Second Semi-Annual 2013 Groundwater Monitoring and Reclamation Progress Report for the State 1-18 Lease Site Lincoln County, Colorado COGCC Case 4320

Prepared for:

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November 2013

1.0 INTRODUCTION

Nicholson GeoSolutions LLC was retained by Ritchie Exploration, Inc. (Ritchie) to continue groundwater monitoring activities at the State 1-18 Lease, a plugged and abandoned oil well site located in Lincoln County, Colorado. The site is located on the floodplain of Big Sandy Creek near Limon, Colorado in the SE¼ SW¼, Section 18, T9S, R56W.

Produced water from the well was discharged into an evaporation pond at the site until August 2007, at which time the well was shut in and remediation of the evaporation pit was conducted.

As part of the remediation activities, a series of groundwater monitoring wells were installed and sampled at the site in September and October 2007. Groundwater Monitoring Reports have been prepared for the site by Buys & Associates, Inc. from November 2007 to January 2011 and by Nicholson GeoSolutions from April 2011 to the present. The frequency of groundwater monitoring was reduced from quarterly to semi-annually and analysis of BTEX was discontinued beginning with the April 2012 sampling event with the approval of the COGCC.

This report provides the results of groundwater monitoring conducted at the site on October 13, 2013 and compares these results to previous sampling results. In addition, this report provides an assessment of the progress of final reclamation of the site.

2.0 GROUNDWATER MONITORING

2.1 Field Procedures

Groundwater samples were collected from three wells (MW-3, MW-4, and MW-12) on October 13th, 2013. Prior to sampling, water levels were measured in ten on-site monitoring wells using an electronic water level indicator to evaluate the depth to groundwater and groundwater flow direction. The site layout and the locations of the monitoring wells are shown on Figure 1.

Samples were collected using a new polyethylene bailer for each well. Prior to sampling, at least three casing volumes of water were removed from the well by bailing. Measurements of pH, temperature, and specific conductance were made at 1.5-gallon intervals during well purging. Purging continued until at least three casing volumes of water had been removed and consecutive readings of pH, temperature, and specific conductance were within 10 percent, indicating that all stagnant water had been removed from the well casing and that fresh groundwater was present for sampling.

Samples were collected in appropriate pre-preserved containers supplied by the laboratory and placed on ice in a cooler. All samples were shipped to Environmental Science Corporation (ESC) Lab Sciences in Mt. Juliet, Tennessee for analysis of sulfate and chloride by EPA Method 9056, and Total Dissolved Solids (TDS) by EPA Method SM 2540C.

2.2 Water Levels and Aquifer Flow

Water level data are provided in Table 1. Groundwater flow direction at the site is generally to the east-southeast. The water levels are 1.14 to 1.29 feet lower than those recorded in April 2013.

Table 1 Water Level Elevations

Well ID	Elevation of Top of PVC Casing (feet above mean sea level)	Depth to Water (feet below ground surface)	Elevation of Groundwater Surface (feet above mean sea level)
MW-1	5285.20	13.37	5271.83
MW-3	5283.81	13.03	5270.78
MW-4	5282.63	12.30	5270.33
MW-5	5281.93	11.98	5269.95
MW-6	5282.58	12.36	5270.22
MW-7	5284.25	13.45	5270.80
MW-8	5286.38	15.50	5270.88
MW-9	5284.48	13.17	5271.31
MW-11	5281.98	11.72	5270.26
MW-12	5283.64	12.14	5271.50

2.3 Conductivity, pH, and Temperature Measurements

Table 2 presents measurements of conductivity, pH, and temperature collected at the time of sampling. Conductivity in well MW-4 exceeded the background (upgradient) value of 1,779 micromhos/centimeter (µmhos/cm) measured in well MW-12.

Table 2 Field Parameters Measured During Sampling

Well ID	pH (Standard Units)	Specific Conductance (µmhos/cm)	Temperature (° Celsius)
MW-3	7.55	1,613	15.4
MW-4	7.76	2,340	14.2
MW-12 (upgradient)	7.51	1,779	14.8

2.4 Analytical Results

Analytical results for groundwater samples collected during this sampling event are provided in Table 3. The laboratory data report is included in Appendix A.

Table 3 Groundwater Analytical Results, October 13, 2013

Well ID	Chloride (mg/l)	Sulfate (mg/l)	TDS (mg/l)
MW-3	32	640	1,200
MW-4	**72**	800	1,600
MW-12 (background)	29	880	1,400
COGCC Allowable Concentration	36.25[1]	1,100[1]	1,750[1]

[1]Allowable concentration is 1.25 times the background concentration measured in well MW-12
Bold values exceed allowable concentrations

Background (upgradient) groundwater conditions are represented by well MW-12. Chloride was reported at 29 milligrams per liter (mg/l) and TDS at 1,400 mg/l for the background well for this sampling event, down slightly from the values of 30 mg/l and 1,500 mg/l recorded in April 2013. Sulfate was reported at 880 mg/l, similar to previous sample results.

