LMS/GUP/S08005

2011 Verification Monitoring Report for the Gunnison, Colorado, Processing Site

December 2011

U.S. DEPARTMENT OF ENERGY | Legacy Management

This page intentionally left blank

LMS/GUP/S08005

2011 Verification Monitoring Report for the Gunnison, Colorado, Processing Site

December 2011

This page intentionally left blank

Contents

Figures

Tables

Appendixes

Abbreviations

CDPHE	Colorado Department of Public Health and Environment
CFR	*Code of Federal Regulations*
COPC	constituent of potential concern
DOE	U.S. Department of Energy
DWEL	Drinking Water Equivalent Level
EPA	U.S. Environmental Protection Agency
ft	foot (feet)
GCAP	Ground Water Compliance Action Plan
GEMS	Geospatial Environmental Mapping System
IC	institutional control
MCL	maximum concentration limit
mg/L	milligram(s) per liter
NRC	U.S. Nuclear Regulatory Commission
RRM	residual radioactive material
SOWP	Site Observational Work Plan
UMTRCA	Uranium Mill Tailings Radiation Control Act
VMR	Verification Monitoring Report

This page intentionally left blank

1.0 Overview

The Gunnison, Colorado, Processing Site (Gunnison site) is located in Gunnison County, Colorado, approximately 0.5 mile southwest of the city of Gunnison, between the Gunnison River and Tomichi Creek (Figure 1). Site characterization details are available in the Final Site Observational Work Plan (SOWP) (DOE 2001).

The compliance strategy for groundwater cleanup at the Gunnison site is natural flushing in conjunction with continued groundwater and surface water monitoring and institutional controls (ICs). Groundwater modeling predicts that natural flushing of the alluvial aquifer beneath and downgradient of the site will be completed within the 100-year time frame specified in Subpart B of Title 40 *Code of Federal Regulations* Part 192 (40 CFR 192). The U.S. Department of Energy (DOE) and the Colorado Department of Public Health and Environment (CDPHE) funded an alternate domestic water supply system in 1994, with upgrades in 2005, to service existing users of potentially contaminated groundwater and to provide a potable water source for future development within the IC area.

Detailed information for the Gunnison site and water quality data through 1999 are available in the SOWP (DOE 2001). Site information and water quality data from recent years can be found in Verification Monitoring Reports (VMRs) (DOE 2007 to DOE 2009; DOE 2010a) located on DOE's Office of Legacy Management website at http://www.LM.doe.gov/Gunnison/Processing/Documents.aspx#vmr. Water quality data for 2011 are provided in Appendixes A through C of this report. All water quality data for the Gunnison site are archived in the SEEPro database at the Office of Legacy Management in Grand Junction, Colorado. Water quality data also are available for viewing with dynamic mapping via the Geospatial Environmental Mapping System (GEMS) website at http://gems.lm.doe.gov/imf/sites/gems_continental_us/jsp/launch.jsp.

The purpose of this VMR is to present and evaluate groundwater and surface water monitoring data collected during the annual 2011 sampling event at the Gunnison site and to provide an update on the progress of the natural flushing compliance strategy. In 2011, concentrations of uranium and manganese, the two constituents of potential concern (COPCs) in the alluvial aquifer, remained above the groundwater standard and risk-based benchmark, respectively. Concentrations of uranium in the alluvial aquifer continue to confirm the site conceptual model of contaminants migrating deeper in the alluvial aquifer with distance from the mill site and provide evidence that natural flushing of the alluvial aquifer is progressing. However, residual soil contamination on the former mill site may be having a localized effect in some wells on and immediately downgradient of the mill site. The distribution of manganese in the alluvial aquifer is limited; the highest concentrations are near the benchmark value. Concentrations of COPCs in samples collected from domestic wells and Gunnison River locations remained low with no indication of site impacts.

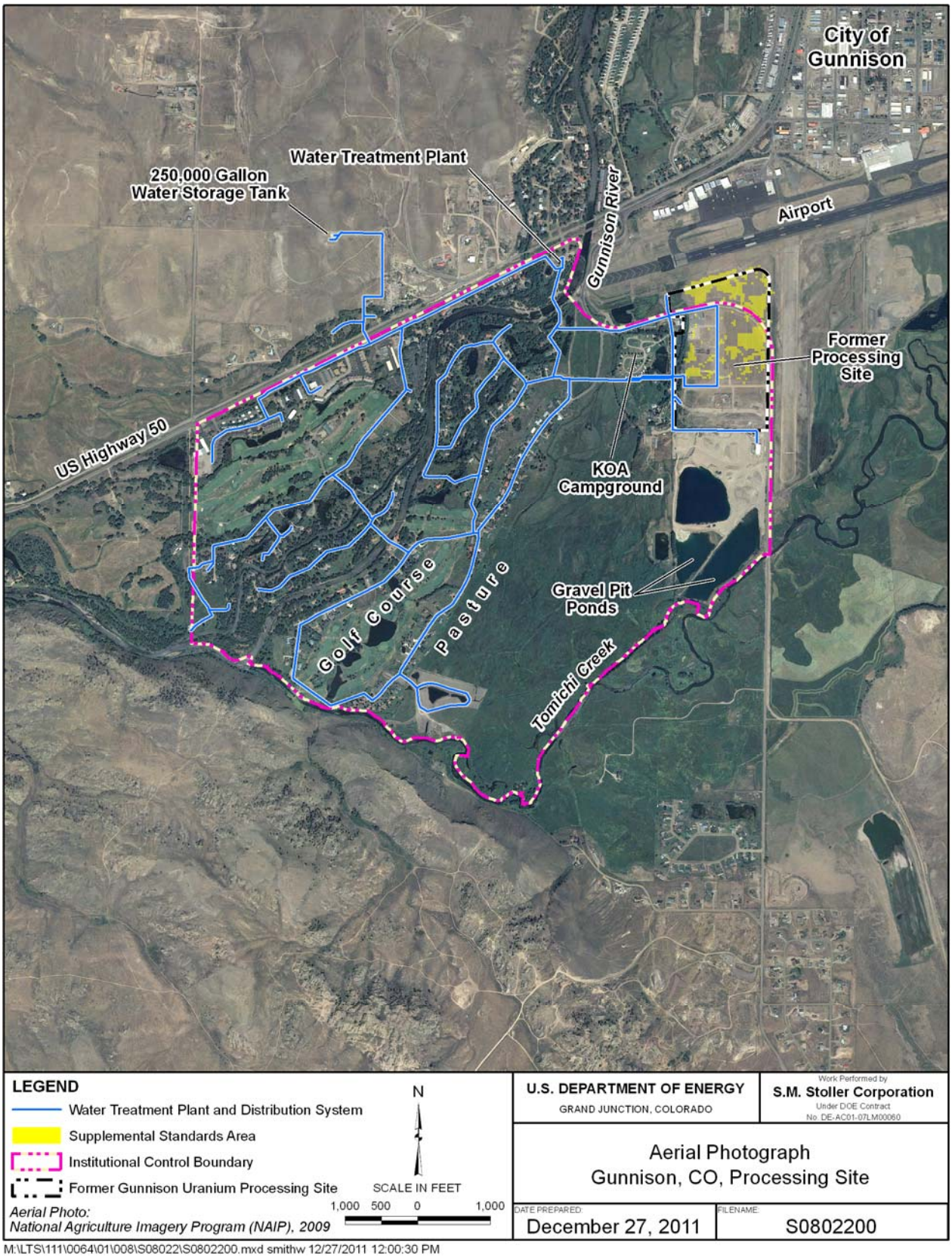


Figure 1. Aerial Photograph of the Gunnison, Colorado, Processing Site

2.0 Site Conditions

2.1 Hydrogeology

Groundwater is unconfined in the alluvial (uppermost) aquifer, with an average depth to the water table of 5 feet (ft). The alluvium is composed of poorly sorted sediments ranging from clay-sized material to gravel, with cobbles and a few boulders. It ranges in thickness from 70 to 130 ft. Groundwater in the alluvial aquifer generally flows to the southwest with an average gradient of 0.005 ft/ft. Hydraulic conductivity ranges from 100 to 170 ft/day. The average linear groundwater velocity ranges from 1.9 to 3.2 ft/day (DOE 2001).

Groundwater in the alluvial aquifer system is recharged by groundwater underflow, adjacent streams, precipitation, flood irrigation of the pasture downgradient of the site, and irrigation of the golf course and residential areas southwest of the site. Groundwater loss is through evapotranspiration and natural discharge to adjacent streams. Groundwater also is discharged by dewatering activities at the adjacent sand and gravel company located south of the former mill site.

2.2 Water Quality

Groundwater in the alluvial aquifer beneath and downgradient of the Gunnison site was contaminated by uranium-ore processing activities. A variety of tailings-related contaminants in the subsurface and groundwater at the site were evaluated, and the potential risks to human health and the environment were assessed in the SOWP (DOE 2001). Only uranium and manganese were identified as COPCs because they exceeded a groundwater standard and risk-based benchmark, respectively.

Uranium is the primary COPC in groundwater, with historical concentrations measured up to 1.5 milligrams per liter (mg/L) beneath the site. Currently, uranium concentrations exceed the U.S. Environmental Protection Agency (EPA) 40 CFR 192 maximum concentration limit (MCL) of 0.044 mg/L for groundwater in several monitoring wells on and adjacent to the former mill site and in one monitoring well (0183) more than 4,000 ft downgradient of the site boundary. Concentrations of uranium that are less than the MCL but above background extend approximately 7,000 ft downgradient of the site boundary and have migrated beneath the Gunnison River just beyond the confluence with Tomichi Creek. The zone of contamination attenuates and migrates deeper into the aquifer as it progresses laterally in a southwesterly direction.

Manganese is also a COPC in groundwater, with historical concentrations that measured up to 77 mg/L beneath the site. There is no MCL for manganese. The EPA Drinking Water Equivalent Level (DWEL) for manganese is 1.6 mg/L (EPA 2011). The DWEL is a lifetime-exposure concentration protective of adverse, noncancer health effects that assumes all of the exposure to a contaminant is from drinking water. Concentrations of manganese are above the DWEL beneath the site and in two downgradient monitoring wells (0113 and 0135). Manganese does not appear to be widespread in the aquifer, and concentrations beneath the site are decreasing.

2.3 Surface Activities

Uranium mill tailings and other residual radioactive material (RRM) were removed from the former mill site from 1992 through 1995 and stabilized in a disposal cell 6 miles east of the city of Gunnison. RRM beneath the site was cleaned up to a depth just below the water table, with some contaminated material left in place through the application of supplemental standards. The site was backfilled with clean fill and revegetated after RRM removal.

The former mill site property is currently being developed as a light industrial park by the owner, Gunnison County. Construction activities in recent years included trenching and excavation for utilities and foundations, construction of buildings, recontouring portions of the site, and landscaping. These activities may potentially mobilize contaminants remaining in the shallow soils into the groundwater. Mobilization of contaminants into the groundwater after construction activity was observed at other Uranium Mill Tailings Radiation Control Act (UMTRCA) sites such as the New Rifle processing site in Rifle, Colorado.

2.4 Institutional Controls

ICs in effect in the vicinity of the Gunnison site were finalized in 2004 and consist of government ownership and deed restrictions on the original mill site property (specified in a quitclaim deed transferring the property from the State of Colorado to Gunnison County), a Gunnison County Resolution (Gunnison County 2004) establishing the New Domestic Well Constraint Area, and construction of a domestic water supply system. The quitclaim deed specifies restrictions on and approvals needed for excavation, groundwater use, and construction of habitable structures. If part or all of the mill site property is transferred to another owner, the deed restrictions will remain in effect. The New Domestic Well Constraint Area is delineated by the IC boundary (Figure 1), and the Gunnison County Resolution specifies that no new wells can be constructed within the constraint area. A domestic water supply system was installed in 1994 to provide safe water to local residents in areas potentially impacted by contaminated groundwater. In 2004, DOE entered into a cooperative agreement with Gunnison County, approved by the U.S. Nuclear Regulatory Commission (NRC) (DOE 2004), in which DOE (along with CDPHE) agreed to fund extensions of the domestic water supply system to accommodate projected future growth within the IC boundary (Figure 1). A major extension was constructed in 2005 and 2006. Smaller extensions were constructed in 2008 to supply water to the former millsite and several parcels of land south and west of the former mill site. Domestic wells within the IC boundary that are not connected to the water system are monitored to verify that concentrations of uranium and manganese remain low and below the MCL and DWEL, respectively.

3.0 Monitoring Program

Verification monitoring occurs on an annual basis. Monitoring is expected to continue annually for the first 10 years after NRC concurrence with a final Ground Water Compliance Action Plan (GCAP) (DOE 2010b) to verify that natural flushing is progressing as predicted by groundwater flow and transport modeling (DOE 2001). Additionally, comprehensive reviews of the monitoring program are planned to occur every 10 years after approval of a final GCAP to assess if natural flushing is consistent with model predictions and to determine the effectiveness and viability of the compliance strategy. The current version of the GCAP is in review with NRC. Ongoing monitoring requirements will be evaluated in subsequent VMRs and modified as determined by DOE and NRC.

During 2011, the monitoring network included sampling of 28 DOE monitoring wells, 6 surface water locations, and 5 domestic wells (Figure 2 and Table 1). Two of those domestic wells (0476 and 0477) were not sampled during the April sampling event because the homeowners could not be contacted. These wells were subsequently sampled in May and June after contact was made with the homeowners. Sampling of domestic well 0479 was discontinued in 2011 because the residence was connected to the water system, and the well is no longer in use. Samples collected from all monitoring locations were analyzed for uranium and manganese. Field measurements of oxidation-reduction potential, pH, specific conductance, temperature, and turbidity were made at each location.

