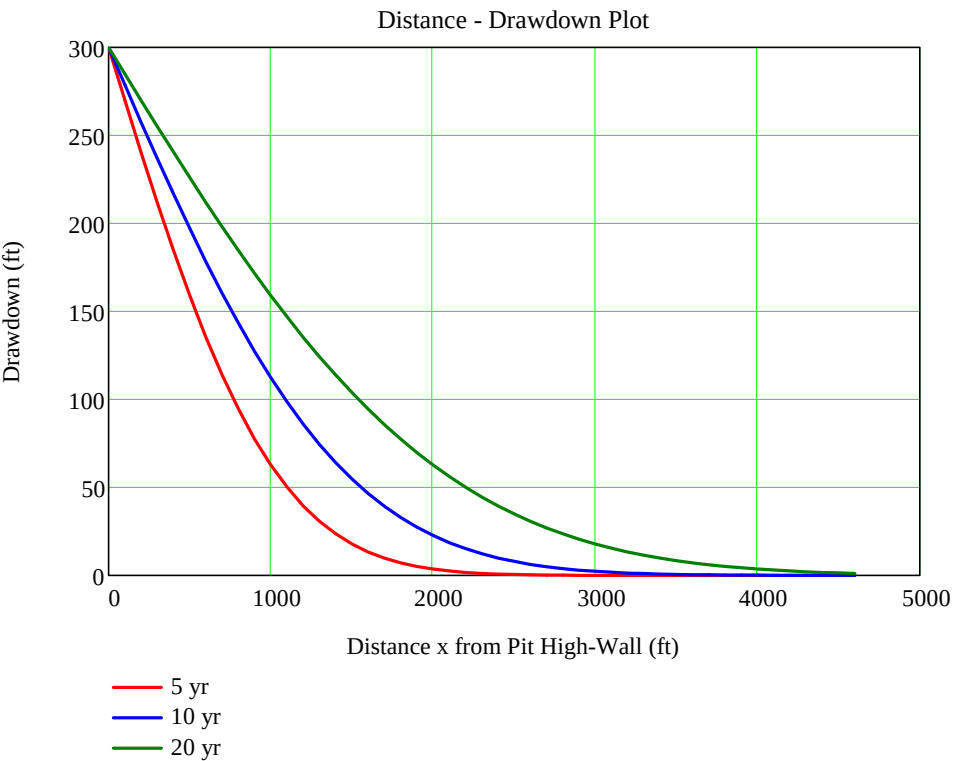
$$\alpha = 173.48 \cdot \frac{\text{ft}^2}{\text{day}}$$

Distance - Drawdown

t is time after "instantaneous" excavation of the pit

$t_1 := 5 \cdot \text{yr}$ $t_2 := 10 \cdot \text{yr}$ $t_3 := 20 \cdot \text{yr}$

$x := 0 \cdot \text{ft}, 100 \cdot \text{ft}.. 4600 \cdot \text{ft}$



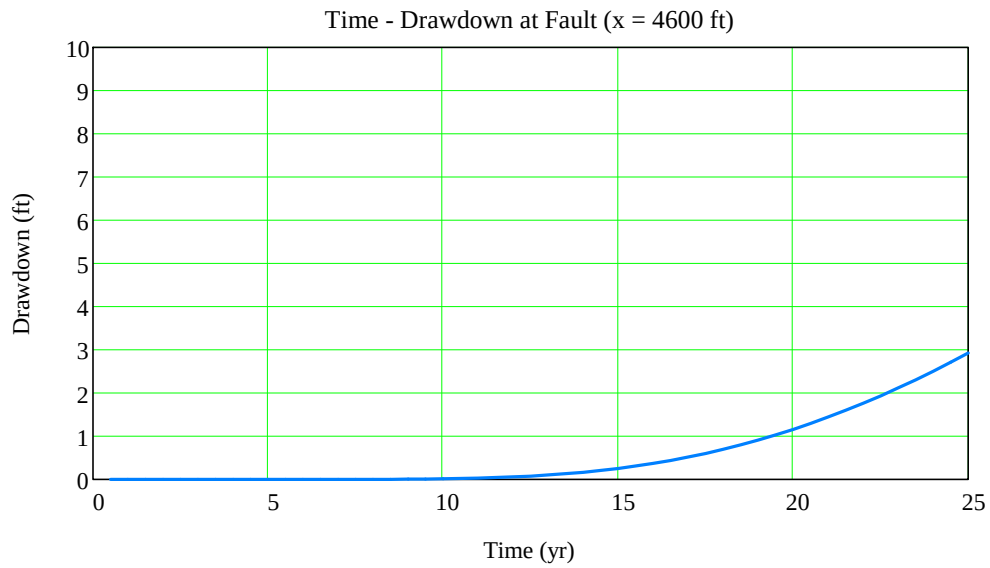
Pit high-wall is at x = 0 (6400 ft on geologic cross-section)

Fault is at x = 4600 ft (11,000 feet on geologic cross-section)

Time - Drawdown at Fault (x = 4600 ft)

t := 0.5·yr, 1·yr .. 25·yr

x := 4600·ft



Time - Flow Rate at Pit High-Wall (x = 0)

$x_w := 0 \cdot \text{ft}$

$$Q(t) := -K \cdot w \cdot b \cdot \frac{d}{dx} s(x, t)$$

