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Moab UMTRA Project
2020 Groundwater Program Report

Revision 0

August 2021

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Moab UMTRA Project 2020 Groundwater Program Report

Revision 0

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Revision History

Revision	Date	Description
0	August 2021	Initial issue.

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Acronyms and Abbreviations

ALS	ALS Environmental
bgs	below ground surface
CA	Contamination Area
CF	configuration
CFR	Code of Federal Regulations
cfs	cubic feet per second
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ft	feet or foot
ft bgs	feet below ground surface
gal	gallon or gallons
gpm	gallons per minute
IA	interim action
kg	kilograms
lb	pounds
µmhos/cm	micromhos per centimeter
mg/L	milligrams per liter
mil	million or millions
msl	mean sea level
TDS	total dissolved solids
UMTRA	Uranium Mill Tailings Remedial Action

1.0 Introduction

1.1 Purpose and Scope

The purpose of the annual Groundwater Program Report is to assess the groundwater interim action performance measures the U.S. Department of Energy (DOE) has taken at the Moab Uranium Mill Tailings Remedial Action (UMTRA) Project site. This report describes the Groundwater Program activities for the Moab Project during calendar year 2020, and evaluates the effectiveness of the remediation systems to remove contaminant mass from the groundwater system and protect endangered fish habitats that may develop in the Colorado River adjacent to the site.

1.2 Site History and Background

The Moab Project site is a former uranium ore-processing facility located approximately 3 miles northwest of the city of Moab in Grand County, Utah (Figure 1). The Moab mill operated from 1956 to 1984. When the processing operations ceased, an estimated 16 million (mil) tons of uranium mill tailings accumulated in an unlined impoundment. A portion of the impoundment is within the 100-year floodplain of the Colorado River. In 2001, ownership of the site was transferred to DOE. Since April 2009, tailings have been relocated by rail to a disposal cell 30 miles north, near Crescent Junction, Utah.

Site-related contaminants, primarily ammonia and uranium, have leached from the tailings pile into the shallow groundwater. Some of the more mobile constituents have migrated downgradient and are discharging into the Colorado River adjacent to the site.

In 2005, DOE issued the *Record of Decision for the Remediation of the Moab Uranium Mill Tailings, Grand and San Juan Counties, Utah* (6450-01-P), which includes the cleanup alternative to continue and expand its ongoing active remediation of contaminated groundwater at the Moab site, as necessary. As an interim action (IA), DOE began limited groundwater remediation that involves extraction of contaminated groundwater from on-site remediation wells that is used for dust suppression inside the Contamination Area (CA). In addition, remediation activities also include the utilization of freshwater injection and surface water diversion systems.

2.0 Groundwater Program Description

The Groundwater Program at the Moab site is designed to limit ecological risk from contaminated groundwater discharging to potential endangered fish habitat areas along the Colorado River. This protection is accomplished by removing contaminant mass with groundwater extraction wells. In addition, freshwater injection between the river and the tailings pile creates a hydraulic barrier that reduces discharge of contaminated water to suitable habitat areas. When necessary, surface water diversion takes place in areas of the Colorado River adjacent to the IA well field when suitable habitats develop for endangered young-of-year fish.

Groundwater and surface water monitoring is performed in conjunction with injection and extraction operations and through water level and analytical data. The level of sampling and reporting completed in 2020 complies with regulation requirements and industry standards, and provides the correct level of monitoring and reporting.

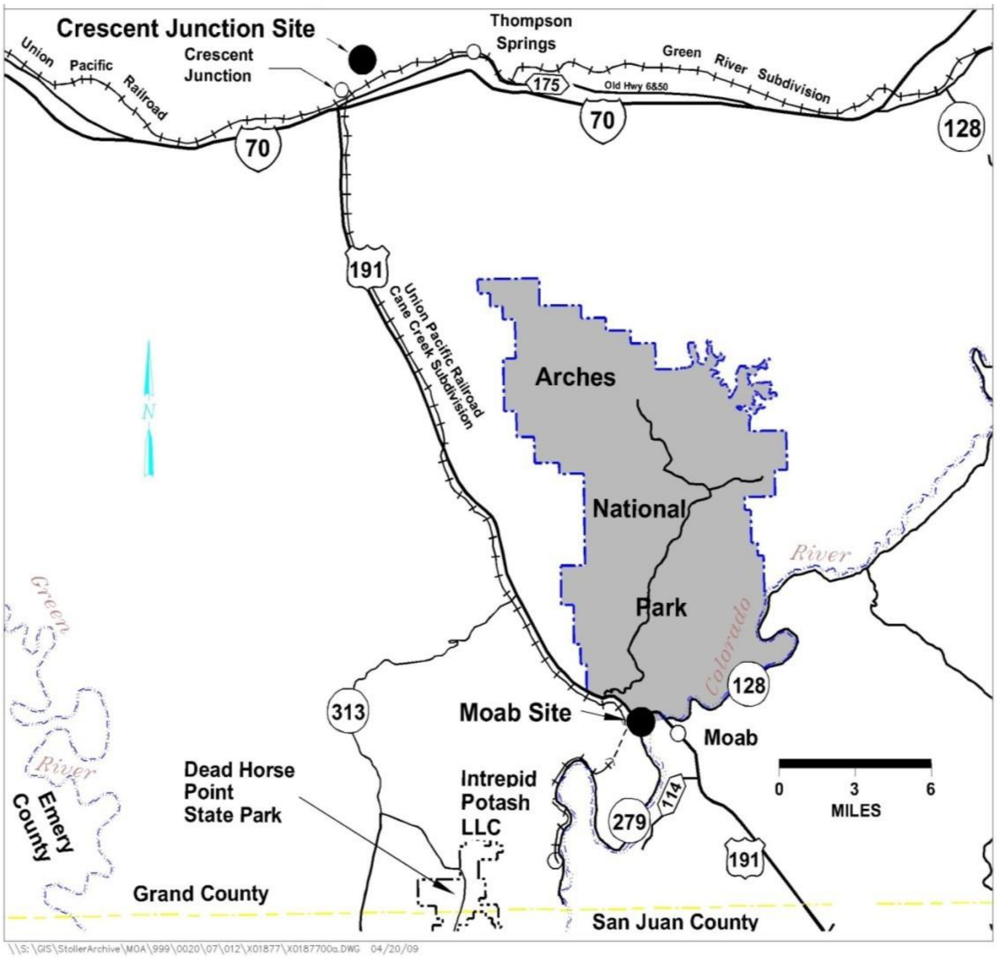

Figure 1. Location of the Moab Project Site

2.1 Interim Action Groundwater System

DOE installed and began operating the first of several configurations (CFs) of extraction/injection wells that comprise the IA groundwater system in 2003 (Figure 2). The objectives of the IA system are to: 1) remove contaminant mass through groundwater extraction, 2) reduce the discharge of ammonia-contaminated groundwater to side channels that may be suitable habitat for endangered aquatic species, and 3) to provide performance data to select and design a final groundwater remedy. Contaminated groundwater from the shallow plume is extracted through a series of eight extraction wells (CF5). The IA system also includes injection of filtered river water into the underlying alluvium through remediation wells (CF4) located near the western bank of the river.

A surface water diversion system is designed to deliver fresh water to any area (primarily side channels) adjacent to the IA well field. This system is utilized when an area develops into a suitable habitat for endangered young-of-year fish species, and is designed to reduce ammonia concentrations below either the acute or chronic criteria established U.S. Environmental Protection Agency (EPA). Monitoring wells are also part of the IA system for evaluation purposes. In 2020, CF4 wells were used for freshwater injection, and extraction operations occurred through the CF5 extraction wells. In addition, the diversion system operated from late June through early October in 2020.

Figure 2. Location of IA Wells

2.2 Hydrology and Contaminant Distribution

The primary hydrogeologic unit present at the Moab site consists of alluvial valley fill deposits. The alluvium is mostly comprised of either the Moab Wash alluvium or the Colorado River basin-fill alluvium. Moab Wash alluvium is composed of fine-grained sand, gravelly sand, and detrital material that travels down the Moab Wash and is deposited along the northwestern boundary of the site with the Colorado River basin-fill alluvium.

The basin-fill alluvium is comprised of two distinct types of material. The upper unit consists mostly of fine sand, silt, and clay and ranges in thickness up to 15 feet (ft) near the saturated zone in some areas. This shallow unit is made of overbank deposits from the Colorado River.

The lower part of the basin-fill alluvium mostly consists of a gravelly sand and sandy gravel, with minor amounts of silt and clay. This deeper, coarse alluvium pinches out to the northwest along the subsurface bedrock contact and thickens to the southwest toward the river more than 450 ft near the deepest part of the basin. The upper silty-sand unit typically has a hydraulic conductivity that ranges from 100 to 200 ft/day.

Because of the conductive nature of the sands and gravels in the subsurface, any fluctuations in the Colorado River flows impact the groundwater surface elevations. Water table contour maps indicate the groundwater in this area discharges into the Colorado River under base flow conditions. Figure 3 is the groundwater surface contour map generated using data collected on May 11 and 12, 2020, when the Colorado River flows ranged from 6,230 to 6,690 cubic feet per second (cfs). Figure 4 shows the groundwater contours in December (during base flows), when the river flow ranged from 1,950 to 2,280 cfs. The river flow ranged from 1,950 to 14,900 cubic feet per second (cfs) during 2020.

Most groundwater beneath the site contains total dissolved solids (TDS) concentrations greater than 10,000 milligrams per liter (mg/L) (brackish water and brine). A brine interface naturally occurs beneath the Moab site that is delineated at a TDS concentration of 35,000 mg/L, which is equivalent to a specific conductance of approximately 50,000 micromhos per centimeter (µmhos/cm). The interface moves laterally and vertically during the course of each year in response to changes in river stage.

The tailings pile fluids contain TDS exceeding 35,000 mg/L, which allows this fluid sufficient density to vertically migrate downward in groundwater under previous operating conditions at the site. This former density-driven flow has created a legacy plume of dissolved ammonia that now resides below the brackish water/brine interface. The ammonia beneath the interface represents a potential long-term source of contamination to the upper alluvial groundwater system.

Since the cessation of milling operations at the site in 1984, the flux of relatively fresh water entering the site upgradient of the tailings pile may have diluted the ammonia concentrations in the shallow groundwater (Figures 5 and 6).

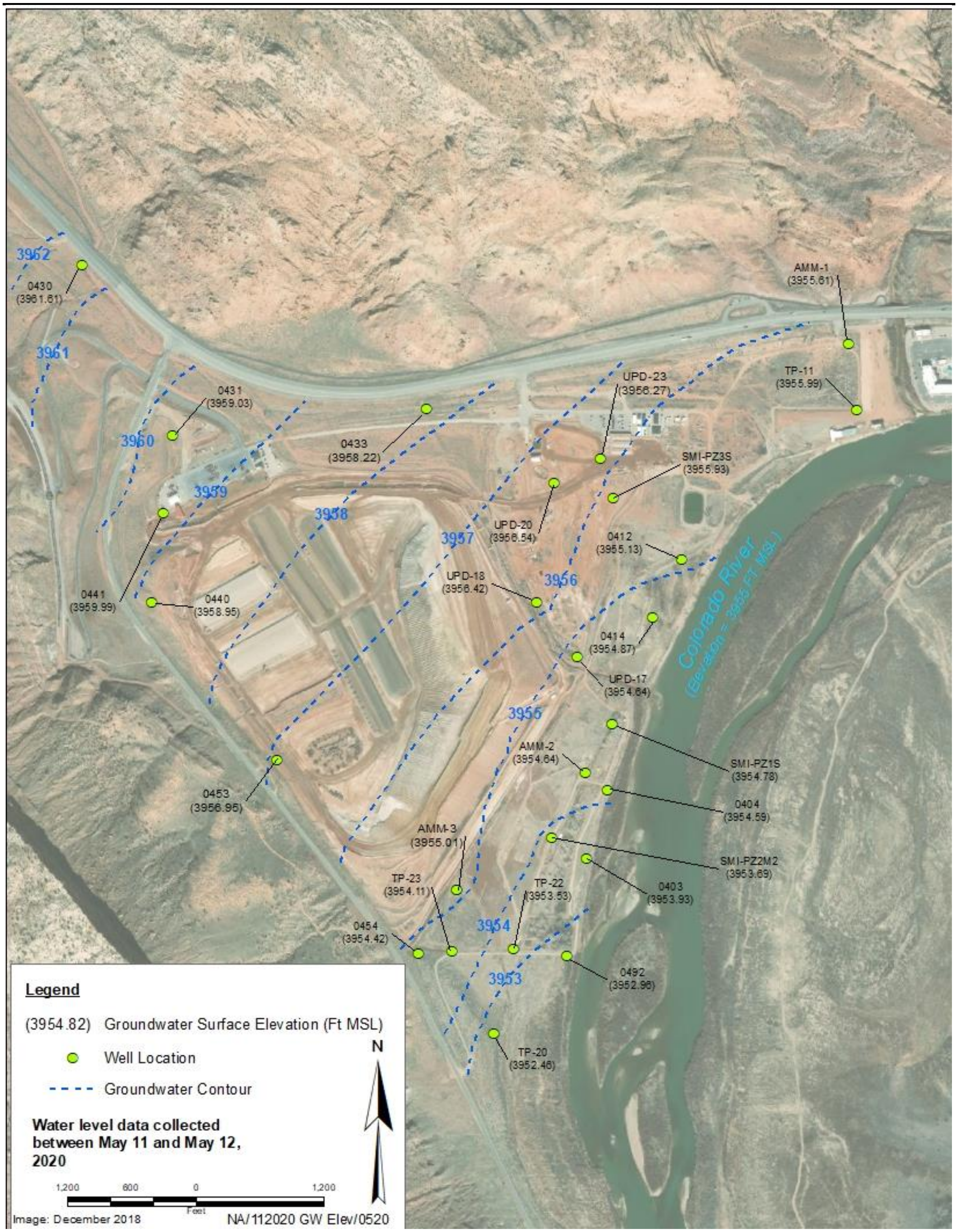

Figure 3. Site-wide Groundwater Elevations, May 11 through May 12, 2020

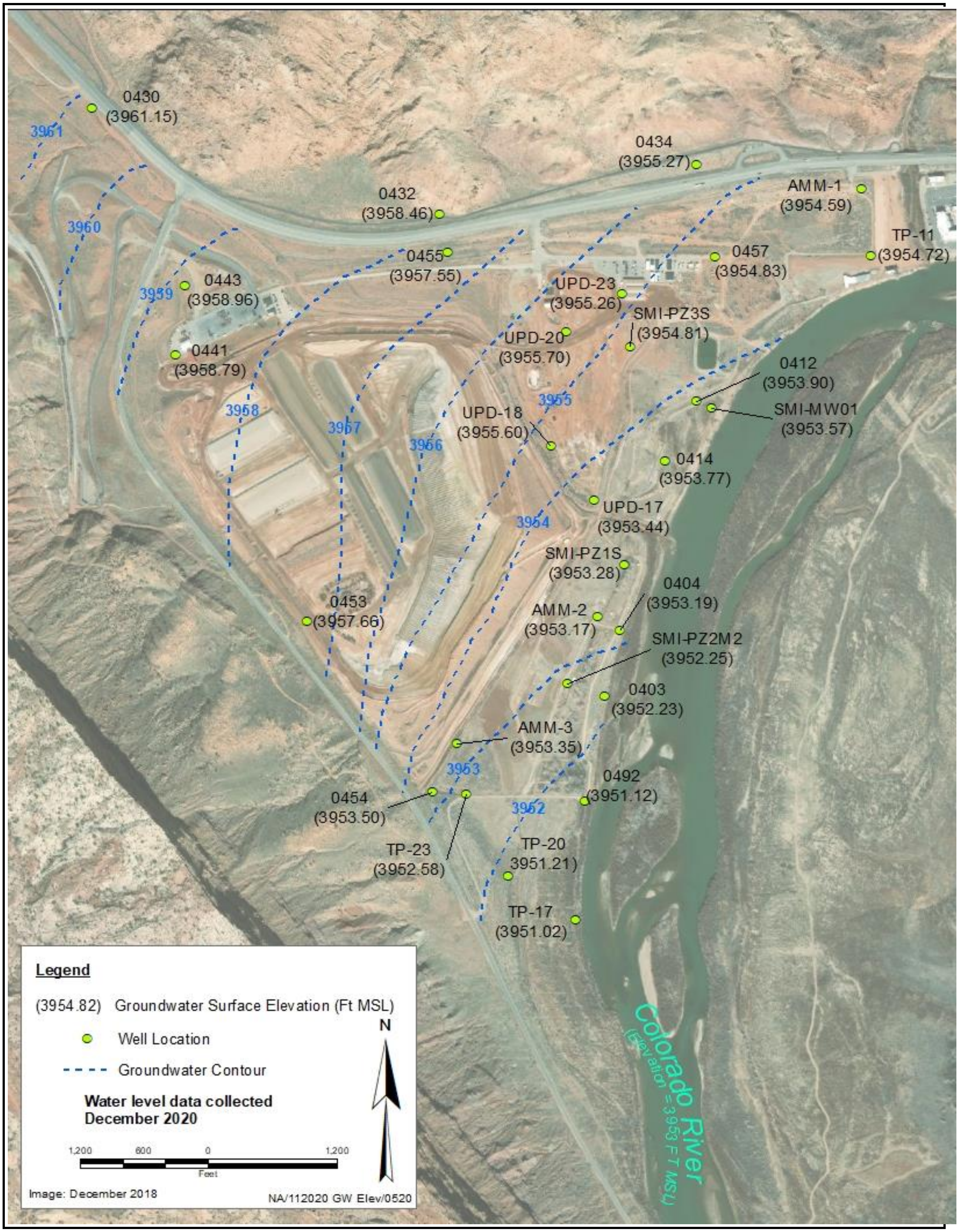

Figure 4. Site-wide Groundwater Elevations, December 2020

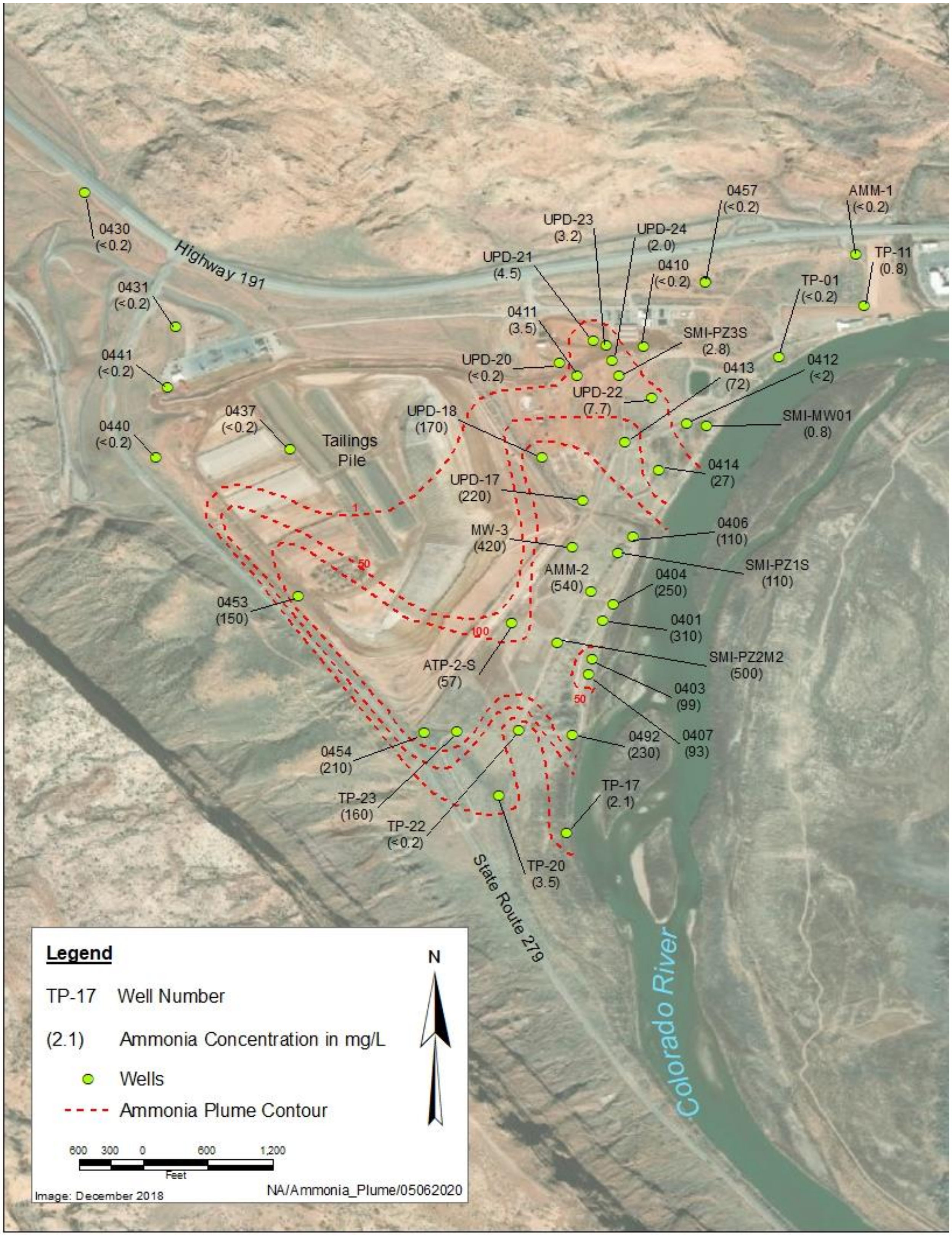

Figure 5. Ammonia Plume in Shallow Groundwater May/June 2020

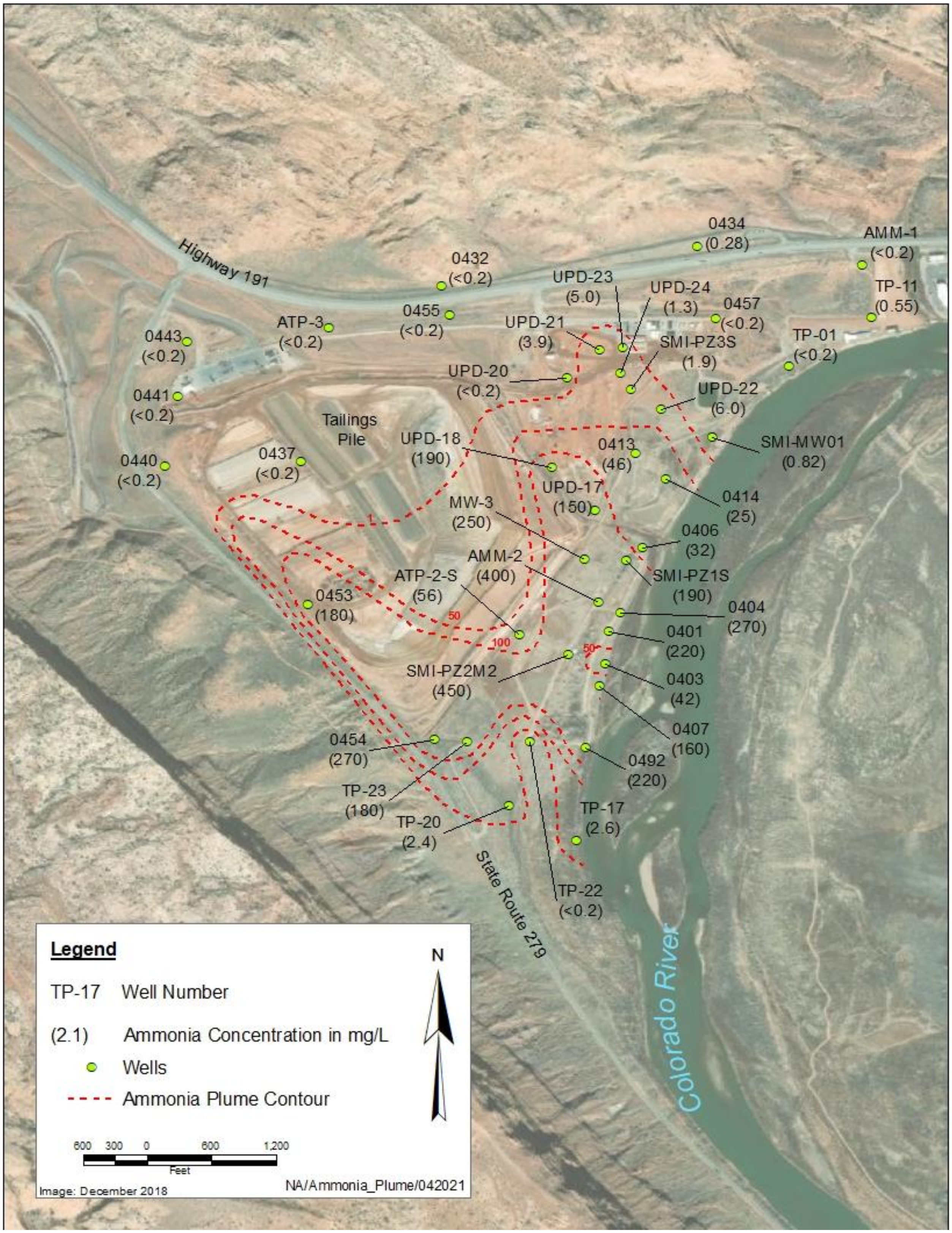

Figure 6. Ammonia Plume in Shallow Groundwater December 2020 – February 2021

Oxidation of ammonia to nitrate or nitrogen may also contribute to lower ammonia concentrations observed in the upgradient shallow groundwater beneath the tailings pile, where aerobic conditions are more likely; however, there is no flushing of the legacy plume by an advective flow of fresh water due to density stratification of the brine zone. Figure 5 shows the ammonia plume in May/June 2020, and Figure 6 shows the ammonia plume in November/December 2020. The two plume maps are comparable.