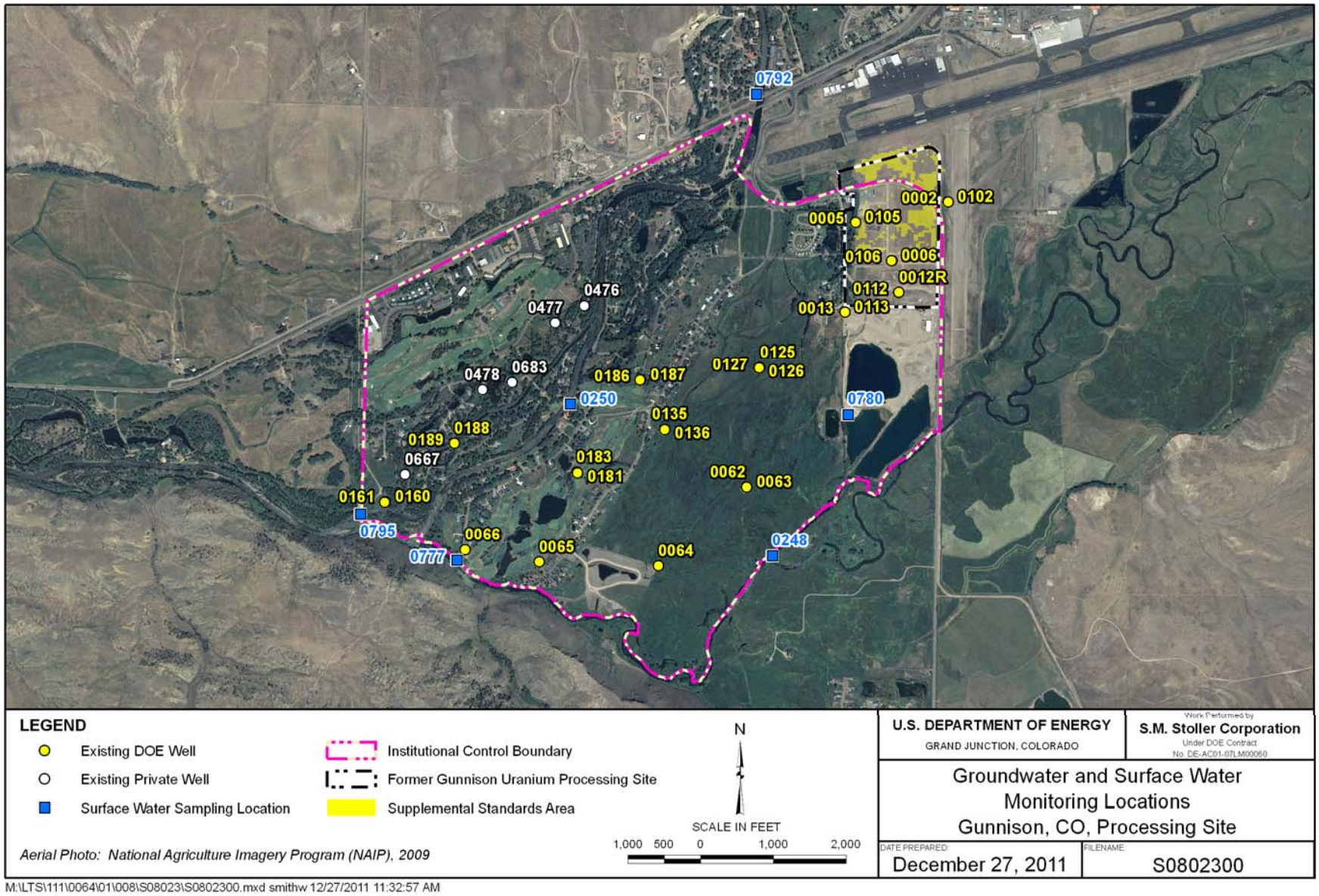


Figure 2. Groundwater and Surface Water Monitoring Locations at the Gunnison, Colorado, Processing Site

Table 1. Groundwater and Surface Water Monitoring at the Gunnison Site

Monitoring Well	Aquifer Zone	Screened Interval (ft)	Location	Rationale (Uranium)
Groundwater [a]				
0002 0102	Shallow	10–15	Airport	Upgradient—background
	Intermediate	42–47	Airport	Upgradient—background
0005 0105	Shallow	10–15	On site	Origin of plume
	Intermediate	42–47	On site	Origin of plume
0006 0106	Shallow	10–15	On site	Origin of plume
	Intermediate	34–39	On site	Origin of plume
0012R 0112	Shallow	6–16	On site	Origin of plume
	Intermediate	40–45	On site	Monitor plume migration
0013 0113	Shallow	11–16	Just off site to southwest	Monitor plume migration
	Intermediate	41–46	Just off site to southwest	Monitor plume migration
0125 0126 0127	Shallow	18–23	Pasture	Monitor plume migration
	Intermediate	54–59	Pasture	Monitor plume migration
	Deep	94–99	Pasture	Monitor plume migration
0135 0136	Shallow	18–23	Pasture	Monitor plume migration
	Intermediate	53–58	Pasture	Monitor plume migration
0064	Deep	87–97	Pasture	Monitor plume migration
0062	Intermediate	48–58	Pasture	Monitor plume migration
0063	Deep	88–98	Pasture	Monitor plume migration
0181 0183	Shallow	18–23	Golf course	Monitor plume migration
	Deep	93–98	Golf course	Monitor plume migration
0065	Intermediate	50–60	Golf course	Monitor plume migration
0066	Intermediate	40–50	End of Tomichi Trail	Monitor plume migration
0186 0187	Intermediate	53–58	End of Monte Vista Dr.	Monitor plume migration
	Deep	93–98	End of Monte Vista Dr.	Monitor plume migration
0188 0189	Intermediate	53–58	West of Gunnison River	Monitor plume migration
	Deep	93–98	West of Gunnison River	Monitor plume migration
0160 0161	Intermediate	51–56	West of Gunnison River	Adjacent to IC boundary
	Deep	93–98	West of Gunnison River	Adjacent to IC boundary
Surface Water				
0248	NA		Tomichi Creek	Downstream of gravel pit pond
0250	NA		Gunnison River	Potential aquifer discharge
0777	NA		Tomichi Creek	Potential aquifer discharge
0780	NA		Gravel pit pond	Gravel pit—aquifer discharge to pond
0792	NA		Gunnison River	Upstream of IC boundary—background
0795	NA		Gunnison River	Potential aquifer discharge
Domestic Wells		**Use**		
0476	Shallow	Potable	West of Gunnison River	Verify low COPC concentrations
0477	Shallow	Potable	West of Gunnison River	Verify low COPC concentrations
0478	Shallow	Potable	West of Gunnison River	Verify low COPC concentrations
0667	Shallow	Potable	West of Gunnison River	Verify low COPC concentrations
0683	Shallow	Potable	West of Gunnison River	Verify low COPC concentrations

[a] Monitoring wells listed in the same table cell are co-located.

This page intentionally left blank

4.0 Results of 2011 Monitoring

Analytical data for uranium and manganese along with field measurements from DOE monitoring wells, domestic wells, and surface water for 2011 are provided in Appendixes A through C, respectively. Water level data collected in 2011 are provided in Appendix D. The distributions of uranium and manganese in groundwater in the alluvial aquifer, based on the 2011 sampling event, are shown in Figure 3 and Figure 4, respectively. Time-concentration plots for uranium and manganese in DOE monitoring wells, domestic wells, and surface water from 1997 (post-remedial action) through 2011 are presented in Figures 5 through 16 located at the end of this section.

4.1 DOE Monitoring Wells

Though not separated lithologically, the alluvial aquifer (up to 130 ft thick) has been divided into three approximate depth zones to facilitate monitoring (wells are screened to monitor these zones separately) and discussion of vertical contaminant migration: (1) shallow zone from 6 to 23 ft, (2) intermediate zone from 34 to 60 ft, and (3) deep zone from 87 to 98 ft (Table 1). Time-concentration plots for uranium and manganese in DOE monitoring wells have been grouped by monitoring wells on site and in three downgradient sectors to show the relationship between distance downgradient of the site and depth in the aquifer.

Results from the 2011 sampling event indicate that uranium in groundwater is still generally decreasing and migrating deeper in the alluvial sequence while progressing downgradient from the former mill site, which is consistent with historical data. Concentrations of uranium in groundwater in the shallow zone exceeded the MCL of 0.044 mg/L in two of three wells on the former mill site (Figure 5) and in one well immediately downgradient of the site (0013) (Figure 6). The MCL was exceeded in intermediate zone well 0113 (immediately downgradient of the site) but was not exceeded in any other intermediate zone well (Figure 6 and Figure 7). The MCL was exceeded in one deep zone well (0183) 4,400 ft downgradient of the site (Figure 7). In wells farthest downgradient, uranium concentrations exceeded background levels (upper limit of background range is 0.009 mg/L) but did not exceed the MCL (Figure 8). Table 2 summarizes the distribution of uranium throughout the alluvial aquifer in each of the three zones.

Concentrations of manganese in groundwater beneath the Gunnison site continue to be slightly above the DWEL of 1.6 mg/L in wells in the intermediate zone, with concentrations below the DWEL in the shallow zone (Figure 9). Downgradient of the site, samples collected from monitoring wells 0113 in the intermediate zone and 0135 in the shallow zone had manganese concentrations that exceeded the DWEL (Figure 10 and Figure 11). Manganese does not appear to be widespread farther downgradient in the alluvial aquifer (Figure 12).

4.2 Domestic Wells

Concentrations of uranium in groundwater in the domestic buffer zone wells (northwest of the Gunnison River) downgradient of the site are below the MCL of 0.044 mg/L and below the action level set by CDPHE of 0.020 mg/L (Figure 13). Concentrations of manganese in groundwater in the domestic wells are below the DWEL of 1.6 mg/L (Figure 14).

Table 2. Summary of 2011 Uranium Distribution at the Gunnison Site

Area	Zone	Wells	Uranium Concentration [a] (mg/L)
Upgradient	Shallow	0002	0.0029
	Intermediate	0102	0.0042
On Site and Just Off Site	Shallow	0005, 0006, 0012R, 0013	0.278
	Intermediate	0105, 0106, 0112, 0113	0.067
Downgradient (Before Gunnison River)	Shallow	0125, 0135, 0181	0.008
	Intermediate	0062, 0065, 0066, 0126, 0136, 0186	0.018
	Deep	0063, 0064, 0127, 0183, 0187	0.021
Downgradient (Beyond Gunnison River)	Intermediate	0160, 0188	0.0245
	Deep	0161, 0189	0.017

[a] Uranium concentrations from 2011 sampling event. Where more than one well is listed, the concentration is the 2011 mean value.

4.3 Surface Water

Concentrations of uranium in surface water in the Gunnison River during 2011 were very low (0.00076 to 0.00084 mg/L) and indicative of high-runoff flows from melting of the mountain snowpack. In addition, there was no significant difference between upstream (background) and downstream uranium concentrations, indicating that water quality in the river was not affected by discharge of alluvial groundwater. The concentration of uranium (0.031 mg/L) in surface water in the gravel pit pond (0780) continued to be elevated above background; however, elevated uranium concentrations are expected as the pond receives discharge of alluvial groundwater (Figure 15).

In 2006 the private landowner rerouted Tomichi Creek to its original channel to establish a conservation area. Location 0248, which is approximately 1,500 ft downstream of the gravel pit pond discharge point, is on the abandoned portion of the channel. The water in the abandoned channel is composed of discharge from the pond, flow through the diversion structure, and groundwater discharge. Concerns have been raised that low flows in the abandoned channel could concentrate uranium by evaporation and groundwater discharge. In 2011, the concentration of uranium in the sample collected from location 0248 (0.012 mg/L) was elevated compared to background, indicating some influence from these factors; however, the concentration is below the groundwater MCL. The concentration of uranium in the sample collected farther downstream on Tomichi Creek at location 0777 was lower (0.005 mg/L) because of dilution as the rerouted creek merges back into a single channel.

Concentrations of manganese in surface water are well below the DWEL of 1.6 mg/L (Figure 16).

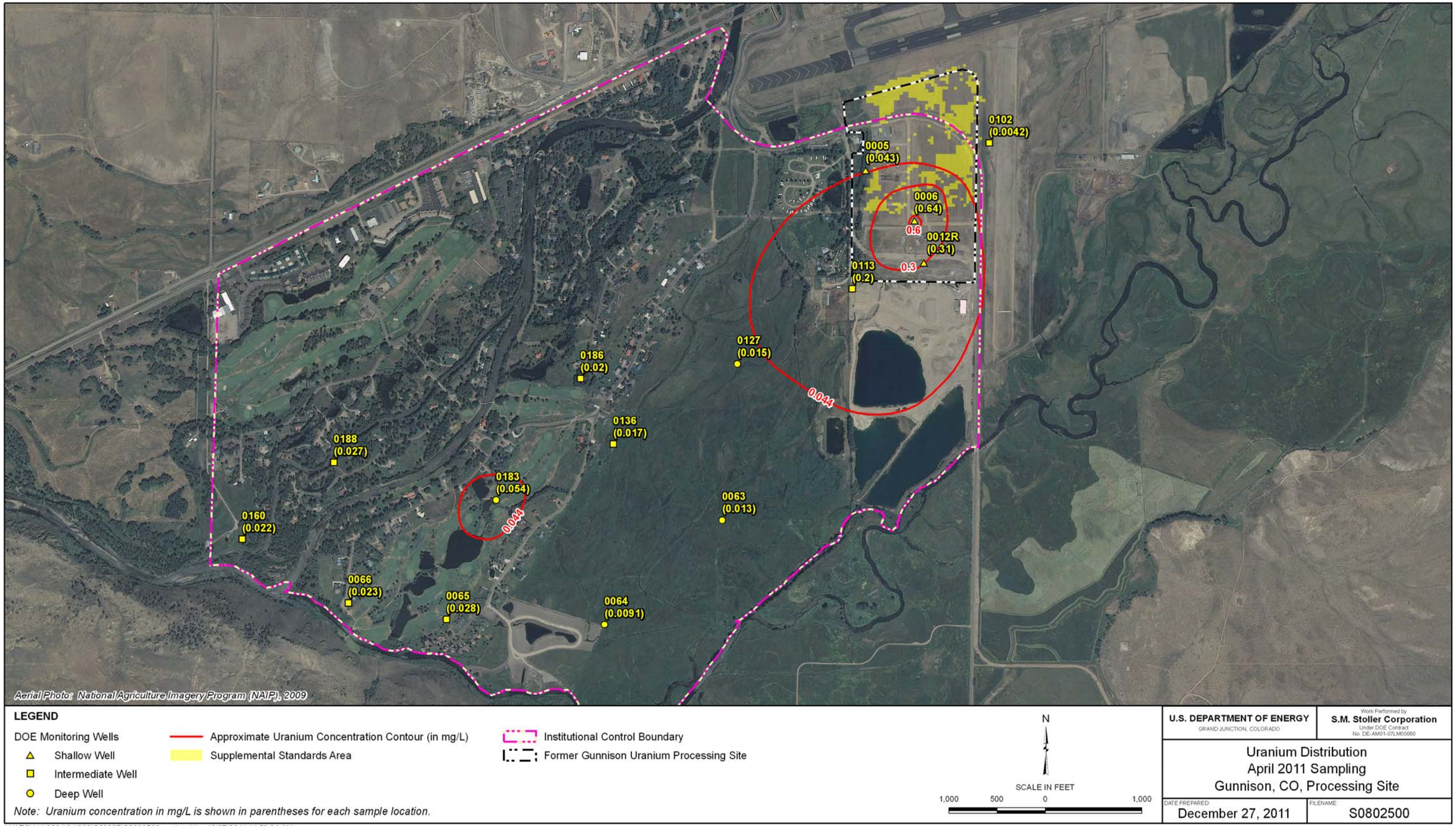


Figure 3. Uranium Distribution from April 2011 Sampling at the Gunnison, Colorado, Processing Site

