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Office of Environmental Management – Grand Junction

MOAB UTAH
UMTRA Project

Moab UMTRA Project Ground Water and Surface Water Monitoring Report January through June 2017

Revision 0

November 2017

U.S. Department of Energy

Office of Environmental Management

Prepared by the Technical Assistance Contractor under contract number DE-EM00005014
for the U.S. Department of Energy Office of Environmental Management, Grand Junction, Colorado.

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Ground Water and Surface Water Monitoring Report
January through June 2017

Revision 0

Review and Approval

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11/2/17
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Revision History

Revision Number	Date	Reason for Revision
0	November 2017	Initial issue.

Contents

Figures

Figures (*continued*)

Tables

Appendices

Acronyms and Abbreviations

bgs	below ground surface
CCB	continuing calibration blank
CCV	continuing calibration verification
CF	Configuration
CFR	Code of Federal Regulations
COC	chain-of-custody
CRI	reporting limit verification
DOE	U.S. Department of Energy
EB	equipment blank
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
ft	feet or foot
ICB	initial calibration blank
ICP	inductively coupled plasma
ICV	initial calibration verification
IDL	instrument detection limit
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
MB	method blank
MDL	method detection limit
µg/L	micromillimeters per liter
mg/L	milligrams per liter
MS	matrix spike or mass spectrometry
MSD	matrix spike duplicate
QC	quality control
r^2	correlation coefficient
RIN	report identification number
RL	reporting limit
RPD	relative percent difference
SD	serial dilution
SDG	sample data group
TDS	total dissolved solids
UMTRA	Uranium Mill Tailings Remedial Action

1.0 Introduction

1.1 Purpose

The purpose of this semi-annual report is to summarize the results associated with ground water and surface water samples collected from the U.S. Department of Energy (DOE) Moab Uranium Mill Tailings Remedial Action (UMTRA) Project sites during the first half of 2017. The results of the data validation process are also presented.

Five sampling events were completed during this time frame. The first event was completed in January 2017. Samples were collected from select Configuration (CF) 1 and CF4 monitoring wells to determine the impacts of freshwater injection in this area of the well field. Samples were also collected from the ground water monitoring wells adjacent to the tree plot area (in the vicinity of CF3) in an attempt to measure the impact of phytoremediation on the ammonia ground water plume. All these locations are shown in Figure 1.

The second sampling event included the collection of a ground water sample from Crescent Junction well 0205 (location shown on Figure 2) in February 2017. This ground water sample was collected as part of the quarterly monitoring for the first quarter of 2017.

The third event was completed in May 2017. Ground water samples were collected from again from the CF4 monitoring wells and also from CF5 ground water extraction wells (Figure 1). The CF4 samples were collected to determine the effectiveness of the freshwater injection system into CF4 wells by measuring the contaminant concentrations in monitoring wells upgradient and downgradient of the CF4 injection wells.

The CF5 samples were collected to determine the effectiveness of the ground water extraction system, with the concentrations measured at each of the CF5 extraction wells used to update the ammonia and uranium concentrations for mass removal calculations and contaminant concentration trends.

The fourth event was started in May and completed in June 2017. Samples were collected from a variety of site-wide ground water and surface water locations. Ground water and surface water sampling locations shown on Figures 3 and 4, respectively.

Site-wide ground water sampling was conducted to assess any changes and trends in water quality. The surface water samples associated with this event were collected to assess surface water quality adjacent to the site compared to the upstream and downstream water quality.

The fifth and final event for the first half of 2017 was associated with the Crescent Junction quarterly monitoring for the second quarter of 2017. In June 2017, another sample was collected from well 0205 to compare to the previous results.

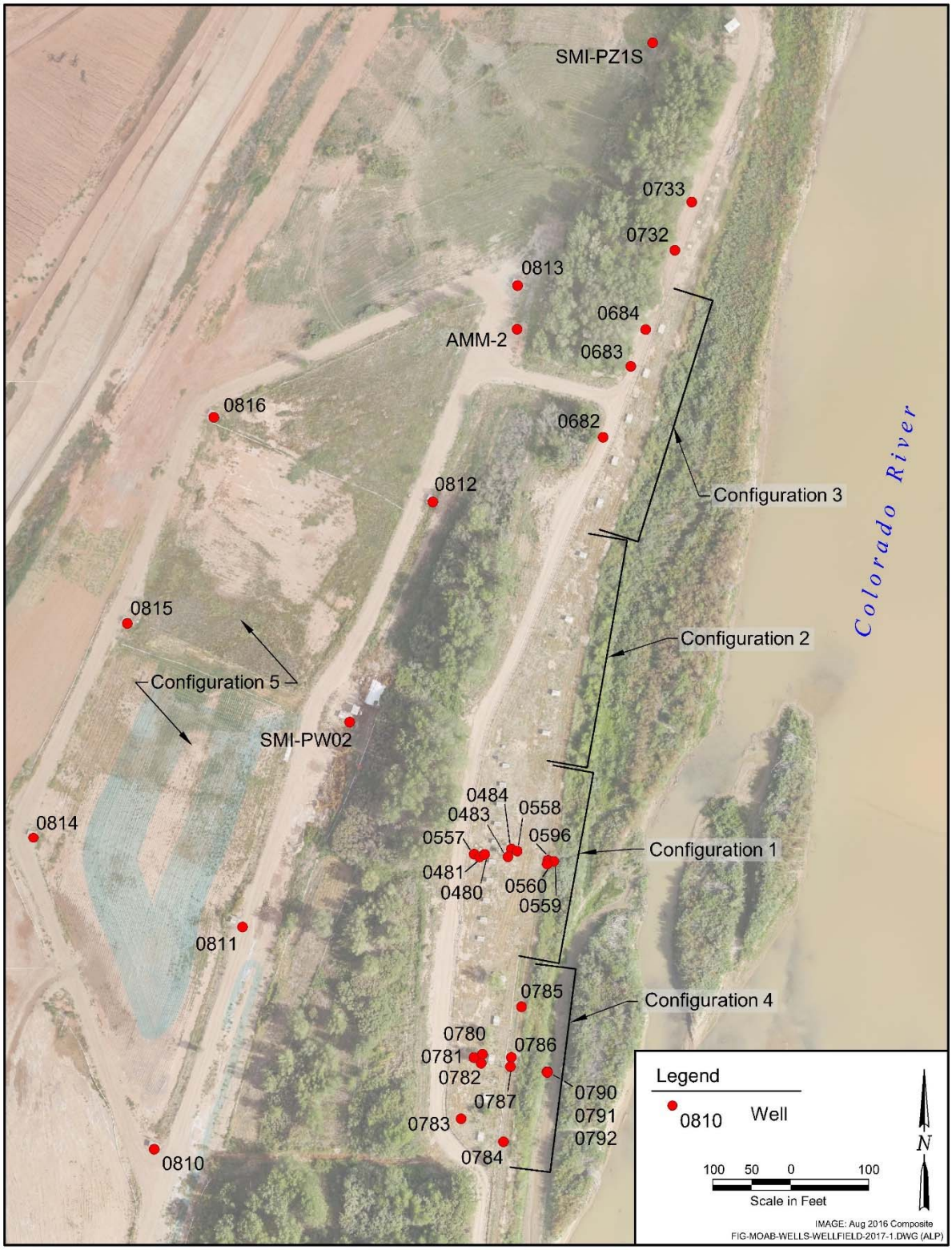

Figure 1. January and May 2017 CF1, CF4, and Tree Plot Area Ground Water Sampling Locations

Figure 2. February and June 2017 Crescent Junction Sampling Location

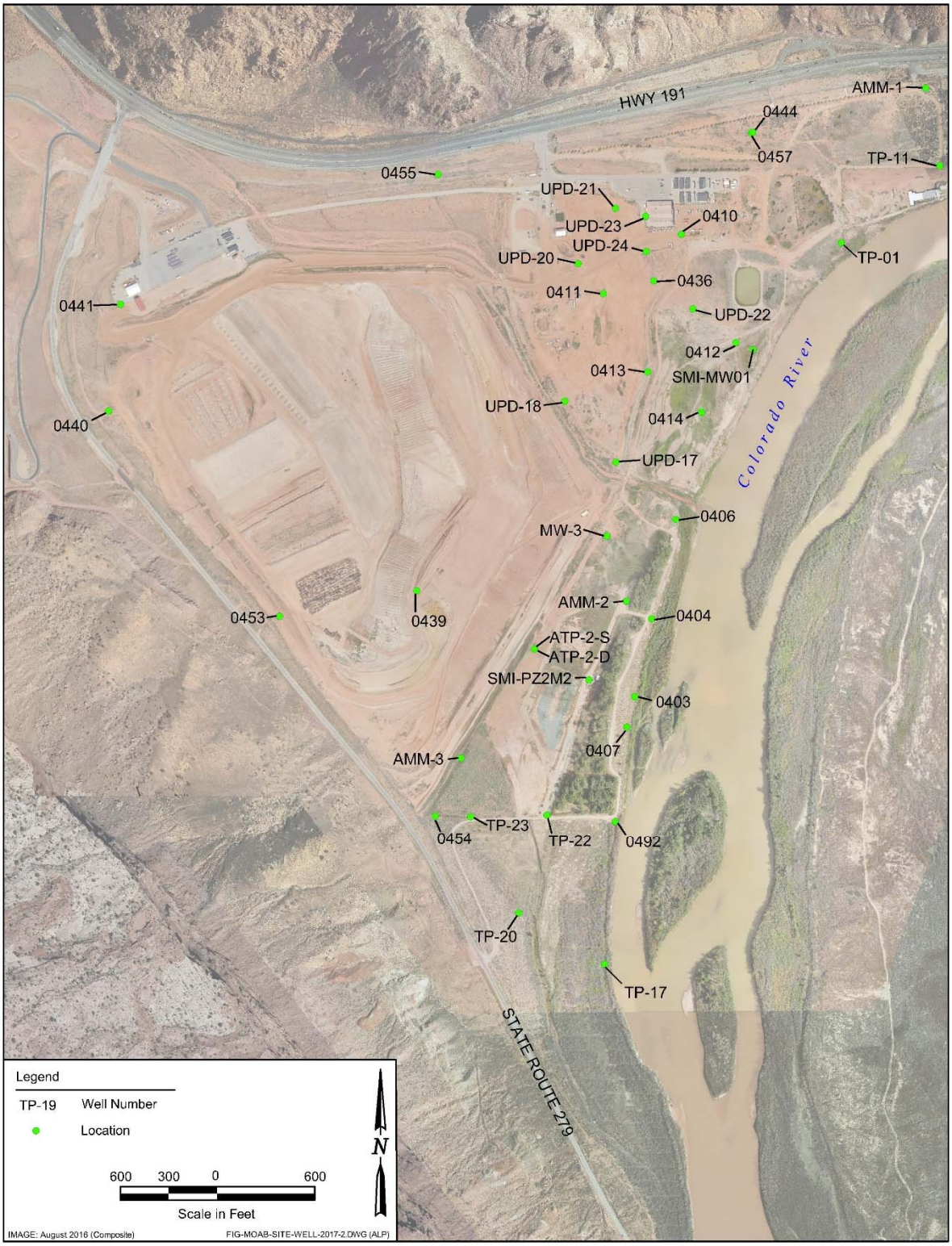

Figure 3. May 2017 Site-wide Ground Water Sampling Locations

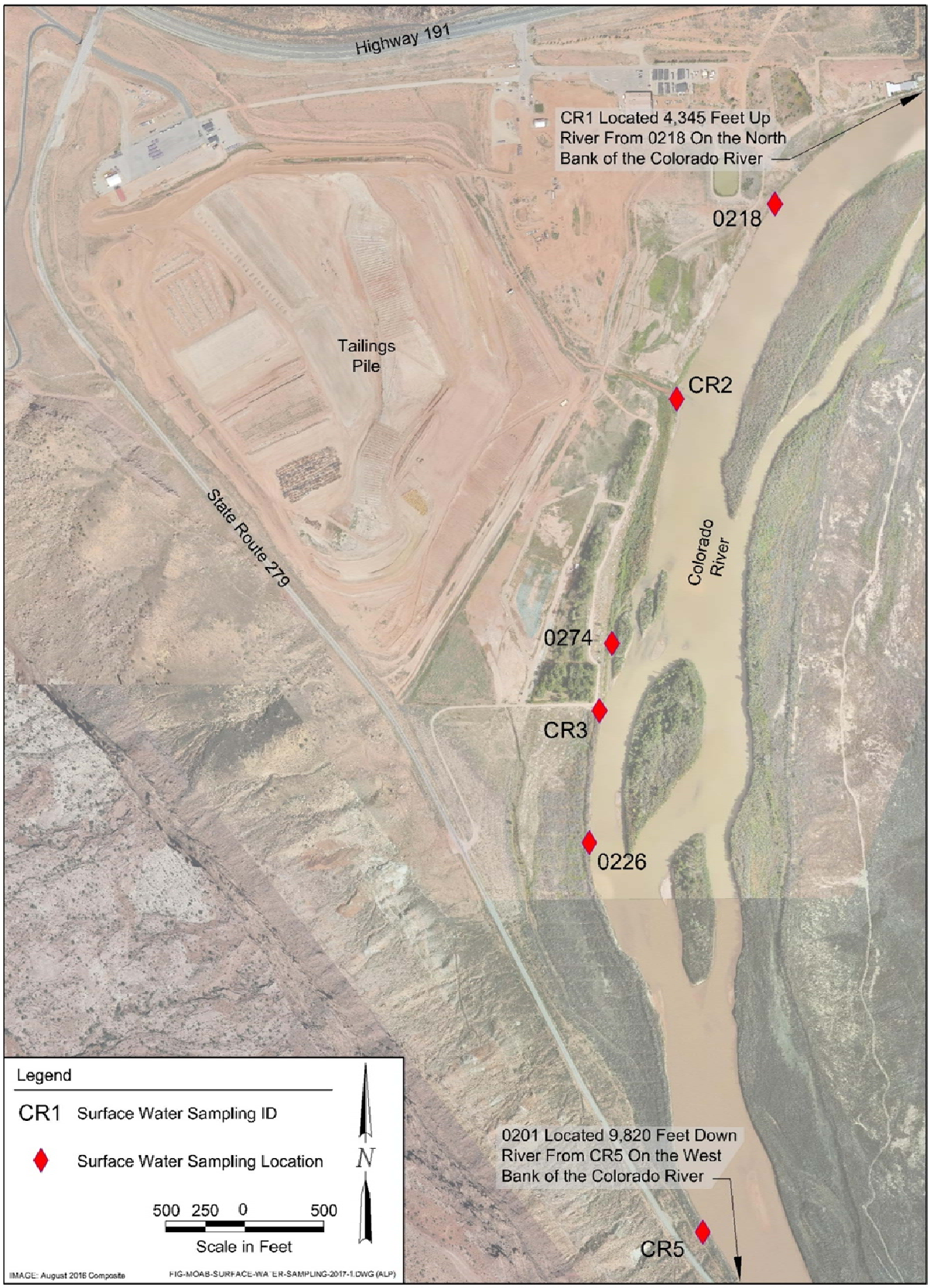

Figure 4. May 2017 Surface Water Sampling Locations

1.2 Scope

This Report presents the Summary of Sampling Events and Data Assessments, including a summary of the anomalous data generated by the validation process, and results for these events. Sampling and analyses were conducted in accordance with the *Moab UMTRA Project Surface Water/Ground Water Sampling and Analysis Plan* (DOE-EM/GJTAC1830). All data validation follows criteria in the *Moab UMTRA Project Standard Practice for Validation of Laboratory Data* (DOE-EM/GJTAC1855).

Appendix A includes Water Sampling Field Activities Verification, Minimums and Maximums Report, Water Quality Data, Water Level Data, and the trip report associated with the January 2017 CF1, CF4 and Tree Plot sampling event. Appendices B and C contain the Water Sampling Field Activities Verifications, Minimums and Maximums Report, Water Quality Data, Water Level Data, and the trip reports associated with the February 2017 Crescent Junction and May 2017 CF4 and CF5 sampling events, respectively.

The Water Sampling Field Activities Verification, Minimums and Maximums Report, Water Quality Data, Water Level Data, and the trip report for the May 2017 Site-wide sampling event are contained in Appendix D. Appendix E includes the Water Sampling Field Activities Verification, Minimums and Maximums Report, Water Quality Data, Trip Blank Report, Water Level Data, and the trip report associated with the June 2017 Crescent Junction sampling event. All Colorado River flow discussed in this document is measured from the U.S. Geological Survey Cisco gaging station number 09180500. River elevation data were collected adjacent to the site.

The Minimums and Maximums Reports were generated (by the Sample Management System and the SEEPro database) to determine if the applicable data are within a normal statistical range. The new data set was compared to the historical data to determine if the new data fall outside the historical range. The results are not considered anomalous if: (1) identified low concentrations are the result of low detection limits, (2) the concentration detected is less or more than 50 percent of historical minimum or maximum values, or (3) there were fewer than five historical samples for comparison.

2.0 Summary of Sampling Events

2.1 January 2017 CF1, CF4, and Tree Plot Sampling Event

Ground water samples were collected from the nine CF1 and eight CF4 monitoring wells to determine how effectively the freshwater injection system was diluting the ammonia concentrations, particularly downgradient of the CF1 and CF4 injection wells. Seven ground water samples in the vicinity of the tree plot area (near CF3) were collected to determine if phytoremediation had impacted ammonia concentrations.

2.2 February 2017 Crescent Junction Sampling Event

A ground water sample was collected from well 0205 as part of the quarterly monitoring at the Crescent Junction site. If water is present in any of the four monitoring wells during a quarterly monitoring event, a sample is collected.

2.3 May 2017 CF4 and CF5 Sampling Event

Ground water samples were collected from the eight CF4 monitoring wells to determine how effectively the freshwater injection system was diluting the ammonia concentrations, particularly downgradient of the CF4 injection wells. Ground water samples were collected from the eight CF5 ground water extraction wells to update the mass removal calculations.

2.4 May 2017 Site-wide Sampling Event

Forty-six ground water and surface water samples were collected as part of the site-wide event. This event corresponds to the time frame when the Colorado River is generally experiencing peak spring runoff conditions. The 38 ground water samples were collected from a variety of downgradient and cross-gradient locations at various depths. The locations in the vicinity of the northeastern uranium plume were also included. All samples were submitted to ALS Global laboratory for ammonia and uranium analysis. The eight surface water samples were collected upstream, downstream, and adjacent to the site during this event.

2.5 June 2017 Crescent Junction Sampling Event

Another sample of the water contained in well 0205 was collected during this event as part of the second quarter 2017 monitoring at the Crescent Junction site.

3.0 Data Assessment

The following definitions are associated with the data validation process and apply to Section 3.0. Data validation details are provided in the following sections of this report for the individual sampling events.

Laboratory Instrument Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure the instrument continues to be capable of producing acceptable qualitative and quantitative data.

In addition, for inductively coupled plasma (ICP) analytes (uranium), reporting limit verifications (CRIs) verify the linearity of the calibration curve near the reporting limit (RL). For ICP-mass spectrometry (MS) analytes (uranium), instrument tuning and performance criteria are checked for mass calibration and resolution verifications. For ICP-MS analyte uranium, internal standards are also analyzed to indicate stability of the instruments.

Method and Calibration Blanks
Method blanks (MBs) are analyzed to assess any contamination that may have occurred during sample preparation. Both initial calibration blanks (ICBs) and continuing calibration blanks (CCBs) are analyzed to assess instrument contamination before and during sample analysis. Detected sample results greater than the method detection limit (MDL) or instrument detection limit (IDL) (depending on method requirements) were qualified "J" when the detections were less than five times the blank concentration. Non-detects were not qualified.

Equipment Blanks
An equipment blank (EB) is a sample of analyte-free media collected from a rinse of non-dedicated sampling equipment used to sample surface water. EBs are collected to document adequate decontamination of non-dedicated equipment.

Laboratory Control Sample Duplicates
Matrix spike (MS) samples may not be generated due to a limited sample volume. Instead, Laboratory Control Sample Duplicates **(**LCSDs) are performed. LCSDs are samples prepared in the laboratory that contain known concentrations of the analyte of interest. The results are used to demonstrate the lab is in control of the preparation and analysis of samples.

Matrix Spike and Replicate Analysis
MS sample analysis, performed at a frequency of one per 20 samples unless otherwise noted, is a measure of the ability to recover analytes in a particular matrix. The MS sample results are required to be within the recovery limits.

Laboratory Replicate Analysis
The laboratory replicate results demonstrate acceptable laboratory precision. The relative percent difference (RPD) values for the reported matrix spike duplicate (MSD) results for all other analytes should be less than 20 percent for results greater than five times the RL.

Field Duplicate Analysis
Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory replicates, which measure only laboratory performance. The duplicate results must met the U.S. Environmental Protection Agency (EPA)-recommended laboratory duplicate criteria of less than 20 RPD for results that are greater than five times the RL.

Laboratory Control Samples
Laboratory control samples (LCSs) provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. Per national environmental laboratory accreditation requirements provided by the NELAC Institute, an MS may be used in place of an LCS provided the acceptance criteria are as stringent.

Metals Serial Dilution
Serial dilution (SD) samples are prepared and analyzed for the metals analyses to monitor chemical or physical interferences in the sample matrix.

Detection Limits/Dilutions
Dilutions are prepared in a consistent and acceptable manner when they are required.

CRIs are re-run at the beginning of each analytical run as a measure of accuracy near the reporting limit (RL). CRIs were made at the required frequency to verify the linearity of the calibration curve near the RL.

3.1 January 2017 CF1, CF4 and Tree Plot Sampling Event

3.1.1 Laboratory Performance Assessment

This validation was performed according to *Standard Practice for Validation of Laboratory Data*. The procedure was applied at Level 3, Data Deliverables Examination. All analyses were successfully completed.

General Information and Validation Results

Report Identification Number (RIN)	1701091
Laboratory:	ALS Global, Fort Collins, Colorado
Sample Data Group (SDG) Numbers:	1702172, 1702248
Analysis:	Metals and Inorganics
Validator:	Elizabeth Moran
Review Date:	18 September 2017

The samples were prepared and analyzed using accepted procedures as shown in Table 1.

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to Table 3 for an explanation of the data qualifiers applied.

Table 1. January 2017 CF1, CF4, and Tree Plot Sampling Event, Analytes and Methods

Analyte	Preparation Method	Analytical Method
Ammonia as N, NH_3-N	EPA 350.1	EPA 350.1
Uranium	SW-846- 3005A	SW-846 6020A

Table 2. January 2017 CF1, CF4, and Tree Plot Sampling Event, Data Qualifiers

Sample Number	Location	Analyte	Flag	Reason
1702172-1 through -13 1702248-1 through -13	All in SDG 1702172 All in SDG 1702248	Uranium	J	SD-1
1702248-1 through -13	All in SDG 1702248	Ammonia	J	MS-1

"J" indicates results are estimated; it becomes "UJ" for analytical results lower than the detection limit.

Table 3. January 2017 CF1, CF4, and Tree Plot Sampling Event, Reason Codes for Data Flags

Reason Code	Qualifier (Detects)	Qualifier (Non-detects)	Explanation
SD-1	J	U	No SDs were run during the uranium analysis.
MS-1	J	U	The recovery of the MS sample (131%) was out of the acceptable range (75-125%).

QC = quality control
"J" indicates results are estimated; it becomes "UJ" for analytical results lower than the detection limit.

Sample Shipping/Receiving
ALS Global in Fort Collins, Colorado, received a total of 26 samples for RIN 1607087 in two shipments. SDG 1702172 consisted of 13 uranium and 13 ammonia samples and arrived on February 10, 2017, (UPS tracking number 1Z5W1Y510199066555). SDG 1702248 also consisted of 13 uranium and 13 ammonia samples and arrived on February 16, 2017 (UPS tracking number 1Z5W1Y510198294168). Both shipments were accompanied by chain-of-custody (COC) forms.

The COC forms were checked to confirm all samples were listed on the form with sample collection dates and times, and that signatures and dates were present, indicating sample relinquishment and receipt. The sample submittal documents, including the COC forms and the sample tickets, had no errors or omissions.

Preservation and Holding Times
SDG 1701091 was received intact with a temperature of 3.2°C, and SDG 1702248 was received with a temperature of 3.6°C, which comply with requirements. All samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Laboratory Instrument Calibration

Method SW-846 6020A, Uranium
The calibration for the uranium analyses were performed on February 14 and 21, 2017. The initial calibrations were all performed using five calibration standards and four blanks, resulting in calibration curves with correlation coefficient (r^2) values greater than 0.995. The values of the calibration curve intercepts for uranium were positive and less than three times the IDL.

Initial calibration verification (ICV) and continuing calibration verification (CCV) checks were made at the required frequency. All calibration checks met the acceptance criteria.

CRIs were made at the required frequency to verify the linearity of the calibration curve near the RL. The CRI verifications were within the acceptance criteria range for all SDGs.

Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries were stable and within acceptable ranges.

Method EPA 350.1, Ammonia as N
Initial calibrations for ammonia as N were performed using six calibration standards and two blanks on February 17 and 21, 2017. The calibration curve had an r^2 value greater than 0.995 and an intercept less than three times the MDL.

ICV and CCV checks were made at the required frequency. All calibration check results for all SDGs were within the acceptance criteria.

Method and Calibration Blanks
Two of the CCBs for ammonia were slightly above the MDL, but none of the sample results were less than five times the highest CCB; therefore, the data were not qualified.

Equipment Blanks
No EBs were collected during this sampling event since all samples were collected using dedicated equipment.

Matrix Spike Analysis
The uranium MS samples passed the requirements, and none of the data had to be qualified.

The ammonia MS sample in SDG 1702248 had a percent recovery of 131 percent, which is higher than the acceptable range of 75 to 125 percent; therefore, the ammonia samples in SDG 1702248 are flagged "J" for reason MS-1.

Laboratory Replicate Analysis
All of the MSDs in both SDGs were within the acceptable range; therefore, no data were qualified.

Field Duplicate Analysis
A duplicate sample was collected from locations 0481 (1702172-2) and SMI-PZ1S (1702248-13).

The duplicate results met the EPA-recommended laboratory duplicate criteria of less than 20 percent relative difference (RPD) for results that are greater than five times the RL.

Laboratory Control Samples
LCSs were not reported for uranium.

Metals Serial Dilution
Since no MS samples were run on the uranium samples, there were no SD samples. The uranium samples are flagged "J" for reason SD-1.

Completeness
Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Electronic Data Deliverable Files
The Electronic Data Deliverable (EDD) files arrived on February 28 and March 2, 2017, for SDGs 1702172 and 1702248, respectively. The contents of the files were manually examined to ensure all and only the requested data were delivered in compliance with requirements and that the sample results accurately reflected the data contained in the sample data package.

3.1.2 Minimums and Maximums Report and Anomalous Data Review
The Minimums and Maximums Report for this sampling event is located in Appendix A. Based on the results, all concentrations were within the acceptable ranges, and there were no anomalous data values associated with this sampling event.

3.2 February 2017 Crescent Junction Sampling Event

3.2.1 Laboratory Performance Assessment

This validation was performed according to *Standard Practice for Validation of Laboratory Data*. The procedure was applied at Level 2, Data Deliverables Examination. All analyses were successfully completed.

General Information and Validation Results

RIN	1702092
Laboratory:	ALS Global, Fort Collins, Colorado
SDG Number:	1702367
Analysis:	Metals, Inorganics, Isotopic Uranium
Validator:	Elizabeth Moran
Review Date:	19 September 2017

The samples were prepared and analyzed using accepted procedures as shown in Table 4.

Data Qualifier Summary

Analytical results were qualified as listed in Table 5. Refer to Table 6 for an explanation of the data qualifiers applied.

Table 4. February 2017 Crescent Junction Sampling Event, Analytes and Methods

Analyte	Preparation Method	Analytical Method
Ammonia as N, NH_3-N	EPA 350.1	EPA 350.1
Alkalinity	EPA 310.1	EPA 310.1
Bicarbonate	EPA 310.1	EPA 310.1
Carbonate	EPA 310.1	EPA 310.1
Nitrate/Nitrite as N	EPA 353.2	EPA 353.2
Bromide	EPA 300.0 Rev 2.1	300.0 Rev 2.1
Chloride	EPA 300.0 Rev 2.1	300.0 Rev 2.1
Fluoride	EPA 300.0 Rev 2.1	300.0 Rev 2.1
Sulfate	EPA 300.0 Rev 2.1	300.0 Rev 2.1
Arsenic, Barium, Boron, Cadmium, Calcium, Chromium, Copper, Iron, Lead, Magnesium, Manganese, Molybdenum, Potassium, Selenium, Silver, Sodium	SW-6010B	EPA 6010B
Uranium	SW-846- 3005A	SW-846 6020A
TDS	EPA 160.1	540 C
Isotopic Uranium	SOP 776/778	SOP 714

TDS = total dissolved solids

Table 5. February 2017 Crescent Junction Sampling Event, Data Qualifiers

Sample Number	Location	Analyte	Flag	Reason
1702367-1	0205	TDS, all Metals	J	MS-1

TDS = total dissolved solids
"J" indicates results are estimated and becomes "UJ" for analytical results lower than the detection limit.

Table 6. February 2017 Crescent Junction Sampling Event, Reason Codes for Data Flags

Reason Code	Qualifier (Detects)	Qualifier (Non-detects)	Explanation
MS-1	J	U	Per method requirements, matrix QC was performed for this analysis; however, a sample from this order number was not the selected QC sample; therefore, the data were not included in the narrative.

QC = quality control
"J" indicates results are estimated and becomes "UJ" for analytical results lower than the detection limit.

Sample Shipping/Receiving
ALS Global in Fort Collins, Colorado, received one sample for RIN 1702092 in a shipment of one cooler. The shipment (SDG 1702367) contained one ground water sample from Crescent Junction well 0205. The temperature of the cooler was 2.7°C, and it arrived on February 24, 2017 (UPS tracking number 1Z5W1Y510199236175). Analytical results were qualified as listed in Table 5. Refer to Table 6 for an explanation of the data qualifiers applied.

The COC forms were checked to confirm all of the samples were listed on the form with sample collection dates and times, and that signatures and dates were present, indicating sample relinquishment and receipt. The sample submittal documents, including the COC forms and the sample tickets, had no errors or omissions.

Preservation and Holding Times
The samples were received in the correct container types and had been correctly preserved for the requested analyses. The samples were analyzed within the applicable holding time.

Case Narratives
The case narratives were reviewed, and all detects where found to be within quality control (QC) procedures except for those described below.

Matrix Spike and Replicate Analysis
For SDG 1702367, an MS was performed for the ammonia as N, nitrate/nitrite as N, alkalinity, bicarbonate, carbonate, bromide, chloride, fluoride, and sulfate analyses.

For the remaining analytes, the selected QC sample was from another client and not included in the narrative, so the total dissolved solids (TDS) and all of the metal analyses are flagged "J" for reason MS-1.

Completeness
Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Electronic Data Deliverable Files
The EDD files arrived on March 18, 2017. The contents of the files were manually examined to ensure all and only the requested data were delivered in compliance with requirements and that the sample results accurately reflected the data contained in the sample data package.

3.2.2 Minimums and Maximums Report and Anomalous Data Review

The Minimums and Maximums Report for this sampling event is located in Appendix B. Based on the results, one data point was associated with the chromium concentration more than 50 percent above the historic maximum concentration. Table 7 presents a summary of the results of the Minimums and Maximums Report for this event.

Table 7. Anomalous Data Associated with the February 2017 Crescent Junction Sampling Event

Location	Sample Date	Analyte	Concentration (µg/L)	Historical Minimum (µg/L)	Historical Maximum (µg/L)	Disposition
0205	2/22/2017	Chromium	0.044	0.00051	0.021	Higher detection limit used during analysis

µg/L = micrograms per liter

3.3 May 2017 CF4 and CF5 Sampling Event

3.3.1 Laboratory Performance Assessment

This validation was performed according to *Standard Practice for Validation of Laboratory Data*. The procedure was applied at Level 3, Data Deliverables Examination. All analyses were successfully completed.

General Information and Validation Results

RIN 1705093
Laboratory: ALS Global, Fort Collins, Colorado
SDG Number: 1705298
Analysis: Inorganics and Metals
Validator: Elizabeth Moran
Review Date: 18 September 2017

The samples were prepared and analyzed using accepted procedures as shown in Table 8.

Table 8. May 2017 CF4 and CF5 Sampling Event, Analytes and Methods

Analyte	Preparation Method	Analytical Method
Ammonia as N, NH_3-N	EPA 350.1	EPA 350.1
Uranium	SW-846- 3005A	SW-846 6020A

Data Qualifier Summary

Analytical results were qualified as listed in Table 9. Refer to Table 10 for an explanation of the data qualifiers applied.

Table 9. May 2017 CF4 and CF5 Sampling Event, Data Qualifiers for Data Flags

Sample Number	Location	Analyte	Flag	Reason
1705298-1 through -17	All in SDG1705298	Uranium	J	SD-1

"J" indicates results are estimated; it becomes "UJ" for analytical results lower than the detection limit.

Table 10. May 2017 CF4 and CF5 Sampling Event, Reason Codes for Data Flags

Reason Code	Qualifier (Detects)	Qualifier (Non-detects)	Explanation
SD-1	J	U	No SDs were run during the uranium analysis.

"J" indicates results are estimated; it becomes "UJ" for analytical results lower than the detection limit.

