

**Verification Monitoring Report
for the Slick Rock, Colorado,
Processing Sites:
September 2015 Sampling**

November 2016



U.S. DEPARTMENT OF
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Abbreviations

ACL	alternate concentration limit
BTEX	benzene, toluene, ethylbenzene, and xylenes
CCR	<i>Colorado Code of Regulations</i>
CDPHE	Colorado Department of Public Health and Environment
CFR	<i>Code of Federal Regulations</i>
COPC	constituent of potential concern
DOE	U.S. Department of Energy
ft	feet
GCAP	Groundwater Compliance Action Plan
K_d	soil-water distribution coefficient
MCL	maximum contaminant level (SDWA); maximum concentration limit (UMTRCA)
mg/L	milligrams per liter
NO ₃	nitrate
NRC	U.S. Nuclear Regulatory Commission
pCi/L	picocuries per liter
²²⁶ Ra	radium-226
²²⁸ Ra	radium-228
SDWA	Safe Drinking Water Act
SOWP	Site Observational Work Plan
SRE	Slick Rock East
SRW	Slick Rock West
UMTRCA	Uranium Mill Tailings Radiation Control Act

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Executive Summary

The Slick Rock, Colorado, Processing Sites consist of two former uranium-ore processing facilities, the Slick Rock East (SRE) site and the Slick Rock West (SRW) site. The sites, managed by the U.S. Department of Energy, are located along the Dolores River in San Miguel County. Surface remediation of the two sites was completed in 1996. The purpose of this Verification Monitoring Report is to evaluate groundwater and surface water monitoring data collected since 2000 and to assess the status of the compliance strategy for groundwater cleanup. The proposed compliance strategy for the Slick Rock sites is natural flushing combined with institutional controls and compliance monitoring, as documented in the *Draft Final Groundwater Compliance Action Plan for the Slick Rock, Colorado, UMTRA Project Sites* (GCAP) for the sites. The U.S. Nuclear Regulatory Commission (NRC) has not yet concurred with this plan because institutional controls have yet to be implemented by the State of Colorado.

Constituents of potential concern (COPCs) at the Slick Rock sites are, in order of general importance: uranium, selenium, molybdenum, nitrate, and manganese. Several other COPCs—benzene, toluene, ethylbenzene, and xylenes (collectively referred to as BTEX); radium-226 (^{226}Ra); and radium-228 (^{228}Ra)—are limited to a single SRW alluvial well (0319). Selenium and uranium are the only COPCs common to both the SRE and SRW sites. To assess the status of compliance, COPC concentrations are compared to either (1) maximum concentration limits (MCLs) established under the Uranium Mill Tailings Radiation Control Act (UMTRCA) or (2) alternative benchmark values (for constituents without UMTRCA MCLs), such as Safe Drinking Water Act (SDWA) maximum contaminant levels, maximum background concentrations, or alternate concentration limits proposed in the GCAP.

The monitoring network at the SRE site consists of eight monitoring wells and three surface water locations. Uranium and selenium are the only groundwater COPCs at this site. Uranium is monitored at all SRE wells, but selenium is monitored at only three wells: 0305 (the only location where it has been elevated), nearby well 0307, and background well 0300. Uranium concentrations are highest in the central portion of the site, just downgradient of the historical tailings boundary. No attenuation is apparent in these wells, as uranium levels have remained generally stable since 2000 at about 1 milligram per liter (mg/L) in wells 0303 and 0305, and at 0.5 mg/L in well 0307. Selenium concentrations in well 0305 have been stable at about 0.02 mg/L since 2006, below the 0.05 mg/L SDWA standard but slightly exceeding the 0.01 mg/L UMTRCA MCL. As was the case in both 2013 and 2014, well 0312 (north of the Dolores River) was dry in 2015 and could not be sampled.

Nine wells and four surface water locations are currently monitored at the SRW site. Relative to the SRE site, the contaminant suite at the SRW site is larger. In addition to uranium and selenium, COPCs at this site are molybdenum, nitrate, manganese, and (in the vicinity of well 0319 only) BTEX and radium ($^{226}\text{Ra} + ^{228}\text{Ra}$ combined). Groundwater concentrations of uranium, selenium, molybdenum, and nitrate remain elevated within the SRW site's historical tailings boundary. Uranium and nitrate levels have decreased in some wells, but molybdenum and selenium have remained fairly stable in alluvial wells since 2000—little to no attenuation is apparent. For example, in all SRW wells, selenium concentrations are about equal to or slightly greater than those measured 15 years ago. In all wells, manganese levels are now comparable to or less than background, suggesting that monitoring for this constituent could be phased out.

In well 0319, only benzene remains elevated relative to the corresponding benchmark. Although stable at about 5 mg/L, this level is still two orders of magnitude above the SDWA standard. Remaining BTEX constituents are below corresponding SDWA standards. This is also true for $^{226}\text{Ra} + ^{228}\text{Ra}$ levels, which have been below the corresponding 5 picocuries per liter benchmark since 2008.

Since monitoring began in 2000, surface water sampling results indicate minimal impact to the Dolores River from historical milling activities at the SRE and SRW sites. At all Dolores River monitoring locations, no State of Colorado water quality benchmarks were exceeded in 2015, consistent with most historical results. Two river locations—SRE surface location 0700 and SRW location 0349—could not be sampled because they were inaccessible at the time of sampling due to the density of vegetation along the bank of the Dolores River.

Although the 100-year time frame established in Title 40 *Code of Federal Regulations* Part 192 does not commence until NRC approves the GCAP, data collected to date indicate that most site constituents are not attenuating as initially predicted in groundwater modeling. This is particularly true of molybdenum and even more so of selenium in SRW wells.

1.0 Introduction

The Slick Rock, Colorado, Processing Sites consist of two former uranium-ore processing facilities, referred to as the Slick Rock East (SRE) site (formerly the North Continent site) and, approximately 1 mile downstream from SRE, the Slick Rock West (SRW) site (formerly the Union Carbide site). The processing sites, owned by Umetco Minerals Corporation but managed by the U.S. Department of Energy (DOE), are located along the Dolores River in San Miguel County (Figure 1 and Figure 2). Surface remediation of the two sites was completed in 1996.

1.1 Purpose

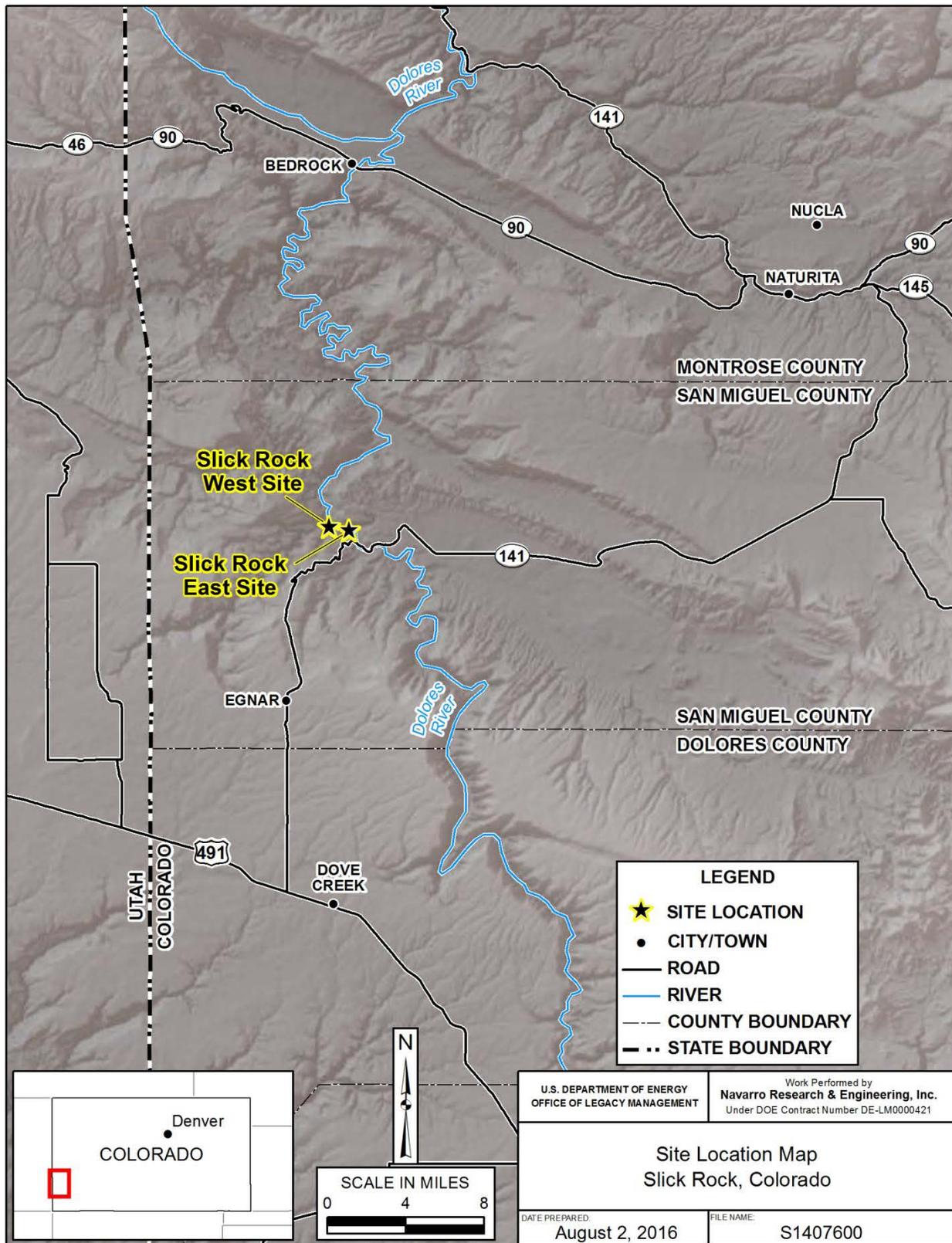
The purpose of this Verification Monitoring Report is to evaluate groundwater and surface water monitoring data collected at the Slick Rock processing sites since 2000 and to assess the status of the compliance strategy for groundwater cleanup.

1.2 Compliance Strategy

The proposed compliance strategy for the Slick Rock sites is natural flushing combined with institutional controls and compliance monitoring, as stated in the *Draft Final Groundwater Compliance Action Plan for the Slick Rock, Colorado, UMTRA Project Sites* (GCAP) (DOE 2006). The GCAP states that public health will be protected during the natural flushing process through institutional controls, which will restrict access to contaminated alluvial groundwater. The institutional controls to be used for the Slick Rock sites are environmental covenants between the State of Colorado, represented by the Colorado Department of Public Health and Environment (CDPHE), and the landowner, Umetco Minerals Corporation. The environmental covenants are still pending for the Slick Rock sites while Umetco and CDPHE resolve mineral ownership issues. The U.S. Nuclear Regulatory Commission (NRC) will not concur with the GCAP until institutional controls are established.

Constituents of potential concern (COPCs) at the Slick Rock sites are manganese, molybdenum, nitrate, selenium, and uranium (Table 1). Several other COPCs—benzene, toluene, ethylbenzene, and xylenes (collectively referred to as BTEX); radium-226 (^{226}Ra); and radium-228 (^{228}Ra)—are limited to a single SRW alluvial well (0319). Selenium and uranium are the only COPCs common to both the SRE and SRW sites.

To assess the status of compliance, COPC concentrations are compared to the benchmark values listed in Table 1. Groundwater benchmarks for molybdenum, nitrate, ^{226}Ra , ^{228}Ra , selenium (at SRE only), and uranium are the maximum concentration limits (MCLs) established under the Uranium Mill Tailings Radiation Control Act (UMTRCA) and codified in Title 40 *Code of Federal Regulations* Part 192 (40 CFR 192). At SRW, benchmarks for BTEX are maximum contaminant levels (also abbreviated as MCLs) established under the U.S. Environmental Protection Agency Safe Drinking Water Act (SDWA). The benchmark for manganese is the maximum background (upgradient) concentration measured at the site. Groundwater modeling conducted for the Site Observational Work Plan (SOWP) (DOE 2002) predicted that natural flushing for all COPCs (except for selenium in SRW wells) would be completed within the 100-year regulatory time frame established in 40 CFR 192.



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Figure 1. Slick Rock, Colorado, Processing Sites Location Map

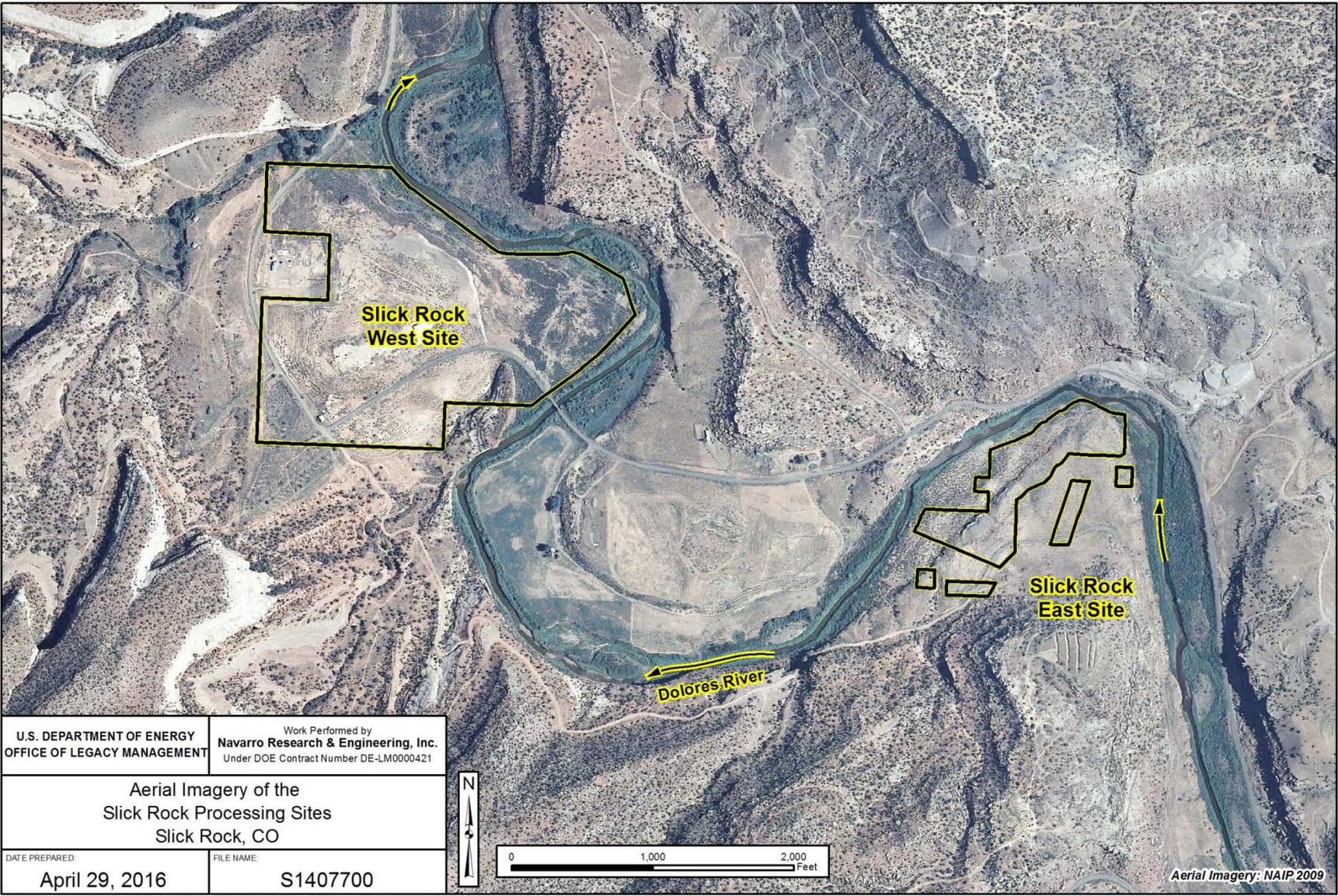


Figure 2. Aerial Photograph of the Slick Rock, Colorado, Processing Sites

Because selenium concentrations at SRW were not expected to decrease to levels below the 0.01 milligram per liter (mg/L) UMTRCA MCL within 100 years, a human health risk-based alternate concentration limit (ACL) of 0.18 mg/L was proposed for the SRW site (DOE 2006).

Table 1. Groundwater Benchmarks for COPCs at the SRE and SRW Sites

COPC ^a	Benchmark	Basis for Benchmark	Applicable Site	Applicable Wells ^b	Comment
Uranium	0.044 mg/L	UMTRCA MCL	SRE, SRW	All wells except SRW wells 0317 and 0319	The 0.044 mg/L standard is equivalent to the uranium standard of 30 picocuries per liter (pCi/L) in 40 CFR 192.
Selenium	SRE: 0.01 mg/L SRW: 0.18 mg/L ^c	SRE: UMTRCA MCL SRW: Proposed ACL (DOE 2002)	SRE, SRW	SRE wells 0305 and 0307 and all SRW wells	The UMTRCA MCL is less than the 0.05 mg/L SDWA MCL.
Manganese	3.5 mg/L ^d	Maximum background (as of March 2001)	SRW	All SRW wells except 0317 and 0319	Since 2001 (when the benchmark was established), manganese levels in background well 0300 have twice exceeded 3.5 mg/L. ^d
Molybdenum	0.10 mg/L	UMTRCA MCL	SRW	All SRW wells except 0319	
Nitrate as NO ₃	44.3 mg/L	UMTRCA MCL (NO ₃ equivalent)	SRW	All SRW wells except 0317 and 0319	The 44.3 mg/L standard is equivalent to the nitrate as nitrogen standard of 10 mg/L in 40 CFR 192.
²²⁶ Ra + ²²⁸ Ra	5 pCi/L	UMTRCA MCL	SRW	SRW well 0319	Analysis for radium in other SRW wells was discontinued after 2001 given levels below 5 pCi/L.
Benzene	0.005 mg/L	SDWA MCL	SRW	SRW well 0319	
Toluene	1 mg/L	SDWA MCL	SRW	SRW well 0319	
Ethylbenzene	0.7 mg/L	SDWA MCL	SRW	SRW well 0319	The 0.7 mg/L benchmark has never been exceeded in well 0319 samples.
Xylenes	10 mg/L	SDWA MCL	SRW	SRW well 0319	The 10 mg/L benchmark has never been exceeded in well 0319 samples.