There is no standard associated with ammonia, while the uranium groundwater standard of 0.044 mg/L is based on Table 1 in Title 40 Code of Federal Regulations Part 192, Subpart A (40 CFR 192A), "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings, Standards for the Control of Residual Radioactive Materials from Inactive Uranium Processing Sites." In addition to ammonia, the other primary constituent of concern in groundwater is uranium. Figures 7 and 8 show the distribution of dissolved uranium in shallow groundwater in 2020. Both 2020 plumes are comparable compared to plume maps from the previous years, suggesting minimal plume lateral migration.

2.3 Surface Water/Groundwater Interaction

Previous investigations have shown that Colorado River flows impact the groundwater elevations and contaminant concentrations in the well field. For the majority of the year, when the river is experiencing baseflow (less than 4,000 cfs), groundwater discharges into the river (river gaining conditions). As the river flow increases in response to the spring runoff, the river changes from gaining to losing conditions, and a freshwater lens starts to develop in the aquifer underlying the well field.

During higher flows, the groundwater gradient direction reverses adjacent to the river, and the groundwater contaminant concentrations are diluted. Once these flows subside, the river switches back from losing to gaining, and the groundwater gradient direction is re-established towards the river (to the southeast).

Figure 9 displays the groundwater elevation versus the elevation of the Colorado River in 2020. The elevation of the Colorado River was calculated using the river flows from the USGS Cisco gaging station and converting the flow to an elevation using the site rating curve included in the *Moab UMTRA Project Flood and Drought Mitigation Plan* (DOE-EM/GJTAC1640). The Colorado River Basin experienced a low water year in 2020 likely due to dry soil conditions despite an average snowpack.

Between January and May 2020, the Colorado River was under gaining conditions (when the groundwater elevation was higher than the river surface elevation). The river switched to losing conditions (groundwater elevation lower than the river surface elevation) in early May through mid-June. After mid-June, with the exception of the time period between early September and late October when the river elevation was slightly higher than the groundwater surface elevation, the river was under gaining conditions through the end of 2020.

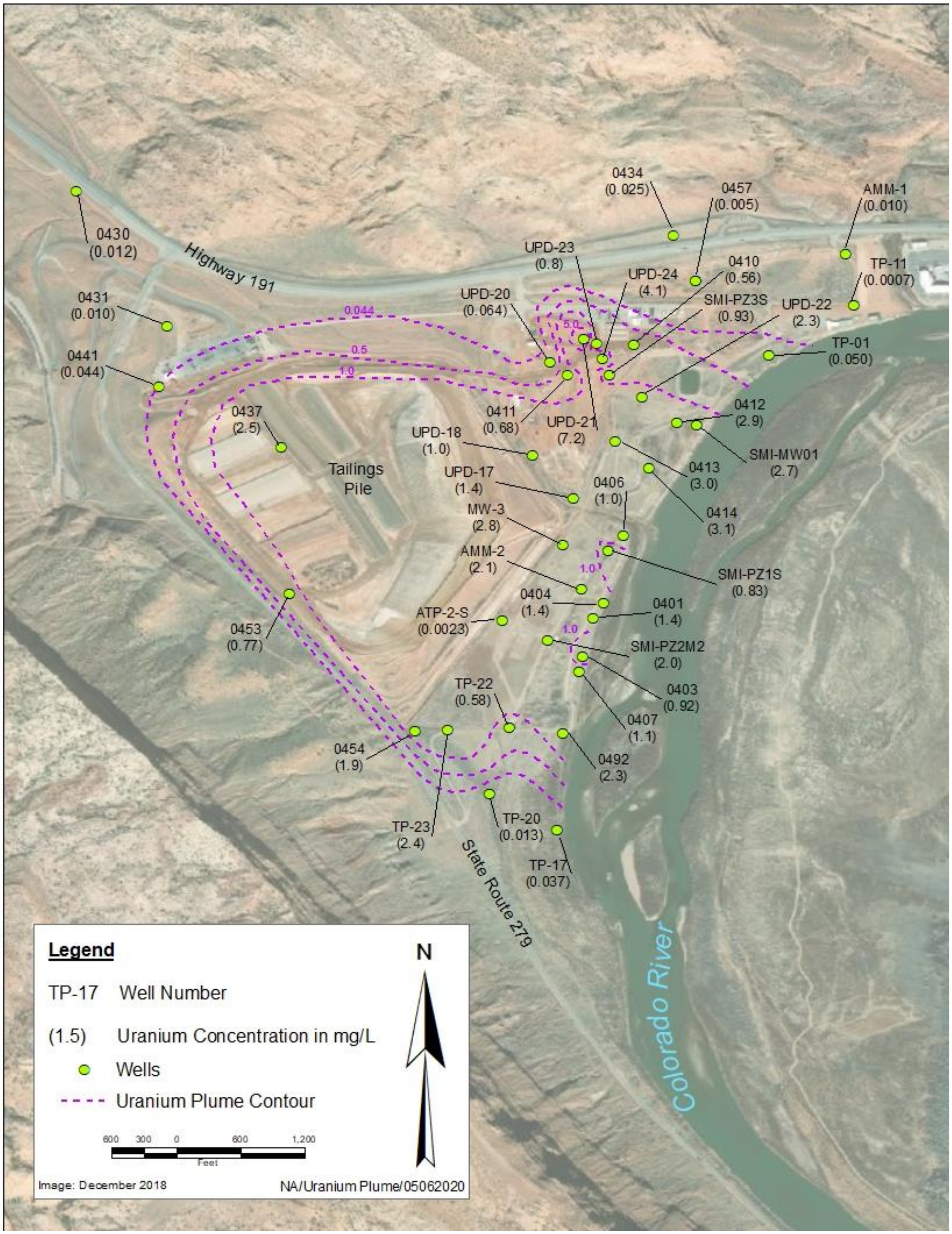

Figure 7. Uranium Plume in Shallow Groundwater May/June 2020

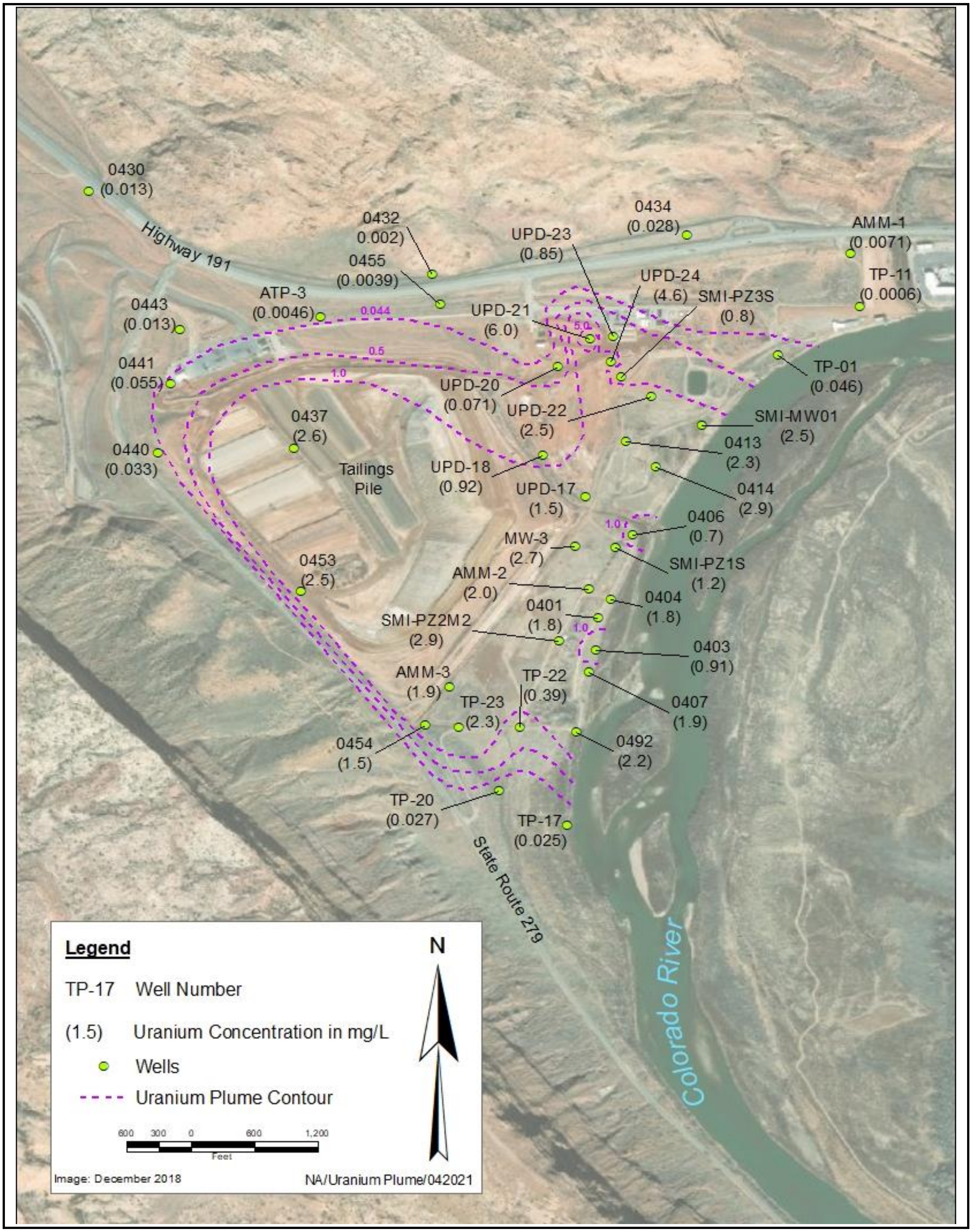

Figure 8. Uranium Plume in Shallow Groundwater December 2020 – February 2021

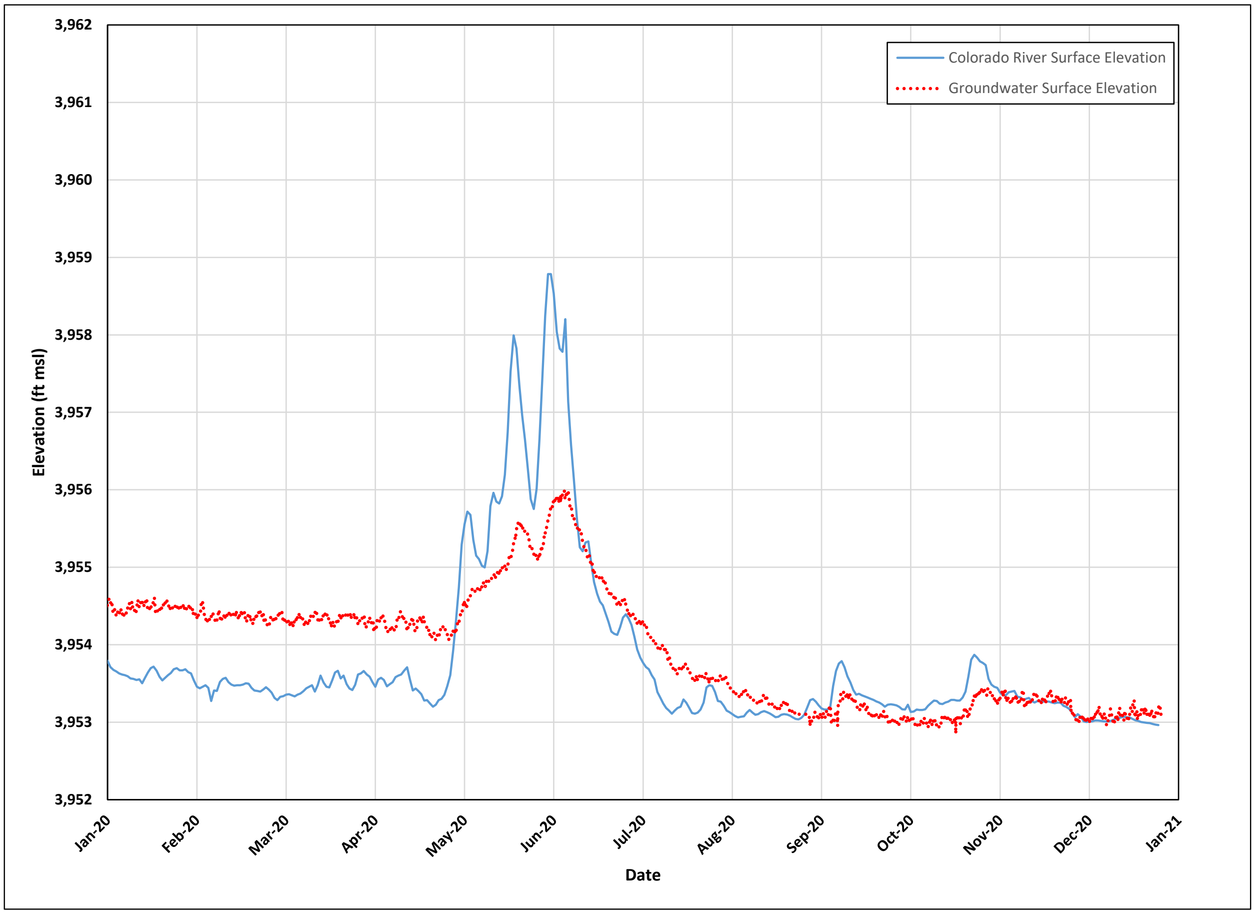

Figure 9. Groundwater Surface Elevation Compared to the Colorado River Surface Elevation 2020

3.0 Methods

Well field performance is assessed by measuring extraction/injection rates of remediation wells, measuring water levels, and the collection of samples from surface water locations, extraction wells, and monitoring wells for analytical analysis. In 2020, the IA well field operations included extraction at CF5 and injection at CF4. In addition, the surface water diversion system was operational starting in late June through early October 2020.

3.1 Remediation Well Extraction

Each extraction well contains a flow meter that displays the instantaneous flow rate in gallons (gal) per minute (gpm), the cumulative total volume extracted, and the net volume since the last reset of the internal memory. Flow meter readings are manually recorded on a weekly basis during extraction operations and are used in conjunction with water quality data to calculate the contaminant mass removal and evaluate the performance of the system.

This extracted groundwater is used as dust suppression in the CA. Any contaminants deposited as salts in the CA will eventually be removed for disposal with tailings and transported to the Crescent Junction disposal site.

3.2 Remediation Well Injection

Each injection well contains a flow meter that displays the instantaneous injection rate (in gpm) and the total volume. Flow meter readings are recorded manually on a weekly basis during injection operations. Water level data are used to calculate the elevation of freshwater mounding in response to the injection activities.

3.3 Water Levels

Groundwater levels are recorded in the IA well field on a weekly basis during injection operations to monitor groundwater drawdown and freshwater mounding. A water level indicator is used to measure the depth to groundwater (below top of casing). Data logging equipment with pressure transducers is installed at various locations to measure water levels more frequently.

3.4 Water Quality

Select well and surface water locations are sampled at various times, depending on the purpose of the sampling event. Prior to collecting a sample, the field parameters (which include temperature, pH, and conductivity) are measured and recorded. Observation wells are primarily sampled with dedicated down-hole tubing and a peristaltic pump, while extraction wells are sampled with dedicated submersible pumps.

Water samples are collected from observation wells at various depths and locations to monitor the primary contaminants of concern, ammonia (as N) and uranium. All sampling was performed in accordance with the *Moab UMTRA Project Surface Water/Groundwater Sampling and Analysis Plan* (DOE- EM/GJTAC1830). Samples are shipped overnight to ALS Environmental (ALS) in Fort Collins, Colorado, for analysis.

4.0 Groundwater Extraction System Operations and Performance

4.1 Interim Action Operations

This section provides information regarding the IA well field extraction performance during the 2020 pumping season. This section also includes a discussion of the total groundwater extraction rate, hydraulic control, mass removal, and water quality. Appendix A contains tables of well construction information (Table A-1), a chronology of 2020 activities (Table A-2), pumping volumes (Table A-3), and mass removal (Tables A-4 and A-5).

Groundwater extraction operations are controlled by an automated system, which utilize extraction wells that supply groundwater directly to two 21,000-gal holding tanks. The water is then pumped into a 12,000-gal Klein tank, where it transferred to water trucks and used for dust suppression in the CA.

Extraction operations are limited by how much water is needed for dust suppression in the CA and by weather conditions (wet weather leads to less extraction, and warm, windy weather leads to more extraction). The 2020 extraction schedule was focused on optimizing ammonia and uranium mass removal and rotating through each of the eight CF5 remediation wells. In 2020, the extraction system was re-started in mid-March and operated consistently until the system was winterized in mid-November. Figure 10 provides a graphic summary of when the 9.7 mil gal of groundwater was extracted from CF5 in 2020.

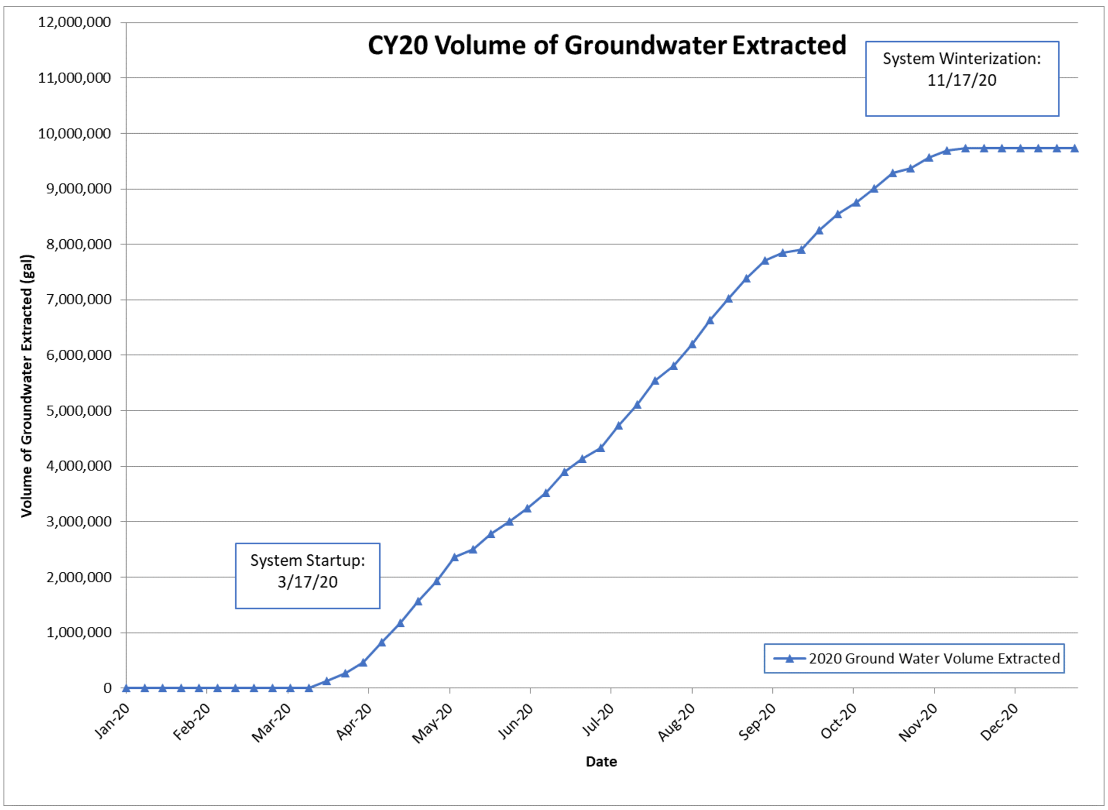

Figure 10. Cumulative Volume of Extracted Groundwater during 2020

4.2 CF5 Groundwater Volume Extracted and Contaminant Mass Removal

Monthly extraction volumes for each of the eight extraction wells are listed in Table A-3. The majority of the 2020 extracted water was removed from wells 0813 (2.1 mil gal) and 0816 (2.0 mil gal). The remaining CF5 wells extracted between approximately 535,000 and 1.2 mil gal in 2020. Extraction operations were maximized in July, when 1.7 mil gal were removed from the groundwater system.

The annual 2020 ammonia and uranium mass removed by CF5 extraction wells is presented in Tables A-4 and A-5. These values are based on groundwater extraction volumes recorded by individual flow meters. The mass of ammonia and uranium removed from groundwater by the extraction wells was calculated by multiplying the extracted volume by the corresponding contaminant mass concentration measured in each well's discharge.

The concentrations used in these calculations were drawn from analytical data presented in Table 1 and in Appendix D (available on the Project's SharePoint website). In 2020, a total of 19,520 pounds (lb) (8,854 kilograms [kg]) of ammonia and 195.9 lb (88.9 kg) of uranium were extracted from the groundwater system.

Table A-4 shows that extraction wells 0813 and PW02 removed the most ammonia mass at 4,023 lb (1,825 kg) and 4,016 lb (1,821 kg), respectively. Estimated mass withdrawals of uranium at CF5 extraction wells are presented in Table A-5, which shows the greatest mass of uranium was extracted from well 0816 (42.0 lb, or 19.0 kg).