Sample Shipping/Receiving

ALS Global in Fort Collins, Colorado, received a total of 34 samples for RIN 1610088 in one shipment. SDG 1611025 consisted of 34 uranium and 34 ammonia samples that arrived on November 1, 2016 (UPS tracking number 1Z5W1Y510192998169). The SDG was accompanied by a COC form.

The COC form was checked to confirm all samples were listed on the form with sample collection dates and times, and that signatures and dates were present, indicating sample relinquishment and receipt. The sample submittal documents, including the COC forms and the sample tickets, had no errors or omissions.

Preservation and Holding Times

SDG 1705093 was received intact with a temperature of 3.5°C, which complies with requirements. All samples were received in the correct container types and had been correctly preserved for the requested analyses. All samples were analyzed within the applicable holding times.

Laboratory Instrument Calibration

Method SW-846 6020A, Uranium

The calibration for the uranium analyses were performed on May 25, 2017. The initial calibrations were all performed using five calibration standards and four blanks, resulting in calibration curves with r^2 values greater than 0.995. The values of the calibration curve intercepts for uranium were positive and less than three times the IDL.

ICV and CCV checks were made at the required frequency. All calibration checks met the acceptance criteria.

CRIs were made at the required frequency to verify the linearity of the calibration curve near the RL. The CRI verifications were within the acceptance criteria range for all SDGs.

Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries were stable and within acceptable ranges.

EPA 350.1, Ammonia as N

Initial calibrations for ammonia as N were performed using six calibration standards and two blanks on May 25, 2017. The calibration curve had an r^2 value greater than 0.995 and an intercept less than three times the MDL.

ICV and CCV checks were made at the required frequency. All calibration check results for all SDGs were within the acceptance criteria.

Method and Calibration Blanks
Two of the CCBs for uranium were slightly above the MDL, but none of the sample results were more than five times the highest CCB; therefore, the data were not qualified.

Equipment Blanks
No EBs were collected during this sampling event since all samples were collected using dedicated equipment.

Matrix Spike Analysis
The uranium SDG used a laboratory control sample for the MS. Since the sample was not from another client and is of a similar matrix, the use of a spiked LCS is acceptable.

The ammonia MS sample passed the requirements listed in the procedure, and none of the data had to be qualified.

Laboratory Replicate Analysis
All of the MSDs in both SDGs were within the acceptable range; therefore, no data were qualified.

Field Duplicate Analysis
A duplicate sample was collected from location 0781 (1705298-2). The duplicate results met the EPA-recommended laboratory duplicate criteria of less than 20 percent relative difference (RPD) for results that are greater than five times the RL.

Laboratory Control Samples
LCSs were not reported for uranium. Per national environmental laboratory accreditation requirements provided by the NELAC Institute, an MS may be used in place of an LCS provided the acceptance criteria are as stringent.

Metals Serial Dilution
Since no MS samples were run on the uranium samples, there were no SD samples. The uranium samples are flagged “J” for reason SD-1.

Detection Limits/Dilutions
Dilutions were prepared in a consistent and acceptable manner when they were required. The required detection limits were achieved for all analytes.

Completeness
Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Electronic Data Deliverable Files
The EDD files arrived on June 23, 2017. The contents of the files were manually examined to ensure all and only the requested data were delivered in compliance with requirements and that the sample results accurately reflected the data contained in the sample data package.

3.3.2 Minimums and Maximums Report and Anomalous Data Review

The Minimums and Maximums Report for this sampling event is located in Appendix C. Based on the results, all concentrations were within the acceptable ranges, and there were no anomalous data values associated with this sampling event.

3.4 May 2017 Site-wide Sampling Event

3.4.1 Laboratory Performance Assessment

This validation was performed according to *Standard Practice for Validation of Laboratory Data.* The procedure was applied at Level 3, Data Deliverables Examination. All analyses were successfully completed.

General Information and Validation Results

RIN 1705094
Laboratory: ALS Global, Fort Collins, Colorado
SDG Numbers: 1706138, 1706371
Analysis: Metals, Inorganics, Isotopic Uranium
Validator: Elizabeth Moran
Review Date: 08 September 2017

The samples were prepared and analyzed using accepted procedures as shown in Table 11. Analytical results were qualified as listed in Table 12. Refer to Table 13 for an explanation of the data qualifiers applied.

Table 11. May 2017 Site-wide Sampling Event, Analytes and Methods

Analyte	Preparation Method	Analytical Method
Ammonia as N	EPA 350.1	EPA 350.1
Uranium	SW-846 3005A	SW-846 6020A

Table 12. May 2017 Site-wide Sampling Event, Data Qualifiers

Sample Number	Location	Analyte	Flag	Reason
1706371-18	CR1	Ammonia	J	CCB-1
1706138-1 through -29 1706371-1 through -21	All in SDG 1706138 All in SDG 1706371	Uranium	J	SD-1
1706371-1 through -21	All in SDG 1706371	Ammonia	J	MS-1
1706371-1 through -21	All in SDG 1706371	Uranium	J	MS-2
1706371-1 through -29	All in SDG 1706371	Uranium	J	MSD-1
1706371-18	CR1	Ammonia	J	CCB-1
1706138-1 through -29 1706371-1 through -21	All in SDG 1706138 All in SDG 1706371	Uranium	J	SD-1

"J" indicates results are estimated and becomes "UJ" for analytical results lower than the detection limit.

Table 13. May 2017 Site-wide Sampling Event, Reason Codes for Data Flags

Reason Code	Qualifier (Detects)	Qualifier (Non-detects)	Explanation
CCB-1	J	U	At least one CCB was higher than the MDL therefore, all detects less than five times the highest blank should be flagged.
SD-1	J	U	No SDs were run during the uranium analysis.
MS-1	J	U	Only one MS sample was run for 21 sample locations. This does not meet the requirements of 1 MS per 10 samples.
MS-2	J	U	The MS sample for the sample group was from another client.
MSD-1	J	U	No MSD data were included in the narrative.

"J" indicates results are estimated and becomes "UJ" for analytical results lower than the detection limit.

Sample Shipping/Receiving

ALS Global in Fort Collins, Colorado, received a total of 50 samples for RIN 1705094 in two shipments. SDG 1706138 consisted of 29 uranium and 29 ammonia samples and arrived on June 5, 2017 (UPS tracking number 1Z5W1Y510196822224). SDG 1706371 also consisted of 21 uranium and 21 ammonia samples and arrived on June 15, 2017, (UPS tracking number 1Z5W1Y510191630315). Both shipments were accompanied by chain-of-custody (COC) forms.

The two SDGs were accompanied by a COC form. The COC form was checked to confirm that all of the samples were listed on the form with sample collection dates and times, and that signatures and dates were present, indicating sample relinquishment and receipt. The sample submittal documents, including the COC forms and the sample tickets, had no errors or omissions.

When the second shipment (SDG 1706371) arrived at the lab, three of the sample locations were incorrectly entered (1706371-7, 1706371-8, and 1706371-9) by the lab into their database. This error was identified during the validation process, and the lab was contacted and able to fix the error without having to re-run any of the samples. The corrected data files were received on September 20, 2017.

Preservation and Holding Times

SDG 1706138 was received intact with a temperature of 3.4°C, and SDG 1706371 was received intact with a temperature of 3.6°C, which comply with requirements. All samples were received in the correct container types. The uranium samples for SDG 1706371 were preserved at the laboratory since the nitric acid dispenser in the ground water laboratory was not functioning properly. All samples analyzed were within the applicable holding times.

Laboratory Instrument Calibration

Method SW-846 6020A, Uranium

The calibration for the uranium analyses were performed on July 11 and 12 and on July 15 and 16, 2017. The initial calibrations were all performed using three calibration standards and four blanks, resulting in calibration curves with r^2)values greater than 0.995. The values of the calibration curve intercepts for uranium were positive and less than three times the IDL.

ICV and CCV checks were made at the required frequency. All calibration checks met the acceptance criteria. CRIs were made at the required frequency to verify the linearity of the calibration curve near the RL. The CRI verifications were within the acceptance criteria range for all SDGs.

Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries were stable and within acceptable ranges.

EPA 350.1, Ammonia as N

Initial calibrations for ammonia as N were performed using six calibration standards and one blank on June 8, 2017 for SDG 1706138, and using seven calibration standards and one blank on June 30, 2017 for SDG1706371. The calibration curve had a correlation coefficient (r^2) value greater than 0.995 and an intercept less than three times the MDL.

ICV and CCV checks were made at the required frequency. All calibration check results for all SDGs were within the acceptance criteria.

Method and Calibration Blanks

Six of the CCBs on the ammonia SDG 11706138 were slightly above the MDL but none of the sample results were less than the highest CCB; therefore, the data were not qualified.

Two of the CCBs on the ammonia SDG 1706371 were slightly above the MDL, and one of the sample results was less than five the highest CCB; therefore, this sample location (1706371-18, CR1), was flagged "J" for reason MS-1.

Three of the CCBs on uranium SDG 1706138 were slightly above the MDL, but none of the samples results were less than five times the highest CCB; therefore, the data were not qualified.

One CCB on uranium SDG 1706371 was slightly above the MDL, but none of the sample results were less than five times the highest CCB; therefore, the data were not qualified.

Equipment Blanks

One EB (location 2001, 1706138-16) was collected after the surface water tubing was decontaminated. The sample results are at or below the RL for ammonia. The uranium concentration is 0.0000363 milligrams per liter (mg/L), which is a lower concentration than the samples that were collected with the tubing. No data had to be qualified.

Matrix Spike Analysis

For ammonia SDG 1706371, only one MS was conducted, which does not meet the requirement of one MS for each 10 samples; therefore, the ammonia data for this SDG were flagged J for reason MS-1.

For uranium SDG 1706138, the MS sample that was slected for QC analysis was from another client, and the information was not included in the analysis; therefore, all of the uranium data on this SDG were flagged "J" for reason MS-2.

Laboratory Replicate Analysis
The uranium SDG 1706371 did not contain an MS or MSD sample; therefore, the data are flagged "J" for reason MSD-1.

Field Duplicate Analysis
Duplicate samples were collected from locations 0407 (1706138-5), 0444 (1706371-8), and 0404 (1706371-2). The duplicate results met the EPA-recommended laboratory duplicate criteria of less than 20 RPD for results that are greater than five times the RL.

Laboratory Control Samples
LCS results were acceptable for ammonia analyses. LCSs were not reported for uranium. Per national environmental laboratory accreditation requirements provided by the NELAC Institute, an MS may be used in place of an LCS provided the acceptance criteria are as stringent.

Metals Serial Dilution
Because no SD samples were run on the uranium samples in SDGs 1706138 and 1706371, the uranium samples were flagged "J" for reason SD-1.

Detection Limits/Dilutions
Dilutions were prepared in a consistent and acceptable manner when they were required. The required detection limits were achieved for all analytes.

Completeness
Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Electronic Data Deliverable Files
The EDD files for both SDGs arrived on July 31, 2017. The contents of the files were manually examined to ensure all and only the requested data were delivered in compliance with requirements and that the sample results accurately reflected the data contained in the sample data package.

3.4.2 Minimums and Maximums Report and Anomalous Data Review

The Minimums and Maximums Report for this sampling event is located in Appendix D. Based on the results, there was one anomalous data point associated the sample collected from location UPD-17, with the ammonia concentration lower than the historic minimum. Table 14 presents a summary of the results of the Minimums and Maximums Report for this event.

Table 14. Anomalous Data Associated with the May 2017 Site-wide Sampling Event

Location	Sample Date	Analyte	Concentration (mg/L)	Historical Minimum (mg/L)	Historical Maximum (mg/L)	Disposition
UPD-17	6/6/2017	Ammonia Total as N	7.2	100	320	Sample was re-analyzed by the lab, but it remains a suspect result.

3.5 June 2017 Crescent Junction Sampling Event

3.5.1 Laboratory Performance Assessment

This validation was performed according to *Standard Practice for Validation of Laboratory Data.* The procedure was applied at Level 2, Data Deliverables Examination. All analyses were successfully completed.

General Information and Validation Results

RIN 1706095
Laboratory: ALS Global, Fort Collins, Colorado
SDG Number: 1706509
Analysis: Metals, Inorganics, Isotopic Uranium
Validator: Elizabeth Moran
Review Date: 19 September 2017

The samples were prepared and analyzed using accepted procedures as shown in Table 15.

Table 15. June 2017 Crescent Junction Sampling Event, Analytes and Methods

Analyte	Preparation Method	Analytical Method
Ammonia as N, NH_3-N	EPA 350.1	EPA 350.1
Alkalinity	EPA 310.1	EPA 310.1
Bicarbonate	EPA 310.1	EPA 310.1
Carbonate	EPA 310.1	EPA 310.1
Nitrate/Nitrite as N	EPA 353.2	EPA 353.2
Bromide	EPA 300.0 Rev 2.1	300.0 Rev 2.1
Chloride	EPA 300.0 Rev 2.1	300.0 Rev 2.1
Fluoride	EPA 300.0 Rev 2.1	300.0 Rev 2.1
Sulfate	EPA 300.0 Rev 2.1	300.0 Rev 2.1
Arsenic, Barium, Boron, Cadmium, Calcium, Chromium, Copper, Iron, Lead, Magnesium, Manganese, Molybdenum, Potassium, Selenium, Silver, Sodium	SW-6010B	EPA 6010B
Uranium	SW-846- 3005A	SW-846 6020A
TDS	EPA 160.1	540 C
Isotopic Uranium	SOP 776/778	SOP 714

Analytical results were qualified as listed in Table 16. Refer to Table 17 for an explanation of the data qualifiers applied.

Table 16. June 2017 Crescent Junction Sampling Event, Data Qualifiers

Sample Number	Location	Analyte	Flag	Reason
1607557-1	0205	Alkalinity, Bicarbonate, Carbonate, TDS, Bromide, Fluoride, Sulfate, Chloride, all Metals	J	MS-1

"J" indicates results are estimated and becomes "UJ" for analytical results lower than the detection limit.

Table 17. June 2017 Crescent Junction Sampling Event, Reason Codes for Data Flags

Reason Code	Qualifier (Detects)	Qualifier (Non-detects)	Explanation
MS-1	J	U	Per method requirements, matrix QC was performed for this analysis, however, a sample from this order number was not the selected QC sample. Therefore, the data were not included in the narrative.

"J" indicates results are estimated and becomes "UJ" for analytical results lower than the detection limit.

Sample Shipping/Receiving

ALS Global in Fort Collins, Colorado, received one sample for RIN 1706095 in a shipment of one cooler. The shipment (SDG 1706509) contained one ground water sample from Crescent Junction well 0205. The temperature of the cooler was 3.0°C, and it arrived on June 25, 2017 (UPS tracking number 1Z5W1Y510190038324).

The COC forms were checked to confirm that all of the samples were listed on the form with sample collection dates and times, and that signatures and dates were present, indicating sample relinquishment and receipt. The sample submittal documents, including the COC forms and the sample tickets, had no errors or omissions.

Preservation and Holding Times

The samples were received in the correct container types and had been correctly preserved for the requested analyses. The nitric acid pipette in the ground water laboratory was not working correctly, so ALS added the appropriate amount of nitric to the metals and isotopic uranium sample jars. The samples were analyzed within the applicable holding time.

Case Narratives

The case narratives were reviewed, and all detects where found to be within QC procedures except for the following.

Method and Calibration Blanks

MBs are analyzed to assess any contamination that may have occurred during sample preparation. Both ICB and CCBs are analyzed to assess instrument contamination before and during sample analysis.

Two of the fluoride and one of the chloride CCVs failed; however, sample 1706509-1 was not bracketed by the failed CCVs.

Matrix Spike and Replicate Analysis

Sample 1706509-1 was used as the MS/MSD sample for the ammonia and nitrate/nitrite as N; but, a sample from another client was used for the rest of the analyses; therefore, the alkalinity, carbonate, bicarbonate, chloride, TDS, bromide, sulfate, and all metals data are flagged "J" for reason MS-1.

Laboratory Control Sample

LCSs provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. LCS results were acceptable for all analyses.

Completeness
Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Electronic Data Deliverable File
The EDD files arrived on August 4, 2017. The contents of the files were manually examined to ensure all and only the requested data were delivered in compliance with requirements and that the sample results accurately reflected the data contained in the sample data package.

3.5.2 Minimums and Maximums Report and Anomalous Data Review
The Minimums and Maximums Report for this sampling event is located in Appendix E. Based on the results, there were no anomalous data points associated with this event.

4.0 Results

4.1 January 2017 CF1, CF4, and Tree Plot Sampling Event Results

The observation wells surrounding the CF1 and CF4 injection wells were sampled in January 2017 to evaluate the effectiveness of the freshwater injection system. The results are presented on Figure 5.

The CF1 injection wells are screened such that they deliver fresh water into the subsurface from 10 to 20 feet (ft) below ground surface (bgs) when the system is operating. When these samples were collected, there had been no fresh water injected in this portion of the well field since November 2016.

Results indicate the CF1 ammonia concentrations increase with depth, with a maximum concentration of 610 mg/L at a depth of 36 ft bgs. Below the zone at which water was injected (greater than 20 ft bgs), there is no significant difference between upgradient and downgradient concentrations.

In the shallow zone, the results indicate the ammonia concentrations are highest in the upgradient direction (210 mg/L), decrease in the zone just downgradient of the injection wells (6.3 mg/L) and then increase at the riverbank (71 mg/L). These results suggest that even after no injection occurred for nearly 2 months, the impact of the injection system on the shallow ground water system is still apparent.

The CF4 wells are screened and deliver fresh water into the zone from 15 to 35 ft bgs. These wells were sampled after the injection system had been consistently injecting filtered fresh water into the CF4 wells since early July 2016 (with the exception of the 2-week time period over the holidays). The CF4 monitoring well sampling results indicate a significant reduction in ammonia concentrations in the downgradient direction, particularly in the zone higher than 35 ft bgs.

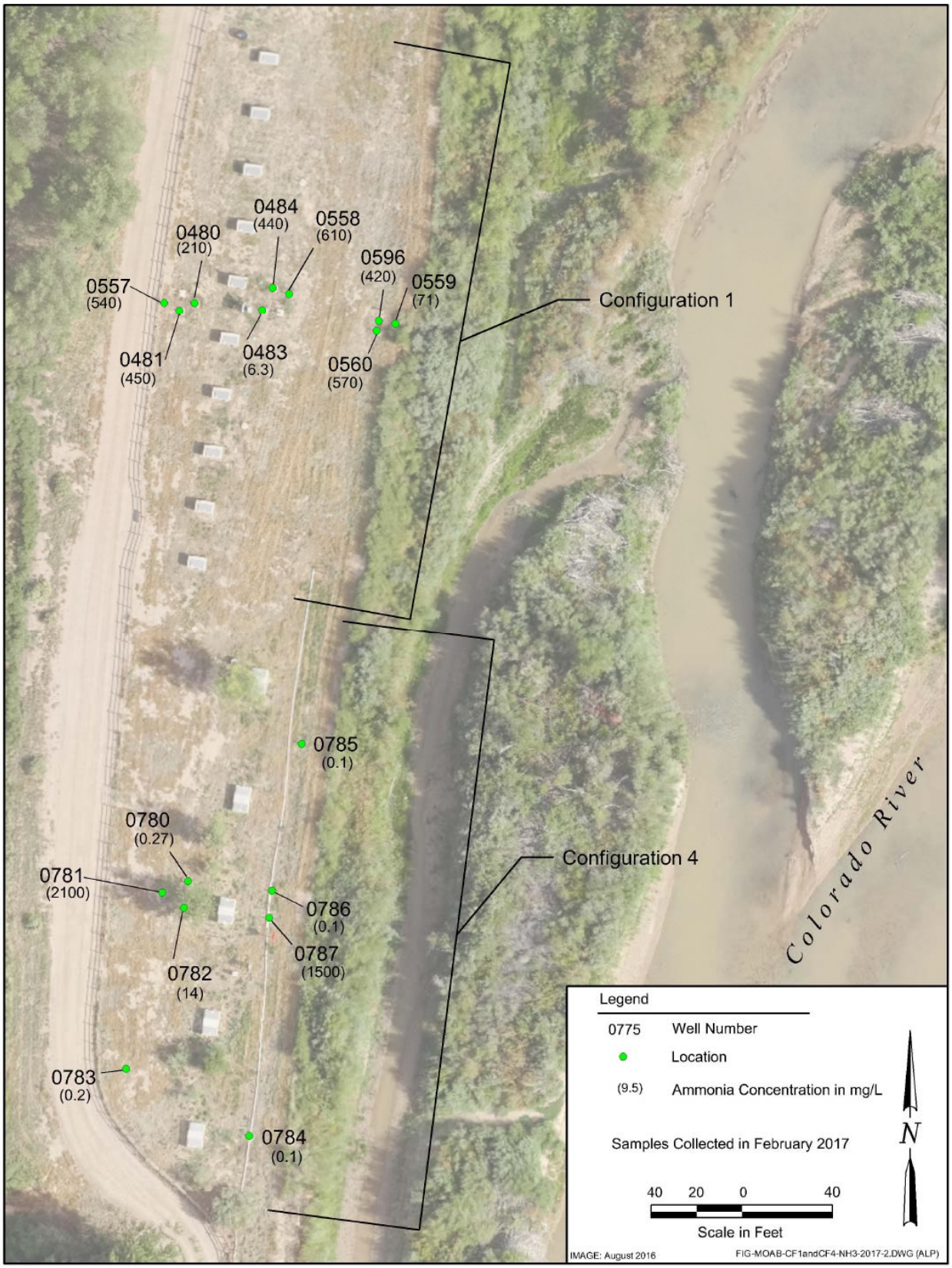

Figure 5. January 2017 CF1 and CF4 Ground Water Ammonia Concentrations during Injection

During this sampling event, additional samples were also collected from the locations in the vicinity of the tree plot. Figure 6 presents the ammonia concentrations measured since 2014 from wells located upgradient and downgradient of the tree plot.

The concentration data are plotted with the river stage during this same time period. In general, ammonia concentrations for all downgradient locations gradually increase after the spring runoff flows peak in late May-early June. The data collected during this sampling event display this same trend.

Typically, this area is subjected to flood irrigation between April and September. In addition, ground water extraction from nearby well 0813 may impact the concentration. It is difficult to quantify the impacts of phytoremediation due to the number of impacts to the ground water system in this area.

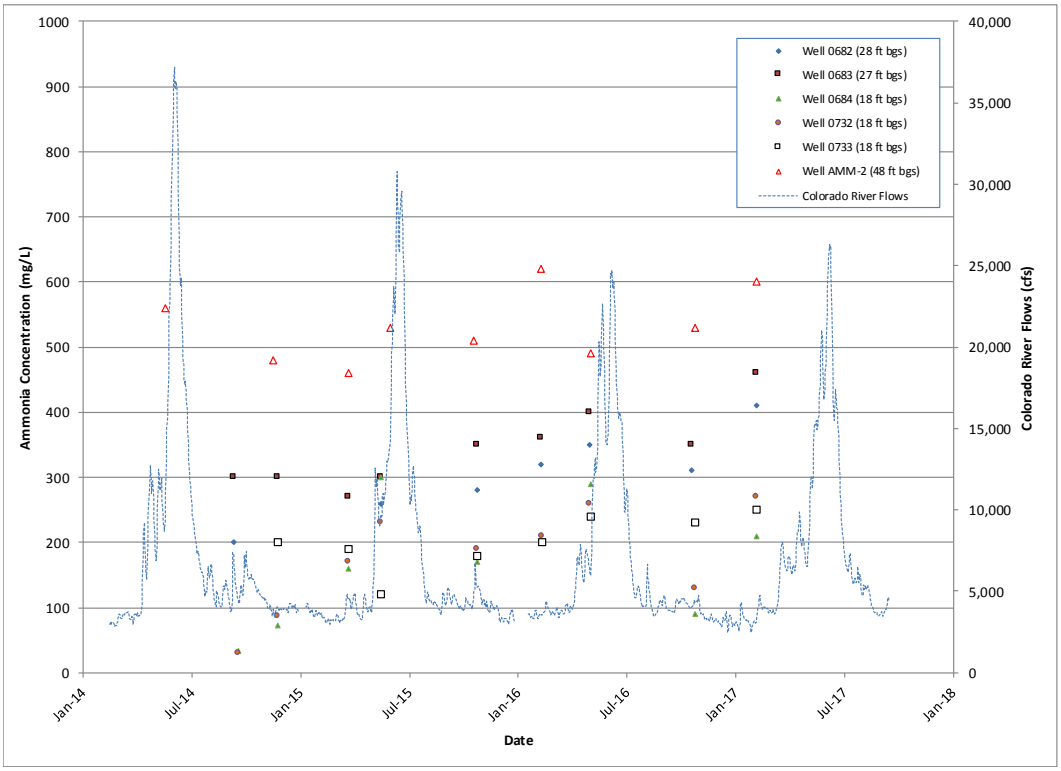

Figure 6. Ground Water Ammonia Concentrations in Vicinity of Tree Plot Area Since 2014

Figure 7 presents May 2017 CF4 Ground Water Ammonia Concentrations during Injection, and Figure 8 May 2017 CF4 Ground Water Elevation Contour Map during Injection.

Figure 7. May 2017 CF4 Ground Water Ammonia Concentrations during Injection

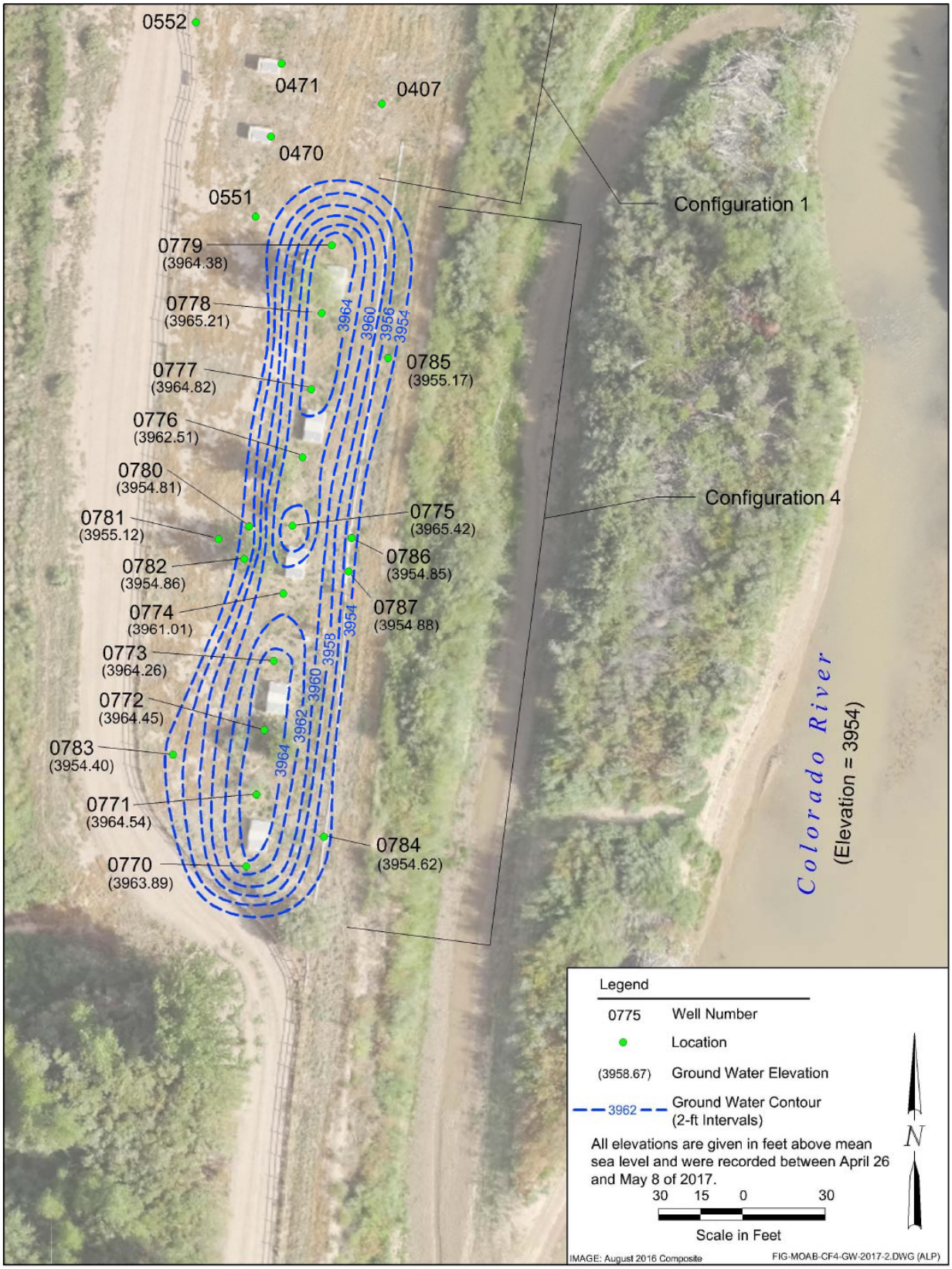

Figure 8. May 2017 CF4 Ground Water Elevation Contour Map during Injection

Ground water samples were collected from the CF5 extraction wells in May 2017. The ammonia and uranium concentrations associated with this sampling event are displayed on Figure 9. Time versus concentration plots were generated to display the trends displayed by the CF5 extraction wells during the past 7 years, which represents the approximate lifespan of the CF5 well field (extraction was started in April 2010).

Figure 10 is the time versus ammonia concentration plot for extraction wells 0810 through 0813 and SMI-PW02, all of which are located along the CF5 southeastern boundary. Figure 11 displays a time versus uranium concentration plot for the same set of wells.

Figures 12 and 13 are the time versus ammonia and uranium concentration plots, respectively, for CF5 wells 0814 through 0816, which are located closer to the base of the tailings pile (location shown on Figure 1).

As the plots exhibit, the ammonia concentrations along the CF5 southeastern boundary have ranged from 160 to 550 mg/L since 2011, with the lowest concentrations occurring after the well field was flooded from May to August 2011.

Well PW02, which is located at the center of this line of wells (and near the center of the ground water plume), has generally had the highest concentration. During the May 2017 sampling event, all five of these wells had ammonia concentrations between 330 and 460 mg/L.

Ammonia concentrations in the wells located closer to the base of the tailings pile have historically been lower compared to the wells 0810 through 0183 and PW02, ranging from 150 to 350 mg/L during this same time frame.

Similar to the line of wells to the southeast, well 0815, which is located in the center of these wells, has generally had the highest ammonia concentration. During this recent 2017 event, all three of these wells have ranged between 150 and 180 mg/L ammonia.

Taking into account all eight extraction wells, the uranium concentrations over the past 7 years have ranged from 0.9 to 4.9 mg/L. The wells along the CF5 southeastern boundary have generally had higher concentrations compared to the wells located along the toe of the tailings pile and the wells near the center of the well field (PW02 and 0815) having elevated concentrations. In 2017, the uranium concentrations for all eight wells have ranged from 1.6 to 3.5 mg/L.

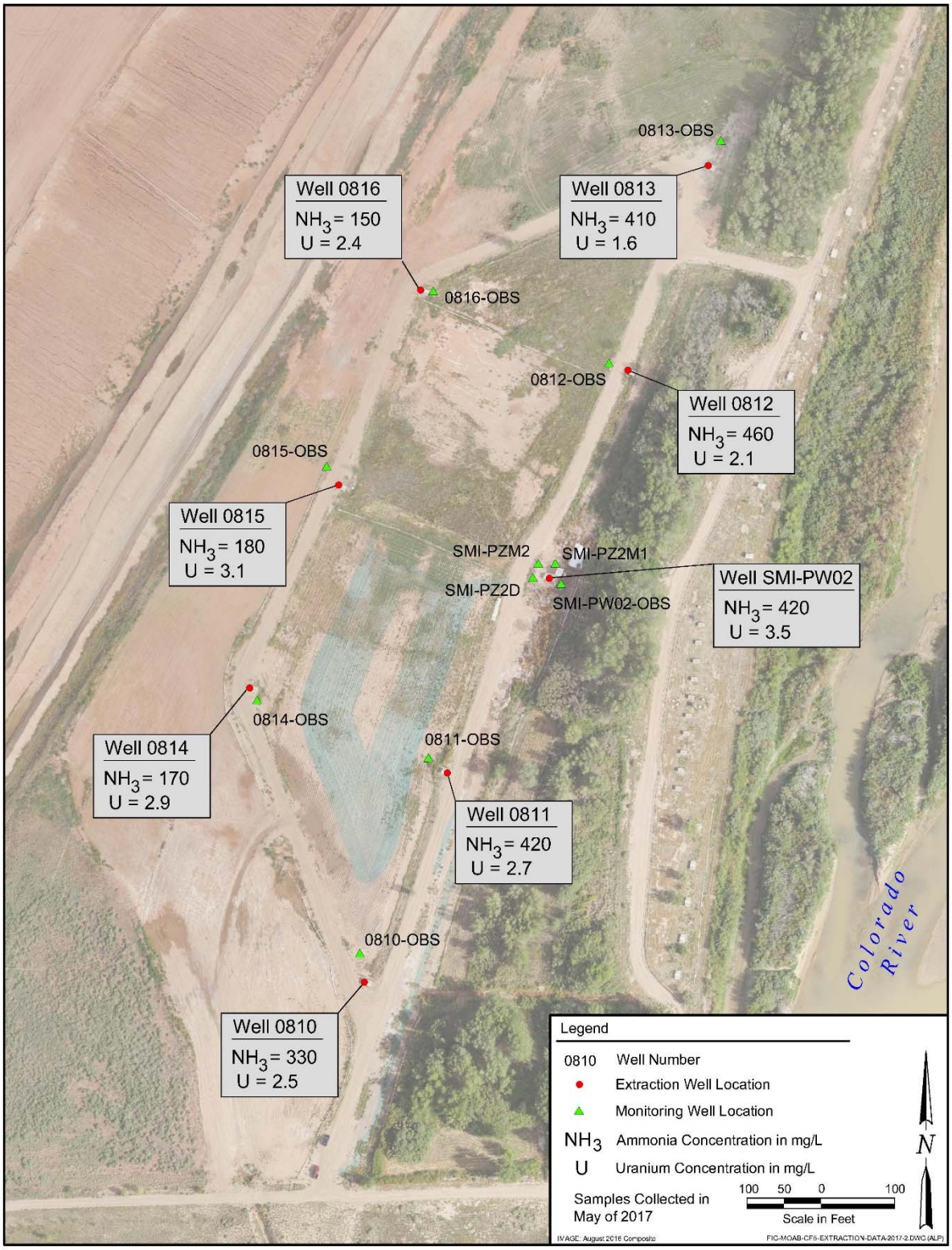

Figure 9. May 2017 CF5 Ammonia and Uranium Ground Water Concentrations

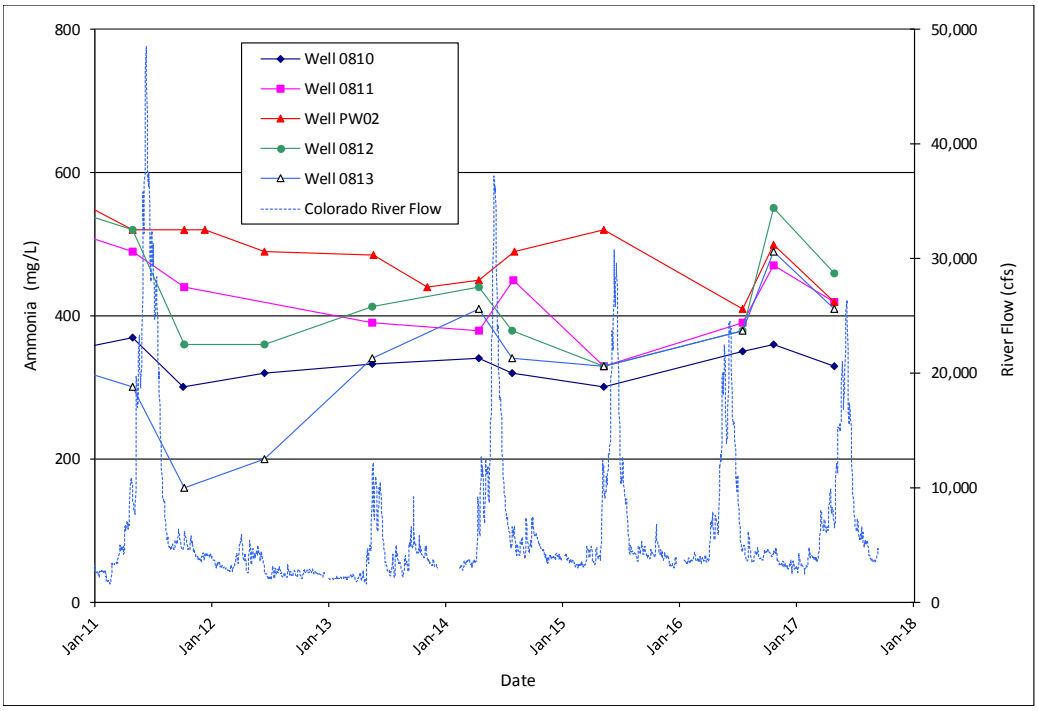

Figure 10. CF5 Extraction Wells 0810, 0811, 0812, 0813, and PW02 Time versus Ammonia Concentration Plot

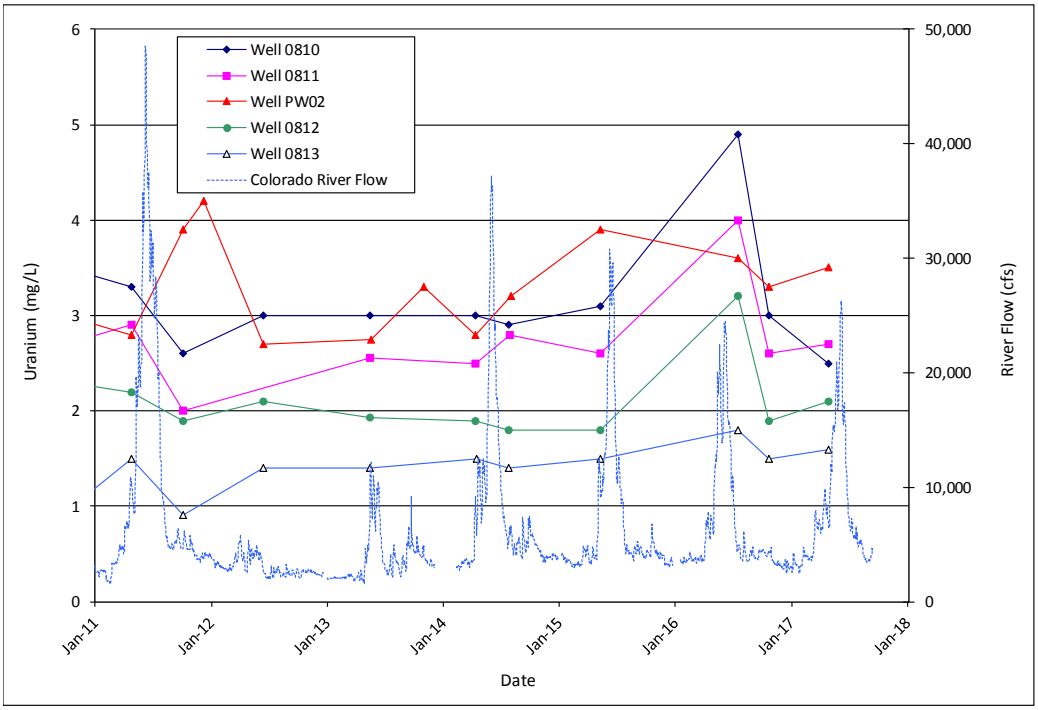

Figure 11. CF5 Extraction Wells 0810, 0811, 0812, 0813, and PW02 Time versus Uranium Concentration Plot

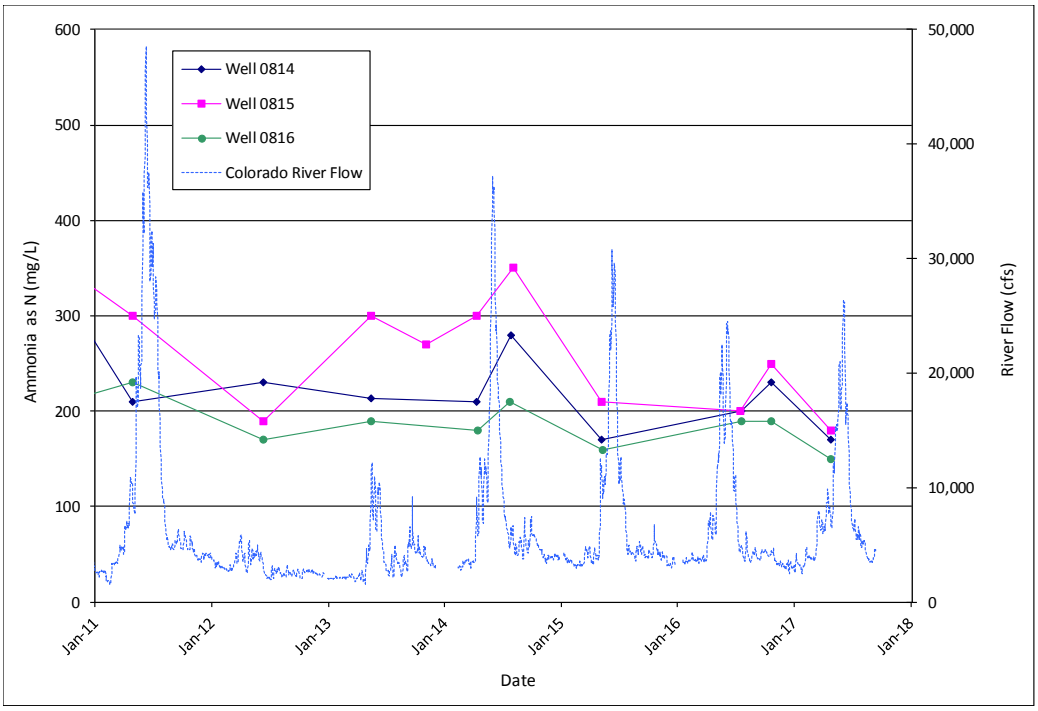

Figure 12. CF5 Extraction Wells 0814, 0815, and 0816 Time versus Ammonia Concentration Plot

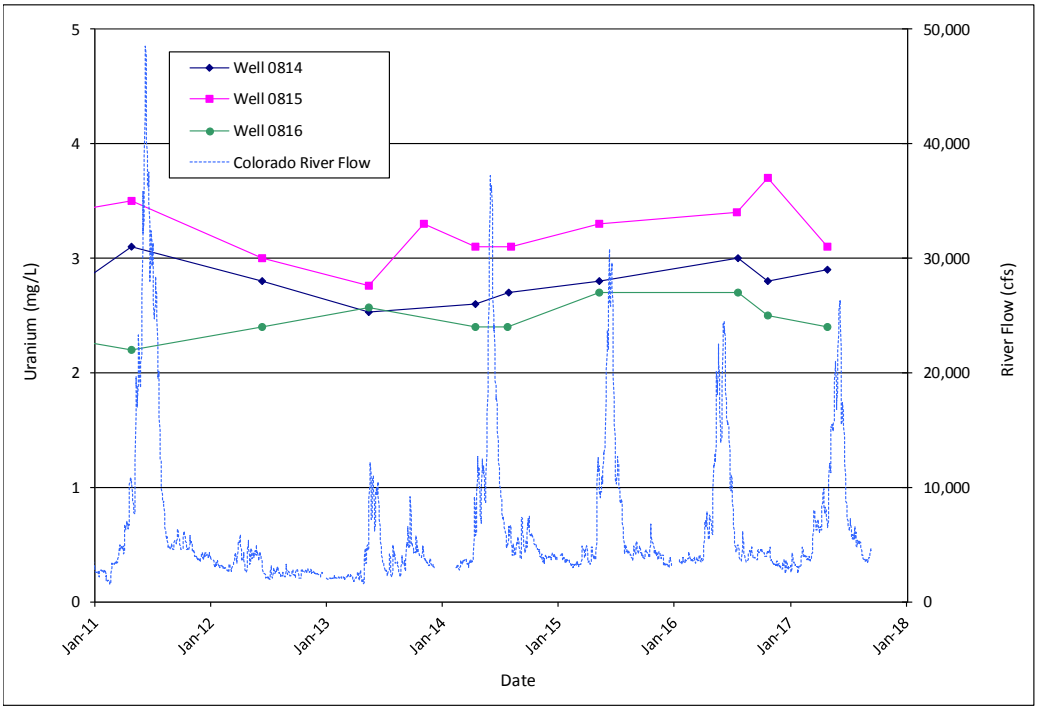

Figure 13. CF5 Extraction Wells 0814, 0815, and 0816 Time versus Uranium Concentration Plot

4.2 May 2017 Site-wide Sampling Event Results

All samples collected during this event were analyzed for both ammonia and uranium. Table 18 presents all locations sampled that exceeded the 0.044 mg/L uranium ground water standard. This standard is based on Table 1 in Title 40 Code of Federal Regulations Part 192 (40 CFR 192) "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings, Subpart A, Standards for the Control of Residual Radioactive Materials from Inactive Uranium Processing Sites," assuming uranium-234 and uranium-238 activities are in equilibrium.

Included in this table are the locations from the other sampling event from January to June 2017 that exceeded this concentration.

Table 18. January through June 2017 Sampling Events, Ground Water Locations Exceeding the 0.044 mg/L Uranium Ground Water Standard

Well Number	Date	Location	Sample Depth (ft bgs)	Uranium Concentration (mg/L)
0403	6/8/2017	CF1	18	0.35
0404	6/13/2017	CF3	18	1.4
0406	6/14/2017	CF1	18	0.6
0407	5/31/2017	CF1	18	0.53
0410	6/6/2017	NE Uranium Plume Area	24	0.38
0411	6/6/2017	NE Uranium Plume Area	8	0.91
0412	5/23/2017	NE Uranium Plume Area	10	2.6
0413	5/24/2017	NE Uranium Plume Area	10	3.3
0414	5/24/2017	NE Uranium Plume Area	7.5	3.7
0439	6/5/2017	On Tailings Pile	118	1.4
0441	6/13/2017	Support Area	53	0.049
0453	6/5/2017	Along SW Site Boundary	80	0.88
0454	5/25/2017	Along SW Site Boundary	13	0.75
0480	2/2/2017	CF1	18	2
0481	2/2/2017	CF1	28	2.4
0483	2/7/2017	CF1	18	1.2
0484	2/7/2017	CF1	30	2.4
0492	5/31/2017	Along S Site Boundary	18	0.22
0557	2/7/2017	CF1	44	2.6
0558	2/7/2017	CF1	44	2.6
0559	2/8/2017	CF1	18	1.3
0560	2/8/2017	CF1	36	2.4
0596	2/8/2017	CF1	25	1.9
0682	2/8/2017	Tree Plot Area	28	1.8
0683	2/7/2017	Tree Plot Area	27	1.7
0684	2/8/2017	Tree Plot Area	18	2.6
0732	2/7/2017	Tree Plot Area	18	2.2
0733	2/7/2017	Tree Plot Area	18	1.3

Table 18. July through December 2016 Sampling Events, Ground Water Locations Exceeding the 0.044 mg/L Uranium Ground Water Standard (continued)

Well Number	Date	Location	Sample Depth (ft bgs)	Uranium Concentration (mg/L)
0781	2/2/2017	CF4	48	2.1
	5/8/2017			2.5
0782	2/2/2017	CF4	33	0.048
	5/8/2017			1.6
0783	1/31/2017	CF4	18	0.046
0787	1/31/2017	CF4	36	1.9
	5/8/2017			2.1
0810	5/2/2017	CF5 Extraction Well	10 to 40	2.5
0811	5/2/2017	CF5 Extraction Well	9 to 39	2.7
0812	5/2/2017	CF5 Extraction Well	14 to 44	2.1
0813	5/1/2017	CF5 Extraction Well	14 to 44	1.6
0814	5/2/2017	CF5 Extraction Well	12 to 42	2.9
0815	5/2/2017	CF5 Extraction Well	22 to 52	3.1
0816	5/1/2017	CF5 Extraction Well	21 to 51	2.4
AMM-2	2/8/2017	CF5 Vicinity	48	2
	5/30/2017			2.4
AMM-3	6/7/2017	CF5 Vicinity	48	2.6
SMI-MW01	5/23/2017	NE Uranium Plume Area	16	3.5
SMI-PW02	5/2/2017	CF5 Extraction Well	20 to 60	3.5
SMI-PZ1S	2/8/2017	CF5 Vicinity	18	0.55
SMI-PZ2M2	5/25/2017	CF5 Vicinity	56	1.6
TP-01	5/24/2017	NE Uranium Plume Area	22	0.07
TP-22	5/25/2017	NE Uranium Plume Area	17	0.42
TP-23	5/25/2017	NE Uranium Plume Area	25	2.7
UPD-17	6/6/2017	NE Uranium Plume Area	14	1.5
UPD-18	6/6/2017	NE Uranium Plume Area	13	1.7
UPD-20	6/6/2017	NE Uranium Plume Area	17	0.067
UPD-21	6/6/2017	NE Uranium Plume Area	25	6.6
UPD-22	5/24/2017	NE Uranium Plume Area	9	3.3
UPD-23	6/13/2017	NE Uranium Plume Area	26	0.54
UPD-24	6/6/2017	NE Uranium Plume Area	27	3.2

NE = northeastern; SW = southwestern

To present the trends observed in the water chemistry for the site-wide locations, the site was divided into six areas. These include the northeastern base of the tailings pile, the northeastern uranium plume (which includes the PW03 cluster), the southeastern base of the tailings pile, along the southwestern boundary, along the Colorado River bank, and south of the site. All results are also plotted against the Colorado River flow to determine if the river stage may impact the concentrations.

4.2.1 Northeastern Base of Tailings Pile

Figures 14 and 15 are time versus ammonia and uranium concentration plots, respectively, for locations UPD-17 and UPD-18. In the past, the ammonia concentrations displayed a general trend of higher ammonia concentrations during river base flows and, conversely, lower concentrations during the spring runoff or higher flows.

The ammonia concentrations for both UPD-17 and UPD-18 decreased in response to the higher river flows compared to the previous sampling event. The uranium concentrations generally decrease during low river stage time periods and increase during high river stages. The results indicate this general trend, with uranium concentrations associated with both locations increasing during this recent sampling event.

4.2.2 Northeastern Uranium Plume Area

Due to the number of wells associated with the northeastern uranium plume, this area of the site was further subdivided into the center of the plume, the vicinity of the Atlas building, and the northeastern edge of the plume area.

4.2.3 Center of Northeastern Uranium Plume Area

Figures 16 and 17 are the time versus ammonia and uranium concentration plots, respectively, for the center of the northeastern uranium plume area, which includes locations 0411, 0413, 0414, and UPD-20.

As displayed in Figure 16, the ammonia concentrations remained lower than 10 mg/L in the samples collected from wells UPD-20 and 0411. Ammonia concentrations have ranged from 50 to 62 mg/L since 2015 in samples collected from 0413, while the well 0414 concentrations have ranged from 14 to 39 mg/L during the same time period.

The uranium concentrations in samples collected from wells 0411, 0413, and 0414 have fluctuated at approximately the same percentage since December 2014, slightly increasing during river peak flows and decreasing during river base flows (Figure 17). The sample collected from well UPD-20 remains lower than 0.1 mg/L.

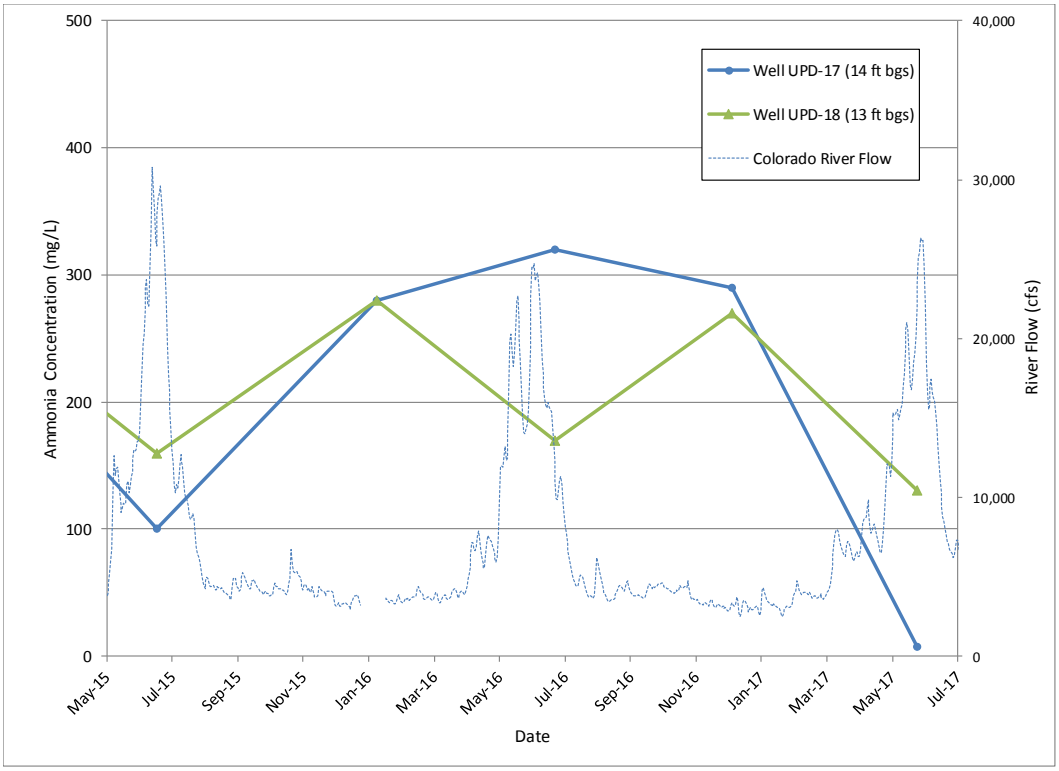

Figure 14. Wells UPD-17 and UPD-18 Time versus Ammonia Concentration Plot

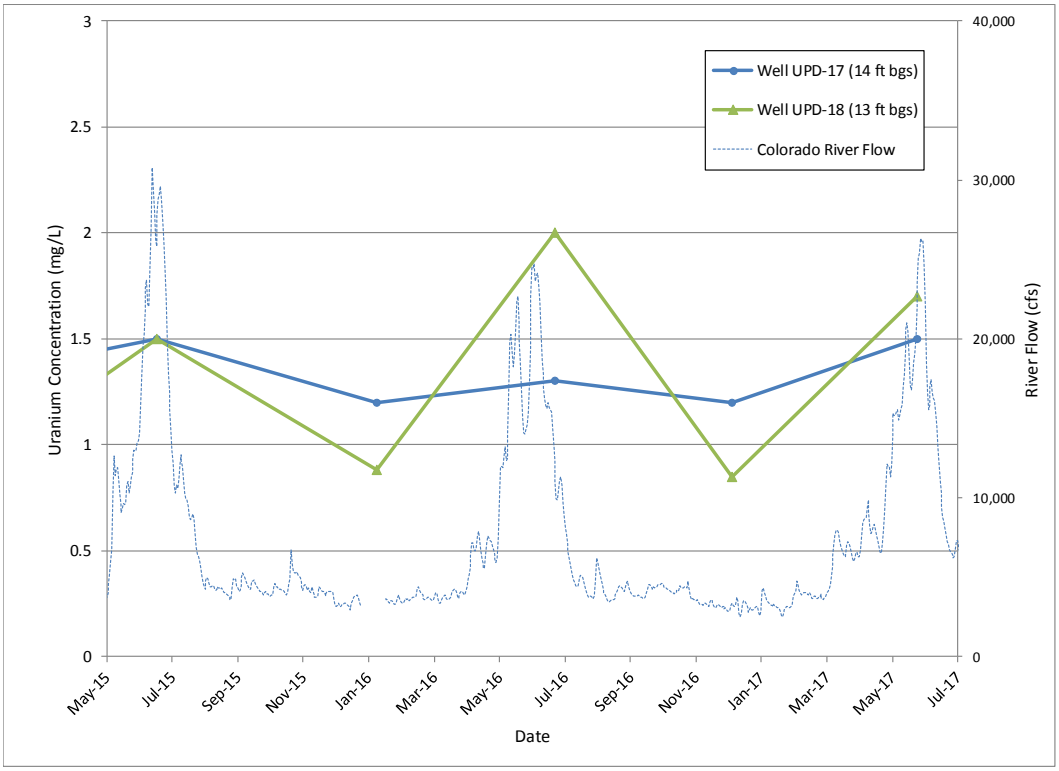

Figure 15. Wells UPD-17 and UPD-18 Time versus Uranium Concentration Plot

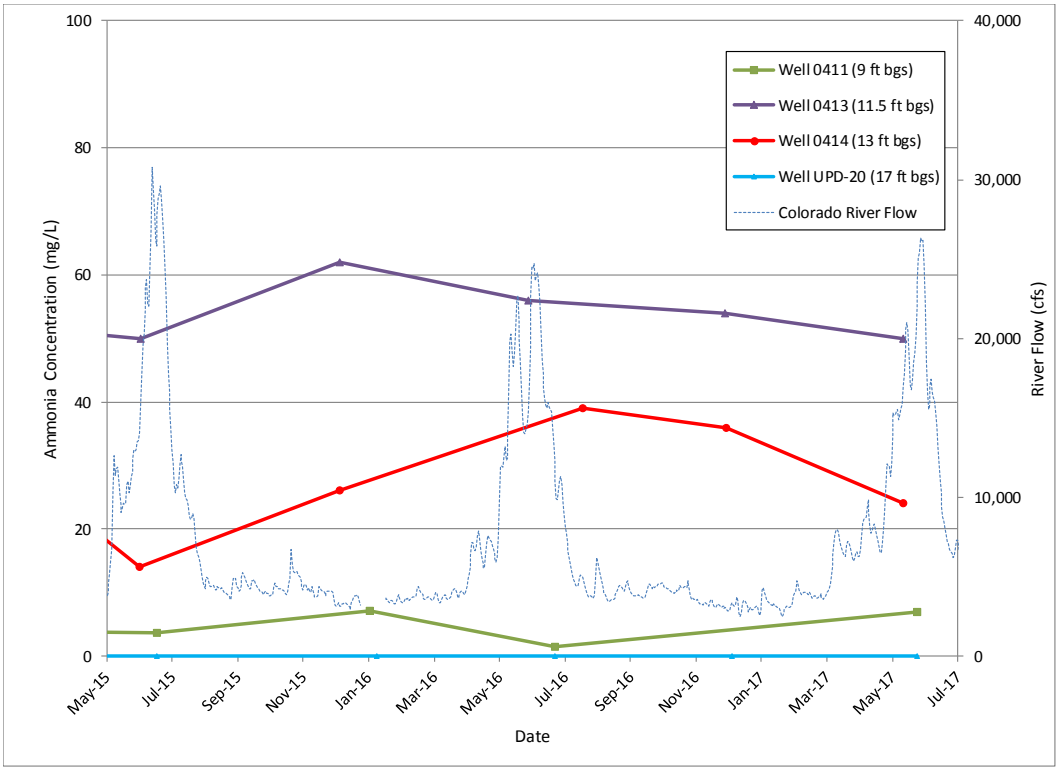

Figure 16. Center of Northeastern Uranium Plume Area Observation Wells 0411, 0413, 0414, and UPD-20 Time versus Ammonia Concentration Plot

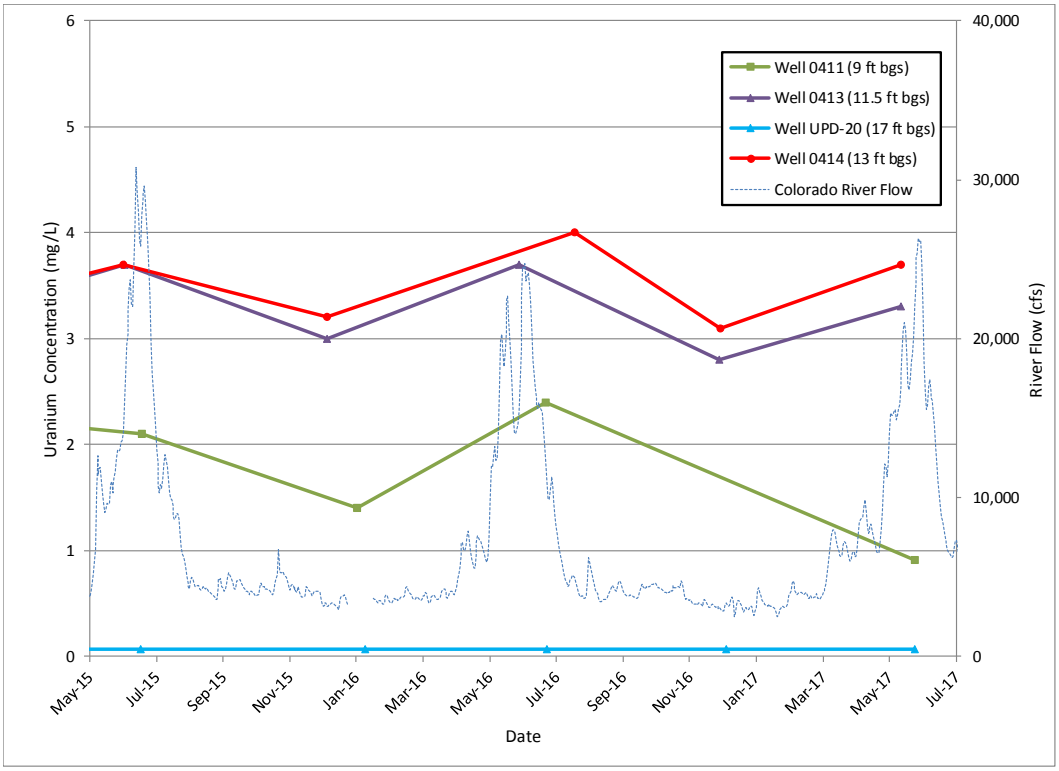

Figure 17. Center of Northeastern Uranium Plume Area Observation Wells 0411, 0413, 0414, and UPD-20 Time versus Uranium Concentration Plot

4.2.4 Atlas Building Vicinity

The ammonia and uranium concentrations associated with samples collected from locations in the vicinity of the Atlas building are displayed in Figures 18 and 19, respectively. These wells include 0410, UPD-21, UPD-23, and UPD-24.

As shown in Figure 18, the ammonia concentrations in the samples collected from wells 0410, UPD-23, and UPD-24 have not changed significantly since 2015, and all remain less than 3 mg/L. The concentration in the sample collected from well UPD-21 has fluctuated between 2 and 8 mg/L since May 2015.

The uranium concentrations in the samples from UPD-24 display a definitive seasonal fluctuation (Figure 19), while the uranium concentrations in the samples collected from UPD-21 have not significantly changed over the past 2 years. Figure 19 also displays the uranium concentrations in samples collected from wells 0410 and UPD-23 are lower than 1.0 mg/L.

4.2.5 Northeastern Edge of Uranium Plume Area

Figures 20 and 21 display ammonia and uranium concentration data for the wells located in the vicinity of the northeastern edge of the plume area (wells 0412, UPD-22, SMI-MW01, and SMI-PZ3S).

As Figure 20 exhibits, with the exception of the ammonia concentration in the sample collected from UPD-22 (which has more than doubled since May 2015), the concentrations have remained consistent since June 2014.

Since May 2015, the ammonia concentration in well 0412 has remained at or below the detection limit of 0.1 mg/L. The ammonia concentration in the sample from well SMI-MW01 remains less than 2.0 mg/L.

The uranium concentrations have not significantly fluctuated in the samples from locations UPD-22, 0412, and SMI-PZ3S over the past 2 years (Figure 21). Uranium concentrations in the samples from SMI-MW01 have decreased from 5.3 to 1.6 mg/L during this same time frame.

4.2.6 Base of Tailings Pile

The time versus ammonia and uranium concentration plots for the area near the base of the tailings pile are presented in Figures 22 and 23 for wells AMM-3, ATP-2-S, ATP-2-D, and MW-3 (listed from south to north). As Figure 22 exhibits, the most recent sampling event ammonia results indicate locations ATP-2-D, ATP-2-S, and MW-3 all decreased over the past year.

Uranium concentrations in wells ATP-2-S (sample depth 25 ft bgs) and ATP-2-D (sample depth 88 ft bgs) have been less than 0.015 mg/L since 2010.

Figure 23 suggests the uranium concentrations associated with the samples collected from wells MW-3 and AMM-3 continue to exhibit a strong seasonal fluctuation (well AMM-3 was not sampled in December 2016), which may be in response to the site flooding during spring runoff or flood irrigation activities over the past 2 years.