Notes:

^a Constituents are listed in order of prevalence at the Slick Rock sites. For example, uranium is most prevalent at both sites, whereas radium (²²⁶Ra + ²²⁸Ra) is limited to the immediate vicinity of SRW well 0319.

^b Applicable wells are only those currently monitored. For historical results, refer to the SOWP (DOE 2002) and previous Verification Monitoring Reports.

^c The proposed ACL for selenium, 0.18 mg/L, was established in the SOWP (DOE 2002).

^d Manganese levels in upgradient background well 0300 have fluctuated, and on two occasions have exceeded the 3.5 mg/L benchmark established in the site Environmental Assessment (DOE 2003): 4.2 mg/L in August 2001 and most recently (the maximum) 4.5 mg/L in September 2015. This variation should be acknowledged when comparing monitoring well results to the initial (3.5 mg/L) benchmark.

2.0 Site Conditions

2.1 Hydrogeology

The hydrostratigraphic units at the Slick Rock sites are, in descending stratigraphic order, the Dolores River alluvium (Quaternary Period), the Salt Wash Member of the Morrison Formation, the Summerville Formation, the Entrada Sandstone, and the Navajo Sandstone (all Jurassic Period). Although both sites overlie the Dolores River alluvium, not all of the other units are present at both sites.

The Dolores River alluvium contains the uppermost aquifer and is the only unit known to be affected by site-related contamination. The alluvial aquifer is unconfined and consists of unconsolidated material, primarily silty sands and silty sandy gravels with an occasional interbedded clay lens. The alluvium ranges from 15 to 20 feet (ft) in thickness and is laterally restricted by bedrock that forms the walls of the Dolores River canyon. In addition, the Dolores River floodplain is discontinuous and pinches out in areas where the river meets the canyon wall. Depth to groundwater in the alluvial aquifer ranges from 7 to 15 ft below ground surface. Groundwater flow generally follows the downstream direction of the Dolores River, which is the main recharge source for the alluvial aquifer.

At the SRE site, the Salt Wash Member of the Morrison Formation and the Summerville Formation underlie the Dolores River alluvium. Because these formations in the site area consist of fine-grained, low-permeability material, they are considered aquitards that prevent contaminated groundwater in the alluvial aquifer from moving downward into deeper aquifers (DOE 2002).

At the SRW site, Entrada Sandstone underlies the Dolores River alluvium. This formation ranges from 40 to 60 ft in thickness in the floodplain area (DOE 2002). The Entrada aquifer is unconfined near the top of the unit (in contact with the alluvial aquifer), and it may be semi-confined near the bottom (in partial contact with the underlying Navajo aquifer). In wells completed in the Navajo Sandstone, groundwater has an upward vertical gradient with respect to water in the overlying Entrada, signifying that the Navajo aquifer discharges upward. The Entrada aquifer receives recharge from upgradient infiltration of precipitation, creating artesian pressure. Entrada groundwater has a slight upward vertical gradient with respect to water in the overlying alluvial aquifer, and hydraulic conductivity in the alluvial aquifer is two orders of magnitude greater than that of the Entrada. These conditions inhibit groundwater from flowing downward from the alluvial aquifer into underlying aquifers.

2.2 Groundwater Quality

2.2.1 SRE Site

Alluvial groundwater beneath the SRE site was contaminated as a result of former uranium-ore processing activities. Contamination is limited to the alluvial aquifer at the SRE site (Section 2.1) and COPCs are uranium and selenium (DOE 2002). Since 2000, when site monitoring began, uranium concentrations in wells 0303 and 0305 (wells with the highest concentrations) have averaged approximately 1 mg/L, exceeding the UMTRCA MCL of 0.044 mg/L.

Selenium has been elevated in only one well at the SRE site, well 0305 (historical range of 0.014–0.05 mg/L). Since 2006, selenium levels in this well have been fairly stable at about 0.02 mg/L, slightly exceeding the UMTRCA groundwater standard of 0.01 mg/L, yet below the SDWA primary drinking water standard of 0.05 mg/L.

2.2.2 SRW Site

Former uranium-ore processing activities also contaminated the groundwater beneath the SRW site. COPCs in the alluvial aquifer at the SRW site are manganese, molybdenum, nitrate, selenium, uranium, radium (^{226}Ra + ^{228}Ra combined), and BTEX. Contamination in the alluvial aquifer is contained within the site boundary, while radium and BTEX contamination is isolated to the region of one well (0319). The primary COPCs in the alluvial aquifer are molybdenum, nitrate, selenium, and uranium (refer to Section 4.0 for contaminant distributions and trends).

2.3 Surface Water Quality

The Dolores River is the only perennial surface water feature in the vicinity of the Slick Rock sites. Results from surface water sampling have demonstrated minimal impact to the Dolores River from site contamination.¹

2.4 Remediation Activities

Surface remediation at the Slick Rock sites began in 1995 and was completed in 1996. As part of the remediation process, uranium mill tailings and other residual radioactive materials associated with the former milling operations were relocated to the Slick Rock disposal cell (formerly called the Burro Canyon disposal cell), approximately 5 miles east of the Slick Rock processing sites. The sites were regraded with onsite material, and subsequent revegetation efforts have been successful.

2.5 Land and Water Use

Umetco Minerals Corporation currently owns the SRE and SRW sites. The SRE site is used for livestock grazing (it is not fenced). The majority of the SRW site is enclosed with a barbed-wire fence. Land between the two sites is privately owned; land use includes alfalfa production (fields irrigated with water pumped from the Dolores River), livestock grazing, and gravel-mining operations. There is no current use of alluvial groundwater beneath the former processing sites. There are also no known uses of groundwater from the Entrada Sandstone in the area near the SRE and SRW sites. Groundwater for domestic or agricultural use in the Slick Rock area is primarily supplied by the Navajo Sandstone aquifer. Historically, wells completed in the Navajo Sandstone provided water for the milling operations and for the mill community at the SRW site.

¹ This stream segment of the Lower Dolores River Basin (Segment 2 or COGULD02) has the following use classifications: Agriculture, Aquatic Life Warm 1, Recreation E, and Water Supply. The classifications with the most restrictive water quality standards apply, in accordance with Volume 5 *Colorado Code of Regulations* Regulation 1002-35 (5 CCR 1002-35) (CDPHE 2016).

3.0 Monitoring Program

According to the draft GCAP, monitoring at the Slick Rock processing sites is to be performed annually for the first 10 years following NRC concurrence with the compliance strategy (DOE 2006). To date, NRC has not concurred with the GCAP because institutional controls have yet to be implemented by the State of Colorado. Despite the lack of concurrence by NRC, annual monitoring has been performed at the site since 2003. Sampling also occurred in 2000–2001 during site characterization efforts conducted in support of the SOWP. This section describes the monitoring programs for the SRE and SRW sites.

3.1 SRE Site

At the SRE site, the current monitoring network consists of eight monitoring wells and three surface water locations, shown in Figure 3. Table 2 lists each of these locations and describes the monitoring rationale and analytes measured.

Table 2. Monitoring Program at the SRE Site

ID	Matrix	Location ^a	Rationale/Comment	Analytes
0300	Groundwater	Upgradient	Upgradient (background) monitoring location for both SRE and SRW sites	Manganese, molybdenum, nitrate, selenium, and uranium
0303	Groundwater	Onsite	Hot spot for uranium	Uranium
0305	Groundwater	Onsite	Hot spot for uranium; selenium above the UMTRCA MCL	Selenium and uranium
0307	Groundwater	Onsite	Downgradient of hot spots, monitor plume migration	Selenium and uranium
0309	Groundwater	Onsite	Farthest downgradient well onsite	Uranium
0310	Groundwater	Offsite (across the Dolores River) ^b	Monitor migration of uranium between the SRE and SRW sites	Uranium
0311	Groundwater	Offsite (across river) ^b	Monitor migration of uranium between the SRE and SRW sites	Uranium
0312	Groundwater	Offsite (across the Dolores River) ^b	This well has not been sampled since September 2012 because it has been dry	Uranium
0696	Surface Water	Upstream	Surface water background (inlet area)	Uranium
0692	Surface Water	Adjacent to site	Location where the centroid of the uranium plume was predicted to intersect the river	Uranium
0700	Surface Water	Downstream	Location established in 2005; located about 100 ft southwest of well 0309	Uranium

Notes:

^a The sampling locations in this table are listed first in order of matrix, and then by general flow direction (upgradient or upstream locations are listed first). Samples are to be collected annually as specified in the GCAP (DOE 2002).

^b Early characterization and modeling conducted for the SOWP indicated that a paleochannel might exist that connects the aquifer on each side of the Dolores River (DOE 2002). Therefore, wells 0310, 0311, and 0312 were installed in August 2000 to assess potential uranium migration offsite. Given the doubling of uranium concentrations in well 0311 between 2001 and 2004 (from 0.04 to 0.08 mg/L), sampling at wells 0310 and 0312 resumed in 2005 after a 4-year hiatus.

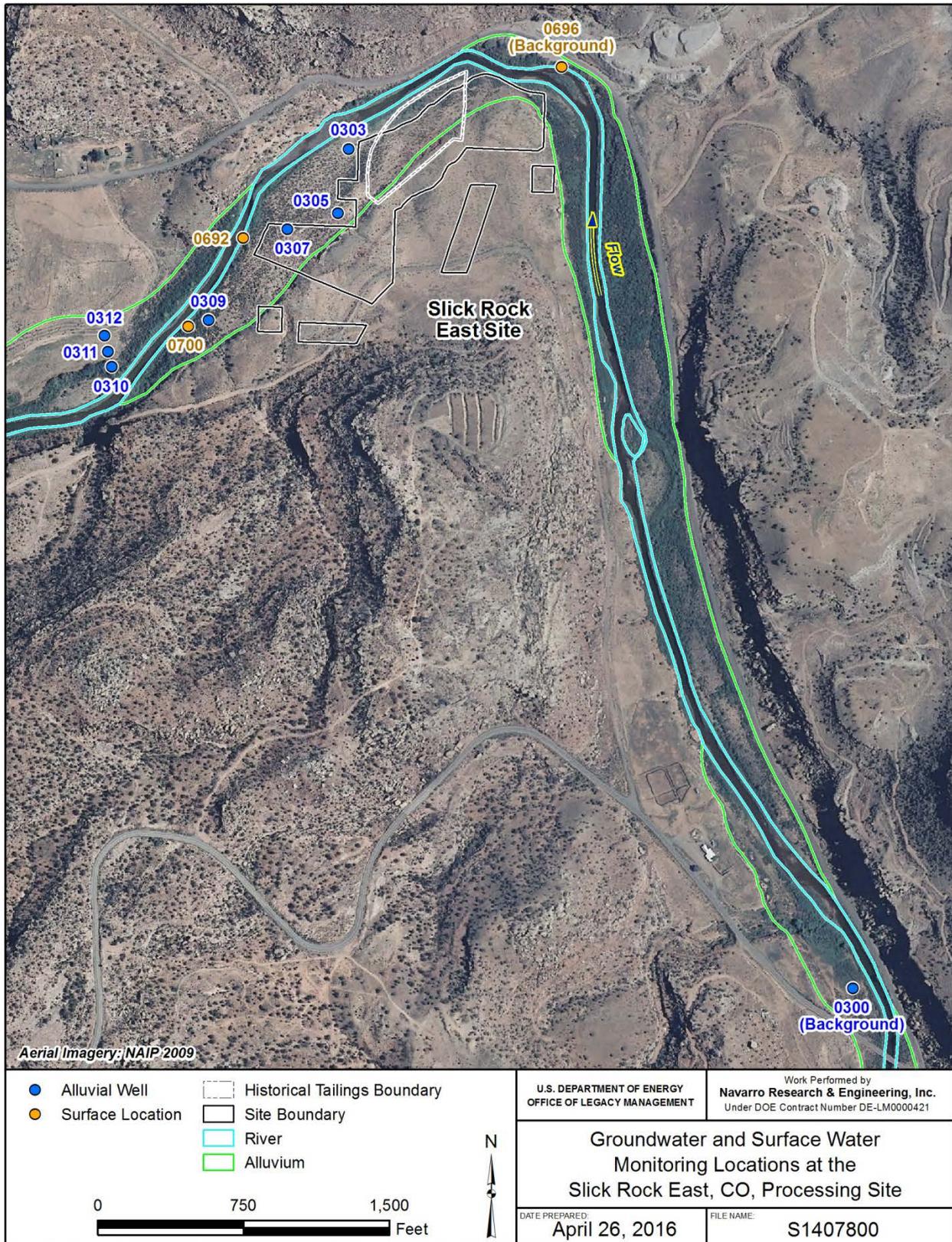


Figure 3. Groundwater and Surface Water Monitoring Locations at the Slick Rock East Site

3.2 SRW Site

At the SRW site, the monitoring network consists of nine monitoring wells and four surface water locations (Table 3 and Figure 4). In 2010, three new wells were installed at the SRW site: 0318A, 0339, and 0340. Well 0318A replaced damaged well 0318 (the well had a broken well screen), and wells 0339 and 0340 were installed to enable a better understanding of the distribution and transport of selenium in the alluvial aquifer in this region.

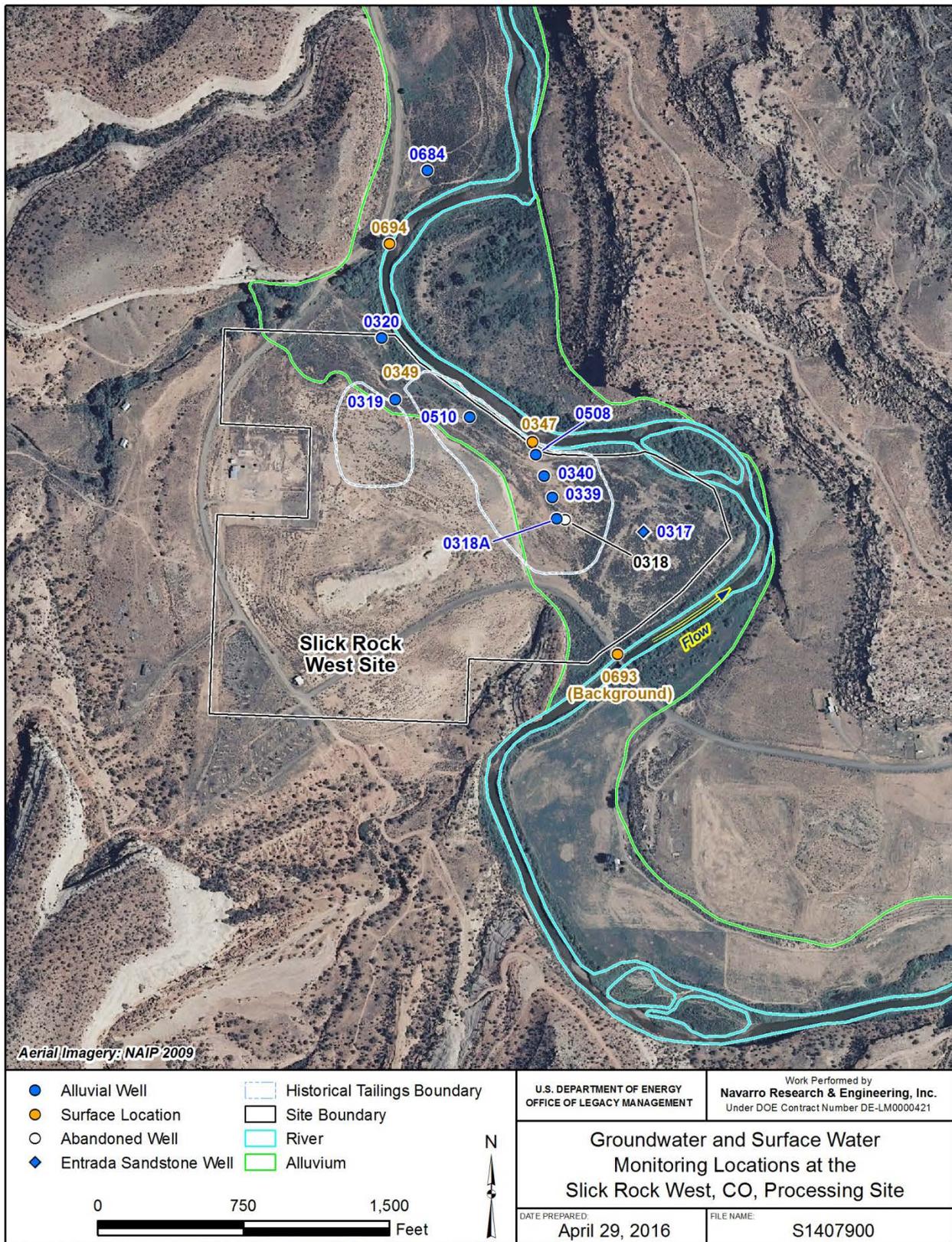
Table 3. Monitoring Program at the SRW Site

ID	Matrix	Location ^a	Rationale	Analytes
0317	Groundwater	Onsite	Entrada Sandstone well—molybdenum exceeds UMTRCA MCL.	Molybdenum and selenium ^b
0318, 0318A	Groundwater	Onsite	Area of highest measured concentrations for several COPCs. Due to a broken well screen, well 0318 was abandoned and replaced with well 0318A in September 2010.	Manganese, molybdenum, nitrate, selenium, and uranium
0339	Groundwater	Onsite	Installed in September 2010 to better characterize the extent of elevated selenium in the eastern area of the former tailings pile.	Manganese, molybdenum, nitrate, selenium, and uranium
0340	Groundwater	Onsite	Installed in September 2010 (same rationale as for well 0339 above).	Manganese, molybdenum, nitrate, selenium, and uranium
0508	Groundwater	Onsite	High selenium, nitrate, molybdenum, and uranium.	Manganese, molybdenum, nitrate, selenium, and uranium
0510	Groundwater	Onsite	Edge of former tailings pile, high COPC concentrations.	Manganese, molybdenum, nitrate, selenium, and uranium
0319	Groundwater	Onsite	Hot spot for BTEX and radium.	BTEX, ²²⁶ Ra, ²²⁸ Ra, and selenium ^b
0320	Groundwater	Onsite	Farthest downgradient well onsite; monitor plume movement.	Manganese, molybdenum, nitrate, selenium, and uranium
0684	Groundwater	Offsite	Farthest downgradient well; purpose is to verify that contaminants are not migrating offsite.	Manganese, molybdenum, nitrate, selenium, and uranium
0693	Surface Water	Upstream	Upstream SRW surface water location (but downstream of SRE).	Manganese, molybdenum, nitrate, selenium, and uranium
0347	Surface Water	Adjacent to site	Predicted location where the centroid of the selenium plume intersects the river; potential point of exposure for selenium (DOE 2006).	Manganese, molybdenum, nitrate, selenium, and uranium
0349	Surface Water	Adjacent to site	Predicted location where the centroids of contaminant plumes intersect the river. Potential point of exposure.	Manganese, molybdenum, nitrate, selenium, and uranium
0694	Surface Water	Downstream	Potential for contaminant plumes to discharge to the river at this location.	Manganese, molybdenum, nitrate, selenium, and uranium

Notes:

^a The sampling locations in this table are listed first in order of matrix, and then by general flow direction (upgradient or upstream are listed first). Samples are to be collected annually as specified in the GCAP (DOE 2002).