4.3 Groundwater Chemistry

Groundwater samples were collected from the CF5 extraction wells in April and September 2020 (Table 1). Ammonia concentrations ranged from 120 mg/L (well 0816) to 420 mg/L (well 0812), and the uranium concentration ranged from 1.5 mg/L (well 0813) to 3 mg/L (wells 0815 and PW02). Specific conductance ranged from approximately 11,250 µmhos/cm at well 0813 (northern end of CF5) to 29,730 µmhos/cm at well 0810 (located at the southern end of the well field).

Figures 11 through 14 are time versus concentration trend plots that display trends of the CF5 extraction wells from 2012 through 2020, which represents the majority of the CF5 well field lifespan (extraction was started in April 2010). Figure 11 is the time versus ammonia concentration trend plot for extraction wells 0810 through 0813 and SMI-PW02, all of which are located along the CF5 southeastern boundary. Figure 12 displays the ammonia concentration trend plots for CF5 wells 0814 through 0816, which are located closer to the base of the tailings pile. Figures 13 and 14 are the time versus uranium concentration trend plots for the same sets of wells.

Taking into account all eight extraction wells, the ammonia concentrations continue to be significantly higher (in some cases twice as high) in the samples collected from wells located along the CF5 southeastern boundary compared to the wells located along the toe of the tailings pile. A similar trend is not apparent regarding the uranium concentrations, with both lines of wells having very similar results. In general, ammonia contaminant concentrations associated with samples collected from all CF5 have been gradually decreasing, whereas uranium concentrations have been slightly increasing.

The sampling of wells AMM-2 and SMI-PZ2M2 provide some insight on how the CF5 extraction wells are impacting the groundwater system. Well AMM-2 is a monitoring well that is located approximately 100 ft off extraction well 0813, and well SMI-PZ2M2 is within the well PW02 cluster. Samples have been consistently collected from these locations at depths of 48 and 56 ft bgs, respectively.

Figure 15 presents the ammonia concentrations measured from these locations along with linear trend lines for each data set. As shown in this plot, the trend lines for both data sets are displaying a decreasing ammonia concentration since 2009. The trend line associated with well SMI-PZ2M2 exhibits a larger decrease in the concentrations, likely in response to this monitoring well's close proximity to an extraction well compared to AMM-2.

Figure 16 is a similar plot for the uranium concentrations. Both trend lines show the uranium concentrations are increasing, which is consistent with the trend line data associated with the extraction well chemical data.

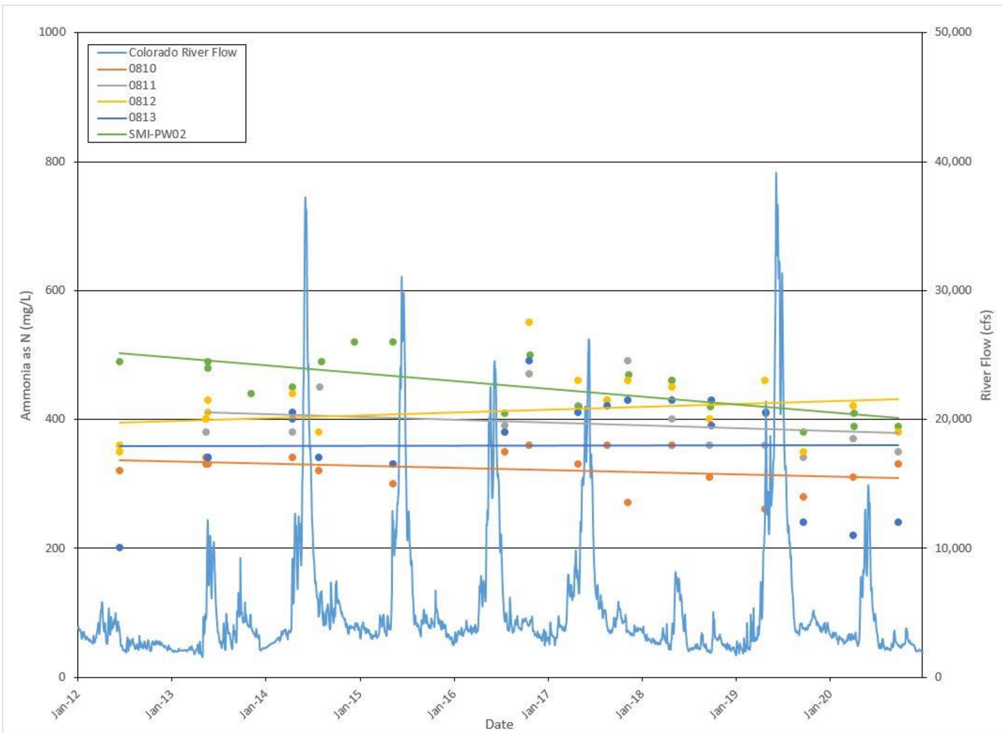

Figure 11. CF5 Extraction Wells 0810, 0811, 0812, 0813, and SMI-PW02 Time versus Ammonia Concentration Plot

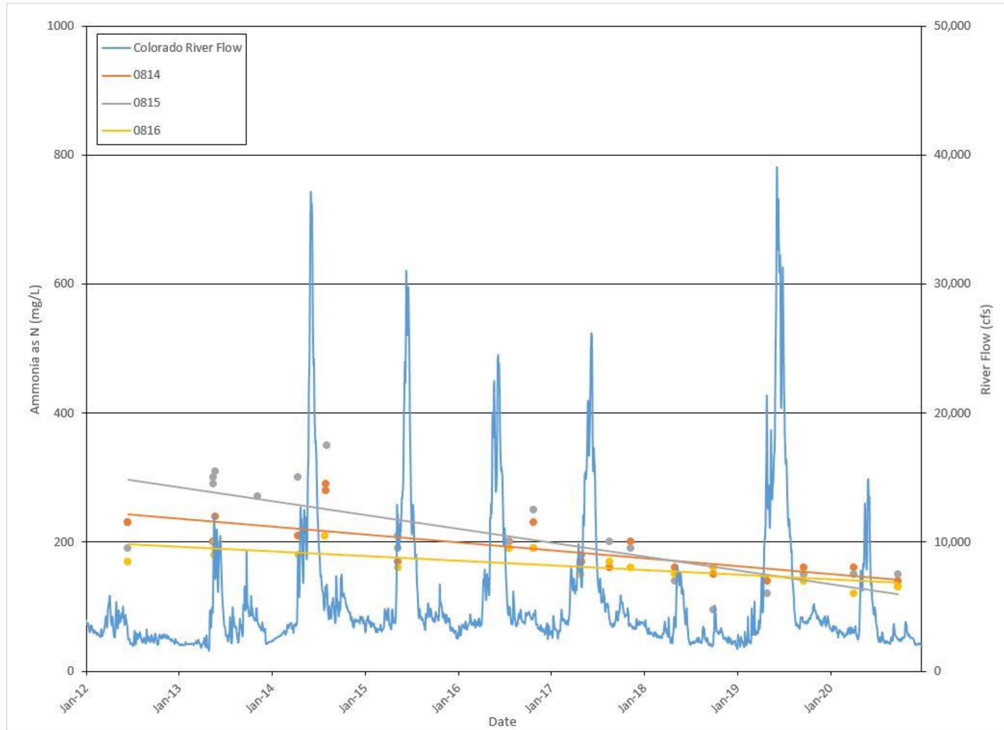

Figure 12. CF5 Extraction Wells 0814, 0815, and 0816 Time versus Ammonia Concentration Plot

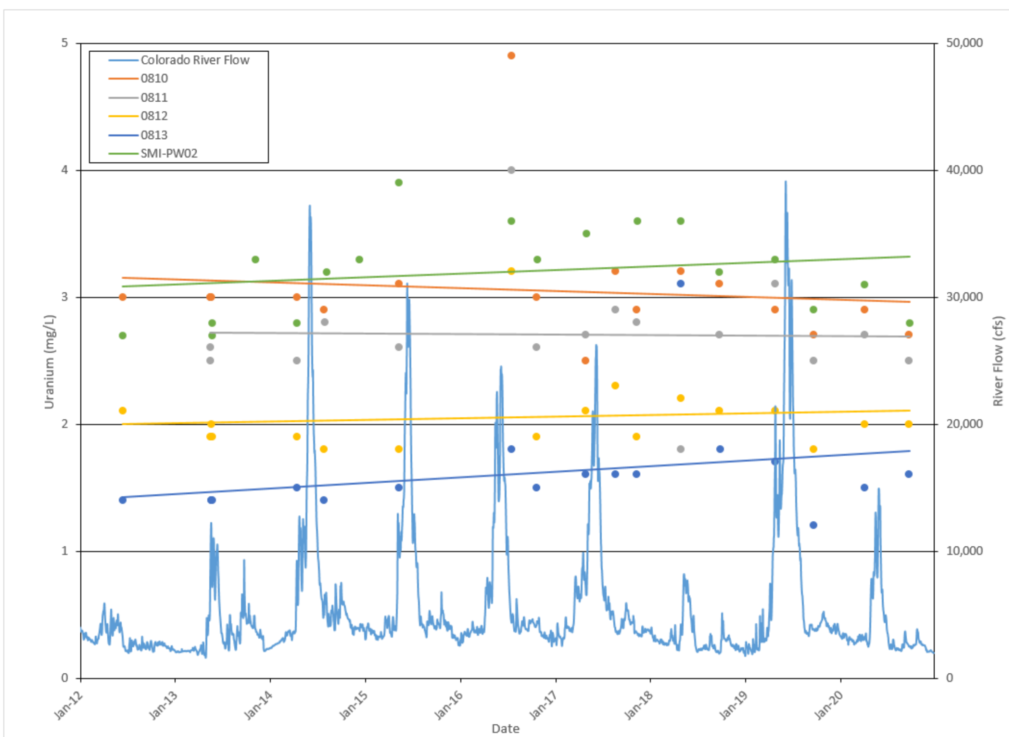

Figure 13. CF5 Extraction Wells 0810, 0811, 0812, 0813, and SMI-PW02 Time versus Uranium Concentration Plot

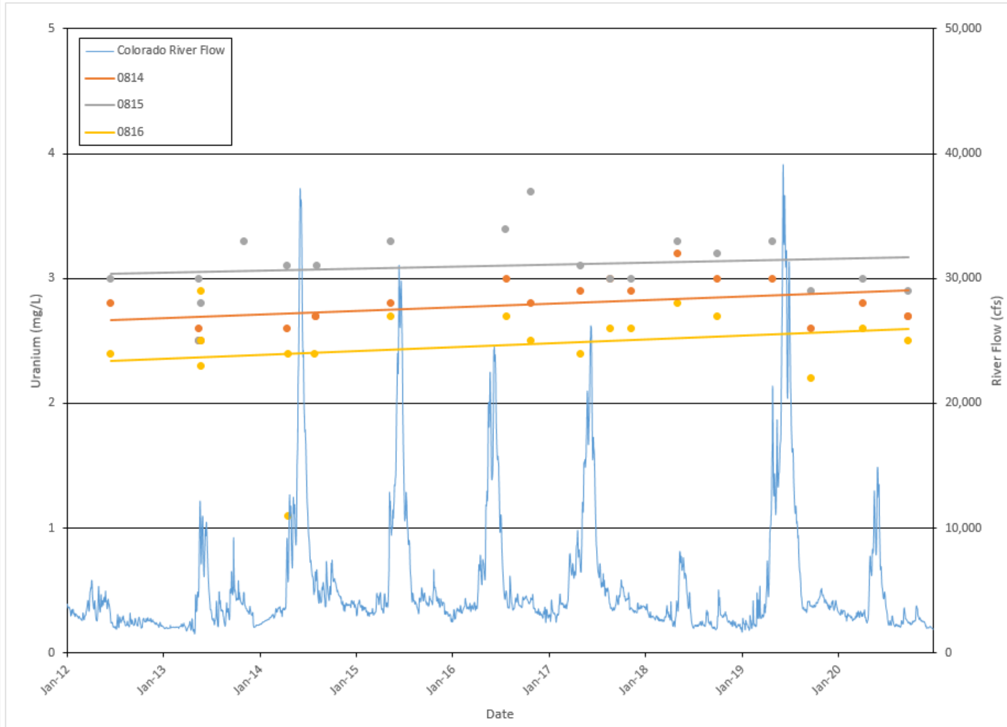

Figure 14. CF5 Extraction Wells 0814, 0815, and 0816 Time versus Uranium Concentration Plot

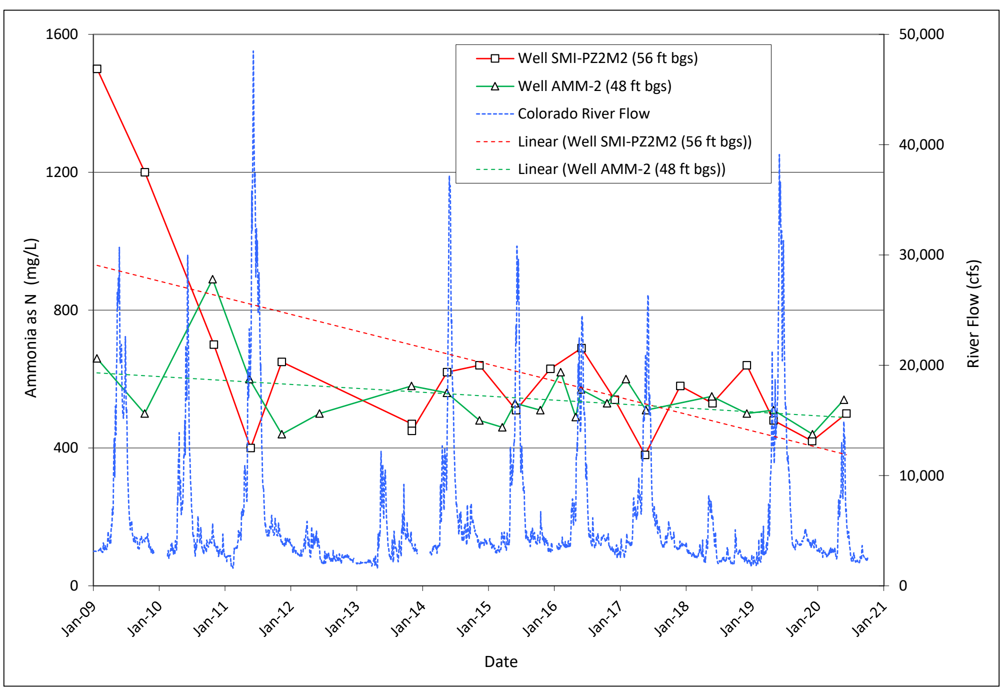

Figure 15. Monitoring Wells AMM-2 and SMI-PZ2M2 Time versus Ammonia Concentration Plot and Trend Lines

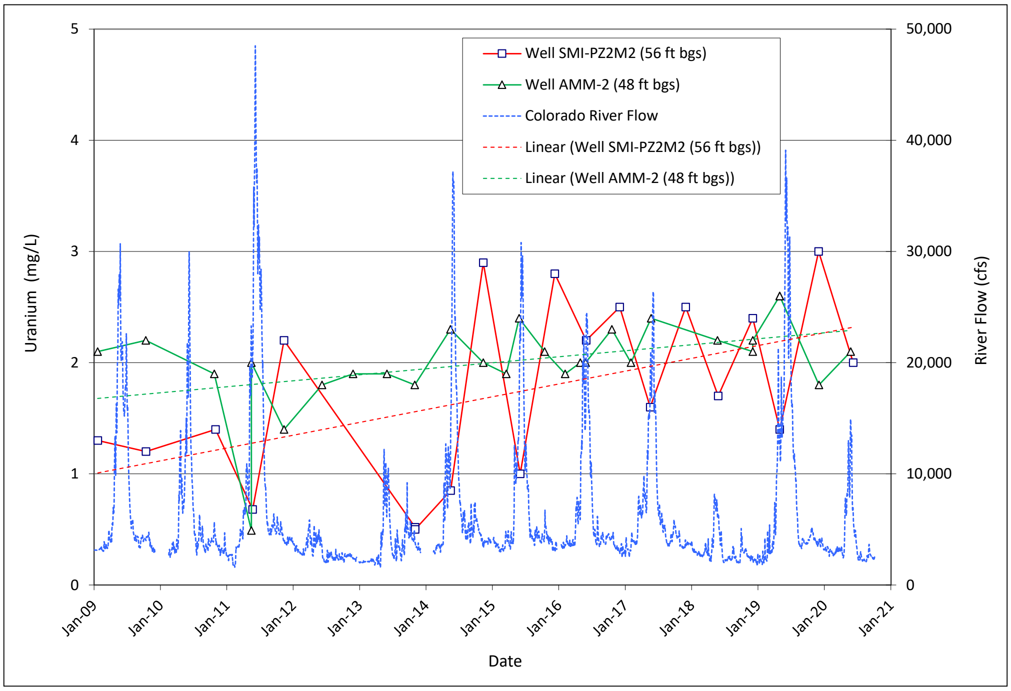

Figure 16. Monitoring Wells AMM-2 and SMI-PZ2M2 Time versus Uranium Concentration Plot and Trend Lines

Table 1. CF5 Ammonia, Uranium, and Specific Conductance Results, 2020

Location	Date	Ammonia (mg/L)	Uranium (mg/L)	Specific Conductance (µmhos/cm)
0810	4/8/20	310	2.9	28,179
	9/28/20	330	2.7	29,736
0811	4/8/20	370	2.7	18,716
	9/28/20	350	2.5	20,853
0812	4/8/20	420	2	16,332
	9/28/20	380	2	17,181
0813	4/8/20	220	1.5	11,256
	9/28/20	240	1.6	14,008
0814	4/8/20	160	2.8	21,122
	9/28/20	130	2.7	22,425
0815	4/8/20	150	3	19,569
	9/28/20	150	2.9	24,465
0816	4/8/20	120	2.6	19,723
	9/28/20	130	2.5	23,021
PW02	4/8/20	410	3	25,411
	9/28/20	390	2.8	29,408

5.0 Freshwater Injection System Operation and Performance

The main objective of freshwater injection is to form a hydrologic barrier between the tailings pile and the Colorado River side channel the potentially develops into a habitat. In addition, the contaminant concentrations are diluted prior to discharging into the river. The injection system uses Colorado River water that is diverted to the freshwater pond. This water is pumped through a sand and gravel media, and then through 1 to 5 micron bag filter prior to being injected into the CF4 remediation wells. Construction information for the CF4 wells can be found in Table B-1 of Appendix B. Table B-2 also contains a chronology of CF4 activities.

CF4 is located in the southern portion of the IA well field adjacent to a prominent side channel that typically remains open to the main channel until the river flow drops below 3,000 cfs and a backwater (open at the bottom and closed off at the top) forms. During 2020, a suitable habitat was present for several months due to below average river flows.

5.1 Injection Performance

Freshwater injection into the CF4 wells in 2020 occurred consistently from January through May. However, due to a number of factors injection into CF4 was minimal through the rest of the year. As a result, only 5.4 mil gal of freshwater was injection in 2020. Figure 17 provides a graphic summary of the cumulative volume of freshwater injected into CF4 in 2020.

Factors that contributed to limited injection included sand filter operation issues, system pressure issues, and a power surge that damaged the injection pump motor. In addition the injection system was utilized for surface water diversion into the backwater channel and suitable habitat from June 22 through September 15.

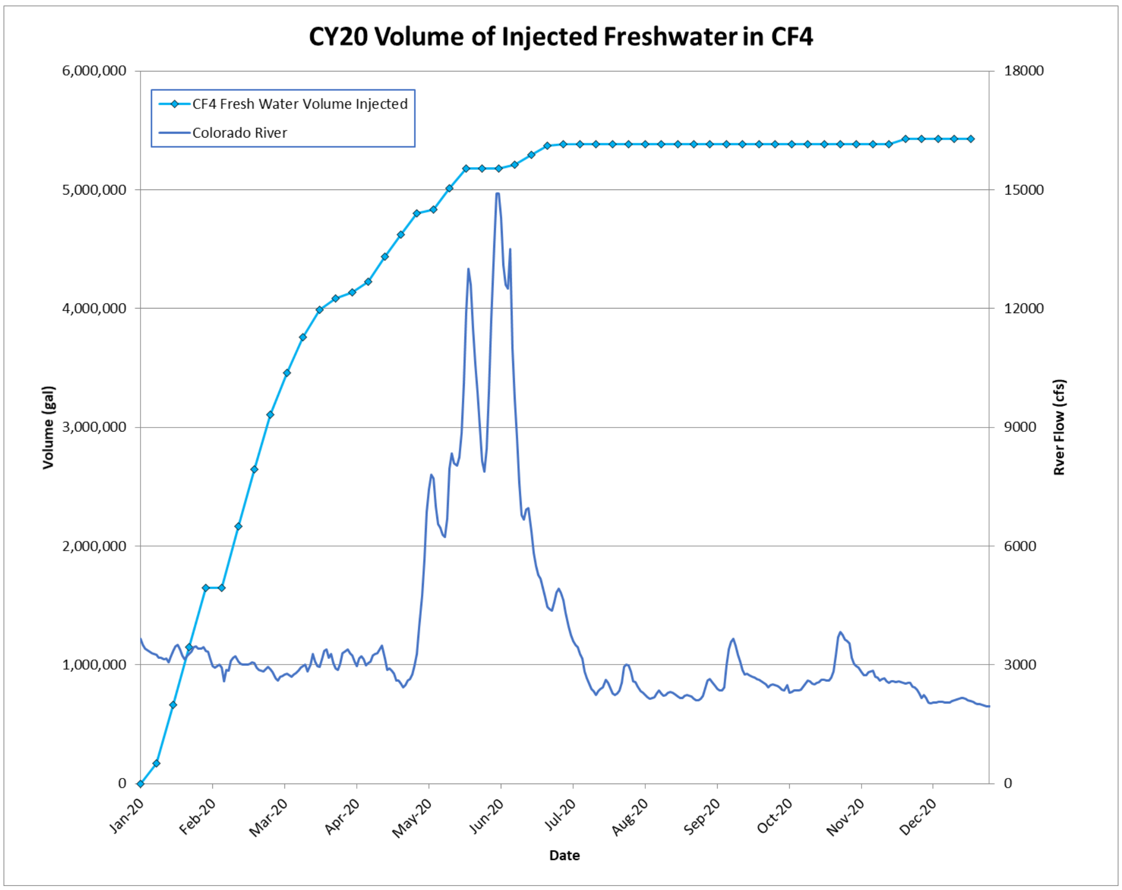

Figure 17. Cumulative Volume of Injected Freshwater during 2020

5.2 Observation Well Chemical Data Summary

Groundwater samples were collected from the CF4 observation wells during April and September 2020 to assess the effectiveness of the system (Table B-3). The April samples were collected while the system was operational but prior to a significant increase in river flow.

Table 2. CF4 Observation Well Ammonia Concentrations, April and September 2020

Location	Sample Depth (ft bgs)	Relative Location to Injection Wells	April 2020 Concentration (mg/L)	September 2020 Concentration (mg/L)
0780	28	Upgradient	34	310
0781	46	Upgradient	1,600	1,500
0782	33	Upgradient	370	440
0783	18	Upgradient	0.2#	4.1
0784	18	Downgradient	0.2#	0.2#
0785	18	Downgradient	0.2#	3
0786	28	Downgradient	94	500
0787	36	Downgradient	1,800	1,900

ft bgs = feet below ground surface, # = the result was below the detection limit

The CF4 wells are screened to deliver fresh water into the subsurface from 15 to 35 feet below ground surface (ft bgs). Samples collected from observation wells 0780, 0783, 0784, 0785, and 0786 are all screened within this shallow zone, and represent the ammonia concentrations directly impacted by the freshwater injection. Wells 0781, 0782, and 0787 represent the conditions near the bottom of the zone where the CF4 injection wells deliver freshwater into the subsurface when the system is active. Samples collected from these locations typically have the highest concentrations.