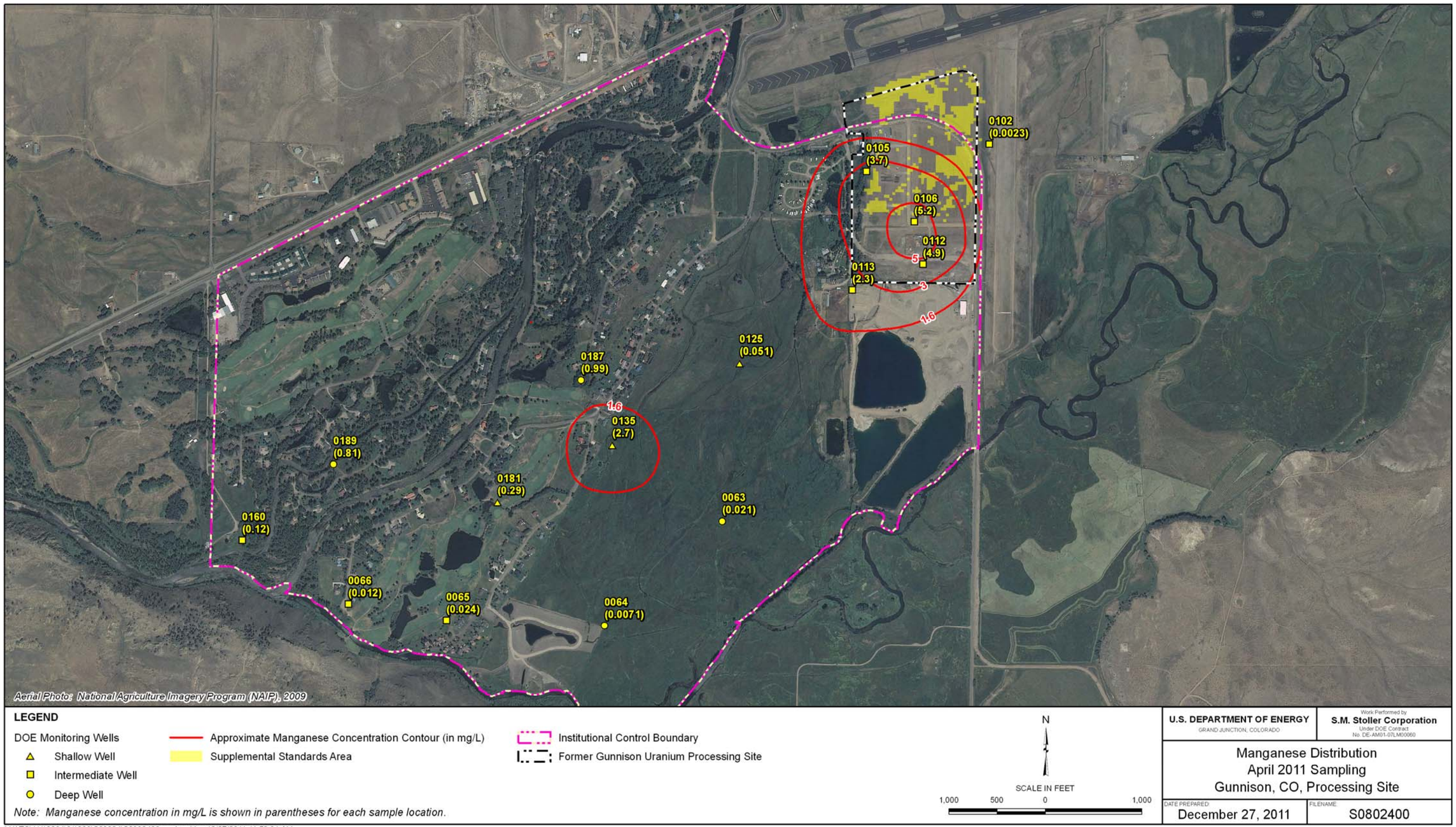
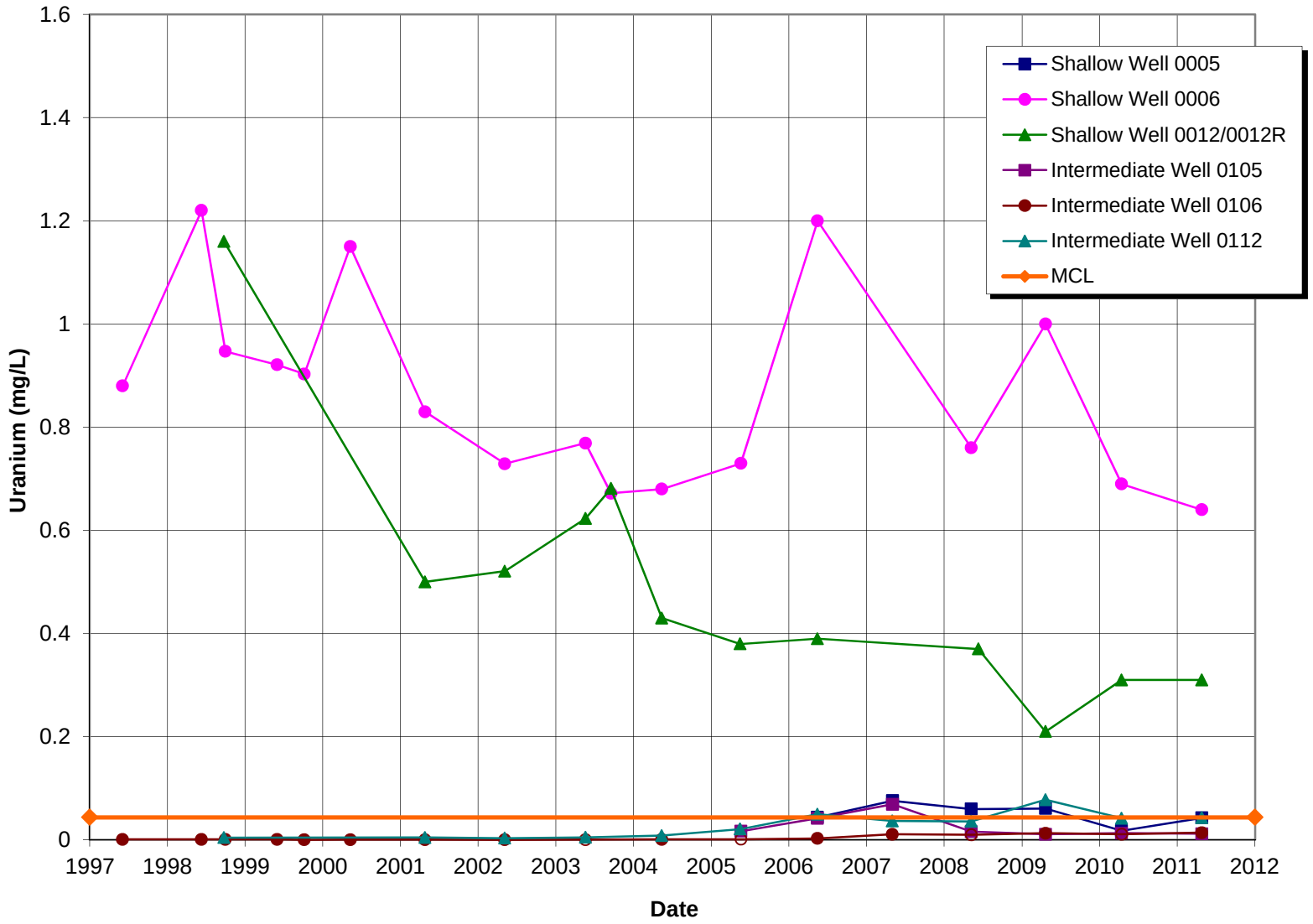
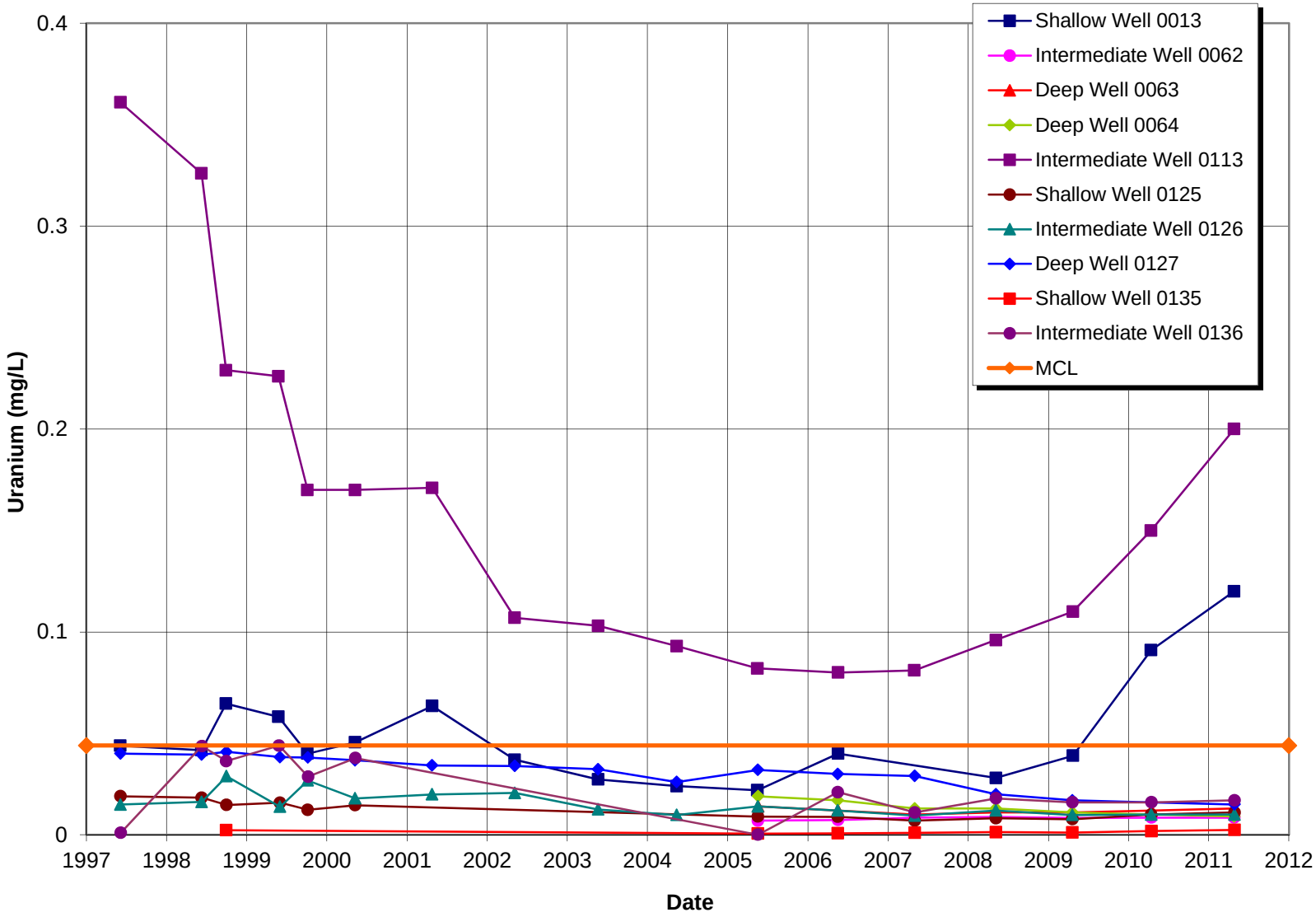


Figure 4. Manganese Distribution from April 2011 Sampling at the Gunnison, Colorado, Processing Site



Note: A hollow symbol denotes an analytical result below the detection limit.

Figure 5. Uranium Concentrations in Groundwater: On-Site DOE Monitoring Wells at the Gunnison Site



Note: A hollow symbol denotes an analytical result below the detection limit.

Figure 6. Uranium Concentrations in Groundwater: Downgradient DOE Monitoring Wells—Pasture, near the Gunnison Site

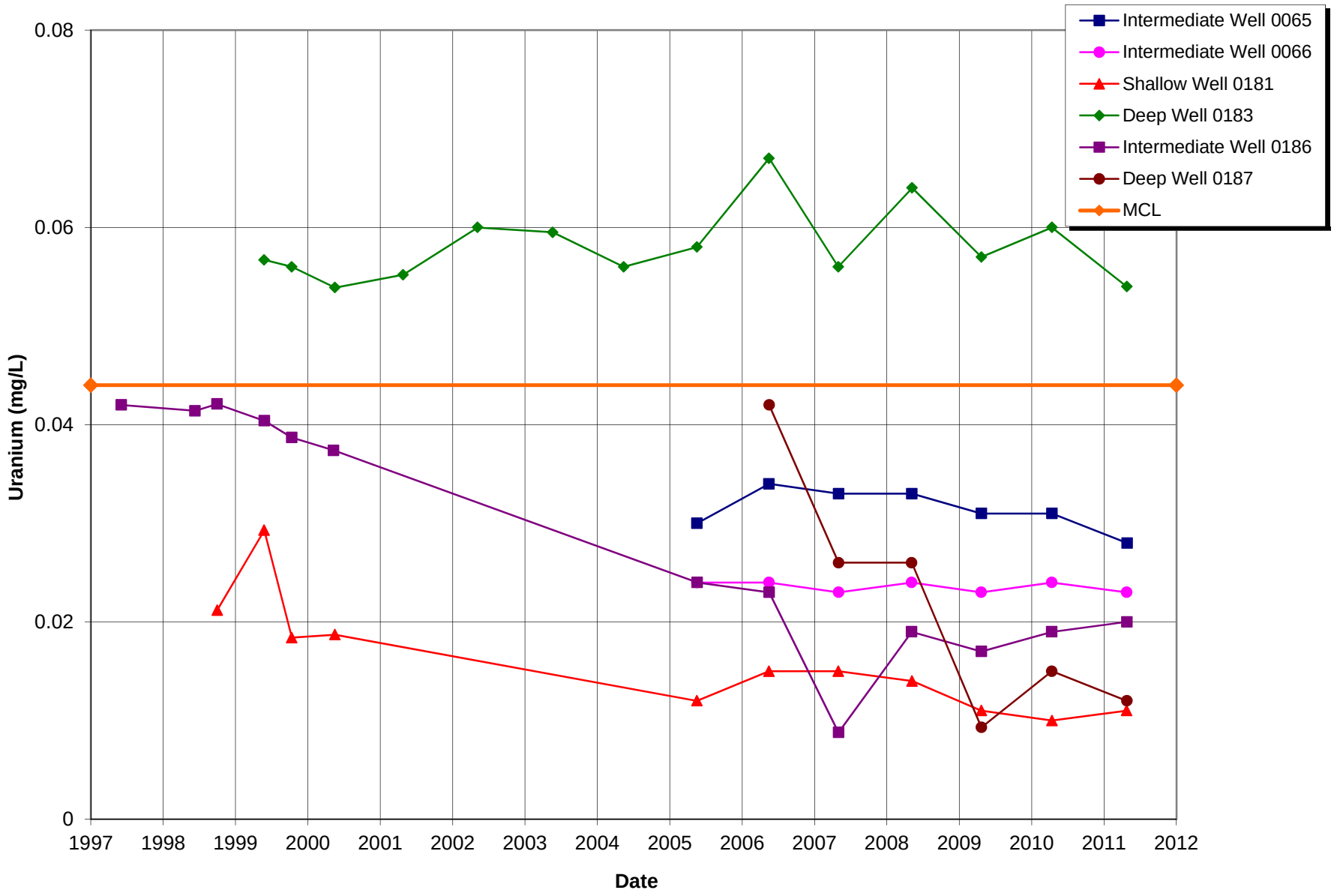


Figure 7. Uranium Concentrations in Groundwater: Downgradient DOE Monitoring Wells—Golf Course and Residential, near the Gunnison Site