^b In Entrada well 0317 and alluvial well 0319, monitoring for selenium resumed in 2010 after an 8-year hiatus.



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Figure 4. Groundwater and Surface Water Monitoring Locations at the Slick Rock West Site

4.0 Results of 2015 Monitoring

This section documents the results of groundwater and surface water monitoring conducted in 2015 for the SRE and SRW sites. Detailed analytical results for groundwater and surface water are provided in Appendixes A and B, respectively. Appendix C includes supporting static water level data and hydrographs. Additional information, including a data quality assessment and time-concentration graphs for all analytes and monitoring locations, is provided in the corresponding Data Validation Package (DOE 2016).

4.1 SRE Site Groundwater Monitoring Results

Apart from field parameters, uranium and selenium are the only constituents currently monitored at SRE, as levels of other constituents have been below respective benchmarks. Background well 0300 is an exception (other analytes are monitored) as this well also serves as the background location for SRW. While uranium is monitored at all SRE well locations, selenium is monitored only at three wells (0300, 0305, and 0307). Recent and historical trends observed for each of these constituents are discussed below.

4.1.1 SRE Uranium

Figure 5 shows the historical distribution of uranium in currently active SRE wells, ordered from left to right by direction of groundwater flow (upgradient to downgradient). Graduated symbol plots of the most recent (2015) sampling effort are shown in Figure 6. As has been the case historically, uranium concentrations are highest in SRE wells 0303, 0305, and 0307, located in the central portion of the SRE site just downgradient of the historical tailings boundary. Uranium concentrations in these wells and in well 0309 have also been the most variable. Time-concentration plots of uranium in SRE wells are shown in Figure 7.

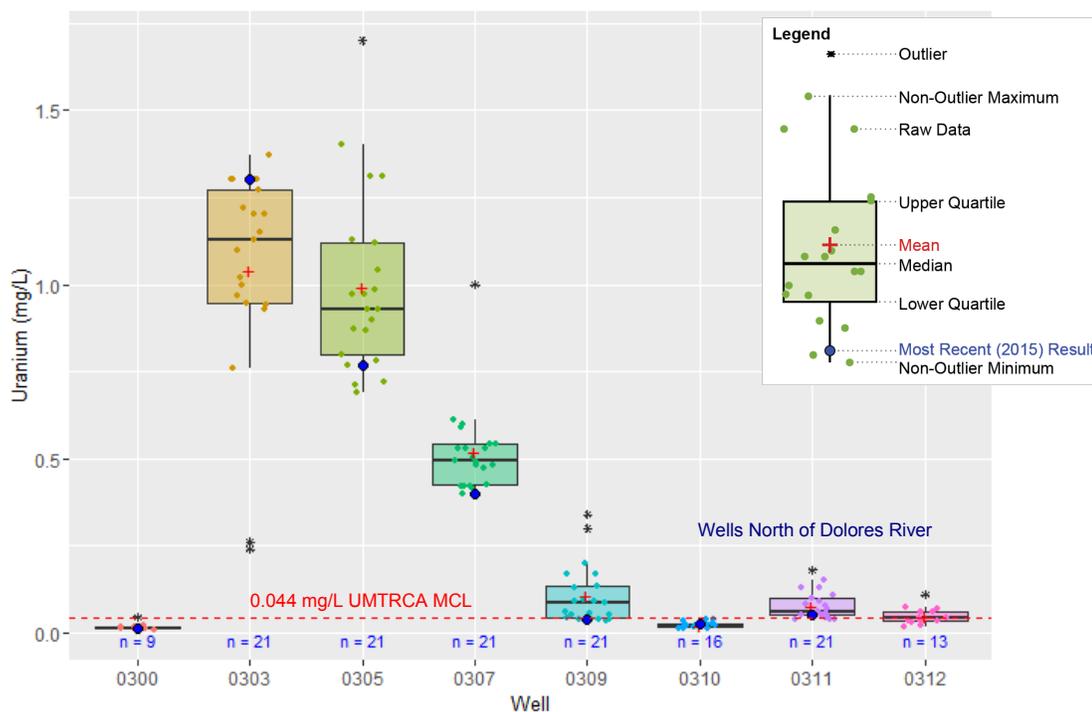


Figure 5. Distributions of Uranium in SRE Wells

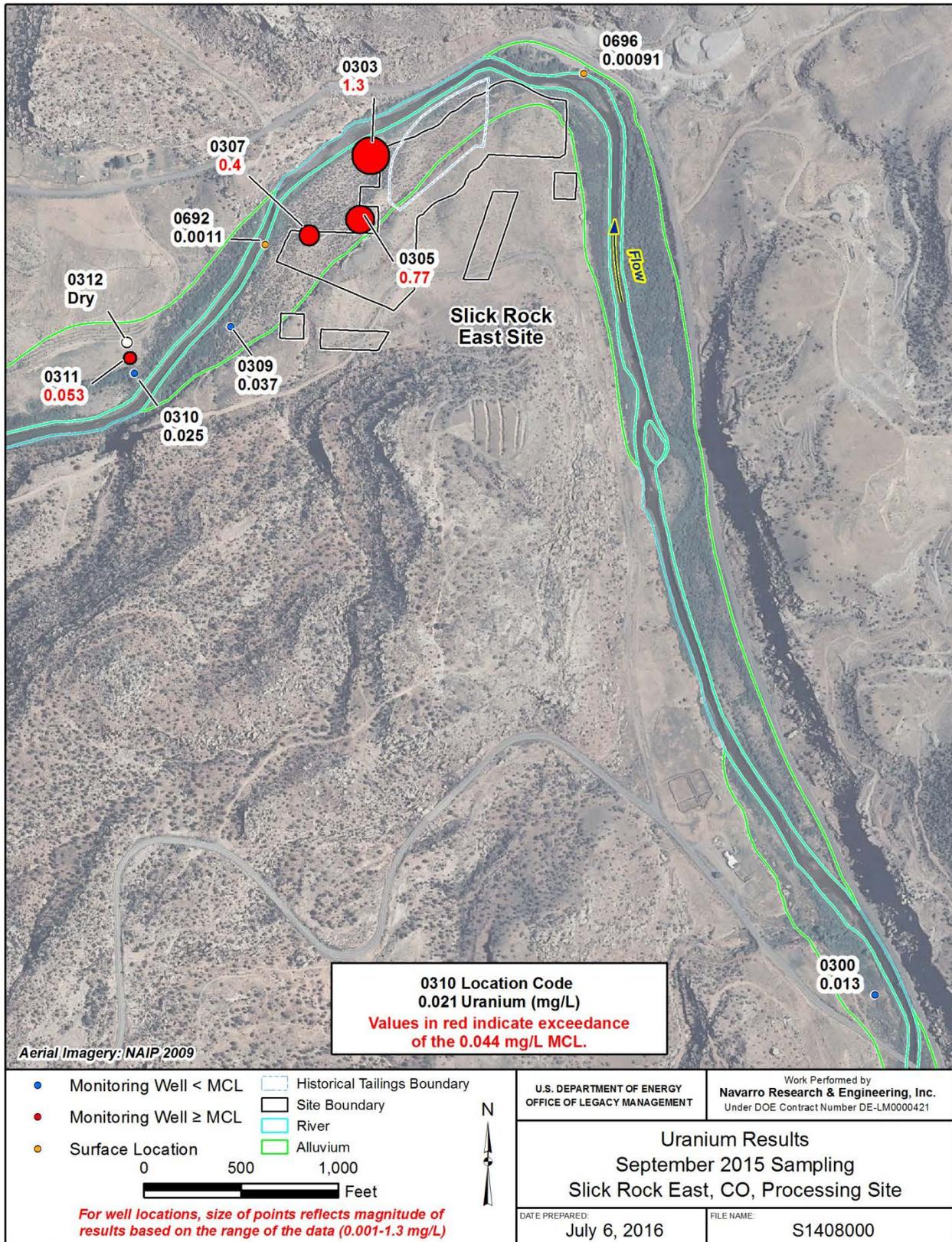
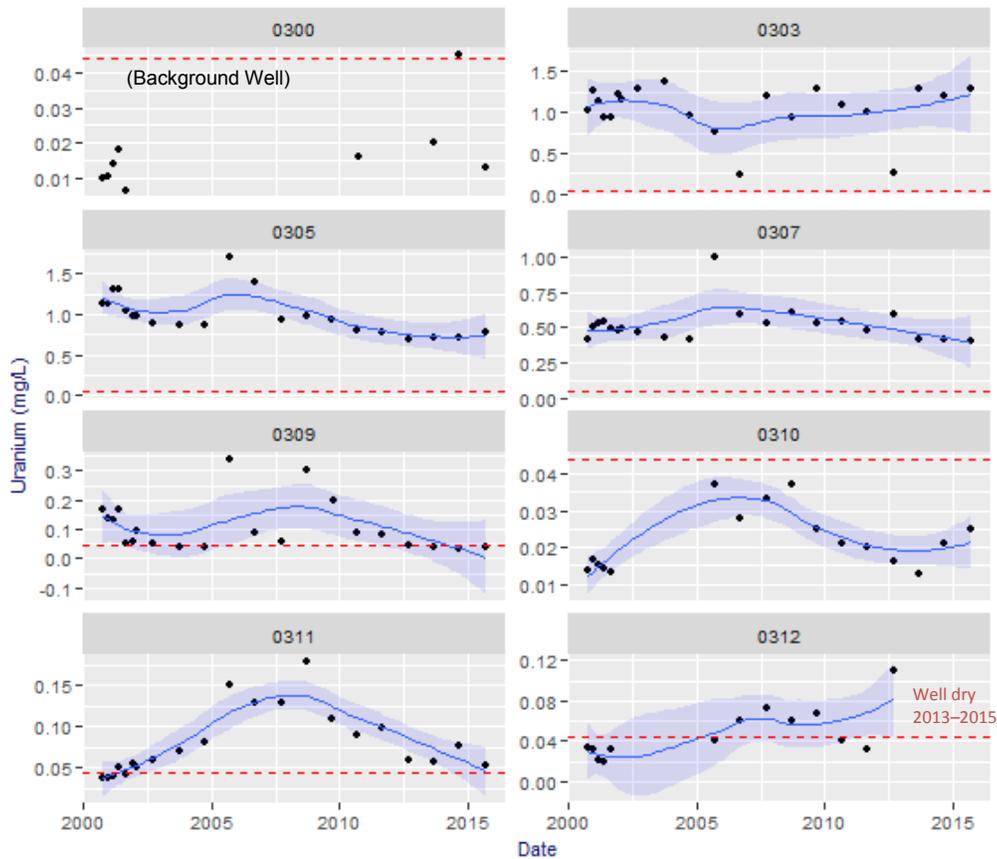


Figure 6. Uranium Distribution at SRE Monitoring Locations: September 2015 Sampling



Notes:
 — blue line is loess local regression line; shaded area is the corresponding 95% point-wise confidence interval; - - - denotes the 0.044 mg/L UMTRCA MCL. The loess smoothing line is omitted from the plot for background location 0300 because of the gap in sampling between 2001 and 2010.

Figure 7. Uranium Concentrations in SRE Wells, 2000–Present

In Figure 7, the data are partitioned such that the y-axis is unique to each well. For those wells with sufficient data, a non-parametric smoothing method or locally weighted regression—“loess” (not to be confused with the geologic term)—is used. With this smoothing approach, overall trends in the data are more apparent and not obscured by “noise,” as is the case in some traditional time-concentration plots.²

Uranium concentrations continue to be elevated in central-plume-area wells 0303, 0305, and 0307, just downgradient of the historical tailings boundary (Figure 6, Figure 7). Apart from low (outlier) measurements in 2006 and 2012, uranium concentrations in SRE well 0303 have been relatively stable at about 1 mg/L. This is also the case for well 0305, although a slight decreasing trend is apparent. Uranium concentrations in well 0307 have been stable at about 0.5 mg/L since 2000. Farther downgradient at well 0309, a slight decreasing trend is apparent; uranium concentrations have been stable at just below the MCL (0.04 mg/L) since 2012.

² Figure 7 and subsequent similar “facet” plot figures were developed using R version 3.3.0 (R Core Team 2016) and the ggplot2 package, version 2.1.0 (Wickham 2009).

North of the Dolores River, uranium concentrations in alluvial well 0310 (closest to the river), although variable, have been below the MCL. This is not the case in wells 0311 and 0312 (farther from the river), where uranium concentrations have exceeded the MCL. Initially (in 2000–2001), uranium concentrations in well 0311 were <0.044 mg/L, but then levels more than tripled to 0.15 mg/L (2005 result). Since 2005, uranium concentrations have gradually declined to just above the MCL (2015 result was 0.05 mg/L). The last measurement in well 0312 (0.11 mg/L), taken in September 2012, is a historical maximum for that well. However, at the time of the last three sampling events—2013, 2014, and 2015—the well was dry and could not be sampled.

At upgradient well 0300, uranium concentrations have ranged from 0.01 to 0.02 mg/L with one exception. The 2014 measurement (0.046 mg/L) exceeded the UMTRCA MCL, but the subsequent September 2015 sample result (0.013 mg/L) is consistent with the general (0.01-0.02 mg/L) historical trend. (This well was redeveloped in early August 2015).

4.1.2 SRE Selenium

At the SRE site, selenium concentrations have been elevated at one location, well 0305. Figure 8 plots selenium concentrations in well 0305, nearby well 0307, and background well 0300. Selenium concentrations in well 0305 have ranged from 0.014 to 0.046 mg/L. Although levels decreased by more than half between 2001 and 2006, they have since stabilized at about 0.02 mg/L. Although historically exceeding the 0.01 mg/L UMTRCA MCL, all results have been below the 0.05 mg/L SDWA maximum contaminant level (SDWA MCL). Selenium concentrations in background well 0300 and well 0307 have been less than 0.005 mg/L, well below the UMTRCA MCL.