The April samples were collected after the injection system was consistently operational for four months, while the September samples were collected after the system was inactive nearly three months. The ammonia concentrations are provided in Table 2, and are graphically displayed in Figure 18 for the upgradient and Figure 19 for the downgradient observation wells, respectively. Included in these plots is the volume of freshwater injected on a weekly basis in 2020.

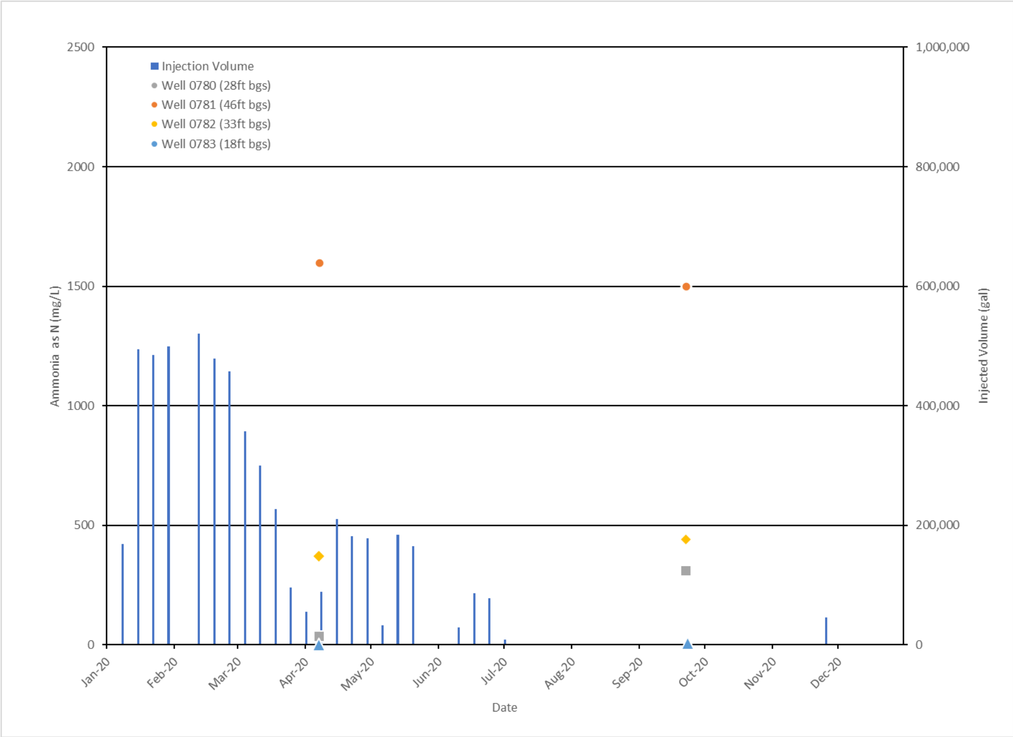

Figure 18. CF4 Upgradient Observation Wells 2020 Ammonia Concentrations

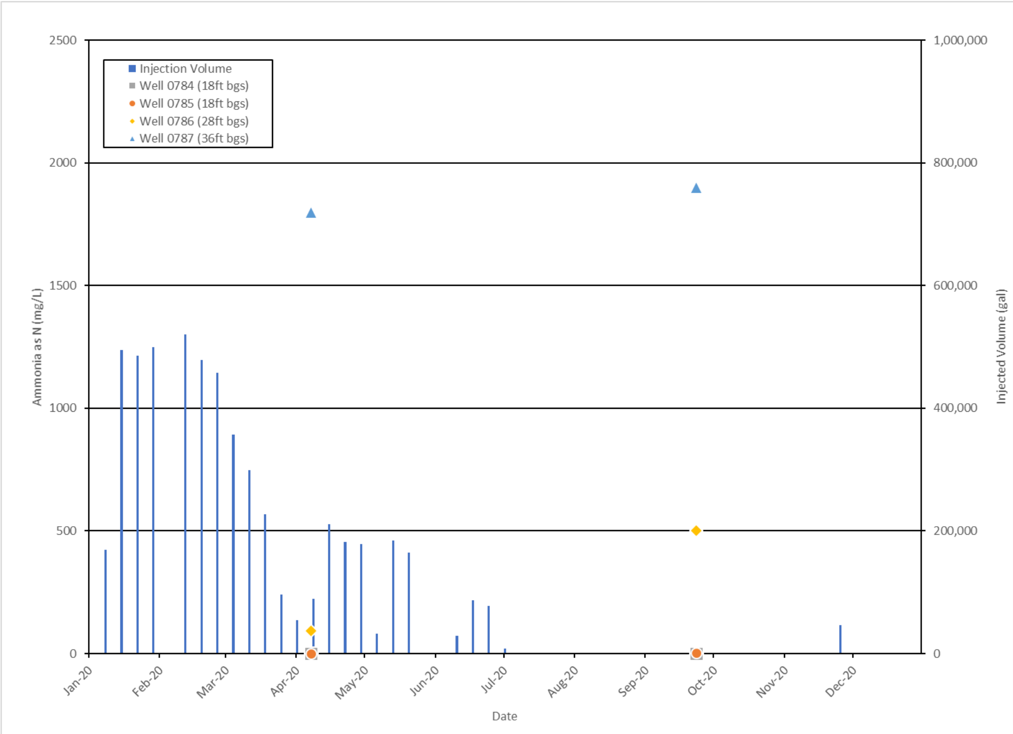

Figure 19. CF4 Downgradient Observation Wells 2020 Ammonia Concentrations

5.3 Freshwater Mounding

Water levels were collected on a regular basis during injection operations. To determine the amount of freshwater mounding in each well, the water level data were plotted against the water levels measured in background well 0405.

The water levels in each well were adjusted to match well 0405 during non-pumping, baseflow conditions. Tables 3 and 4 summarize the mounding data that are shown in Figures B-1 to B-10 (Appendix B) for the injection wells. Mounding data were collected when the injection system was operating and not undergoing maintenance. Figures B-11 through B-18 illustrate the mounding data in CF4 observation wells.

Figure 20 displays the CF4 groundwater elevations in monitoring and injection wells in April 2020 during injection operations. The highest freshwater mounding occurs within 30 ft of the injection system. The amount of mounding was dependent on the individual well's efficiency and the corresponding injection rate.

Table 3 presents the maximum mounding measured in each of the injection wells and the corresponding injection rate. The maximum mounding in the CF4 observation wells is presented in Table 4 and varied from 0.34 to 0.89 ft in the upgradient wells and from 0.35 to 1.32 ft in the downgradient wells.

6.0 Surface Water Monitoring

Surface water monitoring occurs during site-wide sampling events that occur twice a year, when samples are collected upgradient of the site, on site, and downgradient of the site. The riverine zone adjacent to CF4 is monitored from June to September to determine if and when it becomes a suitable habitat for young-of-year fish. By late June in 2020, the high waters had receded enough for the side channel to be considered a viable habitat and was monitored as such until October 1.

6.1 Site-wide Surface Water Monitoring

Site-wide surface water sampling was conducted adjacent to the well field in June and December 2020 (locations are shown on Figure 21). The results of this sampling event can be found in the *Moab UMTRA Project Groundwater and Surface Water Monitoring January through June 2020* (DOE-EM/GJTAC3024) and *Moab UMTRA Project Groundwater and Surface Water Monitoring July through December 2020* (DOE-EM/GJTAC3031). Results are presented in Table 5.

The ammonia concentrations measured during these events were mostly below the respective detection limits, and all were below the applicable EPA criteria (for a suitable habitat) for both acute and chronic concentrations.

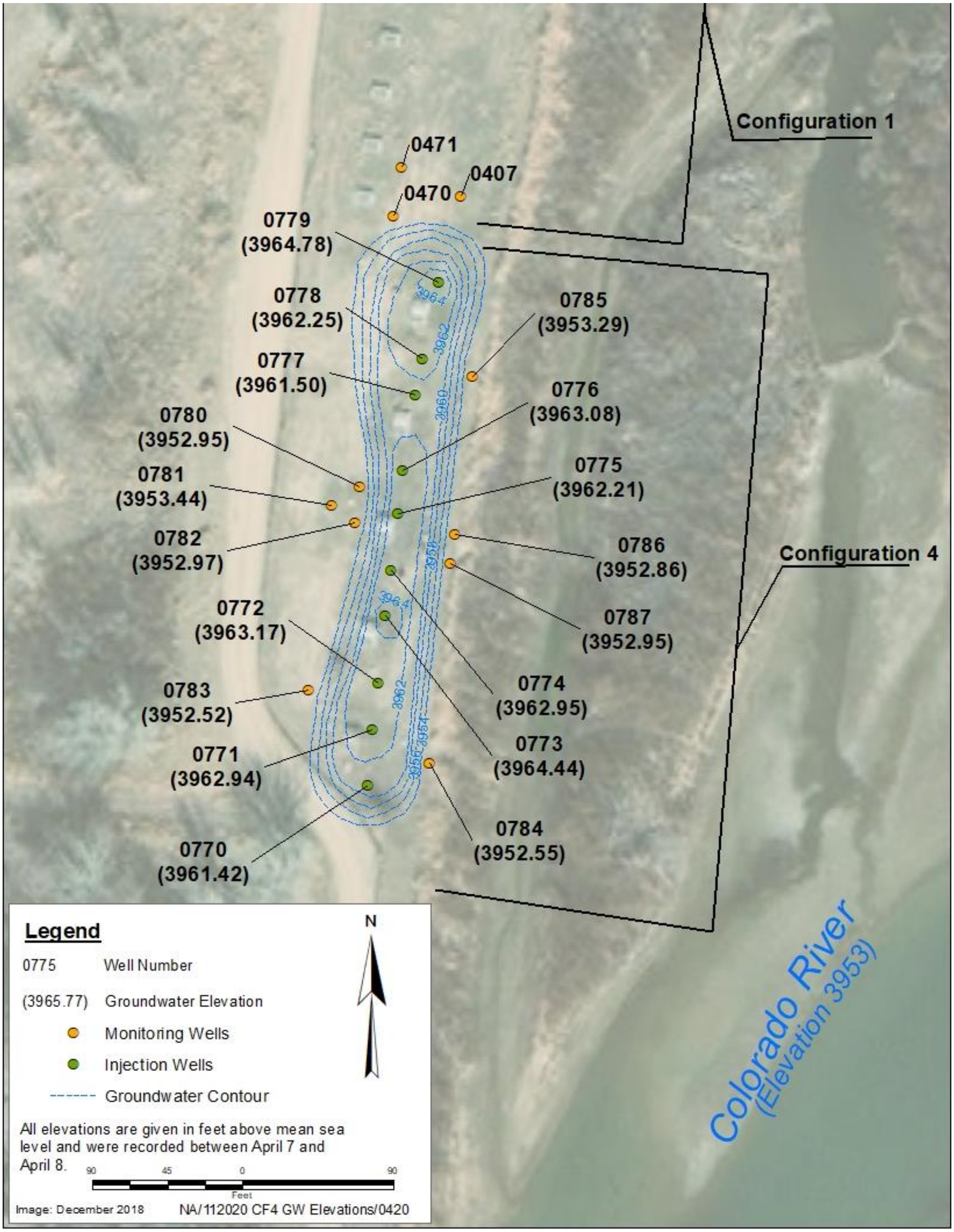

Figure 20. Freshwater Mounding at CF4 during Injection Operations April 2020

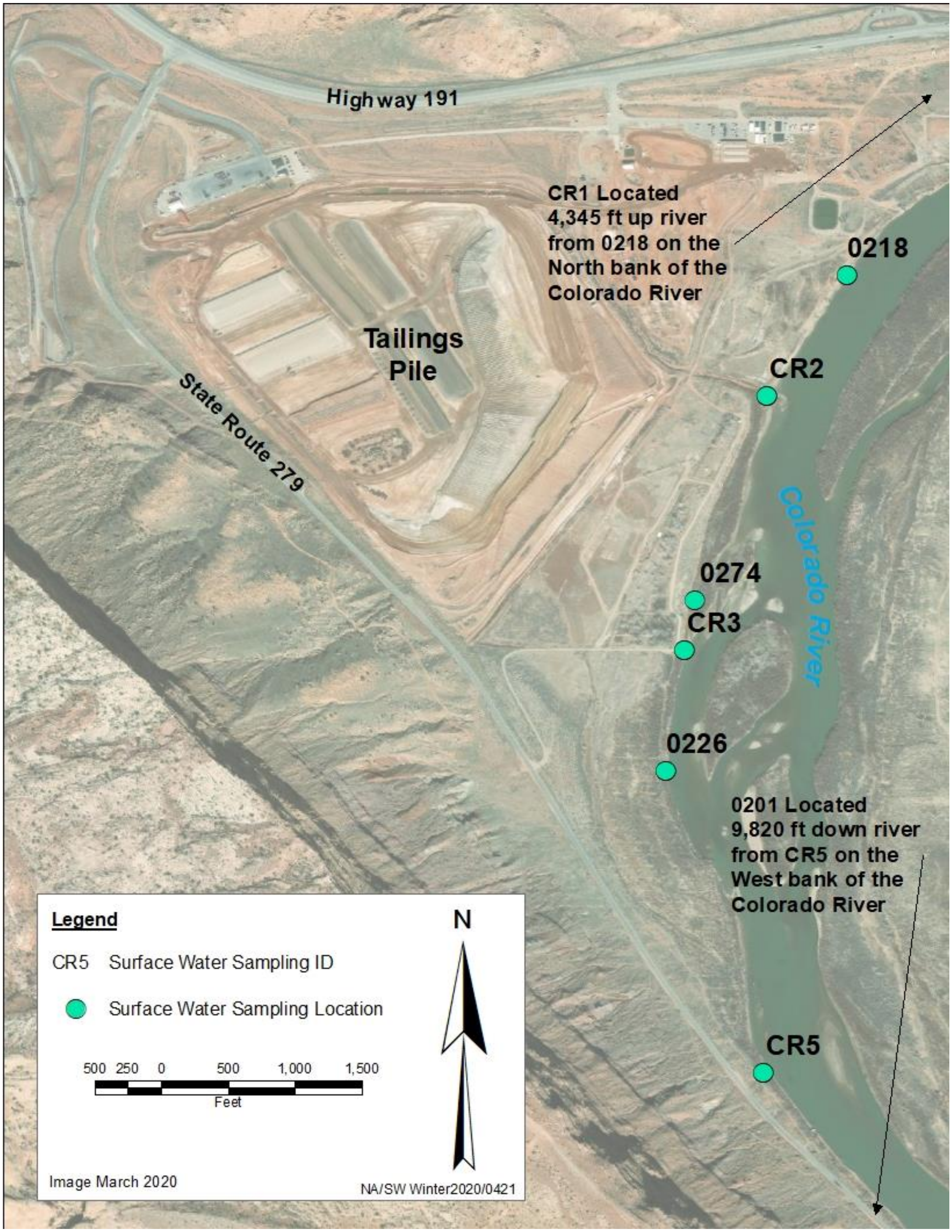

Figure 21. 2020 Site-wide Surface Water Sampling Locations

Table 3. Maximum Mounding Observed in CF4 Injection Wells, 2020

Well	Date	Type	Maximum Mounding (ft)	Injection Rate (gpm)
0770	3/9/20	Injection Well	13.73	5.94
0771	3/18/20	Injection Well	12.50	5.42
0772	3/2/20	Injection Well	13.70	3.59
0773	2/25/20	Injection Well	13.64	1.93
0774	2/25/20	Injection Well	13.68	3.40
0775	3/2/20	Injection Well	13.72	4.41
0776	3/2/20	Injection Well	13.64	4.45
0777	3/11/20	Injection Well	13.55	3.25
0778	2/25/20	Injection Well	13.48	5.74
0779	3/4/20	Injection Well	13.65	2.70

ND = No data collected

Table 4. Freshwater Mounding Observed in CF4 Observation Wells, 2020

Well	Date	Location	Maximum Mounding (ft)	Distance from Injection Source (ft)
0780	6/4/20	Upgradient	0.74	25
0781	1/6/20	Upgradient	0.34	30
0782	6/4/20	Upgradient	0.64	25
0783	6/4/20	Upgradient	0.89	30
0784	1/6/20	Downgradient	1.32	30
0785	6/4/20	Downgradient	0.35	25
0786	6/4/20	Downgradient	0.95	30
0787	6/4/20	Downgradient	0.63	30

Table 5. May and December 2020/January 2021 Site-wide 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	6/11/20	18.36	7.97	<0.2	8.8	0.88
	1/27/21	1.21	7.38	<0.2	24	3.5
0218	6/11/20	18.27	8.01	<0.2	8.8	0.88
	1/27/21	0.87	7.86	<0.2	11	2.1
0226	6/11/20	19.34	8.35	<0.2	4.1	0.52
	2/1/21	2.45	8.48	<0.2	3.3	0.8
CR1	6/11/20	17.46	7.72	<0.2	15	1.2
	1/27/21	1.76	6.37	1.6	51	4.9
CR2	6/11/20	18.58	7.98	<0.2	8.8	0.83
	1/27/21	0.9	7.83	<0.2	13	2.3
CR3	6/11/20	19.7	8.13	<0.2	7.3	0.67
	2/1/21	2.33	8.35	0.35	4.1	0.95
CR5	6/11/20	18.07	7.99	<0.2	8.8	0.88
	1/27/21	0.69	7.57	<0.2	18	2.9

*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)

6.2 Surface Water/Habitat Monitoring

Surface water monitoring adjacent to CF4 is typically conducted after the spring peak river flow begins to recede and a suitable habitat develops. The purpose is to monitor the water quality and protect young-of-year endangered fish species (e.g., Colorado pikeminnow, razorback sucker) from elevated ammonia concentrations. In 2020, the side channel adjacent to CF4 was identified as suitable habitat on June 22 and surface water diversion operation was initiated.

Samples were collected in the backwater twice before the river dropped enough to cut off water to the area. A second habitat area was present from July 8 through July 13 and sampled twice while fish were present. The surface water diversion was operational in this area for those six days. As the river continued to drop a third habitat became present on July 13 and persisted through September. This area was sampled eleven times. All three habitat areas and their sample locations can be seen on Figure 22. The third habitat are was large and difficult to keep diluted. In the end three manifolds were running constantly to keep fresh water flowing into the habitat.

The efficacy of the surface water diversion system and the compliant levels of ammonia in the habitat are calculated monthly averages based on *Table 6 of the EPA Aquatic Life Ambient Water Quality Criteria for Ammonia.* At each location, the chronic criteria's for a given month derived from the table are averaged and then multiplied by 2.5 to determine the four day limit. This four day limit represents the ammonia concentrations that shall not be exceeded at that location in that month. Table 6 is an example of the chronic criteria calculation for one select sampling location, SC09. Similar data for the remaining locations is provided in Appendix D.

The habitat sampling results were collected to confirm the surface water diversion system was effective in lowering the ammonia concentrations below the acute and chronic concentrations. The sample results are also an effective tool for staff to determine the best placement of surface water diversion manifolds.

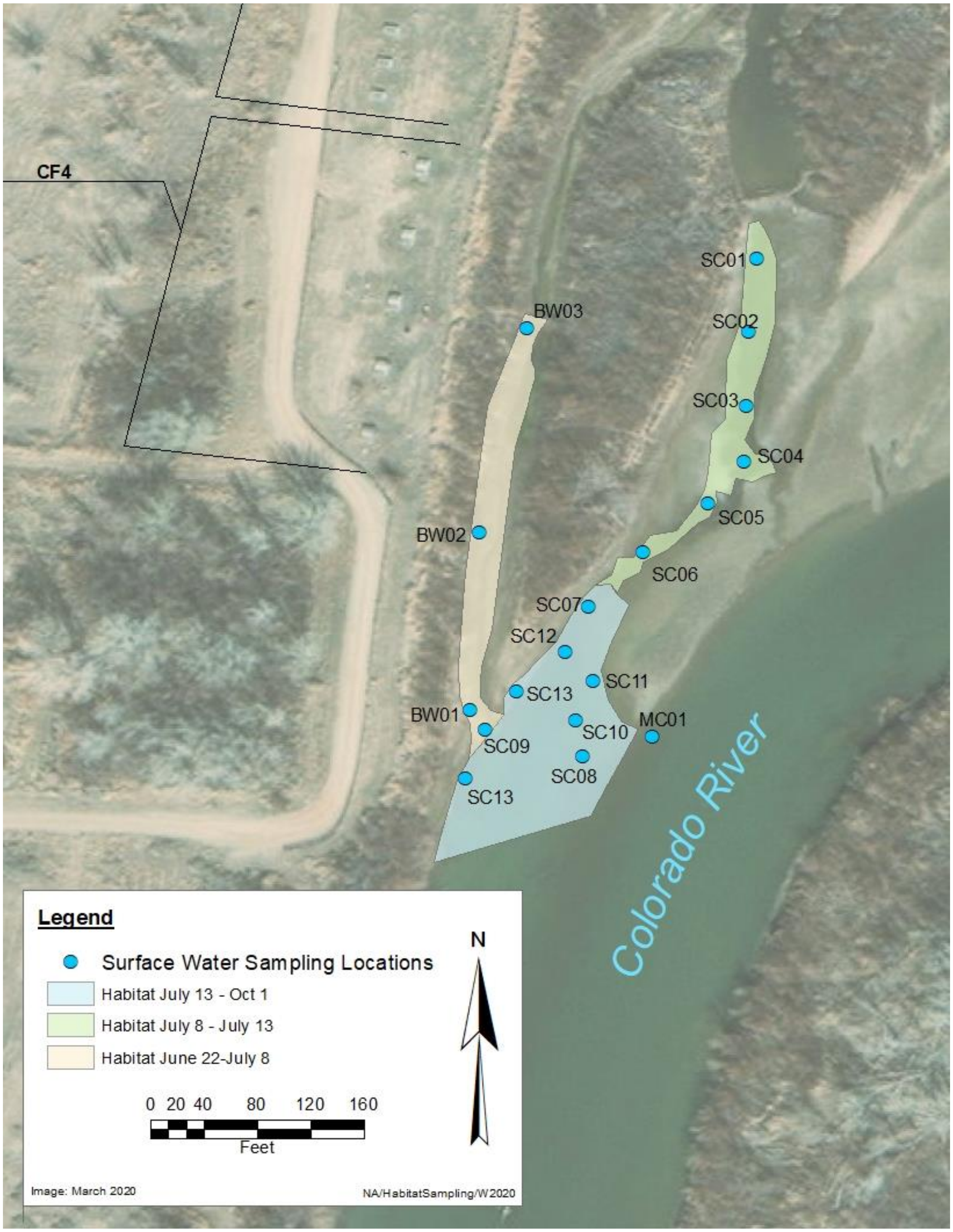

Figure 22. 2020 Habitat Area Sampling Locations

Table 6. September 2020 Habitat Area Location SC09 Surface Water Ammonia Concentrations and Comparisons to EPA Acute and Chronic Criteria

SC09	Temperature	pH	Ammonia	Acute Limit	Chronic Limit		
7/14/20	23.29	8.25	0.916	5.6	0.47		
7/15/2020	24.47	8.36	0.86	4.2	0.32		
7/30/2020	24.41	8.13	0.49	6.2	0.52		
8/4/2020	28.76	8.41	0.7	1.6	0.23		
8/11/2020	20.21	7.91	0.27	11	0.89		
8/20/2020	24.21	8.06	0.56	6.2	0.52	July Chronic Average	0.436667
8/25/2020	23.24	8.16	0.16	5.6	0.47	Four Day Limit	1.091667
9/3/2020	25.18	8.36	0.17	3.2	0.3	August Chronic Average	0.5275
9/9/2020	17.89	8.11	0.072	7.3	0.76	Four Day Limit	1.31875
9/17/2020	19.84	7.89	0.01	11	0.89	September Chronic Average	0.725
9/23/2020	19.3	7.92	0.11	11	0.95	Four Day Limit	1.8125

[1]EPA Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater State (Effective April 2013), Table N.4
[2]Temperature and pH-Dependent Values, Acute Concentration of Total Ammonia as Nitrogen (N) (mg/L)

NA = Sample data out of range for EPA table

6.3 Surface Water Monitoring Summary

This system was operational from June 22 to October 1, and pumped a total of 14.2 mil gal of fresh water through the suitable habitat. Ammonia sampling efforts showed that the surface water diversion system was effective in diluting the critical habitat to compliant levels, and no dead fish were observed.