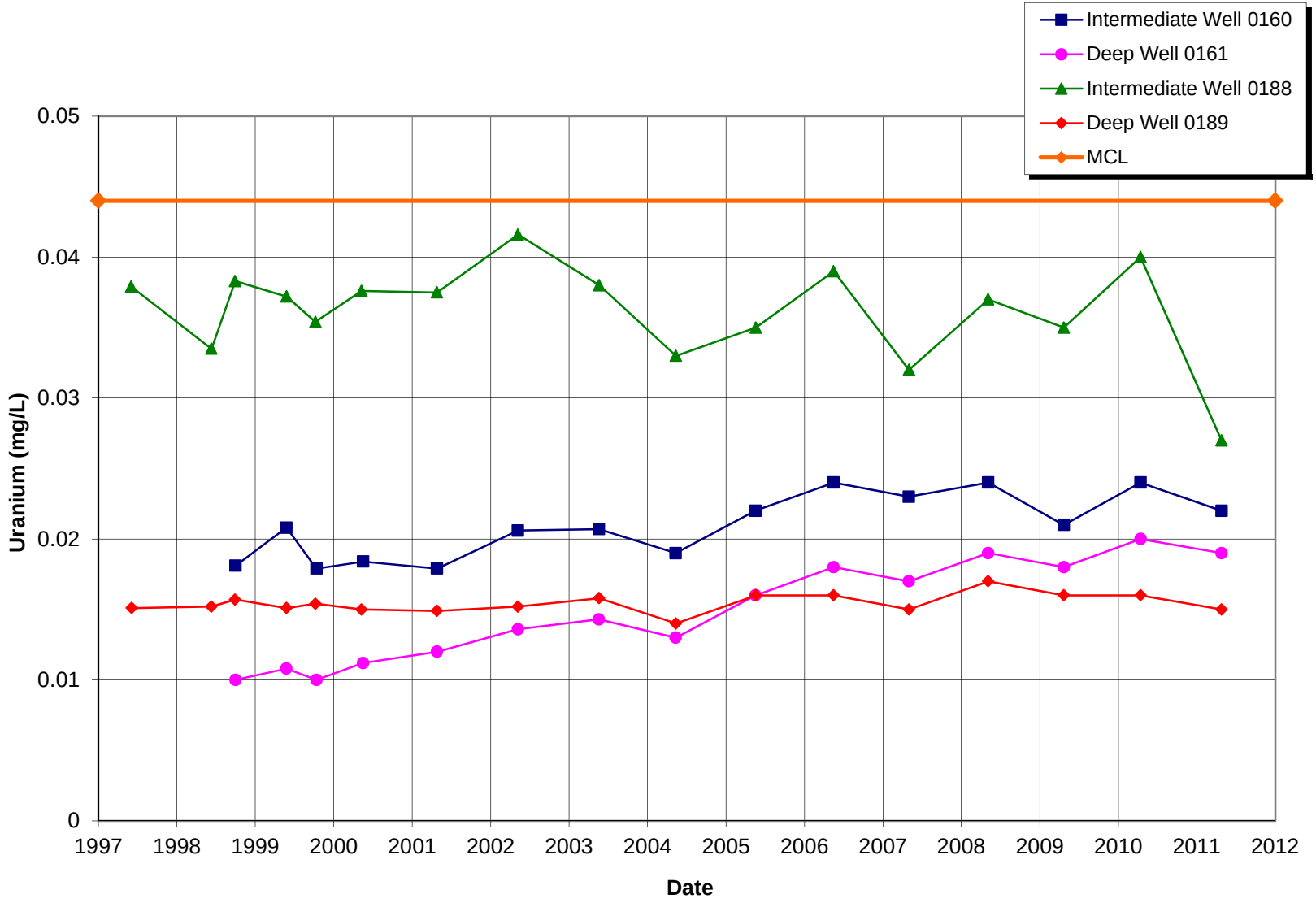


Figure 8. Uranium Concentrations in Groundwater: Downgradient DOE Monitoring Wells—West of the Gunnison River, Near the Gunnison Site

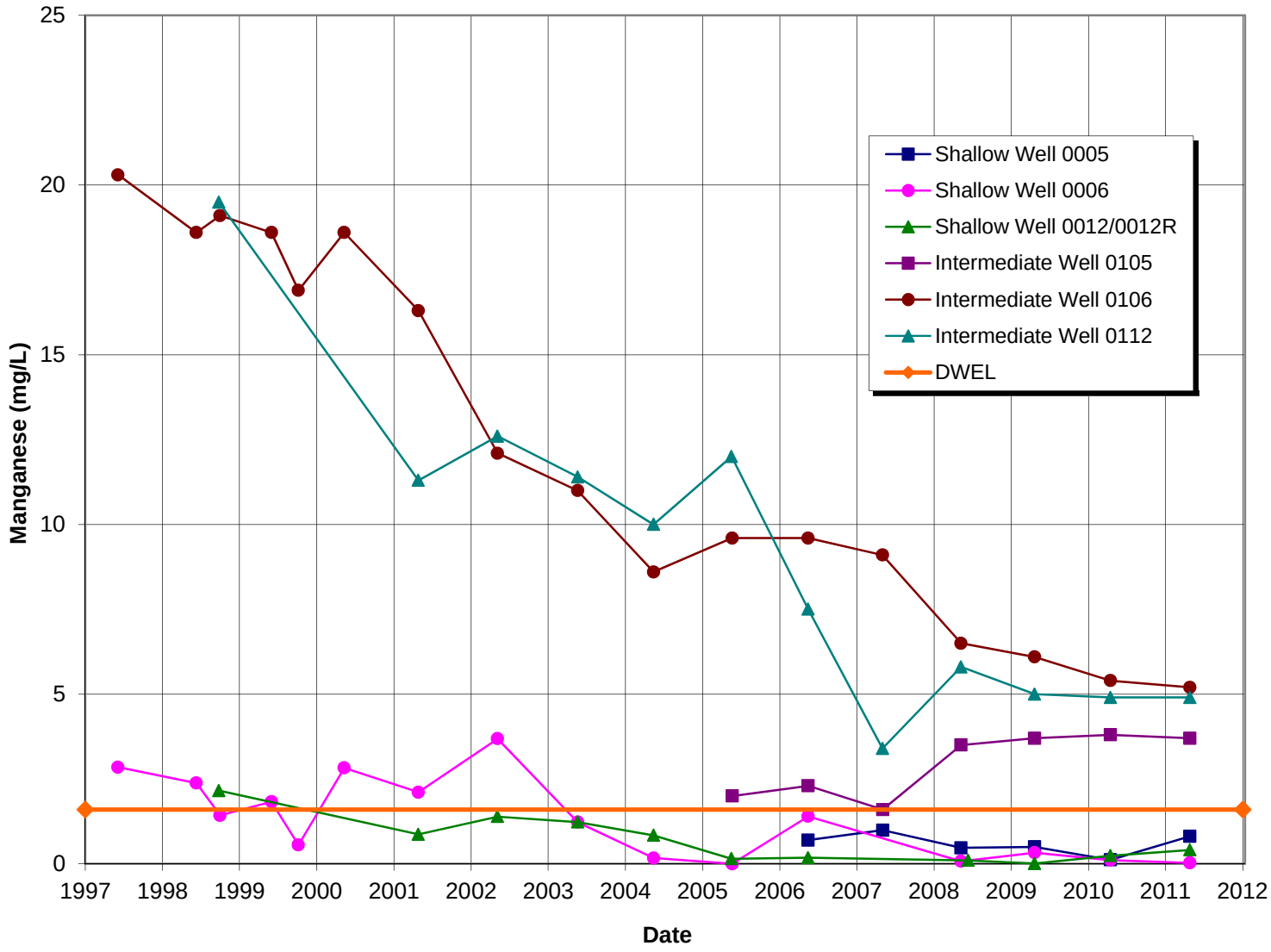


Figure 9. Manganese Concentrations in Groundwater: On-Site DOE Monitoring Wells at the Gunnison Site

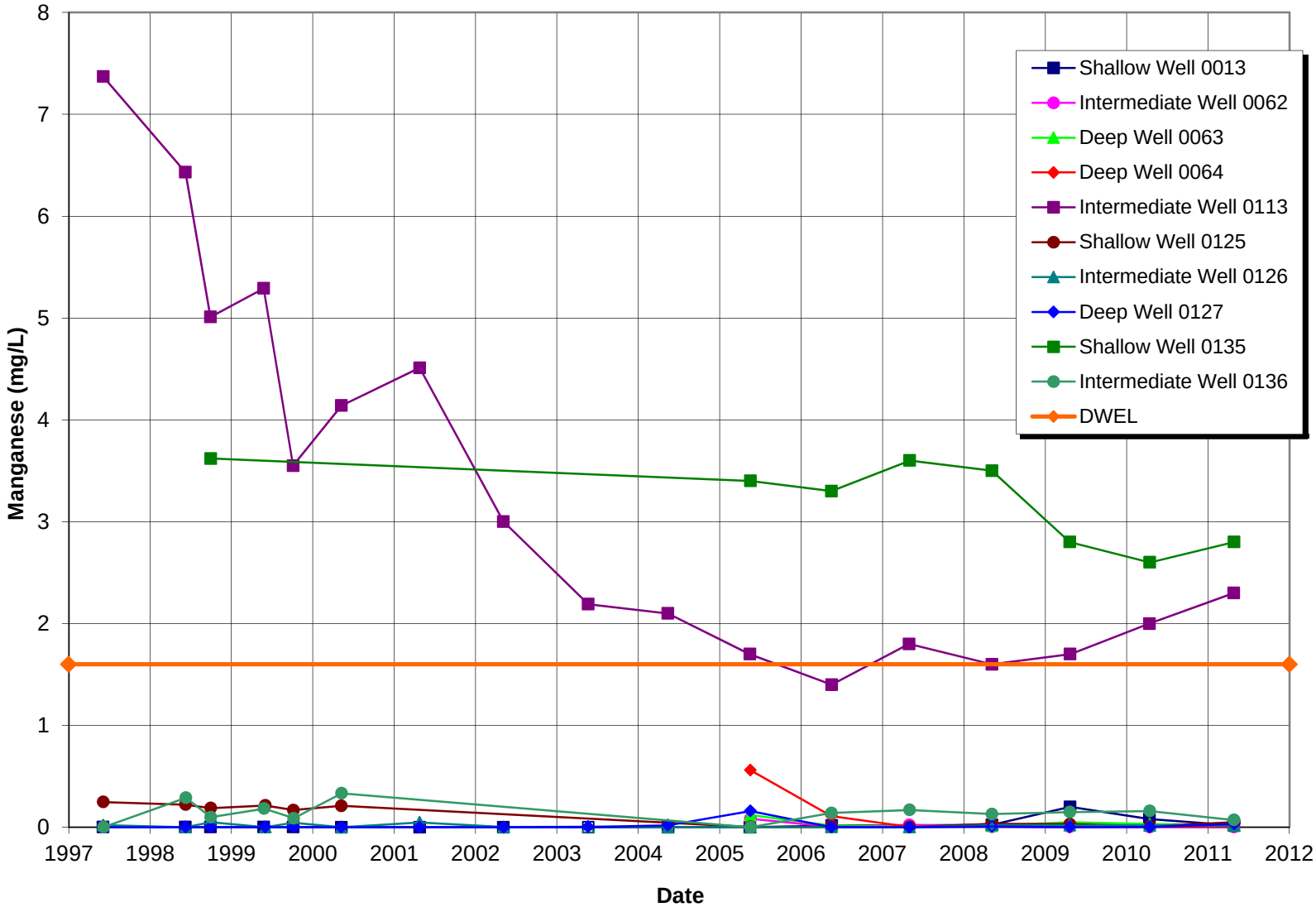
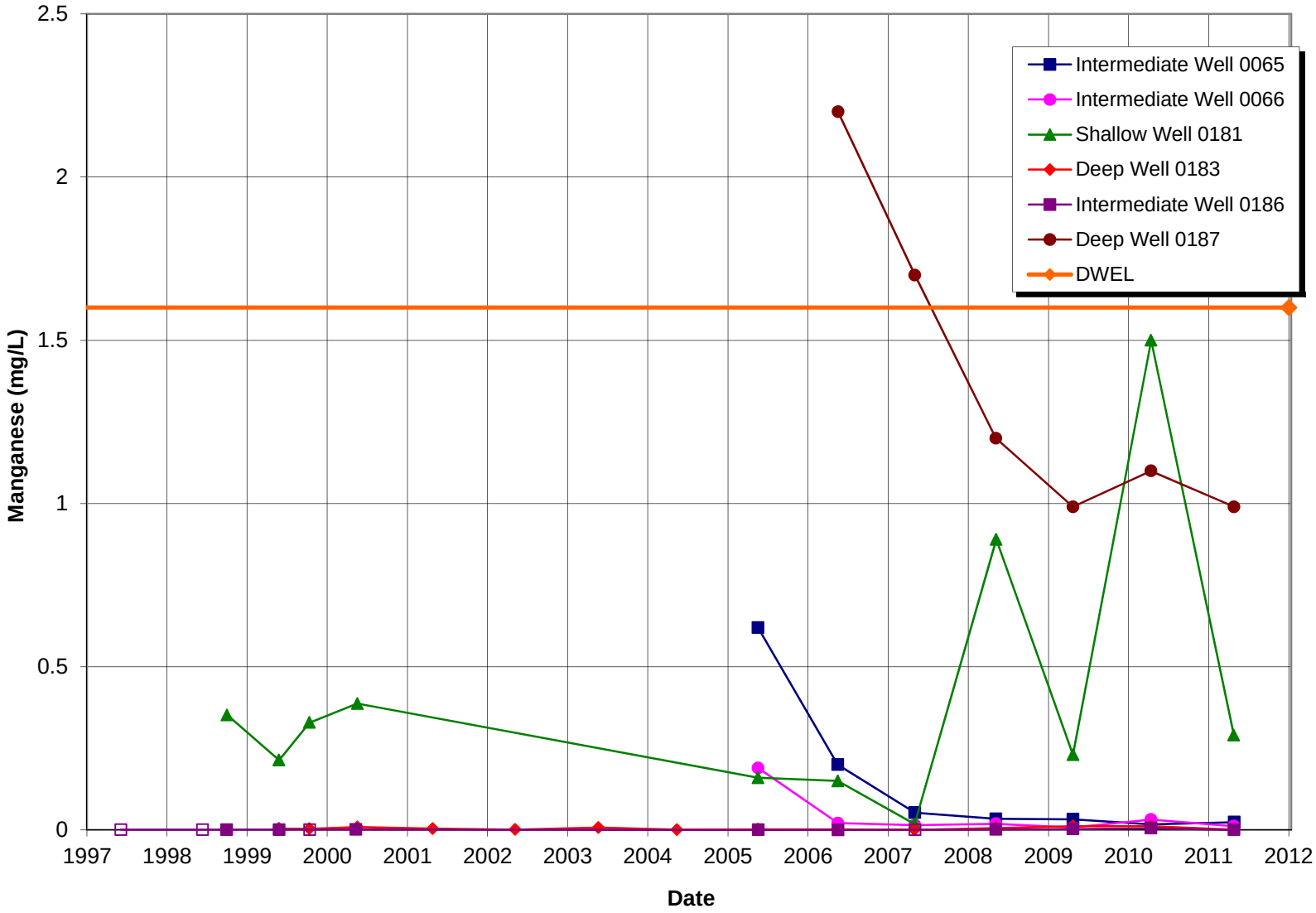
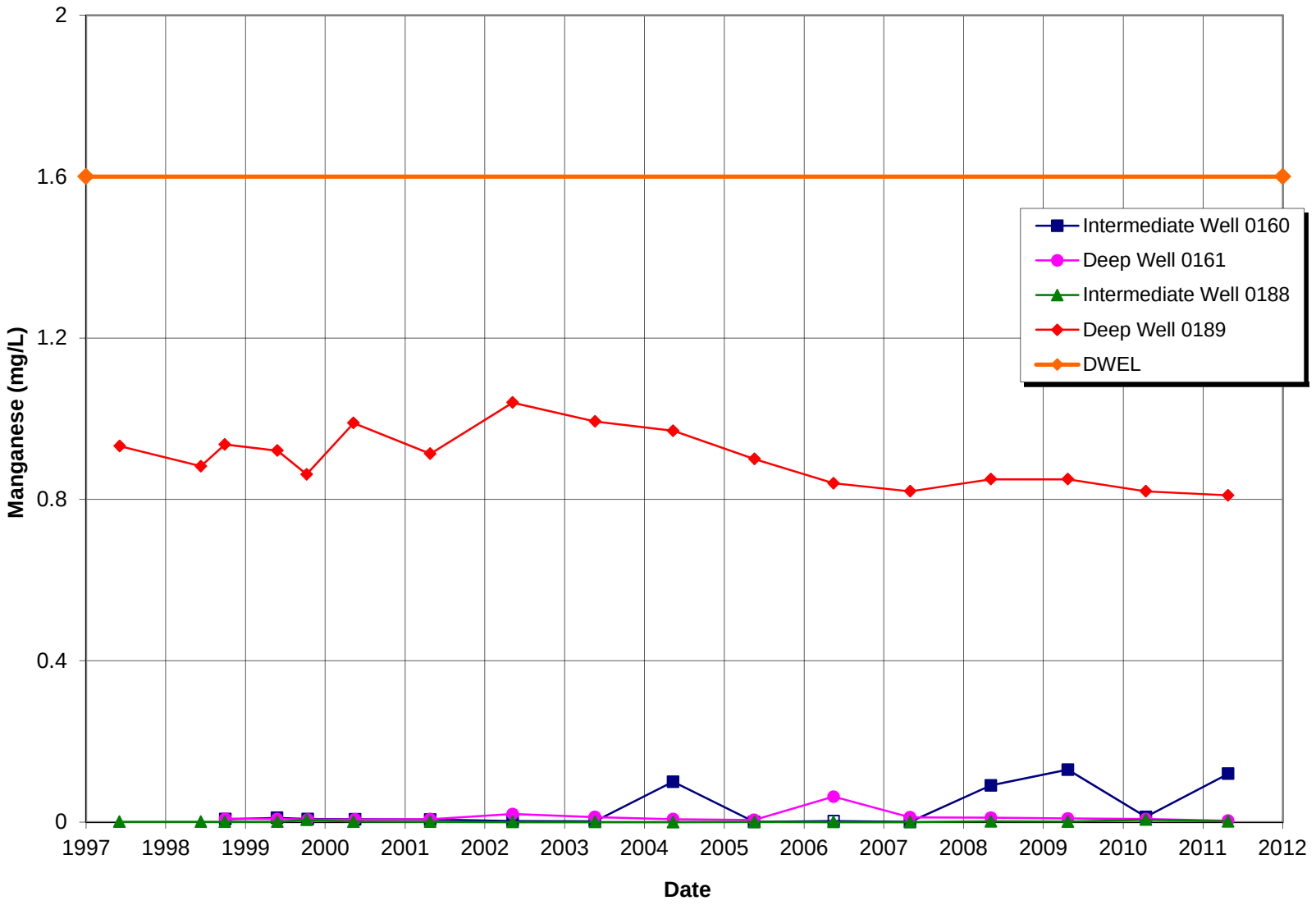