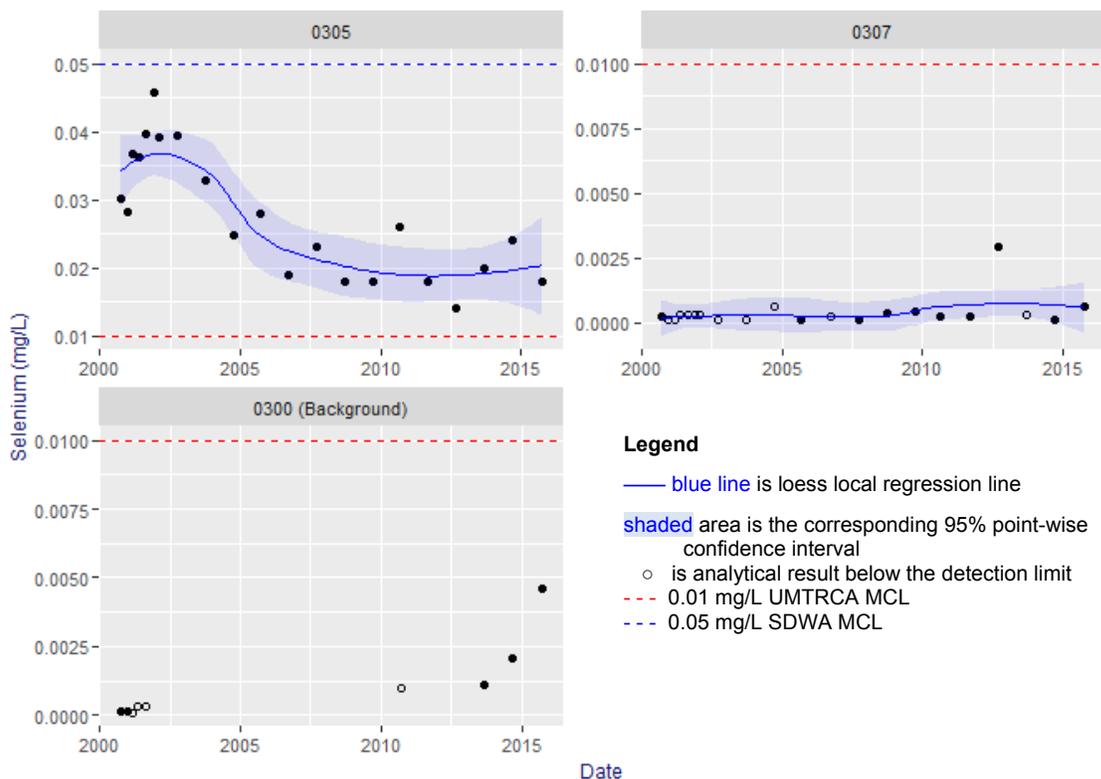


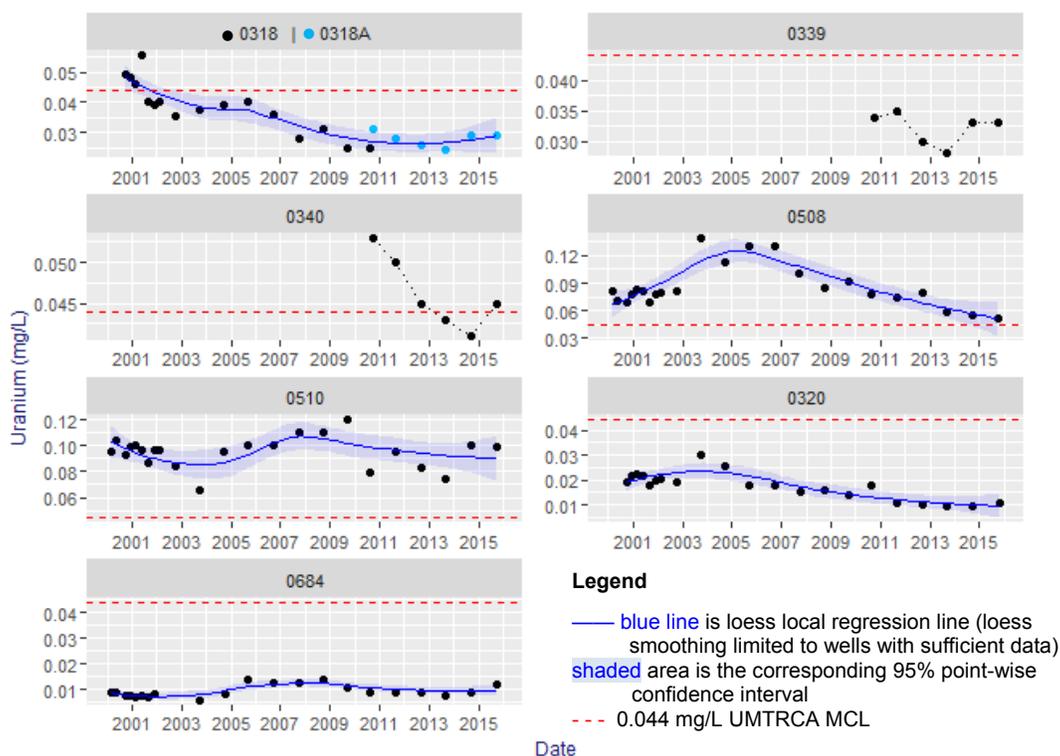
Figure 8. Selenium Concentrations over Time in SRE Wells 0300, 0305, and 0307

4.2 SRW Site Groundwater Monitoring Results

The two COPCs common to both Slick Rock sites are uranium and selenium. Other constituents monitored at the SRW site include manganese, molybdenum, and nitrate. BTEX, ^{226}Ra , and ^{228}Ra are monitored at a single SRW well, 0319, as this is the only location where these constituents have been elevated.

4.2.1 SRW Uranium

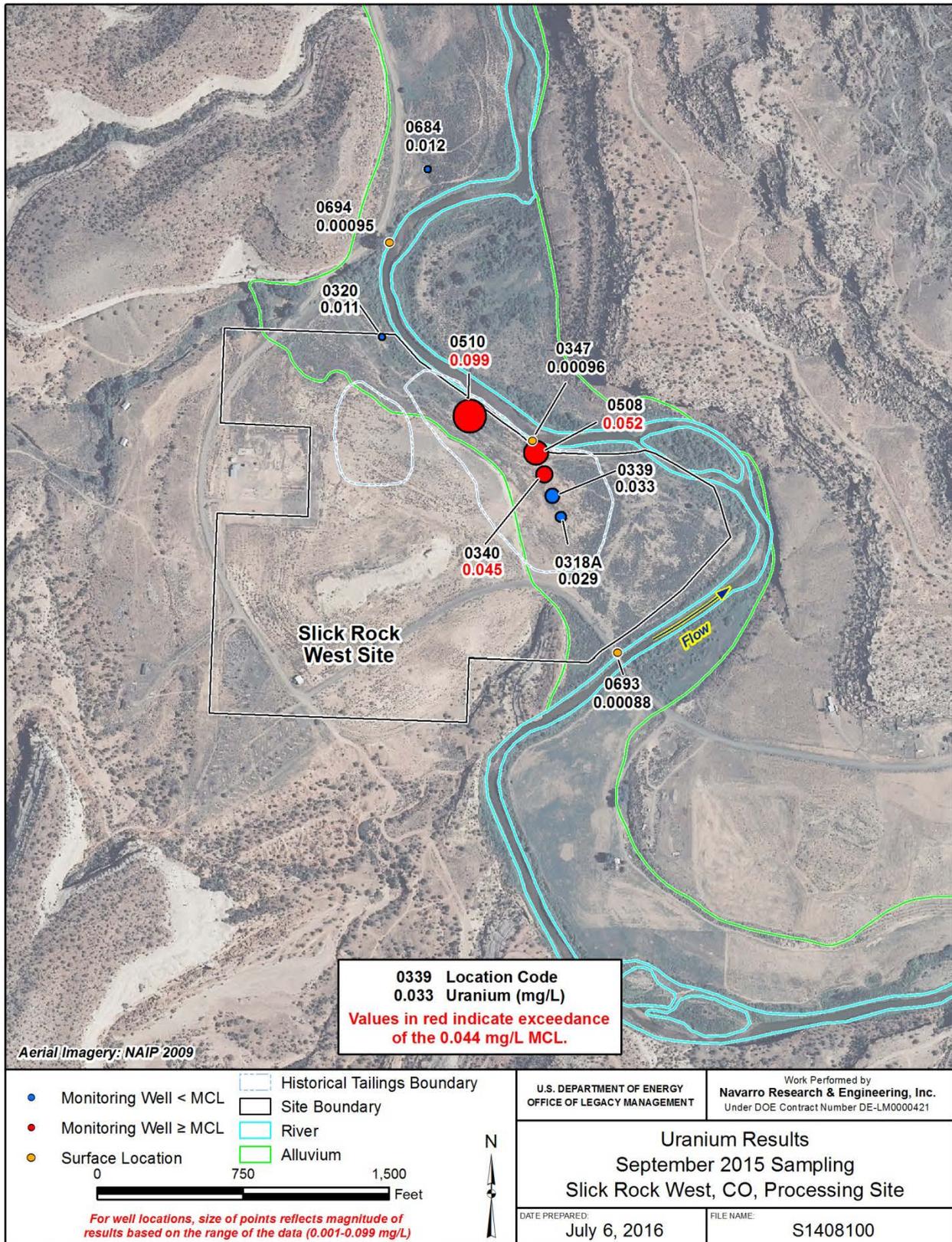
Uranium concentrations have consistently exceeded the 0.044 mg/L UMTRCA MCL in only two SRW wells—wells 0508 and 0510 (Figure 9). Since 2006, uranium concentrations in well 0508 have decreased to levels approaching the MCL. The most recent result, 0.052 mg/L, is the lowest uranium level measured in this well. To the north, in well 0510, uranium levels have been generally stable at about 0.1 mg/L. Since 2000, uranium concentrations in well 0318|0318A have declined to about 0.03 mg/L, below the MCL. Levels in nearby wells 0339 and 0340 are similar but slightly higher. The most recent (2015) result for well 0340, 0.045 mg/L, slightly exceeds the MCL. (Due to a broken well screen, well 0318 was abandoned and replaced with well 0318A in September 2010; wells 0339 and 0340 were installed at the same time [Section 3.2].) Uranium concentrations in remaining wells 0320 and 0684 have been consistently below the MCL, stable at about 0.01 mg/L. Figure 10 plots the most recent (September 2015) uranium results for all SRW wells along with Dolores River surface water monitoring results (discussed in Section 4.3).



Note:

In this and subsequent SRW figures, well-specific plots are ordered to reflect spatial locations shown in Figure 10, where wells 0320 and 0684 are farthest from the historical tailings boundary.

Figure 9. Uranium Concentrations over Time in SRW Monitoring Wells



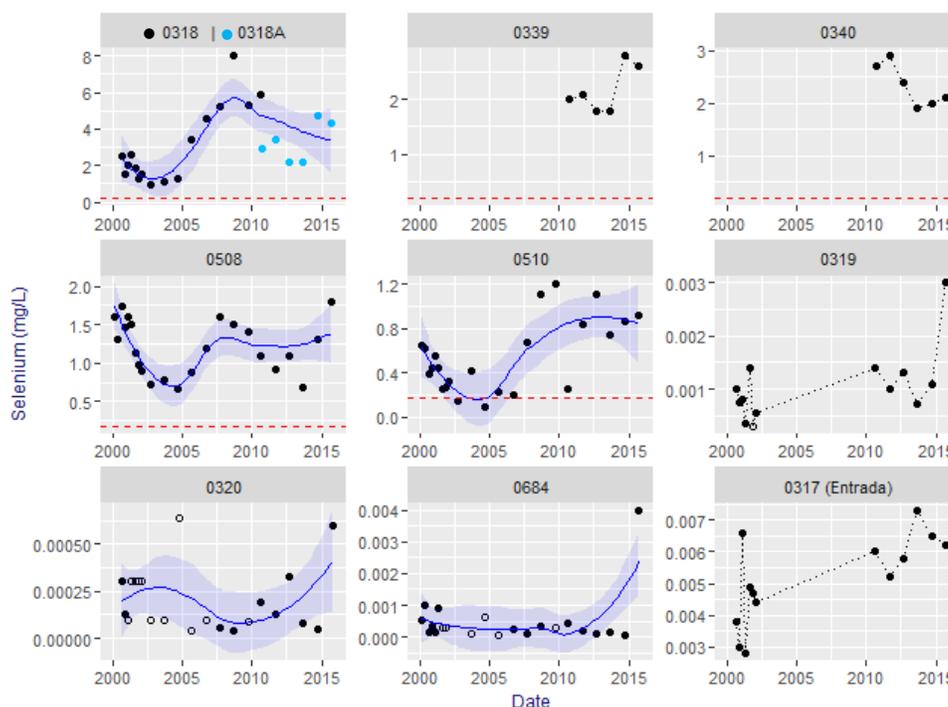
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Figure 10. Uranium Distribution at SRW Site, September 2015

4.2.2 SRW Selenium

Figure 11 plots selenium concentrations over time in all SRW wells. Figure 12 maps the most recent (September 2015) monitoring results for both groundwater and surface water samples. Selenium has been historically elevated in SRW alluvial wells 0318|0318A, 0508, and 0510 within the historical tailings area; this is also the case for recently installed wells 0339 and 0340. Selenium levels have been highest in well 0318|0318A. For the first few years following the installation of replacement well 0318A in 2010, selenium levels in that well were about half those measured in well 0318 between 2006 and 2010 (but still well above the 0.18 mg/L proposed ACL). In more recent years, selenium levels in well 0318A have rebounded to about 4 mg/L. Selenium concentrations in wells 0339 and 0340 are now about half those measured in well 0318A.

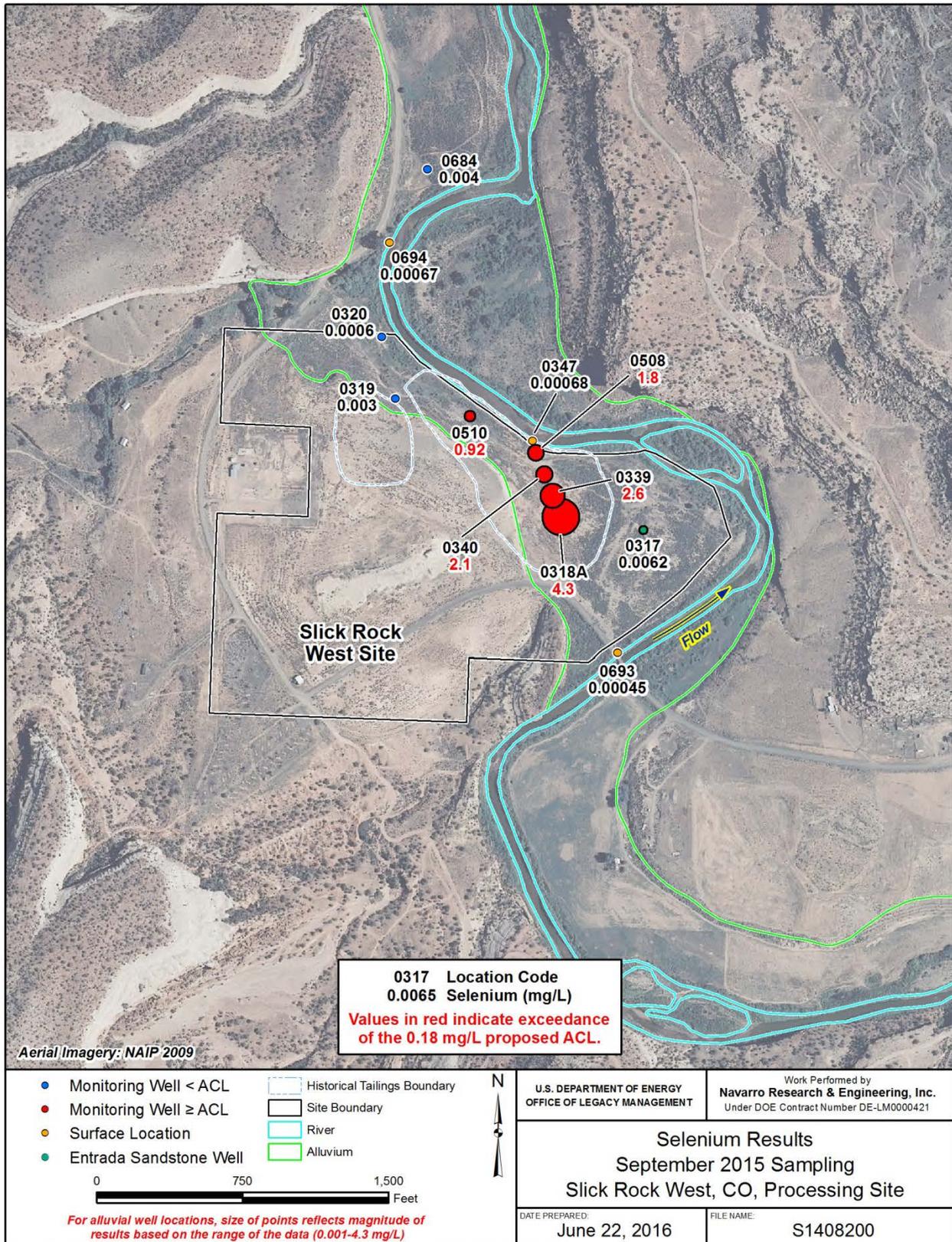
Selenium levels in wells 0508 and 0510 have fluctuated, but in the last several years they have averaged about 1 mg/L. In 2010, to verify the extent of the selenium plume, DOE resumed monitoring for selenium at alluvial well 0319 (previously sampled only for BTEX and radium) and Entrada well 0317. In these wells, selenium concentrations have always been below both the 0.18 mg/L proposed ACL and the 0.01 mg/L UMRCA MCL. This is also the case for northernmost wells 0320 and 0684, which have a longer and more consistent monitoring history. For all SRW wells, selenium concentrations measured in 2015 are higher, albeit slightly, than those measured in 2000, the start of the monitoring period.



Notes:

— blue line is loess local regression line (omitted for wells with limited data or large gaps in sampling);
 shaded area is the corresponding 95% point-wise confidence interval; --- 0.18 mg/L ACL for SRW site
 (not shown for wells with historical results below 0.01 mg/L); ○ is analytical result below the detection limit.

Figure 11. Selenium Concentrations over Time in SRW Wells

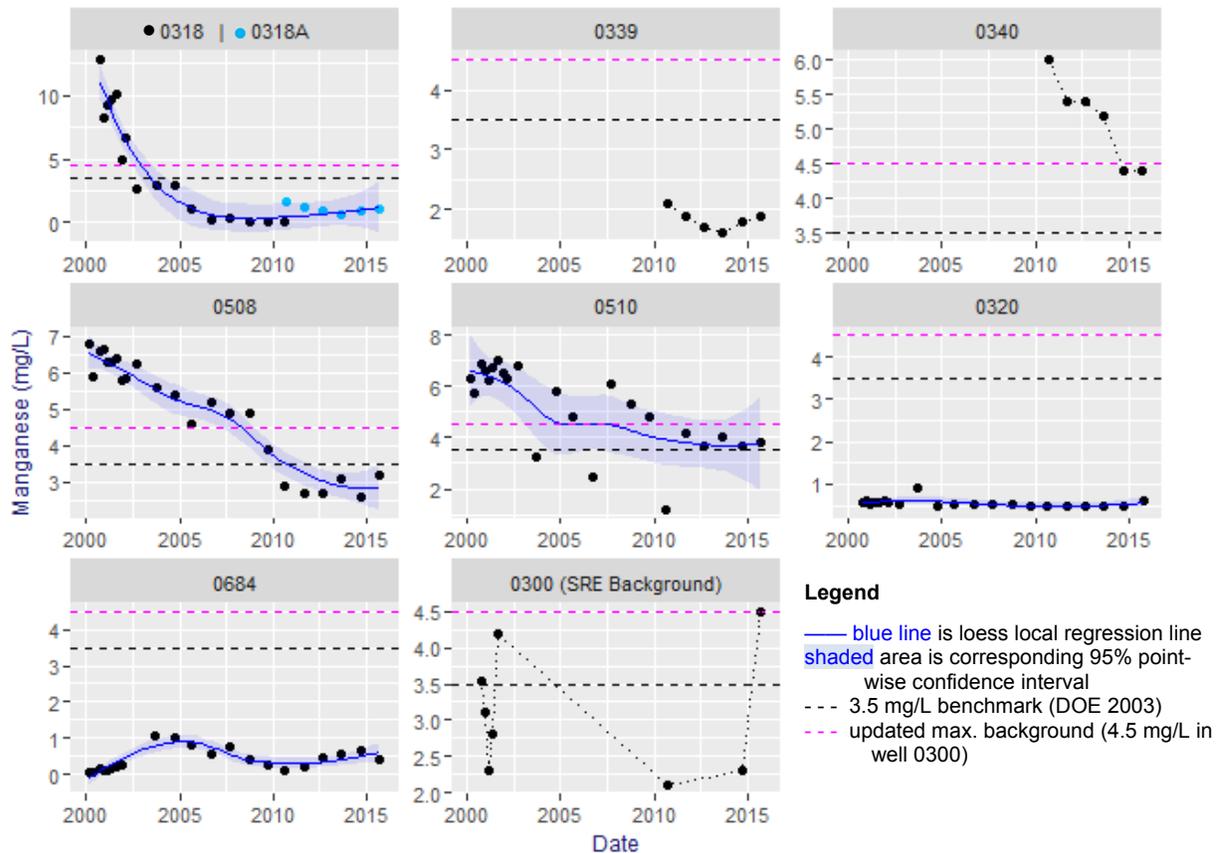


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Figure 12. Selenium Distribution at SRW Site, September 2015

4.2.3 Manganese

Manganese concentrations measured in SRW wells in September 2015 (0.42–4.4 mg/L) are all below the recent (maximum) level measured in SRE background well 0300 (4.5 mg/L). Although levels in tailings area wells 0318|0318A, 0340, 0508, and 0510 have been elevated relative to the 3.5 mg/L benchmark (see Table 1, Note "d"), they have since declined and are now comparable to or less than background (Figure 13). Manganese concentrations in northernmost alluvial wells 0320 and 0684 have always been low (about 1 mg/L) relative to the background benchmark.



Note:

The loess smoothing line is omitted for wells with limited data or large gaps in sampling.

Figure 13. Manganese Concentrations over Time at the SRW Site

4.2.4 Molybdenum

Figure 14 plots molybdenum concentrations over time at currently monitored SRW wells. This constituent has been elevated in all SRW alluvial wells except downgradient well 0320 and offsite (northernmost) well 0684, where levels have been stable at about 0.01 mg/L for the last decade. In wells within the historical tailings area—0318|0318A, 0339, 0340, 0508, and 0510—molybdenum concentrations have been fairly stable at about 1 to 1.5 mg/L, one order of magnitude above the UMTRCA MCL, for several years.

The increase in molybdenum concentrations in former well 0318 between 2004 and 2008 (peaking at 4.8 mg/L) has been attributed to sediment accumulation within the damaged well (e.g., DOE 2015).³ Molybdenum levels in replacement well 0318A have been lower but are still high (0.7–1.7 mg/L) relative to the MCL. As shown in Figure 14, molybdenum concentrations in all SRW alluvial wells are comparable to those measured in 2000, the start of the monitoring period. Attenuation of molybdenum is apparent in Entrada well 0317, however, where levels have halved: from an early peak of 0.32 mg/L in December 2000 to the current level of 0.16 mg/L in September 2015, approaching the 0.1 mg/L benchmark. This downward trend is apparent in Figure 14.

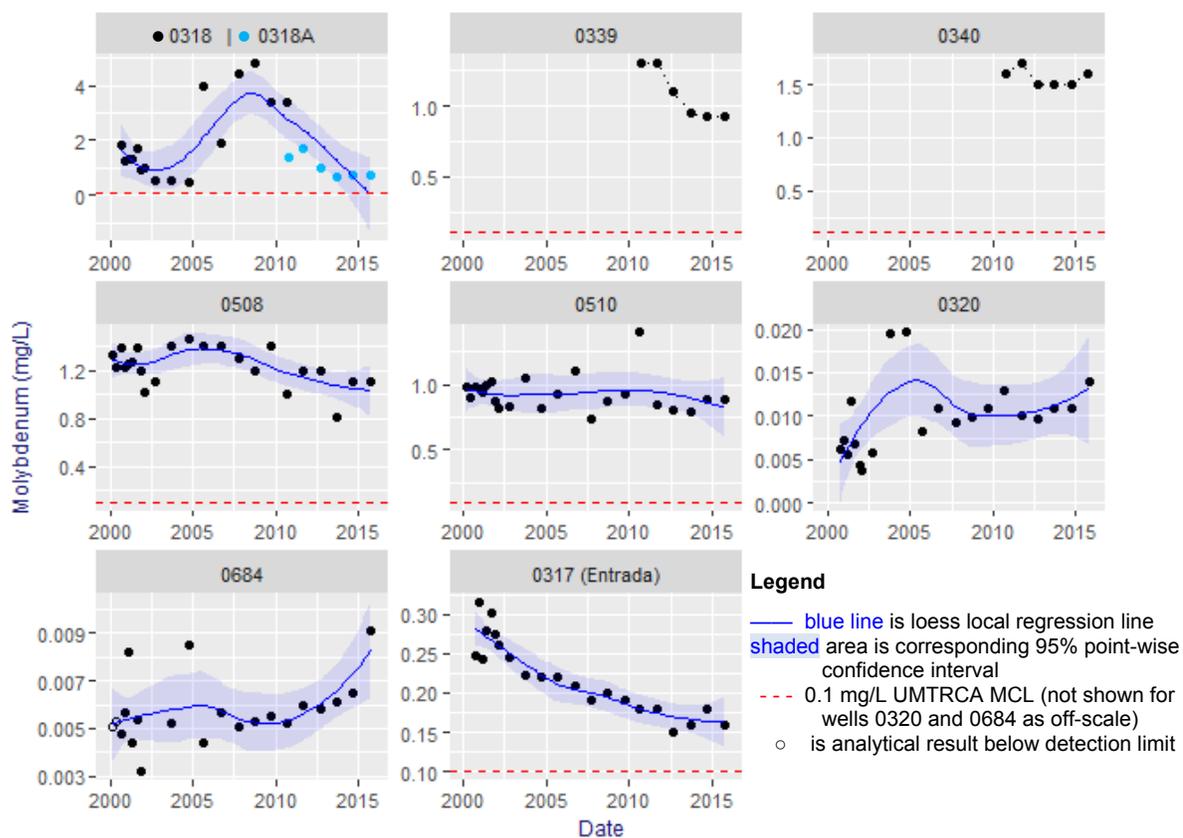


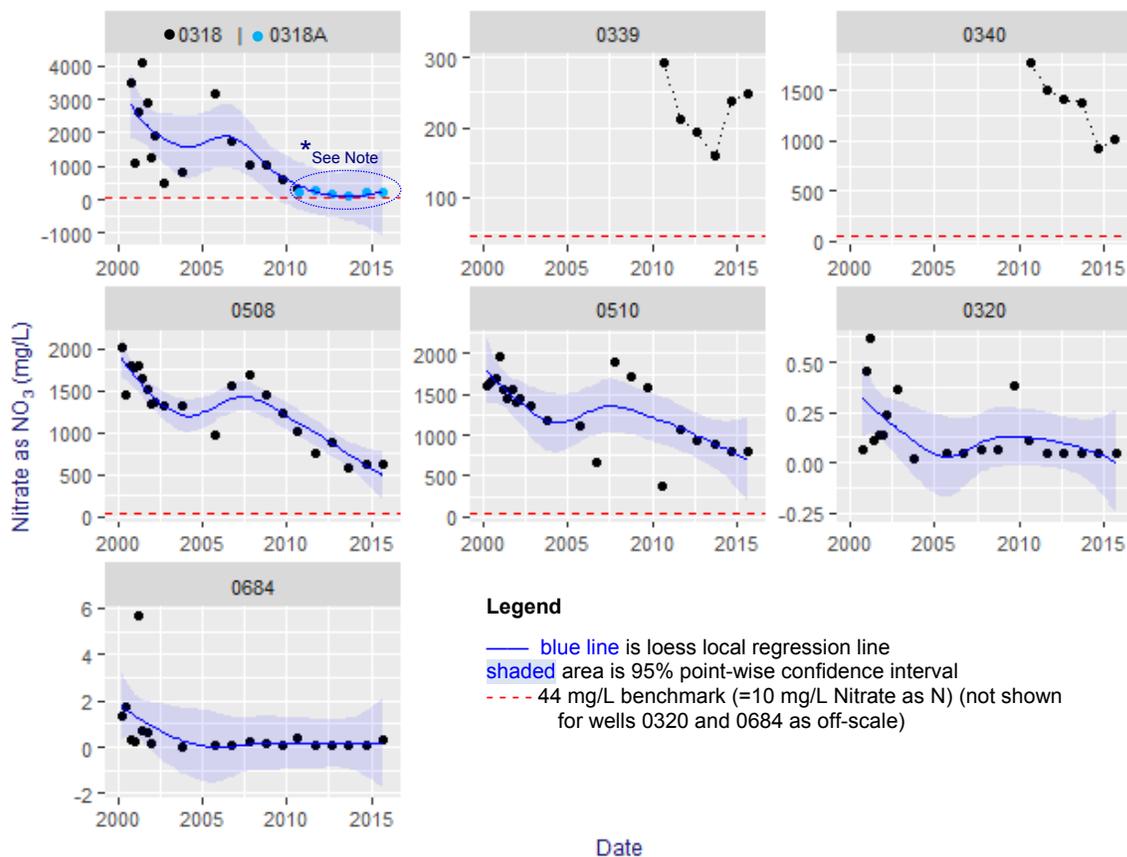
Figure 14. Molybdenum Concentrations over Time in SRW Wells with Elevated Concentrations

³ Because of the sediment accumulation, it was not possible to sample from within the screened interval. Rather, samples were collected from within the uppermost blank casing near the top of the water table.

4.2.5 Nitrate

Figure 15 shows nitrate (as NO_3) concentrations over time at currently monitored SRW wells. Since 2000, nitrate levels have declined in all alluvial wells within the historical tailings boundary: 0318|0318A, 0508, and 0510. Those in well 0318|0318A have declined by more than an order of magnitude: from a peak of 4090 mg/L in 2001 to 221 mg/L in 2015. Downward trends are also apparent for well 0508—2010 mg/L baseline vs. current 620 mg/L—and well 0510, where concentrations halved (from 1600 to 800 mg/L). Despite these declines, nitrate levels are still substantially above the 44.3 mg/L benchmark in these former tailings area wells.

Nitrate concentrations in wells 0339 and 0340, installed downgradient of well 0318A in 2010, have also exceeded the UMTRCA MCL. Levels in well 0339 (159–292 mg/L) have been comparable to those measured in well 0318A, while those in well 0339 have been higher (930–1771 mg/L). Although there are not enough data to evaluate trends, nitrate concentrations in well 0340 have declined somewhat since 2010, from about 1800 mg/L to 1019 mg/L (2015 result). Nitrate levels in downgradient well 0320 and northernmost offsite well 0684 continue to be well below the 44.3 mg/L benchmark; no trending is apparent. Concentrations in these wells have ranged from 0.02 to 0.6 mg/L and 0.02–6 mg/L, respectively.



Notes:

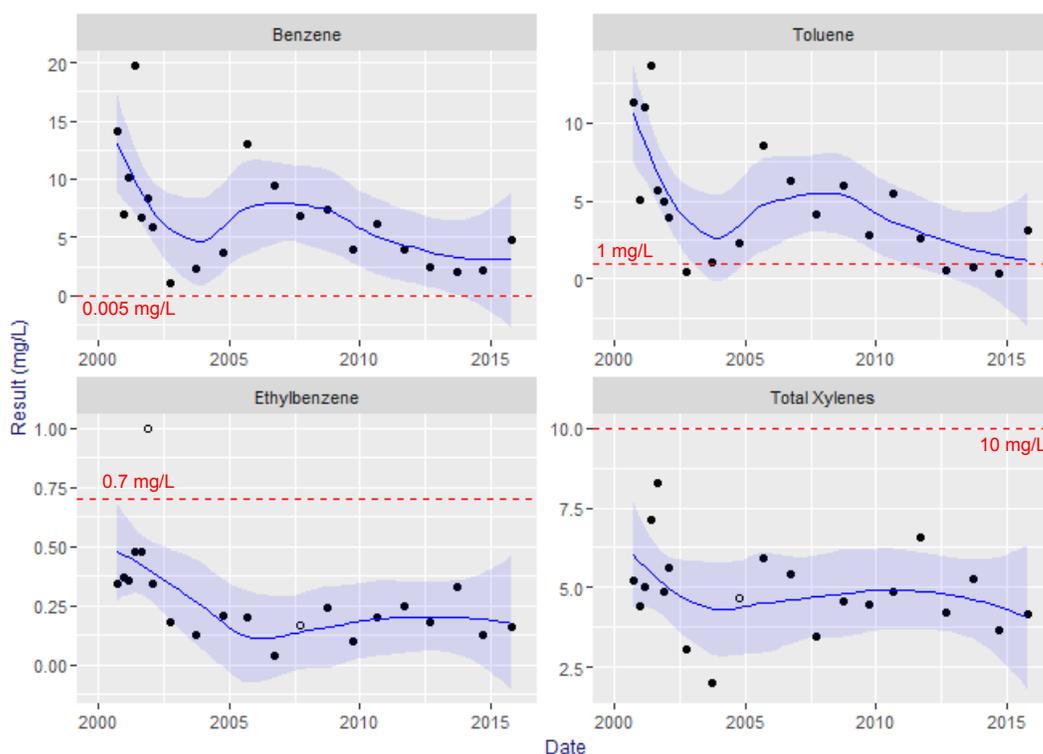
Nitrate concentrations in 0318A (●), difficult to discern in this plot given initial highly elevated levels in collocated former well 0318, have been very similar to those measured in nearby well 0339. Levels have ranged from about 100 to 300 mg/L; most recent measurement is 221 mg/L.

Figure 15. Nitrate (as NO_3) Concentrations over Time in SRW Wells

4.2.6 BTEX (Well 0319)

During site characterization activities conducted for the SOWP (DOE 2002), a localized aromatic hydrocarbon plume was identified in the area of alluvial well 0319 (Figure 4), where light nonaqueous phase liquid had been identified. This is the only SRW well currently monitored for BTEX.⁴ As shown in Figure 16, benzene is the only constituent that has consistently exceeded the corresponding SDWA MCL. Although concentrations have varied over time with no apparent trend, benzene levels have stabilized somewhat since 2010, averaging about 4 mg/L. These recent levels are about 2 orders of magnitude above the 0.005 mg/L SDWA MCL drinking water standard. However, because there is no exposure to alluvial groundwater at the site, these exceedances pose no human health risk.

Concentrations of toluene have declined since 2000, from a maximum of 13.7 mg/L to 3.1 mg/L (2015 result). The three previous (2012–2014) measurements were below the 1 mg/L SDWA MCL. Detectable levels of ethylbenzene and total xylenes have never exceeded corresponding benchmarks in well 0319 groundwater samples.



Notes:

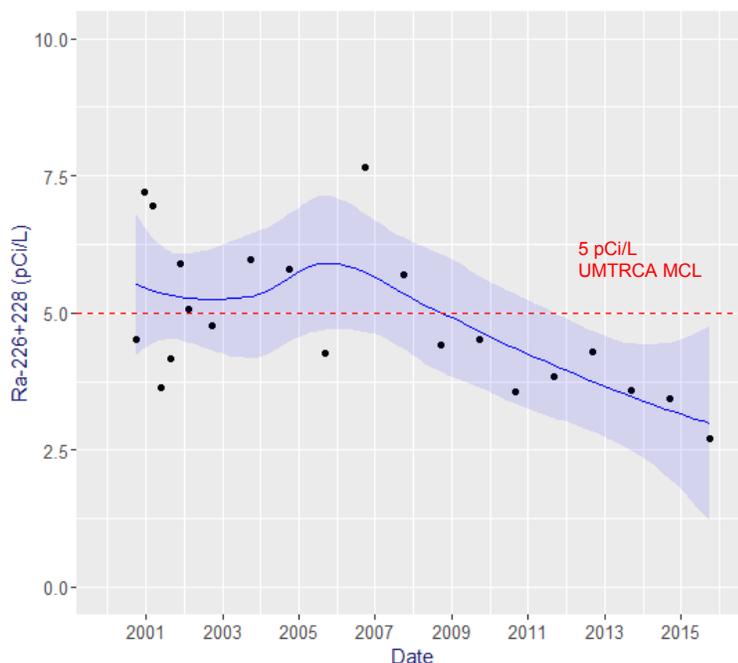
— blue line is loess local regression line; shaded area is the corresponding 95% point-wise confidence interval; ○ is analytical result below the detection limit; --- denotes the SDWA MCLs listed in Table 1.

Figure 16. BTEX Concentrations over Time in SRW Well 0319

⁴ During initial site characterization activities, nine other SRW wells, in addition to well 0319, were monitored for BTEX: 0320, 0326, and 0332–0338 (7 wells). In 2000–2001, elevated levels were detected in wells 0332 and 0333, located within 100 ft of well 0319 to the south and southwest. Because the maximum benzene concentration was in well 0319 (nearly 20 mg/L), this well is the focus of continued monitoring. Wells 0332–0338 have since been decommissioned.