7.0 Investigations

In addition to the operation of the groundwater extraction, fresh water injection, and surface water diversion systems, other activities were completed during 2020. These include the surface water/groundwater interaction investigation and the monitoring of Crescent Junction wells 0202 and 0205. These activities are discussed in Sections 7.1 and 7.2, respectively.

7.1 Surface Water/Groundwater Interaction

Throughout 2020 groundwater parameters (primarily specific conductance) were monitored in a series of well clusters located in the well field. These wells are sampled over various depths of the subsurface, as shown in Table 7.

Table 7. Surface Water/Groundwater Interaction Well Clusters

Well Cluster	Well Number	Sample Depth (ft bgs)
SMI-PW01	SMI-PZ1S	18
	SMI-PZ1M	57
Baseline Area	0405	18
	0488	39
	0493	54
CF1 Upgradient	0480	18
	0557	40
	0482	58
CF1 Midpoint	0483	18
	0558	36
	0485	58

Table 7. Surface Water/Groundwater Interaction Well Clusters (continued)

CF1 Downgradient	0559	19
	0560	31
	0561	50

Groundwater parameter data collected from these different zones provided information regarding the impact of the Colorado River flows on the groundwater system by comparing the specific conductivity at varying depths to river stage over time.

The time vs specific conductance plots for each of these well clusters are presented in Appendix C. The plots also display the Colorado River conductivity and elevation for 2020. As these plots display, the deepest well in each of the five clusters has the highest conductivity, and typically decreases as the river moves into losing conditions.

The same trend is displayed in the more shallow wells of the clusters, but less significantly as their conductivity levels were not as high to begin with. The decreases in monitoring well conductivity levels as the river elevations rise demonstrates how the losing conditions of the river impacts the groundwater system.

7.2 Crescent Junction Wells 0202 and 0205 Sampling and Recharge Monitoring

The placement of the cell cover has significantly altered the surface runoff/hydrology of the vicinity of well 0205. Before the installation of the cell cover, the majority of precipitation would evaporate with larger storm events producing surface runoff, with a very small portion slowly infiltrating over a much larger area. With the cover material in place, there is often less evaporation and more surface runoff that tends to accumulate in discrete areas of the site and provides a longer-term source of infiltration.

Water was first encountered in well 0205 in late June 2015 and has been present in the well since. Observations show that after a significant event or multiple precipitation events, the runoff collects into the retention ditch at the toe of the cell. As this water infiltrates into the subsurface, it likely intercepts a fracture system that is in part connected to the fracture observed inside well 0205 and eventually flows into the well. A sample was collected from well 0205 in February and December 2020, with the results presented in Table 8.

Between the March and late June 2019 quarterly monitoring events water was first encountered in well 0202, located to the west of the completed portion of the disposal cell (Figure 23). Samples of this water were also collected in February and December 2020 and was submitted to the analytical lab for the same analyte suite as that of samples collected from well 0205. The results of the analysis of the water sample collected from well 0202 is also presented in Table 8.

Short-term recovery tests were completed in February and December 2020 on well 0205, and the recharge rates measured were 0.035 and 0.029 gpm, respectively. These recharge rates are within the historical range, and are indicative of drought conditions. Due to an extremely low recharge rate, it was not possible to complete any tests on well 0202.

The manner in which the well 0205 water elevation responds to the site precipitation is graphically displayed on Figure 24, and the fluctuation of the recharge rate in response to precipitation is shown on Figure 25. Both the chemical and recharge results indicate precipitation surface runoff is the source of this water, and it is not associated with the tailings placed in the disposal cell.

Table 8. 2020 Crescent Junction Wells 0202 and 0205 Analyte Concentrations

Analyte	Analyte Concentration			
	Well 0202		Well 0205	
	2/26/20	12/8/20	2/26/20	12/8/20
Ammonia as N	15	11	12	15
Arsenic	0.039#	0.039#	0.039#	0.039#
Bicarbonate as $CaCO_3$	1,100	1,100	960	890
Boron	1,400	1,500	1200	1300
Bromide	40#	20#	40#	20#
Cadmium	0.0033#	0.0033#	0.0033#	0.0033#
Calcium	390	440	290	350
Carbonate as $CaCO_3$	20#	20#	20#	20#
Chloride	6,000	6,900	3,000	4,400
Chromium	0.0051#	0.0051#	0.0051#	0.0051#
Copper	0.0097#	0.0097#	0.0097#	0.0097#
Fluoride	20#	10#	20#	10#
Iron	0.049#	0.049#	0.049#	0.049#
Lead	0.013#	0.013#	0.013#	0.013#
Magnesium	690	810	710	1000
Manganese	0.510	0.550	0.330	0.310
Molybdenum	11#	11#	11#	11#
Nitrate/ Nitrite as N	520	500	700	530
Potassium	73	90	50	70
Selenium	0.051	0.027#	2.9	2.5
Sodium	9,400	10,000	8,400	9700
Sulfate	19,000	19,000	20,000	23,000
Total Alkalinity as $CaCO_3$	1,100	1,100	960	890
Total Dissolved Solids	26,000	22,000	21,000	19,000
Uranium $_{234}$	42.9 +/- 7.30 pCi/L	41.8 +/- 7.30 pCi/L	27.9 +/- 4.9 pCi/L	63 +/- 11.0 pCi/L
Uranium $_{235}$	1.17 +/- 0.46 pCi/L	0.95 +/- 0.39 pCi/L	0.59 +/- 0.33 pCi/L	1.16 +/- 0.45 pCi/L
Uranium $_{238}$	10.9 +/- 2.1 pCi/L	9 +/- 1.8 pCi/L	9.5 +/- 1.9 pCi/L	14.3 +/- 2.7 pCi/L
Uranium	0.028	0.029	0.027	0.043

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

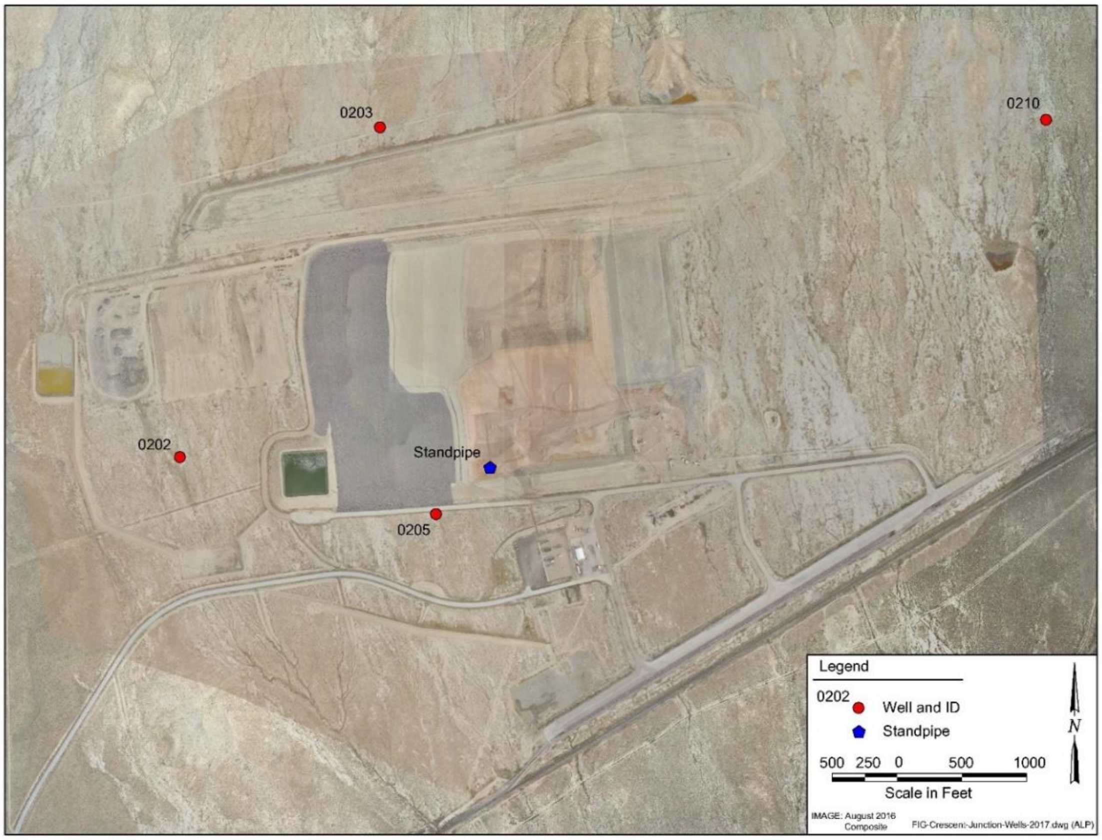

Figure 23. Crescent Junction Well Location Map

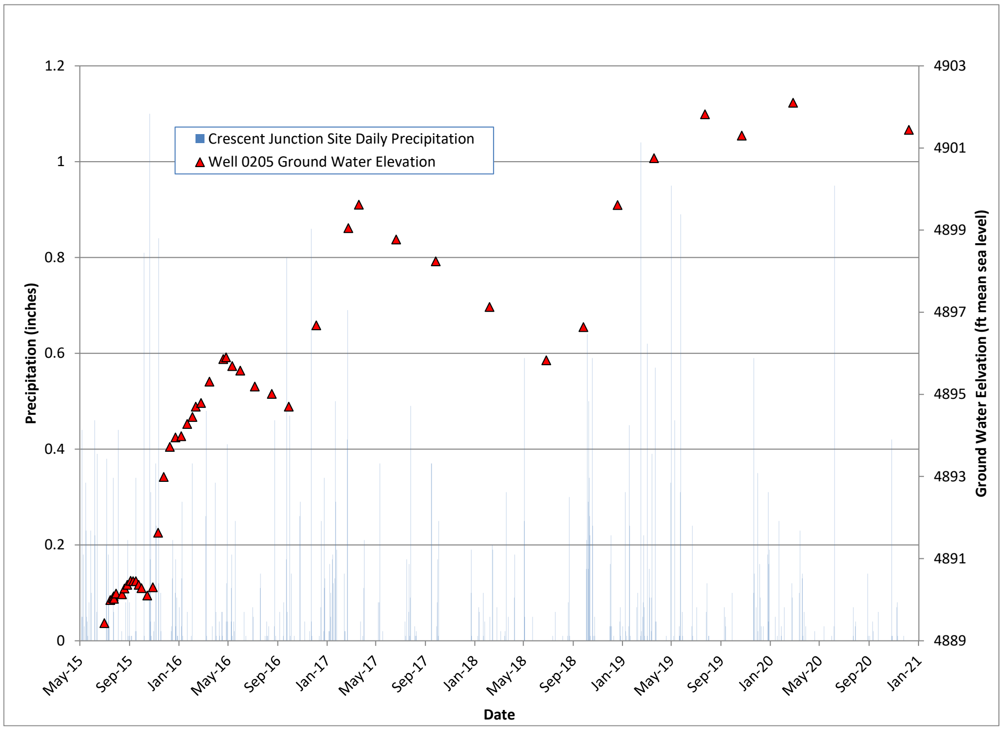

Figure 24. Crescent Junction Well 0205 Water Level Changes in Response to Precipitation through 2020

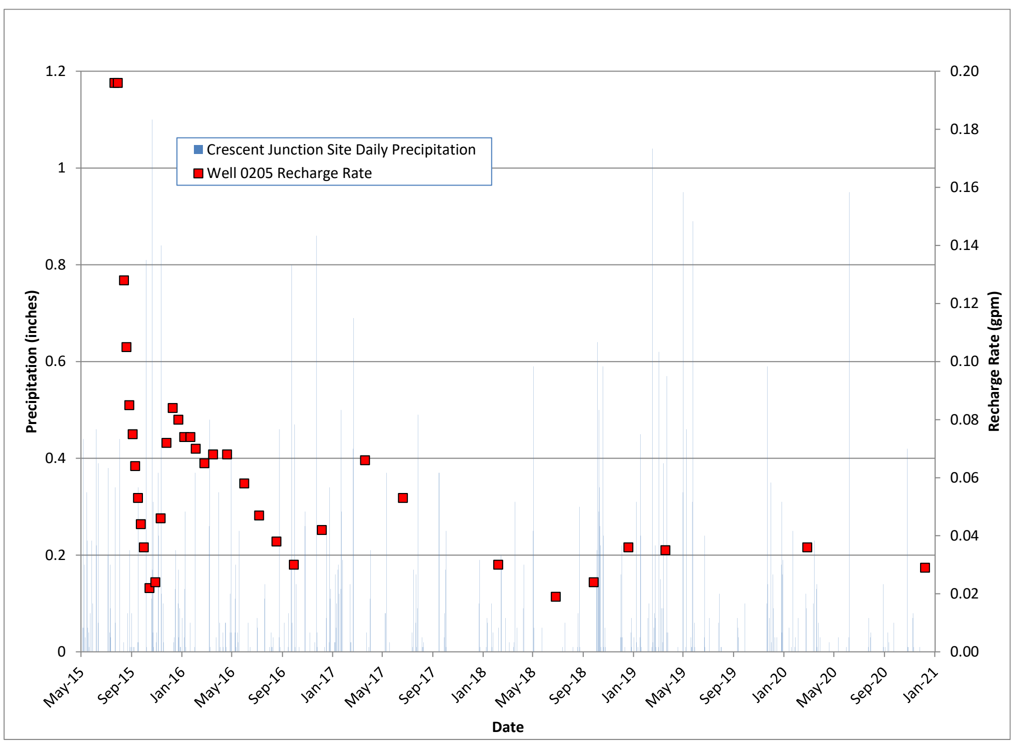

Figure 25. Crescent Junction Well 0205 Recharge Rate Changes in Response to Precipitation through 2020

8.0 Summary and Conclusions

The level of sampling and reporting completed in 2020 complies with regulation requirements and industry standards, and provides the correct level of monitoring and reporting. In 2020, the IA operations focused on groundwater extraction (from CF5) and freshwater injection (CF4); the surface water diversion system was operational from June 22 to October 3 in an area located to the east of the CF4 side channel.

A total of 9.7 mil gal of water were extracted from CF5 in 2020. The extraction rate peaked in July and August, and operations continued through the fall. Each of the eight extraction wells were utilized in 2020. Figure 26 shows the ammonia and uranium mass removed and the volume of groundwater extracted from the CF5 extraction wells from 2003 through 2020.

A larger volume of extracted groundwater and more contaminant mass were removed in 2020 compared to the previous year. A total 9.7 mil gal of groundwater, which included 19,520 lbs of ammonia and 195.9 lbs of uranium, was removed from the groundwater system in 2020.

Approximately 5.4 mil gal of fresh water were injected into CF4 in 2020. Laboratory data from the CF4 observation wells during injection operations indicate the system is effective at diluting ammonia concentrations, especially from the groundwater surface down to a depth of 28 ft bgs. However, the injection system was used to divert freshwater into the critical habitat rather than inject into the wells for part of the year. Ammonia concentrations generally increased while injection system operations were suspended, further indicating the effectiveness of the injection. Site-wide surface water samples indicated the contaminants do not extend past the site boundary.

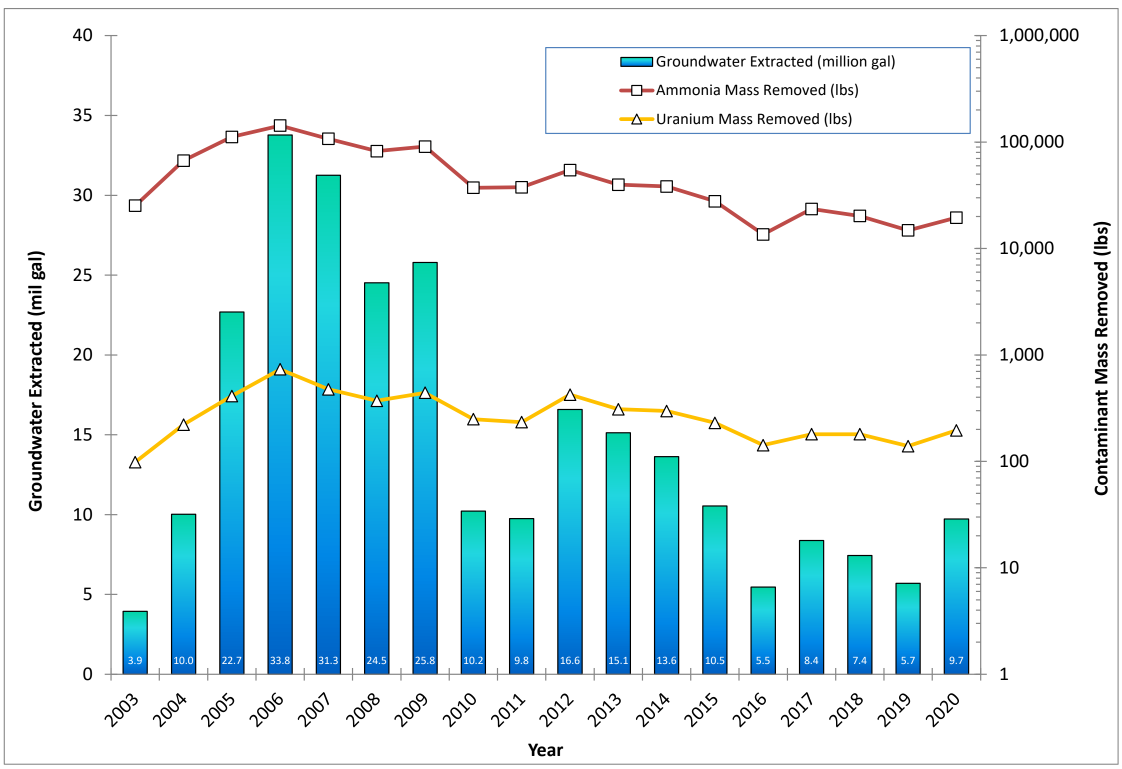

Figure 26. Groundwater Extracted Volume and Contaminant Mass Removal, 2003 through 2020

9.0 References

40 CFR 192A (U.S. Code of Federal Regulations), "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 Flood and Drought Mitigation Plan* (DOE-EM/GJTAC1640).

DOE (U.S. Department of Energy), *Moab UMTRA Project Groundwater and Surface Water Monitoring January through June 2020* (DOE-EM/GJTAC3043).

DOE (U.S. Department of Energy), *Moab UMTRA Project Groundwater and Surface Water Monitoring July through December 2020* (DOE-EM/GJTAC3055).

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

DOE (U.S. Department of Energy), *Record of Decision for the Remediation of the Moab Uranium Mill Tailings, Grand and San Juan Counties, Utah* (6450-01-P).

Appendix A.

Tables and Data for 2020 Groundwater Extraction

Appendix A. Tables and Data for 2020 Groundwater Extraction

Table A-1. Well Construction for CF5 Extraction Wells

Well	Well Type	Diameter (in.)	Ground Surface Elevation (ft above msl)	Screen Interval (ft bgs)	Total Depth (ft bgs)
0810	Extraction	8	3,966.56	10.4 – 40.4	40.4
0811	Extraction	8	3,966.59	8.8 – 38.6	38.6
0812	Extraction	8	3,966.62	14.2 – 44.2	44.2
0813	Extraction	8	3,966.67	14.4 – 44.4	44.4
0814	Extraction	8	3,967.02	12.4 – 42.4	42.4
0815	Extraction	8	3,967.13	21.7 – 51.7	51.7
0816	Extraction	8	3,967.38	20.9 – 50.9	50.9
SMI-PW02	Extraction	4	3,965.60	20.0 – 60.0	60.3

In. = inch

Table A-2. 2020 Chronology of CF5 Activities

Date	Activity
January	System winterized.
February	System winterized.
March	Restarted extraction system on March 17.
April	Extraction system operation in automatic mode.
May	Bodec reinstalled level sensors and equipment to new Klein tank from 5/11 to 5/12. Additional troubleshooting occurred on 5/19. Transfer pump was run manually. Repair made to PW02 valve and cap on 5/11.
June	Extraction system operation in automatic mode.
July	Extraction system operation in automatic mode.
August	Extraction system operation in automatic mode.
September	Extraction system operation in automatic mode.
October	Extraction system operation in automatic mode.
November	System shut down on 11/13. Winterization of the extraction system (well vaults, pump house, and storage tanks) occurred on Nov 16 and 17.
December	System winterized.