Figure 10. Manganese Concentrations in Groundwater: Downgradient DOE Monitoring Wells—Pasture, near the Gunnison Site



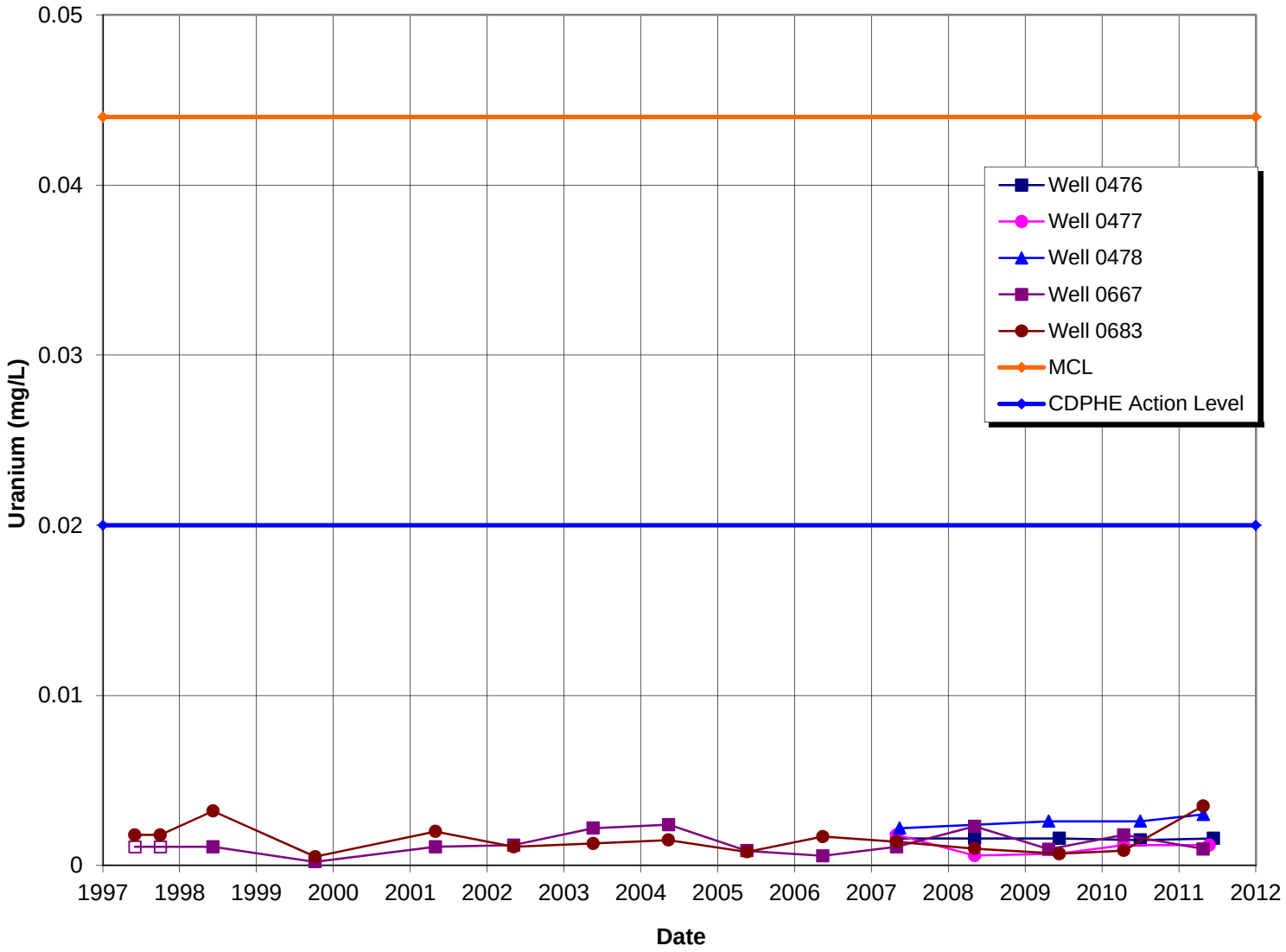
Note: A hollow symbol denotes an analytical result below the detection limit.

Figure 11. Manganese Concentrations in Groundwater: Downgradient DOE Monitoring Wells—Golf Course and Residential, near the Gunnison Site



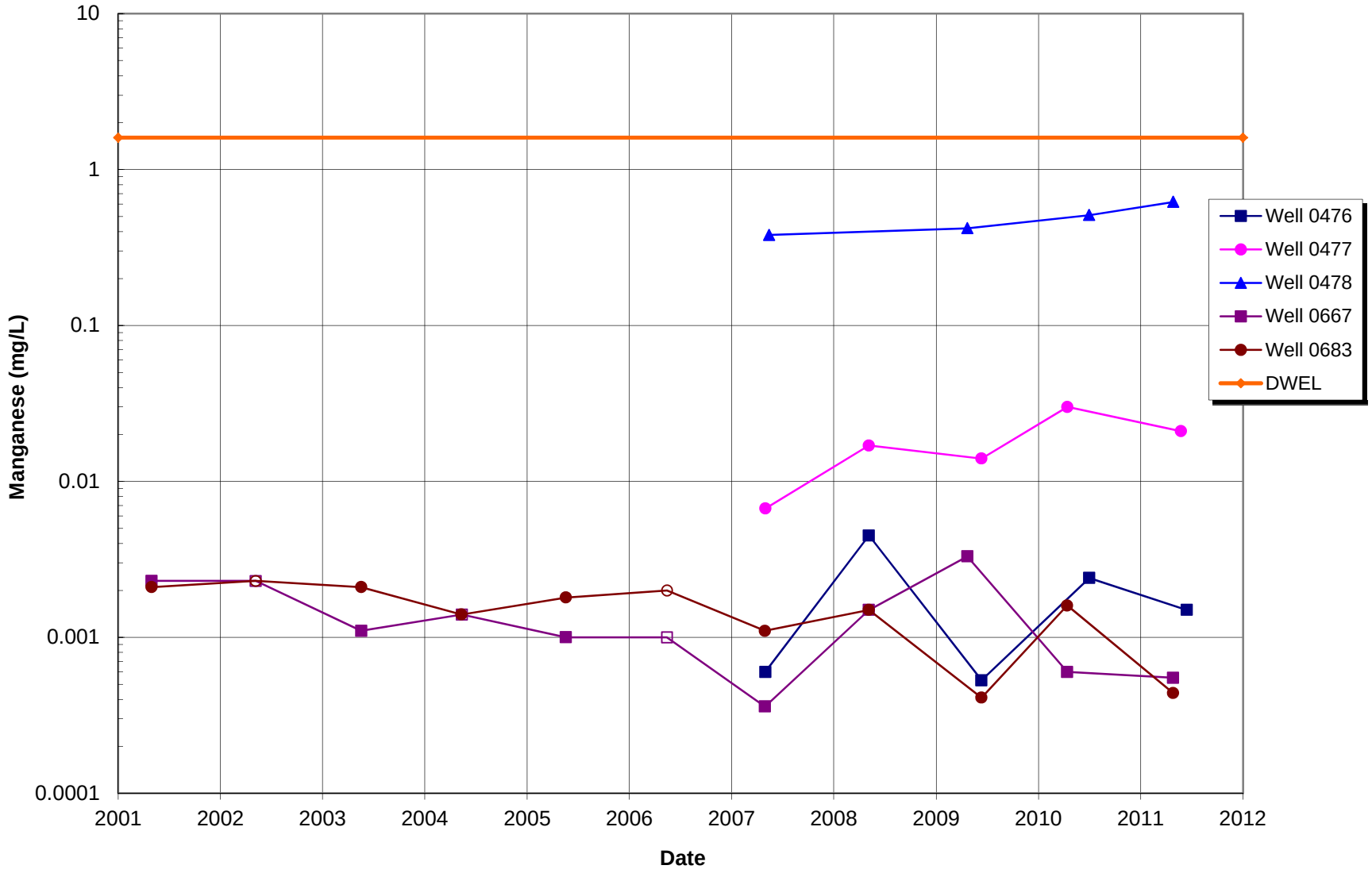
Note: A hollow symbol denotes an analytical result below the detection limit.

Figure 12. Manganese Concentrations in Groundwater: Downgradient DOE Monitoring Wells—West of the Gunnison River, near the Gunnison Site



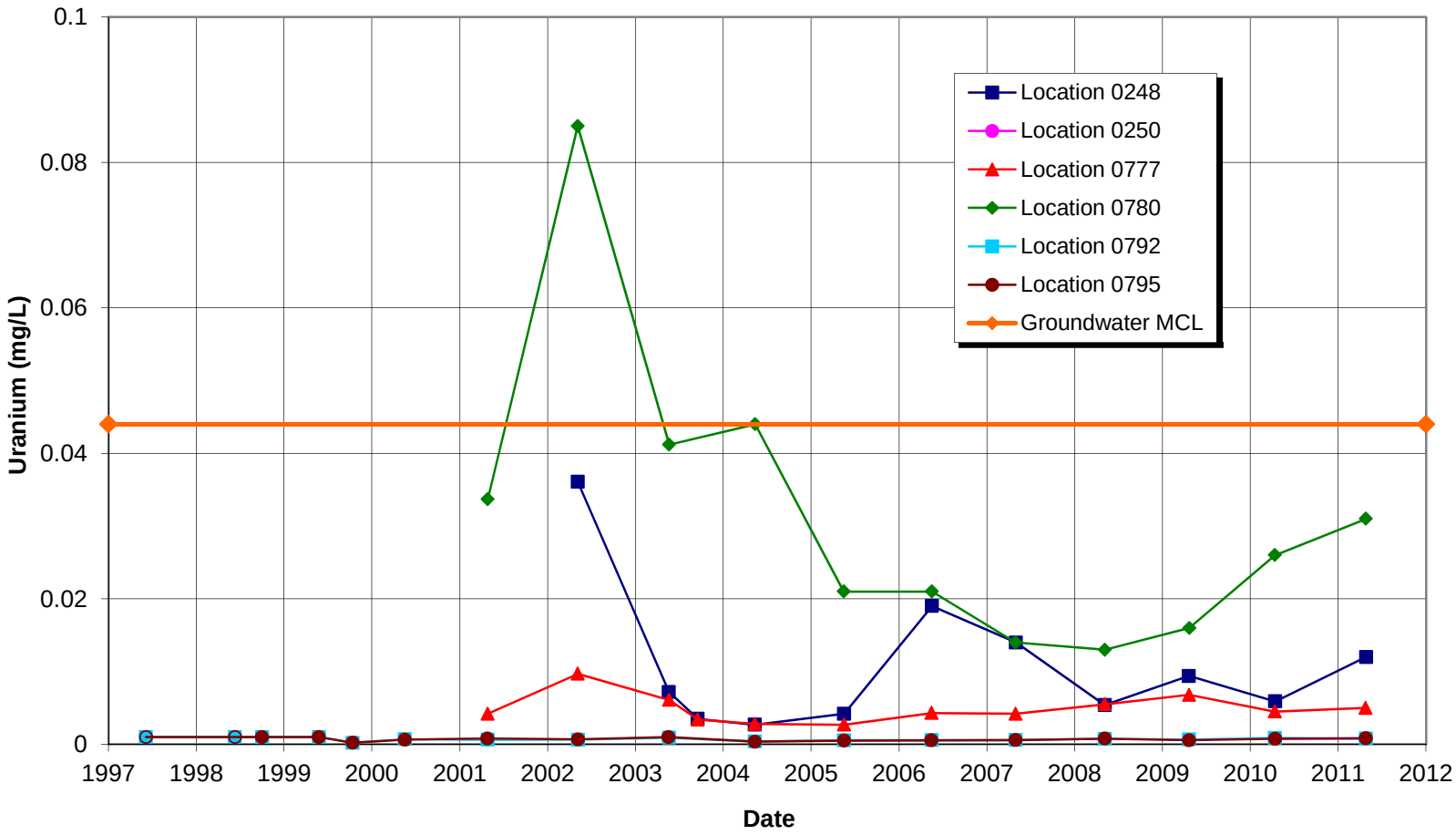
Note: A hollow symbol denotes an analytical result below the detection limit.

Figure 13. Uranium Concentrations in Groundwater: Domestic Wells Downgradient from the Gunnison Site



Note: A hollow symbol denotes an analytical result below the detection limit.

Figure 14. Manganese Concentrations in Groundwater: Domestic Wells Downgradient from the Gunnison Site



Note: A hollow symbol denotes an analytical result below the detection limit.