4.2.7 ^{226}Ra and ^{228}Ra (Well 0319)

Although ^{226}Ra and ^{228}Ra have been detected in other wells, their presence above the 5 picocuries per liter (pCi/L) UMTRCA MCL has historically been limited to well 0319, which is also the BTEX hotspot. Figure 17, which plots $^{226}\text{Ra} + ^{228}\text{Ra}$ concentrations in well 0319 over time, shows that radium levels have been below 5 pCi/L since 2008.



Notes:

— blue line is loess local regression line; shaded area is the corresponding 95% point-wise confidence interval.

Figure 17. Concentrations of $^{226}\text{Ra} + ^{228}\text{Ra}$ (Combined) in SRW Well 0319

4.3 Surface Water Monitoring Results (Both SRE and SRW Sites)

Based on annual surface water sampling conducted since 2000 and comparison to corresponding surface water standards, there has been no apparent impact to the Dolores River from historical milling activities at the Slick Rock former processing sites. At all Dolores River monitoring locations, CDPHE water quality benchmarks were not exceeded in 2015 (Table 4), consistent with most historical results. For most analytes and locations, concentrations were well below these standards.

Two Dolores River locations—SRE surface location 0700 and SRW location 0349—could not be sampled because they were inaccessible at the time of sampling due to the density of vegetation along the bank of the Dolores River (DOE 2016).

Table 4. Comparison of 2015 COPC Concentrations in the Dolores River to CDPHE Benchmarks

COPC	CDPHE Benchmark ^a (mg/L)		Lower Dolores River Location						
			SRE Site			SRW Site			
			0696 Bkgd.	0692	0700 ^b	0693 Bkgd.	0347	0349 ^b	0694
			Acute	Chronic	2015 Result (mg/L)				
Manganese	---	0.05	–	–	NS	0.0031	0.028	NS	0.0059
Molybdenum	---	0.16 (T)	–	–	NS	0.0011	0.0014	NS	0.0016
Nitrate as NO ₃	44.3 ^c		–	–	NS	<0.044	<0.044	NS	<0.044
Selenium	0.0184	0.0046	–	–	NS	0.0004	0.0006	NS	0.0006
Uranium	TVS	0.0168–0.03 (SWDA) (T) ^d	0.0009	0.0011	NS	0.0008	0.0009	NS	0.0009

Notes:

^a From CDPHE Regulation 35, Table 35.6, unless indicated otherwise (CDPHE 2016). Applicable segment is Segment 2 (COGULD02): Mainstem of the Dolores River from Highway 141 road crossing near Slick Rock to the Colorado/Utah border, Agriculture, Aquatic Life, WS-I, Recreation E, WS.

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https://www.colorado.gov/pacific/sites/default/files/35_2016%2806%29-Appendix35-1_.pdf

Within LM, the links above can only be opened with Google Chrome or other non-Microsoft-Explorer browser.

^b SRE surface location 0700 and SRW location 0349 could not be sampled because they were inaccessible at the time of sampling because of the density of vegetation along the bank of the Dolores River (DOE 2016).

^c CDPHE (2016) benchmark is 10 mg/L nitrate as N; value in table is converted to 44.3 mg/L to express nitrate as NO₃. In 2015, nitrate was not detected in SRW surface water samples.

^d The uranium standard is a range, from the CDPHE Water Quality Control Commission's health-based value (0.0168 mg/L) to the SDWA MCL (0.03 mg/L). The acute TVS value for uranium is a function of hardness: Acute = $e^{(1.1021[\ln(\text{hardness})]+2.7088)}$. Hardness is not analyzed for in Dolores River samples so the chronic criterion is used.

Abbreviations:

– = not sampled for that analyte

Bkgd. = background

N = nitrogen

NS = not sampled

T = total recoverable

TVS = table value standard; this designation refers to numerical criteria set forth in the Basic Standards and Methodologies for Surface Water (first link of those listed above)

WS = water supply

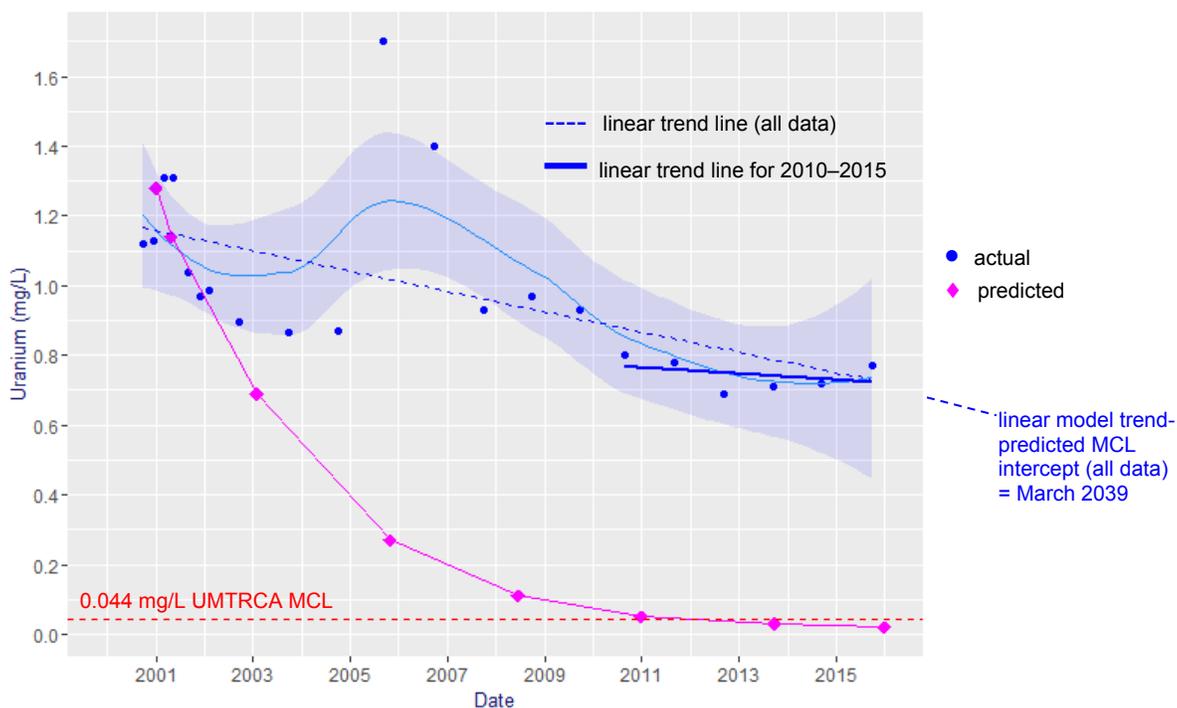
WS-I = warm stream temperature tier one

5.0 Natural Flushing Assessment

In support of the SOWP for the Slick Rock site, a groundwater flow and transport model was developed to evaluate whether natural flushing would reduce concentrations of site COPCs in the alluvial aquifer to levels below benchmark values within 100 years (DOE 2002). Because modeling predicted that site COPCs would be below benchmarks within 50 years, natural flushing was selected as a compliance strategy. This section evaluates the status of natural flushing for the Slick Rock former processing sites by plotting actual versus predicted concentrations for modeled constituents in the target wells, SRE well 0305 and SRW well 0508.

5.1 SRE Site

Figure 18 plots uranium concentrations in SRE well 0305 versus groundwater model predictions. Uranium concentrations, although slightly decreasing, are not attenuating as rapidly as predicted. Actual concentrations, 0.7–0.8 mg/L in the last several years, are more than an order of magnitude above predicted values. The current linear trendline (all data since 2000) shows that uranium levels would decline to the MCL by March 2039. However, as shown in Figure 18, uranium levels seem to have stabilized since 2010. If the linear trend is recalculated to include only recent data (2010–2015), the time projected to reach the 0.044 mg/L MCL increases by another 54 years (predicted MCL intercept of July 2093).



Notes:

— blue line is loess local regression line; shaded area is the corresponding 95% point-wise confidence interval.

Figure 18. Actual Versus Predicted Uranium Concentrations in SRE Well 0305

The model-predicted uranium trend shown in Figure 18 is based on results from a 2001 modeling effort. At that time, the soil-water distribution coefficient (K_d) was believed to be the primary transport parameter controlling uranium migration rates in groundwater. Since then, research conducted at the Riverton, Wyoming, Processing Site has found that there are other physical and geochemical processes that control uranium migration rates in groundwater, and that uranium plumes are expected to persist beyond previous predictions based on K_d alone (Dam and others 2015). The Riverton site is similar to the Slick Rock site in that both are underlain by alluvium and are located adjacent to rivers. While the mechanisms controlling uranium transport at the two sites may not be identical, it is likely that the transport mechanisms present at the Slick Rock processing site are more complex than the controls assumed during the modeling assessment performed in 2001.

5.2 SRW Site

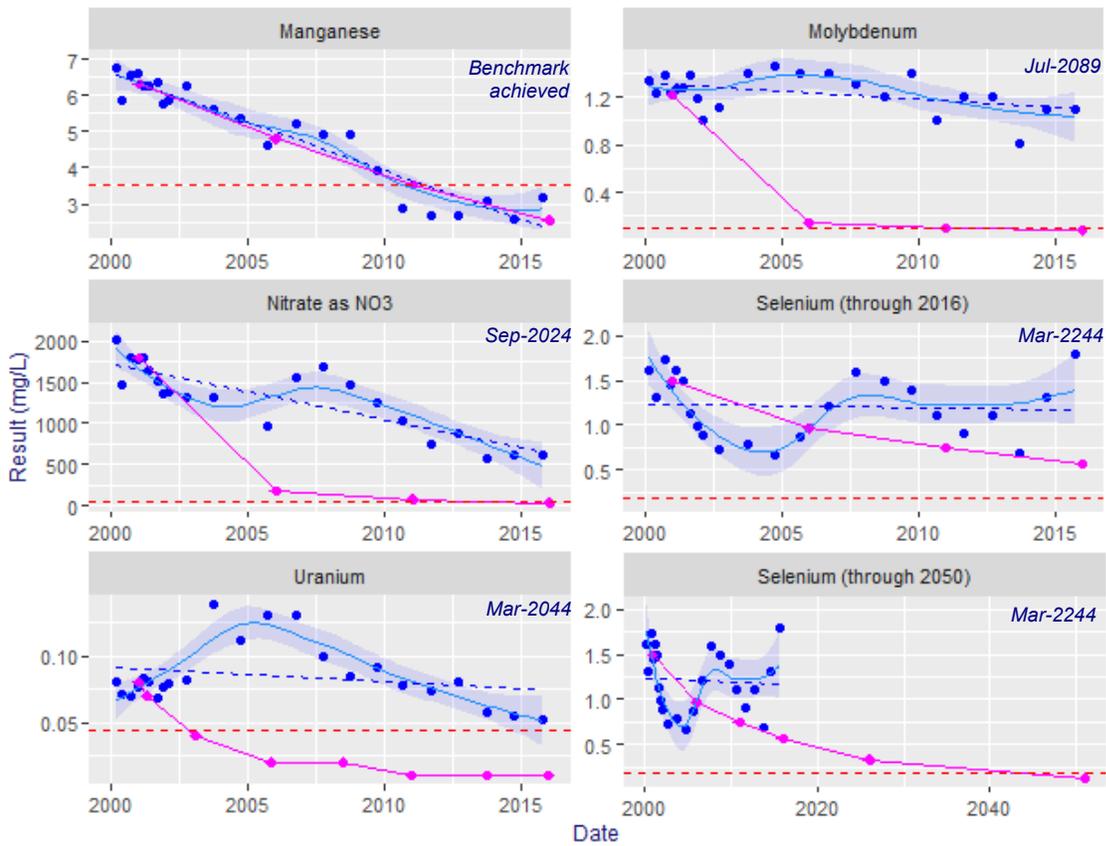
Figure 19 plots measured concentrations of manganese, molybdenum, nitrate, selenium, and uranium in SRW well 0508 versus model predictions. Except for selenium, concentrations of all these parameters had been predicted to decline to levels below corresponding benchmarks by 2016. Based on actual data, this has occurred only for manganese, for which there is close agreement between actual measurements and predicted values. Manganese concentrations have fallen below background levels in this (0508) and remaining SRW wells (Figure 13).

Molybdenum levels, although showing a slight decrease, are still an order of magnitude above both the 0.1 mg/L benchmark and predicted concentrations. Nitrate levels in SRW well 0508 have declined from about 2000 mg/L to 600 mg/L. While recent actual measurements are still about an order of magnitude above the 44 mg/L standard, the trend for nitrate indicates that concentrations should continue to decline to levels below the MCL within the accepted remedy timeframe.

Except for a few outliers, selenium concentrations have remained stable at about 1–1.5 mg/L since 2007, well above the 0.18 mg/L benchmark. Selenium was initially predicted to fall below this level by 2051, but when applying a linear model to actual measurements, this is not estimated to happen until 2244, well beyond the 100-year time frame required to meet the natural flushing objective.

Although the actual trend does not parallel the predicted trend for uranium, concentrations in SRW well 0508 have declined from 0.13 mg/L to 0.05 mg/L, approaching the 0.044 mg/L UMTRCA MCL.

In summary, manganese, nitrate, and uranium levels in SRW well 0508 have declined, although not as quickly as predicted. However, selenium and molybdenum seem recalcitrant to attenuation in this and other SRW alluvial wells.



Notes:

• actual; ♦ predicted; — blue line is loess local regression line; shaded region is corresponding 95% point-wise confidence interval; - - - corresponding benchmark listed in Table 1; For all COCs except manganese (for which benchmark has been met), the date listed in the upper right corner of each plot (e.g., *Jul-2089*) denotes the updated linear model trend-projected-benchmark intercept based on actual measurements through 2015—i.e., the time when contaminant concentrations are predicted to decline to levels below corresponding benchmarks.

Figure 19. Predicted Versus Actual Concentrations of SRW COCs in SRW Well 0508

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6.0 Conclusions

6.1 Status of Site Compliance

Although the 100-year time frame established in 40 CFR 192 does not commence until NRC approves the GCAP (DOE 2006), data presented in Sections 4.0 and 5.0 suggest that some constituents are not attenuating as initially predicted by groundwater modeling conducted for the SOWP (DOE 2002). For example, no attenuation of uranium is apparent in SRE plume area wells, as levels have remained generally stable (0.5–1 mg/L) since monitoring began in 2000. In SRW wells, groundwater concentrations of uranium, selenium, molybdenum, and nitrate remain elevated within the site's historical tailings boundary. Uranium and nitrate levels have decreased in some wells, but little to no attenuation is apparent for molybdenum and selenium in alluvial wells since 2000. Selenium appears most recalcitrant to attenuation; in all SRW wells, selenium levels are about equal to or slightly greater than those measured 15 years ago. Manganese concentrations in SRW wells are now comparable to or less than background, suggesting that monitoring for this constituent could be phased out from the monitoring program. In SRW well 0319, concentrations of BTEX are slowly declining, but benzene is still above the benchmark. Concentrations of $^{226}\text{Ra} + ^{228}\text{Ra}$ (combined) in SRW well 0319 have been below the 5 pCi/L benchmark since 2008.

6.2 Recommendations

Annual verification monitoring of groundwater from designated monitoring wells and surface water locations, and from newer wells 0339 and 0340, should continue as specified in the draft final GCAP (DOE 2006), with the modifications recommended in this section. Annual monitoring is planned for 10 years after NRC concurrence with the GCAP, after which monitoring requirements will be reevaluated. Based on earlier modeling predictions it was anticipated that monitoring at the Slick Rock processing site could eventually be decreased to once every 5 years. However, given historical fluctuations in contaminant concentrations in some wells and persistent contamination north of the Dolores River, it may be advisable to adjust this projected decrease in monitoring frequency to once every 2 years until contaminant concentrations stabilize or decline.

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7.0 References

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Appendix A

Groundwater Quality Data by Parameter

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GROUNDWATER QUALITY DATA BY PARAMETER WITH DEPTH (USEE200) FOR SITE SRK06, Slick Rock East Processing Site
 REPORT DATE: 6/21/2016 10:51 am

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	0300	WL	09/28/2015	N001	9.50 - 19.50	618	F #	-	-
	mg/L	0303	WL	09/29/2015	N001	4.30 - 14.30	572	F #	-	-
	mg/L	0305	WL	09/29/2015	N001	8.70 - 18.70	398	F #	-	-
	mg/L	0307	WL	09/29/2015	N001	4.40 - 14.40	309	F #	-	-
	mg/L	0309	WL	09/29/2015	N001	10.20 - 20.20	584	F #	-	-
	mg/L	0310	WL	09/28/2015	N001	14.70 - 19.70	170	F #	-	-
	mg/L	0311	WL	09/28/2015	N001	14.10 - 19.10	229	F #	-	-
	mg/L	0672	WL	10/15/2015	N001		261	#	-	-
Manganese	mg/L	0300	WL	09/28/2015	N001	9.50 - 19.50	4.500	F #	0.0012	-
	mg/L	0672	WL	10/15/2015	N001		0.00024 U	#	0.00024	-
Molybdenum	mg/L	0300	WL	09/28/2015	N001	9.50 - 19.50	0.0038	F #	0.00032	-
	mg/L	0672	WL	10/15/2015	N001		0.00057 J	J #	0.00032	-
Nitrate + Nitrite as Nitrogen	mg/L	0300	WL	09/28/2015	N001	9.50 - 19.50	0.03	F #	0.01	-
Oxidation Reduction Potential	mV	0300	WL	09/28/2015	N001	9.50 - 19.50	-94.3	F #	-	-
	mV	0303	WL	09/29/2015	N001	4.30 - 14.30	-100.6	F #	-	-
	mV	0305	WL	09/29/2015	N001	8.70 - 18.70	60.9	F #	-	-
	mV	0307	WL	09/29/2015	N001	4.40 - 14.40	-86.8	F #	-	-
	mV	0309	WL	09/29/2015	N001	10.20 - 20.20	-126.7	F #	-	-
	mV	0310	WL	09/28/2015	N001	14.70 - 19.70	-69.1	F #	-	-
	mV	0311	WL	09/28/2015	N001	14.10 - 19.10	106.9	F #	-	-
	mV	0672	WL	10/15/2015	N001		80.1	#	-	-
pH	s.u.	0300	WL	09/28/2015	N001	9.50 - 19.50	6.87	F #	-	-
	s.u.	0303	WL	09/29/2015	N001	4.30 - 14.30	7.22	F #	-	-
	s.u.	0305	WL	09/29/2015	N001	8.70 - 18.70	7.20	F #	-	-

GROUNDWATER QUALITY DATA BY PARAMETER WITH DEPTH (USEE200) FOR SITE SRK06, Slick Rock East Processing Site
 REPORT DATE: 6/21/2016 10:51 am

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN-CERTAINTY
pH	s.u.	0307	WL	09/29/2015	N001	4.40 - 14.40	7.17	F #	-	-
	s.u.	0309	WL	09/29/2015	N001	10.20 - 20.20	7.65	F #	-	-
	s.u.	0310	WL	09/28/2015	N001	14.70 - 19.70	7.17	F #	-	-
	s.u.	0311	WL	09/28/2015	N001	14.10 - 19.10	6.98	F #	-	-
	s.u.	0672	WL	10/15/2015	N001		8.07	#	-	-
Radium-226	pCi/L	0300	WL	09/28/2015	N001	9.50 - 19.50	0.16	U F #	0.16	± 0.12
Radium-228	pCi/L	0300	WL	09/28/2015	N001	9.50 - 19.50	0.453	UF #	0.45	± 0.31
Selenium	mg/L	0300	WL	09/28/2015	N001	9.50 - 19.50	0.0046	FJ #	0.00032	-
	mg/L	0305	WL	09/29/2015	N001	8.70 - 18.70	0.018	F #	0.00032	-
	mg/L	0307	WL	09/29/2015	N001	4.40 - 14.40	0.00063	J FJ #	0.00032	-
	mg/L	0672	WL	10/15/2015	N001		0.0016	J #	0.00032	-
Specific Conductance	umhos/cm	0300	WL	09/28/2015	N001	9.50 - 19.50	10900	F #	-	-
	umhos/cm	0303	WL	09/29/2015	N001	4.30 - 14.30	3826	F #	-	-
	umhos/cm	0305	WL	09/29/2015	N001	8.70 - 18.70	2826	F #	-	-
	umhos/cm	0307	WL	09/29/2015	N001	4.40 - 14.40	5168	F #	-	-
	umhos/cm	0309	WL	09/29/2015	N001	10.20 - 20.20	1752	F #	-	-
	umhos/cm	0310	WL	09/28/2015	N001	14.70 - 19.70	994	F #	-	-
	umhos/cm	0311	WL	09/28/2015	N001	14.10 - 19.10	1113	F #	-	-
	umhos/cm	0672	WL	10/15/2015	N001		518	#	-	-
Temperature	C	0300	WL	09/28/2015	N001	9.50 - 19.50	16.19	F #	-	-
	C	0303	WL	09/29/2015	N001	4.30 - 14.30	17.97	F #	-	-
	C	0305	WL	09/29/2015	N001	8.70 - 18.70	15.33	F #	-	-
	C	0307	WL	09/29/2015	N001	4.40 - 14.40	14.96	F #	-	-
	C	0309	WL	09/29/2015	N001	10.20 - 20.20	14.67	F #	-	-
	C	0310	WL	09/28/2015	N001	14.70 - 19.70	15.13	F #	-	-

GROUNDWATER QUALITY DATA BY PARAMETER WITH DEPTH (USEE200) FOR SITE SRK06, Slick Rock East Processing Site
 REPORT DATE: 6/21/2016 10:51 am

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN-CERTAINTY
Temperature	C	0311	WL	09/28/2015	N001	14.10 - 19.10	17.50	F #	-	-
	C	0672	WL	10/15/2015	N001		26.40	#	-	-
Turbidity	NTU	0300	WL	09/28/2015	N001	9.50 - 19.50	3.96	F #	-	-
	NTU	0303	WL	09/29/2015	N001	4.30 - 14.30	7.88	F #	-	-
	NTU	0305	WL	09/29/2015	N001	8.70 - 18.70	9.59	F #	-	-
	NTU	0307	WL	09/29/2015	N001	4.40 - 14.40	6.17	F #	-	-
	NTU	0309	WL	09/29/2015	N001	10.20 - 20.20	9.25	F #	-	-
	NTU	0310	WL	09/28/2015	N001	14.70 - 19.70	3.54	F #	-	-
	NTU	0311	WL	09/28/2015	N001	14.10 - 19.10	4.77	F #	-	-
	NTU	0672	WL	10/15/2015	N001		14.2	#	-	-
Uranium	mg/L	0300	WL	09/28/2015	N001	9.50 - 19.50	0.013	F #	2.9E-05	-
	mg/L	0303	WL	09/29/2015	N001	4.30 - 14.30	1.300	F #	0.00029	-
	mg/L	0305	WL	09/29/2015	N001	8.70 - 18.70	0.770	F #	2.9E-05	-
	mg/L	0307	WL	09/29/2015	N001	4.40 - 14.40	0.400	F #	2.9E-05	-
	mg/L	0309	WL	09/29/2015	N001	10.20 - 20.20	0.037	F #	2.9E-05	-
	mg/L	0310	WL	09/28/2015	N001	14.70 - 19.70	0.025	F #	2.9E-05	-
	mg/L	0311	WL	09/28/2015	N001	14.10 - 19.10	0.053	F #	2.9E-05	-
	mg/L	0672	WL	10/15/2015	N001		0.0034	#	2.9E-05	-

GROUNDWATER QUALITY DATA BY PARAMETER WITH DEPTH (USEE200) FOR SITE SRK06, Slick Rock East Processing Site
 REPORT DATE: 6/21/2016 10:51 am

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN-CERTAINTY
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RECORDS: SELECTED FROM USEE200 WHERE site_code='SRK06' AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED between #1/1/2015# and #1/1/2016#

SAMPLE ID CODES: 000X = Filtered sample. N00X = Unfiltered sample. X = replicate number.

LOCATION TYPES: WL WELL

LAB QUALIFIERS:

- * Replicate analysis not within control limits.
- + Correlation coefficient for MSA < 0.995.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: 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
- M GFAA duplicate injection precision not met.
- 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.
- S Result determined by method of standard addition (MSA).
- U Analytical result below detection limit.
- W Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
- X Laboratory defined qualifier, see case narrative.
- Y Laboratory defined qualifier, see case narrative.
- Z Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

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

QA QUALIFIER: # = validated according to Quality Assurance guidelines.

GROUNDWATER QUALITY DATA BY PARAMETER WITH DEPTH (USEE200) FOR SITE SRK05, Slick Rock West Processing Site
 REPORT DATE: 6/21/2016 10:53 am

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE:		DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS:			UN-CERTAINTY
				DATE	ID			LAB	DATA	QA	
Alkalinity, Total (As CaCO3)	mg/L	0317	WL	09/29/2015	N001	19.46 - 39.52	303	F	#	-	-
	mg/L	0318A	WL	09/29/2015	N001	9.20 - 14.20	289	F	#	-	-
	mg/L	0319	WL	10/15/2015	N001	4.55 - 14.58	946	F	#	-	-
	mg/L	0320	WL	10/15/2015	N001	4.92 - 9.96	324	F	#	-	-
	mg/L	0339	WL	09/29/2015	N001	11.00 - 14.00	289	F	#	-	-
	mg/L	0340	WL	09/30/2015	N001	6.51 - 11.51	135	F	#	-	-
	mg/L	0508	WL	09/30/2015	N001	1.01 - 11.01	317	F	#	-	-
	mg/L	0510	WL	09/30/2015	N001	4.92 - 13.92	130	F	#	-	-
	mg/L	0684	WL	09/30/2015	N001	11.00 - 21.00	230	F	#	-	-
Benzene	ug/L	0319	WL	10/15/2015	N001	4.55 - 14.58	4800	F	#	30	-
Ethylbenzene	ug/L	0319	WL	10/15/2015	N001	4.55 - 14.58	160	F	#	30	-
m,p-Xylene	ug/L	0319	WL	10/15/2015	N001	4.55 - 14.58	3400	F	#	30	-
Manganese	mg/L	0318A	WL	09/29/2015	N001	9.20 - 14.20	1.100	F	#	0.00011	-
	mg/L	0318A	WL	09/29/2015	N002	9.20 - 14.20	1.100	F	#	0.00024	-
	mg/L	0320	WL	10/15/2015	N001	4.92 - 9.96	0.590	F	#	0.00024	-
	mg/L	0339	WL	09/29/2015	N001	11.00 - 14.00	1.900	F	#	0.00011	-
	mg/L	0340	WL	09/30/2015	0001	6.51 - 11.51	4.400	F	#	0.00011	-
	mg/L	0508	WL	09/30/2015	N001	1.01 - 11.01	3.200	F	#	0.00024	-
	mg/L	0510	WL	09/30/2015	N001	4.92 - 13.92	3.800	F	#	0.00024	-
	mg/L	0684	WL	09/30/2015	N001	11.00 - 21.00	0.420	F	#	0.00024	-
Molybdenum	mg/L	0317	WL	09/29/2015	N001	19.46 - 39.52	0.160	F	#	0.00032	-
	mg/L	0318A	WL	09/29/2015	N001	9.20 - 14.20	0.710	F	#	0.00032	-
	mg/L	0318A	WL	09/29/2015	N002	9.20 - 14.20	0.720	F	#	0.00032	-
	mg/L	0320	WL	10/15/2015	N001	4.92 - 9.96	0.014	F	#	0.00032	-
	mg/L	0339	WL	09/29/2015	N001	11.00 - 14.00	0.920	F	#	0.00032	-

GROUNDWATER QUALITY DATA BY PARAMETER WITH DEPTH (USEE200) FOR SITE SRK05, Slick Rock West Processing Site
 REPORT DATE: 6/21/2016 10:53 am

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN-CERTAINTY
Molybdenum	mg/L	0340	WL	09/30/2015	0001	6.51 - 11.51	1.600	F #	0.00032	-
	mg/L	0508	WL	09/30/2015	N001	1.01 - 11.01	1.100	F #	0.00032	-
	mg/L	0510	WL	09/30/2015	N001	4.92 - 13.92	0.890	F #	0.00032	-
	mg/L	0684	WL	09/30/2015	N001	11.00 - 21.00	0.0091	F #	0.00032	-
Nitrate + Nitrite as Nitrogen	mg/L	0318A	WL	09/29/2015	N001	9.20 - 14.20	50	F #	1	-
	mg/L	0318A	WL	09/29/2015	N002	9.20 - 14.20	50	F #	1	-
	mg/L	0320	WL	10/15/2015	N001	4.92 - 9.96	0.01	U F #	0.01	-
	mg/L	0339	WL	09/29/2015	N001	11.00 - 14.00	56	F #	1	-
	mg/L	0340	WL	09/30/2015	0001	6.51 - 11.51	230	F #	5	-
	mg/L	0508	WL	09/30/2015	N001	1.01 - 11.01	140	F #	2	-
	mg/L	0510	WL	09/30/2015	N001	4.92 - 13.92	180	F #	5	-
	mg/L	0684	WL	09/30/2015	N001	11.00 - 21.00	0.078	F #	0.01	-
Oxidation Reduction Potential	mV	0317	WL	09/29/2015	N001	19.46 - 39.52	155.0	F #	-	-
	mV	0318A	WL	09/29/2015	N001	9.20 - 14.20	135.4	F #	-	-
	mV	0319	WL	10/15/2015	N001	4.55 - 14.58	-91.0	F #	-	-
	mV	0320	WL	10/15/2015	N001	4.92 - 9.96	-70.8	F #	-	-
	mV	0339	WL	09/29/2015	N001	11.00 - 14.00	157.8	F #	-	-
	mV	0340	WL	09/30/2015	N001	6.51 - 11.51	123.5	F #	-	-
	mV	0508	WL	09/30/2015	N001	1.01 - 11.01	88.7	F #	-	-
	mV	0510	WL	09/30/2015	N001	4.92 - 13.92	123.9	F #	-	-
	mV	0684	WL	09/30/2015	N001	11.00 - 21.00	84.3	F #	-	-
o-Xylene	ug/L	0319	WL	10/15/2015	N001	4.55 - 14.58	770	F #	30	-
pH	s.u.	0317	WL	09/29/2015	N001	19.46 - 39.52	7.18	F #	-	-
	s.u.	0318A	WL	09/29/2015	N001	9.20 - 14.20	6.98	F #	-	-

GROUNDWATER QUALITY DATA BY PARAMETER WITH DEPTH (USEE200) FOR SITE SRK05, Slick Rock West Processing Site
 REPORT DATE: 6/21/2016 10:53 am

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN-CERTAINTY
pH	s.u.	0319	WL	10/15/2015	N001	4.55 - 14.58	7.04	F #	-	-
	s.u.	0320	WL	10/15/2015	N001	4.92 - 9.96	7.18	F #	-	-
	s.u.	0339	WL	09/29/2015	N001	11.00 - 14.00	6.94	F #	-	-
	s.u.	0340	WL	09/30/2015	N001	6.51 - 11.51	6.69	F #	-	-
	s.u.	0508	WL	09/30/2015	N001	1.01 - 11.01	6.76	F #	-	-
	s.u.	0510	WL	09/30/2015	N001	4.92 - 13.92	6.60	F #	-	-
	s.u.	0684	WL	09/30/2015	N001	11.00 - 21.00	7.29	F #	-	-
Radium-226	pCi/L	0319	WL	09/28/2015	0001	4.55 - 14.58	1.41	F #	0.13	± 0.45
	pCi/L	0319	WL	09/28/2015	0002	4.55 - 14.58	1.41	F #	0.17	± 0.45
Radium-228	pCi/L	0319	WL	09/28/2015	0001	4.55 - 14.58	1.3	F #	0.43	± 0.44
	pCi/L	0319	WL	09/28/2015	0002	4.55 - 14.58	1.28	FJ #	0.44	± 0.44
Selenium	mg/L	0317	WL	09/29/2015	N001	19.46 - 39.52	0.0062	FJ #	0.00032	-
	mg/L	0318A	WL	09/29/2015	N001	9.20 - 14.20	4.300	F #	0.00032	-
	mg/L	0318A	WL	09/29/2015	N002	9.20 - 14.20	4.400	F #	0.00032	-
	mg/L	0319	WL	09/28/2015	0001	4.55 - 14.58	0.003	FJ #	0.00032	-
	mg/L	0319	WL	09/28/2015	0002	4.55 - 14.58	0.0074	FJ #	0.00032	-
	mg/L	0320	WL	10/15/2015	N001	4.92 - 9.96	0.0006	J FJ #	0.00032	-
	mg/L	0339	WL	09/29/2015	N001	11.00 - 14.00	2.600	F #	0.00032	-
	mg/L	0340	WL	09/30/2015	0001	6.51 - 11.51	2.100	F #	0.00032	-
	mg/L	0508	WL	09/30/2015	N001	1.01 - 11.01	1.800	F #	0.00032	-
	mg/L	0510	WL	09/30/2015	N001	4.92 - 13.92	0.920	F #	0.00032	-
	mg/L	0684	WL	09/30/2015	N001	11.00 - 21.00	0.004	FJ #	0.00032	-
Specific Conductance	umhos/cm	0317	WL	09/29/2015	N001	19.46 - 39.52	2553	F #	-	-
	umhos/cm	0318A	WL	09/29/2015	N001	9.20 - 14.20	1939	F #	-	-
	umhos/cm	0319	WL	10/15/2015	N001	4.55 - 14.58	3350	F #	-	-

GROUNDWATER QUALITY DATA BY PARAMETER WITH DEPTH (USEE200) FOR SITE SRK05, Slick Rock West Processing Site
 REPORT DATE: 6/21/2016 10:53 am

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE:		DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS:			UN-CERTAINTY
				DATE	ID			LAB	DATA	QA	
Specific Conductance	umhos/cm	0320	WL	10/15/2015	N001	4.92 - 9.96	964	F	#	-	-
	umhos/cm	0339	WL	09/29/2015	N001	11.00 - 14.00	2028	F	#	-	-
	umhos/cm	0340	WL	09/30/2015	N001	6.51 - 11.51	3536	F	#	-	-
	umhos/cm	0508	WL	09/30/2015	N001	1.01 - 11.01	3004	F	#	-	-
	umhos/cm	0510	WL	09/30/2015	N001	4.92 - 13.92	3510	F	#	-	-
	umhos/cm	0684	WL	09/30/2015	N001	11.00 - 21.00	1006	F	#	-	-
Temperature	C	0317	WL	09/29/2015	N001	19.46 - 39.52	15.03	F	#	-	-
	C	0318A	WL	09/29/2015	N001	9.20 - 14.20	18.86	F	#	-	-
	C	0319	WL	10/15/2015	N001	4.55 - 14.58	15.72	F	#	-	-
	C	0320	WL	10/15/2015	N001	4.92 - 9.96	16.20	F	#	-	-
	C	0339	WL	09/29/2015	N001	11.00 - 14.00	17.05	F	#	-	-
	C	0340	WL	09/30/2015	N001	6.51 - 11.51	18.64	F	#	-	-
	C	0508	WL	09/30/2015	N001	1.01 - 11.01	17.47	F	#	-	-
	C	0510	WL	09/30/2015	N001	4.92 - 13.92	16.20	F	#	-	-
	C	0684	WL	09/30/2015	N001	11.00 - 21.00	13.88	F	#	-	-
Toluene	ug/L	0319	WL	10/15/2015	N001	4.55 - 14.58	3100	F	#	30	-
Turbidity	NTU	0317	WL	09/29/2015	N001	19.46 - 39.52	9.85	F	#	-	-
	NTU	0318A	WL	09/29/2015	N001	9.20 - 14.20	8.62	F	#	-	-
	NTU	0319	WL	10/15/2015	N001	4.55 - 14.58	7.71	F	#	-	-
	NTU	0320	WL	10/15/2015	N001	4.92 - 9.96	9.80	F	#	-	-
	NTU	0339	WL	09/29/2015	N001	11.00 - 14.00	8.05	F	#	-	-
	NTU	0340	WL	09/30/2015	N001	6.51 - 11.51	33.8	F	#	-	-
	NTU	0508	WL	09/30/2015	N001	1.01 - 11.01	7.21	F	#	-	-
	NTU	0510	WL	09/30/2015	N001	4.92 - 13.92	9.56	F	#	-	-
	NTU	0684	WL	09/30/2015	N001	11.00 - 21.00	9.63	F	#	-	-

GROUNDWATER QUALITY DATA BY PARAMETER WITH DEPTH (USEE200) FOR SITE SRK05, Slick Rock West Processing Site
 REPORT DATE: 6/21/2016 10:53 am

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE:		DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS:			UN-CERTAINTY
				DATE	ID			LAB	DATA	QA	
Uranium	mg/L	0318A	WL	09/29/2015	N001	9.20 - 14.20	0.029	F	#	2.9E-05	-
	mg/L	0318A	WL	09/29/2015	N002	9.20 - 14.20	0.028	F	#	2.9E-05	-
	mg/L	0320	WL	10/15/2015	N001	4.92 - 9.96	0.011	F	#	2.9E-05	-
	mg/L	0339	WL	09/29/2015	N001	11.00 - 14.00	0.033	F	#	2.9E-05	-
	mg/L	0340	WL	09/30/2015	0001	6.51 - 11.51	0.045	F	#	2.9E-05	-
	mg/L	0508	WL	09/30/2015	N001	1.01 - 11.01	0.052	F	#	2.9E-05	-
	mg/L	0510	WL	09/30/2015	N001	4.92 - 13.92	0.099	F	#	2.9E-05	-
	mg/L	0684	WL	09/30/2015	N001	11.00 - 21.00	0.012	F	#	2.9E-05	-

GROUNDWATER QUALITY DATA BY PARAMETER WITH DEPTH (USEE200) FOR SITE SRK05, Slick Rock West Processing Site
 REPORT DATE: 6/21/2016 10:53 am

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN-CERTAINTY
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RECORDS: SELECTED FROM USEE200 WHERE site_code='SRK05' AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED between #1/1/2015# and #1/1/2016#

SAMPLE ID CODES: 000X = Filtered sample. N00X = Unfiltered sample. X = replicate number.

LOCATION TYPES: WL WELL

LAB QUALIFIERS:

- * Replicate analysis not within control limits.
- + Correlation coefficient for MSA < 0.995.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: 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
- M GFAA duplicate injection precision not met.
- 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.
- S Result determined by method of standard addition (MSA).
- U Analytical result below detection limit.
- W Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
- X Laboratory defined qualifier, see case narrative.
- Y Laboratory defined qualifier, see case narrative.
- Z Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

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

QA QUALIFIER: # = validated according to Quality Assurance guidelines.

Appendix B

Surface Water Quality Data by Parameter

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SURFACE WATER QUALITY DATA BY PARAMETER (USEE800) FOR SITE SRK06, Slick Rock East Processing Site
 REPORT DATE: 6/21/2016 11:00 am

PARAMETER	UNITS	LOCATION CODE	SAMPLE: DATE	ID	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO ₃)	mg/L	0692	09/29/2015	N001	124	#	-	-
	mg/L	0696	09/29/2015	N001	114	#	-	-
Oxidation Reduction Potential	mV	0692	09/29/2015	N001	110.3	#	-	-
	mV	0696	09/29/2015	N001	127.7	#	-	-
pH	s.u.	0692	09/29/2015	N001	8.52	#	-	-
	s.u.	0696	09/29/2015	N001	8.54	#	-	-
Specific Conductance	umhos/cm	0692	09/29/2015	N001	379	#	-	-
	umhos/cm	0696	09/29/2015	N001	380	#	-	-
Temperature	C	0692	09/29/2015	N001	27.89	#	-	-
	C	0696	09/29/2015	N001	21.36	#	-	-
Turbidity	NTU	0696	09/29/2015	N001	69.4	#	-	-
Uranium	mg/L	0692	09/29/2015	0001	0.0011	#	2.9E-05	-
	mg/L	0696	09/29/2015	0001	0.0009	#	2.9E-05	-

SURFACE WATER QUALITY DATA BY PARAMETER (USEE800) FOR SITE SRK06, Slick Rock East Processing Site
 REPORT DATE: 6/21/2016 11:00 am

PARAMETER	UNITS	LOCATION CODE	SAMPLE: DATE	ID	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN-CERTAINTY
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RECORDS: SELECTED FROM USEE800 WHERE site_code='SRK06' AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED between #1/1/2015# and #1/1/2016#

SAMPLE ID CODES: 000X = Filtered sample. N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

- * Replicate analysis not within control limits.
- + Correlation coefficient for MSA < 0.995.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: 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
- M GFAA duplicate injection precision not met.
- 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.
- S Result determined by method of standard addition (MSA).
- U Analytical result below detection limit.
- W Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
- X Laboratory defined qualifier, see case narrative.
- Y Laboratory defined qualifier, see case narrative.
- 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. |
| N Presumptive evidence that analyte is present. The analyte is "tentatively identified". | 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.

SURFACE WATER QUALITY DATA BY PARAMETER (USEE800) FOR SITE SRK05, Slick Rock West Processing Site
 REPORT DATE: 6/21/2016 11:01 am

PARAMETER	UNITS	LOCATION CODE	SAMPLE: DATE	ID	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN-CERTAINTY
Alkalinity, Total (As CaCO3)	mg/L	0347	09/30/2015	N001	124		#	-
	mg/L	0693	10/15/2015	0001	107		#	-
	mg/L	0694	09/30/2015	N001	155		#	-
Manganese	mg/L	0347	09/30/2015	N001	0.028		#	0.00024
	mg/L	0693	10/15/2015	0001	0.0031	J	#	0.00024
	mg/L	0694	09/30/2015	0001	0.0059		#	0.00024
Molybdenum	mg/L	0347	09/30/2015	N001	0.0014		#	0.00032
	mg/L	0693	10/15/2015	0001	0.0011	J	#	0.00032
	mg/L	0694	09/30/2015	0001	0.0016		#	0.00032
Nitrate + Nitrite as Nitrogen	mg/L	0347	09/30/2015	N001	0.01	U	#	0.01
	mg/L	0693	10/15/2015	0001	0.01	U	#	0.01
	mg/L	0694	09/30/2015	0001	0.01	U	#	0.01
Oxidation Reduction Potential	mV	0347	09/30/2015	N001	50.6		#	-
	mV	0693	10/15/2015	N001	73.6		#	-
	mV	0694	09/30/2015	N001	97.2		#	-
pH	s.u.	0347	09/30/2015	N001	8.33		#	-
	s.u.	0693	10/15/2015	N001	8.37		#	-
	s.u.	0694	09/30/2015	N001	7.62		#	-
Selenium	mg/L	0347	09/30/2015	N001	0.0006	J J	#	0.00032
	mg/L	0693	10/15/2015	0001	0.0004	J J	#	0.00032
	mg/L	0694	09/30/2015	0001	0.0006	J J	#	0.00032
Specific Conductance	umhos/cm	0347	09/30/2015	N001	405		#	-
	umhos/cm	0693	10/15/2015	N001	365		#	-
	umhos/cm	0694	09/30/2015	N001	373		#	-
Temperature	C	0347	09/30/2015	N001	18.41		#	-
	C	0693	10/15/2015	N001	10.53		#	-
	C	0694	09/30/2015	N001	15.31		#	-
Turbidity	NTU	0347	09/30/2015	N001	55.6		#	-
	NTU	0693	10/15/2015	N001	84.0		#	-
	NTU	0694	09/30/2015	N001	39.2		#	-
Uranium	mg/L	0347	09/30/2015	N001	0.0009		#	2.9E-05
	mg/L	0693	10/15/2015	0001	0.0008		#	2.9E-05
	mg/L	0694	09/30/2015	0001	0.0009		#	2.9E-05

SURFACE WATER QUALITY DATA BY PARAMETER (USEE800) FOR SITE SRK05, Slick Rock West Processing Site
 REPORT DATE: 6/21/2016 11:01 am

PARAMETER	UNITS	LOCATION CODE	SAMPLE: DATE	ID	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN-CERTAINTY
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RECORDS: SELECTED FROM USEE800 WHERE site_code='SRK05' AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED between #1/1/2015# and #1/1/2016#

SAMPLE ID CODES: 000X = Filtered sample. N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

- * Replicate analysis not within control limits.
- + Correlation coefficient for MSA < 0.995.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
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- S Result determined by method of standard addition (MSA).
- U Analytical result below detection limit.
- W Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
- X Laboratory defined qualifier, see case narrative.
- Y Laboratory defined qualifier, see case narrative.
- Z Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

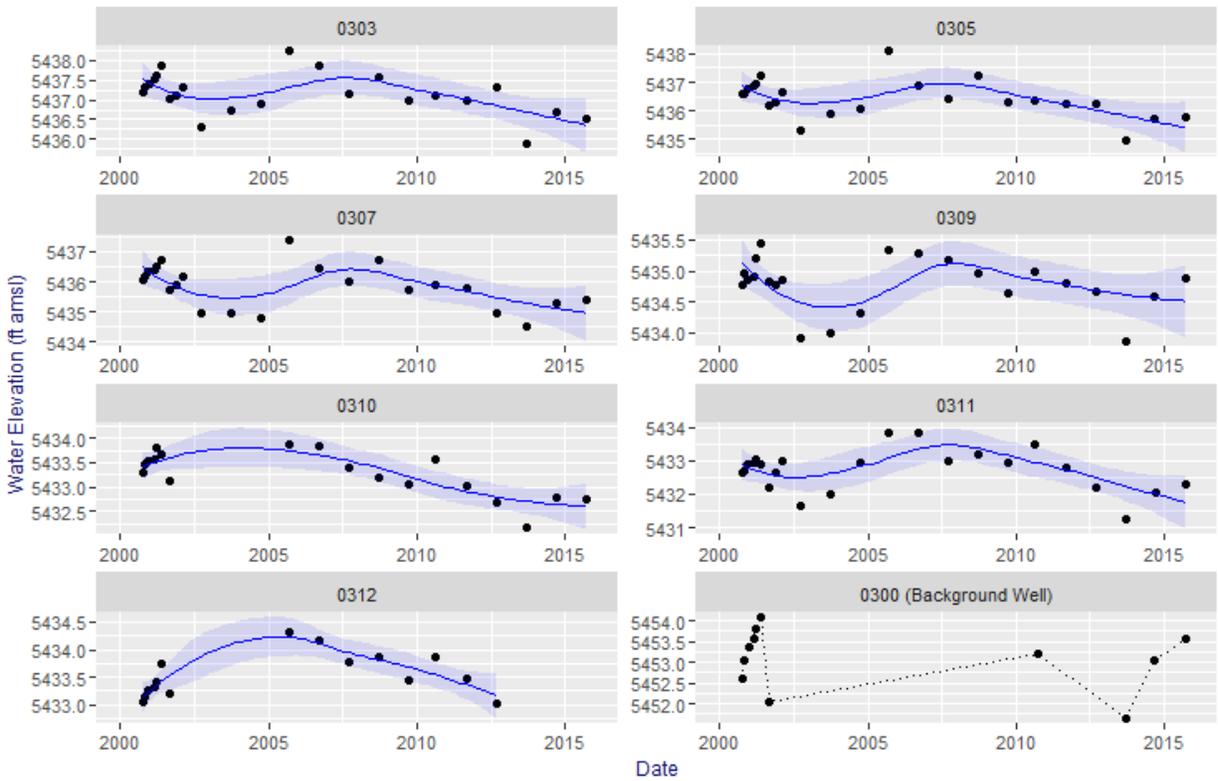
- | | |
|--|--|
| F Low flow sampling method used. | G Possible grout contamination, pH > 9. |
| J Estimated value. | L Less than 3 bore volumes purged prior to sampling. |
| N Presumptive evidence that analyte is present. The analyte is "tentatively identified". | Q Qualitative result due to sampling 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 C

Hydrographs and Static Water Level Data

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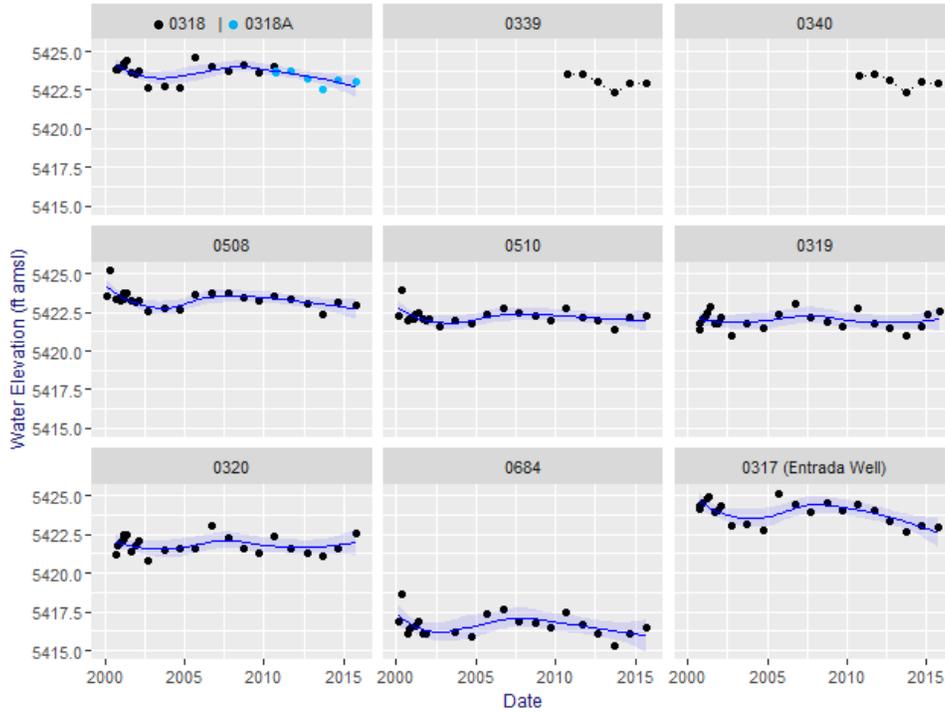


Notes:

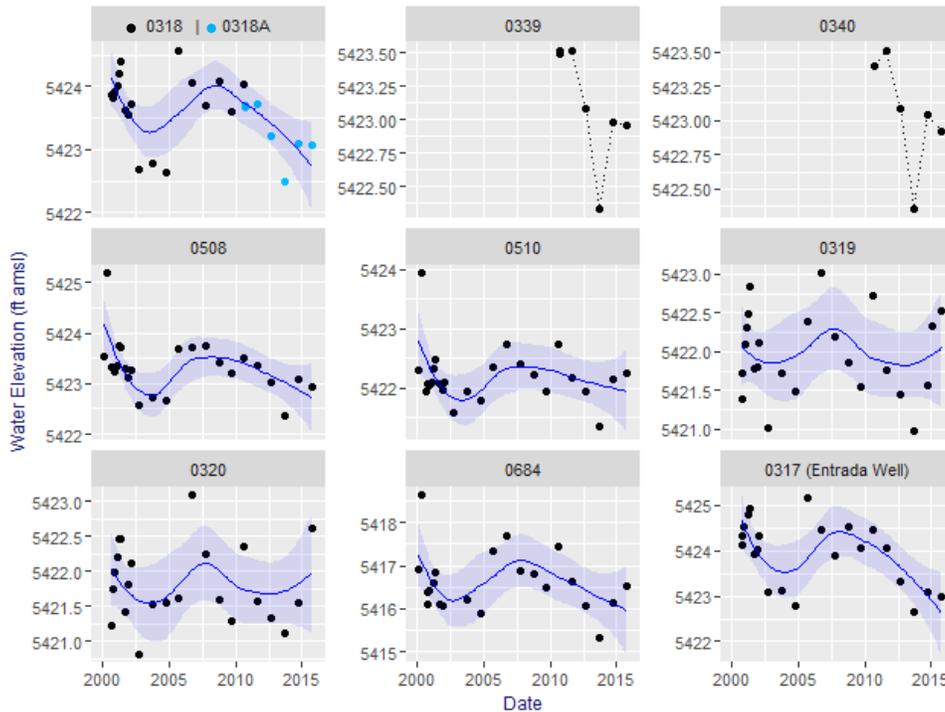
ft amsl = feet above mean sea level; —blue line is loess local regression line; shaded area is the corresponding 95% point-wise confidence interval; The loess smoothing line is omitted from the plot for background location 0300 because of the gap in sampling between 2001 and 2010.

Figure C-1. Hydrographs for Slick Rock East Processing Site Wells

a. Common y-axis



b. y-axis Unique to Each Well



Notes:

ft amsl = feet above mean sea level; —blue line is loess local regression line; shaded area is the corresponding 95% point-wise confidence interval; Wells 0318A, 0339 and 0340 were installed on September 28, 2010 (well 0318A replaced abandoned well 0318); The loess smoothing line is omitted for wells 0339 and 0340 due to lack of data; Alluvial wells are listed in general order of distance from site source area.

Figure C-2. Hydrographs for Slick Rock West Processing Site Wells