Appendix A. Tables and Data for 2020 Groundwater Extraction (*continued*)

Table A-3. CF5 Extraction Volumes 2020

Well	Extraction Volumes Removed (gal)												
	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Well Total
0810	0	0	15,401	139,402	151,136	100,762	221,320	112,902	141,684	126,288	35,942	0	**1,044,837**
0811	0	0	7,105	87,994	62,048	57,975	78,235	105,545	64,441	52,710	19,311	0	**535,364**
0812	0	0	15,773	133,492	114,013	57,933	120,839	98,242	82,604	65,839	28,574	0	**717,309**
0813	0	0	67,103	419,088	198,379	277,213	354,087	289,179	231,430	200,130	96,133	0	**2,132,742**
0814	0	0	18,461	174,623	129,419	154,042	144,189	199,566	129,958	86,610	43,620	0	**1,080,488**
0815	0	0	38,928	183,462	132,414	129,177	152,173	188,720	130,998	66,943	1,168	0	**1,023,983**
0816	0	0	62,149	320,997	170,803	222,162	386,033	362,858	236,238	143,264	90,967	0	**1,995,471**
SMI-PW02	0	0	38,127	212,545	113,150	124,811	225,064	217,247	137,798	86,883	41,601	0	**1,197,226**
Monthly Total	**0**	**0**	**263,047**	**1,671,603**	**1,071,362**	**1,124,075**	**1,681,940**	**1,574,259**	**1,155,151**	**828,667**	**357,316**	**0**	
Annual Total													**9,727,420**

Table A-4. CF5 Ammonia Mass Removal 2020

Well	Ammonia Mass Removed (lbs)												
	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Well Total
0810	0	0	36	336	390	260	571	291	366	347	99	0	**2,696**
0811	0	0	20	252	191	179	241	325	199	154	56	0	**1,617**
0812	0	0	46	405	399	203	423	344	289	208	90	0	**2,406**
0813	0	0	134	823	363	508	649	530	424	400	192	0	**4,023**
0814	0	0	25	233	172	205	192	266	173	101	51	0	**1,418**
0815	0	0	49	229	165	161	190	236	164	84	1	0	**1,279**
0816	0	0	72	362	171	222	386	363	236	155	98	0	**2,065**
SMI-PW02	0	0	121	685	386	426	768	742	470	282	135	0	**4,016**
Monthly Total	**0**	**0**	**502**	**3,325**	**2,238**	**2,164**	**3,420**	**3,096**	**2,320**	**1,731**	**723**	**0**	
Annual Total													**19,520**

Table A-5. CF5 Uranium Mass Removal 2020

Well	Uranium Mass Removed (lbs)												
	Jan-19	**Feb-19**	**Mar-19**	**Apr-19**	**May-19**	**Jun-19**	**Jul-19**	**Aug-19**	**Sep-19**	**Oct-19**	**Nov-19**	**Dec-19**	**Well Total**
0810	0.0	0.0	0.3	3.2	3.6	2.4	5.3	2.7	3.4	2.8	0.8	0.0	**24.8**
0811	0.0	0.0	0.1	1.9	1.4	1.3	1.8	2.4	1.4	1.1	0.4	0.0	**11.8**
0812	0.0	0.0	0.2	2.0	1.9	1.0	2.0	1.6	1.4	1.1	0.5	0.0	**11.7**
0813	0.0	0.0	0.7	4.4	2.5	3.5	4.4	3.6	2.9	2.7	1.3	0.0	**25.9**
0814	0.0	0.0	0.4	3.8	3.0	3.6	3.4	4.7	3.0	1.9	1.0	0.0	**24.8**
0815	0.0	0.0	0.9	4.5	3.3	3.2	3.8	4.7	3.3	1.6	0.0	0.0	**25.4**
0816	0.0	0.0	1.1	6.1	3.7	4.8	8.4	7.9	5.1	3.0	1.9	0.0	**42.0**
SMI-PW02	0.0	0.0	0.9	5.2	2.8	3.1	5.6	5.4	3.4	2.0	1.0	0.0	**29.5**
Monthly Total	**0.0**	**0.0**	**4.8**	**31.1**	**22.3**	**22.9**	**34.7**	**33.0**	**24.0**	**16.3**	**6.8**	**0.0**	
Annual Total													**195.9**

Appendix B.

Tables and Data for 2020 Freshwater Injection

Appendix B. Tables and Data for 2020 Freshwater Injection

Table B-1. CF4 Well Construction Details

Well	Well Type / Relative Depth	Diameter (in)	Screen Interval (ft bgs)	Total Depth (ft bgs)
0770	Remediation/Deep	6	14.9 – 34.8	35.2
0771	Remediation/Deep	6	15.0 – 34.9	35.3
0772	Remediation/Deep	6	15.2 – 35.1	35.5
0773	Remediation/Deep	6	15.2 – 35.1	35.5
0774	Remediation/Deep	6	15.5 – 35.4	35.8
0775	Remediation/Deep	6	15.1 – 35.0	35.4
0776	Remediation/Deep	6	15.2 – 35.1	35.5
0777	Remediation/Deep	6	15.3 – 35.2	35.6
0778	Remediation/Deep	6	15.1 – 35.0	35.4
0779	Remediation/Deep	6	15.7 – 35.6	36.0
0780	Observation/Shallow	6	20.3 – 30.1	30.5
0781	Observation/Deep	6	44.8 – 54.5	55.0
0782	Observation/Deep	6	31.0 – 40.8	41.2
0783	Observation/Shallow	2	8.6 – 18.6	19.1
0784	Observation/Shallow	2	9.4 – 19.4	19.9
0785	Observation/Shallow	2	9.6 – 19.6	19.9
0786	Observation/Shallow	6	20.5 – 30.3	30.7
0787	Observation/Deep	6	35.4 – 45.2	45.7

Appendix B. Tables and Data for 2020 Freshwater Injection (*continued*)

Table B-2. 2020 Chronology of CF4 Activities

Month	Activity
January	Injection system restarted on 1/8 and operated all month.
February	System operational with few minor repairs.
March	Injection suspended 3/26-3/31 for freshwater pond clean out. Sand filter was inspected and additional sand was added prior to restart.
April	System operational. Injection suspended in wells 0773 and 0779 due to high mounding and low flow. System shut down on 4/30 due to high river flows (3,940 cfs)
May	System operational from 5/7 through 5/19.
June	System shut down due to high river flows/flooding. Started using injection system for freshwater diversion on 6/22. Filtration system clogged on 6/29.
July	Media removed from filtration system on 7/7 and system used for freshwater diversion from 7/8 to 7/16 and restarted on 7/28. No injection into wells.
August	System used for freshwater diversion. No injection into wells.
September	System used for freshwater diversion through 9/15. Filtration system required maintenance and Nelson valve replacement. No injection into wells.
October	New Nelson valve replaced in filtration system on 10/22.
November	New flow meter install on 11/4. Injection restarted on 11/18. Site power outage damages injection pump on 11/19.
December	Injection system not operational.

Table B-3. CF4 Observation Well Analytical Sample Results 2020

Location	Location from Injection	Sample Depth (ft bgs)	Date	Ammonia as N (mg/L)	Uranium (mg/L)	Specific Conductance (µmhos/cm)
0780	Upgradient	28	4/7/20	34	0.3	3,679
			9/22/20	310	2.4	18,841
0781	Upgradient	46	4/7/20	1600	2.2	77,821
			9/22/20	1500	1.9	84,311
0782	Upgradient	33	4/7/20	370	2.5	17,997
			9/22/20	440	2.7	22,777
0783	Upgradient	18	4/7/20	0.2	0.05	1,198
			9/23/20	4.1	0.25	3,132
0784	Downgradient	18	4/7/20	0.2	0.0088	1,191
			9/23/20	0.2	0.013	1,655
0785	Downgradient	18	4/7/20	0.2	0.012	1,218
			9/23/20	3	0.47	9,233
0786	Downgradient	28	4/7/20	94	0.53	6,412
			9/23/20	500	2.7	25,369
0787	Downgradient	36	4/7/20	1800	2.4	76,321
			9/23/20	1900	2.2	77,384

Note: µmhos/cm = micromhos per centimeter

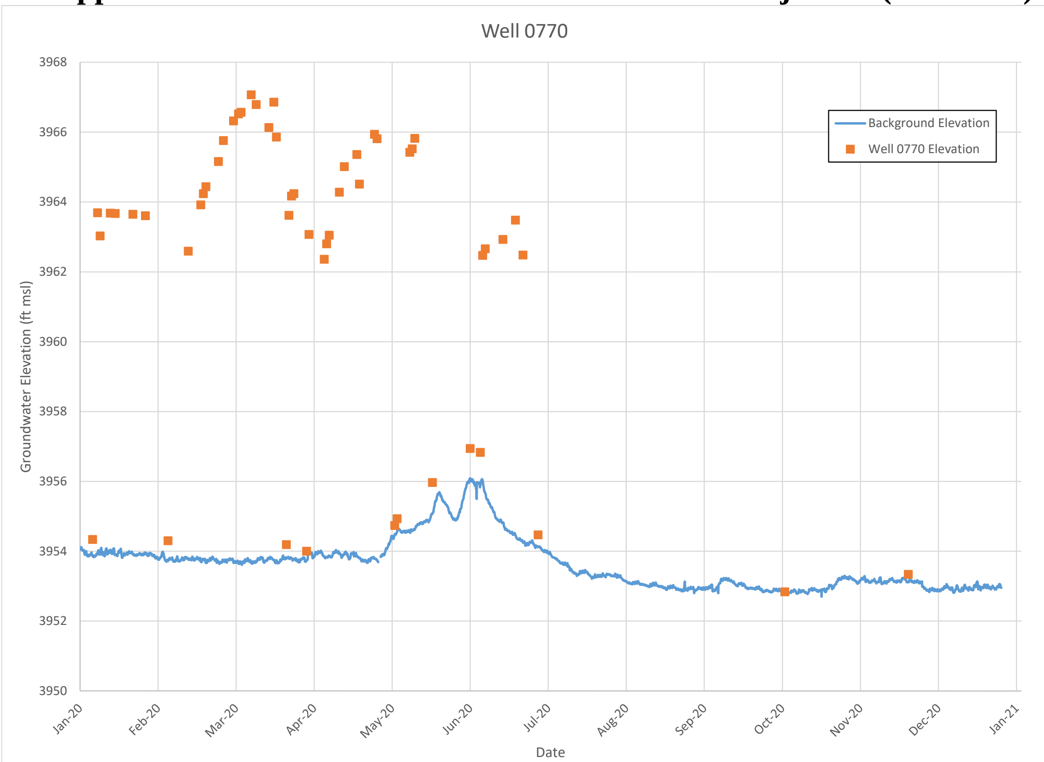

Figure B-1. Freshwater Mounding in Remediation Well 0770 during Injection

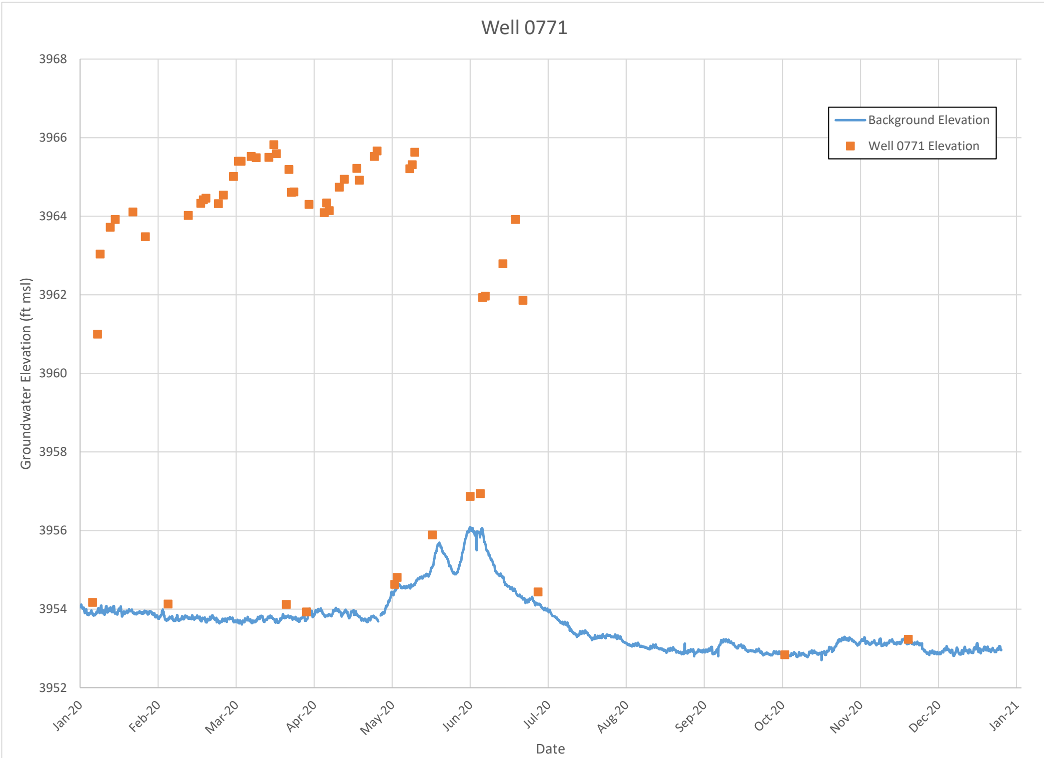

Figure B-2. Freshwater Mounding in Remediation Well 0771 during Injection

Appendix B. Tables and Data for 2020 Freshwater Injection (*continued*)

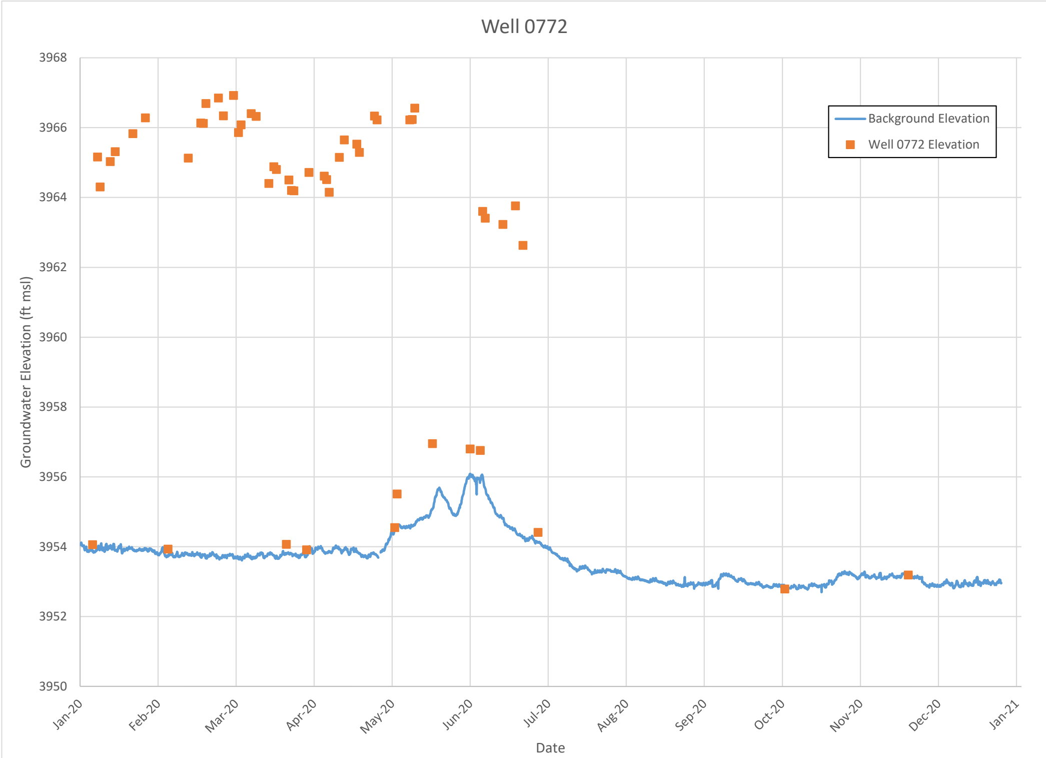

Figure B-3. Freshwater Mounding in Remediation Well 0772 during Injection

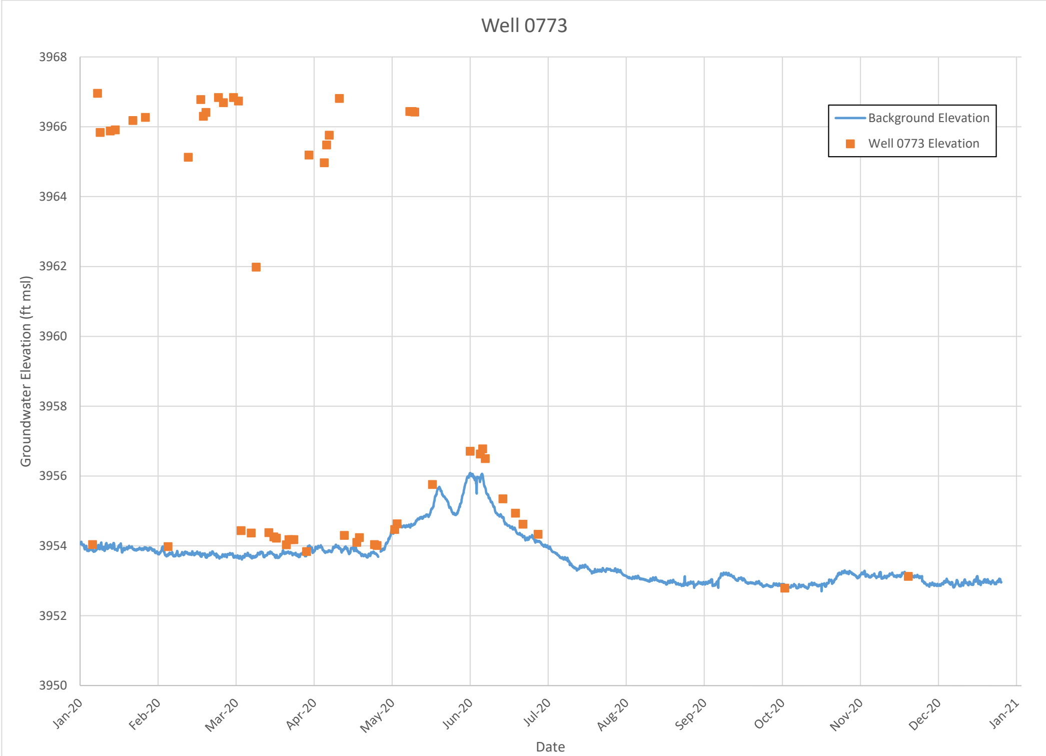

Figure B-4. Freshwater Mounding in Remediation Well 0773 during Injection

Appendix B. Tables and Data for 2020 Freshwater Injection (*continued*)