Chloride exceeded the COGCC allowable concentration of 36.25 mg/l (1.25 times the background concentration measured in well MW-12) in well MW-4. Chloride in well MW-4 increased slightly from 68 mg/l in April 2013 to 72 mg/l for this sampling event. Chloride in well MW-3 decreased from 53 mg/l in April 2013 to 32 mg/l and is now below the allowable concentration for the first time since sampling began in 2007.

TDS was reported at 1,200 mg/l and 1,600 mg/l for wells MW-3 and MW-4, similar to previous results and below the COGCC allowable limit of 1,750 mg/l. Sulfate concentrations ranged from 640 mg/l to 880 mg/l and were below the COGCC allowable concentration of 1,100 mg/l for wells MW-3 and MW-4.

Table 4 provides a comparison of chloride concentrations for the remaining well with chloride above the COGCC allowable concentration at the site (MW-4). Chloride has dropped by 95% in well MW-4 since use of the evaporation pit ceased in August 2007.

Table 4 Comparison of Chloride Results for MW-4

Well ID	Initial Concentration (mg/l)[1]	Current Concentration (mg/l)	Percent Change
MW-4	1,470	72	-95%

[1]Well MW-4 was first sampled in October 2007

2.5 Data Quality Review

A data quality review was conducted using the quality assurance reports supplied by ESC and standard EPA data validation guidelines. All analyses were conducted within the recommended holding times, and all method blank results were reported as not detected. All Laboratory Control Sample (LCS), surrogate, and Matrix Spike/Matrix Spike Duplicate (MS/MSD) recoveries were within the laboratory control limits.

All results are usable for the intended purposes (no results were rejected during data validation).

3.0 Reclamation Progress

Inspection of the site and assessment of the final reclamation progress was performed on October 13, 2013. Appendix B provides photographs of the vegetative cover at the site.

The inspection showed that the overall vegetative coverage of the site is about the same as that observed during the last inspection in April 2013. The vegetative cover was mostly grasses and common weeds dominated by Koshia.

Overall coverage was estimated to be about 90-100% on the former wellhead area. The overall coverage was 80-100% over approximately 90% of the salt-impacted area, and 70-80% over the remaining 10%. The coverage over the former evaporation pit and process area was about 40-60% in the north half of the area and 60-80% over the southern half. No significant bare areas were noted.