Figure 15. Uranium Concentrations in Surface Water near the Gunnison Site

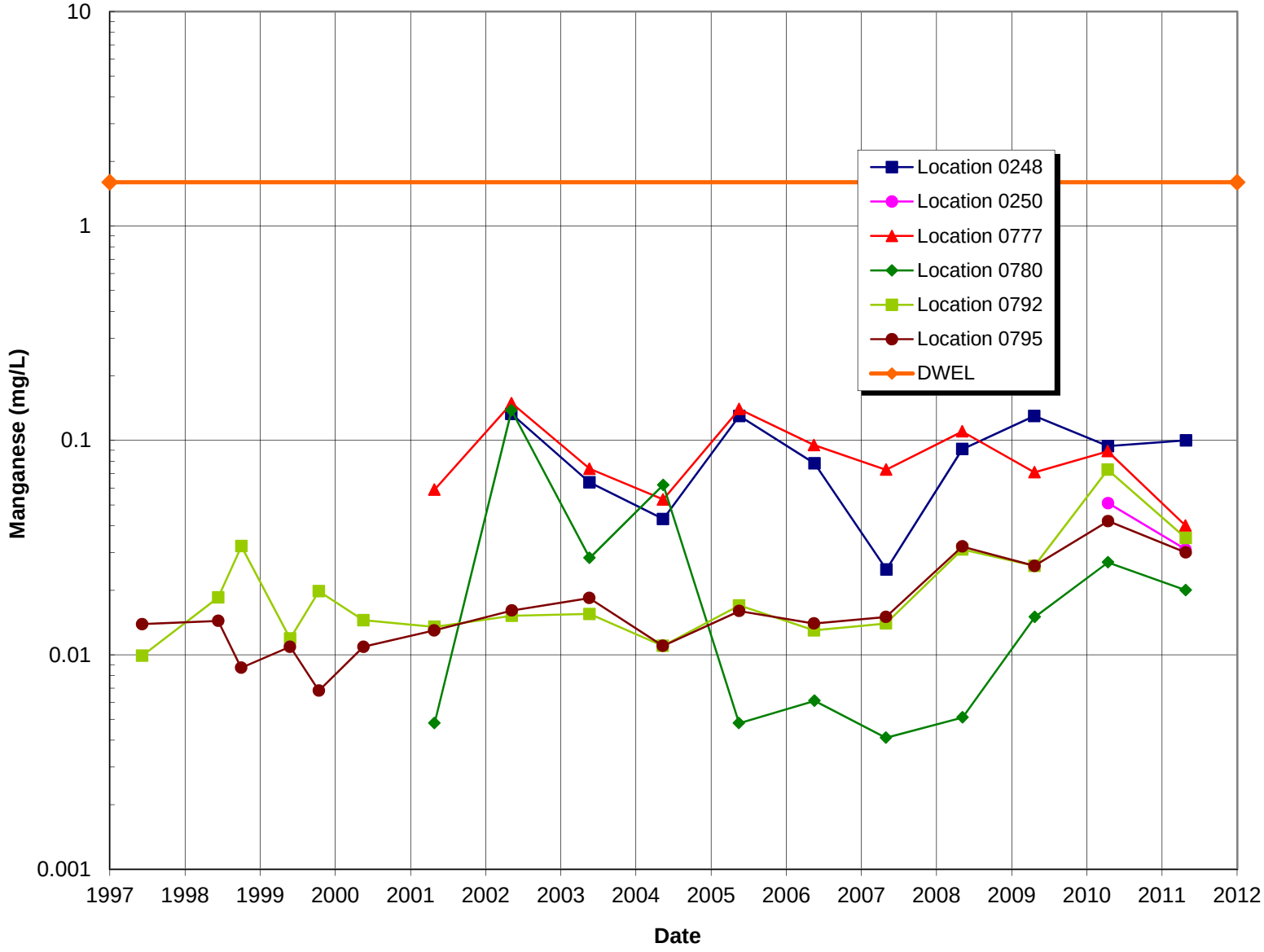


Figure 16. Manganese Concentrations in Surface Water near the Gunnison Site

5.0 Natural Flushing Assessment

Groundwater flow and transport modeling predicted that uranium concentrations in alluvial groundwater will decrease to levels below EPA's 40 CFR 192 groundwater standard within 100 years. To assess the progress of natural flushing, a trend analysis using the Mann-Kendall test (Gilbert 1987) was performed to assess the temporal behavior of uranium concentrations. This test determines if an upward trend, a downward trend, or no trend exists at a 5 percent level of significance. Table 3 shows the trend analysis, which includes 1997 – 2011 uranium sampling data, and lists 2011 uranium concentrations. Observations from Table 3 included the following:

- For the 26 monitoring wells listed in Table 3; 4 wells had upward trends, 12 wells had no trend, and 10 wells had downward trends.
- 5 out of the 26 monitoring wells had uranium concentrations that exceeded the uranium MCL. For the five monitoring wells where the uranium levels exceeded the MCL, three wells had downward trends and two had no trend.
- Uranium concentration in shallow zone monitoring well 0006 on the former mill site remains relatively high (0.64 mg/L) with a downward trend. Uranium concentrations in this well have been highly variable (1 mg/L in 2009), which indicates a possible localized, continual source of uranium from supplemental standards areas.
- Uranium concentration of 0.310 mg/L in shallow zone monitoring well 0012R located on the former mill site is significantly lower than that in monitoring well 0006 and has an overall downward trend, which indicates the source contributing to the high concentrations in monitoring well 0006 is localized.
- Upward trends in the intermediate zone (wells 0106 and 0112) on the mill site indicate that uranium is migrating vertically downward from the shallow zone.
- Immediately downgradient of the former mill site, uranium trends are generally downward, which indicates that RRM on the former mill site is not having a widespread effect on the alluvial aquifer.
- In the monitoring wells farthest downgradient of the mill site, uranium trends are upward (although concentrations are below the MCL), which indicates that natural flushing processes are effective in transporting uranium through the aquifer to these wells approximately 1.4 miles downgradient of the former mill site.

Figure 17 shows the comparison of uranium concentrations predicted by groundwater flow and transport modeling to actual concentrations determined by analysis of groundwater samples from intermediate zone monitoring well 0113. This intermediate zone monitoring well was selected as an indicator of natural flushing progress because of its depth and location adjacent to and immediately downgradient of the mill site, which is in an area of the aquifer that should be the first to flush as the plume migrates off the former mill site. Additionally, data from this well are used to assess potential aquifer-wide groundwater impacts from the RRM supplemental standard areas remaining on the mill site. As shown in Figure 17, uranium concentrations have historically tracked with concentrations predicted by the groundwater model but deviated from model predictions in 2010 and 2011, when concentrations increased sharply.

Table 3. Assessment of Uranium Concentration Trends at the Gunnison Site

Location	No. of Samples	Trend [a]	2011 Result (mg/L)	Standard [b] Exceeded in 2011? (Yes/No)
0005	6	No trend	0.043	No
0006	17	Downward	0.640	Yes
0012/0012R	12	Downward	0.310	Yes
0013	16	No trend	0.120	Yes
0062	7	No trend	0.0085	No
0063	7	No trend	0.013	No
0064	7	Downward	0.0091	No
0065	7	No trend	0.028	No
0066	7	No trend	0.023	No
0105	7	No trend	0.012	No
0106	17	Upward	0.014	No
0112	12	Upward	0.043	No
0113	17	Downward	0.200	Yes
0125	13	Downward	0.011	No
0126	17	Downward	0.010	No
0127	16	Downward	0.015	No
0135	8	No trend	0.0024	No
0136	13	No trend	0.017	No
0160	15	Upward	0.022	No
0161	15	Upward	0.019	No
0181	11	Downward	0.011	No
0183	14	No trend	0.054	Yes
0186	13	Downward	0.020	No
0187	6	Downward	0.012	No
0188	17	No trend	0.027	No
0189	16	No trend	0.015	No

[a] Data from 1997 to 2011.
[b] 0.044 mg/L from 40 CFR 192.

Long-term monitoring of this well will determine if recent increases in uranium concentrations are temporary due to construction activities at the former mill site or are a result of RRM in supplemental standards areas at the former mill site.

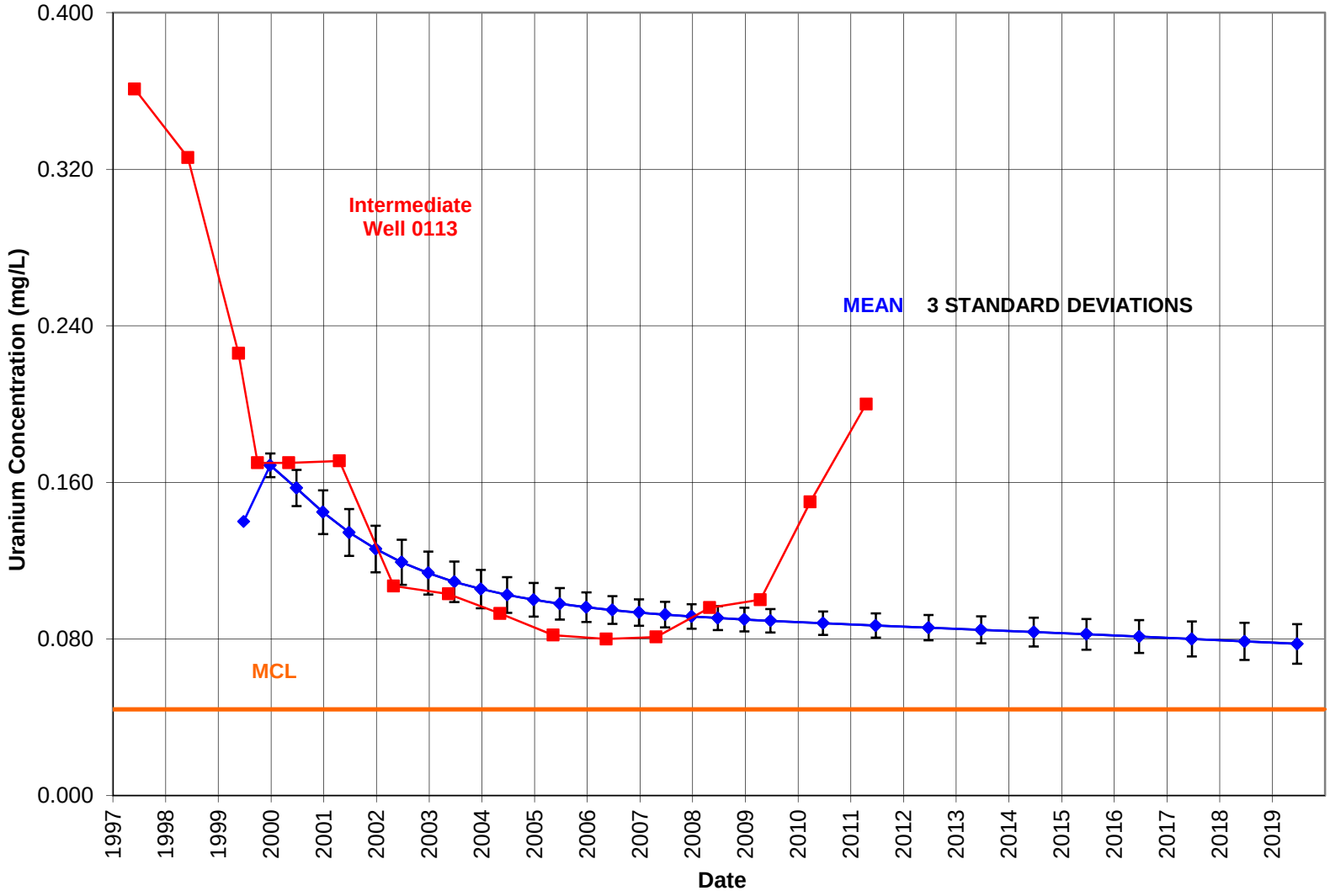


Figure 17. Uranium Concentration—Predicted (Blue) and Actual (Red)—In DOE Monitoring Well 0113 at the Gunnison Site

This page intentionally left blank

6.0 Conclusions

Concentrations of manganese in the alluvial groundwater are still above the DWEL; however, the distribution and magnitude of manganese concentrations are limited. Samples from five wells in the monitoring network exceed the DWEL, with concentrations less than four times the DWEL.

Concentrations of uranium in the alluvial groundwater beneath the former mill site are above the MCL. The uranium concentration in monitoring well 0006, which completed in the shallow zone, remains high but has a downward trend. Highly variable uranium concentrations in this well indicate that residual soil contamination has a localized effect. Construction activities on the former mill site may be mobilizing uranium in soils and contributing to elevated concentrations in groundwater. If concentrations continue to remain high, the 99 year natural flushing time predicted by groundwater modeling and compliance with the 100 year regulatory time-frame for natural flushing at monitoring well 0006 may be unlikely. Accordingly, the compliance strategy for this site may need to be revised.

Concentrations of uranium in the alluvial groundwater immediately downgradient of the former mill site are generally decreasing with time, indicating that natural flushing is progressing. Concentrations of uranium in groundwater farther downgradient of the site and deeper in the alluvial aquifer are still elevated and increasing in some areas, as expected, as the plume migrates downgradient. Contaminant distribution continues to confirm the site conceptual model of contaminants migrating deeper in the alluvial aquifer with distance from the mill site.

Uranium concentrations in the domestic wells sampled near the processing site were all below the MCL and the CDPHE action levels. Manganese concentrations in these wells were all below the DWEL.

The uranium concentrations in the Gunnison River and Tomichi Creek locations indicate minimal impacts from contaminated groundwater discharge. Uranium concentration at the gravel pit pond (0780) is elevated when compared to background, which is expected because the gravel pit receives discharge of contaminated groundwater. Uranium concentrations in the pond have decreased over time, indicating flushing of the alluvial aquifer.

Groundwater in the alluvial aquifer and surface water in the vicinity of the Gunnison site will continue to be monitored annually to assess the progress of natural flushing. The next update to this report will be compiled after groundwater and surface water monitoring in April 2012.

7.0 References

DOE (U.S. Department of Energy), 2001. *Final Site Observational Work Plan for the Gunnison, Colorado, Uranium Mill Tailings Remedial Action (UMTRA) Project Site,* GJO-2001-214-TAR, Grand Junction Office, Grand Junction, Colorado, March.

DOE (U.S. Department of Energy), 2004. Cooperative Agreement DE-FC01-04LM00004.

DOE (U.S. Department of Energy), 2007. *Verification Monitoring Report for the Gunnison, Colorado, Processing Site*, DOE-LM/1524-2007, Office of Legacy Management, Grand Junction, Colorado, September.

DOE (U.S. Department of Energy), 2008. *Verification Monitoring Report for the Gunnison, Colorado, Processing Site*, LMS/GUP/S04496, Office of Legacy Management, Grand Junction, Colorado, August.

DOE (U.S. Department of Energy), 2009. *Verification Monitoring Report for the Gunnison, Colorado, Processing Site*, LMS/GUP/S05527, Office of Legacy Management, Grand Junction, Colorado, August.

DOE (U.S. Department of Energy), 2010a. 2010 *Verification Monitoring Report for the Gunnison, Colorado, Processing Site*, LMS/GUP/S06692, Office of Legacy Management, Grand Junction, Colorado, September.

DOE (U.S. Department of Energy), 2010b. *Final Ground Water Compliance Action Plan for the Gunnison, Colorado, Processing Site*, LMS/GUP/S06004, Office of Legacy Management, Grand Junction, Colorado, April.

EPA (U. S. Environmental Protection Agency), 2011. *2011 Edition of the Drinking Water Standards and Health Advisories*, EPA 822-R-04-005, Winter.

Gilbert, R.O., 1987. *Statistical Methods for Environmental Pollution Monitoring*, Van Nostrand Reinhold, New York, New York.

Gunnison County, 2004. *A Resolution Approving a Special Geographic Area, the New Domestic Well Constraint Area*, Board of County Commissioners of Gunnison County Resolution No. 59, Series 2004, November.