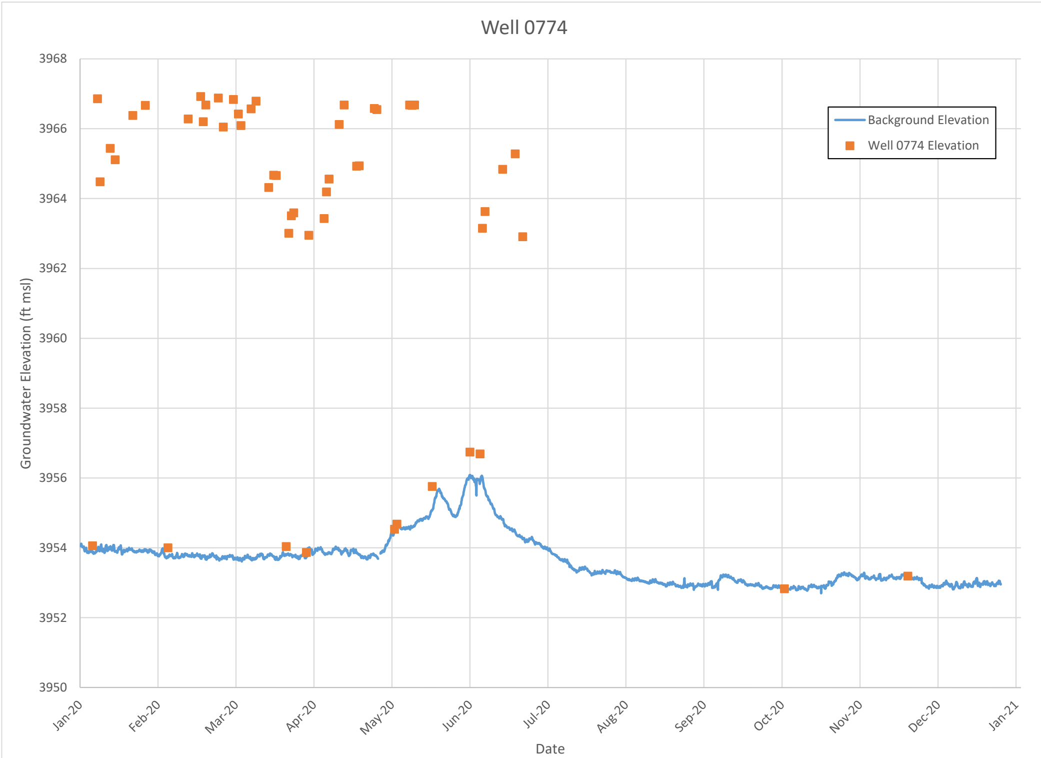

Figure B-5. Freshwater Mounding in Remediation Well 0774 during Injection

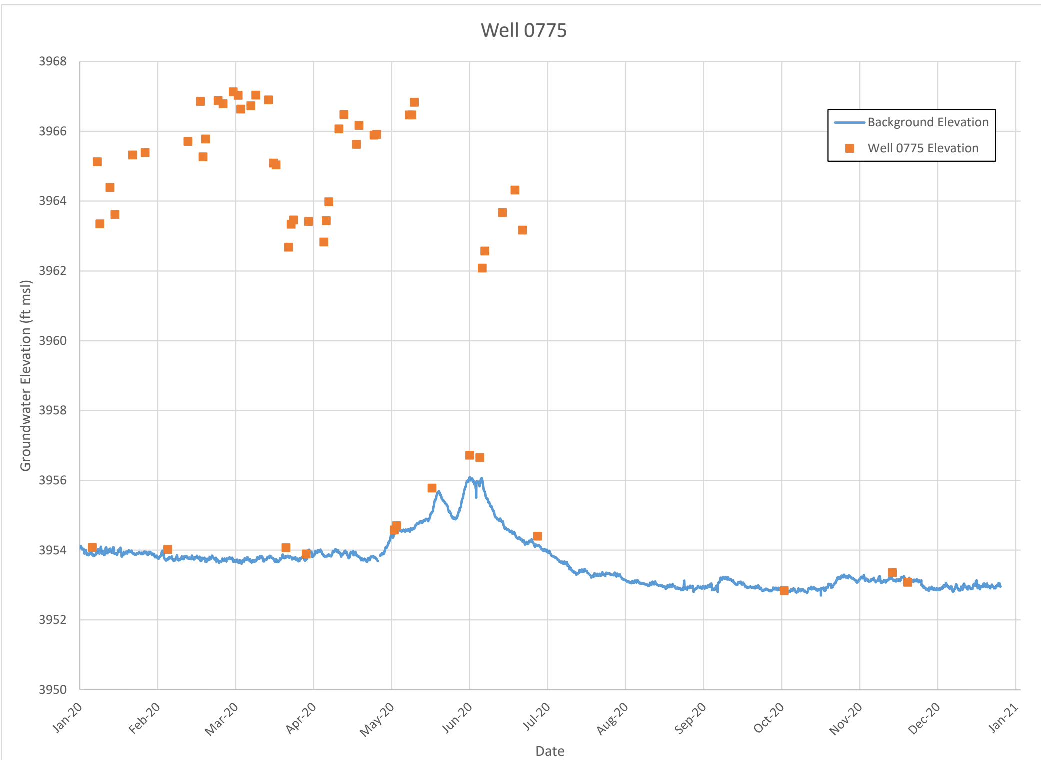

Figure B-6. Freshwater Mounding in Remediation Well 0775 during Injection

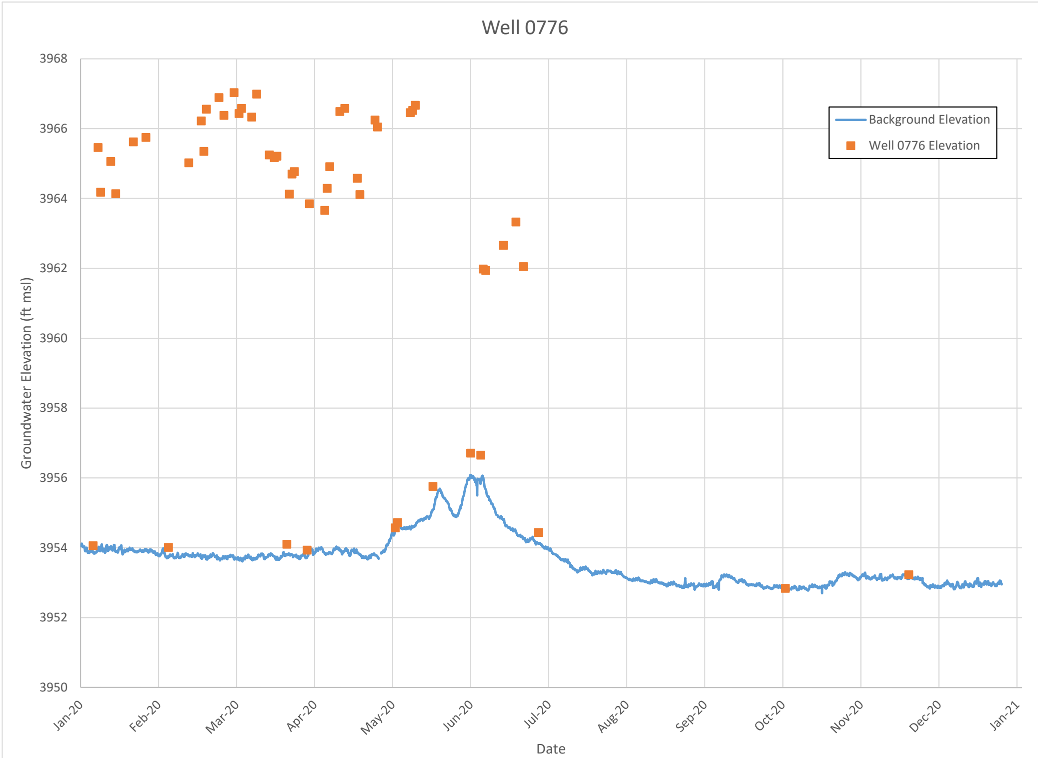

Figure B-7. Freshwater Mounding in Remediation Well 0776 during Injection

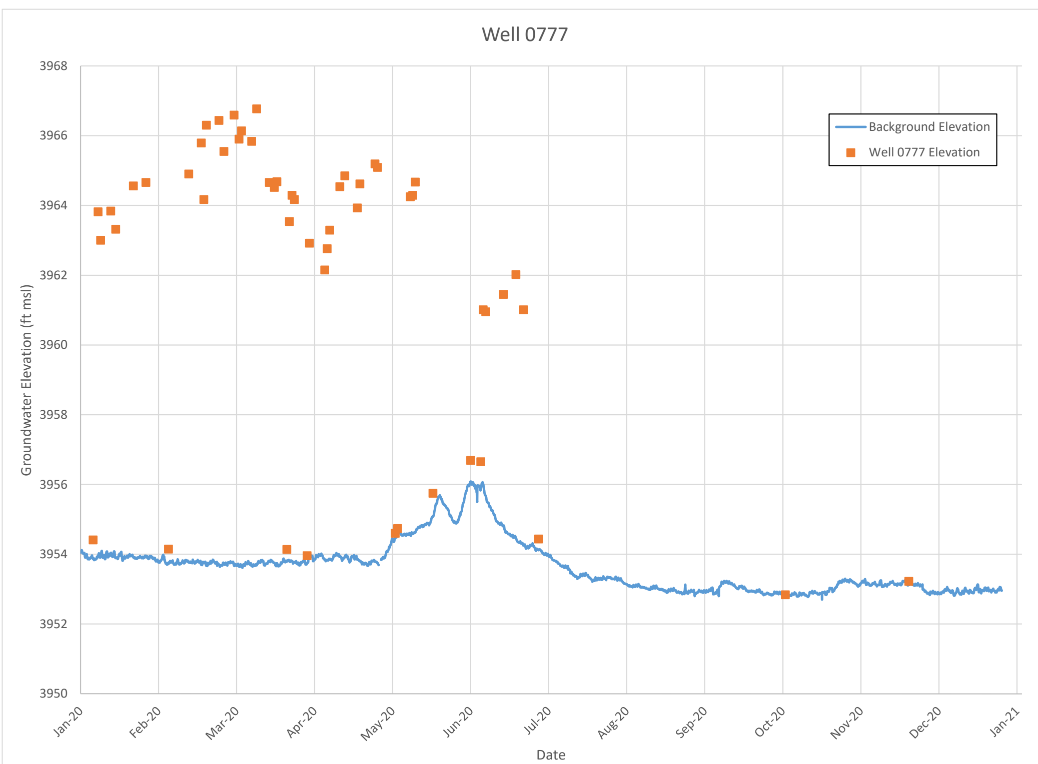

Figure B-8. Freshwater Mounding in Remediation Well 0777 during Injection

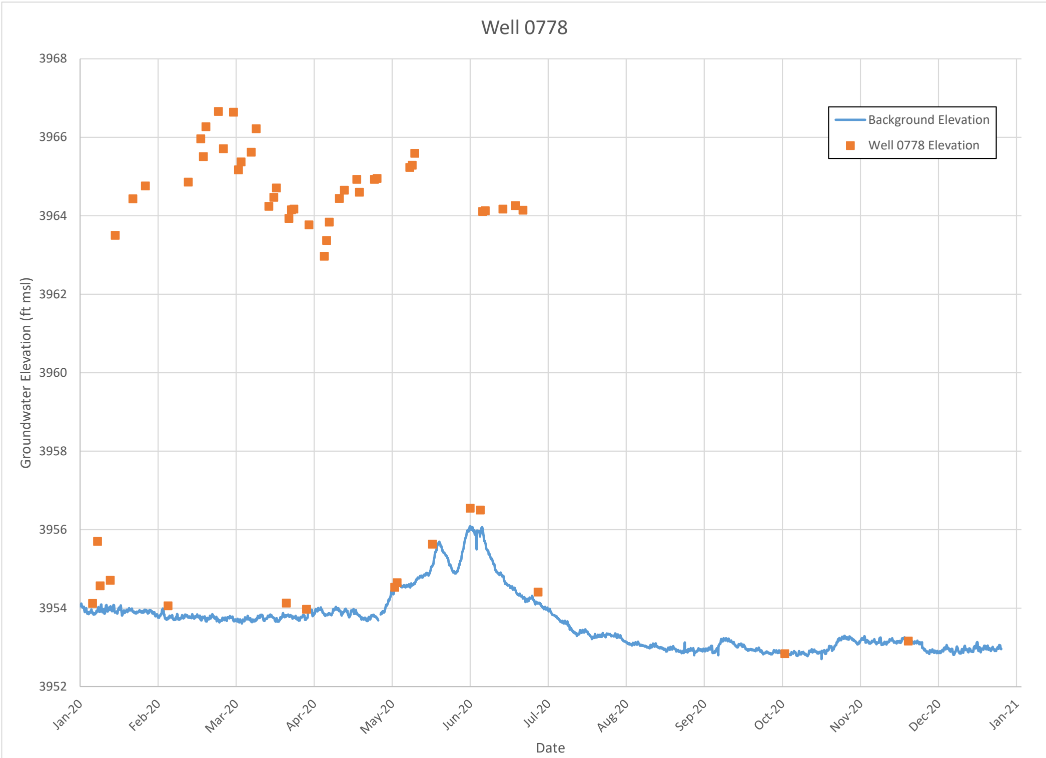

Figure B-9. Freshwater Mounding in Remediation Well 0778 during Injection

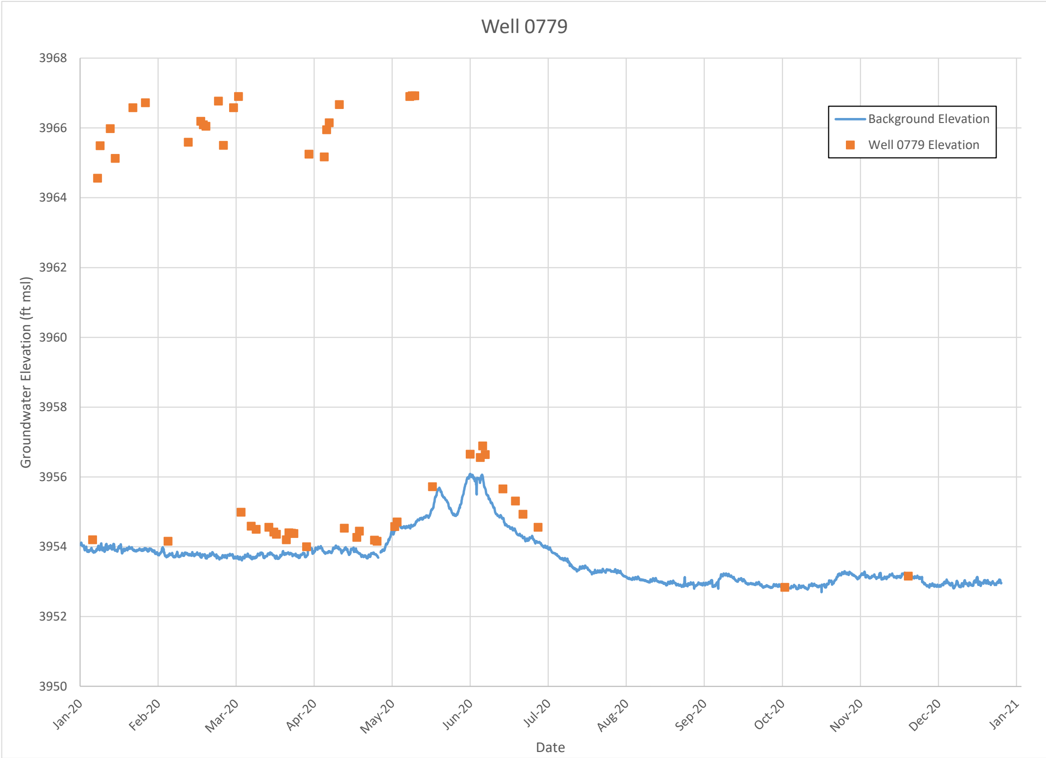

Figure B-10. Freshwater Mounding in Remediation Well 0779 during Injection

Appendix B. Tables and Data for 2020 Freshwater Injection (*continued*)

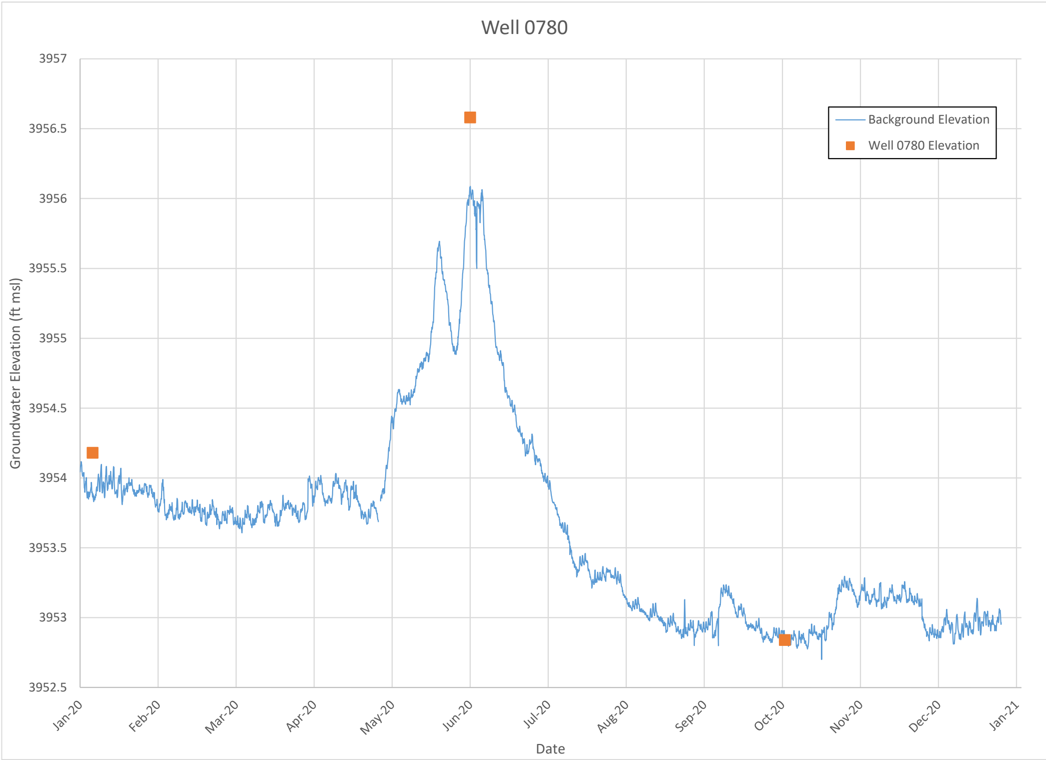

Figure B-11. Freshwater Mounding in Observation Well 0780

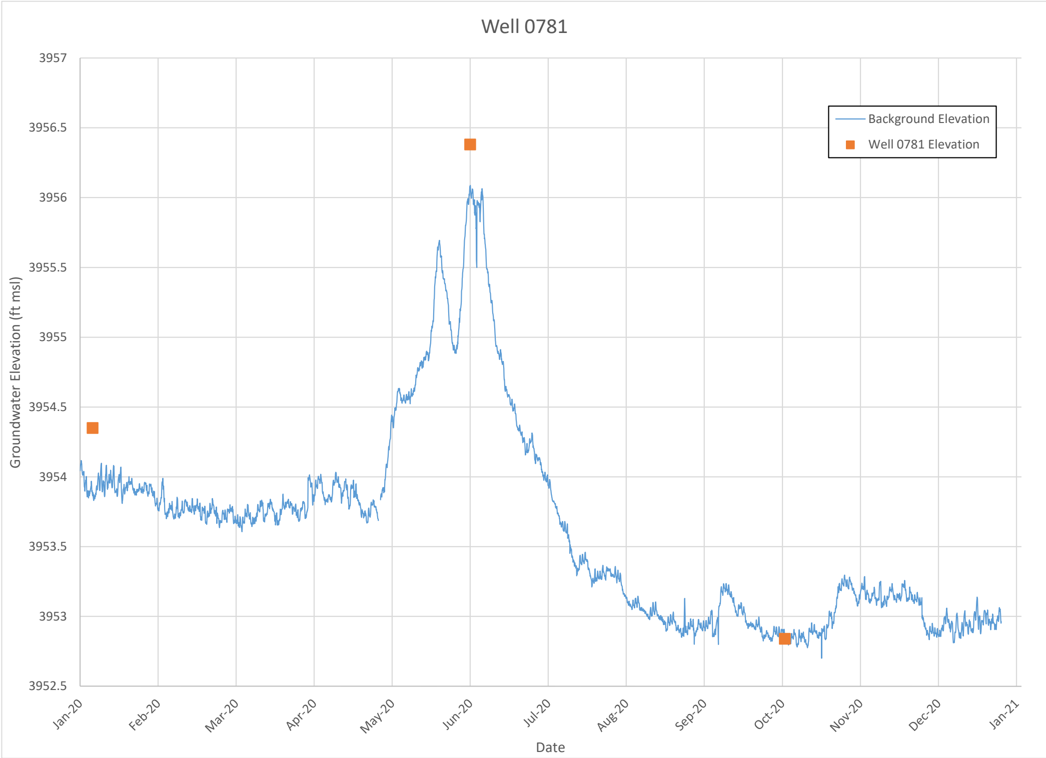

Figure B-12. Freshwater Mounding in Observation Well 0781

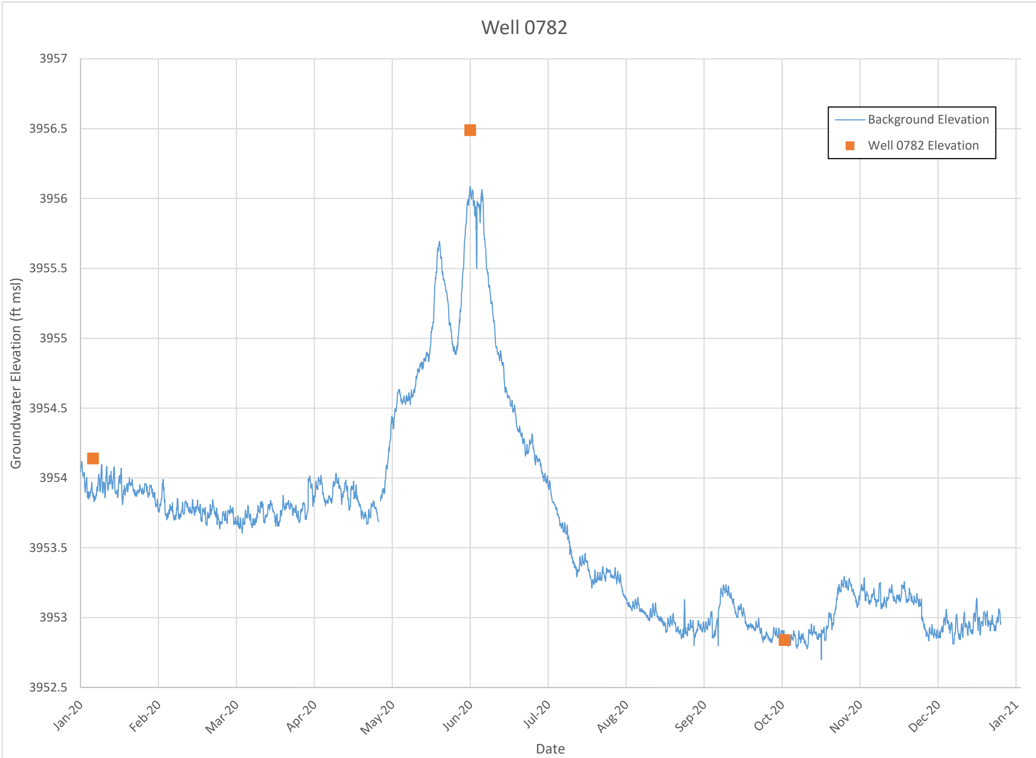

Figure B-13. Freshwater Mounding in Observation Well 0782

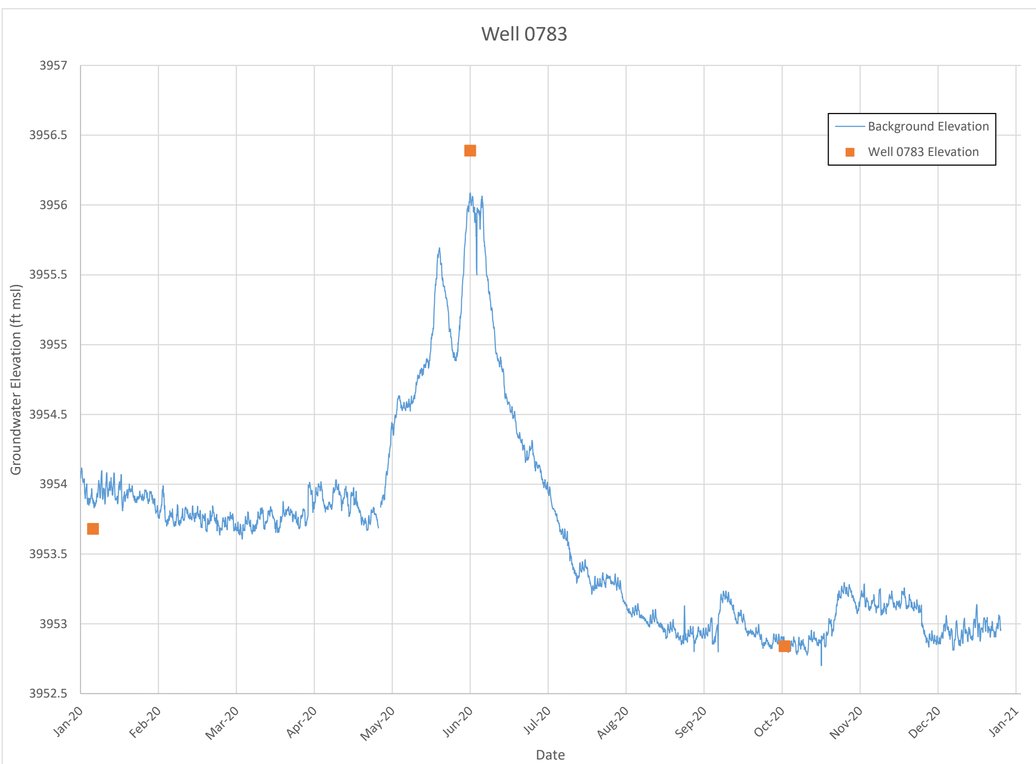

Figure B-14. Freshwater Mounding in Observation Well 0783

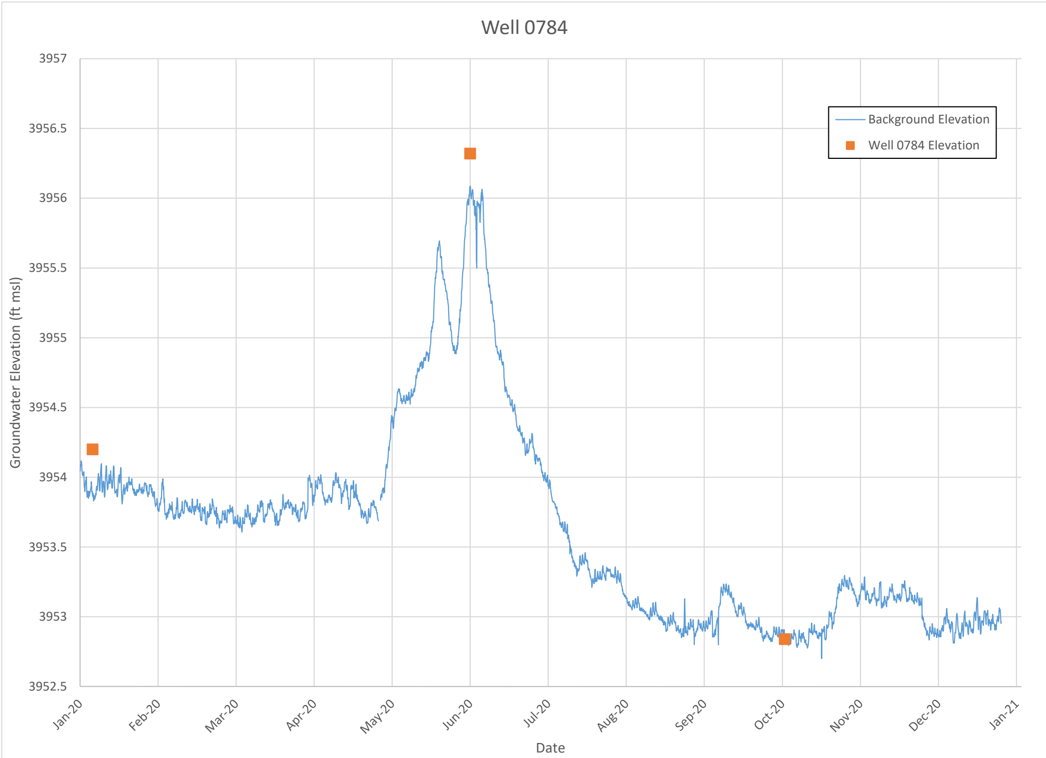

Figure B-15. Freshwater Mounding in Observation Well 0784

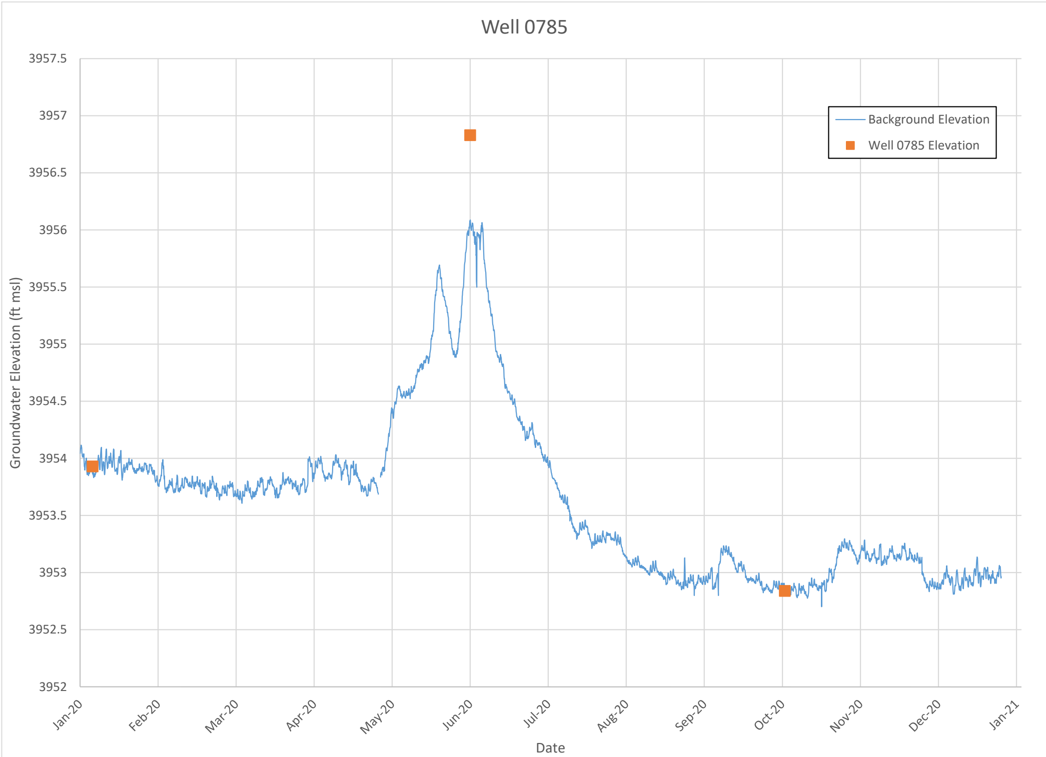

Figure B-16. Freshwater Mounding in Observation Well 0785

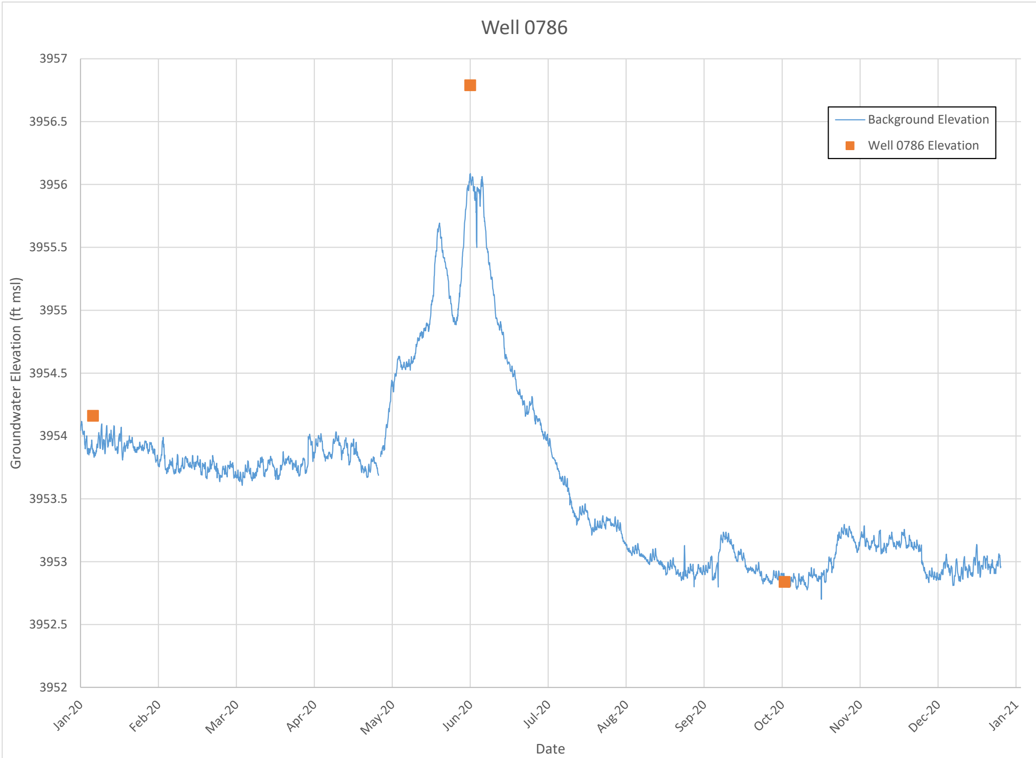

Figure B-17. Freshwater Mounding in Observation Well 0786

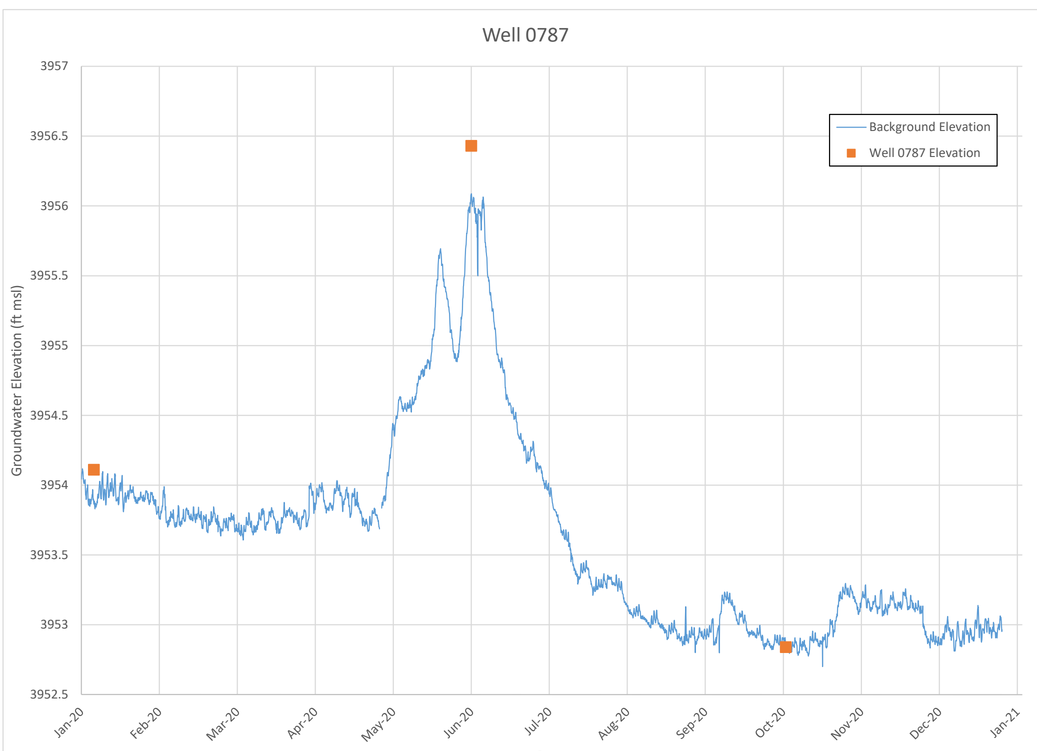

Figure B-18. Freshwater Mounding in Observation Well 0787

Appendix C.

2020 Surface Water/Groundwater Investigation Plots

Appendix C. 2020 Surface Water/Groundwater Investigation Plots

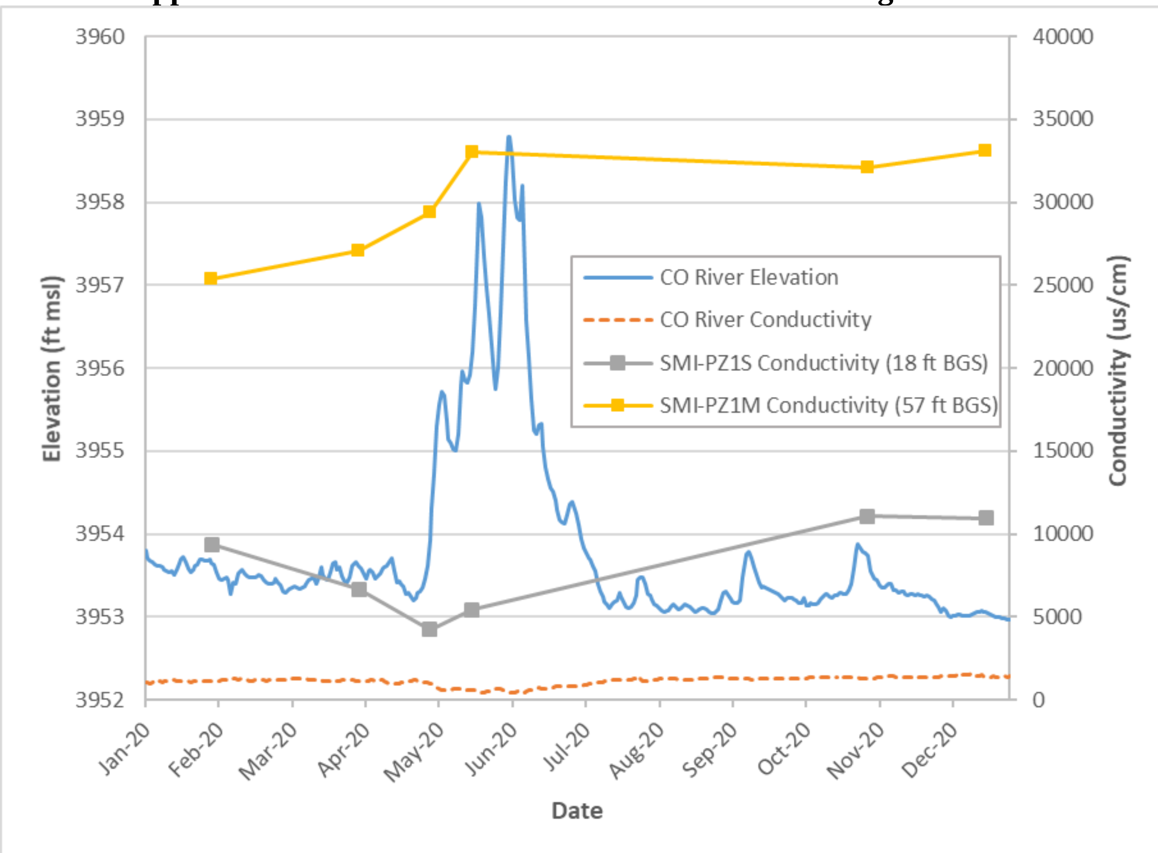

Figure C-1. SMI-PW01 Well Cluster Specific Conductance

Appendix C. 2020 Surface Water/Groundwater Investigation Plots (*continued*)

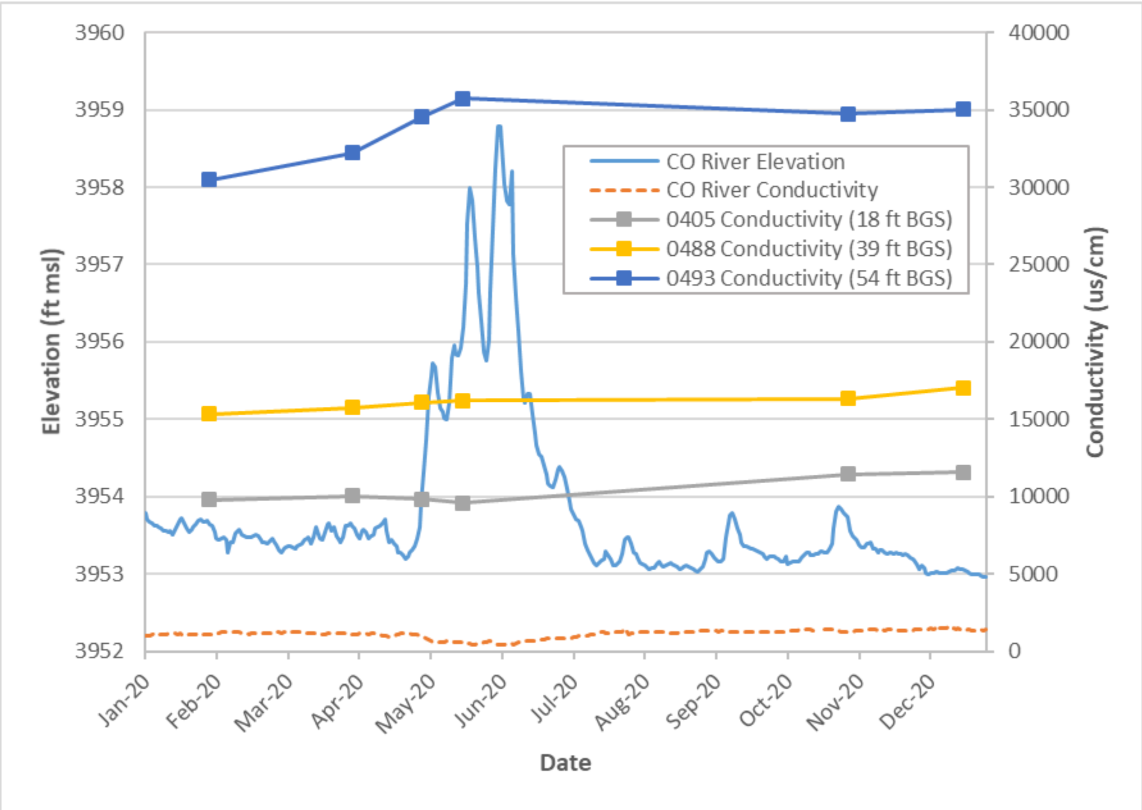

Figure C-2. Baseline Area Well Cluster Specific Conductance 2020

Appendix C. 2020 Surface Water/Groundwater Investigation Plots (*continued*)

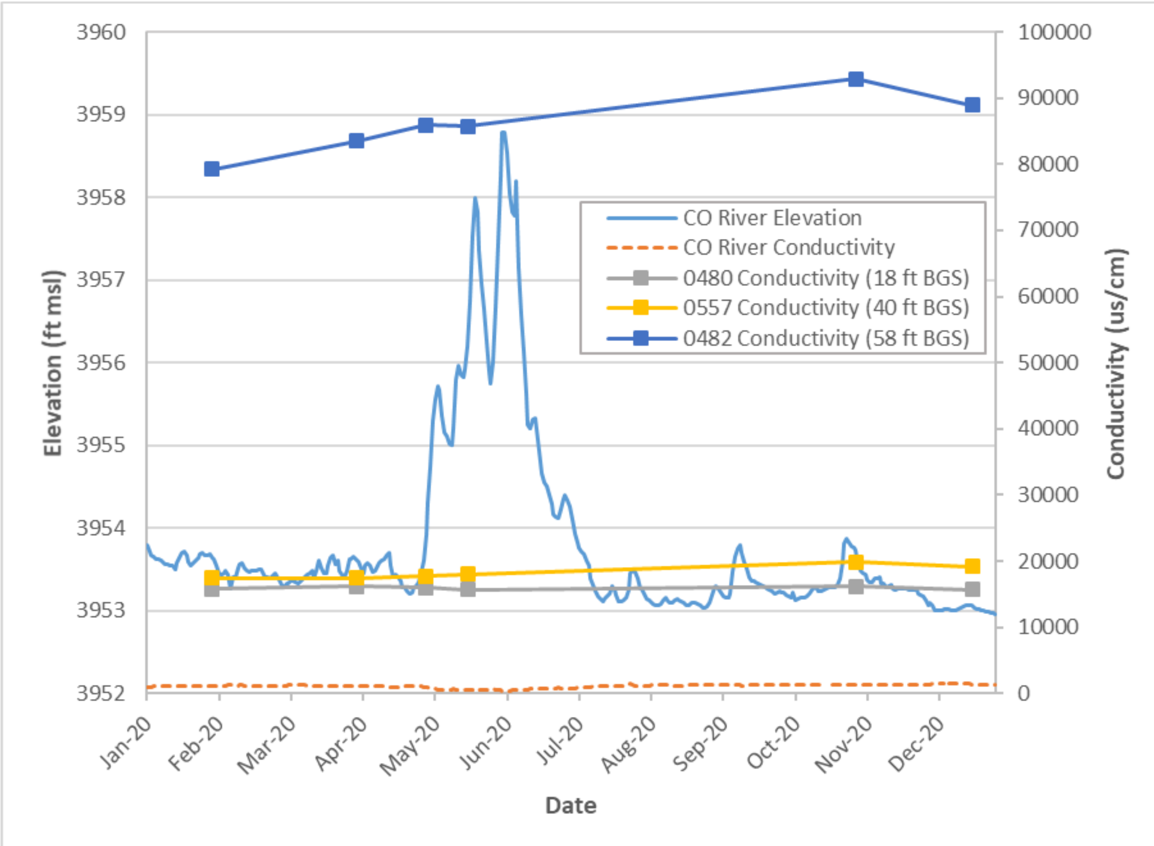

Figure C-3. CF1 Upgradient Well Cluster Specific Conductance 2020

Appendix C. 2020 Surface Water/Groundwater Investigation Plots (*continued*)

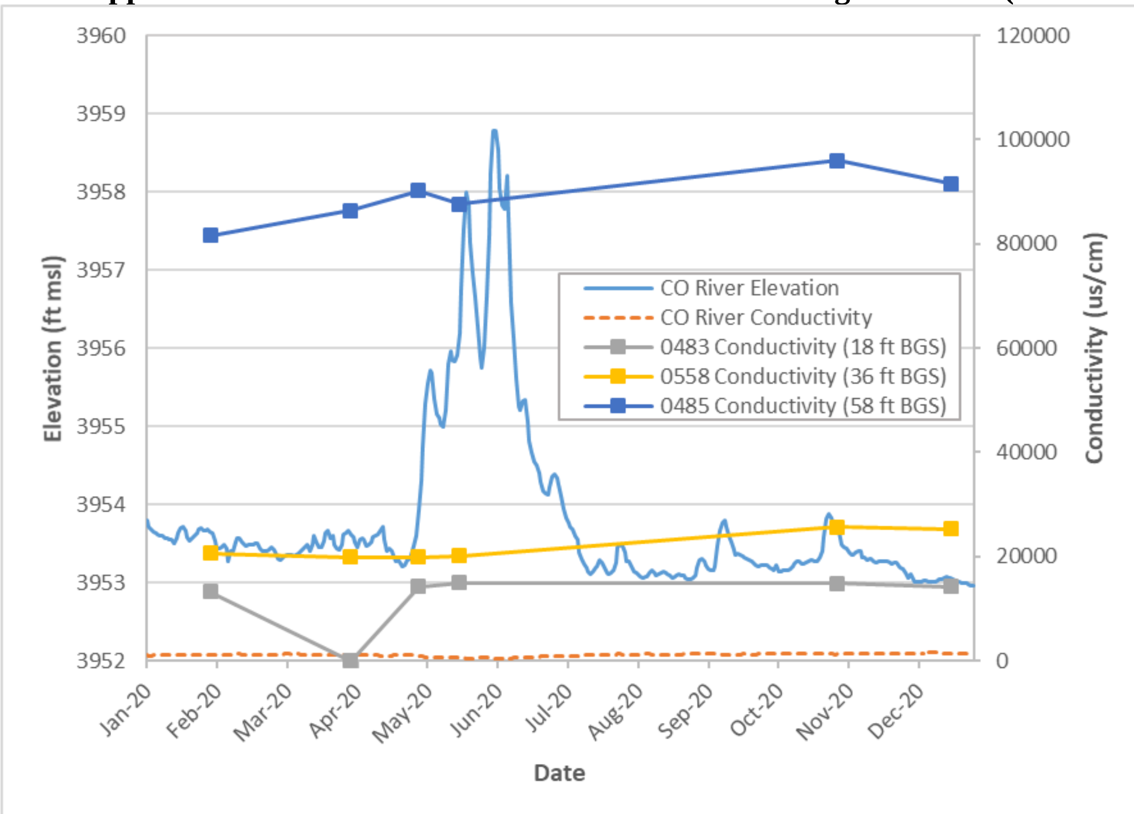

Figure C-4. CF1 Midpoint Well Cluster Specific Conductance 2020

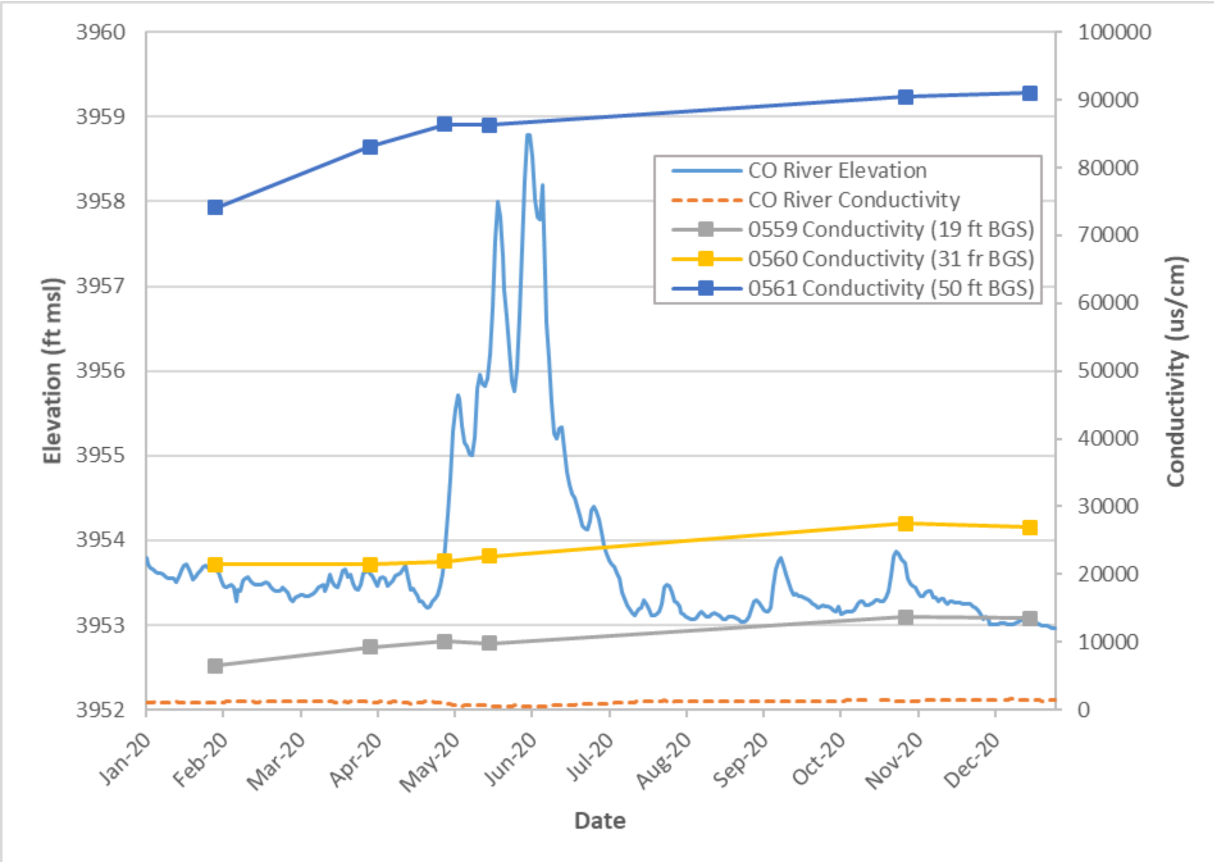

Figure C-5. CF1 Downgradient Well Cluster Specific Conductance 2020