4.0 SUMMARY AND RECOMMENDATIONS

4.1 SUMMARY

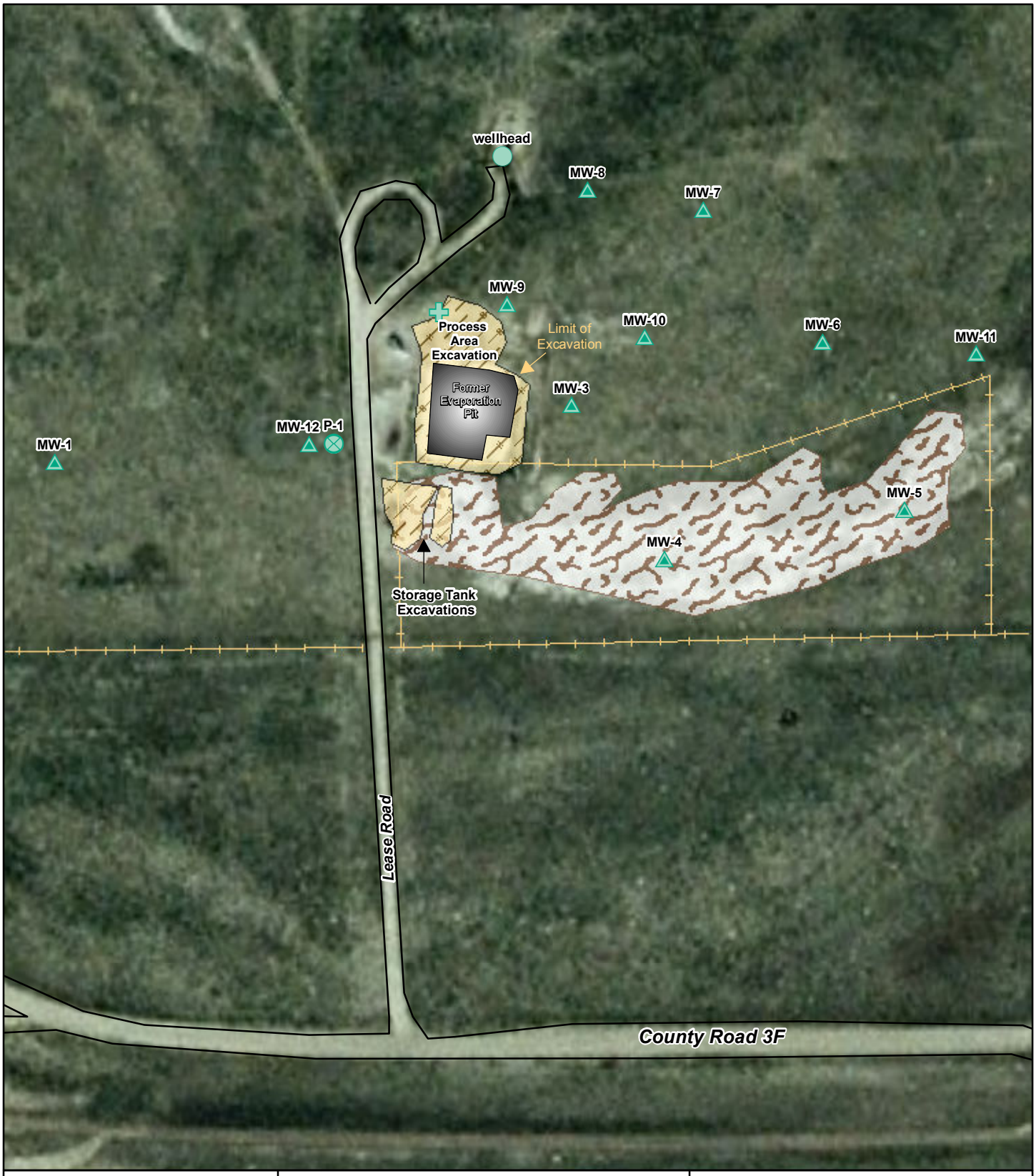
For the October 2013 sampling event, chloride exceeded the COGCC allowable concentration of 36.25 mg/l in well MW-4 (72 mg/l). Chloride in well MW-3 decreased from 53 mg/l in April 2013 to 32 mg/l and is now below the allowable concentration for the first time since sampling began in 2007. All sulfate and TDS concentrations were below the COGCC allowable concentrations.

Chloride has dropped by 95% in well MW-4 since use of the evaporation pit ceased in August 2007. TDS concentrations have been within the range of background concentrations at the site for the past four sampling events.

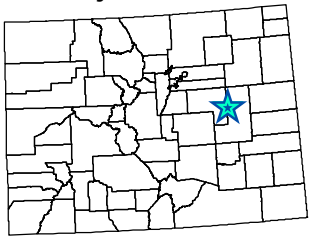
Overall vegetative coverage of the site is about the same as that noted in the last inspection in April 2013. Coverage was estimated to be about 90-100% on the former wellhead area, 70-100% on the salt-impacted area, and 40-80% over the former evaporation pit and process area.

4.2 RECOMMENDATIONS

It is recommended that sampling of the remaining impacted well on site (MW-4), well MW-3, and background well MW-12 be continued on a semi-annual basis until chloride concentrations return to background levels in well MW-4. At that time, sampling would be increased to quarterly until four consecutive quarters of results are below the COGCC allowable concentrations.



Project Location



Legend

- Monitoring Well
- Production Well
- Pit Water Sample
- Wellhead
- Former Pit Location
- Excavation Areas
- Salt Impacted Soils
- Fence

0 37.5 75 150 225 300

Feet

N

W E

S

Ritchie Exploration, Inc.

State 1-18 Lease Site Plan Figure 1

Nicholson GeoSolutions, LLC

APPENDIX A
Laboratory Report

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

Dave Nicholson
Ritchie Exploration, Inc.- Wichita, KS
8100 E. 22th St. North
Wichita, KS 67226

Report Summary

Friday October 18, 2013

Report Number: L663188
Samples Received: 10/15/13
Client Project:

Description: State 1-18

The analytical results in this report are based upon information supplied by you, the client, and are for your exclusive use. If you have any questions regarding this data package, please do not hesitate to call.

Entire Report Reviewed By:

Mark W. Beasley , ESC Representative

Laboratory Certification Numbers

A2LA - 1461-01, AIHA - 100789, AL - 40660, CA - 01157CA, CT - PH-0197, FL - E87487, GA - 923, IN - C-TN-01, KY - 90010, KYUST - 0016, NC - ENV375/DW21704/BIO041, ND - R-140. NJ - TN002, NJ NELAP - TN002, SC - 84004, TN - 2006, VA - 460132, WV - 233, AZ - 0612, MN - 047-999-395, NY - 11742, WI - 998093910, NV - TN000032011-1, TX - T104704245-11-3, OK - 9915, PA - 68-02979, IA Lab #364

Accreditation is only applicable to the test methods specified on each scope of accreditation held by ESC Lab Sciences.
Note: The use of the preparatory EPA Method 3511 is not approved or endorsed by the CA ELAP.

Where applicable, sampling conducted by ESC is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.

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YOUR LAB OF CHOICE

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REPORT OF ANALYSIS

Dave Nicholson
Ritchie Exploration, Inc.- Wichita,
8100 E. 22th St. North
Wichita, KS 67226

October 18, 2013

ESC Sample # : L663188-01

Date Received : October 15, 2013
Description : State 1-18

Site ID :

Sample ID : MW-3

Project # :

Collected By : DK Nicholson
Collection Date : 10/13/13 15:55

Parameter	Result	Det. Limit	Units	Method	Date	Dil.
Chloride	32.	10.	mg/l	9056	10/16/13	10
Sulfate	640	50.	mg/l	9056	10/16/13	10
Dissolved Solids	1200	10.	mg/l	2540 C-2011	10/17/13	1

BDL - Below Detection Limit
Det. Limit - Practical Quantitation Limit(PQL)
Note:
The reported analytical results relate only to the sample submitted.

.
Reported: 10/18/13 16:08 Printed: 10/18/13 16:08

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REPORT OF ANALYSIS

Dave Nicholson
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8100 E. 22th St. North
Wichita, KS 67226

October 18, 2013

ESC Sample # : L663188-02

Date Received : October 15, 2013
Description : State 1-18

Site ID :

Sample ID : MW-12

Project # :

Collected By : DK Nicholson
Collection Date : 10/13/13 16:15

Parameter	Result	Det. Limit	Units	Method	Date	Dil.
Chloride	29.	20.	mg/l	9056	10/16/13	20
Sulfate	880	100	mg/l	9056	10/16/13	20
Dissolved Solids	1400	10.	mg/l	2540 C-2011	10/17/13	1

BDL - Below Detection Limit
Det. Limit - Practical Quantitation Limit(PQL)
Note:
The reported analytical results relate only to the sample submitted.

.
Reported: 10/18/13 16:08 Printed: 10/18/13 16:08

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REPORT OF ANALYSIS

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8100 E. 22th St. North
Wichita, KS 67226

October 18, 2013

ESC Sample # : L663188-03

Date Received : October 15, 2013
Description : State 1-18

Site ID :

Sample ID : MW-4

Project # :

Collected By : DK Nicholson
Collection Date : 10/13/13 16:30

Parameter	Result	Det. Limit	Units	Method	Date	Dil.
Chloride	72.	20.	mg/l	9056	10/16/13	20
Sulfate	800	100	mg/l	9056	10/16/13	20
Dissolved Solids	1600	10.	mg/l	2540 C-2011	10/18/13	1

BDL - Below Detection Limit
Det. Limit - Practical Quantitation Limit(PQL)
Note:
The reported analytical results relate only to the sample submitted.

.
Reported: 10/18/13 16:08 Printed: 10/18/13 16:08

Summary of Remarks For Samples Printed
10/18/13 at 16:08:55

TSR Signing Reports: 134
R5 - Desired TAT

Sample: L663188-01 Account: RITEXPWKS Received: 10/15/13 09:00 Due Date: 10/22/13 00:00 RPT Date: 10/18/13 16:08

Sample: L663188-02 Account: RITEXPWKS Received: 10/15/13 09:00 Due Date: 10/22/13 00:00 RPT Date: 10/18/13 16:08

Sample: L663188-03 Account: RITEXPWKS Received: 10/15/13 09:00 Due Date: 10/22/13 00:00 RPT Date: 10/18/13 16:08

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Quality Assurance Report
Level II

L663188

October 18, 2013

Laboratory Blank

Analyte	Result	Units	% Rec	Limit	Batch	Date Analyzed
Chloride	< 1	mg/l			WG687284	10/16/13 06:50
Sulfate	< 5	mg/l			WG687284	10/16/13 06:50
Dissolved Solids	< 10	mg/l			WG687219	10/17/13 15:55
Dissolved Solids	< 10	mg/l			WG687220	10/18/13 15:15

Duplicate

Analyte	Units	Result	Duplicate	RPD	Limit	Ref Samp	Batch
Chloride	mg/l	18.0	18.0	0.0	20	L663214-02	WG687284
Sulfate	mg/l	21.0	21.0	0.0	20	L663214-02	WG687284
Chloride	mg/l	43.0	44.0	2.30	20	L663252-02	WG687284
Sulfate	mg/l	55.0	55.0	0.0	20	L663252-02	WG687284
Dissolved Solids	mg/l	1430	1450	1.39	5	L663017-01	WG687219
Dissolved Solids	mg/l	4130	4190	1.44	5	L663132-01	WG687220

Laboratory Control Sample

Analyte	Units	Known Val	Result	% Rec	Limit	Batch
Chloride	mg/l	40	40.2	101.	90-110	WG687284
Sulfate	mg/l	40	41.0	103.	90-110	WG687284
Dissolved Solids	mg/l	8800	8590	97.6	85-115	WG687219
Dissolved Solids	mg/l	8800	8620	98.0	85-115	WG687220

Laboratory Control Sample Duplicate

Analyte	Units	Result	Ref	%Rec	Limit	RPD	Limit	Batch
Chloride	mg/l	40.2	40.2	100.	90-110	0.0	20	WG687284
Sulfate	mg/l	41.0	41.0	102.	90-110	0.0	20	WG687284
Dissolved Solids	mg/l	8450	8590	96.0	85-115	1.64	5	WG687219
Dissolved Solids	mg/l	8560	8620	97.0	85-115	0.698	5	WG687220

Matrix Spike

Analyte	Units	MS Res	Ref Res	TV	% Rec	Limit	Ref Samp	Batch
Chloride	mg/l	65.8	16.0	50	100.	80-120	L663214-03	WG687284
Sulfate	mg/l	87.0	39.0	50	96.0	80-120	L663214-03	WG687284

Matrix Spike Duplicate

Analyte	Units	MSD	Ref	%Rec	Limit	RPD	Limit	Ref Samp	Batch
Chloride	mg/l	66.5	65.8	101.	80-120	1.06	20	L663214-03	WG687284
Sulfate	mg/l	87.8	87.0	97.6	80-120	0.915	20	L663214-03	WG687284

* Performance of this Analyte is outside of established criteria.
For additional information, please see Attachment A 'List of Analytes with QC Qualifiers.'

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Wichita, KS 67226

Quality Assurance Report
Level II

L663188

October 18, 2013

Batch number /Run number / Sample number cross reference

WG687284: R2841152: L663188-01 02 03
WG687219: R2841220: L663188-01 02
WG687220: R2841750: L663188-03

* * Calculations are performed prior to rounding of reported values.
* Performance of this Analyte is outside of established criteria.
For additional information, please see Attachment A 'List of Analytes with QC Qualifiers.'

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Quality Assurance Report
Level II

L663188

October 18, 2013

The data package includes a summary of the analytic results of the quality control samples required by the SW-846 or CWA methods. The quality control samples include a method blank, a laboratory control sample, and the matrix spike/matrix spike duplicate analysis. If a target parameter is outside the method limits, every sample that is effected is flagged with the appropriate qualifier in Appendix B of the analytic report.

Method Blank - an aliquot of reagent water carried through the entire analytic process. The method blank results indicate if any possible contamination exposure during the sample handling, digestion or extraction process, and analysis. Concentrations of target analytes above the reporting limit in the method blank are qualified with the "B" qualifier.

Laboratory Control Sample - is a sample of known concentration that is carried through the digestion/extraction and analysis process. The percent recovery, expressed as a percentage of the theoretical concentration, has statistical control limits indicating that the analytic process is "in control". If a target analyte is outside the control limits for the laboratory control sample or any other control sample, the parameter is flagged with a "J4" qualifier for all effected samples.

Matrix Spike and Matrix Spike Duplicate - is two aliquots of an environmental sample that is spiked with known concentrations of target analytes. The percent recovery of the target analytes also has statistical control limits. If any recoveries that are outside the method control limits, the sample that was selected for matrix spike/matrix spike duplicate analysis is flagged with either a "J5" or a "J6". The relative percent difference (%RPD) between the matrix spike and the matrix spike duplicate recoveries is all calculated. If the RPD is above the method limit, the effected samples are flagged with a "J3" qualifier.

APPENDIX B
Photographs

Former pit area looking southeast

Former pit area near well MW-3

Former wellhead area looking northeast

South portion of former pit area looking southwest

Former pit area looking east

Former salt-impacted area looking west

Former salt-impacted area looking east

Former salt-impacted area looking east near well MW-4