Appendix A

Groundwater Quality Data by Parameter for DOE Monitoring Wells

This page intentionally left blank

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE GUN01, Gunnison Processing Site
REPORT DATE: 7/26/2011 12:53 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Manganese	mg/L	0002	WL	04/27/2011	N001	AL	U	0.00044	B	FJ	#	0.00011	-
	mg/L	0005	WL	04/26/2011	N001	AL	O	0.810		F	#	0.00011	-
	mg/L	0006	WL	04/26/2011	N001	AL	O	0.030		F	#	0.00011	-
	mg/L	0012R	WL	04/26/2011	N001	AL		0.410		F	#	0.00011	-
	mg/L	0012R	WL	04/26/2011	N002	AL		0.370		F	#	0.00011	-
	mg/L	0013	WL	04/26/2011	N001	AL	D	0.019		F	#	0.00011	-
	mg/L	0062	WL	04/27/2011	N001	AL	O	0.0013	B	F	#	0.00011	-
	mg/L	0063	WL	04/27/2011	N001	AL	O	0.021		F	#	0.00011	-
	mg/L	0064	WL	04/27/2011	N001	AL	O	0.0071		F	#	0.00011	-
	mg/L	0065	WL	04/27/2011	N001	AL	O	0.024		F	#	0.00011	-
	mg/L	0066	WL	04/25/2011	N001	AL	O	0.012		F	#	0.00011	-
	mg/L	0102	WL	04/27/2011	N001	AL	U	0.0023	B	F	#	0.00011	-
	mg/L	0105	WL	04/26/2011	N001	AL	O	3.700		F	#	0.00011	-
	mg/L	0106	WL	04/26/2011	N001	AL	O	5.200		F	#	0.00011	-
	mg/L	0112	WL	04/26/2011	N001	AL	O	4.900		F	#	0.00011	-
	mg/L	0113	WL	04/26/2011	N001	AL	D	2.300		F	#	0.00011	-
	mg/L	0125	WL	04/28/2011	N001	AL	D	0.051		F	#	0.00011	-
	mg/L	0126	WL	04/28/2011	N001	AL	D	0.015		F	#	0.00011	-
	mg/L	0127	WL	04/28/2011	N001	AL	D	0.032		F	#	0.00011	-
	mg/L	0135	WL	04/27/2011	N001	AL	D	2.700		F	#	0.00011	-
	mg/L	0136	WL	04/27/2011	N001	AL	D	0.072		F	#	0.00011	-
	mg/L	0160	WL	04/26/2011	N001	AL	D	0.120		F	#	0.00011	-
	mg/L	0161	WL	04/26/2011	N001	AL	D	0.0034	B	F	#	0.00011	-
	mg/L	0161	WL	04/26/2011	N002	AL	D	0.0029	B	F	#	0.00011	-
	mg/L	0181	WL	04/25/2011	N001	AL	D	0.290		F	#	0.00011	-
	mg/L	0183	WL	04/26/2011	0001	AL	D	0.0012	B	F	#	0.00011	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE GUN01, Gunnison Processing Site
REPORT DATE: 7/26/2011 12:53 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Manganese	mg/L	0186	WL	04/26/2011	N001	AL	D	0.00052	B	FJ	#	0.00011	-
	mg/L	0187	WL	04/26/2011	N001	AL	D	0.990		F	#	0.00011	-
	mg/L	0188	WL	04/26/2011	N001	AL	D	0.002	B	F	#	0.00011	-
	mg/L	0189	WL	04/26/2011	0001	AL	D	0.810		FQ	#	0.00011	-
Oxidation Reduction Potential	mV	0002	WL	04/27/2011	N001	AL	U	67.7		F	#	-	-
	mV	0005	WL	04/26/2011	N001	AL	O	18.9		F	#	-	-
	mV	0006	WL	04/26/2011	N001	AL	O	102.2		F	#	-	-
	mV	0012R	WL	04/26/2011	N001	AL		100.0		F	#	-	-
	mV	0013	WL	04/26/2011	N001	AL	D	85.1		F	#	-	-
	mV	0062	WL	04/27/2011	N001	AL	O	70.0		F	#	-	-
	mV	0063	WL	04/27/2011	N001	AL	O	67.6		F	#	-	-
	mV	0064	WL	04/27/2011	N001	AL	O	50.5		F	#	-	-
	mV	0065	WL	04/27/2011	N001	AL	O	71		F	#	-	-
	mV	0066	WL	04/25/2011	N001	AL	O	149.1		F	#	-	-
	mV	0102	WL	04/27/2011	N001	AL	U	70.0		F	#	-	-
	mV	0105	WL	04/26/2011	N001	AL	O	31.3		F	#	-	-
	mV	0106	WL	04/26/2011	N001	AL	O	90.6		F	#	-	-
	mV	0112	WL	04/26/2011	N001	AL	O	54.9		F	#	-	-
	mV	0113	WL	04/26/2011	N001	AL	D	71.7		F	#	-	-
	mV	0125	WL	04/28/2011	N001	AL	D	162.2		F	#	-	-
	mV	0126	WL	04/28/2011	N001	AL	D	140.9		F	#	-	-
	mV	0127	WL	04/28/2011	N001	AL	D	136.2		F	#	-	-
	mV	0135	WL	04/27/2011	N001	AL	D	44.0		F	#	-	-
	mV	0136	WL	04/27/2011	N001	AL	D	0.1		F	#	-	-
	mV	0160	WL	04/26/2011	N001	AL	D	62.7		F	#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Oxidation Reduction Potential	mV	0161	WL	04/26/2011	N001	AL	D	79		F	#	-	-
	mV	0181	WL	04/25/2011	N001	AL	D	122.6		F	#	-	-
	mV	0183	WL	04/26/2011	N001	AL	D	113		F	#	-	-
	mV	0186	WL	04/26/2011	N001	AL	D	-29.9		F	#	-	-
	mV	0187	WL	04/26/2011	N001	AL	D	54.3		F	#	-	-
	mV	0188	WL	04/26/2011	N001	AL	D	-25.8		F	#	-	-
	mV	0189	WL	04/26/2011	N001	AL	D	2.9		FQ	#	-	-
pH	s.u.	0002	WL	04/27/2011	N001	AL	U	7.28		F	#	-	-
	s.u.	0005	WL	04/26/2011	N001	AL	O	7.15		F	#	-	-
	s.u.	0006	WL	04/26/2011	N001	AL	O	6.86		F	#	-	-
	s.u.	0012R	WL	04/26/2011	N001	AL		6.89		F	#	-	-
	s.u.	0013	WL	04/26/2011	N001	AL	D	7.00		F	#	-	-
	s.u.	0062	WL	04/27/2011	N001	AL	O	7.42		F	#	-	-
	s.u.	0063	WL	04/27/2011	N001	AL	O	7.47		F	#	-	-
	s.u.	0064	WL	04/27/2011	N001	AL	O	7.34		F	#	-	-
	s.u.	0065	WL	04/27/2011	N001	AL	O	7.32		F	#	-	-
	s.u.	0066	WL	04/25/2011	N001	AL	O	7.16		F	#	-	-
	s.u.	0102	WL	04/27/2011	N001	AL	U	7.53		F	#	-	-
	s.u.	0105	WL	04/26/2011	N001	AL	O	6.65		F	#	-	-
	s.u.	0106	WL	04/26/2011	N001	AL	O	5.88		F	#	-	-
	s.u.	0112	WL	04/26/2011	N001	AL	O	6.21		F	#	-	-
	s.u.	0113	WL	04/26/2011	N001	AL	D	6.81		F	#	-	-
	s.u.	0125	WL	04/28/2011	N001	AL	D	7.14		F	#	-	-
	s.u.	0126	WL	04/28/2011	N001	AL	D	7.16		F	#	-	-
	s.u.	0127	WL	04/28/2011	N001	AL	D	7.35		F	#	-	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE GUN01, Gunnison Processing Site
REPORT DATE: 7/26/2011 12:53 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
pH	s.u.	0135	WL	04/27/2011	N001	AL	D	6.95		F	#	-	-
	s.u.	0136	WL	04/27/2011	N001	AL	D	7.34		F	#	-	-
	s.u.	0160	WL	04/26/2011	N001	AL	D	6.66		F	#	-	-
	s.u.	0161	WL	04/26/2011	N001	AL	D	6.63		F	#	-	-
	s.u.	0181	WL	04/25/2011	N001	AL	D	6.99		F	#	-	-
	s.u.	0183	WL	04/26/2011	N001	AL	D	6.65		F	#	-	-
	s.u.	0186	WL	04/26/2011	N001	AL	D	7.63		F	#	-	-
	s.u.	0187	WL	04/26/2011	N001	AL	D	6.47		F	#	-	-
	s.u.	0188	WL	04/26/2011	N001	AL	D	7.19		F	#	-	-
	s.u.	0189	WL	04/26/2011	N001	AL	D	6.32		FQ	#	-	-
Specific Conductance	umhos/cm	0002	WL	04/27/2011	N001	AL	U	555		F	#	-	-
	umhos/cm	0005	WL	04/26/2011	N001	AL	O	540		F	#	-	-
	umhos/cm	0006	WL	04/26/2011	N001	AL	O	2179		F	#	-	-
	umhos/cm	0012R	WL	04/26/2011	N001	AL		1182		F	#	-	-
	umhos/cm	0013	WL	04/26/2011	N001	AL	D	1005		F	#	-	-
	umhos/cm	0062	WL	04/27/2011	N001	AL	O	539		F	#	-	-
	umhos/cm	0063	WL	04/27/2011	N001	AL	O	515		F	#	-	-
	umhos/cm	0064	WL	04/27/2011	N001	AL	O	478		F	#	-	-
	umhos/cm	0065	WL	04/27/2011	N001	AL	O	722		F	#	-	-
	umhos/cm	0066	WL	04/25/2011	N001	AL	O	508		F	#	-	-
	umhos/cm	0102	WL	04/27/2011	N001	AL	U	588		F	#	-	-
	umhos/cm	0105	WL	04/26/2011	N001	AL	O	527		F	#	-	-
	umhos/cm	0106	WL	04/26/2011	N001	AL	O	1936		F	#	-	-
	umhos/cm	0112	WL	04/26/2011	N001	AL	O	930		F	#	-	-
	umhos/cm	0113	WL	04/26/2011	N001	AL	D	788		F	#	-	-
	umhos/cm	0125	WL	04/28/2011	N001	AL	D	637		F	#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Specific Conductance	umhos/cm	0126	WL	04/28/2011	N001	AL	D	692		F	#	-	-
	umhos/cm	0127	WL	04/28/2011	N001	AL	D	754		F	#	-	-
	umhos/cm	0135	WL	04/27/2011	N001	AL	D	474		F	#	-	-
	umhos/cm	0136	WL	04/27/2011	N001	AL	D	763		F	#	-	-
	umhos/cm	0160	WL	04/26/2011	N001	AL	D	786		F	#	-	-
	umhos/cm	0161	WL	04/26/2011	N001	AL	D	842		F	#	-	-
	umhos/cm	0181	WL	04/25/2011	N001	AL	D	570		F	#	-	-
	umhos/cm	0183	WL	04/26/2011	N001	AL	D	1155		F	#	-	-
	umhos/cm	0186	WL	04/26/2011	N001	AL	D	604		F	#	-	-
	umhos/cm	0187	WL	04/26/2011	N001	AL	D	800		F	#	-	-
	umhos/cm	0188	WL	04/26/2011	N001	AL	D	731		F	#	-	-
	umhos/cm	0189	WL	04/26/2011	N001	AL	D	2113		FQ	#	-	-
Temperature	C	0002	WL	04/27/2011	N001	AL	U	7.71		F	#	-	-
	C	0005	WL	04/26/2011	N001	AL	O	5.39		F	#	-	-
	C	0006	WL	04/26/2011	N001	AL	O	7.14		F	#	-	-
	C	0012R	WL	04/26/2011	N001	AL		6.05		F	#	-	-
	C	0013	WL	04/26/2011	N001	AL	D	6.86		F	#	-	-
	C	0062	WL	04/27/2011	N001	AL	O	7.70		F	#	-	-
	C	0063	WL	04/27/2011	N001	AL	O	7.65		F	#	-	-
	C	0064	WL	04/27/2011	N001	AL	O	7.65		F	#	-	-
	C	0065	WL	04/27/2011	N001	AL	O	10.41		F	#	-	-
	C	0066	WL	04/25/2011	N001	AL	O	6.81		F	#	-	-
	C	0102	WL	04/27/2011	N001	AL	U	9.37		F	#	-	-
	C	0105	WL	04/26/2011	N001	AL	O	8.15		F	#	-	-
	C	0106	WL	04/26/2011	N001	AL	O	7.82		F	#	-	-
	C	0112	WL	04/26/2011	N001	AL	O	7.99		F	#	-	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE GUN01, Gunnison Processing Site
REPORT DATE: 7/26/2011 12:53 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Temperature	C	0113	WL	04/26/2011	N001	AL	D	10.21		F	#	-	-
	C	0125	WL	04/28/2011	N001	AL	D	5.50		F	#	-	-
	C	0126	WL	04/28/2011	N001	AL	D	7.79		F	#	-	-
	C	0127	WL	04/28/2011	N001	AL	D	7.26		F	#	-	-
	C	0135	WL	04/27/2011	N001	AL	D	5.66		F	#	-	-
	C	0136	WL	04/27/2011	N001	AL	D	8.28		F	#	-	-
	C	0160	WL	04/26/2011	N001	AL	D	6.54		F	#	-	-
	C	0161	WL	04/26/2011	N001	AL	D	6.85		F	#	-	-
	C	0181	WL	04/25/2011	N001	AL	D	7.30		F	#	-	-
	C	0183	WL	04/26/2011	N001	AL	D	6.17		F	#	-	-
	C	0186	WL	04/26/2011	N001	AL	D	6.11		F	#	-	-
	C	0187	WL	04/26/2011	N001	AL	D	6.78		F	#	-	-
	C	0188	WL	04/26/2011	N001	AL	D	6.52		F	#	-	-
	C	0189	WL	04/26/2011	N001	AL	D	5.90		FQ	#	-	-
Turbidity	NTU	0002	WL	04/27/2011	N001	AL	U	3.54		F	#	-	-
	NTU	0005	WL	04/26/2011	N001	AL	O	3.36		F	#	-	-
	NTU	0006	WL	04/26/2011	N001	AL	O	9.20		F	#	-	-
	NTU	0012R	WL	04/26/2011	N001	AL		7.29		F	#	-	-
	NTU	0013	WL	04/26/2011	N001	AL	D	1.89		F	#	-	-
	NTU	0062	WL	04/27/2011	N001	AL	O	1.44		F	#	-	-
	NTU	0063	WL	04/27/2011	N001	AL	O	3.79		F	#	-	-
	NTU	0064	WL	04/27/2011	N001	AL	O	1.70		F	#	-	-
	NTU	0065	WL	04/27/2011	N001	AL	O	5.58		F	#	-	-
	NTU	0066	WL	04/25/2011	N001	AL	O	3.95		F	#	-	-
	NTU	0102	WL	04/27/2011	N001	AL	U	4.21		F	#	-	-
	NTU	0105	WL	04/26/2011	N001	AL	O	4.92		F	#	-	-