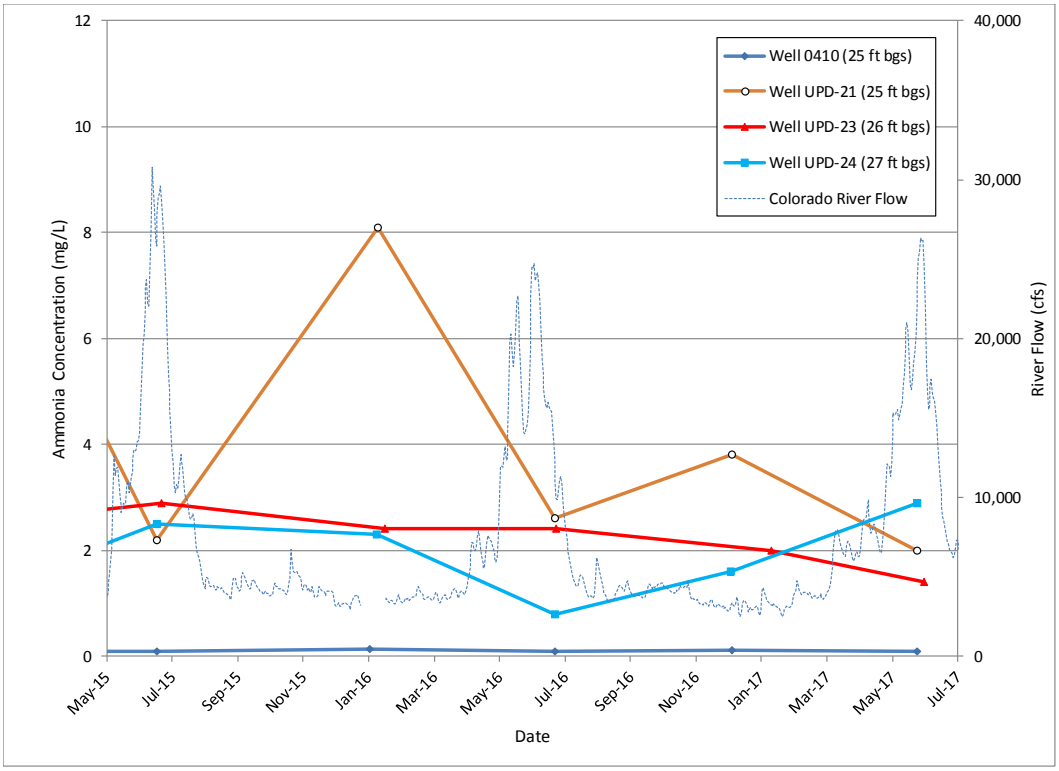

Figure 18. Vicinity of Atlas Building Observation Wells 0410, UPD-21, UPD-23, and UPD-24 Time versus Ammonia Concentration Plot

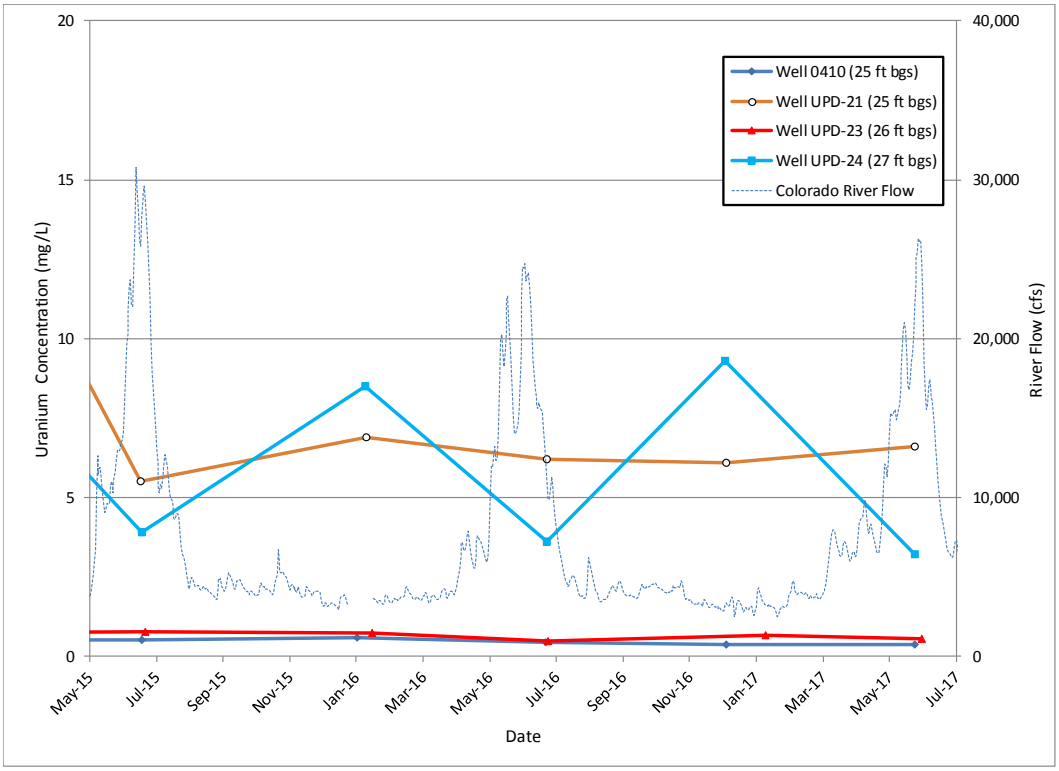

Figure 19. Vicinity of Atlas Building Observation Wells 0410, UPD-21, UPD-23, and UPD-24 Time versus Uranium Concentration Plot

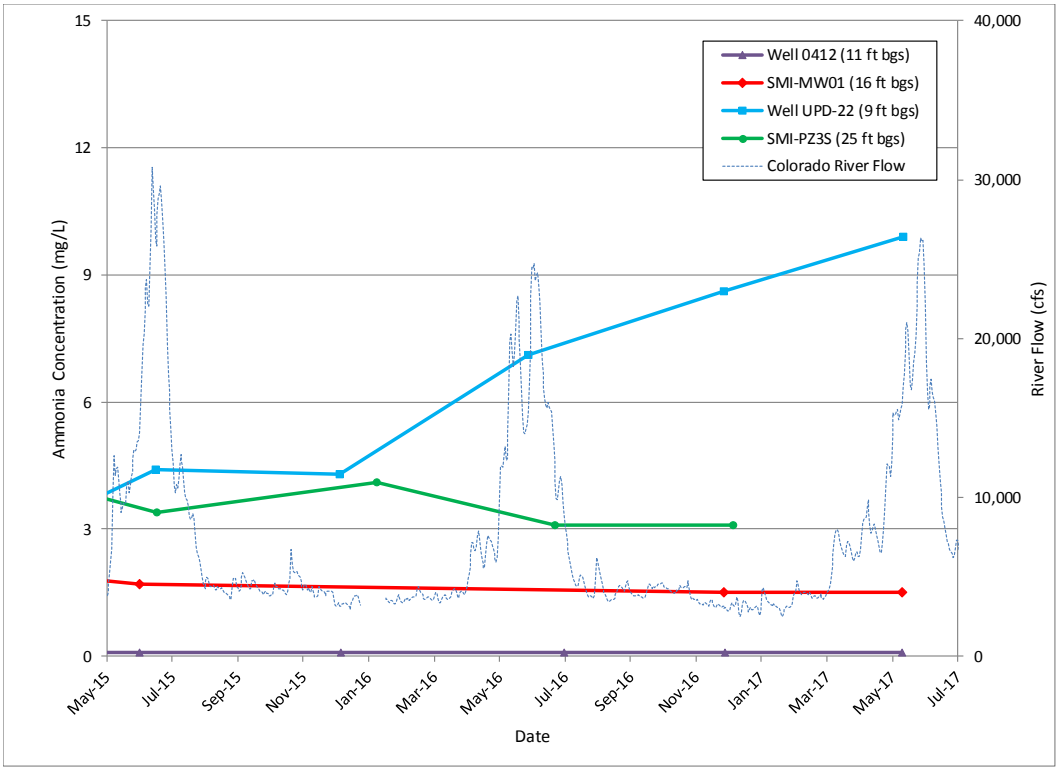

Figure 20. Northeastern Edge of Uranium Area Observation Wells 0412, SMI-MW01, SMI-PZ3S, and UPD-22 Time versus Ammonia Concentration Plot

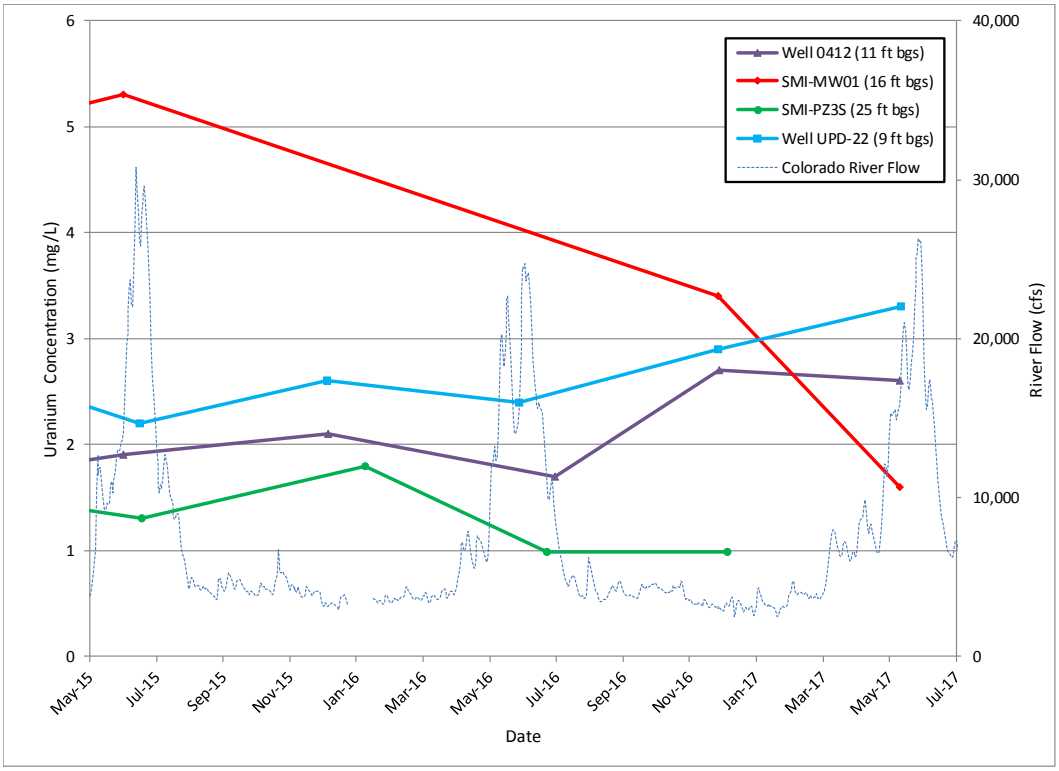

Figure 21. Northeastern Edge of Uranium Area Observation Wells 0412, SMI-MW01, SMI-PZ3S, and UPD-22 Time versus Uranium Concentration Plot

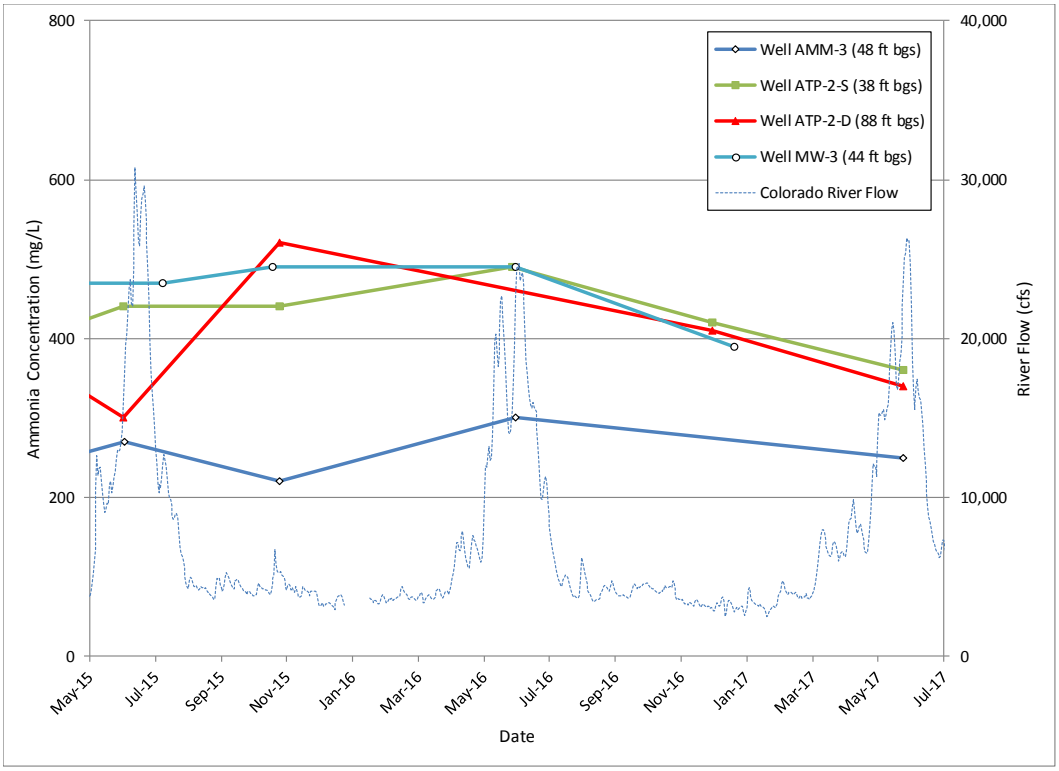

Figure 22. Base of Tailings Pile Observation Wells AMM-3, ATP-2-S, ATP-2-D, and MW-3 Time versus Ammonia Concentration Plot

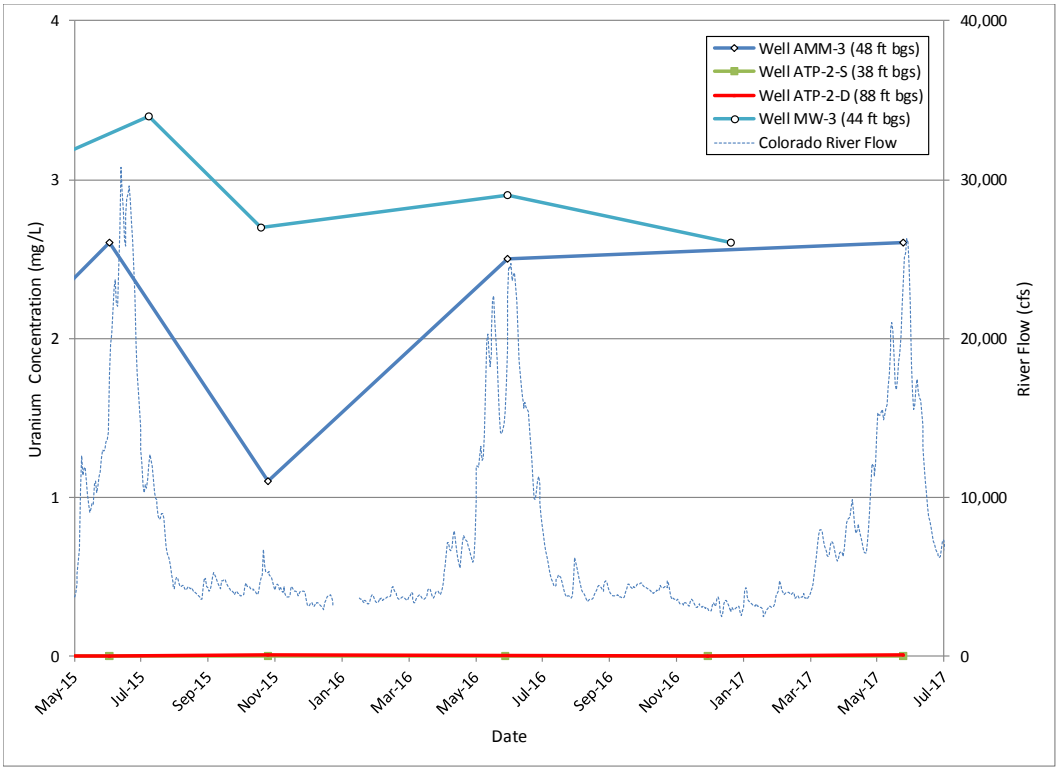

Figure 23. Base of Tailings Pile Observation Wells AMM-3, ATP-2-S, ATP-2-D, and MW-3 Time versus Uranium Concentration Plot

4.2.7 Southwestern Boundary

Figures 24 and 25 are time versus concentration plots for ammonia and uranium, respectively, for locations 0441, 0440, 0453, and 0454 (listed from northwest to southeast or from upgradient to downgradient ground water flow direction) along the southwestern site boundary.

Since May 201,5 both well 0453 and 0454 ammonia concentrations (Figure 24) have seasonally fluctuated (higher concentrations during the winter months and lower concentrations in the summer months) between 200 and 410 mg/L and between 170 and 370 mg/L, respectively. The concentrations in the samples collected from wells 0440 and 0441 (the upgradient locations) have been at or lower than the 0.1 mg/L detection limit since 2009.

The uranium concentrations (Figure 25) in the samples collected from well 0453 display the same seasonal fluctuation, with the concentrations ranging from 0.78 to 2.2 mg/L over the past 2 years.

Well 0454 uranium concentrations display a similar trend to the ammonia concentrations, with the uranium concentration measured in the samples from wells 0453 and 0454 decreasing during peak river flows and increasing during river base flow conditions. Samples collected from well 0440 and 0441 have had uranium concentrations lower than the 0.044 mg/L UMTRA standard since 2009, while the concentration associated with the well 0441 sample collected in May 2017 were just over the standard (0.049 mg/L).

4.2.8 Riverbank Area

Figures 26 and 27 are the time versus ammonia and uranium concentration plots, respectively, for the locations sampled along the riverbank, presented from south to north (wells 0492, 0407, 0401, 0404, and TP-01).

Because these wells are located along the riverbank, their water chemistry has historically been heavily influenced by the seasonal changes of the Colorado River stage; however, the ammonia concentrations associated with these samples do not follow this trend, with each location having fluctuating results. Sampling locations to the south (0492) and north (TP-01) of the plume continue to have lower concentrations.

The same can be said for the uranium concentrations, with the samples collected from wells 0492 and TP-01 in general having the lowest concentrations. The expected seasonal trend is evident for the uranium concentrations measured at location 0492. The sample collected from well TP-01 had uranium concentrations less than 0.1 mg/L since 2014.

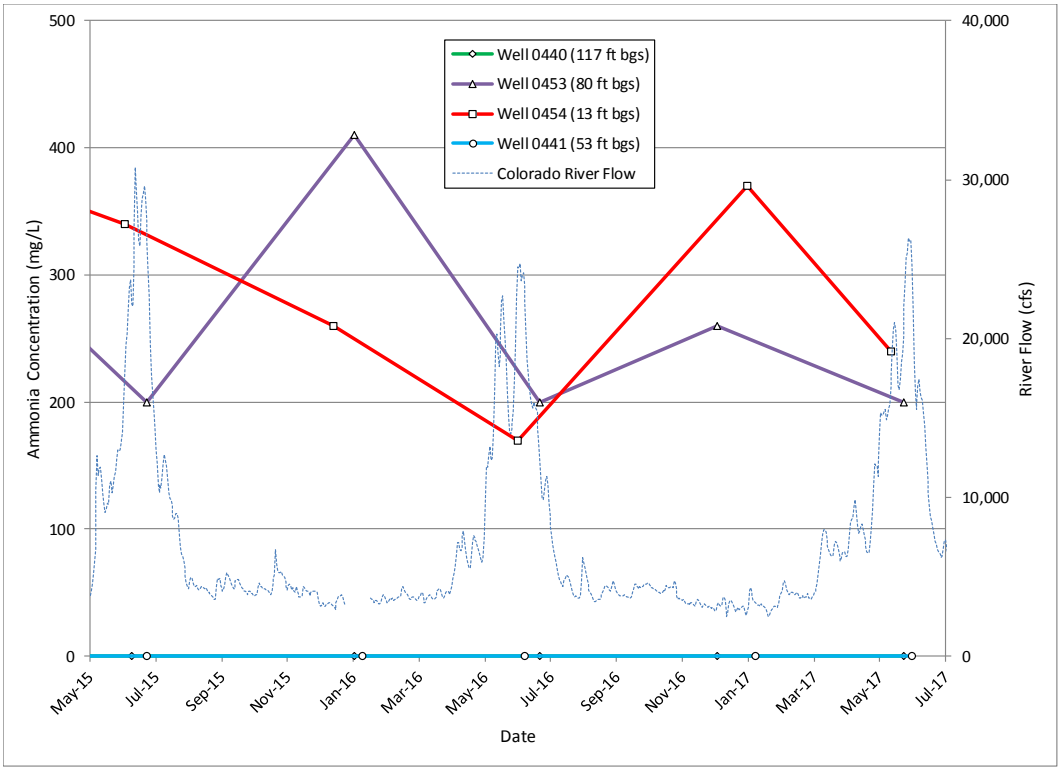

Figure 24. Southwestern Boundary Observation Wells 0453, 0454, and 0440 Time versus Ammonia Concentration Plot

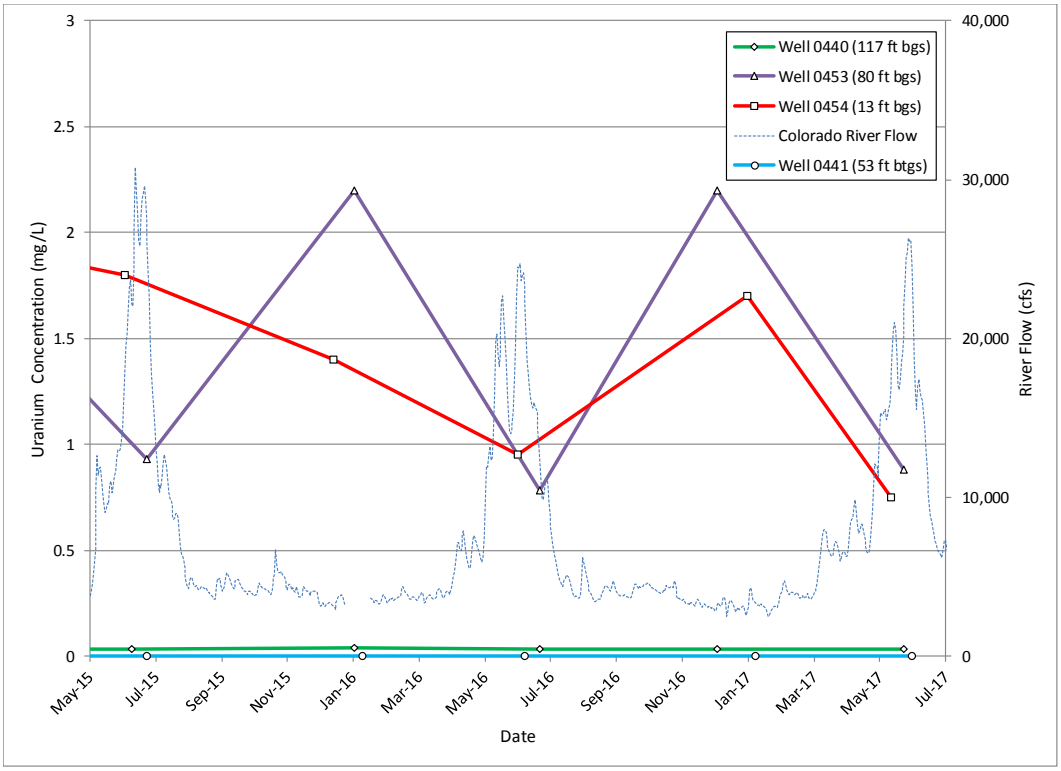

Figure 25. Southwestern Boundary Observation Wells 0453, 0454, and 0440 Time versus Uranium Concentration Plot

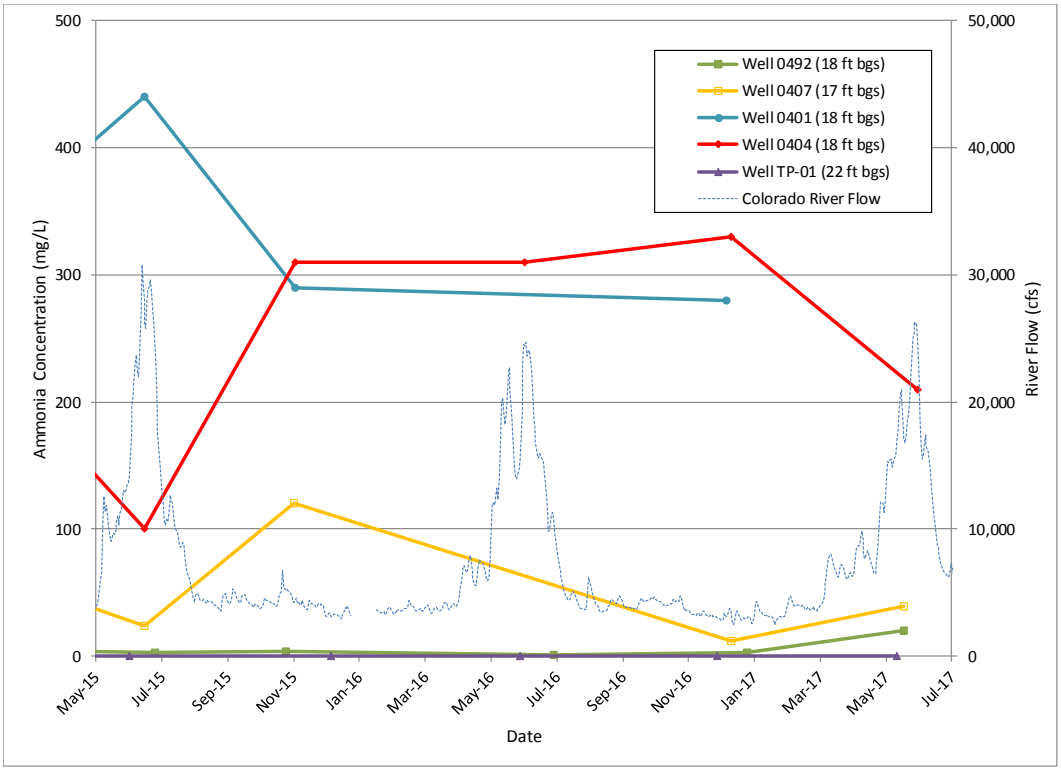

Figure 26. Riverbank Observation Wells 0492, 0407, 0401, 0404, and TP-01 Time versus Ammonia Concentration Plot

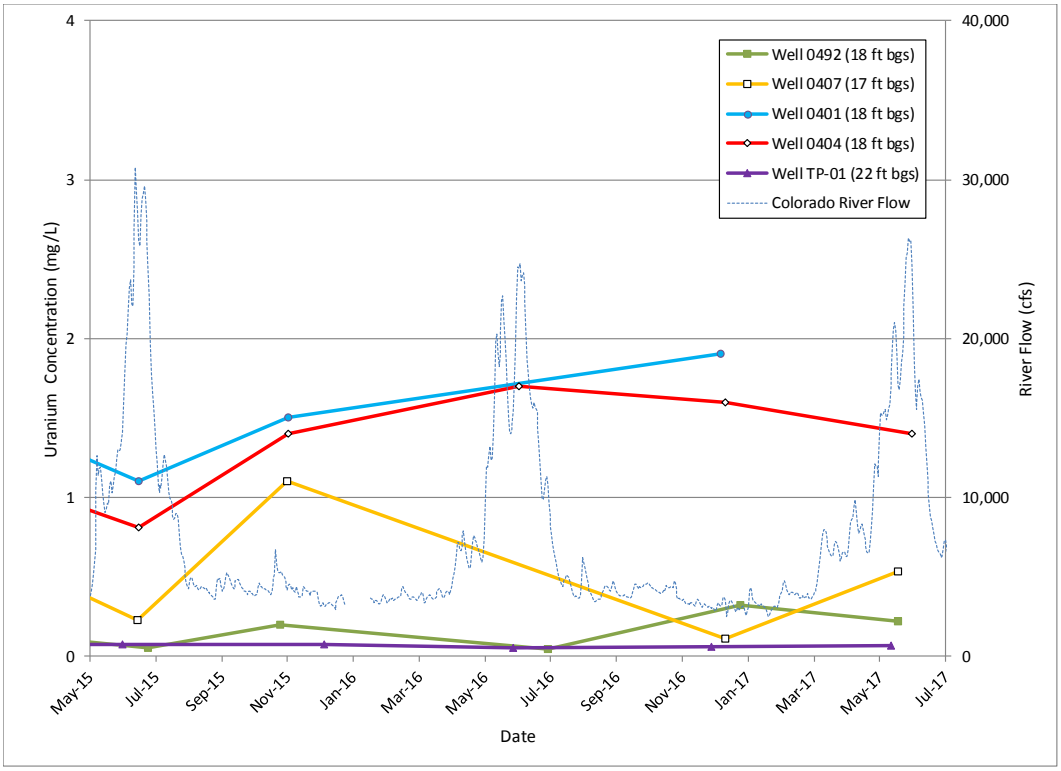

Figure 27. Riverbank Observation Wells 0492, 0407, 0401, 0404, and TP-01 Time versus Uranium Concentration Plot

4.2.9 Southern and Off-site Areas

Figures 28 and 29 are the plots for the two locations sampled south of the site, wells TP-17 and TP-20. Well TP-17 is located along the riverbank, and well TP-20 is located approximately 600 ft off the bank. Typically, ammonia and uranium concentrations are low at TP-20 because it is located along the southern edge of the contaminant plumes.

Ammonia concentrations (Figure 28) in well TP-20 have ranged from 3.7 to 4.2 mg/L since May 2015. The ammonia concentrations in well TP-17 have historically displayed the impacts of the river stage. The uranium concentrations (Figure 29) continue to display seasonal fluctuations with the concentrations below the 0.044 mg/L UMTRA standard since 2008.

4.2.10 Surface Water Sampling Results

Table 19 presents the ammonia results from the surface water sampling conducted in late May/early June 2017 from locations 0201, 0218, 0226, 0274, CR1, CR2, CR3, and CR5 (as shown in Figure 4). The ammonia concentrations and comparisons to the applicable EPA criteria for both acute and chronic concentrations (along with the temperature and pH data used to calculate these concentrations) are shown in Table 19.

The ammonia concentrations measured during this event, all of which were below than 0.1 mg/L detection limit, with the exception of the sample collected from location 0226. The sample collected from location 0226 was analyzed using a higher detection limit (1.0 compared to 0.1 mg/L), with the concentration below the detection limit. As a result, it is assumed that all surface water ammonia concentrations are below the applicable EPA criteria (for a suitable habitat) for both acute and chronic concentrations.

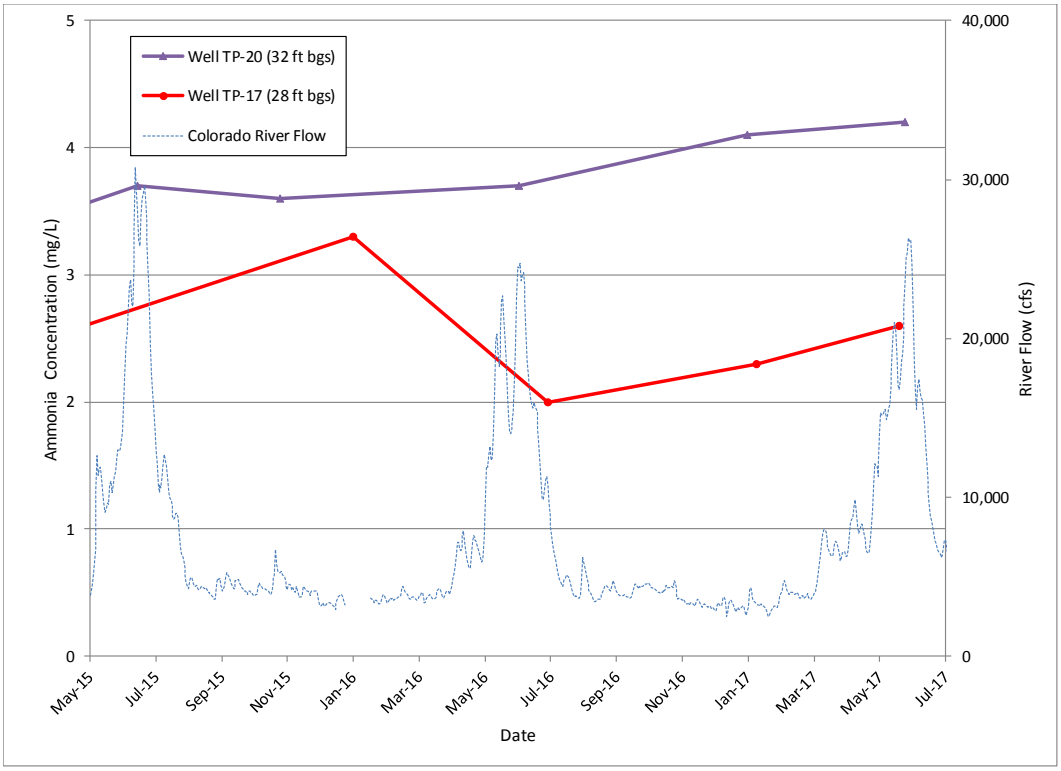

Figure 28. South of Site Observation Wells TP-17 and TP-20 Time versus Ammonia Concentration Plot

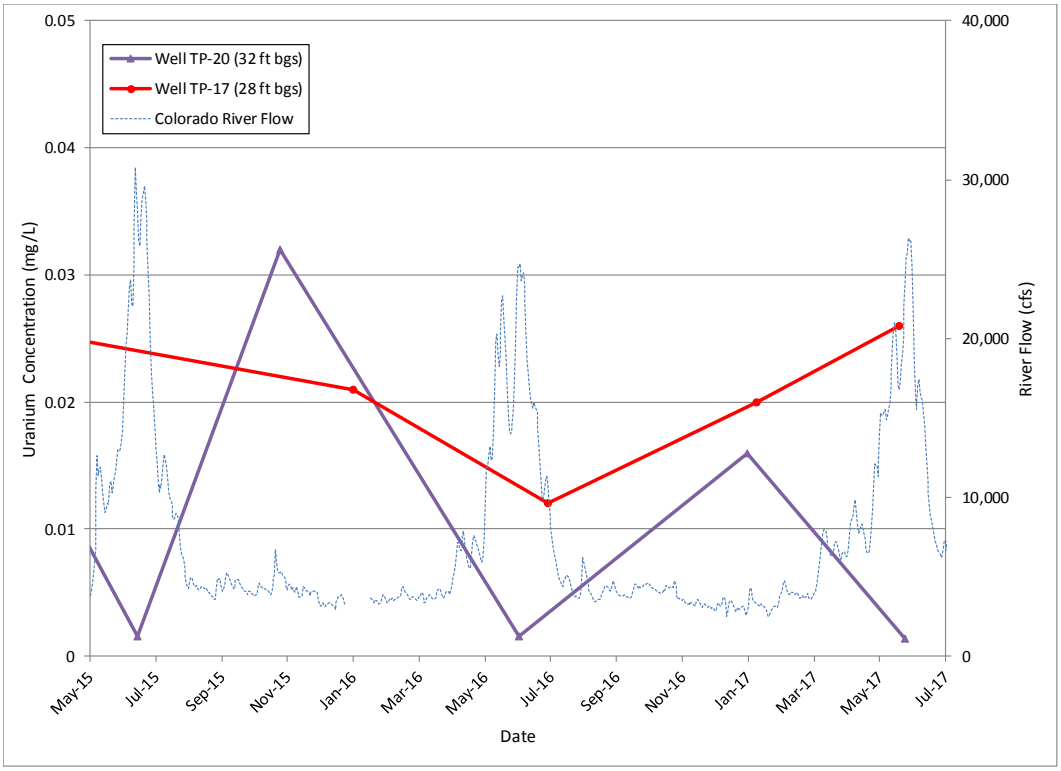

Figure 29. South of Site Observation Wells TP-17 and TP-20 Time versus Uranium Concentration Plot

Table 19. May/June 2017 Surface Water Ammonia Concentrations and Comparisons to EPA Acute and Chronic Criteria

Location	Date	Temp (ºC)	pH	Ammonia as N (mg/L)	EPA - Acute Total as N (mg/L)*	EPA - Chronic Total as N (mg/L)**
0201	6/1/17	18.3	8.10	<0.1	7.3	0.76
0218	5/31/17	16.2	8.11	<0.1	7.3	0.76
0226	6/1/17	17.8	8.20	<1.0	6.0	0.65
0274	6/1/17	18.3	8.04	<0.1	8.8	0.88
CR1	5/31/17	16.2	8.06	<0.1	7.3	0.87
CR2	5/31/17	16.5	8.09	<0.1	7.3	0.81
CR3	5/31/17	16.9	7.94	<0.1	11	1.1
CR5	6/1/17	17.8	8.01	<0.1	8.8	0.88

*U.S. EPA Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater State (Effective April 2013), Table N.4., Temperature and pH-Dependent Values, Acute Concentration of Total Ammonia as N (mg/L)
**U.S. EPA Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater State (Effective April 2013), Table 6. Temperature and pH-Dependent Values, Chronic Concentration of Total Ammonia as N (mg/L)

4.3 June 2017 Crescent Junction Sampling Event Results

Table 20 displays the analytical results of the February and June 2017 samples collected from well 0205, along with the results from the two previous sampling events in July and December 2016. These results indicate the well 0205 analyte concentrations of the samples collected from well 0205 have generally not significantly changed in 2017, and the well continues to be recharged from the same water source after samples and short-term recovery tests have been completed.

Table 20. Crescent Junction Well 0205 Analyte Concentrations, July 2016 through June 2017

Analyte	Analyte Concentration on 7/27/16	Analyte Concentration on 12/5/16	Analyte Concentration on 2/22/17	Analyte Concentration on 6/20/17
Ammonia as N	15	15	15	13
Arsenic	0.039#	0.002#	0.039#	0.0039#
Barium	0.013	0.020	0.014	0.012
Bicarbonate as $CaCO_3$	990	1,000	1,000	950
Boron	1.2	1.4	1.3	1.2
Bromide	10#	10#	8#	10#
Cadmium	0.00033#	0.00021#	0.0033#	0.00033#
Calcium	300	320	370	260
Carbonate as $CaCO_3$	20#	20#	50#	100#
Chloride	2,900	3,200	3,600	3,700
Chromium	0.00051#	0.0015	0.044	0.00051#
Copper	0.0026	0.023	0.0097#	0.0016
Fluoride	5#	5#	4#	5#
Iron	0.0064	0.016	0.3	7
Lead	0.0013#	0.0018#	0.013#	0.0013#
Magnesium	1,000	1,100	920	820
Manganese	0.42	0.59	0.53	0.3
Molybdenum	0.0022	0.0047#	0.055	0.0022
Nitrate/ Nitrite as N	960	1,000	780	830
Potassium	69	32	53	58
Selenium	4.6	6.0	4.3	4.4
Sodium	9,900	11,000	10,000	9,700
Sulfate	21,000	22,000	22,000	24,000
Total Alkalinity as $CaCO_3$	990	1,000	1,000	950
Total Dissolved Solids	40,000	27,000	25,000	40,000
Uranium $_{234}$	35.7 +/- 6.2 pCi/L	33.1 +/- 5.5 pCi/L	32.5 +/- 5.5 pCi/L	27.1 +/- 4.6 pCi/L
Uranium $_{235}$	0.81 +/- 0.2 pCi/L	0.64 +/- 0.2 pCi/L	0.49 +/- 0.1 pCi/L	0.34 +/- 0.2 pCi/L
Uranium $_{238}$	12.2 +/- 2.2 pCi/L	11.1 +/- 1.9 pCi/L	11.2 +/- 2 pCi/L	9.2 +/- 1.7 pCi/L
Uranium	0.034	0.029	0.031	0.026

= Concentration at or below the detection limit
Note: All concentrations in mg/L, except where noted

4.4 Ground Water Surface Elevation

Water level data were collected between June 5 and June 14, 2017, when the Colorado River mean daily flows ranged from 19,000 to 26,300 cubic feet per second, and the river stage at the southern end of the site ranged from only from 3,957.4 to 3,960.0 feet above mean sea level. Because ground water elevations fluctuate significantly during this time of the year while the site is impacted spring runoff flows, only the data collected during this time frame were used to generate the ground water surface contour map displayed in Figure 30.

This contour map displays how the site ground water system responds to the river during losing conditions, and a freshwater lens is present. Ground water flow direction and gradient displayed in this contour map are comparable to historical contour maps generated using ground water data collected during this same time of year.

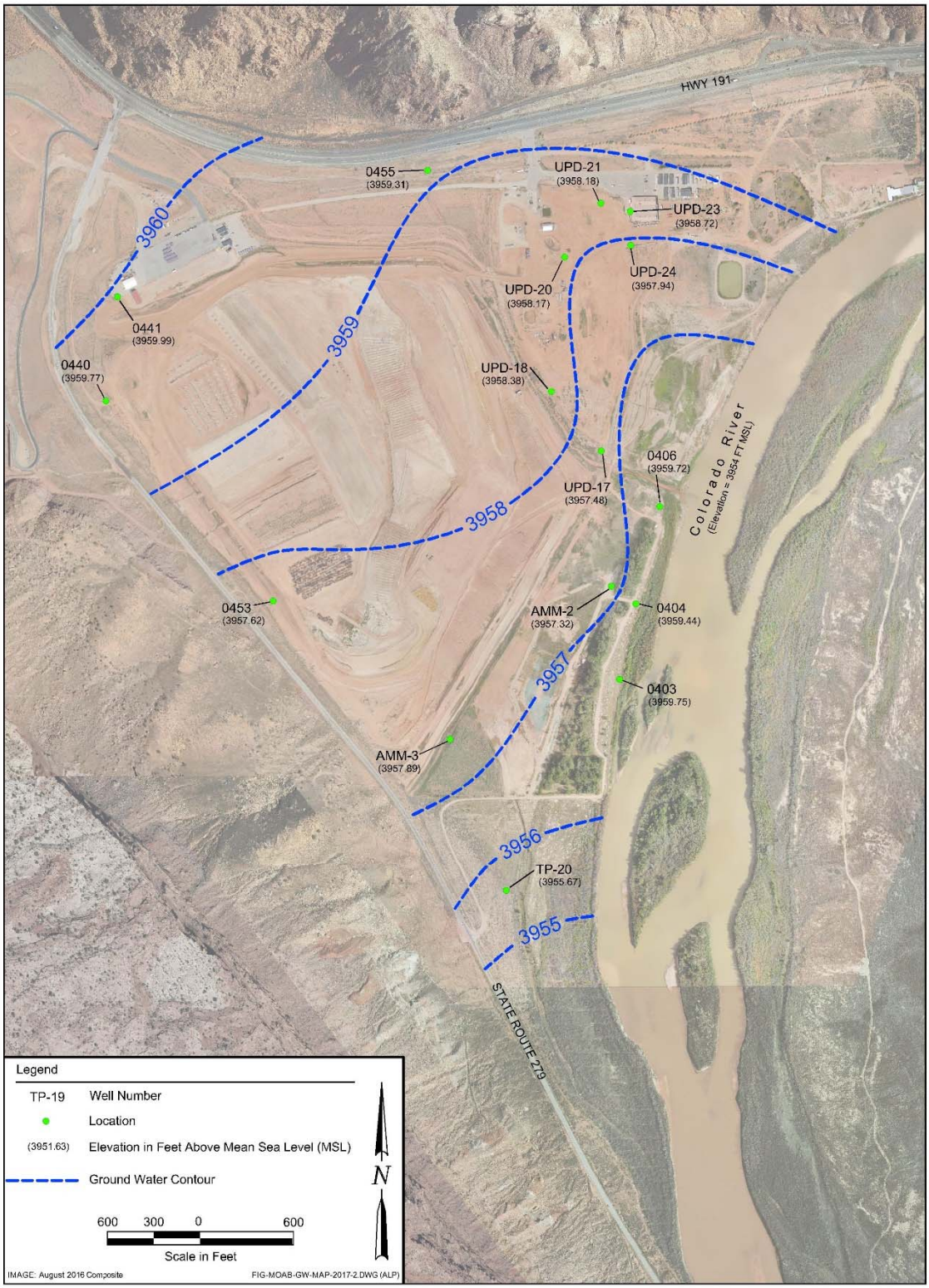

Figure 30. Site-wide Ground Water Elevations, June 5 through June 14, 2017

4.5 Contaminant Distribution

Figures 31 and 32 are maps showing shallow ground water ammonia and uranium plumes, respectively, using data collected during the May 2017 site-wide events. Contaminant distribution is generally comparable to previous plume maps generated using data collected during the past 2 years.

5.0 Conclusions

This report presents the results of sampling conducted at the Moab UMTRA and Crescent Junction disposal sites between January and June 2017. The primary contaminants of interest are ammonia and uranium, and while there is no EPA drinking water standard maximum concentration level for ammonia, the UMTRA ground water standard for uranium is 0.044 mg/L. This uranium standard was exceeded in at least one location for each of the Moab site sampling events, but not exceeded in the two Crescent Junction sampling events. Refer to Table 18 for a complete list of the Moab site locations and associated uranium concentrations that exceeded the 0.044 mg/L uranium standard.

5.1 January 2017 CF1, CF4, and Tree Plot Sampling Event

The rationale for the collection of ground water samples from observation wells surrounding the CF1 and CF4 injection wells was to evaluate the effectiveness of the freshwater injection system. When these CF1 samples were collected there had been no fresh water injected in this portion of the well field since November 2016. As a result, these values were expected to represent baseline ammonia concentrations.

Results indicate the CF1 monitoring well ammonia concentrations increase with depth, with a maximum concentration of 610 mg/L at a depth of 36 ft bgs. Below the zone at which water was injected (greater than 20 ft bgs), there is no significant difference between upgradient and downgradient concentrations.

In the shallow zone, the results indicate the ammonia concentrations are highest in the upgradient direction (210 mg/L), decrease in the zone just downgradient of the injection wells (6.3 mg/L), and then increase at the riverbank (71 mg/L). These results suggest that even after no injection occurred for nearly 2 months, the impact of the injection system on the shallow ground water system was still apparent.

At the time of the sampling event, the system had been actively (with the exception of the two week time period over the holidays) injecting consistently filtered fresh water into the CF4 wells since early July 2016. The results indicate the injection system reduced the ammonia concentrations within 10 to 20 ft bgs in the vicinity of CF1 and from 15 to 35 ft bgs in the vicinity of CF4.

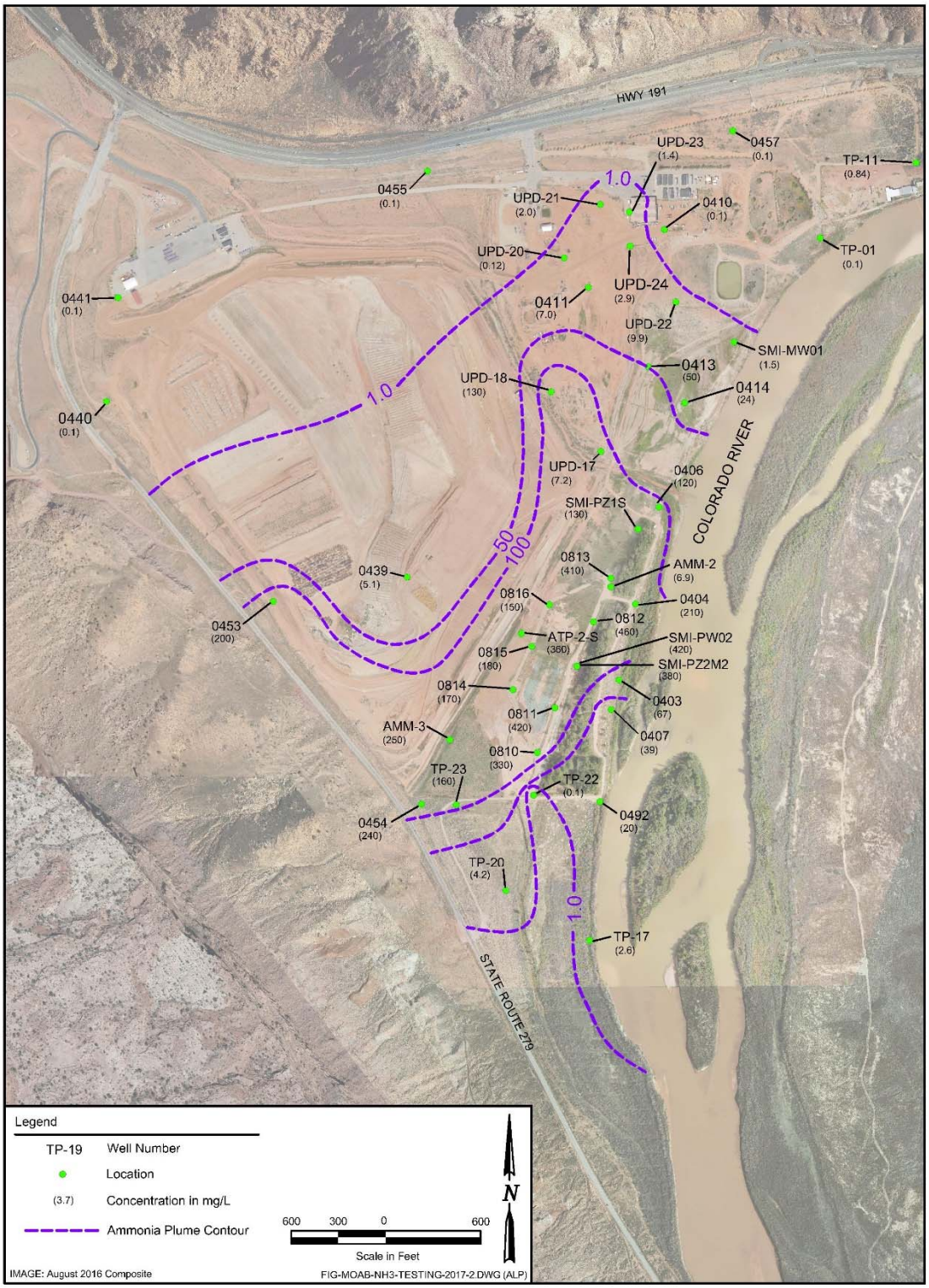

Figure 31. Ammonia Plume in Shallow Ground Water May 2017

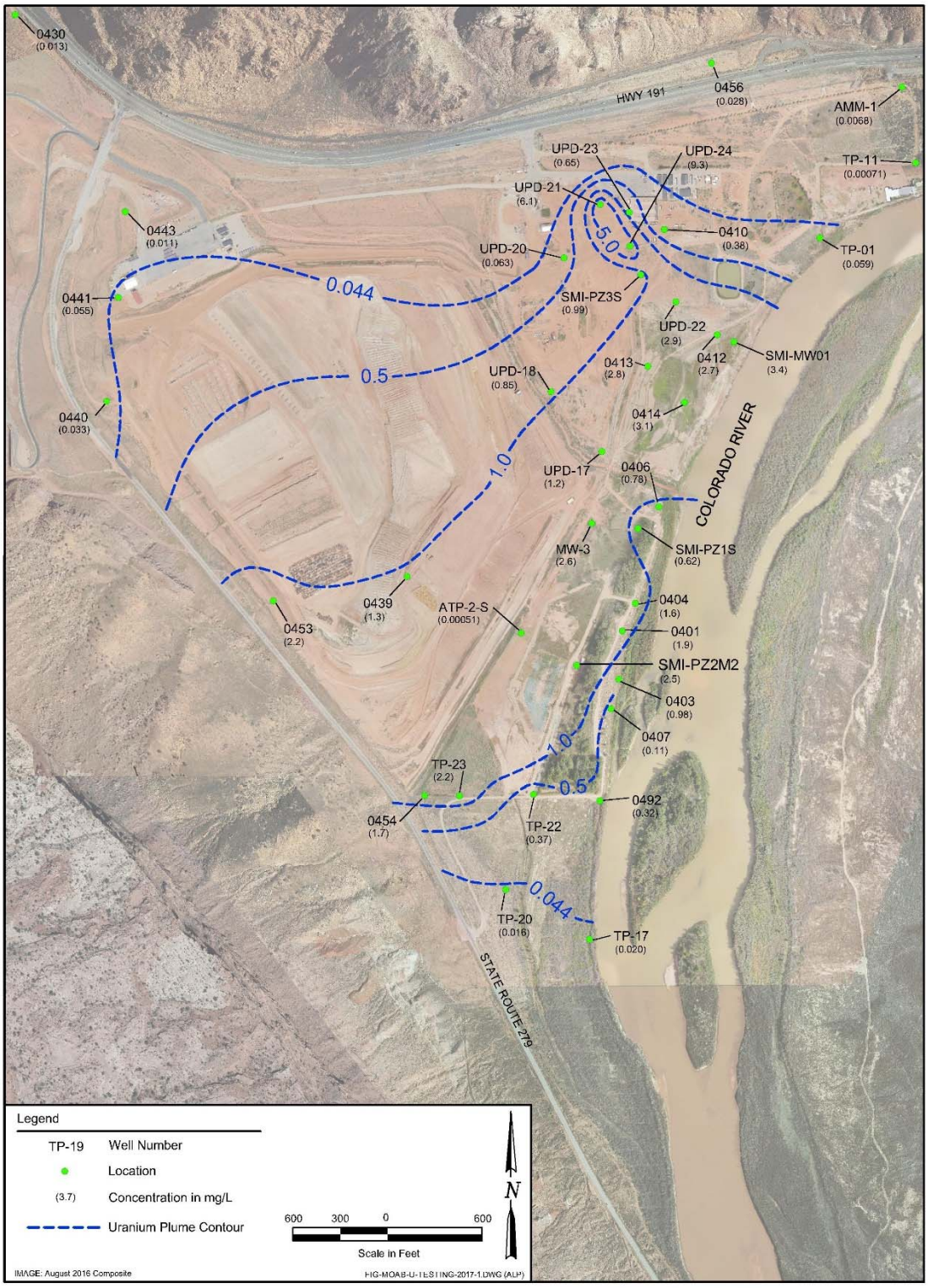

Figure 32. Uranium Plume in Shallow Ground Water May 2017

Five ground water samples downgradient and one upgradient of the tree plot area (near CF3) were collected to determine if phytoremediation had impacted ammonia concentrations. In general, ammonia concentrations for all downgradient locations gradually increase after the spring runoff flows peak in late May-early June. The data collected during this sampling event display this same trend.

The influence of phytoremediation on the ground water system is difficult to determine because of the other hydrogeologic impacts to the tree plot area in the vicinity of CF3. Flood irrigation between the months of April and September has taken place inside the tree plot since 2005/2006 and upgradient to the tree plot since 2010. CF5 ground water extraction and the area's close proximity to the riverbank further impact the ammonia concentrations.

Based on an analysis of the results, all concentrations were within the acceptable ranges, and there were no anomalous data values associated with this sampling event.

5.2 February 2017 Crescent Junction Sampling Event

The rationale for collecting the ground water sample from Crescent Junction monitoring well 0205 was to help identify the source of the water present in well 0205. The ground water sample was collected as part of the quarterly monitoring for the third quarter of 2016. In addition to the standard analytes, this sample was also analyzed for bicarbonate as $CaCO_3$, carbonate as $CaCO_3$, total alkalinity as $CaCO_3$, uranium-234, uranium-235, and uranium-238. These results will be used to discriminate the different water types encountered historically and over the past year for this investigation. The analyte concentrations of the well 0205 sample did not significantly change compared to the concentrations detected in December 2016. There was one anomalous data value associated with the chromium concentration.

5.3 May 2017 CF4 and CF5 Sampling Event

The collection of ground water samples from observation wells surrounding the CF4 injection wells in early May 2017 was to further evaluate the effectiveness of the freshwater injection system after the system had been operational since early April 2017. It was necessary to shut down the system in late February for work on the freshwater pond. The results indicate the injection system reduced the ammonia concentrations from 15 to 35 ft bgs in the vicinity of CF4. Water elevation data confirmed up to 11 ft of mounding was generated from this system.

All eight CF5 wells were sampled to monitor contaminant concentration trends and update the contaminant concentrations used for the mass removal calculations. In general, ammonia and uranium concentrations have not significantly changed over the past 2 years. The data indicate the historical trend of the extraction wells located along CF5 southeastern boundary having the highest ammonia and uranium concentrations continues. Based on an analysis of these results, all concentrations were within the acceptable ranges, and there were no anomalous data values associated with this sampling event.

5.4 May 2017 Site-wide Sampling Event

The rationale for conducting the May 2017 site-wide sampling event was to collect data from the site when the Colorado River typically peak spring runoff flows and to assess any changes or trends in the ground water system water chemistry. Surface water sampling was also conducted to assess surface water quality adjacent to the site compared to the upstream and downstream water quality.

In general, with the exception of the locations in the vicinity of the Colorado River bank, the ammonia and uranium concentrations did not significantly change since the previous site-wide sampling event in December 2016. Concentrations associated with locations impacted by the river stage tend to increase during this time of the water year.

The analysis of the sample collected from UPD-17 resulted in an ammonia concentration well below the historical minimum. The sample was re-analyzed by the laboratory with a similar result. This result remains suspect. All remaining ammonia and uranium concentrations in the site-wide wells were within 50 percent of historical ranges during this sampling event.

All eight surface water samples collected during this sampling event, with exception of one that had ammonia concentrations below 0.1 mg/L. The sample collected from location 0226 was analyzed using a higher detection limit (1.0 compared to 0.1 mg/L), with the concentration below the detection limit. As a result, it is assumed that all surface water ammonia concentrations are below the applicable EPA criteria (for a suitable habitat) for both acute and chronic concentrations.

5.5 June 2017 Crescent Junction Sampling Event

Well 0205 was sampled again in June 2017 as part of the second quarter monitoring event at the Crescent Junction site. This was the ninth sample collected at this location since mid-July 2015, and it was analyzed for the same analyte list as the February 2017 sample. All analyte concentrations were comparable to the concentrations detected in the previous event.

6.0 References

40 CFR 192A (Code of Federal Regulations) Subpart A, “Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings, Standards for the Control of Residual Radioactive Materials from Inactive Uranium Processing Sites.”

DOE (U.S. Department of Energy), *Moab UMTRA Project Standard Practice for Validation of Laboratory Data* (DOE-EM/GJTAC1855).

DOE (U.S. Department of Energy), *Moab UMTRA Project Surface Water/Ground Water Sampling and Analysis Plan* (DOE-EM/GJTAC1830).

Appendix A.
January 2017 CF1, CF4 and Tree Plot Sampling Event

Water Sampling Field Activities Verification
Minimums and Maximums Report
Water Quality Data
Water Level Data
Trip Report

Appendix A. January 2017 CF1, CF4, and Tree Plot Sampling Event

Water Sampling Field Activities Verification

Sampling Event/RIN	January 2017 CF1, CF4, and Tree Plot Sampling Event /1701091	**Date(s) of Water Sampling**	January 31 through February 8, 2017
Date(s) of Verification	August 15, 2017	**Name of Verifier**	Ken Pill

		Response (Yes, No, NA)	Comments
1.	Is the Sampling Analysis Plan (SAP) the primary document directing field procedures?	Yes	
	List other documents, standard operating procedures, instructions.	NA	
2.	Were the sampling locations specified in the planning documents sampled?	Yes	
3.	Was a pre-trip calibration conducted as specified in the aforementioned documents?	Yes	
4.	Was an operational check of the field equipment conducted in accordance with the SAP?	Yes	
	Did the operational checks meet criteria?	Yes	
5.	Were the number and types (alkalinity, temperature, electrical conductivity, pH, turbidity, oxidation reduction potential) of field measurements taken as specified?	Yes	Field measurements for temperature, pH, turbidity, oxidation reduction potential, and conductivity were collected.
6.	Was the category of the well documented?	Yes	
7.	Were the following conditions met when purging a Category I well: Was one pump/tubing volume purged before sampling?	Yes	
	Did the water level stabilize before sampling?	Yes	
	Did pH, specific conductance, and turbidity measurements stabilize before sampling?	Yes	
	Was the flow rate less than 500 milliliters per minute?	Yes	
	If a portable pump was used, was there a 4-hour delay between pump installation and sampling?	Yes	
8.	Were the following conditions met when purging a Category II well:		
	Was the flow rate less than 500 milliliters per minute?	Yes	
	Was one pump/tubing volume removed before sampling?	Yes	
9.	Were duplicates taken at a frequency of one per 20 samples?	Yes	Two duplicate samples were collected for 26 samples

Appendix A. January 2017 CF1, CF4, and Tree Plot Sampling Event (*continued*)

Water Sampling Field Activities Verification (*continued*)

Sampling Event/RIN	January 2017 CF1, CF4, and Tree Plot Sampling Event /1701091	**Date(s) of Water Sampling**	January 31 through February 8, 2017
Date(s) of Verification	August 15, 2017	**Name of Verifier**	Ken Pill

	Response (Yes, No, NA)	Comments
10. Were EBs taken at a frequency of one per 20 samples that were collected with non-dedicated equipment?	NA	All samples were collected using dedicated equipment.
11. Were trip blanks prepared and included with each shipment of volatile organic compound samples?	NA	
12. Were quality-control samples assigned a fictitious site identification number?	Yes	
13. Was the true identity of the samples recorded on the quality assurance sample log?	Yes	
14. Were samples collected in the containers specified?	Yes	
15. Were samples filtered and preserved as specified?	Yes	
16. Were the number and types of samples collected as specified?	Yes	
17. Were COC records completed, and was sample custody maintained?	Yes	
18. Are field data sheets signed and dated by both team members?	Yes	
19. Was all other pertinent information documented on the field data sheets?	Yes	
20. Was the presence or absence of ice in the cooler documented at every sample location?	Yes	
21. Were water levels measured at the locations specified in the planning documents?	Yes	

Appendix A. January 2017 CF1, CF4, and Tree Plot Sampling Event (*continued*)

Minimums and Maximums Report

Data Validation Minimums and Maximums Report - No Field Parameters
Laboratory: ALS
RIN: 1701091
Comparison: All Historical Data
Report Date: 9/25/2017

				Current			Historical Maximum			Historical Minimum			Count	
					Qualifiers			Qualifiers			Qualifiers			
Site Code	Location Code	Sample Date	Analyte	Result	Lab	Data	Result	Lab	Data	Result	Lab	Data	N	N Below Detect
MOA01	0732	02/07/2017	Ammonia Total as N	270			260			0.1	U	J	19	1
MOA01	0733	02/07/2017	Ammonia Total as N	250			240			0.19		J	22	0
MOA01	0784	01/31/2017	Uranium	0.0073			3.7		F	0.0089			23	0
MOA01	SMI-PZ1S	02/08/2017	Uranium	0.55			4.5		F	0.62			41	0
MOA01	SMI-PZ1S	02/08/2017	Uranium	0.58			4.5		F	0.62			41	0

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

BLS = below land surface; µmhos/cm = micromhos per centimeter; mV = millivolt; NTU = nephelometric turbidity unit; SL = surface location; S.U. = standard unit; TS = treatment system; WL = well

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X,Y,Z	Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G Possible grout contamination, pH > 9. J Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	Q Qualitative result due to sampling technique. R Unusable result.
U	Parameter analyzed for but was not detected.	X Location is undefined.

QA QUALIFIER:# Validated according to quality assurance guidelines.

Water Quality Data

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site
REPORT DATE: 9/25/2017
Location: 0480 WELL Configuration 1

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	02/02/2017	0001	18	-	210			#	10	
Oxidation Reduction Potential	mV	02/02/2017	N001	18	-	104			#		
pH	s.u.	02/02/2017	N001	18	-	7.1			#		
Specific Conductance	umhos /cm	02/02/2017	N001	18	-	13819			#		
Temperature	C	02/02/2017	N001	18	-	16.32			#		
Turbidity	NTU	02/02/2017	N001	18	-	0.84			#		
Uranium	mg/L	02/02/2017	0001	18	-	2		J	#	0.00012	

Location: 0481 WELL Configuration 1

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	02/02/2017	0001	28	-	450			#	10	
Ammonia Total as N	mg/L	02/02/2017	0002	28	-	430			#	10	
Oxidation Reduction Potential	mV	02/02/2017	N001	28	-	121			#		
pH	s.u.	02/02/2017	N001	28	-	8.2			#		
Specific Conductance	umhos /cm	02/02/2017	N001	28	-	18003			#		
Temperature	C	02/02/2017	N001	28	-	15.87			#		
Turbidity	NTU	02/02/2017	N001	28	-	2.31			#		
Uranium	mg/L	02/02/2017	0001	28	-	2.4		J	#	0.00012	
Uranium	mg/L	02/02/2017	0002	28	-	2.3		J	#	0.00012	

Location: 0483 WELL Configuration 1

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	02/07/2017	0001	18	-	6.3			#	0.5	
Oxidation Reduction Potential	mV	02/07/2017	N001	18	-	184			#		
pH	s.u.	02/07/2017	N001	18	-	6.56			#		
Specific Conductance	umhos /cm	02/07/2017	N001	18	-	9491			#		
Temperature	C	02/07/2017	N001	18	-	15.49			#		
Turbidity	NTU	02/07/2017	N001	18	-	1.34			#		
Uranium	mg/L	02/07/2017	0001	18	-	1.2		J	#	0.00012	

Location: 0484 WELL Configuration 1

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	02/07/2017	0001	28	-	440			#	10	
Oxidation Reduction Potential	mV	02/07/2017	N001	28	-	202			#		
pH	s.u.	02/07/2017	N001	28	-	6.45			#		
Specific Conductance	umhos /cm	02/07/2017	N001	28	-	18592			#		
Temperature	C	02/07/2017	N001	28	-	15.62			#		
Turbidity	NTU	02/07/2017	N001	28	-	5.69			#		
Uranium	mg/L	02/07/2017	0001	28	-	2.4		J	#	0.00012	

Location: 0557 WELL Configuration 1

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	02/07/2017	0001	40	-	540	N		#	50	
Oxidation Reduction Potential	mV	02/07/2017	N001	40	-	208			#		
pH	s.u.	02/07/2017	N001	40	-	6.44			#		
Specific Conductance	umhos /cm	02/07/2017	N001	40	-	19141			#		
Temperature	C	02/07/2017	N001	40	-	15.87			#		
Turbidity	NTU	02/07/2017	N001	40	-	6.84			#		
Uranium	mg/L	02/07/2017	0001	40	-	2.6		J	#	0.00012	

Location: 0558 WELL Configuration 1

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	02/07/2017	0001	36	-	610			#	50	
Oxidation Reduction Potential	mV	02/07/2017	N001	36	-	210			#		
pH	s.u.	02/07/2017	N001	36	-	6.46			#		
Specific Conductance	umhos /cm	02/07/2017	N001	36	-	21882			#		
Temperature	C	02/07/2017	N001	36	-	15.09			#		
Turbidity	NTU	02/07/2017	N001	36	-	0.84			#		
Uranium	mg/L	02/07/2017	0001	36	-	2.6		J	#	0.00012	

Location: 0559 WELL Configuration 1

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	02/08/2017	0001	19	-	71			#	5	
Oxidation Reduction Potential	mV	02/08/2017	N001	19	-	175			#		
pH	s.u.	02/08/2017	N001	19	-	8.59			#		
Specific Conductance	umhos /cm	02/08/2017	N001	19	-	10394			#		
Temperature	C	02/08/2017	N001	19	-	16.77			#		
Turbidity	NTU	02/08/2017	N001	19	-	1.44			#		
Uranium	mg/L	02/08/2017	0001	19	-	1.3		J	#	0.00012	

Location: 0560 WELL Configuration 1

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	02/08/2017	0001	36	-	570			#	50	
Oxidation Reduction Potential	mV	02/08/2017	N001	36	-	193			#		
pH	s.u.	02/08/2017	N001	36	-	6.54			#		
Specific Conductance	umhos /cm	02/08/2017	N001	36	-	23677			#		
Temperature	C	02/08/2017	N001	36	-	16.81			#		
Turbidity	NTU	02/08/2017	N001	36	-	0.81			#		
Uranium	mg/L	02/08/2017	0001	36	-	2.4		J	#	0.00012	

Location: 0596 WELL Configuration 1

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	02/08/2017	0001	24	-	420			#	20	
Oxidation Reduction Potential	mV	02/08/2017	N001	24	-	191			#		
pH	s.u.	02/08/2017	N001	24	-	6.53			#		
Specific Conductance	umhos /cm	02/08/2017	N001	24	-	17889			#		
Temperature	C	02/08/2017	N001	24	-	16.72			#		
Turbidity	NTU	02/08/2017	N001	24	-	1.33			#		
Uranium	mg/L	02/08/2017	0001	24	-	1.9		J	#	0.00012	

Location: : 0682 WELL Configuration 3

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	02/08/2017	0001	28	-	410			#	20	
Oxidation Reduction Potential	mV	02/08/2017	N001	28	-	184			#		
pH	s.u.	02/08/2017	N001	28	-	7.47			#		
Specific Conductance	umhos /cm	02/08/2017	N001	28	-	16326			#		
Temperature	C	02/08/2017	N001	28	-	16.31			#		
Turbidity	NTU	02/08/2017	N001	28	-	1.39			#		
Uranium	mg/L	02/08/2017	0001	28	-	1.8		J	#	0.00012	

Appendix A. January 2017 CF1, CF4, and Tree Plot Sampling Event (*continued*)

Water Quality Data (*continued*)

Location: : 0683 WELL Configuration 3

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	02/07/2017	0001	27	-	460			#	20	
Oxidation Reduction Potential	mV	02/07/2017	N001	27	-	181			#		
pH	s.u.	02/07/2017	N001	27	-	6.5			#		
Specific Conductance	umhos /cm	02/07/2017	N001	27	-	15110			#		
Temperature	C	02/07/2017	N001	27	-	16.1			#		
Turbidity	NTU	02/07/2017	N001	27	-	8.62			#		
Uranium	mg/L	02/07/2017	0001	27	-	1.7		J	#	0.00012	

Location: : 0684 WELL Configuration 3

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	02/08/2017	0001	18	-	210			#	10	
Oxidation Reduction Potential	mV	02/08/2017	N001	18	-	185			#		
pH	s.u.	02/08/2017	N001	18	-	6.95			#		
Specific Conductance	umhos /cm	02/08/2017	N001	18	-	16269			#		
Temperature	C	02/08/2017	N001	18	-	14.38			#		
Turbidity	NTU	02/08/2017	N001	18	-	2.48			#		
Uranium	mg/L	02/08/2017	0001	18	-	2.6		J	#	0.00012	

Appendix A. January 2017 CF1, CF4, and Tree Plot Sampling Event (*continued*)

Water Quality Data (*continued*)

Location: : 0732 WELL Infiltration Trench

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	02/07/2017	0001	18	-	270			#	20	
Oxidation Reduction Potential	mV	02/07/2017	N001	18	-	181			#		
pH	s.u.	02/07/2017	N001	18	-	6.48			#		
Specific Conductance	umhos /cm	02/07/2017	N001	18	-	14073			#		
Temperature	C	02/07/2017	N001	18	-	15.56			#		
Turbidity	NTU	02/07/2017	N001	18	-	2.18			#		
Uranium	mg/L	02/07/2017	0001	18	-	2.2		J	#	0.00012	

Location: : 0733 WELL Infiltration Trench

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	02/07/2017	0001	18	-	250			#	20	
Oxidation Reduction Potential	mV	02/07/2017	N001	18	-	180			#		
pH	s.u.	02/07/2017	N001	18	-	6.48			#		
Specific Conductance	umhos /cm	02/07/2017	N001	18	-	11863			#		
Temperature	C	02/07/2017	N001	18	-	15.43			#		
Turbidity	NTU	02/07/2017	N001	18	-	8.9			#		
Uranium	mg/L	02/07/2017	0001	18	-	1.3		J	#	0.00012	

Appendix A. January 2017 CF1, CF4, and Tree Plot Sampling Event (*continued*)

Water Quality Data (*continued*)

Location: : 0780 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	02/02/2017	0001	28	-	0.27			#	0.1	
Oxidation Reduction Potential	mV	02/02/2017	N001	28	-	96			#		
pH	s.u.	02/02/2017	N001	28	-	8.26			#		
Specific Conductance	umhos /cm	02/02/2017	N001	28	-	1377			#		
Temperature	C	02/02/2017	N001	28	-	8.06			#		
Turbidity	NTU	02/02/2017	N001	28	-	8.7			#		
Uranium	mg/L	02/02/2017	0001	28	-	0.01		J	#	0.000012	

Location: : 0781 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	02/02/2017	0001	46	-	2100			#	100	
Oxidation Reduction Potential	mV	02/02/2017	N001	46	-	212			#		
pH	s.u.	02/02/2017	N001	46	-	6.98			#		
Specific Conductance	umhos /cm	02/02/2017	N001	46	-	78103			#		
Temperature	C	02/02/2017	N001	46	-	12.65			#		
Turbidity	NTU	02/02/2017	N001	46	-	2.34			#		
Uranium	mg/L	02/02/2017	0001	46	-	2.1		J	#	0.00012	

Appendix A. January 2017 CF1, CF4, and Tree Plot Sampling Event (*continued*)

Water Quality Data (*continued*)

Location: : 0782 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	02/02/2017	0001	33	-	14			#	1	
Oxidation Reduction Potential	mV	02/02/2017	N001	33	-	118			#		
pH	s.u.	02/02/2017	N001	33	-	7.96			#		
Specific Conductance	umhos /cm	02/02/2017	N001	33	-	1527			#		
Temperature	C	02/02/2017	N001	33	-	9			#		
Turbidity	NTU	02/02/2017	N001	33	-	1.4			#		
Uranium	mg/L	02/02/2017	0001	33	-	0.048		J	#	0.000012	

Location: : 0783 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	01/31/2017	0001	18	-	0.2			#	0.1	
Oxidation Reduction Potential	mV	01/31/2017	N001	18	-	93			#		
pH	s.u.	01/31/2017	N001	18	-	7.74			#		
Specific Conductance	umhos /cm	01/31/2017	N001	18	-	1279			#		
Temperature	C	01/31/2017	N001	18	-	15.51			#		
Turbidity	NTU	01/31/2017	N001	18	-	2.93			#		
Uranium	mg/L	01/31/2017	0001	18	-	0.046		J	#	0.000012	

Location: : 0784 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	01/31/2017	0001	18	-	0.1	U		#	0.1	
Oxidation Reduction Potential	mV	01/31/2017	N001	18	-	104			#		
pH	s.u.	01/31/2017	N001	18	-	7.99			#		
Specific Conductance	umhos /cm	01/31/2017	N001	18	-	1264			#		
Temperature	C	01/31/2017	N001	18	-	7.55			#		
Turbidity	NTU	01/31/2017	N001	18	-	2.21			#		
Uranium	mg/L	01/31/2017	0001	18	-	0.0073		J	#	0.000012	

Location: : 0785 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	02/02/2017	0001	18	-	0.1	U		#	0.1	
Oxidation Reduction Potential	mV	02/02/2017	N001	18	-	84			#		
pH	s.u.	02/02/2017	N001	18	-	7.67			#		
Specific Conductance	umhos /cm	02/02/2017	N001	18	-	1355			#		
Temperature	C	02/02/2017	N001	18	-	8.89			#		
Turbidity	NTU	02/02/2017	N001	18	-	3.73			#		
Uranium	mg/L	02/02/2017	0001	18	-	0.0094		J	#	0.000012	

Appendix A. January 2017 CF1, CF4, and Tree Plot Sampling Event (*continued*)

Water Quality Data (*continued*)

Location: : 0786 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	01/31/2017	0001	28	-	0.1	U		#	0.1	
Oxidation Reduction Potential	mV	01/31/2017	N001	28	-	95			#		
pH	s.u.	01/31/2017	N001	28	-	7.56			#		
Specific Conductance	umhos /cm	01/31/2017	N001	28	-	1347			#		
Temperature	C	01/31/2017	N001	28	-	8.08			#		
Turbidity	NTU	01/31/2017	N001	28	-	0.66			#		
Uranium	mg/L	01/31/2017	0001	28	-	0.0086		J	#	0.000012	

Location: : 0787 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	01/31/2017	0001	36	-	1500			#	100	
Oxidation Reduction Potential	mV	01/31/2017	N001	36	-	150			#		
pH	s.u.	01/31/2017	N001	36	-	6.96			#		
Specific Conductance	umhos /cm	01/31/2017	N001	36	-	55958			#		
Temperature	C	01/31/2017	N001	36	-	10.34			#		
Turbidity	NTU	01/31/2017	N001	36	-	6.13			#		
Uranium	mg/L	01/31/2017	0001	36	-	1.9		J	#	0.00012	

Appendix A. January 2017 CF1, CF4, and Tree Plot Sampling Event (*continued*)

Water Quality Data (*continued*)

Location: : AMM-2 WELL East of pile along road

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	02/08/2017	0001	48	-	600			#	50	
Oxidation Reduction Potential	mV	02/08/2017	N001	48	-	184			#		
pH	s.u.	02/08/2017	N001	48	-	6.72			#		
Specific Conductance	umhos /cm	02/08/2017	N001	48	-	18737			#		
Temperature	C	02/08/2017	N001	48	-	16.61			#		
Turbidity	NTU	02/08/2017	N001	48	-	4.12			#		
Uranium	mg/L	02/08/2017	0001	48	-	2		J	#	0.00012	

Location: : SMI-PZ1S WELL Baseline Area

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	02/08/2017	0001	18	-	40			#	2.5	
Ammonia Total as N	mg/L	02/08/2017	0002	18	-	39			#	2.5	
Oxidation Reduction Potential	mV	02/08/2017	N001	18	-	163			#		
pH	s.u.	02/08/2017	N001	18	-	9.29			#		
Specific Conductance	umhos /cm	02/08/2017	N001	18	-	2875			#		
Temperature	C	02/08/2017	N001	18	-	8.79			#		
Turbidity	NTU	02/08/2017	N001	18	-	17			#		
Uranium	mg/L	02/08/2017	0001	18	-	0.55		J	#	0.000012	
Uranium	mg/L	02/08/2017	0002	18	-	0.58		J	#	0.000012	

BLS = below land surface; µmhos/cm = micromhos per centimeter; mV = millivolt; NTU = nephelometric turbidity unit; SL = surface location; S.U. = standard unit; TS = treatment system;
WL = well

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X,Y,Z	Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G Possible grout contamination, pH > 9. J Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	Q Qualitative result due to sampling technique. R Unusable result.
U	Parameter analyzed for but was not detected.	X Location is undefined.

QA QUALIFIER:# Validated according to quality assurance guidelines.

Appendix A. January 2017 CF1, CF4, and Tree Plot Sampling Event (*continued*)

Water Level Data

STATIC WATER LEVELS (USEE700) FOR SITE MOA01, Moab Site						
REPORT DATE: 9/25/2017						
Location Code	Flow Code	Top of Casing Elevation (Ft)	Measurement Date Time	Depth From Top of Casing (Ft)	Water Elevation (MSL)	Water Level Flag
480	O	3968.65	2/2/2017	15.65	3953.00	
481	O	3968.83	2/2/2017	15.49	3953.34	
483	O	3968.90	2/7/2017	15.97	3952.93	
484	O	3969.19	2/7/2017	15.98	3953.21	
557	O	3968.85	2/7/2017	13.35	3955.50	
558	O	3968.79	2/7/2017	15.68	3953.11	
559	O	3969.92	2/8/2017	17.06	3952.86	
560	O	3968.77	2/8/2017	15.63	3953.14	
596	O	3968.76	2/8/2017	15.95	3952.81	
682	O	3970.18	2/8/2017	13.98	3956.20	
683	O	3970.73	2/7/2017	14.41	3956.32	
684	O	3970.22	2/8/2017	14.38	3955.84	
732	O	3968.99	2/7/2017	12.65	3956.34	
733	O	3964.45	2/7/2017	14.2	3950.25	
780	O	3968.45	2/2/2017	15.26	3953.19	
781	O	3968.56	2/2/2017	15.08	3953.48	
782	O	3968.46	2/2/2017	15.24	3953.22	
783	O	3966.16	1/31/2017	13.73	3952.43	
784	O	3968.73	1/31/2017	16.38	3952.35	
785	O	3969.24	2/2/2017	15.98	3953.26	
786	O	3968.14	1/31/2017	15.3	3952.84	
787	O	3968.43	1/31/2017	15.5	3952.93	
AMM-2	O	3964.09	2/8/2017	10.07	3954.02	
SMI-PZ1S	O	3964.13	2/8/2017	9.96	3954.17	

Flow Codes: B = background; C = cross gradient; D = downgradient; MSL = mean sea level O = on site; U = upgradient, Water Level Flags: D = dry

Date: June 29, 2017
To: Ken Pill
From: James Ritchey
Subject: January 2017 Sampling Event
Site: Moab – CF1, CF4, and Tree Plot Sampling Event – January 2017
Date of Sampling Event: January 31 - February 8, 2017
Team Members: E. Moran and J. Ritchey
RIN Number Assigned: All samples were assigned to RIN 1701091.
Sample Shipment: Samples coolers were shipped overnight UPS to ALS Laboratory from Moab, Utah on February 9 and 15 of 2016 (Tracking numbers 1Z5W1Y510199066555 and 1Z5W1Y510198294168).

January 2017 Configuration 1 Sampling

Number of Locations Sampled: Nine observation wells (0480, 0481, 0483, 0484, 0557, 0558, 0559, 0560, and 0596) and one duplicate were sampled during the January 2017 Sampling Event.

Locations Not Sampled: None.

Field Variance: None.

Quality Control Sample Cross Reference: Following are the false identifications assigned to the quality control samples:

False ID	True ID	Sample Type	Associated matrix
2000	0481	Duplicate from 28 ft bgs	Ground Water

Location Specific Information – Observation Wells: All observation wells were sampled using micro-purge techniques with a peristaltic pump and dedicated pump-head and downhole tubing. Sample depths and water levels for each observation well are listed below.

Well No.	Date	Time	Depth to Water (ft btoc)	Sample Depth (ft bgs)
0480	02/02/2017	15:55	15.65	18
0481	02/02/2017	16:15	15.49	28
0483	02/07/2017	09:55	15.97	18
0484	02/07/2017	10:10	15.98	28
0557	02/07/2017	10:40	13.35	40
0558	02/07/2017	10:25	15.68	36
0559	02/08/2017	11:40	17.06	19
0560	02/08/2017	11:30	15.63	36
0596	02/08/2017	11:15	15.95	25

January 2017 Configuration 4 Sampling

Number of Locations Sampled: Eight observation wells (0780, 0781, 0782, 0783, 0784, 0785, 0786, and 0787) were sampled during the January 2017 Sampling Event.

Locations Not Sampled: None.

Field Variance: None.

Quality Control Sample Cross Reference: None.

Location Specific Information – Observation Wells: All observation wells were sampled using micro-purge techniques with a peristaltic pump and dedicated pump-head and downhole tubing. Sample depths and water levels for each observation well are listed below.

Well No.	Date	Time	Depth to Water (ft btoc)	Sample Depth (ft bgs)
0780	02/02/2017	15:10	15.26	28
0781	02/02/2017	14:35	15.08	46
0782	02/02/2017	14:55	15.24	33
0783	01/31/2017	13:20	13.73	18
0784	01/31/2017	13.45	16.38	18
0785	02/02/2017	15:30	15.98	18
0786	01/31/2017	14:30	15.30	28
0787	01/31/2017	14:10	15.50	36

January 2017 Tree Plot Sampling

Number of Locations Sampled: Seven observations wells (0682, 0683, 0684, 0732, 0733, AMM-2, and SMI-PZ1S) and one duplicate were sampled during the January 2017 Sampling Event.

Locations Not Sampled: None.

Field Variance: None.

Quality Control Sample Cross Reference: Following are the false identifications assigned to the quality control samples:

False ID	True ID	Sample Type	Associated matrix
2001	SMI-PZ1S	Duplicate from 18 ft bgs	Ground Water

Location Specific Information – Observation Wells: All observation wells were sampled using micro-purge techniques with a peristaltic pump and dedicated pump-head and downhole tubing. Sample depths and water levels for each observation well are listed below.

Well No.	Date	Time	Depth to Water (ft btoc)	Pump Intake Depth (ft bgs)
0682	02/08/2017	15:30	13.98	28
0683	02/07/2017	14:40	14.41	27
0684	02/08/2017	15:50	14.38	18
0732	02/07/2017	15:25	12.65	18
0733	02/07/2017	15:05	14.20	18
AMM-2	02/08/2017	15:15	10.07	48
SMI-PZ1S	02/08/2017	16:10	9.96	18

Well Inspection Summary: A well inspection was not conducted.

Equipment: None.

Regulatory: None.

Site Issues: According to the USGS Cisco Gaging Station (Station No. 09180500), the mean daily Colorado River flow during this sampling event is provided below:

Date	Daily Mean Flow (cfs)
01/31/2017	2,820
02/01/2017	2,960
02/02/2017	3,020
02/03/2017	3,160
02/04/2017	3,140
02/05/2017	3,060
02/06/2017	3,070
02/07/2017	3,120
02/08/2017	3,300

Corrective Action Required/Taken: None.

Appendix B.
February 2017 Crescent Junction Sampling Event

Water Sampling Field Activities Verification
Minimums and Maximums Report
Water Quality Data
Water Level Data
Trip Report

Appendix B. February 2017 Crescent Junction Sampling Event

Water Sampling Field Activities Verification

Sampling Event/RIN	February 2017 Crescent Junction Sampling Event/1702092	**Date(s) of Water Sampling**	February 22, 2017
Date(s) of Verification	August 15, 2017	**Name of Verifier**	Ken Pill

		Response (Yes, No, NA)	Comments
1.	Is the Sampling Analysis Plan (SAP) the primary document directing field procedures?	Yes	
	List other documents, standard operating procedures, instructions.	NA	
2.	Were the sampling locations specified in the planning documents sampled?	Yes	
3.	Was a pre-trip calibration conducted as specified in the aforementioned documents?	Yes	
4.	Was an operational check of the field equipment conducted in accordance with the SAP?	Yes	
	Did the operational checks meet criteria?	Yes	
5.	Were the number and types (alkalinity, temperature, electrical conductivity, pH, turbidity, oxidation reduction potential) of field measurements taken as specified?	Yes	Field measurements for temperature, pH, turbidity, oxidation reduction potential, and conductivity were collected.
6.	Was the category of the well documented?	Yes	
7.	Were the following conditions met when purging a Category I well: Was one pump/tubing volume purged before sampling?	Yes	
	Did the water level stabilize before sampling?	Yes	
	Did pH, specific conductance, and turbidity measurements stabilize before sampling?	Yes	
	Was the flow rate less than 500 milliliters per minute?	Yes	
	If a portable pump was used, was there a 4-hour delay between pump installation and sampling?	NA	
8.	Were the following conditions met when purging a Category II well:		
	Was the flow rate less than 500 milliliters per minute?	NA	
	Was one pump/tubing volume removed before sampling?	NA	
9.	Were duplicates taken at a frequency of one per 20 samples?	No	Only 1 sample collected

Appendix B. February 2017 Crescent Junction Sampling Event (*continued*)

Water Sampling Field Activities Verification Event (*continued*)

Sampling Event/RIN	February 2017 Crescent Junction Sampling Event/1702092	**Date(s) of Water Sampling**	February 22, 2017
Date(s) of Verification	August 15, 2017	**Name of Verifier**	Ken Pill

	Response (Yes, No, NA)	Comments
10. Were EBs taken at a frequency of one per 20 samples that were collected with non-dedicated equipment?	NA	All samples were collected using dedicated equipment.
11. Were trip blanks prepared and included with each shipment of volatile organic compound samples?	NA	
12. Were quality-control samples assigned a fictitious site identification number?	Yes	
Was the true identity of the samples recorded on the quality assurance sample log?	Yes	
13. Were samples collected in the containers specified?	Yes	
14. Were samples filtered and preserved as specified?	Yes	
15. Were the number and types of samples collected as specified?	NA	
16. Were COC records completed, and was sample custody maintained?	Yes	
17. Are field data sheets signed and dated by both team members?	Yes	
18. Was all other pertinent information documented on the field data sheets?	NA	
19. Was the presence or absence of ice in the cooler documented at every sample location?	Yes	
20. Were water levels measured at the locations specified in the planning documents?	NA	

Appendix A. February 2017 Crescent Junction Sampling Event (*continued*)

Minimums and Maximums Report

Data Validation Minimums and Maximums Report - No Field Parameters
Laboratory: ALS
RIN: 1702092
Comparison: All Historical Data
Report Date: 9/25/2017

				Current			Historical Maximum			Historical Minimum			Count	
					Qualifiers			Qualifiers			Qualifiers			
Site Code	Location Code	Sample Date	Analyte	Result	*Lab*	*Data*	Result	*Lab*	*Data*	Result	*Lab*	*Data*	N	N Below Detect
CRJ01	0205	02/22/2017	Chromium	0.044	J		0.021	J		0.00051	U		9	5
CRJ01	0205	02/22/2017	MOLYBDENUM	55	J		54	J		2.2	J		7	3

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.
Analyte concentrations presented in blue text represent the historical minimum or maximum value exceeded by the concentration presented in red, which is associated with this current sampling event.

BLS = below land surface; µmhos/cm = micromhos per centimeter; mV = millivolt; NTU = nephelometric turbidity unit; SL = surface location; S.U. = standard unit; TS = treatment system; WL = well
SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.
LAB QUALIFIERS:

*	Replicate analysis not within control limits.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X,Y,Z	Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G	Possible grout contamination, pH > 9. J Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	Q	Qualitative result due to sampling technique. R Unusable result.
U	Parameter analyzed for but was not detected.	X	Location is undefined.

QA QUALIFIER:# Validated according to quality assurance guidelines.

Appendix B. February 2017 Crescent Junction Sampling Event (*continued*)

Water Quality Data

General Water Quality Data by Location (USEE105) FOR SITE CRJ01, Crescent Junction Site
REPORT DATE: 9/25/2017
Location: 0205 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	02/22/2017	0001	68	-	15			#	1	
Arsenic	mg/L	02/22/2017	0001	68	-	0.039	U	J	#	0.039	
Barium	mg/L	02/22/2017	0001	68	-	0.014	J	J	#	0.0019	
BICARBONATE AS CaCO3	mg/L	02/22/2017	0001	68	-	1000			#	50	
BORON	ug/L	02/22/2017	0001	68	-	1300		J	#	31	
Bromide	mg/L	02/22/2017	0001	68	-	8	U		#	8	
Cadmium	mg/L	02/22/2017	0001	68	-	0.0033	U	J	#	0.0033	
Calcium	mg/L	02/22/2017	0001	68	-	370		J	#	0.12	
CARBONATE AS CaCO3	mg/L	02/22/2017	0001	68	-	50	U		#	50	
Chloride	mg/L	02/22/2017	0001	68	-	3600			#	100	
Chromium	mg/L	02/22/2017	0001	68	-	0.044	J	J	#	0.0051	
Copper	mg/L	02/22/2017	0001	68	-	0.0097	U	J	#	0.0097	
Fluoride	mg/L	02/22/2017	0001	68	-	4	U		#	4	
Iron	mg/L	02/22/2017	0001	68	-	0.3	J	J	#	0.049	
Lead	mg/L	02/22/2017	0001	68	-	0.013	U	J	#	0.013	
Magnesium	mg/L	02/22/2017	0001	68	-	920		J	#	0.13	

General Water Quality Data by Location (USEE105) FOR SITE CRJ01, Crescent Junction Site
REPORT DATE: 9/25/2017
Location: 0205 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Manganese	mg/L	02/22/2017	0001	68	-	0.53		J	#	0.0011	
MOLYBDENUM	ug/L	02/22/2017	0001	68	-	55	J	J	#	11	
Nitrate + Nitrite as Nitrogen	mg/L	02/22/2017	0001	68	-	780			#	50	
Oxidation Reduction Potential	mV	02/22/2017	N001	68	-	195			#		
pH	s.u.	02/22/2017	N001	68	-	7.15			#		
Potassium	mg/L	02/22/2017	0001	68	-	53		J	#	1.1	
Selenium	mg/L	02/22/2017	0001	68	-	4.3		J	#	0.027	
Sodium	mg/L	02/22/2017	0001	68	-	10000		J	#	3.3	
Specific Conductance	umhos /cm	02/22/2017	N001	68	-	43308			#		
Sulfate	mg/L	02/22/2017	0001	68	-	22000			#	500	
Temperature	C	02/22/2017	N001	68	-	14.65			#		
TOTAL ALKALINITY AS CaCO3	mg/L	02/22/2017	0001	68	-	1000			#	50	
Total Dissolved Solids	mg/L	02/22/2017	0001	68	-	25000		J	#	1000	
Turbidity	NTU	02/22/2017	N001	68	-	6.15			#		
Uranium	mg/L	02/22/2017	0001	68	-	0.031		J	#	0.000012	
Uranium-234	pCi/L	02/22/2017	0001	68	-	32.5			#	0.1	5.5
Uranium-235	pCi/L	02/22/2017	0001	68	-	0.49			#	0.07	0.18
Uranium-238	pCi/L	02/22/2017	0001	68	-	11.2			#	0.1	2

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X,Y,Z	Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G	Possible grout contamination, pH > 9.	J	Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	Q	Qualitative result due to sampling technique.	R	Unusable result.
U	Parameter analyzed for but was not detected.	X	Location is undefined.		

QA QUALIFIER:

#	Validated according to quality assurance guidelines.

Appendix B. February 2017 Crescent Junction Sampling Event (*continued*)

Water Level Data

STATIC WATER LEVELS (USEE700) FOR SITE MOA01, Moab Site

REPORT DATE: 9/25/2017

Location Code	Flow Code	Top of Casing Elevation (Ft)	Measurement Date Time	Depth From Top of Casing (Ft)	Water Elevation (MSL)	Water Level Flag
0205	O	4949.0	02/22/2017	49.95	4899.05	

Flow Codes: B = background; C = cross gradient; D = downgradient; MSL = mean sea level O = on site; U = upgradient, Water Level Flags: D = dry

Trip Report

Moab TAC Team

Date: June 28, 2017
To: Ken Pill
From: James Ritchey
Subject: February 2017 CJ Sampling Event
Site: Crescent Junction – Site Wide Sampling Event – February 2017
Date of Sampling Event: February 22, 2017
Team Members: E. Moran, K. Pill, and J. Ritchey
RIN Number Assigned: All samples were assigned to RIN 1702092.
Sample Shipment: The sample was shipped overnight UPS to ALS Laboratory from Moab, Utah on Feb 22 of 2017 (Tracking number: 1Z5W1Y510199236175).

Number of Locations Sampled: A one sample was collected from well 0205 during the Feb 2017 CJ sampling event.

Locations Not Sampled/Reason: None.

Field Variance: None.

Quality Control Sample Cross Reference: None.

Location Specific Information: Well 0205 was sampled using a dedicated submersible pump with dedicated tubing. The table below provides additional information:

Location	Date	Sample Depth (ft bgs)	Depth to Water (ft btoc)	Comments
0205	02/22/2017	68	49.95	Water is yellow.

Notes: ft bgs = feet below ground surface

Well Inspection Summary: A well inspection was not conducted.

Equipment: None.

Regulatory: None.

Site Issues: None.

Corrective Action Required/Taken: None.

Appendix C.
May 2017 CF4 and CF5 Sampling Event

Water Sampling Field Activities Verification
Minimums and Maximums Report
Water Quality Data
Water Level Data
Trip Report

Appendix C. May 2017 CF4 and CF5 Sampling Event

Water Sampling Field Activities Verification

Sampling Event/RIN	May 2017 CF4 and CF5 Sampling Event/1705093	**Date(s) of Water Sampling**	May 1 – 8, 2017
Date(s) of Verification	August 15, 2017	**Name of Verifier**	Ken Pill

		Response (Yes, No, NA)	Comments
1.	Is the Sampling Analysis Plan (SAP) the primary document directing field procedures?	Yes	
2.	List other documents, standard operating procedures, instructions.	NA	
3.	Were the sampling locations specified in the planning documents sampled?	Yes	
4.	Was a pre-trip calibration conducted as specified in the aforementioned documents?	Yes	
5.	Was an operational check of the field equipment conducted in accordance with the SAP?	Yes	
6.	Did the operational checks meet criteria?	Yes	
7.	Were the number and types (alkalinity, temperature, electrical conductivity, pH, turbidity, oxidation reduction potential) of field measurements taken as specified?	Yes	Field measurements for temperature, pH, turbidity, oxidation reduction potential, and conductivity were collected.
8.	Was the category of the well documented?	Yes	
9.	Were the following conditions met when purging a Category I well:		
	Was one pump/tubing volume purged before sampling?	Yes	
	Did the water level stabilize before sampling?	Yes	
	Did pH, specific conductance, and turbidity measurements stabilize before sampling?	Yes	
	Was the flow rate less than 500 milliliters per minute?	Yes	
	If a portable pump was used, was there a 4-hour delay between pump installation and sampling?	NA	
10.	Were the following conditions met when purging a Category II well:		
	Was the flow rate less than 500 milliliters per minute?	Yes	
	Was one pump/tubing volume removed before sampling?	Yes	
11.	Were duplicates taken at a frequency of one per 20 samples?	Yes	One duplicate was collected for 17 samples.

Appendix C. May 2017 CF4 and CF5 Sampling Event (*continued*)

Water Sampling Field Activities Verification (*continued*)

Sampling Event/RIN	May 2017 CF4 and CF5 Sampling Event/1705093	**Date(s) of Water Sampling**	May 1 – 8, 2017
Date(s) of Verification	August 15, 2017	**Name of Verifier**	Ken Pill

	Response (Yes, No, NA)	Comments
12. Were EBs taken at a frequency of one per 20 samples that were collected with non-dedicated equipment?	NA	All samples were collected using dedicated equipment.
13. Were trip blanks prepared and included with each shipment of volatile organic compound samples?	NA	
14. Were quality-control samples assigned a fictitious site identification number?	Yes	
Was the true identity of the samples recorded on the quality assurance sample log?	Yes	
15. Were samples collected in the containers specified?	Yes	
16. Were samples filtered and preserved as specified?	Yes	
17. Were the number and types of samples collected as specified?	NA	
18. Were COC records completed, and was sample custody maintained?	Yes	
19. Are field data sheets signed and dated by both team members?	Yes	
20. Was all other pertinent information documented on the field data sheets?	NA	
21. Was the presence or absence of ice in the cooler documented at every sample location?	Yes	
22. Were water levels measured at the locations specified in the planning documents?	Yes	

Appendix C. May 2017 CF4 and CF5 Sampling Event (*continued*)

Minimums and Maximums Report

Data Validation Minimums and Maximums Report - No Field Parameters
Laboratory: ALS
RIN: 1705093
Comparison: All Historical Data
Report Date: 9/25/2017

				Current			Historical Maximum			Historical Minimum			Count	
					Qualifiers			Qualifiers			Qualifiers			
Site Code	Location Code	Sample Date	Analyte	Result	*Lab*	*Data*	Result	*Lab*	*Data*	Result	*Lab*	*Data*	N	N Below Detect
MOA01	0783	05/08/2017	Uranium	0.043			3.7		F	0.046			22	0
MOA01	0784	05/08/2017	Uranium	0.0038			3.7		F	0.0073			24	0
MOA01	0787	05/08/2017	Uranium	2.1			2			0.022			46	0
MOA01	0810	05/02/2017	Uranium	2.5			4.9			2.6			19	0

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.
Analyte concentrations presented in blue text represent the historical minimum or maximum value exceeded by the concentration presented in red, which is associated with this current sampling event.

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:
* Replicate analysis not within control limits.
\> Result above upper detection limit.
A TIC is a suspected aldol-condensation product.

B	Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X,Y,Z	Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G Possible grout contamination, pH > 9.	J Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	Q Qualitative result due to sampling technique.	R Unusable result.
U	Parameter analyzed for but was not detected.	X Location is undefined.	

Appendix C. May 2017 CF4 and CF5 Sampling Event (*continued*)

Water Quality Data

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site
REPORT DATE: 9/25/17
Location: 0780 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/08/2017	0001	28	-	0.14			#	0.1	
Oxidation Reduction Potential	mV	05/08/2017	N001	28	-	162			#		
pH	s.u.	05/08/2017	N001	28	-	7.61			#		
Specific Conductance	umhos /cm	05/08/2017	N001	28	-	649			#		
Temperature	C	05/08/2017	N001	28	-	14.22			#		
Turbidity	NTU	05/08/2017	N001	28	-	3.69			#		
Uranium	mg/L	05/08/2017	0001	28	-	0.0076		J	#	0.000012	

Location: 0781 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/08/2017	0001	48	-	1800			#	50	
Ammonia Total as N	mg/L	05/08/2017	0002	48	-	1700			#	100	
Oxidation Reduction Potential	mV	05/08/2017	N001	48	-	162			#		
pH	s.u.	05/08/2017	N001	48	-	6.62			#		
Specific Conductance	umhos /cm	05/08/2017	N001	48	-	63554			#		
Temperature	C	05/08/2017	N001	48	-	14.39			#		
Turbidity	NTU	05/08/2017	N001	48	-	2.15			#		
Uranium	mg/L	05/08/2017	0001	48	-	2.5		J	#	0.00012	
Uranium	mg/L	05/08/2017	0002	48	-	2.3		J	#	0.00012	

Location: 0782 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/08/2017	0001	33	-	230			#	50	
Oxidation Reduction Potential	mV	05/08/2017	N001	33	-	27			#		
pH	s.u.	05/08/2017	N001	33	-	6.75			#		
Specific Conductance	umhos /cm	05/08/2017	N001	33	-	13605			#		
Temperature	C	05/08/2017	N001	33	-	14.13			#		
Turbidity	NTU	05/08/2017	N001	33	-	3.13			#		
Uranium	mg/L	05/08/2017	0001	33	-	1.6		J	#	0.00012	

Location: 0783 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/08/2017	0001	18	-	0.1	U		#	0.1	
Oxidation Reduction Potential	mV	05/08/2017	N001	18	-	111			#		
pH	s.u.	05/08/2017	N001	18	-	7.55			#		
Specific Conductance	umhos /cm	05/08/2017	N001	18	-	986			#		
Temperature	C	05/08/2017	N001	18	-	12.66			#		
Turbidity	NTU	05/08/2017	N001	18	-	3.45			#		
Uranium	mg/L	05/08/2017	0001	18	-	0.043		J	#	0.000012	

Location: 0784 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/08/2017	0001	18	-	0.1	U		#	0.1	
Oxidation Reduction Potential	mV	05/08/2017	N001	18	-	-65			#		
pH	s.u.	05/08/2017	N001	18	-	7.79			#		
Specific Conductance	umhos /cm	05/08/2017	N001	18	-	598			#		
Temperature	C	05/08/2017	N001	18	-	15.79			#		
Turbidity	NTU	05/08/2017	N001	18	-	3.01			#		
Uranium	mg/L	05/08/2017	0001	18	-	0.0038		J	#	0.000012	

Location: 0785 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/08/2017	0001	18	-	0.1	U		#	0.1	
Oxidation Reduction Potential	mV	05/08/2017	N001	18	-	-47			#		
pH	s.u.	05/08/2017	N001	18	-	7.61			#		
Specific Conductance	umhos /cm	05/08/2017	N001	18	-	829			#		
Temperature	C	05/08/2017	N001	18	-	13.6			#		
Turbidity	NTU	05/08/2017	N001	18	-	2.62			#		
Uranium	mg/L	05/08/2017	0001	18	-	0.012		J	#	0.000012	

Location: 0786 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/08/2017	0001	28	-	1.1			#	0.1	
Oxidation Reduction Potential	mV	05/08/2017	N001	28	-	-44			#		
pH	s.u.	05/08/2017	N001	28	-	7.93			#		
Specific Conductance	umhos /cm	05/08/2017	N001	28	-	831			#		
Temperature	C	05/08/2017	N001	28	-	14.1			#		
Turbidity	NTU	05/08/2017	N001	28	-	1.05			#		
Uranium	mg/L	05/08/2017	0001	28	-	0.028		J	#	0.000012	

Location: 0787 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/08/2017	0001	36	-	1000			#	50	
Oxidation Reduction Potential	mV	05/08/2017	N001	36	-	62			#		
pH	s.u.	05/08/2017	N001	36	-	6.88			#		
Specific Conductance	umhos /cm	05/08/2017	N001	36	-	45477			#		
Temperature	C	05/08/2017	N001	36	-	14.5			#		
Turbidity	NTU	05/08/2017	N001	36	-	3.29			#		
Uranium	mg/L	05/08/2017	0001	36	-	2.1		J	#	0.00012	

Location: 0810 WELL Configuration 5

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/02/2017	0001	10.4	-	40.4	330			#	50	
Oxidation Reduction Potential	mV	05/02/2017	N001	10.4	-	40.4	250			#		
pH	s.u.	05/02/2017	N001	10.4	-	40.4	6.9			#		
Specific Conductance	umhos /cm	05/02/2017	N001	10.4	-	40.4	29314			#		
Temperature	C	05/02/2017	N001	10.4	-	40.4	17.03			#		
Turbidity	NTU	05/02/2017	N001	10.4	-	40.4	12.9			#		
Uranium	mg/L	05/02/2017	0001	10.4	-	40.4	2.5		J	#	0.00012	

Location: 0811 WELL Configuration 5

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/02/2017	0001	8.6	-	38.6	420			#	50	
Oxidation Reduction Potential	mV	05/02/2017	N001	8.6	-	38.6	240			#		
pH	s.u.	05/02/2017	N001	8.6	-	38.6	6.85			#		
Specific Conductance	umhos /cm	05/02/2017	N001	8.6	-	38.6	21525			#		
Temperature	C	05/02/2017	N001	8.6	-	38.6	16.7			#		
Turbidity	NTU	05/02/2017	N001	8.6	-	38.6	7.43			#		
Uranium	mg/L	05/02/2017	0001	8.6	-	38.6	2.7		J	#	0.00012	

Location: 0812 WELL Configuration 5

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/02/2017	0001	14.2	-	44.2	460			#	50	
Oxidation Reduction Potential	mV	05/02/2017	N001	14.2	-	44.2	241			#		
pH	s.u.	05/02/2017	N001	14.2	-	44.2	6.81			#		
Specific Conductance	umhos /cm	05/02/2017	N001	14.2	-	44.2	18234			#		
Temperature	C	05/02/2017	N001	14.2	-	44.2	15.1			#		
Turbidity	NTU	05/02/2017	N001	14.2	-	44.2	3.18			#		
Uranium	mg/L	05/02/2017	0001	14.2	-	44.2	2.1		J	#	0.00012	

Location: 0813 WELL Configuration 5

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/01/2017	0001	14.4	-	44.4	410			#	50	
Oxidation Reduction Potential	mV	05/01/2017	N001	14.4	-	44.4	166			#		
pH	s.u.	05/01/2017	N001	14.4	-	44.4	7.16			#		
Specific Conductance	umhos /cm	05/01/2017	N001	14.4	-	44.4	14840			#		
Temperature	C	05/01/2017	N001	14.4	-	44.4	14.7			#		
Turbidity	NTU	05/01/2017	N001	14.4	-	44.4	4.28			#		
Uranium	mg/L	05/01/2017	0001	14.4	-	44.4	1.6		J	#	0.00012	

Location: 0814 WELL Configuration 5

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/02/2017	0001	12.4	-	42.4	170			#	50	
Oxidation Reduction Potential	mV	05/02/2017	N001	12.4	-	42.4	275			#		
pH	s.u.	05/02/2017	N001	12.4	-	42.4	6.98			#		
Specific Conductance	umhos /cm	05/02/2017	N001	12.4	-	42.4	19926			#		
Temperature	C	05/02/2017	N001	12.4	-	42.4	17.95			#		
Turbidity	NTU	05/02/2017	N001	12.4	-	42.4	8.74			#		
Uranium	mg/L	05/02/2017	0001	12.4	-	42.4	2.9		J	#	0.00012	

Location: 0815 WELL Configuration 5

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/02/2017	0001	21.7	-	51.7	180			#	50	
Oxidation Reduction Potential	mV	05/02/2017	N001	21.7	-	51.7	263			#		
pH	s.u.	05/02/2017	N001	21.7	-	51.7	6.98			#		
Specific Conductance	umhos /cm	05/02/2017	N001	21.7	-	51.7	23012			#		
Temperature	C	05/02/2017	N001	21.7	-	51.7	17.04			#		
Turbidity	NTU	05/02/2017	N001	21.7	-	51.7	4.79			#		
Uranium	mg/L	05/02/2017	0001	21.7	-	51.7	3.1		J	#	0.00012	

Location: 0816 WELL Configuration 5

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/01/2017	0001	20.9	-	50.9	150			#	50	
Oxidation Reduction Potential	mV	05/01/2017	N001	20.9	-	50.9	172			#		
pH	s.u.	05/01/2017	N001	20.9	-	50.9	7.2			#		
Specific Conductance	umhos /cm	05/01/2017	N001	20.9	-	50.9	21042			#		
Temperature	C	05/01/2017	N001	20.9	-	50.9	17.3			#		
Turbidity	NTU	05/01/2017	N001	20.9	-	50.9	3.65			#		
Uranium	mg/L	05/01/2017	0001	20.9	-	50.9	2.4		J	#	0.00012	

Location: SMI-PW02 WELL Configuration 5

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/02/2017	0001	20	-	60	420			#	50	
Oxidation Reduction Potential	mV	05/02/2017	N001	20	-	60	206			#		
pH	s.u.	05/02/2017	N001	20	-	60	7.56			#		
Specific Conductance	umhos /cm	05/02/2017	N001	20	-	60	28733			#		
Temperature	C	05/02/2017	N001	20	-	60	16.22			#		
Turbidity	NTU	05/02/2017	N001	20	-	60	3.13			#		
Uranium	mg/L	05/02/2017	0001	20	-	60	3.5		J	#	0.00012	

BLS = below land surface; µmhos/cm = micromhos per centimeter; mV = millivolt; NTU = nephelometric turbidity unit; SL = surface location; S.U. = standard unit; TS = treatment system; WL = well
SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.
LAB QUALIFIERS:
* Replicate analysis not within control limits.
\> Result above upper detection limit.
A TIC is a suspected aldol-condensation product.

B	Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X,Y,Z	Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G Possible grout contamination, pH > 9.	J Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	Q Qualitative result due to sampling technique.	R Unusable result.
U	Parameter analyzed for but was not detected.	X Location is undefined.	

QA QUALIFIER:

#	Validated according to quality assurance guidelines.

Water Level Data

STATIC WATER LEVELS (USEE700) FOR SITE MOA01, Moab Site

REPORT DATE: 3/10/2017

Location Code	Flow Code	Top of Casing Elevation (Ft)	Measurement Date Time	Depth From Top of Casing (Ft)	Water Elevation (MSL)	Water Level Flag
780	O	3968.45	5/8/2017	13.64	3954.81	
781	O	3968.56	5/8/2017	13.44	3955.12	
782	O	3968.46	5/8/2017	13.6	3954.86	
783	O	3966.16	5/8/2017	11.76	3954.40	
784	O	3968.73	5/8/2017	14.11	3954.62	
785	O	3969.24	5/8/2017	14.07	3955.17	
786	O	3968.14	5/8/2017	13.29	3954.85	
787	O	3968.43	5/8/2017	13.55	3954.88	
810	O	3961.88	5/2/2017	23.21	3938.67	
811	O	3962.82	5/2/2017	19.2	3943.62	
812	O	3963.12	5/2/2017	18.8	3944.32	
813	O	3964.45	5/1/2017	10.3	3954.15	
814	O	3960.98	5/2/2017	7.8	3953.18	
815	O	3963.14	5/2/2017	NA	NA	
816	O	3961.87	5/1/2017	15.15	3946.72	
SMI-PW02	O	3966.73	5/2/2017	22	3944.73	

Flow Codes: B = background; C = cross gradient; D = downgradient; MSL = mean sea level O = on site; U = upgradient, Water Level Flags: D = dry, NA = data not available

Date: June 28, 2017
To: Ken Pill
From: James Ritchey
Subject: May 2017 Sampling Trip Report
Site: Moab – CF4 and CF5 Sampling Event – May 2017
Date of Sampling Event: May 1 – 8, 2017
Team Members: E. Moran and J. Ritchey
RIN Number Assigned: All samples were assigned to RIN 1705093.
Sample Shipment: All samples were shipped in one cooler overnight UPS to ALS Laboratory from Moab, Utah, on May 11, 2017 (Tracking No. 1Z5W1Y510190209498).

May 2017 Configuration 4 Sampling

Number of Locations Sampled: Eight observation wells (0780, 0781, 0782, 0783, 0784, 0785, 0786, and 0787) were sampled during the May 2017 Sampling Event.

Locations Not Sampled: None.

Field Variance: None.

Quality Control Sample Cross Reference: Following are the false identifications assigned to the quality control samples:

False ID	True ID	Sample Type	Associated Matrix	Ticket Number
2000	0781	Duplicate from 48 ft bgs	Ground Water	MAY 011

Location Specific Information – Observation Wells: All observation wells were sampled using micro-purge techniques with a peristaltic pump and dedicated pump-head and downhole tubing.

Sample depths and water levels for each observation well are listed below.

Well No.	Date	Time	Depth to Water (ft btoc)	Sample Depth (ft bgs)
0780	05/08/2017	11:40	13.64	28
0781	05/08/2017	11:55	13.44	46
0782	05/08/2017	12:20	13.60	33
0783	05/08/2017	14:00	11.76	18
0784	05/08/2017	14:20	14.11	18
0785	05/08/2017	14:50	14.07	18
0786	05/08/2017	15:15	13.29	28
0787	05/08/2017	15:35	13.55	36

May 2017 Configuration 5 Sampling

Number of Locations Sampled: Eight extraction wells (0810, 0811, 0812, 0813, 0814, 0815, 0816, and SMI-PW02) and one duplicate were sampled during the May 2017 Monthly Sampling Event.

Locations Not Sampled: None.

Field Variance: None.

Quality Control Sample Cross Reference: None.

Location Specific Information – Extraction Wells: Extraction wells were sampled using dedicated submersible pumps. Samples were filtered and collected into open containers using dedicated flexible tubing. Sample depths and water levels for each extraction well are listed below.

Well No.	Date	Time	Depth to Water (ft btoc)	Pump Intake Depth (ft bgs)
0810	05/02/2017	08:20	23.21	10.4 – 40.4
0811	05/02/2017	08:30	19.2	8.6 – 38.6
0812	05/02/2017	08:50	18.80	14.2 – 44.2
0813	05/01/2017	13:55	10.30	14.4 – 44.4
0814	05/02/2017	08:15	7.80	12.4 – 42.4
0815	05/02/2017	08:05	-	21.7 – 51.7
0816	05/01/2017	14:00	15.15	20.9 – 50.9
SMI-PW02	05/02/2017	08.50	22.0	20.0 – 60.0

Site Issues: According to the USGS Cisco Gaging Station (Station No. 09180500), the mean daily Colorado River flows during this sampling event are provided below:

Date	Daily Mean Flow (cfs)
05/01/2017	6,930
05/02/2017	6,550
05/03/2017	6,510
05/04/2017	6,510
05/05/2017	7,120
05/05/2017	8,010
05/07/2017	9,160
05/08/2017	10,800

Equipment Issues: None.

Corrective Action Required/Taken: None.

Appendix D.
May 2017 Site-wide Sampling Event

Water Sampling Field Activities Verification
Minimums and Maximums Report
Blanks Report
Water Quality Data
Water Level Data
Trip Report

Appendix D. May 2017 Site-wide Sampling Event

Water Sampling Field Activities Verification

Sampling Event/RIN	May 2017 Site-wide Sampling Event/1705094	**Date(s) of Water Sampling**	May 23 to June 14, 2017
Date(s) of Verification	August 25, 2017	**Name of Verifier**	Ken Pill

		Response (Yes, No, NA)	Comments
1.	Is the Sampling Analysis Plan (SAP) the primary document directing field procedures?	Yes	
	List other documents, standard operating procedures, instructions.	NA	
2.	Were the sampling locations specified in the planning documents sampled?	Yes	
3.	Was a pre-trip calibration conducted as specified in the aforementioned documents?	Yes	
4.	Was an operational check of the field equipment conducted in accordance with the SAP?	Yes	
	Did the operational checks meet criteria?	Yes	
5.	Were the number and types (alkalinity, temperature, electrical conductivity, pH, turbidity, oxidation reduction potential) of field measurements taken as specified?	Yes	Field measurements for temperature, pH, turbidity, oxidation reduction potential, and conductivity were collected.
6.	Was the category of the well documented?	Yes	
7.	Were the following conditions met when purging a Category I well: Was one pump/tubing volume purged before sampling?	Yes	
	Did the water level stabilize before sampling?	Yes	
	Did pH, specific conductance, and turbidity measurements stabilize before sampling?	Yes	
	Was the flow rate less than 500 milliliters per minute?	Yes	
	If a portable pump was used, was there a 4-hour delay between pump installation and sampling?	NA	
8.	Were the following conditions met when purging a Category II well:		
	Was the flow rate less than 500 milliliters per minute?	NA	
	Was one pump/tubing volume removed before sampling?	NA	
9.	Were duplicates taken at a frequency of one per 20 samples?	NA	Three duplicates were collected for 44 samples.

Appendix D. May 2017 Site-wide Sampling Event (*continued*)

Water Sampling Field Activities Verification (*continued*)

Sampling Event/RIN	May 2017 Site-wide Sampling Event/1705094	**Date(s) of Water Sampling**	May 23 to June 14, 2017
Date(s) of Verification	August 25, 2017	**Name of Verifier**	Ken Pill

	Response (Yes, No, NA)	Comments
10. Were EBs taken at a frequency of one per 20 samples that were collected with non-dedicated equipment?	Yes	One blank was collected for the eight surface water samples, all other samples were collected using dedicated equipment.
11. Were trip blanks prepared and included with each shipment of volatile organic compound samples?	NA	
12. Were quality-control samples assigned a fictitious site identification number?	Yes	
Was the true identity of the samples recorded on the quality assurance sample log?	Yes	
13. Were samples collected in the containers specified?	Yes	
14. Were samples filtered and preserved as specified?	Yes	
15. Were the number and types of samples collected as specified?	NA	
16. Were COC records completed, and was sample custody maintained?	Yes	
17. Are field data sheets signed and dated by both team members?	Yes	
18. Was all other pertinent information documented on the field data sheets?	NA	
19. Was the presence or absence of ice in the cooler documented at every sample location?	Yes	
20. Were water levels measured at the locations specified in the planning documents?	Yes	

Appendix D. May 2017 Site-wide Sampling Event (*continued*)

Minimums and Maximums Report

Data Validation Minimums and Maximums Report - No Field Parameters
Laboratory: ALS
RIN: 1705094
Comparison: All Historical Data
Report Date: 9/5/2016

				Current			Historical Maximum			Historical Minimum			Count	
					Qualifiers			Qualifiers			Qualifiers			
Site Code	Location Code	Sample Date	Analyte	Result	Lab	Data	Result	Lab	Data	Result	Lab	Data	N	N Below Detect
MOA01	0406	06/14/2017	Uranium	0.6			2.2		F	0.78			21	0
MOA01	0411	06/06/2017	Uranium	0.91			19			1.4			13	0
MOA01	0436	06/06/2017	Ammonia Total as N	3.2			950			3.3			15	0
MOA01	0455	06/13/2017	Uranium	0.0019			0.0067			0.0021			11	0
MOA01	SMI-PZ2M2	05/25/2017	Ammonia Total as N	380			4600			400			15	0
MOA01	UPD-17	06/06/2017	Ammonia Total as N	7.2			320			100			10	0
MOA01	UPD-18	06/06/2017	Ammonia Total as N	130			310			160			10	0
MOA01	UPD-21	06/06/2017	Ammonia Total as N	2			74			2.2			10	0
MOA01	UPD-22	05/24/2017	Ammonia Total as N	9.9			8.6			0.76			10	0
MOA01	UPD-23	06/13/2017	Ammonia Total as N	1.4			3.2			2			8	0
MOA01	UPD-24	06/06/2017	Uranium	3.2			14			3.6			13	0

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.
Analyte concentrations presented in blue text represent the historical minimum or maximum value exceeded by the concentration presented in red, which is associated with this current sampling event.
LAB QUALIFIERS:

*	Replicate analysis not within control limits.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.

J	Estimated
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X,Y,Z	Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G Possible grout contamination, pH > 9.	J Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	Q Qualitative result due to sampling technique.	R Unusable result.
U	Parameter analyzed for but was not detected.	X Location is undefined.	

Appendix D. May 2017 Site-wide Sampling Event (*continued*)

Blanks Report

Parameter	Site Code	Location ID	Sample Date	Sample ID	Units	Result	Qualifiers Lab	Qualifiers Data	Detection Limit	Uncertainty	Sample Type
Ammonia Total as N	MOA01	0999	06/05/2017	0001	mg/L	.1	U		.1		E
Uranium	MOA01	0999	06/05/2017	0001	mg/L	.00036			.000012		E

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X,Y,Z	Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G	Possible grout contamination, pH > 9.	J	Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	Q	Qualitative result due to sampling technique.	R	Unusable result.
U	Parameter analyzed for but was not detected.	X	Location is undefined.		

SAMPLE TYPES:

E	Equipment Blank.

Appendix D. May 2017 Site-wide Sampling Event (*continued*)

Water Quality Data

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site
REPORT DATE: 10/2/17
Location: 0201 SURFACE LOCATION

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/01/2017	0001	0	-	0	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	06/01/2017	N001	0	-	0	141			#		
pH	s.u.	06/01/2017	N001	0	-	0	8.1			#		
Specific Conductance	umhos /cm	06/01/2017	N001	0	-	0	523			#		
Temperature	C	06/01/2017	N001	0	-	0	18.31			#		
Turbidity	NTU	06/01/2017	N001	0	-	0	81.9			#		
Uranium	mg/L	06/01/2017	0001	0	-	0	0.002		J	#	0.000012	

Location: 0218 SURFACE LOCATION

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/31/2017	0001	0	-	0	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	05/31/2017	N001	0	-	0	97			#		
pH	s.u.	05/31/2017	N001	0	-	0	8.11			#		
Specific Conductance	umhos /cm	05/31/2017	N001	0	-	0	563			#		
Temperature	C	05/31/2017	N001	0	-	0	16.23			#		
Turbidity	NTU	05/31/2017	N001	0	-	0	84.9			#		
Uranium	mg/L	05/31/2017	0001	0	-	0	0.002		J	#	0.000012	

Location: 0226 SURFACE LOCATION

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/01/2017	0001	0	-	0	1	U	J	#	1	
Oxidation Reduction Potential	mV	06/01/2017	N001	0	-	0	-97			#		
pH	s.u.	06/01/2017	N001	0	-	0	8.2			#		
Specific Conductance	umhos /cm	06/01/2017	N001	0	-	0	711			#		
Temperature	C	06/01/2017	N001	0	-	0	17.75			#		
Turbidity	NTU	06/01/2017	N001	0	-	0	81.9			#		
Uranium	mg/L	06/01/2017	0001	0	-	0	0.002		J	#	0.000012	

Location: 0403 WELL Configuration 2

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/08/2017	0001	18	-		67		J	#	20	
Oxidation Reduction Potential	mV	06/08/2017	N001	18	-		-19			#		
pH	s.u.	06/08/2017	N001	18	-		7.35			#		
Specific Conductance	umhos /cm	06/08/2017	N001	18	-		3184			#		
Temperature	C	06/08/2017	N001	18	-		16.39			#		
Turbidity	NTU	06/08/2017	N001	18	-		2.04			#		
Uranium	mg/L	06/08/2017	0001	18	-		0.35		J	#	0.000012	

Location: 0404 WELL Configuration 1

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/13/2017	0001	18	-	210		J	#	20	
Ammonia Total as N	mg/L	06/13/2017	0002	18	-	210			#	20	
Oxidation Reduction Potential	mV	06/13/2017	N001	18	-	186			#		
pH	s.u.	06/13/2017	N001	18	-	6.76			#		
Specific Conductance	umhos /cm	06/13/2017	N001	18	-	11360			#		
Temperature	C	06/13/2017	N001	18	-	16.79			#		
Turbidity	NTU	06/13/2017	N001	18	-	5.3			#		
Uranium	mg/L	06/13/2017	0001	18	-	1.4			#	0.00012	
Uranium	mg/L	06/13/2017	0002	18	-	1.3		J	#	0.00012	

Location: 0406 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/14/2017	0001	18	-	120		J	#	20	
Oxidation Reduction Potential	mV	06/14/2017	N001	18	-	-66			#		
pH	s.u.	06/14/2017	N001	18	-	7.28			#		
Specific Conductance	umhos /cm	06/14/2017	N001	18	-	4303			#		
Temperature	C	06/14/2017	N001	18	-	16.52			#		
Turbidity	NTU	06/14/2017	N001	18	-	8.49			#		
Uranium	mg/L	06/14/2017	0001	18	-	0.6		J	#	0.000012	

Location: 0407 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/31/2017	0001	17	-	39		J	#	5	
Ammonia Total as N	mg/L	05/31/2017	0002	17	-	38			#	5	
Oxidation Reduction Potential	mV	05/31/2017	N001	17	-	117			#		
pH	s.u.	05/31/2017	N001	17	-	6.97			#		
Specific Conductance	umhos /cm	05/31/2017	N001	17	-	4513			#		
Temperature	C	05/31/2017	N001	17	-	17.23			#		
Turbidity	NTU	05/31/2017	N001	17	-	6.56			#		
Uranium	mg/L	05/31/2017	0001	17	-	0.53			#	0.000012	
Uranium	mg/L	05/31/2017	0002	17	-	0.53		J	#	0.000012	

Location: 0410 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/06/2017	0001	23.5	-	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	06/06/2017	N001	23.5	-	-24			#		
pH	s.u.	06/06/2017	N001	23.5	-	7.18			#		
Specific Conductance	umhos /cm	06/06/2017	N001	23.5	-	5244			#		
Temperature	C	06/06/2017	N001	23.5	-	24.53			#		
Turbidity	NTU	06/06/2017	N001	23.5	-	166			#		
Uranium	mg/L	06/06/2017	0001	23.5	-	0.38		J	#	0.000012	

Location: 0411 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/06/2017	0001	8	-	7		J	#	1	
Oxidation Reduction Potential	mV	06/06/2017	N001	8	-	206			#		
pH	s.u.	06/06/2017	N001	8	-	7.35			#		
Specific Conductance	umhos /cm	06/06/2017	N001	8	-	6536			#		
Temperature	C	06/06/2017	N001	8	-	19.67			#		
Turbidity	NTU	06/06/2017	N001	8	-	28.2			#		
Uranium	mg/L	06/06/2017	0001	8	-	0.91		J	#	0.000012	

Location: 0412 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/23/2017	0001	9.5	-	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	05/23/2017	N001	9.5	-	-53			#		
pH	s.u.	05/23/2017	N001	9.5	-	7.61			#		
Specific Conductance	umhos /cm	05/23/2017	N001	9.5	-	1537			#		
Temperature	C	05/23/2017	N001	9.5	-	16.97			#		
Turbidity	NTU	05/23/2017	N001	9.5	-	181			#		
Uranium	mg/L	05/23/2017	0001	9.5	-	2.6		J	#	0.00012	

Location: 0413 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/24/2017	0001	10.5	-	50		J	#	5	
Oxidation Reduction Potential	mV	05/24/2017	N001	10.5	-	19			#		
pH	s.u.	05/24/2017	N001	10.5	-	7.62			#		
Specific Conductance	umhos /cm	05/24/2017	N001	10.5	-	5278			#		
Temperature	C	05/24/2017	N001	10.5	-	16.29			#		
Turbidity	NTU	05/24/2017	N001	10.5	-	2.57			#		
Uranium	mg/L	05/24/2017	0001	10.5	-	3.3		J	#	0.00012	

Location: 0414 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/24/2017	0001	7.5	-	24		J	#	5	
Oxidation Reduction Potential	mV	05/24/2017	N001	7.5	-	-99			#		
pH	s.u.	05/24/2017	N001	7.5	-	7.05			#		
Specific Conductance	umhos /cm	05/24/2017	N001	7.5	-	8145			#		
Temperature	C	05/24/2017	N001	7.5	-	15.59			#		
Turbidity	NTU	05/24/2017	N001	7.5	-	33.7			#		
Uranium	mg/L	05/24/2017	0001	7.5	-	3.7		J	#	0.00012	

Location: 0436 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/06/2017	0001	197	-	3.2		J	#	0.1	
Oxidation Reduction Potential	mV	06/06/2017	N001	197	-	-234			#		
pH	s.u.	06/06/2017	N001	197	-	7.01			#		
Specific Conductance	umhos /cm	06/06/2017	N001	197	-	126674			#		
Temperature	C	06/06/2017	N001	197	-	19.56			#		
Turbidity	NTU	06/06/2017	N001	197	-	2.03			#		
Uranium	mg/L	06/06/2017	0001	197	-	0.0091		J	#	0.000012	

Location: 0439 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/05/2017	0001	118	-	5.1		J	#	1	
Oxidation Reduction Potential	mV	06/05/2017	N001	118	-	184			#		
pH	s.u.	06/05/2017	N001	118	-	6.8			#		
Specific Conductance	umhos /cm	06/05/2017	N001	118	-	10522			#		
Temperature	C	06/05/2017	N001	118	-	18.58			#		
Turbidity	NTU	06/05/2017	N001	118	-	106			#		
Uranium	mg/L	06/05/2017	0001	118	-	1.4		J	#	0.00012	

Location: 0440 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/05/2017	0001	117	-	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	06/05/2017	N001	117	-	99			#		
pH	s.u.	06/05/2017	N001	117	-	6.97			#		
Specific Conductance	umhos /cm	06/05/2017	N001	117	-	8444			#		
Temperature	C	06/05/2017	N001	117	-	21.12			#		
Turbidity	NTU	06/05/2017	N001	117	-	27.4			#		
Uranium	mg/L	06/05/2017	0001	117	-	0.033		J	#	0.000012	

Location: 0441 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/13/2017	0001	53	-	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	06/13/2017	N001	53	-	198			#		
pH	s.u.	06/13/2017	N001	53	-	7.01			#		
Specific Conductance	umhos /cm	06/13/2017	N001	53	-	16024			#		
Temperature	C	06/13/2017	N001	53	-	19.58			#		
Turbidity	NTU	06/13/2017	N001	53	-	5.18			#		
Uranium	mg/L	06/13/2017	0001	53	-	0.049		J	#	0.000012	

Appendix D. May 2017 Site-wide Sampling Event (*continued*)

Water Quality Data (*continued*)

Location: 0444 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/08/2017	0001	116	-	1.8		J	#	0.1	
Ammonia Total as N	mg/L	06/08/2017	0002	116	-	1.8			#	0.1	
Oxidation Reduction Potential	mV	06/08/2017	N001	116	-	-139			#		
pH	s.u.	06/08/2017	N001	116	-	6.87			#		
Specific Conductance	umhos /cm	06/08/2017	N001	116	-	111682			#		
Temperature	C	06/08/2017	N001	116	-	19.3			#		
Turbidity	NTU	06/08/2017	N001	116	-	4.4			#		
Uranium	mg/L	06/08/2017	0001	116	-	0.015			#	0.000012	
Uranium	mg/L	06/08/2017	0002	116	-	0.015		J	#	0.000012	

Location: 0453 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/05/2017	0001	80	-	200		J	#	10	
Oxidation Reduction Potential	mV	06/05/2017	N001	80	-	71			#		
pH	s.u.	06/05/2017	N001	80	-	6.93			#		
Specific Conductance	umhos /cm	06/05/2017	N001	80	-	35197			#		
Temperature	C	06/05/2017	N001	80	-	25.46			#		
Turbidity	NTU	06/05/2017	N001	80	-	2.42			#		
Uranium	mg/L	06/05/2017	0001	80	-	0.88		J	#	0.000012	

Location: 0454 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/25/2017	0001	13	-	240		J	#	10	
Oxidation Reduction Potential	mV	05/25/2017	N001	13	-	-304			#		
pH	s.u.	05/25/2017	N001	13	-	6.61			#		
Specific Conductance	umhos /cm	05/25/2017	N001	13	-	90740			#		
Temperature	C	05/25/2017	N001	13	-	17.93			#		
Turbidity	NTU	05/25/2017	N001	13	-	6.89			#		
Uranium	mg/L	05/25/2017	0001	13	-	0.75		J	#	0.000012	

Location: 0455 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/13/2017	0001	46	-	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	06/13/2017	N001	46	-	150			#		
pH	s.u.	06/13/2017	N001	46	-	7.49			#		
Specific Conductance	umhos /cm	06/13/2017	N001	46	-	3091			#		
Temperature	C	06/13/2017	N001	46	-	20.09			#		
Turbidity	NTU	06/13/2017	N001	46	-	999	>		#		
Uranium	mg/L	06/13/2017	0001	46	-	0.0019		J	#	0.000012	

Location: 0457 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/25/2017	0001	29	-	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	05/25/2017	N001	29	-	-140			#		
pH	s.u.	05/25/2017	N001	29	-	7.63			#		
Specific Conductance	umhos /cm	05/25/2017	N001	29	-	5283			#		
Temperature	C	05/25/2017	N001	29	-	17.38			#		
Turbidity	NTU	05/25/2017	N001	29	-	1.2			#		
Uranium	mg/L	05/25/2017	0001	29	-	0.0026		J	#	0.000012	

Location: 0492 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/31/2017	0001	18	-	20		J	#	5	
Oxidation Reduction Potential	mV	05/31/2017	N001	18	-	-106			#		
pH	s.u.	05/31/2017	N001	18	-	7.15			#		
Specific Conductance	umhos /cm	05/31/2017	N001	18	-	4112			#		
Temperature	C	05/31/2017	N001	18	-	16.61			#		
Turbidity	NTU	05/31/2017	N001	18	-	1.44			#		
Uranium	mg/L	05/31/2017	0001	18	-	0.22		J	#	0.000012	

Location: AMM-2 WELL East of pile along road

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/30/2017	0001	48	-	510		J	#	100	
Oxidation Reduction Potential	mV	05/30/2017	N001	48	-	220			#		
pH	s.u.	05/30/2017	N001	48	-	6.7			#		
Specific Conductance	umhos /cm	05/30/2017	N001	48	-	19970			#		
Temperature	C	05/30/2017	N001	48	-	17.64			#		
Turbidity	NTU	05/30/2017	N001	48	-	7.24			#		
Uranium	mg/L	05/30/2017	0001	48	-	2.4		J	#	0.00012	

Location: AMM-3 WELL Near SE corner of pile

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/07/2017	0001	48	-	250		J	#	20	
Oxidation Reduction Potential	mV	06/07/2017	N001	48	-	-127			#		
pH	s.u.	06/07/2017	N001	48	-	6.84			#		
Specific Conductance	umhos /cm	06/07/2017	N001	48	-	16993			#		
Temperature	C	06/07/2017	N001	48	-	20.48			#		
Turbidity	NTU	06/07/2017	N001	48	-	123			#		
Uranium	mg/L	06/07/2017	0001	48	-	2.6		J	#	0.00012	

Location: ATP-2-D WELL Piezometer

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/07/2017	0001	395	-	340		J	#	20	
Oxidation Reduction Potential	mV	06/07/2017	N001	395	-	323.5			#		
pH	s.u.	06/07/2017	N001	395	-	7.44			#		
Specific Conductance	umhos /cm	06/07/2017	N001	395	-	120402			#		
Temperature	C	06/07/2017	N001	395	-	19.22			#		
Turbidity	NTU	06/07/2017	N001	395	-	46.1			#		
Uranium	mg/L	06/07/2017	0001	395	-	0.0062		J	#	0.000012	

Location: ATP-2-S WELL Piezometer

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/07/2017	0001	25	-	360		J	#	20	
Oxidation Reduction Potential	mV	06/07/2017	N001	25	-	-164.3			#		
pH	s.u.	06/07/2017	N001	25	-	8.97			#		
Specific Conductance	umhos /cm	06/07/2017	N001	25	-	15078			#		
Temperature	C	06/07/2017	N001	25	-	22.13			#		
Turbidity	NTU	06/07/2017	N001	25	-	6.39			#		
Uranium	mg/L	06/07/2017	0001	25	-	0.00059		J	#	0.000012	

Location: CR1 SURFACE LOCATION

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/31/2017	0001	0	-	0	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	05/31/2017	N001	0	-	0	142			#		
pH	s.u.	05/31/2017	N001	0	-	0	8.06			#		
Specific Conductance	umhos /cm	05/31/2017	N001	0	-	0	885			#		
Temperature	C	05/31/2017	N001	0	-	0	16.19			#		
Turbidity	NTU	05/31/2017	N001	0	-	0	89.1			#		
Uranium	mg/L	05/31/2017	0001	0	-	0	0.0036		J	#	0.000012	

Location: CR2 SURFACE LOCATION

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/31/2017	0001	0	-	0	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	05/31/2017	N001	0	-	0	101			#		
pH	s.u.	05/31/2017	N001	0	-	0	8.09			#		
Specific Conductance	umhos /cm	05/31/2017	N001	0	-	0	551			#		
Temperature	C	05/31/2017	N001	0	-	0	16.48			#		
Turbidity	NTU	05/31/2017	N001	0	-	0	79.9			#		
Uranium	mg/L	05/31/2017	0001	0	-	0	0.0019		J	#	0.000012	

Location: CR3 SURFACE LOCATION

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/31/2017	0001	0	-	0	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	05/31/2017	N001	0	-	0	10			#		
pH	s.u.	05/31/2017	N001	0	-	0	7.94			#		
Specific Conductance	umhos /cm	05/31/2017	N001	0	-	0	539			#		
Temperature	C	05/31/2017	N001	0	-	0	16.88			#		
Turbidity	NTU	05/31/2017	N001	0	-	0	999	>		#		
Uranium	mg/L	05/31/2017	0001	0	-	0	0.0021		J	#	0.000012	

Location: CR5 SURFACE LOCATION

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/01/2017	0001	0	-	0	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	06/01/2017	N001	0	-	0	133			#		
pH	s.u.	06/01/2017	N001	0	-	0	8.01			#		
Specific Conductance	umhos /cm	06/01/2017	N001	0	-	0	528			#		
Temperature	C	06/01/2017	N001	0	-	0	17.82			#		
Turbidity	NTU	06/01/2017	N001	0	-	0	108			#		
Uranium	mg/L	06/01/2017	0001	0	-	0	0.002		J	#	0.000012	

Location: SMI-MW01 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/23/2017	0001	16	-		1.5		J	#	0.1	
Oxidation Reduction Potential	mV	05/23/2017	N001	16	-		165			#		
pH	s.u.	05/23/2017	N001	16	-		7.29			#		
Specific Conductance	umhos /cm	05/23/2017	N001	16	-		4554			#		
Temperature	C	05/23/2017	N001	16	-		17.24			#		
Turbidity	NTU	05/23/2017	N001	16	-		33.7			#		
Uranium	mg/L	05/23/2017	0001	16	-		3.5		J	#	0.00012	

Location: SMI-PZ2M2

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/25/2017	0001	56	-	380		J	#	50	
Oxidation Reduction Potential	mV	05/25/2017	N001	56	-	70			#		
pH	s.u.	05/25/2017	N001	56	-	6.68			#		
Specific Conductance	umhos /cm	05/25/2017	N001	56	-	81860			#		
Temperature	C	05/25/2017	N001	56	-	17.88			#		
Turbidity	NTU	05/25/2017	N001	56	-	1.97			#		
Uranium	mg/L	05/25/2017	0001	56	-	1.6		J	#	0.00012	

Location: TP-01 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/24/2017	0001	22	-	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	05/24/2017	N001	22	-	-113			#		
pH	s.u.	05/24/2017	N001	22	-	7.28			#		
Specific Conductance	umhos /cm	05/24/2017	N001	22	-	6363			#		
Temperature	C	05/24/2017	N001	22	-	18.45			#		
Turbidity	NTU	05/24/2017	N001	22	-	6.04			#		
Uranium	mg/L	05/24/2017	0001	22	-	0.07		J	#	0.000012	

Location: TP-11 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/24/2017	0001	30	-	0.84		J	#	0.1	
Oxidation Reduction Potential	mV	05/24/2017	N001	30	-	-149			#		
pH	s.u.	05/24/2017	N001	30	-	7.26			#		
Specific Conductance	umhos /cm	05/24/2017	N001	30	-	16874			#		
Temperature	C	05/24/2017	N001	30	-	17.69			#		
Turbidity	NTU	05/24/2017	N001	30	-	6.86			#		
Uranium	mg/L	05/24/2017	0001	30	-	0.00078		J	#	0.000012	

Location: TP-17 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/01/2017	0001	28	-	2.6		J	#	0.1	
Oxidation Reduction Potential	mV	06/01/2017	N001	28	-	-128			#		
pH	s.u.	06/01/2017	N001	28	-	7.16			#		
Specific Conductance	umhos /cm	06/01/2017	N001	28	-	90114			#		
Temperature	C	06/01/2017	N001	28	-	14.58			#		
Turbidity	NTU	06/01/2017	N001	28	-	9.65			#		
Uranium	mg/L	06/01/2017	0001	28	-	0.026		J	#	0.000012	

Location: TP-20 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/07/2017	0001	32	-	4.2		J	#	1	
Oxidation Reduction Potential	mV	06/07/2017	N001	32	-	-202			#		
pH	s.u.	06/07/2017	N001	32	-	7.06			#		
Specific Conductance	umhos /cm	06/07/2017	N001	32	-	129546			#		
Temperature	C	06/07/2017	N001	32	-	21.04			#		
Turbidity	NTU	06/07/2017	N001	32	-	4.27			#		
Uranium	mg/L	06/07/2017	0001	32	-	0.0014		J	#	0.000012	

Location: TP-22 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/25/2017	0001	17	-	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	05/25/2017	N001	17	-	108			#		
pH	s.u.	05/25/2017	N001	17	-	6.83			#		
Specific Conductance	umhos /cm	05/25/2017	N001	17	-	31572			#		
Temperature	C	05/25/2017	N001	17	-	17.86			#		
Turbidity	NTU	05/25/2017	N001	17	-	18.3			#		
Uranium	mg/L	05/25/2017	0001	17	-	0.42		J	#	0.000012	

Location: TP-23 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/25/2017	0001	25	-	160		J	#	50	
Oxidation Reduction Potential	mV	05/25/2017	N001	25	-	111			#		
pH	s.u.	05/25/2017	N001	25	-	6.64			#		
Specific Conductance	umhos /cm	05/25/2017	N001	25	-	46610			#		
Temperature	C	05/25/2017	N001	25	-	19.18			#		
Turbidity	NTU	05/25/2017	N001	25	-	3.88			#		
Uranium	mg/L	05/25/2017	0001	25	-	2.7		J	#	0.00012	

Location: UPD-17 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/06/2017	0001	14.5	-	7.2		J	#	1	
Oxidation Reduction Potential	mV	06/06/2017	N001	14.5	-	196			#		
pH	s.u.	06/06/2017	N001	14.5	-	6.59			#		
Specific Conductance	umhos /cm	06/06/2017	N001	14.5	-	9111			#		
Temperature	C	06/06/2017	N001	14.5	-	17.8			#		
Turbidity	NTU	06/06/2017	N001	14.5	-	2.39			#		
Uranium	mg/L	06/06/2017	0001	14.5	-	1.5		J	#	0.00012	

Location: UPD-18 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/06/2017	0001	13	-	130		J	#	20	
Oxidation Reduction Potential	mV	06/06/2017	N001	13	-	183			#		
pH	s.u.	06/06/2017	N001	13	-	6.84			#		
Specific Conductance	umhos /cm	06/06/2017	N001	13	-	12821			#		
Temperature	C	06/06/2017	N001	13	-	17.84			#		
Turbidity	NTU	06/06/2017	N001	13	-	9.75			#		
Uranium	mg/L	06/06/2017	0001	13	-	1.7		J	#	0.00012	

Location: UPD-20 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/06/2017	0001	17	-	0.12		J	#	0.1	
Oxidation Reduction Potential	mV	06/06/2017	N001	17	-	154			#		
pH	s.u.	06/06/2017	N001	17	-	7.19			#		
Specific Conductance	umhos /cm	06/06/2017	N001	17	-	4851			#		
Temperature	C	06/06/2017	N001	17	-	20.19			#		
Turbidity	NTU	06/06/2017	N001	17	-	24.6			#		
Uranium	mg/L	06/06/2017	0001	17	-	0.067		J	#	0.000012	

Location: UPD-21

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/06/2017	0001	25	-	2		J	#	0.1	
Oxidation Reduction Potential	mV	06/06/2017	N001	25	-	157			#		
pH	s.u.	06/06/2017	N001	25	-	7.27			#		
Specific Conductance	umhos /cm	06/06/2017	N001	25	-	4197			#		
Temperature	C	06/06/2017	N001	25	-	19.48			#		
Turbidity	NTU	06/06/2017	N001	25	-	2.62			#		
Uranium	mg/L	06/06/2017	0001	25	-	6.6		J	#	0.00012	

Location: UPD-22 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	05/24/2017	0001	9	-	9.9		J	#	1	
Oxidation Reduction Potential	mV	05/24/2017	N001	9	-	-25			#		
pH	s.u.	05/24/2017	N001	9	-	7.45			#		
Specific Conductance	umhos /cm	05/24/2017	N001	9	-	4543			#		
Temperature	C	05/24/2017	N001	9	-	18			#		
Turbidity	NTU	05/24/2017	N001	9	-	2.97			#		
Uranium	mg/L	05/24/2017	0001	9	-	3.3		J	#	0.00012	

Location: UPD-23

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/13/2017	0001	26	-	1.4		J	#	0.1	
Oxidation Reduction Potential	mV	06/13/2017	N001	26	-	133			#		
pH	s.u.	06/13/2017	N001	26	-	7.69			#		
Specific Conductance	umhos /cm	06/13/2017	N001	26	-	3196			#		
Temperature	C	06/13/2017	N001	26	-	22.4			#		
Turbidity	NTU	06/13/2017	N001	26	-	27.6			#		
Uranium	mg/L	06/13/2017	0001	26	-	0.54		J	#	0.000012	

Location: UPD-24 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/06/2017	0001	27	-	2.9		J	#	0.1	
Oxidation Reduction Potential	mV	06/06/2017	N001	27	-	90			#		
pH	s.u.	06/06/2017	N001	27	-	7.5			#		
Specific Conductance	umhos /cm	06/06/2017	N001	27	-	4382			#		
Temperature	C	06/06/2017	N001	27	-	18.87			#		
Turbidity	NTU	06/06/2017	N001	27	-	4.24			#		
Uranium	mg/L	06/06/2017	0001	27	-	3.2		J	#	0.00012	

BLS = below land surface; µmhos/cm = micromhos per centimeter; mV = millivolt; NTU = nephelometric turbidity unit; SL = surface location; S.U. = standard unit; TS = treatment system; WL = well

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X,Y,Z	Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G	Possible grout contamination, pH > 9.
J	Estimated value.		
L	Less than 3 bore volumes purged prior to sampling.	Q	Qualitative result due to sampling technique.
R	Unusable result.		
U	Parameter analyzed for but was not detected.	X	Location is undefined.

QA QUALIFIER:

#	Validated according to quality assurance guidelines.

Appendix D. May 2017 Site-wide Sampling Event (*continued*)
Water Level Data

STATIC WATER LEVELS (USEE700) FOR SITE MOA01, Moab Site

REPORT DATE: 9/25/2017

Location Code	Flow Code	Top of Casing Elevation (Ft)	Measurement Date Time	Depth From Top of Casing (Ft)	Water Elevation (MSL)	Water Level Flag
403	O	3968.95	6/8/2017	9.2	3959.75	
404	O	3968.30	6/13/2017	8.86	3959.44	
406	O	3964.59	6/14/2017	4.87	3959.72	
407	O	3969.09	5/31/2017	11.81	3957.28	
410	O	3981.05	6/6/2017	23.09	3957.96	
411	O	3962.43	6/6/2017	7.22	3955.21	
412	O	3962.48	5/23/2017	5.47	3957.01	
413	O	3963.19	5/24/2017	6.84	3956.35	
414	O	3959.20	5/24/2017	2.4	3956.8	
436	O	3970.80	6/6/2017	7.91	3962.89	
439	O	4055.27	6/5/2017	76.71	3978.56	
440	O	4070.71	6/5/2017	110.94	3959.77	
441	O	4008.77	6/13/2017	48.78	3959.99	
444	O	3970.99	6/8/2017	12.36	3958.63	
453	O	4031.29	6/5/2017	73.67	3957.62	
454	O	3966.53	5/25/2017	10.85	3955.68	
455	O	3990.20	6/13/2017	30.89	3959.31	
457	O	3971.30	5/25/2017	13.87	3957.43	
492	O	3967.56	5/31/2017	10.26	3957.3	
AMM-2	O	3964.09	5/30/2017	6.77	3957.32	
AMM-3	O	3962.90	6/7/2017	5.01	3957.89	
ATP-2-D	O	3962.17	6/7/2017	3.79	3958.38	
ATP-2-S	O	3962.17	6/7/2017	12.13	3950.04	
SMI-MW01	O	3960.22	5/23/2017	3.02	3957.2	
SMI-PZ2M2	O	3967.18	5/25/2017	11.8	3955.38	
TP-01	O	3969.39	5/24/2017	9.94	3959.45	
TP-11	O	3967.51	5/24/2017	9.4	3958.11	

Appendix D. May 2017 Site-wide Sampling Event (*continued*)
Water Level Data (*continued*)

STATIC WATER LEVELS (USEE700) FOR SITE MOA01, Moab Site

REPORT DATE: 9/25/2017

Location Code	Flow Code	Top of Casing Elevation (Ft)	Measurement Date Time	Depth From Top of Casing (Ft)	Water Elevation (MSL)	Water Level Flag
TP-17	O	3963.69	6/1/2017	7.3	3956.39	
TP-20	O	3967.55	6/7/2017	11.88	3955.67	
TP-22	O	3966.51	5/25/2017	11.48	3955.03	
TP-23	O	3962.6	5/25/2017	6.68	3955.92	
UPD-17	O	3967.44	6/6/2017	9.96	3957.48	
UPD-18	O	3969.00	6/6/2017	10.62	3958.38	
UPD-20	O	3978.73	6/6/2017	20.56	3958.17	
UPD-21	O	3981.45	6/6/2017	23.27	3958.18	
UPD-22	O	3966.2	5/24/2017	9.11	3957.09	
UPD-23	O	3982.38	6/13/2017	23.66	3958.72	
UPD-24	O	3977.1	6/6/2017	19.16	3957.94	

Flow Codes: B = background; C = cross gradient; D = downgradient; MSL = mean sea level O = on site; U = upgradient, Water Level Flags: D = dry

Date: July 29, 2017
To: Ken Pill
From: James Ritchey
Subject: May 2017 Site Wide Sampling Event

Site: Moab – Site Wide Sampling Event –May 2017
Date of Sampling Event: May 23 ¬– June 14, 2017
Team Members: E. Moran, K. Pill, and J. Ritchey
RIN Number Assigned: All samples were assigned to RIN 1705094.
Sample Shipment: Samples coolers were shipped overnight UPS to ALS Laboratory from Moab, Utah, on June 5 and 14 of 2015 (Tracking numbers 1Z5W1Y510196822224 and 1Z5W1Y510191630315).

Number of Locations Sampled: The purpose of the Site Wide Sampling Event is to update contaminant plume maps. A total of 44 locations (eight surface samples and 38 monitoring wells) were sampled during this event. Including three duplicates and one equipment blank, a total of 50 samples were collected during the May 2017 site wide sampling event.

Locations Not Sampled/Reason: None.

Field Variance: None.

Quality Control Sample Cross Reference: Following are the false identifications assigned to the quality control samples:

False ID	True ID	Sample Type	Associated matrix
2000	0407	Duplicate from 17 ft bgs	Ground Water
2001	NA	Equipment Blank	DI Water
2002	0444	Duplicate from 116 ft bgs	Ground Water
2003	0404	Duplicate from 18 ft bgs	Ground Water

Location Specific Information: All of the observation wells were sampled using a peristaltic pump and dedicated tubing unless otherwise noted. The surface water samples were collected with dedicated surface water tubing that was decontaminated with Alconox® and de-ionized water between locations. The table below provides additional information:

Location	Date	Sample Depth (ft bgs)	Comments
0201	06/01/2017	–	
0218	05/31/2017	–	
0226	06/01/2017	–	
0274	06/01/2017	–	Collected ~200 ft down from 0274 due to access issues
0403	06/08/2017	18	
0404	06/13/2017	18	Duplicate 2003.
0406	06/14/2017	18	Sulfur odor.
0407	05/31/2017	17	Duplicate 2000.
0410	06/06/2017	23.5	Could not pump water from bottom of well without pulling tubing. Well recharging slowly.
0411	0606/2017	8	Dewatered at ~0.5 L.
0412	05/23/2017	9.5	Turbid water.
0413	05/24/2017	10.5	
0414	05/24/2017	7.5	
0436	06/06/2017	197	Sulfur odor.
0439	06/05/2017	118	Bladder pump. Casing cut off. Tubing was marked at cut prior to removing and reinstalling pump. Casing cut measured at 14.75 ft.
0440	06/05/2017	117	Bladder pump.
0441	06/13/2017	53	Bladder pump.
0444	06/08/2017	116	Duplicate 2002.
0453	06/05/2017	80	Bladder pump. Water level dropped below top of pump.
0454	05/25/2017	13	Sulfur odor, water is gray.
0455	06/13/2017	46	Inertia pump.
0457	05/25/2017	29	
0492	05/31/2017	18	
AMM-2	05/30/2017	48	
AMM-3	06/07/2017	48	
ATP-2-D	06/07/2017	395	Water color is dark gray, no odor.
ATP-2-S	06/07/2017	25	Water is light muddy color.
CR1	05/31/2017	–	
CR2	05/31/2017	–	
CR3	05/31/2017	–	
CR5	06/01/2017	–	
SMI-MW01	05/23/2017	16	
SMI-PZ2M2	05/25/2017	56	Conductivity jumping around on YSI
TP-01	05/24/2017	22	
TP-11	05/24/2017	30	
TP-17	06/01/2017	28	
TP-20	06/07/2017	32	
TP-22	05/25/2017	17	
TP-23	05/25/2017	25	
UPD-17	06/06/2017	14.5	
UPD-18	06/06/2017	13	
UPD-20	06/06/2017	17	
UPD-21	06/06/2017	25	
UPD-22	05/24/2017	9	
UPD-23	06/13/2017	26	TD taken with “Skinny Dipper” indicator with weights at the end of line.
UPD-24	06/06/2017	27	

Notes: ft bgs = feet below ground surface

Water Level Measurements: Water level data are provided in the table below. These data represent depth to water (ft btoc) measurements.

Well No.	Date	Depth to Water (ft btoc)
0403	06/08/2017	9.20
0404	06/13/2017	8.86
0406	06/14/2017	4.87
0407	05/31/2017	11.81
0410	06/06/2017	23.09
0411	06/06/2017	7.22
0412	05/23/2017	5.47
0413	05/24/2017	6.84
0414	05/24/2017	2.40
0436	06/06/2017	7.91
0439	06/05/2017	76.71
0440	06/05/2017	110.94
0441	06/13/2017	48.78
0444	06/08/2017	12.36
0453	06/05/2017	73.67
0454	05/25/2017	10.85
0455	06/13/2017	30.89
0457	05/25/2017	13.87
0492	05/31/2017	10.26
AMM-2	05/30/2017	6.77
AMM-3	06/07/2017	5.01
ATP-2-D	06/07/2017	3.79
ATP-2-S	06/07/2017	12.13
SMI-MW01	05/23/2017	3.02
SMI-PZ2M2	05/25/2017	11.80
TP-01	05/24/2017	9.94
TP-11	05/24/2017	9.40
TP-17	06/01/2017	7.30
TP-20	06/07/2017	11.88
TP-22	05/25/2017	11.48
TP-23	05/25/2017	6.68
UPD-17	06/06/2017	9.96
UPD-18	06/06/2017	10.62
UPD-20	06/06/2017	20.56
UPD-21	06/06/2017	23.27
UPD-22	05/24/2017	9.11
UPD-23	06/13/2017	23.66
UPD-24	06/06/2017	19.16

Well Inspection Summary: A well inspection was not conducted.

Equipment: None.

Regulatory: None.

Site Issues: According to the USGS Cisco Gaging Station (Station No. 09180500), the mean daily Colorado River flow during this sampling event is provided below:

Date	Daily Mean Flow (cfs)
05/23/2017	15,800
05/24/2017	17,000
05/25/2017	17,700
05/26/2017	19,300
05/27/2017	20,600
05/28/2017	21,000
05/29/2017	20,500
05/30/2017	19,000
05/31/2017	17,100
06/01/2017	16,800
06/02/2017	17,400
06/03/2017	18,500
06/04/2017	19,000
06/05/2017	20,100
06/06/2017	22,000
06/07/2017	23,500
06/08/2017	25,100
06/09/2017	25,400
06/10/2017	26,300
06/11/2017	26,100
06/12/2017	26,200
06/13/2017	24,700
06/14/2017	22,200

Corrective Action Required/Taken: None.

Appendix E.
June 2017 Crescent Junction Sampling Event

Water Sampling Field Activities Verification
Minimums and Maximums Report
Water Quality Data
Water Level Data
Trip Report

Appendix E. June 2017 Crescent Junction Sampling Event

Water Sampling Field Activities Verification

Sampling Event/RIN	May 2017 CJ Sampling Event / 17060957	**Date(s) of Water Sampling**	June 20, 2017
Date(s) of Verification	September 13, 2017	**Name of Verifier**	Ken Pill

	Response (Yes, No, NA)	Comments
1. Is the Sampling Analysis Plan (SAP) the primary document directing field procedures?	Yes	
List other documents, standard operating procedures, instructions.	NA	
2. Were the sampling locations specified in the planning documents sampled?	Yes	
3. Was a pre-trip calibration conducted as specified in the aforementioned documents?	Yes	
4. Was an operational check of the field equipment conducted in accordance with the SAP?	Yes	
Did the operational checks meet criteria?	Yes	
5. Were the number and types (alkalinity, temperature, electrical conductivity, pH, turbidity, oxidation reduction potential) of field measurements taken as specified?	Yes	Field measurements for temperature, pH, turbidity, oxidation reduction potential, and conductivity were collected.
6. Was the category of the well documented?	Yes	
7. Were the following conditions met when purging a Category I well: Was one pump/tubing volume purged before sampling?	Yes	
Did the water level stabilize before sampling?	Yes	
Did pH, specific conductance, and turbidity measurements stabilize before sampling?	Yes	
Was the flow rate less than 500 milliliters per minute?	Yes	
If a portable pump was used, was there a 4-hour delay between pump installation and sampling?	NA	
8. Were the following conditions met when purging a Category II well:		
Was the flow rate less than 500 milliliters per minute?	NA	
Was one pump/tubing volume removed before sampling?	NA	
9. Were duplicates taken at a frequency of one per 20 samples?	No	Only one sample collected.

Appendix E. June 2017 Crescent Junction Sampling Event (*continued*)

Water Sampling Field Activities Verification (*continued*)

Sampling Event/RIN	May 2017 CJ Sampling Event / 17060957	**Date(s) of Water Sampling**	June 20, 2017
Date(s) of Verification	September 13, 2017	**Name of Verifier**	Ken Pill

	Response (Yes, No, NA)	Comments
10. Were EBs taken at a frequency of one per 20 samples that were collected with non-dedicated equipment?	Yes	One equipment blank was collected for the 7 surface water samples
11. Were trip blanks prepared and included with each shipment of volatile organic compound samples?	NA	
12. Were quality-control samples assigned a fictitious site identification number?	Yes	
Was the true identity of the samples recorded on the quality assurance sample log?	Yes	
13. Were samples collected in the containers specified?	Yes	
14. Were samples filtered and preserved as specified?	Yes	
15. Were the number and types of samples collected as specified?	NA	
16. Were COC records completed, and was sample custody maintained?	Yes	
17. Are field data sheets signed and dated by both team members?	Yes	
18. Was all other pertinent information documented on the field data sheets?	NA	
19. Was the presence or absence of ice in the cooler documented at every sample location?	Yes	
20. Were water levels measured at the locations specified in the planning documents?	Yes	

Appendix E. June 2017 Crescent Junction Sampling Event (*continued*)

Minimums and Maximums Report

Data Validation Minimums and Maximums Report - No Field Parameters
Laboratory: ALS
RIN: 1706095
Comparison: All Historical Data
Report Date: 9/25/17

				Current			Historical Maximum			Historical Minimum			Count	
					Qualifiers			Qualifiers			Qualifiers			
Site Code	Location Code	Sample Date	Analyte	Result	Lab	Data	Result	Lab	Data	Result	Lab	Data	N	N Below Detect
MOA01	0218	06/20/2017	BICARBONATE AS CaCO3	950			1100			990			6	0
MOA01	0406	06/20/2017	Calcium	260			400			270			10	0
MOA01	0406	06/20/2017	Copper	0.0016	J		0.023			0.0026	J		10	5
MOA01	0430	06/20/2017	Manganese	0.3			0.71			0.35			10	0
MOA01	ATP-2-S	06/20/2017	Sulfate	24000			22000			100	U		10	1
MOA01	MW-3	06/20/2017	TOTAL ALKALINITY AS CaCO3	950			1100			990			6	0

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X,Y,Z	Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G	Possible grout contamination, pH > 9.	J	Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	Q	Qualitative result due to sampling technique.	R	Unusable result.

U Parameter analyzed for but was not detected.

X Location is undefined.

SAMPLE TYPES:
E Equipment Blank.

Appendix E. June 2017 Crescent Junction Sampling Event (*continued*)

Water Quality Data

General Water Quality Data by Location (USEE105) FOR SITE CRJ01, Crescent Junction Site
REPORT DATE: 3/15/2016
Location: 0205 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ammonia Total as N	mg/L	06/20/2017	0001	68	-	13			#	10	
Arsenic	mg/L	06/20/2017	0001	68	-	0.0039	U	J	#	0.0039	
Barium	mg/L	06/20/2017	0001	68	-	0.012	J	J	#	0.00019	
BICARBONATE AS CaCO3	mg/L	06/20/2017	0001	68	-	950		J	#	100	
BORON	ug/L	06/20/2017	0001	68	-	1200		J	#	3.1	
Bromide	mg/L	06/20/2017	0001	68	-	10	U	J	#	10	
Cadmium	mg/L	06/20/2017	0001	68	-	0.00033	U	J	#	0.00033	
Calcium	mg/L	06/20/2017	0001	68	-	260		J	#	0.012	
CARBONATE AS CaCO3	mg/L	06/20/2017	0001	68	-	100	U	J	#	100	
Chloride	mg/L	06/20/2017	0001	68	-	3700		J	#	100	
Chromium	mg/L	06/20/2017	0001	68	-	0.00051	U	J	#	0.00051	
Copper	mg/L	06/20/2017	0001	68	-	0.0016	J	J	#	0.00097	
Fluoride	mg/L	06/20/2017	0001	68	-	5	U	J	#	5	
Iron	mg/L	06/20/2017	0001	68	-	0.007	J	J	#	0.0049	
Lead	mg/L	06/20/2017	0001	68	-	0.0013	U	J	#	0.0013	
Magnesium	mg/L	06/20/2017	0001	68	-	820		J	#	1.3	

General Water Quality Data by Location (USEE105) FOR SITE CRJ01, Crescent Junction Site
REPORT DATE: 3/15/2016
Location: 0205 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Manganese	mg/L	06/20/2017	0001	68	-	0.3		J	#	0.00011	
MOLYBDENUM	ug/L	06/20/2017	0001	68	-	2.2	J	J	#	1.1	
Nitrate + Nitrite as Nitrogen	mg/L	06/20/2017	0001	68	-	830			#	5	
Oxidation Reduction Potential	mV	06/20/2017	N001	68	-	218			#		
pH	s.u.	06/20/2017	N001	68	-	6.86			#		
Potassium	mg/L	06/20/2017	0001	68	-	58		J	#	0.11	
Selenium	mg/L	06/20/2017	0001	68	-	4.4		J	#	0.0027	
Sodium	mg/L	06/20/2017	0001	68	-	9700		J	#	0.66	
Specific Conductance	umhos /cm	06/20/2017	N001	68	-	40886			#		
Sulfate	mg/L	06/20/2017	0001	68	-	24000		J	#	500	
Temperature	C	06/20/2017	N001	68	-	18.63			#		
TOTAL ALKALINITY AS CaCO3	mg/L	06/20/2017	0001	68	-	950		J	#	100	
Total Dissolved Solids	mg/L	06/20/2017	0001	68	-	40000		J	#	400	
Turbidity	NTU	06/20/2017	N001	68	-	4.24			#		
Uranium	mg/L	06/20/2017	0001	68	-	0.026		J	#	0.000012	
Uranium-234	pCi/L	06/20/2017	0001	68	-	27.1			#	0.1	4.6
Uranium-235	pCi/L	06/20/2017	0001	68	-	0.34			#	0.07	0.15
Uranium-238	pCi/L	06/20/2017	0001	68	-	9.2			#	0.1	1.7

BLS = below land surface; µmhos/cm = micromhos per centimeter; mV = millivolt; NTU = nephelometric turbidity unit; SL = surface location; S.U. = standard unit;

Appendix E. June 2017 Crescent Junction Sampling Event (*continued*)

Water Quality Data (*continued*)

TS = treatment system; WL = well

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

*	Replicate analysis not within control limits.
>	Result above upper detection limit.
A	TIC is a suspected aldol-condensation product.
B	Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
C	Pesticide result confirmed by GC-MS.
D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X,Y,Z	Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G Possible grout contamination, pH > 9.	J Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	Q Qualitative result due to sampling technique.	R Unusable result.
U	Parameter analyzed for but was not detected.	X Location is undefined.	

QA QUALIFIER:

#	validated according to quality assurance guidelines.

Appendix E. June 2017 Crescent Junction Sampling Event (*continued*)
Water Level Data

STATIC WATER LEVELS (USEE700) FOR SITE MOA01, Moab Site						
REPORT DATE: 9/25/2017						
Location Code	**Flow Code**	**Top of Casing Elevation (Ft)**	**Measurement Date Time**	**Depth From Top of Casing (Ft)**	**Water Elevation (MSL)**	**Water Level Flag**
0205	O	4949.0	06/20/2017	50.23	4898.77	

Flow Codes: B = background; C = cross gradient; D = downgradient; MSL = mean sea level O = on site; U = upgradient, Water Level Flags: D = dry

Moab TAC Team

Date: June 29, 2017
To: Ken Pill
From: James Ritchey
Subject: June 2017 CJ Sampling Event

Site: Crescent Junction – Well 0205 Sampling Event –June 2017
Date of Sampling Event: June 20, 2017
Team Members: E. Moran, K. Pill, and J. Ritchey
RIN Number Assigned: All samples were assigned to RIN 1706095.
Sample Shipment: The sample was shipped overnight UPS to ALS Laboratory from Moab, Utah on June 21 of 2017 (Tracking number: 1Z5W1Y510190038324).

Number of Locations Sampled: A one sample was collected from well 0205 during the June 2017 CJ sampling event.

Locations Not Sampled/Reason: None.

Field Variance: None.

Quality Control Sample Cross Reference: None.

Location Specific Information: Well 0205 was sampled using a dedicated submersible pump with dedicated tubing. The table below provides additional information:

Location	Date	Sample Depth (ft bgs)	Depth to Water (ft btoc)	Comments
0205	06/20/2017	68	50.23	Water is yellow.

Notes: ft bgs = feet below ground surface

Well Inspection Summary: A well inspection was not conducted.

Equipment: None.

Regulatory: None.

Site Issues: None.

Corrective Action Required/Taken: None.