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Turbidity	NTU	0106	WL	04/26/2011	N001	AL	O	8.49		F	#	-	-
	NTU	0112	WL	04/26/2011	N001	AL	O	5.64		F	#	-	-
	NTU	0113	WL	04/26/2011	N001	AL	D	5.58		F	#	-	-
	NTU	0125	WL	04/28/2011	N001	AL	D	3.02		F	#	-	-
	NTU	0126	WL	04/28/2011	N001	AL	D	6.84		F	#	-	-
	NTU	0127	WL	04/28/2011	N001	AL	D	1.86		F	#	-	-
	NTU	0135	WL	04/27/2011	N001	AL	D	4.25		F	#	-	-
	NTU	0136	WL	04/27/2011	N001	AL	D	2.76		F	#	-	-
	NTU	0160	WL	04/26/2011	N001	AL	D	9.74		F	#	-	-
	NTU	0161	WL	04/26/2011	N001	AL	D	5.07		F	#	-	-
	NTU	0181	WL	04/25/2011	N001	AL	D	7.48		F	#	-	-
	NTU	0183	WL	04/26/2011	N001	AL	D	22.2		F	#	-	-
	NTU	0186	WL	04/26/2011	N001	AL	D	8.68		F	#	-	-
	NTU	0187	WL	04/26/2011	N001	AL	D	4.65		F	#	-	-
	NTU	0188	WL	04/26/2011	N001	AL	D	4.65		F	#	-	-
	NTU	0189	WL	04/26/2011	N001	AL	D	12.2		FQ	#	-	-
Uranium	mg/L	0002	WL	04/27/2011	N001	AL	U	0.0029		F	#	2.9E-05	-
	mg/L	0005	WL	04/26/2011	N001	AL	O	0.043		F	#	2.9E-05	-
	mg/L	0006	WL	04/26/2011	N001	AL	O	0.640		F	#	0.00015	-
	mg/L	0012R	WL	04/26/2011	N001	AL		0.310		F	#	0.00015	-
	mg/L	0012R	WL	04/26/2011	N002	AL		0.280		F	#	0.00015	-
	mg/L	0013	WL	04/26/2011	N001	AL	D	0.120		F	#	0.00015	-
	mg/L	0062	WL	04/27/2011	N001	AL	O	0.0085		F	#	2.9E-05	-
	mg/L	0063	WL	04/27/2011	N001	AL	O	0.013		F	#	2.9E-05	-
	mg/L	0064	WL	04/27/2011	N001	AL	O	0.0091		F	#	2.9E-05	-
	mg/L	0065	WL	04/27/2011	N001	AL	O	0.028		F	#	2.9E-05	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE GUN01, Gunnison Processing Site
REPORT DATE: 7/26/2011 12:53 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Uranium	mg/L	0066	WL	04/25/2011	N001	AL	O	0.023		F	#	2.9E-05	-
	mg/L	0102	WL	04/27/2011	N001	AL	U	0.0042		F	#	2.9E-05	-
	mg/L	0105	WL	04/26/2011	N001	AL	O	0.012		F	#	2.9E-05	-
	mg/L	0106	WL	04/26/2011	N001	AL	O	0.014		F	#	2.9E-05	-
	mg/L	0112	WL	04/26/2011	N001	AL	O	0.043		F	#	2.9E-05	-
	mg/L	0113	WL	04/26/2011	N001	AL	D	0.200		F	#	0.00015	-
	mg/L	0125	WL	04/28/2011	N001	AL	D	0.011		F	#	2.9E-05	-
	mg/L	0126	WL	04/28/2011	N001	AL	D	0.010		F	#	2.9E-05	-
	mg/L	0127	WL	04/28/2011	N001	AL	D	0.015		F	#	2.9E-05	-
	mg/L	0135	WL	04/27/2011	N001	AL	D	0.0024		F	#	2.9E-05	-
	mg/L	0136	WL	04/27/2011	N001	AL	D	0.017		F	#	2.9E-05	-
	mg/L	0160	WL	04/26/2011	N001	AL	D	0.022		F	#	2.9E-05	-
	mg/L	0161	WL	04/26/2011	N001	AL	D	0.019		F	#	2.9E-05	-
	mg/L	0161	WL	04/26/2011	N002	AL	D	0.018		F	#	2.9E-05	-
	mg/L	0181	WL	04/25/2011	N001	AL	D	0.011		F	#	2.9E-05	-
	mg/L	0183	WL	04/26/2011	0001	AL	D	0.054		F	#	2.9E-05	-
	mg/L	0186	WL	04/26/2011	N001	AL	D	0.020		F	#	2.9E-05	-
	mg/L	0187	WL	04/26/2011	N001	AL	D	0.012		F	#	2.9E-05	-
	mg/L	0188	WL	04/26/2011	N001	AL	D	0.027		F	#	2.9E-05	-
	mg/L	0189	WL	04/26/2011	0001	AL	D	0.015		FQ	#	2.9E-05	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE GUN01, Gunnison Processing Site
REPORT DATE: 7/26/2011 12:53 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY

RECORDS: SELECTED FROM USEE200 WHERE site_code='GUN01' AND location_code in('0002','0005','0006','0012R','0013','0062','0063','0064','0065','0066','0102','0105','0106','0112','0113','0125','0126','0127','0135','0136','0160','0161','0181','0183','0186','0187','0188','0189') AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED between #4/1/2011# and #5/30/2011#

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

LOCATION TYPES: WL WELL

ZONES OF COMPLETION: a zone of completion with a "-" is cross-screened and, therefore, has two zones of completion (1st zone - 2nd zone).

AL ALLUVIUM

FLOW CODES: D DOWN GRADIENT O ON-SITE U UPGRADIENT

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 compund (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 (USEPA CLP organic) qualifier, see case narrative.
Y	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Z	Laboratory defined (USEPA CLP organic) 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.

This page intentionally left blank

Appendix B

Groundwater Quality Data by Parameter for Domestic Wells

This page intentionally left blank

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE GUN01, Gunnison Processing Site
REPORT DATE: 7/26/2011 12:46 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Manganese	mg/L	0476	WL	06/14/2011	N001			0.0015	B	U	#	0.00011	-
	mg/L	0477	WL	05/25/2011	N001			0.021			#	0.00011	-
	mg/L	0478	WL	04/27/2011	N001			0.620			#	0.00011	-
	mg/L	0667	WL	04/26/2011	N001	AL	N	0.00055	B		#	0.00011	-
	mg/L	0683	WL	04/26/2011	N001	AL	N	0.00044	B	J	#	0.00011	-
Oxidation Reduction Potential	mV	0476	WL	06/14/2011	N001			120			#	-	-
	mV	0477	WL	05/25/2011	N001			130.9			#	-	-
	mV	0478	WL	04/27/2011	N001			87.9			#	-	-
	mV	0667	WL	04/26/2011	N001	AL	N	51.4			#	-	-
	mV	0683	WL	04/26/2011	N001	AL	N	89.0			#	-	-
pH	s.u.	0476	WL	06/14/2011	N001			6.67			#	-	-
	s.u.	0477	WL	05/25/2011	N001			7.71			#	-	-
	s.u.	0478	WL	04/27/2011	N001			7.39			#	-	-
	s.u.	0667	WL	04/26/2011	N001	AL	N	7.29			#	-	-
	s.u.	0683	WL	04/26/2011	N001	AL	N	7.39			#	-	-
Specific Conductance	umhos/cm	0476	WL	06/14/2011	N001			255			#	-	-
	umhos/cm	0477	WL	05/25/2011	N001			234			#	-	-
	umhos/cm	0478	WL	04/27/2011	N001			310			#	-	-
	umhos/cm	0667	WL	04/26/2011	N001	AL	N	217			#	-	-
	umhos/cm	0683	WL	04/26/2011	N001	AL	N	295			#	-	-
Temperature	C	0476	WL	06/14/2011	N001			15.6			#	-	-
	C	0477	WL	05/25/2011	N001			10.81			#	-	-
	C	0478	WL	04/27/2011	N001			14.37			#	-	-
	C	0667	WL	04/26/2011	N001	AL	N	9.14			#	-	-
	C	0683	WL	04/26/2011	N001	AL	N	15.50			#	-	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE GUN01, Gunnison Processing Site
REPORT DATE: 7/26/2011 12:46 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Turbidity	NTU	0476	WL	06/14/2011	N001			1.17			#	-	-
	NTU	0477	WL	05/25/2011	N001			8.2			#	-	-
	NTU	0478	WL	04/27/2011	N001			4.85			#	-	-
	NTU	0667	WL	04/26/2011	N001	AL	N	3.52			#	-	-
	NTU	0683	WL	04/26/2011	N001	AL	N	5.99			#	-	-
Uranium	mg/L	0476	WL	06/14/2011	N001			0.0016	E*	J	#	2.9E-05	-
	mg/L	0477	WL	05/25/2011	N001			0.0012			#	2.9E-05	-
	mg/L	0478	WL	04/27/2011	N001			0.003			#	2.9E-05	-
	mg/L	0667	WL	04/26/2011	N001	AL	N	0.00097			#	2.9E-05	-
	mg/L	0683	WL	04/26/2011	N001	AL	N	0.0035			#	2.9E-05	-

CLASSIC GROUNDWATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE GUN01, Gunnison Processing Site
REPORT DATE: 7/26/2011 12:46 pm

PARAMETER	UNITS	LOCATION CODE	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY

RECORDS: SELECTED FROM USEE200 WHERE site_code='GUN01' AND location_code in('0476','0477','0478','0667','0683') AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED between #3/1/2011# and #7/1/2011#

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

LOCATION TYPES: WL WELL

ZONES OF COMPLETION: a zone of completion with a "-" is cross-screened and, therefore, has two zones of completion (1st zone - 2nd zone).

AL ALLUVIUM

FLOW CODES: N UNKNOWN

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 compund (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 (USEPA CLP organic) qualifier, see case narrative.
Y	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Z	Laboratory defined (USEPA CLP organic) 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.

This page intentionally left blank

Appendix C

Surface Water Quality Data by Parameter

This page intentionally left blank

SURFACE WATER QUALITY DATA BY PARAMETER (USEE800) FOR SITE GUN01, Gunnison Processing Site
REPORT DATE: 7/26/2011 12:30 pm

PARAMETER	UNITS	LOCATION CODE	SAMPLE: DATE	ID	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Manganese	mg/L	0248	04/27/2011	N001	0.100			#	0.00011	-
	mg/L	0250	04/25/2011	N001	0.031			#	0.00011	-
	mg/L	0777	04/25/2011	0001	0.040			#	0.00011	-
	mg/L	0780	04/26/2011	N001	0.020			#	0.00011	-
	mg/L	0792	04/26/2011	N001	0.035			#	0.00011	-
	mg/L	0795	04/26/2011	N001	0.030			#	0.00011	-
Oxidation Reduction Potential	mV	0248	04/27/2011	N001	79.4			#	-	-
	mV	0250	04/25/2011	N001	132.5			#	-	-
	mV	0777	04/25/2011	N001	180.6			#	-	-
	mV	0780	04/26/2011	N001	85.3			#	-	-
	mV	0792	04/26/2011	N001	137			#	-	-
	mV	0795	04/26/2011	N001	45.5			#	-	-
pH	s.u.	0248	04/27/2011	N001	8.06			#	-	-
	s.u.	0250	04/25/2011	N001	8.27			#	-	-
	s.u.	0777	04/25/2011	N001	8.20			#	-	-
	s.u.	0780	04/26/2011	N001	8.26			#	-	-
	s.u.	0792	04/26/2011	N001	7.19			#	-	-
	s.u.	0795	04/26/2011	N001	8.11			#	-	-
Specific Conductance	umhos/cm	0248	04/27/2011	N001	398			#	-	-
	umhos/cm	0250	04/25/2011	N001	216			#	-	-
	umhos/cm	0777	04/25/2011	N001	265			#	-	-
	umhos/cm	0780	04/26/2011	N001	517			#	-	-
	umhos/cm	0792	04/26/2011	N001	305			#	-	-
	umhos/cm	0795	04/26/2011	N001	217			#	-	-
Temperature	C	0248	04/27/2011	N001	8.45			#	-	-
	C	0250	04/25/2011	N001	8.55			#	-	-
	C	0777	04/25/2011	N001	8.18			#	-	-
	C	0780	04/26/2011	N001	8.78			#	-	-
	C	0792	04/26/2011	N001	4.79			#	-	-
	C	0795	04/26/2011	N001	4.34			#	-	-
Turbidity	NTU	0248	04/27/2011	N001	7.13			#	-	-
	NTU	0250	04/25/2011	N001	7.16			#	-	-
	NTU	0777	04/25/2011	N001	26.3			#	-	-
	NTU	0780	04/26/2011	N001	7.87			#	-	-
	NTU	0792	04/26/2011	N001	9.74			#	-	-
	NTU	0795	04/26/2011	N001	8.15			#	-	-

SURFACE WATER QUALITY DATA BY PARAMETER (USEE800) FOR SITE GUN01, Gunnison Processing Site
REPORT DATE: 7/26/2011 12:30 pm

PARAMETER	UNITS	LOCATION CODE	SAMPLE: DATE	ID	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Uranium	mg/L	0248	04/27/2011	N001	0.012			#	2.9E-05	-
	mg/L	0250	04/25/2011	N001	0.0007			#	2.9E-05	-
	mg/L	0777	04/25/2011	0001	0.005			#	2.9E-05	-
	mg/L	0780	04/26/2011	N001	0.031			#	2.9E-05	-
	mg/L	0792	04/26/2011	N001	0.0007			#	2.9E-05	-
	mg/L	0795	04/26/2011	N001	0.0008			#	2.9E-05	-

RECORDS: SELECTED FROM USEE800 WHERE site_code='GUN01' AND quality_assurance = TRUE AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND DATE_SAMPLED between #3/1/2011# and #7/1/2011#

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 compund (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 (USEPA CLP organic) qualifier, see case narrative.
Y	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
Z	Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

DATA QUALIFIERS:

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

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

Appendix D

Water Level Data

This page intentionally left blank

STATIC WATER LEVELS (USEE700) FOR SITE GUN01, Gunnison Processing Site
REPORT DATE: 7/26/2011 12:33 pm

LOCATION CODE	FLOW CODE	TOP OF CASING ELEVATION (FT)	MEASUREMENT		DEPTH FROM TOP OF CASING (FT)	WATER ELEVATION (FT)	WATER LEVEL FLAG
			DATE	TIME			
0002	U	7646.75	04/27/2011	15:25	5.43	7641.32	
0005	O	7644.66	04/26/2011	16:10	6.48	7638.18	
0006	O	7647.23	04/26/2011	15:25	11.28	7635.95	
0012R		7645.95	04/26/2011	14:40	11.78	7634.17	
0013	D	7643.75	04/26/2011	13:50	12.18	7631.57	
0062	O	7630.61	04/27/2011	17:20	6.25	7624.36	
0063	O	7630.34	04/27/2011	16:55	7.45	7622.89	
0064	O	7620.76	04/27/2011	18:10	6.57	7614.19	
0065	O	7610.27	04/27/2011	11:00	2.10	7608.17	
0066	O	7606.22	04/25/2011	17:25	2.07	7604.15	
0102	U	7647.30	04/27/2011	16:05	6.05	7641.25	
0105	O	7646.11	04/26/2011	16:20	5.43	7640.68	
0106	O	7647.22	04/26/2011	15:40	11.40	7635.82	
0112	O	7645.74	04/26/2011	14:55	12.14	7633.60	
0113	D	7643.83	04/26/2011	13:25	12.25	7631.58	
0125	D	7633.52	04/28/2011	07:50	6.41	7627.11	
0126	D	7634.14	04/28/2011	08:20	6.51	7627.63	
0127	D	7634.64	04/28/2011	08:40	8.33	7626.31	
0135	D	7627.03	04/27/2011	09:15	5.90	7621.13	
0136	D	7626.24	04/27/2011	14:10	5.32	7620.92	
0160	D	7604.39	04/26/2011	10:00	5.35	7599.04	
0161	D	7605.63	04/26/2011	10:25	6.72	7598.91	
0181	D	7616.38	04/25/2011	16:40	2.72	7613.66	
0183	D	7616.27	04/26/2011	19:40	4.37	7611.90	
0186	D	7627.21	04/26/2011	08:50	5.78	7621.43	
0187	D	7625.91	04/26/2011	08:30	5.36	7620.55	
0188	D	7613.65	04/26/2011	11:40	6.02	7607.63	
0189	D	7613.56	04/26/2011	11:25	6.51	7607.05	

STATIC WATER LEVELS (USEE700) FOR SITE GUN01, Gunnison Processing Site
REPORT DATE: 7/26/2011 12:33 pm

LOCATION CODE	FLOW CODE	TOP OF CASING ELEVATION (FT)	MEASUREMENT DATE	MEASUREMENT TIME	DEPTH FROM TOP OF CASING (FT)	WATER ELEVATION (FT)	WATER LEVEL FLAG

RECORDS: SELECTED FROM USEE700 WHERE site_code='GUN01' AND LOG_DATE between #3/1/2011# and #7/1/2011#

FLOW CODES: D DOWN GRADIENT O ON-SITE U UPGRADIENT

WATER LEVEL FLAGS: