



U.S. DEPARTMENT OF  
**ENERGY**

Legacy  
Management

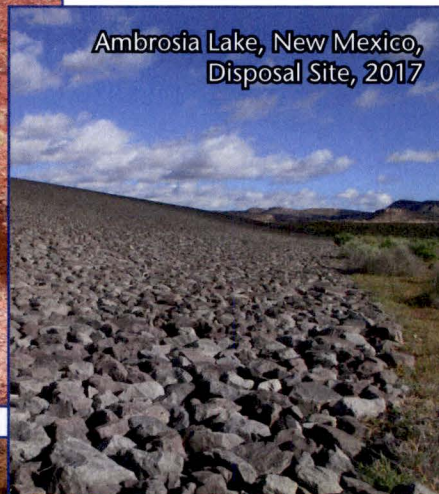
# 2017 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites

March 2018

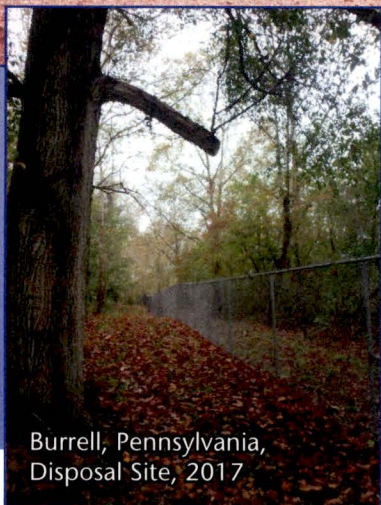
Mexican Hat, Utah,  
Disposal Site, 2017



Ambrosia Lake, New Mexico,  
Disposal Site, 2017



Burrell, Pennsylvania,  
Disposal Site, 2017



MAYBELL, COLORADO  
DATE OF CLOSURE: JULY 20, 1998  
DRY TONS OF TAILINGS: 4,291.928  
RADIOACTIVITY: 455 CURIES, RA-226



Maybell, Colorado,  
Disposal Site, 2017

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**U.S. Department of Energy  
Office of Legacy Management**

**2017 Annual Site Inspection and Monitoring Report  
for  
Uranium Mill Tailings Radiation Control Act  
Title I Disposal Sites**

**March 2018**

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## Abbreviations

ACL	alternate concentration limit
BLM	U.S. Bureau of Land Management
CDPHE	Colorado Department of Public Health and Environment
CFR	<i>Code of Federal Regulations</i>
D <sub>50</sub>	mean diameter
DOE	U.S. Department of Energy
EDA	energy dissipation area
EPA	U.S. Environmental Protection Agency
GCAP	groundwater compliance action plan
ICs	institutional controls
IDEQ	Idaho Department of Environmental Quality
LiDAR	light detection and ranging
LM	Office of Legacy Management
LMS	Legacy Management Support
LTSP	Long-Term Surveillance Plan
MCL	maximum concentration limit
mg/L	milligrams per liter
µrem/hr	microrems per hour
NECA	Navajo Engineering and Construction Authority
NMED	New Mexico Environment Department
NRC	U.S. Nuclear Regulatory Commission
PADEP	Pennsylvania Department of Environmental Protection
PL	photograph location
POC	point-of-compliance
RST	radiation safety technician
UBL	upper baseline limit
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978

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## Executive Summary

This report, in fulfillment of a license requirement, presents the results of long-term surveillance and maintenance activities conducted by the U.S. Department of Energy (DOE) Office of Legacy Management in 2017. Activities occurred at the 19 uranium mill tailings disposal sites established under Title I of the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA).<sup>1</sup> These activities verified that the UMTRCA Title I disposal sites remain in compliance with license requirements. Long-Term Surveillance Plans (LTSPs) and site compliance reports are available on the internet at <https://energy.gov/lm/sites/lm-sites>.

DOE manages 18 UMTRCA Title I sites under a general license granted by the U.S. Nuclear Regulatory Commission (NRC) in accordance with Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). DOE also manages the UMTRCA Title I Grand Junction, Colorado, Disposal Site, which will not be included under the general license until the open, operating portion of the disposal cell is closed. In accordance with “An Act to Extend the Authorization of the Uranium Mill Tailings Radiation Control Act of 1978, and for Other Purposes” (Public Law 104-259), the open portion will be closed either when the capacity has been reached or in 2023, whichever comes first. Members of Congress from the Colorado delegation have introduced bills in the U.S. House and Senate to extend the 2023 closure date until 2048.

Long-term surveillance and maintenance activities and services for these sites include inspecting and maintaining the sites; monitoring environmental media and institutional controls; conducting any necessary corrective actions; and performing administrative, records, stakeholder relations, and other regulatory stewardship functions.

Annual site inspections and monitoring are conducted in accordance with site-specific LTSPs<sup>2</sup> and procedures established by DOE to comply with license requirements. Each site inspection is performed to verify the integrity of visible features at the site; to identify changes or new conditions that may affect the long-term performance of the site; and to determine the need, if any, for maintenance, follow-up inspections, or corrective action in accordance with the LTSP.

All sites require some degree of routine monitoring and maintenance, which may include groundwater and surface water monitoring, minor erosion control, vegetation control, fence and gate repairs, sign replacement, and minor trash removal. The following nonroutine activities<sup>3</sup> occurred in 2017:

- **Lakeview, Oregon, Disposal Site:** A joint NRC/DOE study was conducted at the site to investigate the effects of soil-forming processes on the engineering properties of the disposal cell cover, including radon attenuation.
- **Mexican Hat, Utah, Disposal Site:** Shallow depressions identified in 2016 continue to be observed along the toe and lower portions of the northeast side slope, and evaluations are

<sup>1</sup> Congress directed that the Moab, Utah, Processing Site be remediated under Title I of UMTRCA. This site eventually will become the 20th Title I disposal site.

<sup>2</sup> The Grand Junction Disposal Site is inspected in accordance with an Interim LTSP.

<sup>3</sup> Nonroutine activities are activities implemented in response to changes in site conditions, regulatory setting, or management structure following a regulatory compliance review.

ongoing. DOE has initiated supplemental monitoring of the depression features and related evaluation activities, including installing an onsite meteorological weather station; performing semiannual ground-based light imaging, detection, and ranging (LiDAR) topographic surveys along the northeast side slope; and semiannual collection of horizontal and vertical survey data at the existing settlement plates on the top slope of the disposal cell.

During a site visit on December 14, 2017, a small void was identified at one of the depressions located near the toe of the northeast side slope. The small void extended to the apparent base of the bedding layer and upper portion of the radon barrier. DOE conducted a follow-up inspection with a radiological control technician on December 27, 2017; it confirmed that radiological readings at the void were consistent with background levels at the site. Additional site visits to further evaluate the observed void and to assess the potential for additional areas with similar features are planned for early 2018. NRC was notified of these observations and planned follow-up visits in early January 2018.

Results of the annual site inspection, maintenance, and monitoring activities are reported in the site-specific chapters that follow. Actions and issues are summarized in Table ES-1.

Table ES-1. 2017 Summary of UMTRCA Title I Site Actions and Issues

Site	Chapter	Page	Actions and Issues
Ambrosia Lake, New Mexico	1	1-5	Missing monitoring well lock replaced.
		1-6	Groundwater monitoring conducted as a best management practice.
Burrell, Pennsylvania	2	2-5	Abandoned golf cart found onsite and subsequently removed.
		2-8	No groundwater or seep monitoring was required for 2017.
		2-10	Conducted vegetation management.
		2-10	Test plot established for conservation reuse initiative.
Canonsburg, Pennsylvania	3	3-2	North vehicle gate repaired.
		3-6	Pedestrian bridge temporarily repaired.
		3-7	Conducted a follow-up inspection to assess increased erosion at Chartiers Creek bank.
		3-7	Repaired riprap at Chartiers Creek bank.
		3-7	Additional erosion noted at Chartiers Creek bank requiring a follow-up inspection.
		3-8	No groundwater or surface water monitoring was required for 2017.
		3-10	Conducted vegetation management.
		3-10	Test plot established for conservation reuse initiative.
Durango, Colorado	4	4-2	Replaced entrance sign and damaged perimeter signs.
		4-5	Removed vegetation blocking perimeter signs and boundary monuments.
		4-6	Continued to observe a depression along the north toe of the disposal cell and found no significant changes.
		4-8	Conducted groundwater monitoring.
		4-12	Conducted vegetation management.
Falls City, Texas	5	5-2	Confirmed landowner compliance with deed restrictions.
		5-3	Repaired a broken perimeter fence post.
		5-8	Conducted groundwater monitoring.
Grand Junction, Colorado	6	6-7	Conducted groundwater monitoring.
Green River, Utah	7	7-2	Replaced missing perimeter sign.
		7-6	Observed continued erosion between the security fence and the site boundary.
		7-7	Conducted groundwater monitoring.
Gunnison, Colorado	8	8-2	Repaired broken fence strands.
		8-2	Replaced damaged and missing perimeter signs.
		8-5	Observed rock-monitoring test areas.
		8-6	No groundwater monitoring was required for 2017.
Lakeview, Oregon	9	9-6	Conducted a cover study at site in conjunction with NRC.
		9-6	Conducted riprap gradation monitoring.
		9-9	No groundwater monitoring was required for 2017.
Lowman, Idaho	10	10-6	No groundwater monitoring required.
Maybell, Colorado	11	11-2	Repaired the perimeter fence.
		11-6	No groundwater monitoring required.
		11-7	Conducted vegetation monitoring.



Table ES-1. 2017 Summary of UMTRCA Title I Site Actions and Issues (continued)

Site	Chapter	Page	Actions and Issues
Mexican Hat, Utah	12	12-2	Replaced entrance sign and missing perimeter signs.
		12-5	Continued to observe shallow depressions along the toe and lower portions of the northeast side slope of the disposal cell and found no significant changes.
		12-6	Conducted continual depression evaluation activities, including initiating evaluation of depressions with the installation of meteorological weather stations and collecting baseline topographic data.
		12-6	Removed a deep-rooted plant from the top slope of the disposal cell.
		12-7	Removed scattered trash and abandoned items.
		12-6	Observed a void near the shallow depressions at the toe of the northeast side slope of the disposal cell near the northeast toe drain during a later site visit. A follow-up inspection was conducted on December 27, 2017.
		12-9	No groundwater monitoring required.
		12-9	Conducted observational seep monitoring.
Naturita, Colorado	13	13-2	Repaired the perimeter fence.
		13-2	Stiles tightened.
		13-2	Removed vegetation blocking perimeter signs and culvert.
		13-5	Removed vegetation blocking perimeter signs and culvert.
		13-5	Treated vegetation on the disposal cell.
		13-6	Removed rockfall from the disposal cell access road.
Rifle, Colorado	14	13-6	No groundwater monitoring required.
		14-2	Repaired the stock fence.
		14-5	Replaced damaged perimeter signs.
		14-5	Replaced the plastic water line between standpipe 3 and the evaporation pond and the "Caution, Contamination Area" signs on top of standpipes 2 and 3.
		14-6	Replaced the orange netting and magenta and yellow hazard rope around the evaporation pond.
		14-6	Treated vegetation on the disposal cell.
		14-6	Observed a new gully in the outfall area.
		14-7	Observed two new depressions in the toe ditch outlet.
		14-8	No groundwater monitoring required.
		14-8	Pumped and evaporated disposal cell pore water and monitored pore-water levels.
Salt Lake City, Utah	15	14-10	Exceeded the 6016-foot action level at standpipes 2 and 3.
		15-6	Conducted visual riprap degradation monitoring on the disposal cell.
		15-6	Collected dose rate measurements and radiological wipe samples.
Shiprock, New Mexico	16	15-7	No groundwater monitoring required.
		16-2	Removed sediment from beneath the entrance gate.
		16-5	Sediment and vegetation removed from boundary monuments.
		16-7	Replaced erosion control fabric in the outflow channel.
		16-7	Replaced evaporation pond entrance sign.
		16-8	No disposal cell performance monitoring required.
		16-8	Conducted vegetation monitoring.

*Table ES-1. 2017 Summary of UMTRCA Title I Site Actions and Issues (continued)*

Site	Chapter	Page	Actions and Issues
Slick Rock, Colorado	17	17-6	No groundwater monitoring required.
Spook, Wyoming	18	18-2	Removed damaged perimeter sign.
		18-6	No groundwater monitoring required.
Tuba City, Arizona	19	19-7	Conducted groundwater monitoring.

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## 1.0 Ambrosia Lake, New Mexico, Disposal Site

### 1.1 Compliance Summary

The Ambrosia Lake, New Mexico, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected on September 15, 2017, and October 4, 2017. The inspection was cut short on September 15 due to time constraints and was completed on October 4. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified several routine maintenance needs but found no cause for a follow-up inspection. Groundwater monitoring is not required at the site. However, the U.S. Department of Energy (DOE) conducts groundwater monitoring at three wells as a best management practice at the request of the New Mexico Environment Department (NMED).

### 1.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific DOE Long-Term Surveillance Plan (LTSP) (DOE 1996) and in procedures DOE established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 1-1 lists these requirements.

Table 1-1. License Requirements for the Ambrosia Lake, New Mexico, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 6.0	Section 1.4	(b)(3)
Follow-Up or Contingency Inspections	Section 7.0	Section 1.5	(b)(4)
Maintenance and Repairs	Section 8.0	Section 1.6	(b)(5)
Groundwater Monitoring	Section 5.0	Section 1.7	(b)(2)
Corrective Action	Section 9.0	Section 1.8	

### 1.3 Institutional Controls

The 288-acre site, identified by the property boundary shown in Figure 1-1, is owned by the United States and was accepted under the general license in 1998. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance sign, perimeter signs, site markers, survey and boundary monuments, and wellhead protectors.

### 1.4 Inspection Results

The site, 25 miles north of Grants, New Mexico, was inspected on September 15, 2017, and October 4, 2017. The inspection was conducted by A. Kuhlman and R. Johnson of the DOE Legacy Management Support (LMS) contractor. B. Tsosie (DOE site manager) attended the inspection on both days, and B. Pearson (NMED) and N. Gordon (LMS) attended the inspection

on September 15, 2017. The purposes of the inspection were to confirm the integrity of visible features at the site, to identify changes in conditions that might affect conformance with the LTSP, and to determine the need, if any, for maintenance or additional inspection and monitoring.

#### **1.4.1 Site Surveillance Features**

Figure 1-1 shows in black the locations of site features, including site surveillance features and inspection areas. Site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue text, and new observations identified during the 2017 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are included in the following subsections. Photographs to support specific observations are identified in the text and in Figure 1-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 1.10.

##### ***1.4.1.1 Access Road, Entrance Gate, and Entrance Sign***

Access to the site is from a gravel road that crosses private property and leads to the site for approximately 1 mile from New Mexico Highway 509. Entrance to the site is through a locked steel gate across the access road where it leaves Highway 509. The access road continues to private mining and grazing interests east of the site. The gate and access road are privately owned by Rio Algom Mining LLC. DOE has been granted permanent access to the site but does not maintain the gate or the access road. The entrance sign is near the access road next to site marker SMK-1. No maintenance needs were identified.

##### ***1.4.1.2 Perimeter Signs***

There are 70 perimeter signs, attached to steel posts set in concrete, positioned along the unfenced property boundary. Posts for perimeter signs P1 through P15 include warning signs about mining restrictions; several were bent by cattle but remain legible (PL-1). No maintenance needs were identified.

##### ***1.4.1.3 Site Markers***

The site has two granite site markers. Site marker SMK-1 is just inside the site entrance (PL-2), and site marker SMK-2 is on the top slope of the disposal cell. No maintenance needs were identified.

##### ***1.4.1.4 Survey and Boundary Monuments***

Three combined survey and boundary monuments and five additional boundary monuments delineate the property corners and boundary. Erosion has occurred around the base of boundary monument BM-8, but the monument is stable (PL-3). Boundary monument BM-7 was covered with sediment but was located. It is recommended that steel T-posts be installed next to boundary monuments to help inspectors locate them; this will be completed during the 2018 annual inspection. No other maintenance needs were identified.

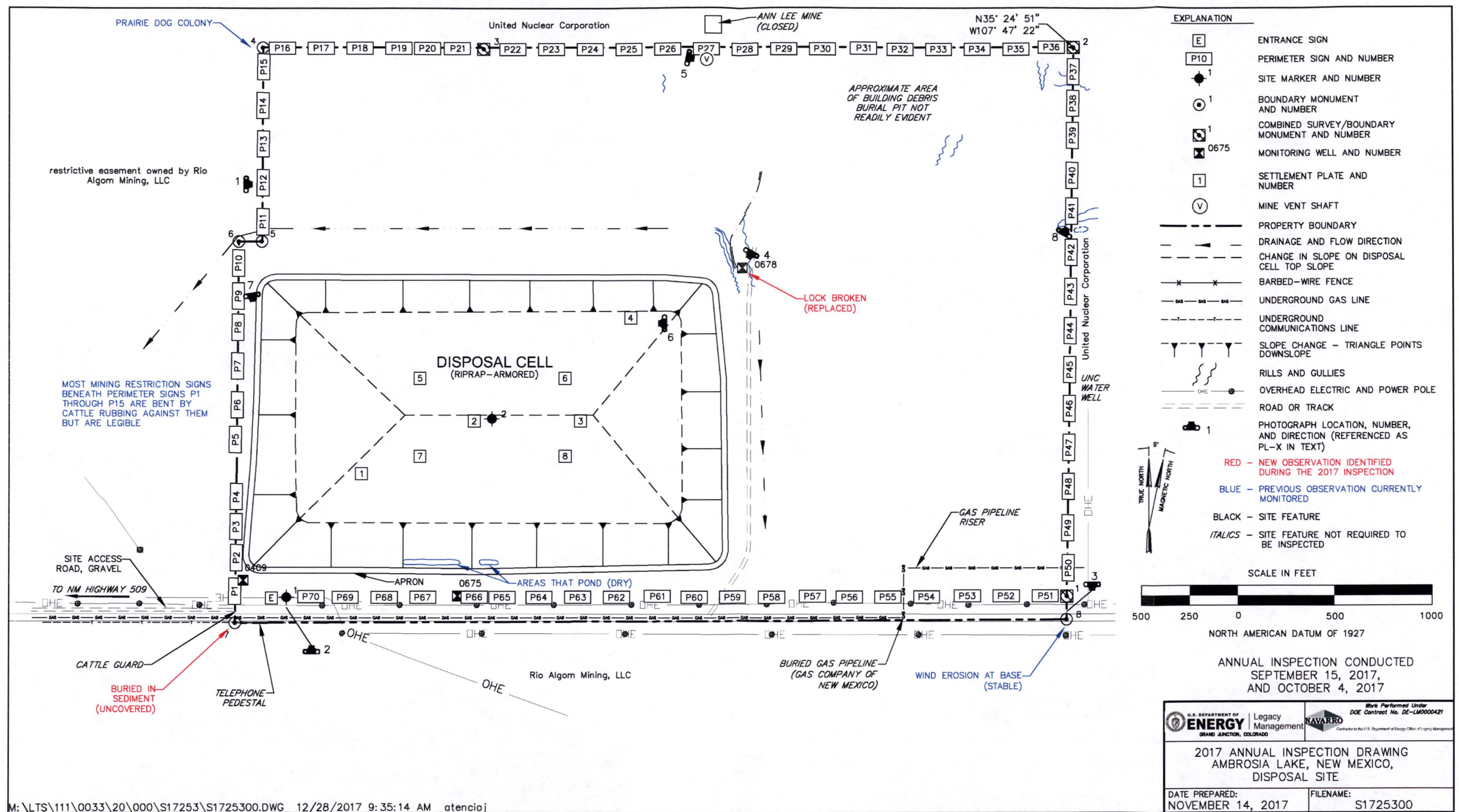


Figure 1-1. 2017 Annual Inspection Drawing for the Ambrosia Lake, New Mexico, Disposal Site



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#### **1.4.1.5    *Monitoring Wells***

The site has three monitoring wells. Gully formation adjacent to monitoring well 0678 appears to be stable, and the well is not affected by the erosion (PL-4). The lock on monitoring well 0678 was broken and was replaced during the inspection. All wellhead protectors observed during the inspection were undamaged and properly labeled. No other maintenance needs were identified.

#### **1.4.1.6    *Mine Vent***

A mine vent shaft associated with an abandoned underground mine is within the site boundary in the northern portion of the site. The vent has a casing that rises approximately 3 feet above the ground and a spot-welded cover. The vent was secure at the time of the inspection (PL-5). Inspectors will continue to monitor the condition of the vent to ensure that the closure remains secure. No maintenance needs were identified.

### **1.4.2    *Inspection Areas***

In accordance with the LTSP, the site is divided into four inspection areas to ensure a thorough and efficient inspection. The inspection areas are (1) the top of the disposal cell, (2) the side slopes and apron of the cell, (3) the graded and revegetated area between the disposal cell and the site perimeter, and (4) the outlying area. Inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with LTSP requirements.

#### **1.4.2.1    *Top of Disposal Cell***

The disposal cell, completed in 1994, occupies 91 acres. The disposal cell is armored with basalt riprap to control erosion. The top slope showed no evidence of cracking, slumping, or erosion, and there was no indication of riprap degradation. A shallow depression around settlement plate SP-4, near the northeast corner of the disposal cell cover, was first noted during the 1997 inspection and continued to grow in depth and area in subsequent years. The depression was repaired in August 2005. Visual observations during the 2017 inspection indicate that very minor settlement may have occurred since the depression was repaired (PL-6). Inspectors will continue to monitor this area.

Scattered annual weeds and perennial grasses and forbs are growing on the disposal cell top slope. In accordance with the LTSP, deep-rooted shrubs are to be removed from the disposal cell cover. No deep-rooted shrubs were noted during the inspection. No maintenance needs were identified.

#### **1.4.2.2    *Side Slopes and Apron***

The basalt riprap-covered side slopes and apron showed no evidence of erosion, settling, slumping, or cracking (PL-7). Standing water is occasionally observed in a portion of the south apron, but the area was dry during the inspection. This location is the topographic low spot along the base of the disposal cell, and rainfall runoff collects in this area. No maintenance needs were identified.



#### **1.4.2.3 Graded and Revegetated Area**

In general, site vegetation appeared to be healthy. However, some areas are windswept and have little growth, particularly in an area north of the disposal cell where mill tailings had formerly been stockpiled. Because the site is not fenced, livestock occasionally enter it. Inspectors did not observe cattle grazing near the disposal cell, but there was evidence of recent grazing on the site. Occasional grazing will not affect the disposal cell protectiveness or long-term performance, because livestock do not walk on riprap-armored surfaces.

Rills and gullies onsite north and east of the disposal cell have been visually monitored for several years. These erosional features do not threaten the disposal cell's performance or integrity, because headward erosion is progressing away from the disposal cell, and there is no significant sedimentation near the disposal cell (PL-8). No maintenance needs were identified.

#### **1.4.2.4 Outlying Area**

The area beyond the site boundary for a distance of 0.25 mile was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. No such impacts were identified.

### **1.5 Follow-Up or Contingency Inspections**

DOE will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) DOE is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up or contingency inspection was identified.

### **1.6 Maintenance and Repairs**

A broken lock was found on monitoring well 0678 and replaced during the inspection. Boundary monument BM-7 was covered with sediment, but the monument was uncovered during the inspection. It is recommended that steel T-posts be installed next to boundary monuments to help inspectors locate them; this will be completed during the 2018 annual inspection. No other maintenance needs were identified.

### **1.7 Groundwater Monitoring**

In accordance with the LTSP, groundwater monitoring is not required at this site because (1) the groundwater is heavily contaminated from underground uranium mining and naturally occurring mineralization, and (2) the uppermost aquifer is of limited use due to its low yield. Consequently, NRC concurred with the application of supplemental standards at the site and the exemption of both compliance and performance groundwater monitoring. However, DOE conducts groundwater monitoring at three monitoring wells (0409, 0675, and 0678) as a best management practice at the request of NMED.

Monitoring well 0675 is completed in weathered Mancos Shale just below its contact with the overlying alluvium, and monitoring well 0678 is completed in the Tres Hermanos B Sandstone unit of the Mancos Shale. DOE originally agreed to sample these locations triennially for



30 years; however, DOE sampled annually from November 2010 to November 2016 at the request of NMED. After the November 2016 sampling event, sampling was returned to a triennial schedule. Monitoring results are provided to NMED and NRC.

DOE installed monitoring well 0409 in May 2011 in support of a regional groundwater investigation being conducted by NMED. The well, located on DOE property adjacent to the southwest corner of the disposal cell, is completed in an alluvium-filled paleochannel. The bottom of the well screen is at the contact between the alluvium and sandstone of the Tres Hermanos C unit of the Mancos Shale. The well is dry, which suggests that groundwater is not leaving the southwest portion of the site via alluvium.

## 1.8 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192. No need for corrective action was identified.

## 1.9 References

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

40 CFR 192. U.S. Nuclear Regulatory Commission, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations*.

DOE (U.S. Department of Energy), 1996. *Long-Term Surveillance Plan for the Ambrosia Lake, New Mexico, Disposal Site*, DOE/AL/62350-211, Rev. 1, July.

## 1.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	85	Perimeter Sign P12 with Mining Restriction Area Warning Sign
PL-2	0	Site Marker SMK-1
PL-3	180	Erosion at Boundary Monument BM-8
PL-4	210	Monitoring Well 0678 with Gullies
PL-5	85	Mine Vent Shaft
PL-6	265	View of Settlement Plate SP-4 and Nearby Settlement
PL-7	170	Disposal Cell West Side Slope
PL-8	30	Gullies at the Site Boundary





PL-1. Perimeter Sign P12 with Mining Restriction Area Warning Sign



PL-2. Site Marker SMK-1





*PL-3. Erosion at Boundary Monument BM-8*

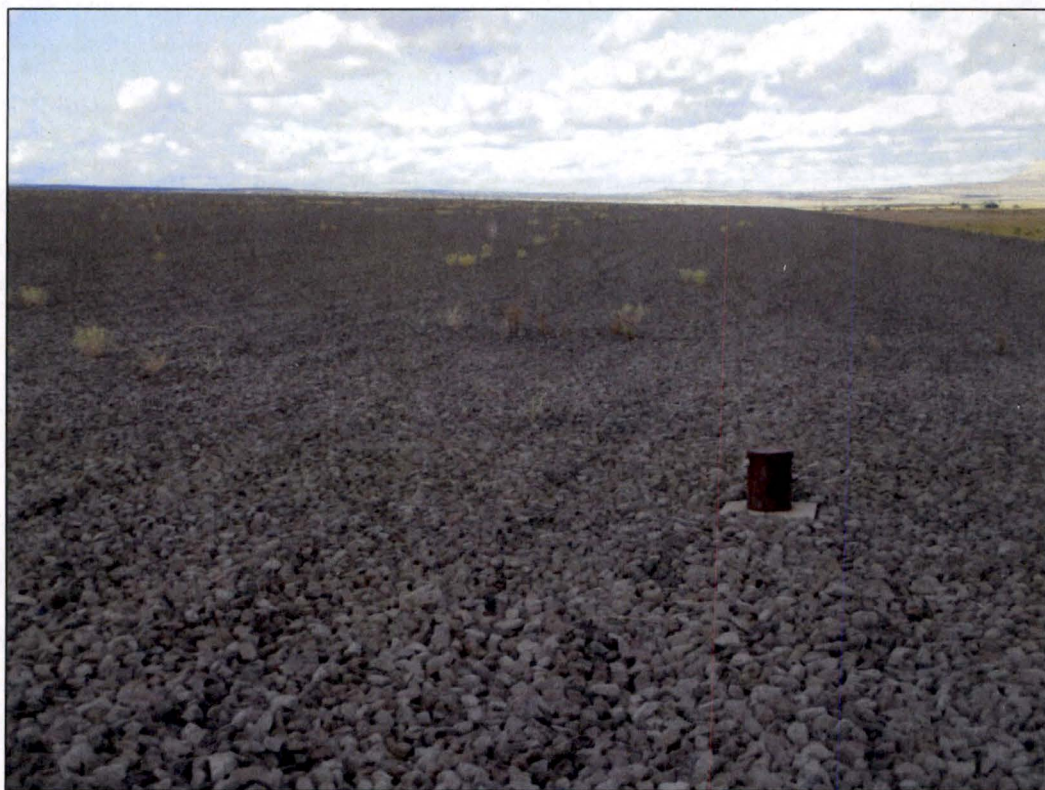


*PL-4. Monitoring Well 0678 with Gullies*





*PL-5. Mine Vent Shaft*



*PL-6. View of Settlement Plate SP-4 and Nearby Settlement*





*PL-7. Disposal Cell West Side Slope*



*PL-8. Gullies at the Site Boundary*



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## 2.0 Burrell, Pennsylvania, Disposal Site

### 2.1 Compliance Summary

The Burrell, Pennsylvania, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected on October 11, 2017. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified several routine maintenance needs but found no cause for a follow-up inspection.

The U.S. Department of Energy (DOE) conducts groundwater monitoring every 5 years as a best management practice to demonstrate that the disposal cell is not leaching contaminants into the groundwater above established groundwater quality protection standards. The most recent sampling event occurred in 2013. Groundwater monitoring results were below the U.S. Environmental Protection Agency (EPA) designated maximum concentration limits (MCLs) in all monitoring wells.

### 2.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific DOE Long-Term Surveillance Plan (LTSP) (DOE 2000) and in procedures DOE established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 2-1 lists these requirements.

Table 2-1. License Requirements for the Burrell, Pennsylvania, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Sections 3.3 and 3.4	Section 2.4	(b)(3)
Follow-Up Inspections	Section 3.5	Section 2.5	(b)(4)
Maintenance	Section 3.6	Section 2.6	(b)(5)
Emergency Measures	Section 3.6	Section 2.7	(b)(5)
Environmental Monitoring	Section 3.7	Section 2.8	(b)(2)

### 2.3 Institutional Controls

The 72-acre site, identified by the property boundary shown in Figure 2-1, is owned by the United States and was accepted under the general license in 1994. DOE is the licensee and, in accordance with requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gate and sign, security fence, perimeter signs, site marker, survey and boundary monuments, erosion-control markers, and wellhead protectors.



## 2.4 Inspection Results

The site, 1 mile east of Blairsville, Pennsylvania, was inspected on October 11, 2017. The inspection was conducted by K. Broberg and J. Homer of the DOE Legacy Management Support (LMS) contractor. C. Carpenter (DOE site manager); D. Shearer, A. Oskin, J. Timcik, and L. Oleyar (Pennsylvania Department of Environmental Protection [PADEP]); J. Goodling (Goat Busters); and C. Young and J. Hackett (LMS) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, to identify changes in conditions that might affect conformance with the LTSP, and to determine the need, if any, for maintenance or additional inspection and monitoring.

### 2.4.1 Site Surveillance Features

Figure 2-1 shows in black the locations of site features, including site surveillance features and inspection areas. Site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue text, and new observations identified during the 2017 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are included in the following subsections. Photographs to support specific observations are identified in the text and in Figure 2-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 2.10.

#### 2.4.1.1 Access Road, Entrance Gate, and Entrance Sign

Access to the site is from a road leading from Strangford Road, along a DOE right-of-way through a parcel of private property (Tract 201-E), and across DOE's leased crossing over Norfolk Southern Railroad tracks (PL-1). Entrance to the site is through a locked gate in the east end of the security fence. Local residents historically have used the area along the DOE right-of-way for unpermitted dumping, hunting, target practice, and riding all-terrain vehicles. Personnel associated with commercial interests use the road for access to the railroad tracks and several nearby natural gas wells. Because the DOE right-of-way cannot be controlled, NRC concurred that the entrance gate in the site security fence is the IC for site access rather than a gate across the access road. The entrance gate was locked and functional. The entrance sign is on the entrance gate (PL-2). No maintenance needs were identified.

#### 2.4.1.2 Security Fence and Perimeter Signs

A chainlink security fence encloses the disposal cell and drainage features. The site herbicide subcontractor keeps the fence line clear of vegetation to prolong the life of the security fence (PL-3). A few tree limbs along the south security fence line were tagged and will be removed before the 2018 annual inspection. There are 16 perimeter signs attached to the outside of the security fence. No other maintenance needs were identified.

#### 2.4.1.3 Site Marker

The site has one granite site marker just inside the main entrance gate (PL-4). No maintenance needs were identified.



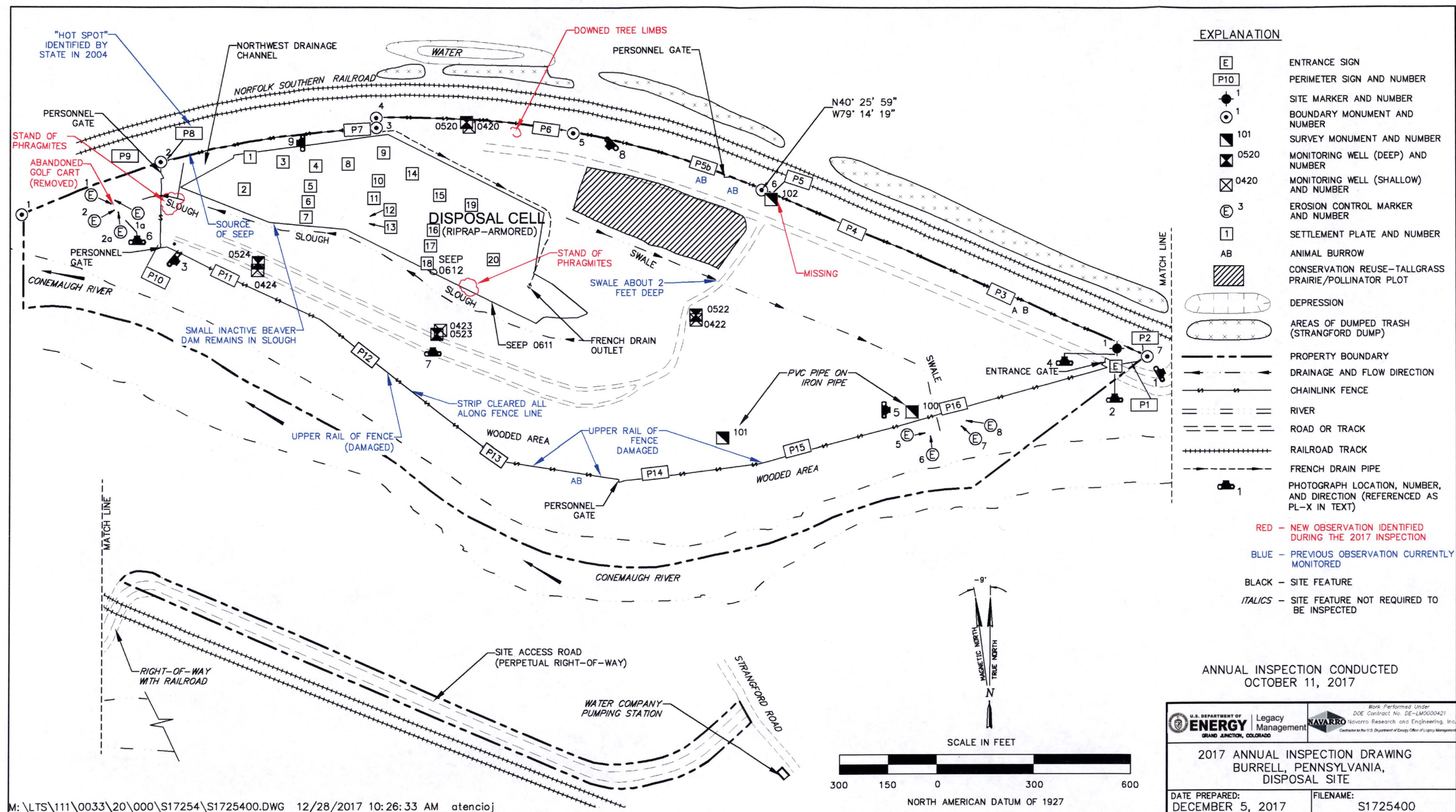


Figure 2-1. 2017 Annual Inspection Drawing for the Burrell, Pennsylvania, Disposal Site



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#### **2.4.1.4 Survey and Boundary Monuments**

The site has three survey monuments and seven boundary monuments. White PVC pipe is installed at survey monuments SM-100 and SM-101 to aid in their location (PL-5). Even with the use of GPS coordinates and a metal detector, survey monument SM-102 could not be located during the inspection. Survey monument SM-102 will be replaced before the 2018 annual inspection; no other maintenance needs were identified.

#### **2.4.1.5 Erosion-Control Markers**

The site has eight erosion-control markers. An abandoned golf cart was found near erosion-control markers on the west side of the site (PL-6). The cart does not appear to have damaged the erosion-control markers, but a better assessment can be made once it is removed. The golf cart was reported as being removed on November 27, 2017. No other maintenance needs were identified.

#### **2.4.1.6 Monitoring Wells**

The site has eight monitoring wells that are inspected when they are sampled. All wellhead protectors that were observed during the annual inspection were locked and undamaged (PL-7). As identified during the 2014 annual inspection, the concrete pad around the surface casing of monitoring well 0523 is cracked. Monitoring well 0424 does not have a concrete pad. During the 2018 sampling event, the well pad at monitoring well 0523 will be repaired, and a concrete pad will be installed at monitoring well 0424.

### **2.4.2 Inspection Areas**

In accordance with the LTSP, the site is divided into four inspection areas (referred to as “transects” in the LTSP) to ensure a thorough and efficient inspection. The inspection areas are (1) the disposal cell, (2) the area adjacent to the disposal cell, (3) the site perimeter, and (4) the outlying area, including the access road that leads to the site. Inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site’s conformance with LTSP requirements.

#### **2.4.2.1 Disposal Cell**

The disposal cell, completed in 1987, occupies 5 acres. The disposal cell is armored with riprap to control erosion. There was no evidence of erosion, settling, slumping, or any other modifying process that might affect the integrity of the disposal cell.

Control of vegetation (including woody vegetation) on the disposal cell is not required for protection of human health and the environment (PL-8). A screening-level risk assessment conducted by DOE from 1996 to 1997 determined that plant succession on the disposal cell does not present significant or credible risk to human health or the environment and may, due to reduced hydraulic flux through the cover from evapotranspiration, improve the long-term performance of the disposal cell. The LTSP was revised in 2000 to reflect these findings. NRC suggested that DOE reevaluate the effects of vegetation on cover performance in 10 or 20 years following the issue of the revised LTSP (i.e., between 2010 and 2020) to confirm performance parameters and predictions. DOE is planning to conduct a follow-up assessment on the effect of



vegetation on cover performance in fiscal year 2019. The assessment will revisit the issue of vegetation growth on the disposal cell cover to determine whether it remains protective of human health and the environment and whether it interferes with the ability of inspectors to determine disposal cell cover stability.

Although vegetation is allowed to grow on the disposal cell, noxious weeds and invasive plants are controlled on the disposal cell and the site through spraying and mowing. In 2008, a site Vegetation Management Plan was issued that included the control of noxious and invasive vegetation on the disposal cell cover to facilitate inspection activities. Vegetation management efforts are effective at limiting the spread of noxious weeds. Other woody species continue to establish but are controlled; no other maintenance needs were identified.

#### ***2.4.2.2 Area Adjacent to the Disposal Cell***

A French drain was installed north of the disposal cell in 1998 to prevent the ponding of water next to the disposal cell. The outlet for the drain is in the southeast corner of the disposal cell. The outlet was not flowing during the inspection, and no outflow has ever been observed during inspections. Water was not ponded anywhere along the French drain depression that runs parallel to the north slope of the disposal cell; this indicates it was operating properly. Inspectors will continue to monitor the French drain area to verify it is operating as designed. Before installation of the drain, the ponded water was thought to be the source of seeps along the south slope of the disposal cell. No water was observed flowing from the seeps on the south slope of the disposal cell after the French drain installation until 2010. In spring 2010, flow was observed in seep 0611. The seep was sampled, and constituent concentrations were below the MCL. Seep 0611 was checked during the inspection and was not flowing.

A small, inactive beaver dam remains in the slough south of the disposal cell. The site herbicide contractor indicated that the dam was inactive in 2017, as no evidence of recent activity was observed around the dam (e.g., animal tracks, new cuts). No maintenance needs were identified.

#### ***2.4.2.3 Site Perimeter***

Downed tree limbs near the area of monitoring wells 0420 and 0520 need to be removed to facilitate mowing operations. This will be completed before the 2018 annual inspection. An active seep is located near the north security fence, about 60 feet east of perimeter sign P8 and west of the disposal cell. Due to unsafe rain conditions, inspectors did not walk down the slick riprap-covered slope to the exact location of the seep (PL-9). The seep does not pose a threat to the integrity of the disposal cell. Inspectors will continue to monitor this area. Conceivably, the seep could destabilize the nearby railroad embankment. The water for the seep appears to be coming from the bluffs north of the railroad tracks. No maintenance needs were identified.

#### ***2.4.2.4 Outlying Area***

The area beyond the site boundary for a distance of 0.25 mile was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. No such impacts were observed. Inspectors did note increased activity along the railroad tracks. New railroad materials and supplies were staged in two areas, and crews were working to load loose track stored on the side of the rails onto trucks for transport. The activity does not affect the long-term integrity of the site.



North of the site, a dirt road parallels the railroad tracks and provides access to a long, narrow wooded area that has been used as an illegal dump. No new piles of trash were observed during the inspection. The dumping of trash is not a threat to the disposal site but is an indication of the overall level of activity near the disposal site and may be a predictor of vandalism. Inspectors will continue to note any dumping activity.

In 2004, a PADEP representative showed inspectors a "hot spot" (having gamma radiation levels of 5 millirem per hour) in the rock ballast adjacent to the railroad tracks northeast of perimeter sign P8. A review of DOE records has confirmed that the area in question was addressed in a Uranium Mill Tailings Remedial Action Project property completion report. Supplemental standards have been applied to contamination beneath the tracks because the benefit of removal does not justify the cost, and the contamination does not pose a risk. DOE communicated the results of the records search to PADEP in late 2004. The hot spot was the subject of a follow-up discussion with State representatives in 2006. At this time, no concerns are associated with this area because the application of supplemental standards remains protective based on current and projected land use and associated exposure scenarios. The area is marked on the site inspection map for future reference.

## **2.5 Follow-Up Inspections**

DOE will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) DOE is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up inspection was identified.

## **2.6 Maintenance**

Survey monument SM-102 needs to be replaced. Tagged tree limbs along the south security fence line need to be removed to prevent damage to the fence. Downed tree limbs near the area of monitoring wells 0420 and 0520 need to be removed to facilitate mowing operations. These maintenance needs will be addressed before the 2018 annual inspection. As part of the 2018 sampling event, the concrete well pad at monitoring well 0523 will be repaired, and a concrete well pad will be installed at monitoring well 0424. No other maintenance needs were identified.

## **2.7 Emergency Measures**

Emergency measures are actions DOE will take in response to unusual damage or disruption that threatens or compromises site safety, security, or integrity in compliance with 10 CFR 40 Appendix A. No need for emergency measures was identified.



## 2.8 Environmental Monitoring

### 2.8.1 Groundwater Monitoring

In accordance with the LTSP, DOE conducts groundwater monitoring every 5 years as a best management practice to aid evaluation of the disposal cell's performance. The most recent sampling event occurred in November 2013. The groundwater monitoring network consists of eight monitoring wells (in four pairs) and two seeps (Figure 2-2 and Table 2-2). Each pair of wells consists of a shallow well completed in unconsolidated fill and alluvium (400-series wells), and a deeper well completed in the deeper bedrock of the Casselman Formation (500-series wells). Groundwater is sampled for four target analytes: lead, molybdenum, selenium, and uranium. The EPA established MCLs for these analytes in groundwater (40 CFR 192 Table 1 Subpart A) (Table 2-3).

Table 2-2. Groundwater Monitoring Network for the Burrell, Pennsylvania, Disposal Site

Monitoring Well or Seep	Hydrologic Relationship
0420 and 0520	Upgradient or background monitoring well
0422 and 0522	Cross-gradient monitoring well
0423 and 0523	Downgradient monitoring well
0424 and 0524	Downgradient monitoring well
0611 and 0612	Seep

Table 2-3. Maximum Concentration Limits for Groundwater at the Burrell, Pennsylvania, Disposal Site

Constituent	MCL <sup>a</sup> (mg/L)
Lead	0.05
Molybdenum	0.1
Selenium	0.01
Uranium	0.044

**Note:**

<sup>a</sup> MCLs as listed in 40 CFR 192 Table 1 Subpart A, given here in milligrams per liter (mg/L).

**Abbreviation:**

mg/L = milligrams per liter

As reported in the 2014 *Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites* (DOE 2014), monitoring results for the four target analytes continue to remain below their respective MCLs and, in most cases, at or near the laboratory detection limit. Groundwater downgradient from the disposal cell was determined not to be degraded relative to upgradient or background groundwater, and DOE concluded that the disposal cell effectively isolates the contaminated waste from the groundwater environment.

After each monitoring event, DOE reviews the data for trends or significant changes. Periodically, and with NRC concurrence, DOE will review the need to continue monitoring and in the future may determine that monitoring is no longer warranted or that a change to the monitoring frequency is warranted. The next sampling event is scheduled for 2018.



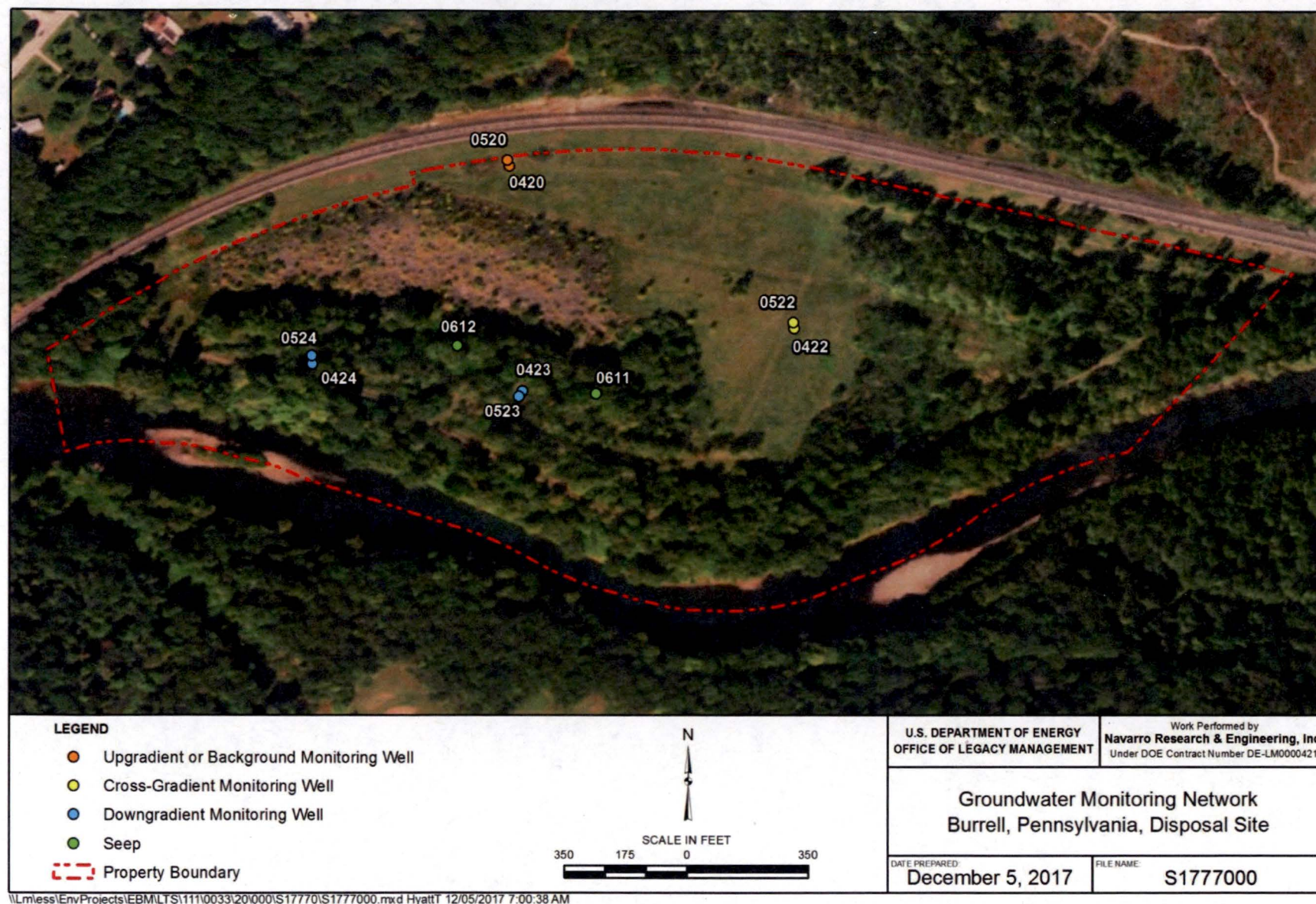


Figure 2-2. Groundwater Monitoring Network for the Burrell, Pennsylvania, Disposal Site



## 2.8.2 Vegetation Management

In accordance with the Vegetation Management Plan, vegetation management activities continue to be conducted at the site. Vegetation management activities include ensuring the security fence line and access paths remain clear of Japanese knotweed (an invasive species), applying herbicide where appropriate, and mowing frequently. These activities are mostly successful in controlling noxious and invasive plants onsite, with the exception of purple loosestrife and Japanese knotweed. Purple loosestrife continues to exist in the swale south and west of the disposal cell, the area between the toe of the north slope of the disposal cell, and the French drain. Wooded areas remained heavily infested with Japanese knotweed. Inspectors noted two new areas of phragmites (an invasive species) that need to be addressed; these will be treated before the 2018 annual inspection.

The use of goats as an innovative way to control noxious and invasive weeds is being considered for portions of the site. Inspectors met with J. Goodling, the owner of a company called Goat Busters that specializes in the deployment of goats for vegetation control. Given terrain challenges at the site (i.e., a riprap-covered disposal cell, steep-sloped slough area, forest understory), the use of goats may prove to be more efficient and cost effective than the conventional spraying techniques currently used.

A conservation reuse initiative for pollinator species is being pursued at the site that involves the establishment of a tallgrass prairie. A 2-acre plot in the mowed field east of the disposal cell was staked out as a test plot. The staked area will be prepared and seeded in spring 2018. If it is successful, there is room at the site to expand the prairie, if that is deemed appropriate.

## 2.9 References

10 CFR 40, Appendix A. U.S. Nuclear Regulatory Commission, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content," *Code of Federal Regulations*.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

40 CFR 192 Table 1 Subpart A. U.S. Nuclear Regulatory Commission, "Maximum Concentration of Constituents for Groundwater Protection" *Code of Federal Regulations*.

DOE (U.S. Department of Energy), 2000. *Long-Term Surveillance Plan for the U.S. Department of Energy Burrell Vicinity Property, Blairsville, Pennsylvania*, GJO-2002-331-TAR, April.

DOE (U.S. Department of Energy), 2014. *2014 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*, LMS/S12245, March.



## 2.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	60	Train Parked West of Site Access Road
PL-2	0	Entrance Sign
PL-3	130	South Security Fence Line
PL-4	0	Site Marker SMK-1
PL-5	90	PVC Pipe Marking Location of Survey Monument SM-100
PL-6	0	Abandoned Golf Cart Resting Against Erosion-Control Marker (Removed)
PL-7	0	Well Pad of Monitoring Well 0423
PL-8	225	Tree-Covered Disposal Cell
PL-9	270	North Security Fence Line with Disposal Cell on Left, Security Fence on Right





*PL-1. Train Parked West of Site Access Road*



*PL-2. Entrance Sign*





*PL-3. South Security Fence Line*



*PL-4. Site Marker SMK-1*





*PL-5. PVC Pipe Marking Location of Survey Monument SM-100*



*PL-6. Abandoned Golf Cart Resting Against Erosion-Control Marker (Removed)*





*PL-7. Well Pad of Monitoring Well 0423*



*PL-8. Tree-Covered Disposal Cell*





*PL-9. North Security Fence Line with Disposal Cell on Left, Security Fence on Right*



### 3.0 Canonsburg, Pennsylvania, Disposal Site

#### 3.1 Compliance Summary

The Canonsburg, Pennsylvania, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected on October 12, 2017. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified several routine maintenance needs. A follow-up inspection was conducted in May 2017 in response to stream bank erosion identified the 2016 annual inspection. Repairs to the riprap armoring of the stream bank were made in September 2017. Another follow-up inspection will be completed by engineering staff in spring 2018 to evaluate additional erosion along the stream bank identified during the 2017 annual inspection.

The U.S. Department of Energy (DOE) conducts groundwater and surface water monitoring every 5 years to evaluate disposal cell performance. The most recent sampling event occurred in November 2013. Monitoring results were below the site-specific limits.

#### 3.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific DOE Long-Term Surveillance Plan (LTSP) (DOE 2013) and in procedures DOE established to comply with requirements of the U.S. Nuclear Regulatory Commission general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 3-1 lists these requirements.

Table 3-1. License Requirements for the Canonsburg, Pennsylvania, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 3.3	Section 3.4	(b)(3)
Follow-Up Inspections	Section 3.4	Section 3.5	(b)(4)
Maintenance	Section 3.5	Section 3.6	(b)(5)
Environmental Monitoring	Section 3.7	Section 3.7	(b)(2)
Emergency Response	Section 3.6	Section 3.8	(b)(5)

#### 3.3 Institutional Controls

The 34.2-acre site, identified by the property boundary shown in Figure 3-1, is owned by the United States and was accepted under the general license in 2008. DOE is the licensee and, in accordance with requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gates and sign, security fence, perimeter signs, site markers, survey and boundary monuments, erosion control markers, and wellhead protectors.

In addition to the area within the property boundary, separate ICs are applied to Area C and Tract 117, which are southeast of Strabane Avenue. Area C (3.1 acres) was sold and transferred



in 2005, and Tract 117 (0.431 acre) was sold and transferred in 2009 to the same private owner. DOE and the Commonwealth of Pennsylvania complied with restrictions on parcel transfers stipulated in UMTRCA and in the cooperative agreement between DOE and the Commonwealth. The deed for Area C and Tract 117 establishes restrictions to limit excavation, prohibits the disturbance of the stream bank, maintains access for monitoring and stream bank maintenance, and prevents the areas from being used for residential purposes. Use of groundwater is not restricted. Adherence to these ICs is evaluated during the annual inspection. There was no evidence that any of the ICs were violated.

### **3.4 Inspection Results**

The site, located in Canonsburg, Pennsylvania, was inspected on October 12, 2017. The inspection was conducted by K. Broberg and J. Homer of the DOE Legacy Management Support (LMS) contractor. C. Melendez (DOE Office of Legacy Management director), C. Carpenter (DOE site manager), T. Biller (Lawn RX), and J. Hackett and C. Young (LMS) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, to identify changes in conditions that may affect conformance with the LTSP, and to determine the need, if any, for maintenance or additional inspection and monitoring.

#### **3.4.1 Site Surveillance Features**

Figure 3-1 shows in black the locations of site features, including site surveillance features and inspection areas. Site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue text, and new observations identified during the 2017 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are included in the following subsections. Photographs to support specific observations are identified in the text and in Figure 3-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 3.10.

##### ***3.4.1.1 Site Access, Entrance Gates, and Entrance Sign***

Access to the site is from Strabane Avenue. There are two vehicle gates: an entrance gate at the southeast corner of the site along Strabane Avenue (the main entrance gate) and a vehicle access gate north of the disposal cell between perimeter signs P8 and P9. The misaligned hinge on the north vehicle gate, identified during the 2016 annual inspection, was repaired before the 2017 annual inspection. There are also two personnel access gates: one is northwest of the disposal cell south of perimeter sign P5, and one is in the southwest corner. All gates were locked and functional. The entrance sign is posted on the main entrance gate. No maintenance needs were identified.

##### ***3.4.1.2 Security Fence and Perimeter Signs***

A chainlink security fence encloses most of the site (PL-1). A vegetation-free buffer zone is maintained around the entire security fence. An area of erosion under the west security fence remains. The area appears to be stable and has not grown in several years. For added security, slats were installed in 2016 across the area beneath the fence to help fill in the gap. There are 11 perimeter signs attached to the security fence (PL-2). No maintenance needs were identified.



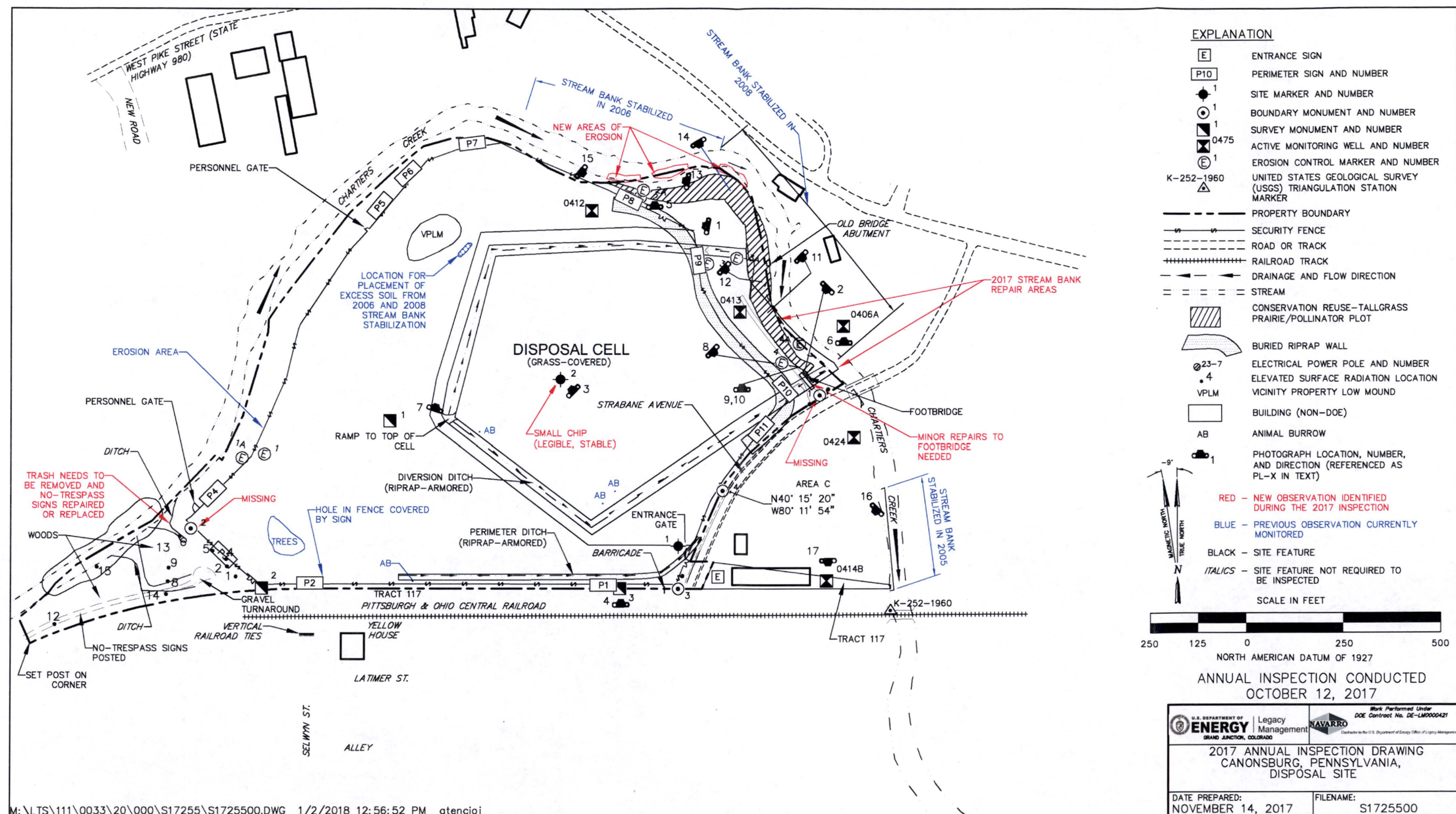


Figure 3-1. 2017 Annual Inspection Drawing for the Canonsburg, Pennsylvania, Disposal Site



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#### **3.4.1.3 Site Markers**

The site has two granite site markers. Site marker SMK-1 is just inside the main entrance gate, and site marker SMK-2 is on the top slope of the disposal cell (PL-3). A small chip was observed in site marker SMK-2 after the 2016 annual inspection. It is assumed that the marker was chipped during mowing. Mowing procedures will be reviewed with the mowing subcontractor to prevent similar damage in the future. Site marker SMK-2 remains legible, and the small chip does not impact the structural integrity. No maintenance needs were identified.

#### **3.4.1.4 Survey and Boundary Monuments**

The site has three survey monuments and four boundary monuments (PL-4). Despite the use of GPS and a metal detector, boundary monuments BM-1 and BM-2 could not be located and need to be replaced; no other maintenance needs were identified.

#### **3.4.1.5 Erosion Control Markers**

The site has four pairs of erosion control markers along the bank of Chartiers Creek (PL-5). No maintenance needs were identified.

#### **3.4.1.6 Monitoring Wells**

The site has five groundwater monitoring wells, which are inspected when the monitoring wells are sampled (PL-6). All wellhead protectors that were observed during the inspection were undamaged and locked. No maintenance needs were identified.

### **3.4.2 Inspection Areas**

In accordance with the LTSP, the site is divided into five inspection areas (referred to as "transects" in the LTSP) to ensure a thorough and efficient inspection. The inspection areas are (1) the disposal cell, (2) the area adjacent to the disposal cell, (3) the diversion channels and perimeter ditches, (4) the site perimeter and security fence, and (5) the outlying areas. Inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with LTSP requirements.

#### **3.4.2.1 Disposal Cell**

The disposal cell, completed in 1985, occupies 6.8 acres and is covered in grass (PL-7). There was no evidence of erosion, settling, slumping, or other modifying processes that might affect the integrity of the disposal cell. Animals burrow on the disposal cell cover, but such burrows should not pose a risk to disposal cell integrity or public health, because the buried tailings are overlain by a 36-inch-thick clay layer (radon barrier), an 18-inch-thick rock layer, and a 12-inch-thick topsoil layer. Biointrusion down to or through the radon barrier is unlikely. Inspectors will continue to monitor the location and the significance of burrows. No new burrows were noted on the disposal cell during the inspection. No maintenance needs were identified.



### **3.4.2.2 Area Adjacent to the Disposal Cell**

The site consists primarily of mowed grasses within the security fence and on the disposal cell cover, with seeded fescues and crown vetch present across the site. The spray-and-mow approach to vegetation management at the site continues to be effective. Noxious weeds within the security fence area are limited to resprouting seedlings that were observed in portions of mowed areas.

A small pedestrian bridge was installed northeast of the disposal cell in 2010. The deck and rails of the bridge were repainted in 2017 (PL-8). Minor repairs to the bridge are needed. A loose vertical handrail support was temporarily repaired in 2017 but requires a more permanent fix (PL-9), and the west end of the south handrail is beginning to rot (PL-10). These repairs will be made at a later date pending budget and schedule. No other maintenance needs were identified.

### **3.4.2.3 Diversion Channels and Perimeter Ditches**

There was no evidence of rock deterioration or woody vegetation in the diversion channels and perimeter ditches. Periodic physical removal and spot herbicide applications have been effective at reducing woody vegetation and will continue to be conducted as needed. No maintenance needs were identified.

### **3.4.2.4 Site Perimeter and Security Fence**

In 2007, a radiological survey was conducted on a small parcel of land southwest of the security fence to evaluate its release for industrial reuse. The survey identified isolated radium-226 contamination in soil in excess of the established average criterion for the site. As a result, the entire parcel did not satisfy release criteria and was removed as a reuse candidate. Under current property usage, these radiological conditions do not pose a risk to personnel, and no corrective measures are required. DOE controls land use through ownership. Inspectors will continue to check the area for evidence of trespassing. No evidence of recent trespassing was observed during the inspection. A former campsite hidden among the trees in the southwest corner of the site appeared to be abandoned. Trash from the former campsite needs to be removed, and some of the no-trespassing signs posted in this area need to be repaired or replaced. These actions will be completed before the 2018 annual inspection.

A local plastics company has cleared some of DOE's property north of the railroad tracks and spread gravel to create a turnaround for its trucks. No-trespassing signs are posted around this area so the turnaround area will not become any larger. An access agreement was established in 2017 with the plastics company for continued use of the turnaround. No other maintenance needs were identified.

### **3.4.2.5 Outlying Area**

**Chartiers Creek Bank:** Chartiers Creek is an active, meandering waterway west, north, and east of the disposal site. Bedrock outcrops and mature trees on the stream bank west of the site indicate that the bank of the creek west of the site is stable. Between 2001 and 2008, several stabilization projects were conducted north and east of the site to stabilize the stream bank. The projects consisted of installing riprap armoring along the stream banks. Vegetation growth on the riprap-armored southern bank of Chartiers Creek is being controlled so visual inspections of



riprap integrity can be performed. Age and recent heavy flow events in Chartiers Creek, though, are taking their toll on those riprap installations.

During the 2015 annual inspection, a small area of erosion was noted along the top of the riprap installed north of the site just west of Strabane Avenue. The erosion may be caused by surface water runoff to the creek. Runoff appears to have undermined the upper extent of the fabric beneath the riprap, resulting in removal of soil from beneath the riprap. The observation was also made that heavy mowing equipment operating near the edge of this area could contribute to the problem by undermining the surrounding soil. Four T-posts were installed around the erosion area to make it more visible to the mowing crews, who were instructed to keep heavy equipment back from the edge of the area to avoid further damage. In 2015, continued monitoring was deemed appropriate.

The area of erosion was larger during the 2016 annual inspection. A follow-up inspection was conducted by LMS engineering staff in May 2017 when it was determined that repairs were necessary (PL-11). Repairs to the riprap were completed in September 2017 (PL-12). It was also determined during the follow-up inspection that herbicide spraying along the top of the riprap was contributing to the onset of erosion by creating bare soil areas. The practice of spraying along the top of the riprap has since been ended. The mowing routine was also changed to allow a buffer strip of high, dense grass to remain along the stream bank. The high, dense grass helps baffle the flow of water down to the edge of the bank.

During the 2017 annual inspection, several other areas of the riprap bank (west of the 2017 repairs) were identified as needing to be evaluated for repair (PL-13 through PL-15). A follow-up inspection by LMS engineering staff will be completed to evaluate the erosion and collect design specifications for mitigation actions. No other maintenance needs were identified.

**Area C and Tract 117:** Area C and Tract 117 form a triangular parcel of property east of the site bounded by Strabane Avenue, Chartiers Creek, and the Pittsburgh and Ohio Central Railroad. Area C and Tract 117 are included in the annual inspection to ensure compliance with ICs put in place to address land use and site access requirements. There was no evidence that any of the ICs in place for Area C and Tract 117 had been violated.

The landowner of Area C and Tract 117 continues to build aboveground storage units. ICs restrict structure excavations deeper than 4 feet and utilities excavation deeper than 6 feet. The storage units constructed so far do not violate these ICs (PL-16).

DOE has two groundwater monitoring wells in Area C and Tract 117 (0424 and 0414B, respectively) that are part of the groundwater monitoring network (PL-17). Inspectors noted that drainage from the storage unit foundation is directed behind monitoring well 0414B via a pipe. Inspectors will continue to monitor this area to assess if the drainage pipe will affect the monitoring well area. No maintenance needs were identified.

**Strabane Avenue:** The maintenance subcontractor, Lawn RX, periodically removes trash found on and adjacent to the site to maintain the site's appearance. Inspectors also pick up trash as necessary. Inspectors observed that Strabane Avenue, next to the site, was relatively clear of trash. Trash was not collected during the inspection. No maintenance needs were identified.



### 3.5 Follow-Up Inspections

DOE will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) DOE is notified by a citizen or outside agency that conditions at the site are substantially changed. LMS engineering staff conducted a follow-up inspection to the 2016 annual inspection in May 2017 to evaluate erosion along the Chartiers stream bank north of the disposal cell and to collect design specification for mitigation actions. Repairs to the riprap armoring were made in September 2017. A new area of erosion (west of the 2017 repairs) was identified during the 2017 annual inspection. LMS engineering staff will conduct another follow-up inspection in spring 2018 to evaluate the additional erosion along the Chartiers stream bank north of the disposal cell and to collect design specification for mitigation actions for this new area. Evaluation results will be reported in the *2018 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*.

### 3.6 Maintenance

A loose hinge on the north vehicle gate and steel pins protruding from the concrete footer near BM-1, identified during the 2016 annual inspection, were repaired before the 2017 annual inspection. During the 2017 annual inspection boundary monuments BM-1 and BM-2 could not be located; both will be replaced. Minor repairs to the pedestrian bridge are needed, including fixing the loose handrail support and rotting south handrail. Trash remaining at an abandoned trespass camp will be removed, and a few no-trespassing signs will be repaired or replaced. All of these maintenance needs will be completed at a later date pending budget and schedule. No other maintenance needs were identified.

### 3.7 Environmental Monitoring

#### 3.7.1 Groundwater Monitoring

In accordance with the LTSP, DOE conducts groundwater monitoring every 5 years to evaluate disposal cell performance. The most recent sampling event occurred in November 2013. The groundwater monitoring network consists of five monitoring wells, including three point of compliance (POC) wells and two best management practice wells (Table 3-2 and Figure 3-2). All monitoring wells are completed in the uppermost aquifer (shallow unconsolidated materials). Groundwater is sampled for the constituent of concern, uranium. The site-specific alternate concentration limit (ACL) is 1.0 milligrams per liter (mg/L) at the POC wells.

Table 3-2. Groundwater Monitoring Network for the Canonsburg, Pennsylvania, Disposal Site

Monitoring Well	Hydrologic Relationship	Groundwater Monitoring Purpose
0406A	Downgradient	Best management practice
0412	Downgradient	Point of compliance
0413	Downgradient	Point of compliance
0414B	Cross-gradient	Point of compliance
0424	Downgradient	Best management practice



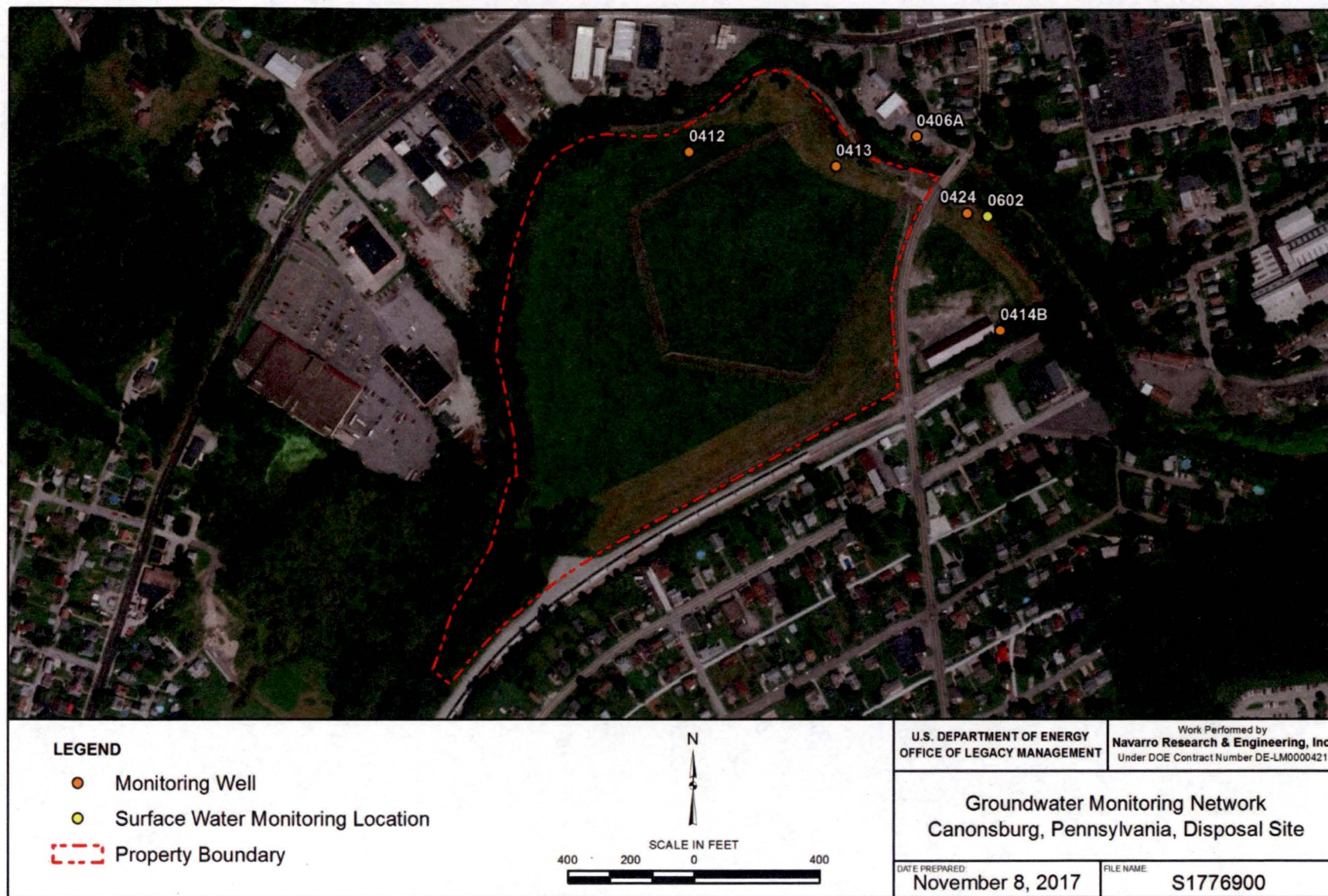


Figure 3-2. Groundwater Monitoring Network for the Canonsburg, Pennsylvania, Disposal Site



As reported in the 2014 *Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites* (DOE 2014), monitoring results remain below the uranium ACL at all monitoring wells and below the maximum concentration limit at most monitoring wells, with the exception of monitoring wells 0412 and 0413.

### **3.7.2 Surface Water Monitoring**

In accordance with the LTSP, DOE conducts surface water monitoring every 5 years. The most recent sampling event occurred in November 2013. Only one location, 0602, is sampled in Chartiers Creek. The location is considered to be a point of exposure for the site. The location is sampled for the constituent of concern, uranium, and a limit of 0.01 mg/L is applied.

As reported in the 2014 *Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites* (DOE 2014), the monitoring results for surface location 0602 remain below the location-specific limit.

### **3.7.3 Vegetation Management**

Vegetation management activities continue to be conducted at the site in accordance with the LTSP. Vegetation management activities include spot-treating tree of heaven (an invasive tree), physical removal and spot herbicide application targeting woody vegetation in diversion channels and perimeter ditches, and the spray-and-mow approach. These activities are mostly successful. Noxious weeds within the fenced area are limited to resprouting seedlings, which were observed in portions of mowed areas. No changes to the current vegetation management approach are recommended.

A conservation reuse initiative is being pursued that involves the establishment of a tallgrass prairie buffer strip along the bank of Chartiers Creek north of the disposal cell. The project is designed to add passive protection to the upper edge of the riprap-armored stream bank. The tall grass will provide thicker vegetation to baffle and slow the movement of water toward the bank's edge during rain events. The deeper roots of the prairie grass will serve to better stabilize the flood plain from future erosion. Based upon the need for additional repairs to the riprap-armored stream bank, which abuts the reuse area, preparation and seeding will be carried out as part of future stream bank stabilization repair projects.

## **3.8 Emergency Response**

Emergency responses are the actions DOE will take in response to "unusual damage or disruption" that threatens or compromises site safety, security, or integrity in compliance with 10 CFR 40 Appendix A Criterion 12. No need for emergency response was identified.

## **3.9 References**

10 CFR 40 Appendix A. U.S. Nuclear Regulatory Commission, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content," *Code of Federal Regulations*.



10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

DOE (U.S. Department of Energy), 2013. *Long-Term Surveillance Plan for the U.S. Department of Energy Canonsburg Uranium Mill Tailings Disposal Site, Canonsburg, Pennsylvania*, LMS/CAN/S00404, March.

DOE (U.S. Department of Energy), 2014. *2014 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*, LMS/S12245, March.

### 3.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	280	Northwest Down the Security Fence Line
PL-2	225	Perimeter Sign P10
PL-3	315	Site Marker SMK-2
PL-4	0	Survey Monument SM-3
PL-5	0	Erosion Control Marker ECM-2
PL-6	0	Monitoring Well 0406A
PL-7	20	Riprap-Armored Diversion Ditch
PL-8	135	Footbridge
PL-9	0	Temporary Footbridge Repair to Northwest Rail Support
PL-10	0	Rot Developing on Top Rail of Footbridge
PL-11	135	Area Needing Repair Along Chartiers Creek (May 2017)
PL-12	135	Repaired Area Along Chartiers Creek (October 2017)
PL-13	280	Top of Riprap Bank Along Chartiers Creek Shows Fabric Pulled Loose from Bank, Erosion Forming
PL-14	150	Southeast Along Chartiers Creek
PL-15	130	Stream Bank Needing Erosion Repair
PL-16	225	New Fill Being Placed on Area C
PL-17	180	Monitoring Well 0414B





*PL-1. Northwest Down the Security Fence Line*



*PL-2. Perimeter Sign P10*





*PL-3. Site Marker SMK-2*



*PL-4. Survey Monument SM-3*





*PL-5. Erosion Control Marker ECM-2*



*PL-6. Monitoring Well 0406A*





*PL-7. Riprap-Armored Diversion Ditch*

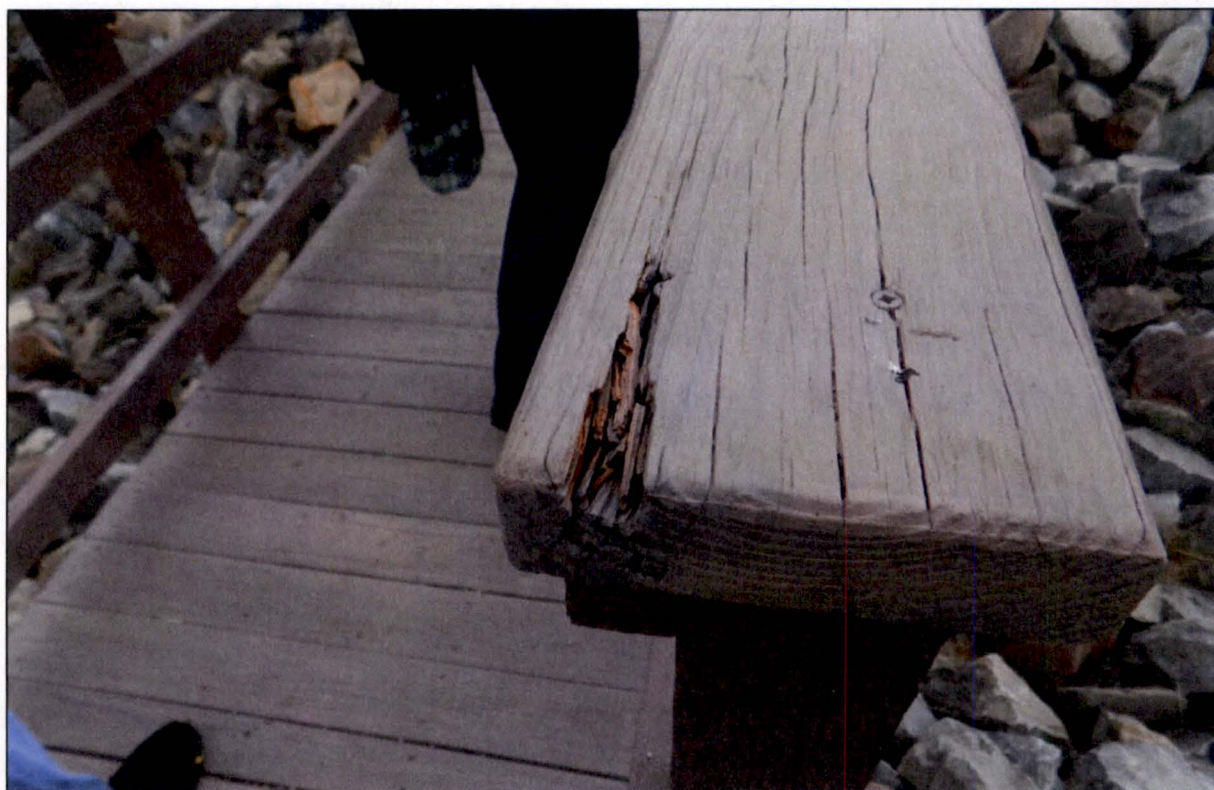


*PL-8. Footbridge*





*PL-9. Temporary Footbridge Repair to Northwest Rail Support*



*PL-10. Rot Developing on Top Rail of Footbridge*





*PL-11. Area Needing Repair Along Chartiers Creek (May 2017)*



*PL-12. Repaired Area Along Chartiers Creek (October 2017)*





*PL-13. Top of Riprap Bank Along Chartiers Creek Shows Fabric Pulled Loose From Bank, Erosion Forming*



*PL-14. Southeast Along Chartiers Creek*





*PL-15. Stream Bank Needing Erosion Repair*



*PL-16. New Fill Being Placed on Area C*





*PL-17. Monitoring Well 0414B*



## 4.0 Durango, Colorado, Disposal Site

### 4.1 Compliance Summary

The Durango, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected on May 24, 2017. Inspectors identified minor maintenance needs, but found no cause for a follow-up inspection.

Monitoring of the minor linear depression on the toe of the northeast side slope continues; however, no change in depth or length of the feature was noted. The U.S Department of Energy (DOE) has consulted with a Colorado Professional Engineer to better understand this anomaly. No changes were observed on the top of the disposal cell or in the associated drainage features. DOE contractors were conducting construction activities associated with the removal of the holding pond (evaporation pond) during the inspection. The holding pond was removed and the surrounding area was restored during the summer of 2017.

DOE conducts annual groundwater monitoring to verify the disposal cell performance. The most recent annual sampling event occurred in June 2017. One best management practice monitoring well (0618) continues to be sampled more frequently in response to variable uranium concentrations typically above site-specific thresholds but does not pose a risk to human health and the environment. Groundwater monitoring results indicate no unexpected changes from previous years.

### 4.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific DOE Long-Term Surveillance Plan (LTSP) (DOE 2015) and in procedures DOE established to comply with the requirements of the U.S. Nuclear Regulatory Commission general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 4-1 lists these requirements.

Table 4-1. License Requirements for the Durango, Colorado, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 3.3	Section 4.4	(b)(3)
Follow-Up Inspections	Section 3.4	Section 4.5	(b)(4)
Maintenance	Section 3.5	Section 4.6	(b)(5)
Emergency Measures	Section 3.5	Section 4.7	(b)(5)
Environmental Monitoring	Section 3.6	Section 4.8	(b)(2)
Corrective Action	Section 3.6	Section 4.9	

### 4.3 Institutional Controls

The 121-acre site, identified by the property boundary shown in Figure 4-1, is owned by the United States and was accepted under the general license in 1996. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the



property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gates, warning or no-trespassing signs (entrance and perimeter signs), site markers, survey and boundary monuments, and wellhead protectors.

## **4.4 Inspection Results**

The site, 3.5 miles southwest of Durango, Colorado, was inspected on May 24, 2017. The inspection was conducted by M. Kastens and A. Kuhlman of the DOE Legacy Management Support (LMS) contractor. J. Dayvault (DOE site manager), M. Cosby and J. Doebele (Colorado Department of Public Health and Environment), and D. Miller and T. Thoele (LMS) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, to identify changes in conditions that might affect conformance with the LTSP, and to determine the need, if any, for maintenance or additional inspection and monitoring.

### **4.4.1 Site Surveillance Features**

Figure 4-1 shows in black the locations of site features, including site surveillance features and inspection areas. Site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue text, and new observations identified during the 2017 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are identified in the text and in Figure 4-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 4.11.

#### **4.4.1.1 Site Access, Entrance Gates, and Entrance Sign**

Access to the site is from La Plata County Road 212, an improved dirt road. Entrance to the site is through the locked steel entrance gate along County Road 212 and an older, original entrance gate. Both gates were locked and functional. Both entrance gates had recently been painted and vegetation along the onsite access road mowed (PL-1). The entrance sign is at the original entrance gate within the property boundary. The entrance sign was recently replaced (PL-2). No maintenance needs were identified.

#### **4.4.1.2 Perimeter Signs**

There are 82 perimeter signs, attached to steel posts set in concrete, positioned along the unfenced property boundary, cutting in at the southwest corner. Two additional perimeter signs (P83 and P84), also attached to steel posts, were installed more recently inside the property boundary along the east perimeter of Ditch No. 1. With the addition of signs P83 and P84, four perimeter signs (P40–P43) located in steep, wooded terrain are not required to be inspected as part of the annual inspection unless the dense vegetation recedes. Perimeter signs identified during the 2016 annual inspection as needing replacement were replaced before the 2017 annual inspection. During the 2017 annual inspection, inspectors applied adhesive sign identification labels to 10 of the 11 replaced perimeter signs; the last adhesive label was added during a later site visit.



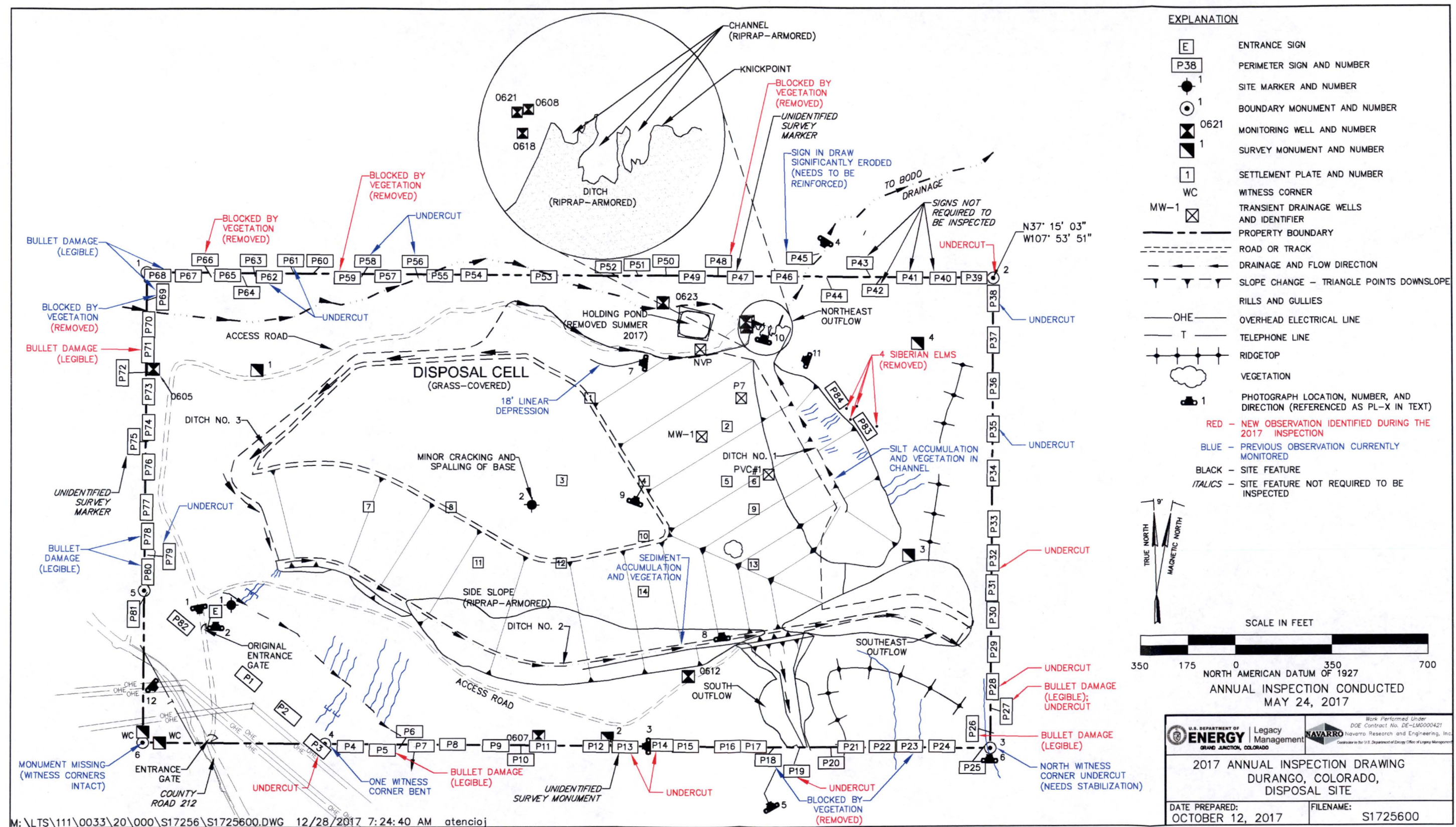


Figure 4-1. 2017 Annual Inspection Drawing for the Durango, Colorado, Disposal Site



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The concrete bases of several perimeter signs have been and continue to be undercut by erosion (PL-3). The concrete base of perimeter sign P45, located in the natural drainage on the north end of the site, is almost entirely free-standing (PL-4), and maintenance is required to protect against further erosion. DOE will reinforce the base of perimeter sign P45 before the 2018 annual inspection. Several perimeter signs have new bullet damage (P5, P26, P27, and P71) but remain legible. Several perimeter signs (P68, P69, P79, and P80) have bullet damage as identified in previous annual inspections but remain legible. Several perimeter signs (P18, P23, P48, P59, P66, and P69) were blocked from view by vegetation (PL-5) during the inspection; the vegetation was removed during a later site visit. No other maintenance needs were identified.

#### **4.4.1.3 Site Markers**

The site has two granite site markers. Site marker SMK-1 is just inside the original entrance gate. Site marker SMK-2 is on the top slope of the disposal cell; its concrete base has several minor cracks, but they do not compromise the integrity of the base, and repairs are not necessary at this time. No immediate maintenance needs were identified.

#### **4.4.1.4 Survey and Boundary Monuments**

Four survey monuments and six boundary monuments (each with two witness corners) delineate the property boundary. The north witness corner for boundary monument BM-3 is undercut by erosion and in need of stabilization (PL-6). Boundary monument BM-3 also was undercut, although not as significantly. Both will be stabilized before the 2018 annual inspection. One of the witness corners for boundary monument BM-4 was bent to the ground, and its cap was missing (as it has been for years), but boundary monument BM-4 was stable. Boundary monument BM-6 has been missing since the adjacent U.S. Bureau of Reclamation pipeline was installed, but both witness corners were present, although they were somewhat hidden by vegetation. Replacement of these features is not warranted at this time. The vegetation was removed during a later site visit; no other maintenance needs were identified.

#### **4.4.1.5 Monitoring Wells**

The site has seven monitoring wells. The LTSP does not require inspection of monitoring wells during the annual inspection. All wellhead protectors observed during the inspection were undamaged and locked. No maintenance needs were identified.

#### **4.4.2 Inspection Areas**

In accordance with the LTSP, the site is divided into six inspection areas (referred to as "transects" in the LTSP) to ensure a thorough and efficient inspection. The inspection areas are (1) the top of the disposal cell, (2) the side slopes of the disposal cell, (3) the drainage ditches, (4) the holding pond, (5) the site boundary, and (6) the outlying areas. Inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with LTSP requirements.



#### **4.4.2.1    *Top of Disposal Cell***

The disposal cell, completed in 1990, occupies 60 acres. Its vegetated cover consists primarily of perennial grasses and broadleaf plants. There was no evidence of erosion, settling, slumping, or other modifying processes on the top of the disposal cell. In the past, inspectors have observed small animal burrows in several areas on the top of the disposal cell; however, none were observed in 2017.

#### **4.4.2.2    *Side Slopes of Disposal Cell***

The side slopes of the disposal cell are armored with riprap. Along the north toe of the disposal cell, rock has moved, resulting in a linear depression approximately 18 feet long. The depression was first observed in 2015. No significant change was observed in 2016 or 2017 (PL-7). Inspectors will continue to monitor this area.

Inspectors observed subtle topographic variations in the surface of the south side slope that had not been noticed during previous inspections (PL-8). The variations, while barely perceptible, appeared as a wavelike series of gentle ridges and swales across and parallel to the slope. It was hypothesized that the variations had not previously been noted because past inspections were typically conducted in afternoons, when the light was flatter, rather than in morning light, as in 2017, when shadows provided additional contrast and revealed topographic variations. The cause of the variations is unknown, but because of their subtle nature, they likely did not form abruptly between the 2016 and 2017 inspections and have been present for some time. Inspectors found no evidence that the side slope was eroding, which would prompt concern, and determined that the observed variations did not pose concerns about disposal cell integrity. Inspectors will continue to monitor this side slope during future inspections.

A dug-out hole was observed around settlement plate 4 on the east-facing side slope (PL-9). It was likely dug out by a large animal. Inspectors replaced the rock around the settlement plate. No maintenance needs were identified.

#### **4.4.2.3    *Drainage Ditches***

Rock-armored drainage ditches are constructed beneath the toe of the side slope on the east (Ditch No. 1), south (Ditch No. 2), and northwest and west (Ditch No. 3) sides of the disposal cell. Storm water is directed into the drainage ditches and conveyed away from the site into natural drainages. The drainage ditches have sufficient depth and rock protection to carry runoff from a probable maximum precipitation event. Erosion occurs on some of the steep slopes above the drainage ditches, depositing sediment into the riprap-armored channel. This process creates locales that favor plant establishment and wildlife habitat enhancement. Sediment accumulation and associated vegetation have not adversely affected the performance of the channel.

The riprap-covered outflows of the drainage ditches were designed to self-armor. The outflows and drainage ditches below them are monitored annually. The uplands above the northeast outflow are steadily eroding over time (PL-10). Erosion of the uplands does not affect the stability or effectiveness of the outflow area. No maintenance needs were identified.



#### **4.4.2.4 Holding Pond**

A holding pond (evaporation pond) associated with the site's transient drainage system is in the northeast corner of the site. The pond, fence, and associated structures were removed during summer 2017. At the time of the inspection, construction personnel were onsite conducting activities in preparation for the holding pond decommissioning (PL-11).

#### **4.4.2.5 Site Boundary**

Boundary monuments and perimeter signs delineate the site boundary (property boundary) with one exception; the site boundary marked by boundary monument BM-6 is not delineated with perimeter signs, because the signs cut across the corner of the site (perimeter signs P82, P1, P2, and P3). There was no evidence of vandalism or changes to the area along or within the site boundary, with the exception of recent trash dumps near boundary monument BM-6 (PL-12). The trash was removed during a later site visit. Gullies on the southeast and southwest portion of the site remain stable and do not threaten the integrity of the disposal cell or drainage ditches. No other maintenance needs were identified.

#### **4.4.2.6 Outlying Areas**

The area beyond the site boundary for a distance of 0.25 mile was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. No such impacts were identified. Colorado Parks and Wildlife manages land to the north, west, and east of the site, and the U.S. Bureau of Reclamation manages land to the south. The primary land uses are wildlife habitat and recreation. Mountain bikers and other recreationists commonly use County Road 212.

### **4.5 Follow-Up Inspections**

DOE will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) DOE is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up inspection was identified.

### **4.6 Maintenance**

The perimeter signs identified during the 2016 annual inspection as needing to be replaced were replaced before the 2017 annual inspection. Adhesive sign identification labels were applied to 10 of the 11 signs during the 2017 annual inspection; the last adhesive label was added during a later site visit. During the 2017 annual inspection several perimeter signs (P18, P23, P48, P59, P66, P69) and the witness corners of boundary monument BM-6 were blocked from view by vegetation; the vegetation was removed during a later site visit. Trash discovered in the area near boundary monument BM-6 was also removed during a later site visit.

The concrete base of perimeter sign P45 is significantly eroded and will be reinforced before the 2018 annual inspection. Boundary monument BM-3 and its north witness corner are undercut; both will be stabilized before the 2018 annual inspection. No other maintenance needs were identified.



## 4.7 Emergency Measures

Emergency measures are the actions that DOE will take in response to “unusual damage or disruption” that threatens or compromises site safety, security, or integrity in compliance with 10 CFR 40 Appendix A Criterion 12). No need for emergency measures was identified.

## 4.8 Environmental Monitoring

### 4.8.1 Groundwater Monitoring

In accordance with the LTSP, DOE conducts annual groundwater monitoring to verify the performance of the disposal cell. Several monitoring wells are sampled more frequently to evaluate variable uranium concentrations in best management practice well 0618. The most recent annual sampling event occurred at the site in June 2017.

The LTSP establishes three POC wells at the site. The POC wells are completed in the uppermost aquifer (bedrock of the Cliff House Sandstone and the Menefee Formation) underlying the site. A background well is also completed in the uppermost aquifer. Three additional monitoring wells are completed in the alluvium and monitored as a best management practice. The alluvium and the groundwater it contains are of very limited extent, so the alluvium is not considered an aquifer. There are no discharge points of alluvial groundwater to the surface. Table 4-2 and Figure 4-2 show the current groundwater monitoring network at the site. The original monitoring network did not include monitoring well 0618, but monitoring was initiated in 2002 because the well intercepts the full, saturated thickness of the alluvium.

*Table 4-2. Groundwater Monitoring Network for the Durango, Colorado, Disposal Site*

Monitoring Well	Well Compliance Type	Hydrologic Relationship
0605	Background	Upgradient (uppermost aquifer)
0607	Point of compliance	Downgradient (uppermost aquifer)
0608	Best management practice	Downgradient (alluvium)
0612	Point of compliance	Downgradient (uppermost aquifer)
0618	Best management practice	Downgradient (alluvium)
0621	Point of compliance	Downgradient (uppermost aquifer)
0623	Best management practice	Upgradient (alluvium)

Groundwater is sampled annually for three indicator parameters: molybdenum, selenium, and uranium. The site-specific standards used for the three indicator parameters are the respective maximum observed background concentrations reported in groundwater samples collected from monitoring wells completed in the bedrock aquifer as identified in Table 2-3 of the LTSP. These site-specific standards are provided in Table 4-3. Figure 4-3 through Figure 4-5 show the time-concentration plots for the three indicator parameters, along with corresponding site-specific standards.





Figure 4-2. Groundwater Monitoring Network for the Durango, Colorado, Disposal Site



Table 4-3. Site-Specific Groundwater Standards for the Durango, Colorado, Disposal Site Based on Background

Constituent	Standard (mg/L)
Molybdenum	0.22
Selenium	0.042
Uranium	0.077

Abbreviation:  
mg/L = milligrams per liter

Selenium, molybdenum, and uranium concentrations in POC wells (0607, 0612, 0621) in the uppermost aquifer are below the respective standards. Therefore, the uppermost aquifer is in compliance with the LTSP groundwater monitoring requirements.

Though not required for compliance, monitoring wells completed in the alluvium are monitored as a best management practice. Uranium concentrations in monitoring well 0618 have consistently been higher than concentrations in the other wells onsite. To monitor the elevated and variable uranium concentrations observed in monitoring well 0618, monitoring wells 0608, 0618, and 0621 are sampled monthly as weather permits. Monthly monitoring was not conducted during summer 2017 while the evaporation pond removal was in progress. Sampling resumed in October 2017. Figure 4-5 shows an overall decreasing trend in uranium concentrations in well 0618 since 2014, with concentrations varying around 0.08 mg/L since 2016. Because well 0618 is not a POC well and not screened in the uppermost aquifer, the concentrations in this well do not affect compliance with the LTSP and do not pose a risk to human health and the environment. The potential cause of variability in this well continues to be investigated.

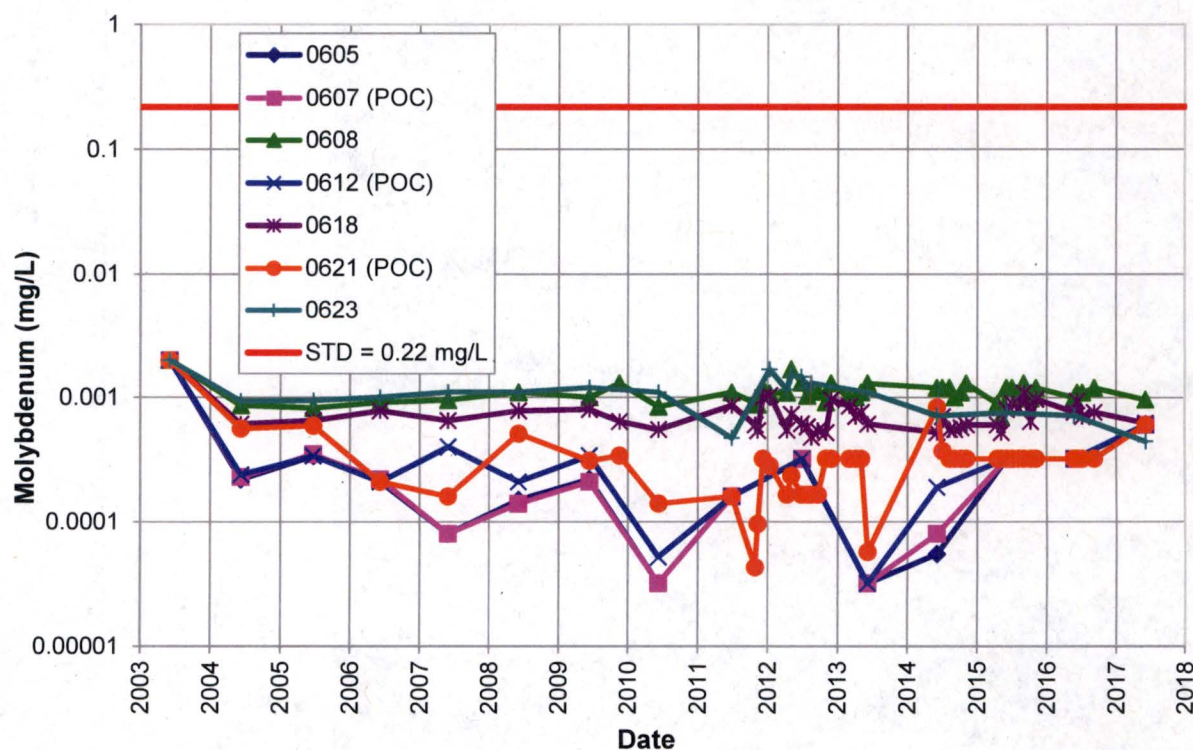


Figure 4-3. Molybdenum in Groundwater at the Durango, Colorado, Disposal Site



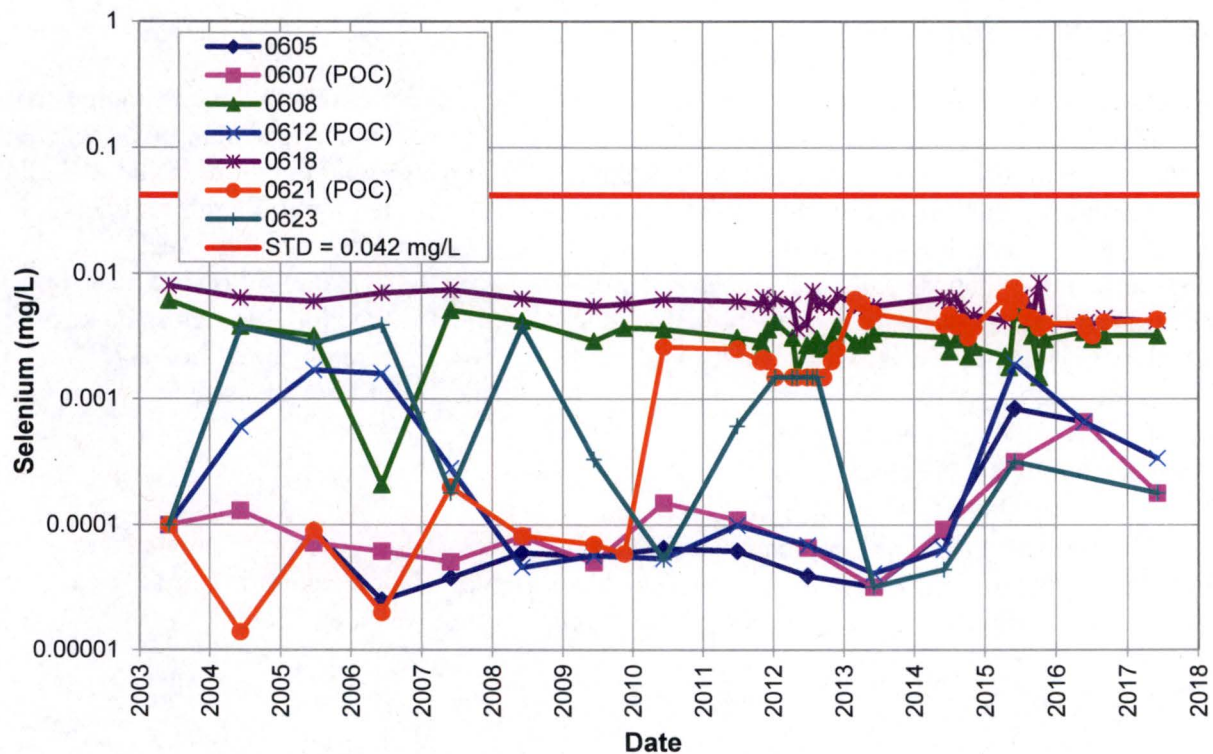


Figure 4-4. Selenium in Groundwater at the Durango, Colorado, Disposal Site

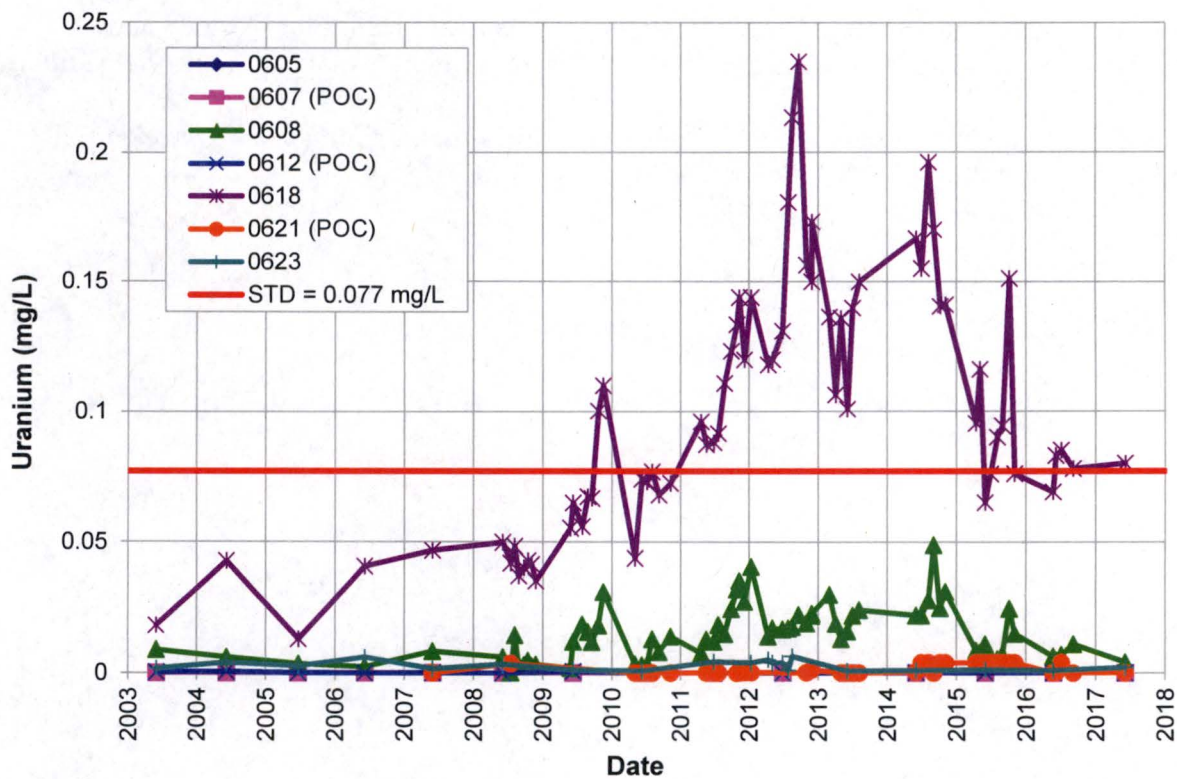


Figure 4-5. Uranium in Groundwater at the Durango, Colorado, Disposal Site



#### 4.8.2 Vegetation Monitoring

Vegetation on top of the disposal cell remains healthy. The LTSP requires that plants on the disposal cell cover are to be removed by either selective spraying or mechanical removal when their shoot height equals or exceeds 3.5 feet. Although the aboveground height of dryland alfalfa will never exceed the height criterion, it is known to be a deep-rooted plant; therefore, this species is also controlled on the disposal cell cover. Several shrubs approaching 3 feet in height were found on the disposal cell side slopes and were treated with herbicide following the inspection. Although weed control is not included in the annual inspection, inspectors make note of any large infestations of noxious weeds. Only scattered weeds were observed in 2017. Siberian elm, an invasive species, was identified in the northeast corner of the site.

#### 4.9 Corrective Action

In accordance with the LTSP, implementation of a corrective action program will be taken within 18 months of verification of an established exceedance of a concentration limit for one or more constituents in a POC well. No need for corrective action was identified.

#### 4.10 References

10 CFR 40 Appendix A. U.S. Nuclear Regulatory Commission, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content," *Code of Federal Regulations*.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

DOE (U.S. Department of Energy), 2015. *Long-Term Surveillance Plan for the Durango, Colorado, Disposal Site*, LMS/DUD/S06297, April.



## 4.11 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	170	Access Road, Recently Mowed, and Original Entrance Gate Post, Newly Painted
PL-2	0	Entrance Sign Showing New Office of Legacy Management Website Address
PL-3	270	Perimeter Sign P13, Undercut by Erosion
PL-4	210	Perimeter Sign P45 in Drainage, Entire Base Nearly Standing Free
PL-5	330	Perimeter Sign P18, Blocked by Vegetation (Removed)
PL-6	0	North Reference Marker at Boundary Monument BM-3, Erosion at Base; Needs Stabilization
PL-7	275	View Uphill of 18-Foot Linear Depression on Toe of Northeast Disposal Cell Side Slope (Yellow Paint Marks Centerline of the Depression)
PL-8	355	Slight Topographic Irregularities on the South Side Slope of the Disposal Cell
PL-9	20	Rocks Dug Out Around Settlement Plate 4, Likely by a Large Animal
PL-10	15	(a) Northeast Outflow Channel Bottom Is Stable, Whereas Upland Area on Right Is Slowly Eroding, 2017 (b) Northeast Outflow Channel, 2006 Photo for Comparison
PL-11	290	Holding Pond Area Showing Construction Activities
PL-12	120	Trash Near Boundary Monument BM-6





*PL-1. Access Road, Recently Mowed, and Original Entrance Gate Post, Newly Painted*



*PL-2. Entrance Sign Showing New Office of Legacy Management Website Address*





*PL-3. Perimeter Sign P13, Undercut by Erosion*



*PL-4. Perimeter Sign P45 in Drainage, Entire Base Nearly Standing Free*





*PL-5. Perimeter Sign P18, Blocked by Vegetation (Removed)*



*PL-6. North Reference Marker at Boundary Monument BM-3, Erosion at Base; Needs Stabilization*





*PL-7. View Uphill of 18-Foot Linear Depression on Toe of Northeast Disposal Cell Side Slope  
(Yellow Paint Marks Centerline of the Depression)*



*PL-8. Slight Topographic Irregularities on the South Side Slope of the Disposal Cell*





*PL-9. Rocks Dug Out Around Settlement Plate 4, Likely by a Large Animal*





*PL-10. (a) Northeast Outflow Channel Bottom Is Stable, Whereas Upland Area on Right Is Slowly Eroding, 2017*



*PL-10. (b) Northeast Outflow Channel, 2006 Photo for Comparison*





*PL-11. Holding Pond Area Showing Construction Activities*



*PL-12. Trash Near Boundary Monument BM-6*



## 5.0 Falls City, Texas, Disposal Site

### 5.1 Compliance Summary

The Falls City, Texas, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected on January 18, 2017. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified several routine maintenance needs but found no cause for a follow-up inspection.

The U.S. Department of Energy (DOE) conducts annual groundwater monitoring as a best management practice. Groundwater monitoring was last completed in April 2017. The compliance strategy for groundwater protection at the site is no further remediation and application of supplemental standards due to widespread ambient contamination that is not due to milling and is not reasonably treatable. Therefore, no concentration limits or points of compliance have been established. Site-related contamination in the uppermost aquifer poses no risk to human health because groundwater from this aquifer is not used for human consumption and is designated as limited use.

### 5.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific DOE Long-Term Surveillance Plan (LTSP) (DOE 2008) and in procedures DOE established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 5-1 lists these requirements.

Table 5-1. License Requirements for the Falls City, Texas, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 3.3	Section 5.4	(b)(3)
Follow-Up Inspections	Section 3.4	Section 5.5	(b)(4)
Maintenance	Section 3.5	Section 5.6	(b)(5)
Emergency Response	Section 3.6	Section 5.7	(b)(5)
Environmental Monitoring	Section 3.7	Section 5.8	(b)(2)

### 5.3 Institutional Controls

The 231-acre site, identified by the property boundary shown in Figure 5-1, is owned by the United States and was accepted under the general license in 1997. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gate and sign, perimeter fence and signs, site markers, survey and boundary monuments, and wellhead protectors.



An adjacent 513-acre offsite property was sold by the State of Texas to Alamo Funding Group in 2005. The State initially acquired this land as part of the designated processing site, but this portion of the processing site was not incorporated into the final DOE-owned site. The warranty deed stipulates that the new owners agree to not use any groundwater underlying the property for commercial or industrial uses in accordance with requirements for parcel transfers stipulated in UMTRCA. No human habitation structures shall be constructed on the property, and nothing may be done to impact groundwater quality or interfere with UMTRCA groundwater remediation activities. Permission must be obtained from the State and DOE before (1) constructing wells or otherwise exposing groundwater to the surface; (2) performing construction, excavation, or soil removal of any kind; or (3) selling the property. Alamo Funding Group subdivided the land and sold it to two parties in 2011 and 2012. DOE confirmed that the deed restrictions remained in recorded real property documents. However, following the inspection, inspectors found that DOE had no record of the landowner requesting permission to build sheds and corrals on the former processing site adjacent to the southeast fence line; the structures were built in 2013. The landowner later provided DOE with documentation of approval granted to the previous landowner. The two landowners have agreed to seek approval from DOE and the State for any future construction.

## **5.4 Inspection Results**

The site, 8 miles southwest of Falls City, Texas, was inspected on January 18, 2017. The inspection was conducted by M. Widdop and K. Broberg of the DOE Legacy Management Support (LMS) contractor. A. Kleinrath and T. Jasso (DOE); K. Tu, T. Gonzalez, and M. Kawasmi (Texas Commission on Environmental Quality); R. Lyssy (site maintenance subcontractor); and J. Carman and K. Toepke (LMS) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, to identify changes in conditions that might affect conformance with the LTSP, and to determine the need, if any, for maintenance or additional inspection and monitoring.

### **5.4.1 Site Surveillance Features**

Figure 5-1 shows in black the locations of site features, including site surveillance features and inspection areas. Site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue text, and new observations identified during the 2017 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 5-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 5.10.

#### **5.4.1.1 Site Access, Entrance Gate, and Entrance Sign**

Access to the site is from Farm-to-Market Road 1344. The entrance gate at the east corner of the site and the vehicle gate at the north corner were locked and functional. New chains and locks were installed on both gates during the April 2017 sampling event. The entrance sign is next to the entrance gate. No maintenance needs were identified.



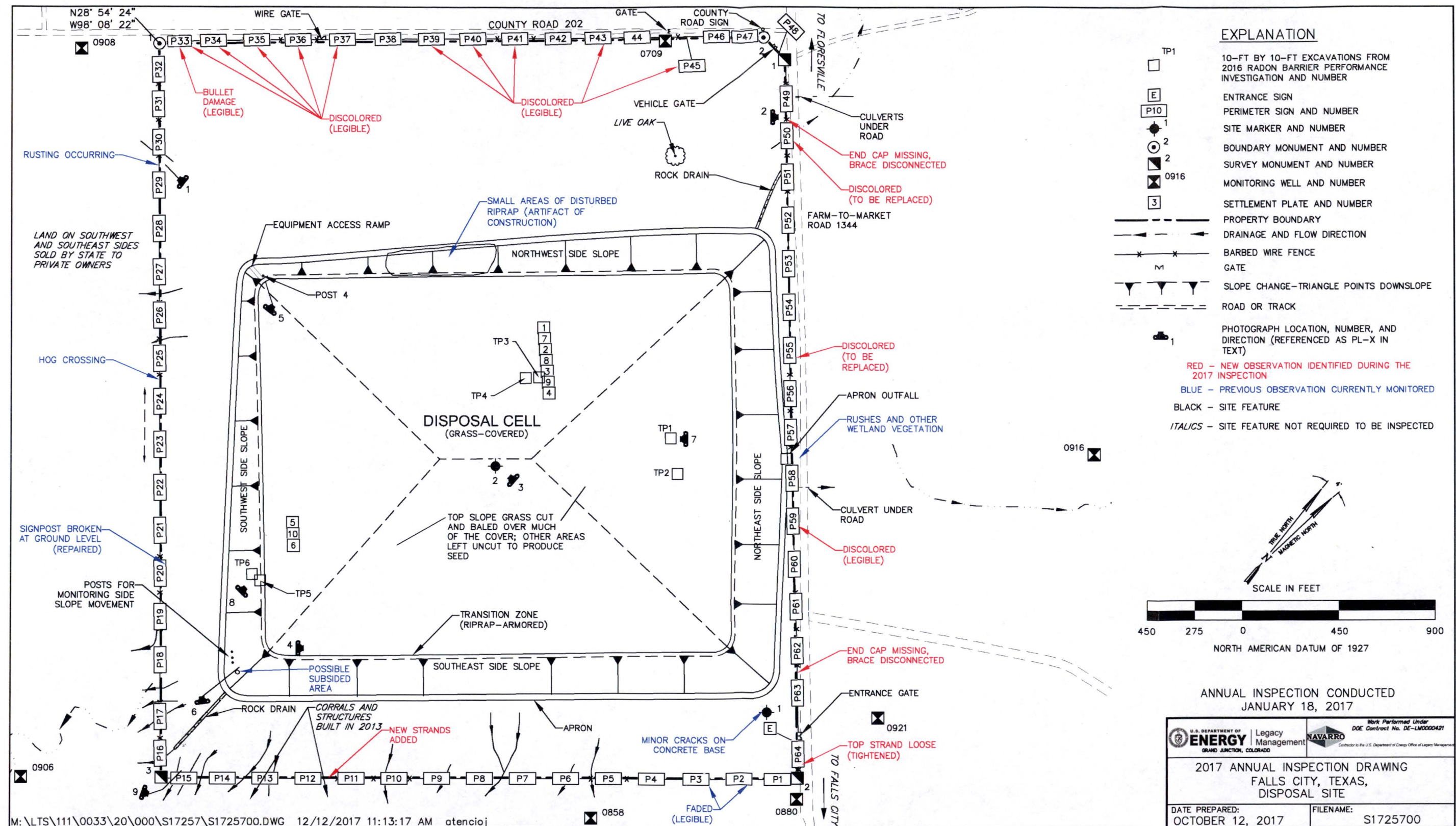


Figure 5-1. 2017 Annual Inspection Drawing for the Falls City, Texas, Disposal Site



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#### **5.4.1.2 Perimeter Fence and Signs**

A five-strand barbed wire perimeter fence encloses the site. As noted in previous inspections, perimeter fence strands and posts are beginning to rust (PL-1) except along the northwest side, where the fence was replaced in 2006. Inspectors observed new strands in the perimeter fence near P10 and P11, presumably installed by the adjacent landowner sometime after 2013. The site maintenance subcontractor recommends that DOE consider replacing the barbed wire with welded wire mesh (to prevent wild hogs from entering the site) when the rusted barbed wire reaches the end of its service life. Inspectors will continue to monitor the fence to determine when it needs to be replaced. A broken perimeter fence post (near P20) identified during the 2016 annual inspection was repaired before the 2017 annual inspection. Inspectors noted the top strand of the perimeter fence was loose south of the entrance gate; this was tightened during the April 2017 sampling event. Several braces along the perimeter fence line (near P50 and P63) were disconnected, and the end caps were missing (PL-2); these will be repaired during the 2018 sampling event.

There are 64 perimeter signs, attached to steel posts set in concrete, positioned along the property boundary, set back 5 feet. Two perimeter signs (P50 and P55) were faded and discolored and will be replaced by the maintenance subcontractor before the 2018 annual inspection. Additional perimeter signs are fading and discolored but remain legible. Perimeter sign P33 has bullet damage but remains legible. No other maintenance needs were identified.

#### **5.4.1.3 Site Markers**

The site has two granite site markers. Site marker SMK-1 is just inside the entrance gate; its concrete base has several minor cracks, but they do not compromise the integrity of the base, and repairs are not necessary at this time. Site marker SMK-2 is on the top slope of the disposal cell (PL-3). No immediate maintenance needs were identified.

#### **5.4.1.4 Survey and Boundary Monuments**

Three survey monuments and two boundary monuments delineate the corners of the property boundary. No maintenance needs were identified.

#### **5.4.1.5 Monitoring Wells**

There is one monitoring well onsite and 11 monitoring wells offsite. Monitoring wells were inspected during the April 2017 sampling event. All wellhead protectors were undamaged and locked. No maintenance needs were identified.

### **5.4.2 Inspection Areas**

In accordance with the LTSP, the site is divided into three inspection areas (referred to as "transects" in the LTSP) to ensure a thorough and efficient inspection. The inspection areas are (1) the top and side slopes of the disposal cell, apron outfall, and rock drains; (2) the region between the apron at the toe of the side slopes and the site perimeter; and (3) the outlying area. Inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with LTSP requirements.



#### **5.4.2.1 Top and Side Slopes of the Disposal Cell, Apron Outfall, and Rock Drains**

The disposal cell, completed in 1994, occupies 127 acres. Its vegetated cover consists primarily of well-established coastal bermuda grass and kleingrass with other species interspersed. The site, including the disposal cell, is managed for hay production, which ensures that turf vitality is maintained. The site maintenance subcontractor can take as many as three cuttings of hay each year from the site. At the time of the inspection, hay bales were present on the property.

There was no evidence of erosion, settling, slumping, or other modifying processes that might affect the integrity of the disposal cell. In past inspections, the surface of the soil on the top slope of the disposal cell had small desiccation cracks, which are especially common in clayey or loamy soils when soil conditions are dry. No desiccation cracks, areas of ponded water, or areas of settlement were observed on the top slope of the disposal cell during the inspection.

The side slopes of the disposal cell are armored with riprap (PL-4). Since shortly after disposal cell construction, vegetation has been observed growing on the side slopes. Much of the vegetation observed in 2017 was dead or dormant grass. The grass does not affect disposal cell performance. Deep roots of woody vegetation could penetrate the radon barrier, so woody vegetation is controlled annually through cutting and applying herbicide. DOE has monitored several small depressions on the northwest side slope of the disposal cell since 2010. These depressions do not compromise the performance of the riprap-armored side slope, and no changes have been observed since 2010. Inspectors will continue to monitor these areas.

Fractured riprap has been observed on the disposal cell side slopes since it was completed. Pieces of riprap are fractured in place, indicating that the fracturing occurred after placement. Fracturing is likely a consequence of mechanical placement or thermal expansion and contraction; the riprap condition does not appear to be worsening. During the inspection, photos were taken of riprap at the base of T-post 4, on the west corner of the disposal cell (PL-5), and these photos were compared to photos taken in previous years (PL-5, from 2010) at this location. There is no indication that the riprap is degrading, but its durability will continue to be monitored. If the number of fractured rocks appears to be increasing, DOE will establish a more quantitative monitoring program.

In 2007, inspectors noted possible subsidence in the riprap at the toe of the south corner of the side slope. In 2008, three T-posts were installed in a straight line running at an orientation of 317° to monitor side slope movement. Each post was installed at a vertical pitch of 90°. These three posts provide reference points to assess whether the area is undergoing movement: If a post moves out of line with the other two posts or the pitch of an individual post changes, it indicates possible movement. The three posts remain in the same straight line in which they were installed and are at the same vertical pitch (PL-6).

An equipment access ramp to the top of the disposal cell is at the west corner of the side slope. The ramp was installed in 2008 using clean, angular riprap of progressively smaller rock sizes to provide a free-draining and stable driving surface that does not encourage vegetation encroachment. Some displacement of smaller rock has occurred, as would be expected from use, but the ramp continues to provide a stable driving surface.

DOE is participating in a project sponsored by NRC to investigate the effect of soil-forming processes on the performance of the radon barrier on UMTRCA disposal cells. In April 2016,



researchers excavated through the cover materials (cover soil and underlying radon barrier) at six locations to measure radon flux and document soil structure (Figure 5-1). Although significant soil structure was developing, radon flux did not exceed the U.S. Environmental Protection Agency (EPA) standard. Vegetation is becoming reestablished at test pit locations TP1 through TP4 on the top slope of the disposal cell (PL-7). Test pit locations TP5 and TP6 are located on the southwest side slope of the disposal cell within the riprap (PL-8). DOE will continue to monitor these locations to confirm that positive drainage is preserved and vegetation continues to thrive.

No water was flowing in the south rock drain during the inspection. Willows that grow along the south drain are periodically removed by the maintenance subcontractor. No water was observed in the north rock drain. Vegetation is left uncut at the outlets of the rock drains to help dissipate the energy of site runoff during storms and to reduce soil erosion. Vegetation in the apron outfall, midway along the northeast side slope, was cut back before the inspection. No maintenance needs were identified.

#### ***5.4.2.2 Region Between the Apron at the Toe of the Side Slopes and the Site Perimeter***

The area between the perimeter fence and the apron at the toe of the disposal cell side slopes is covered with well-established grass, which is primarily kleingrass with some coastal bermuda grass. Grass is cut and baled one to three times annually, depending on precipitation. It is usually left uncut along the perimeter fence, along rock drains, and around some site surveillance features such as survey monuments that cannot be accessed with conventional farming equipment.

Wild hogs burrow along the perimeter fence line in some areas. Their burrows are filled in by the site maintenance contractor, as they can potentially compromise the integrity of the perimeter fence or damage haying equipment. No significant burrows were found during the inspection; an area where hogs enter the site was observed and will continue to be monitored. No maintenance needs were identified.

#### ***5.4.2.3 Outlying Area***

The area beyond the site boundary for a distance of 0.25 mile was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. No such impacts were observed. The remainder of the former processing site is used for occasional livestock grazing. The owners have removed some of the brush to facilitate grazing. In 2013, the landowner southeast of the site constructed corrals and gates, stock watering facilities, and equipment and hay storage structures on former State-owned land that was acquired as part of the original processing site (PL-9).

### **5.5 Follow-Up Inspections**

DOE will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) DOE is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up inspection was observed.



## **5.6 Maintenance**

A loose perimeter fence strand, identified during the 2017 annual inspection, was repaired during the April 2017 sampling event. A broken perimeter sign post, identified during the 2016 annual inspection, was also repaired. Two discolored and faded perimeter signs (P50 and P55) were identified during the 2017 annual inspection and will be replaced by the maintenance subcontractor before the 2018 annual inspection. Several fence braces have become disconnected, and the end caps are missing; these will be repaired during the 2018 sampling event. No other maintenance needs were identified.

## **5.7 Emergency Response**

Emergency response is action DOE will take in response to unusual damage or disruption that threatens or compromises site safety, security, or integrity in compliance with 10 CFR 40 Appendix A Criterion 12. No need for an emergency response was found.

## **5.8 Environmental Monitoring**

### **5.8.1 Groundwater Monitoring**

In accordance with the LTSP, annual groundwater monitoring is conducted as a best management practice. The compliance strategy for groundwater protection at the site is no further remediation and application of supplemental standards in accordance with 40 CFR 192.21(g). Although NRC does not require groundwater monitoring at the site, DOE conducts groundwater monitoring as a best management practice. The most recent sampling event occurred in April 2017.

As prescribed in the LTSP, the site groundwater monitoring program has the following purposes:

- Disposal cell performance monitoring
- Groundwater compliance monitoring to demonstrate that potential users of groundwater downgradient of the site are not exposed to contamination related to the former processing site

Two hydraulically connected groundwater units comprise the uppermost aquifer beneath the site. The shallower of the two units is in sandstone units of the Deweesville Sandstone and Conquista Clay of the Whitsett Formation. The deeper unit is in the Dilworth Sandstone of the Whitsett Formation. The Dilworth Sandstone is underlain by the Manning Clay, a 300-foot-thick aquitard that isolates the uppermost aquifer from better-quality groundwater in deeper aquifers. Samples are collected from both the Deweesville and Conquista units and the Dilworth groundwater units. Figure 5-2 and Table 5-2 show the groundwater monitoring network at the site. The disposal cell performance monitoring wells are near the disposal cell and are all completed in the Deweesville and Conquista units. The groundwater compliance monitoring wells are downgradient of the site and completed in the Deweesville and Conquista units and the Dilworth unit.



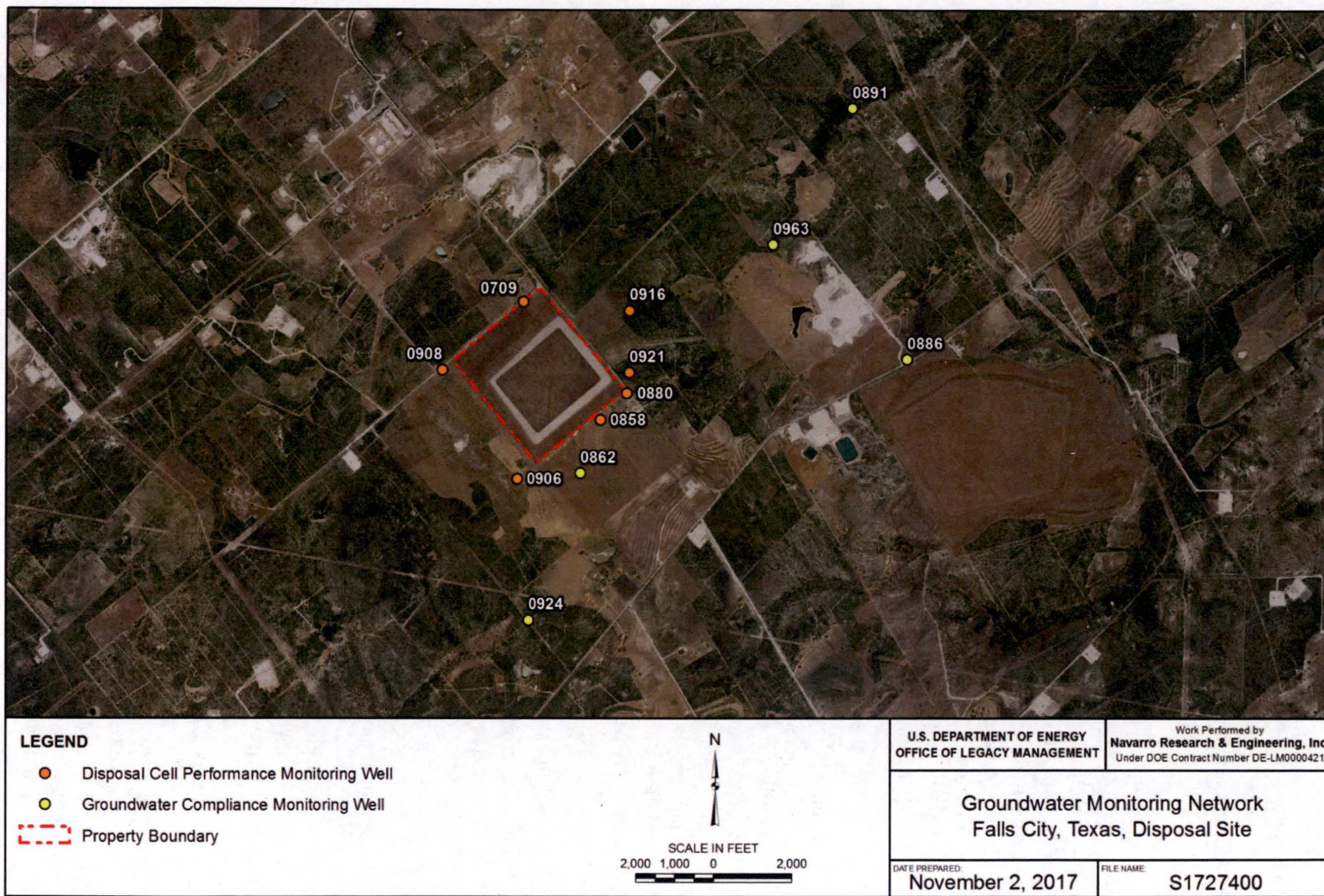


Figure 5-2. Groundwater Monitoring Well Network at the Falls City, Texas, Disposal Site



Table 5-2. Groundwater Monitoring Network for the Falls City, Texas, Disposal Site

Groundwater Monitoring Purpose	Monitoring Wells
Disposal cell performance monitoring	0709, 0858, 0880, 0906, 0908, 0916, and 0921
Groundwater compliance monitoring	0862, 0886, 0891, 0924, and 0963

Groundwater is sampled annually for total uranium and field measurements of water level, temperature, pH, conductivity, turbidity, alkalinity, dissolved oxygen, and oxidation-reduction potential. Of particular interest are total uranium, pH, and water level. The LTSP identifies low pH levels in groundwater as an indicator of the extent and movement of the legacy groundwater plumes. Changes in geochemical conditions might also indicate leachate movement from the disposal cell into the uppermost aquifer. Tailings pore fluids were lower in pH than background groundwater. However, because pH levels and other signature contaminants in tailings pore fluids are essentially indistinguishable from processing-related contamination, it is difficult to determine whether contamination comes from the disposal cell or from legacy processing activities.

DOE has determined that pH and uranium concentrations do not covary (DOE 2008). This is an indication that other factors contribute to uranium distribution in the uppermost aquifer, such as natural redistribution of uranium in this active ore-forming environment. Therefore, increasing uranium levels at a monitoring well without an attendant drop in pH probably do not indicate movement of processing-related contamination. Groundwater chemistry at monitoring wells near the formation subcrop can also be influenced by residence time as a response to precipitation or changes in oxidation state within the formation. If increases in uranium are sporadic and not accompanied by decreases in pH, DOE concludes that the elevated uranium is naturally occurring.

Because supplemental standards apply to the uppermost aquifer at the site, no concentration limits or points of compliance have been established. Groundwater in the uppermost aquifer beneath the site meets the EPA definition of “limited use” (Class III) because it is not currently or potentially a source of drinking water due to widespread ambient contamination that cannot be cleaned up using methods reasonably employed by public water supply systems (40 CFR 192.11[e]). Background groundwater quality in the uppermost aquifer varies by orders of magnitude in the area because it is in contact with naturally occurring uranium mineralization. Figure 5-3 and Figure 5-4 show the water level measurements over time at both the disposal cell performance monitoring wells and the groundwater compliance monitoring wells. Figure 5-5 through Figure 5-8 show the time-concentration plots for pH and uranium at both disposal cell performance monitoring wells and groundwater compliance monitoring wells.

### 5.8.2 Groundwater Level Monitoring Results

Since 1996, groundwater levels in the disposal cell performance monitoring wells have all decreased overall, with decreases ranging from approximately 2 ft to 12 ft (Figure 5-3). In 2017, water level trends in monitoring wells 0709, 0880, and 0906 continued to increase slightly from recent lows (Figure 5-3), while trends in monitoring wells 0858 and 0921 continue downward. The water level in monitoring well 0906 has fluctuated more than water levels in the other monitoring wells, showing other short-term increases while decreasing over the longer period.



Monitoring well 0906 is directly downslope of the disposal cell, and the historical fluctuations might be the result of the infiltration of water that is shed by and conveyed away from the disposal cell, reflecting variations in annual precipitation. The general decrease in water levels across the entire disposal cell performance monitoring network might reflect (1) the dissipation of the processing site-related groundwater mound beneath the disposal cell and (2) the reduction of transient drainage from the disposal cell. Monitoring wells 0908 and 0916 are not shown in Figure 5-3 (nor subsequent time concentration plots Figure 5-5 through Figure 5-8) because vicinity groundwater levels dropped below the bottom of the screens in 1996, rendering the wells dry.

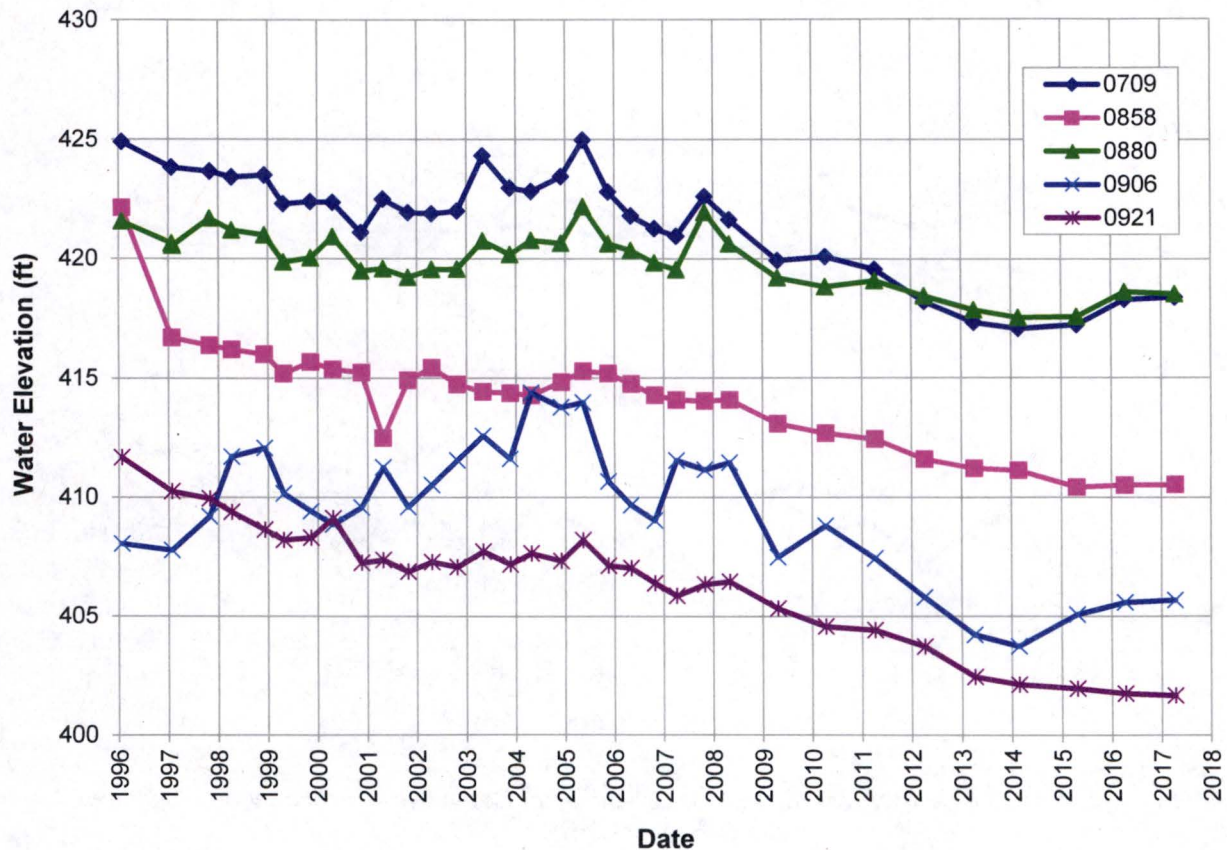


Figure 5-3. Water-Level Measurements at Disposal Cell Performance Monitoring Wells at the Falls City, Texas, Disposal Site



Water level trends vary in the groundwater compliance monitoring wells (Figure 5-4). The 2017 data show a slight upward trend in monitoring wells 0862, 0886, and 0891; overall, these water levels have increased about 4 ft since 1996. Water levels in monitoring well 0963 continued to increase, rising approximately 2 ft from the 2016 measurement. Water levels have fluctuated in monitoring well 0924 and are approximately 0.7 ft higher than 1996 levels.

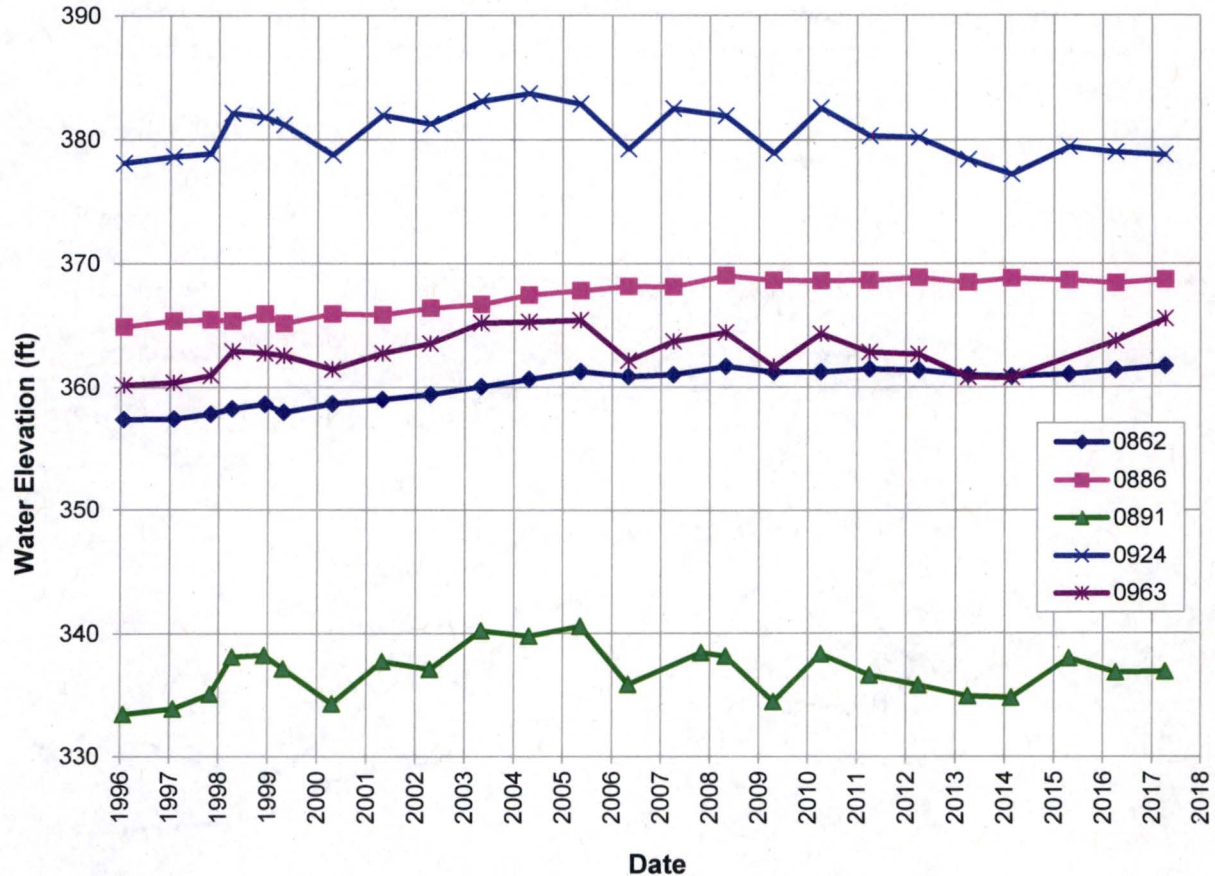


Figure 5-4. Water-Level Measurements at Groundwater Compliance Monitoring Wells at the Falls City, Texas, Disposal Site



### 5.8.3 Groundwater Quality Monitoring Results

**pH:** At the disposal cell performance monitoring wells, pH levels historically have been higher than the pH in tailings pore fluids (pH level of 2.93), with no significant upward or downward trends. In 2017, the pH levels for all disposal cell performance monitoring wells decreased slightly but remained within historic levels (Figure 5-5).

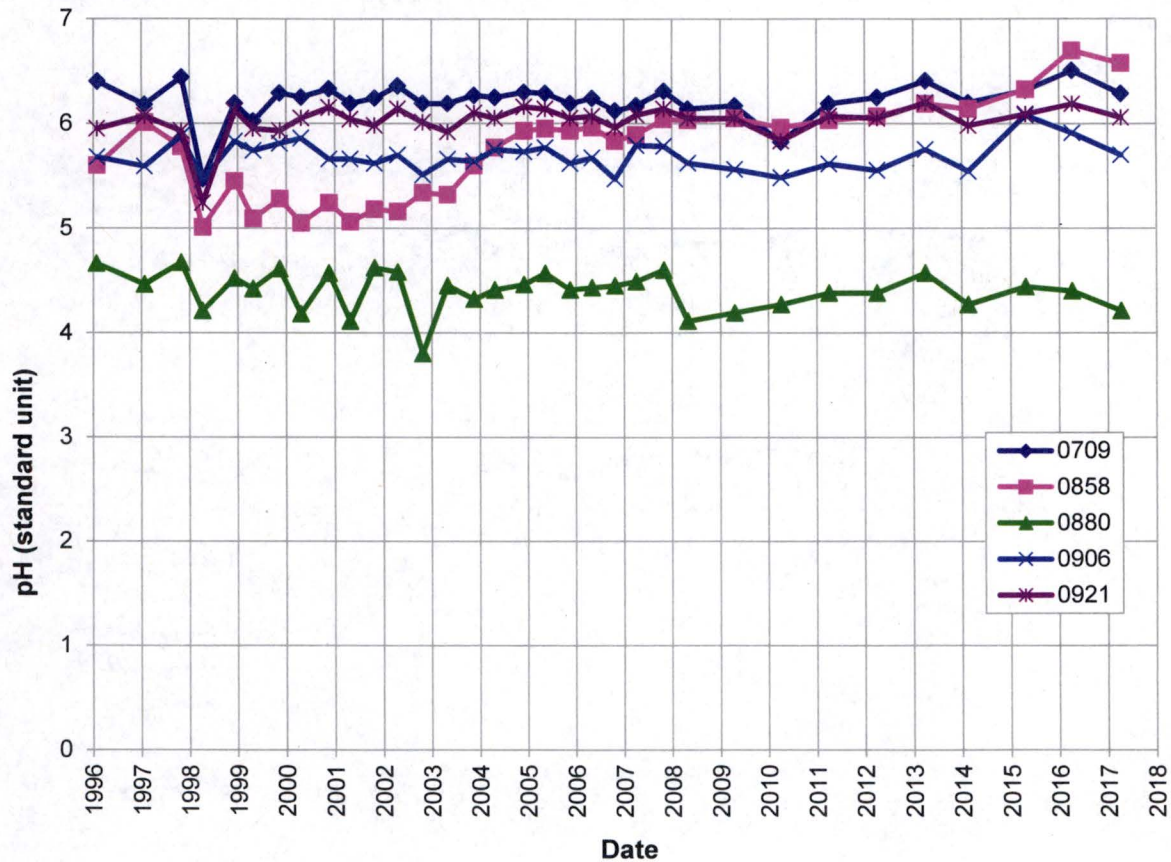


Figure 5-5. pH at Disposal Cell Performance Monitoring Wells at the Falls City, Texas, Disposal Site



At the groundwater compliance monitoring wells, pH levels have historically been higher than the pH in groundwater contaminated by processing activities, with no significant upward or downward trends. In 2017, the pH levels for monitoring wells 0886 and 0963 increased, while the pH levels for monitoring wells 0862, 0891, and 0924 slightly decreased (Figure 5-6). The 2017 pH levels were within the range of historical values for all groundwater compliance monitoring wells. The pH in monitoring well 0963 historically has been lower than at the other locations but, in 2017 at a level of 3.48, it remains higher than the pH in the tailings pore fluids.

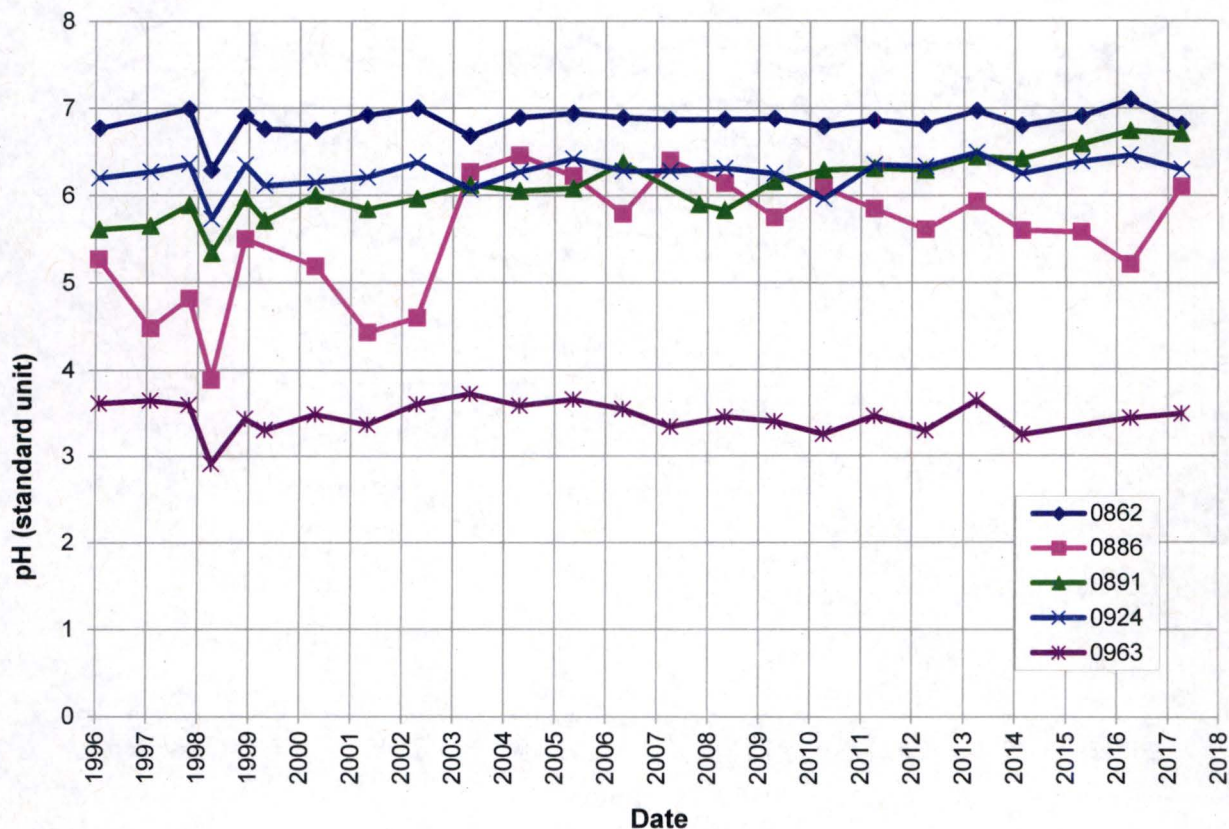


Figure 5-6. pH at Groundwater Compliance Monitoring Wells at the Falls City, Texas, Disposal Site



**Uranium:** In 2017, the uranium concentrations for all disposal cell performance monitoring wells decreased but remained within the range of historical values (Figure 5-7). A downward trend has occurred in monitoring well 0880 since 2004 with considerable variation, ranging from a low of 1.38 milligrams per liter (mg/L) in 2008 to a high of 14 mg/L in 2004. In 2017, the concentration of uranium in monitoring well 0880 decreased from 5.8 mg/L to 3.1 mg/L.

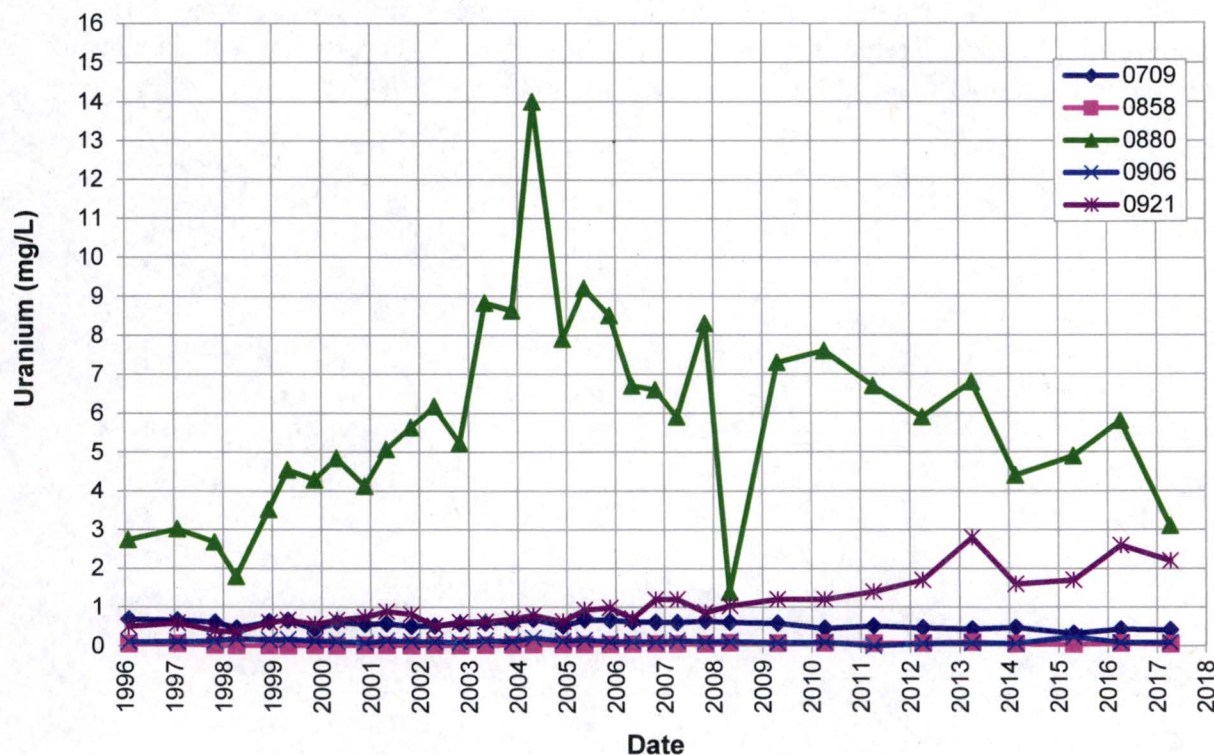


Figure 5-7. Uranium Concentrations at Disposal Cell Performance Monitoring Wells at the Falls City, Texas, Disposal Site



The 2017 uranium concentrations for groundwater compliance monitoring wells were within the range of historical values for all groundwater compliance monitoring wells (Figure 5-8). The uranium concentration at monitoring wells 0862, 0886, and 0963 remains less than 0.2 mg/L. The uranium concentration at monitoring well 0924 has been relatively stable since 2004, fluctuating between 0.4 mg/L and 0.6 mg/L. Since 2008, the uranium concentrations measured at monitoring well 0891 have been significantly higher than the other monitoring wells. The 2017 uranium result (2.5 mg/L) at monitoring well 0891 is a significant decrease from the 2016 uranium result (3.6 mg/L), returning the uranium concentration to historic levels and below the value used in the risk assessment for the Dilworth groundwater (3.04 mg/L).

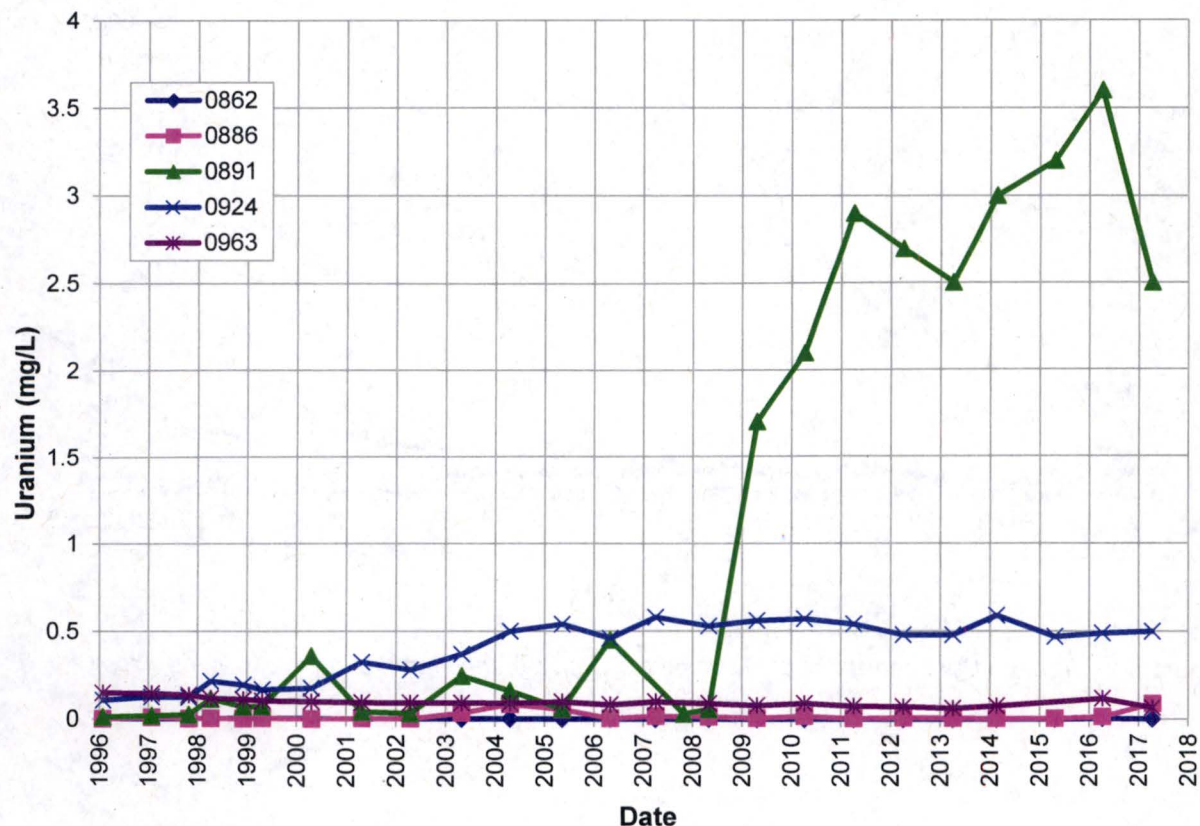


Figure 5-8. Uranium Concentrations in Groundwater Compliance Monitoring Wells at the Falls City, Texas, Disposal Site

#### 5.8.4 Evaluation of Groundwater Monitoring

Uranium concentrations in disposal cell performance monitoring well 0880 have varied considerably since 1996, decreasing from 5.8 mg/L in 2016 to 3.1 mg/L in 2017 (Figure 5-7). The pH at this location is lower than at other disposal cell performance monitoring wells. Water levels in monitoring well 0880 increased slightly from 2014 to 2016, then decreased from 2016 to 2017 (Figure 5-3). These results suggest that the interaction among the disposal cell, legacy groundwater mound, and processing plumes is still equilibrating. However, monitoring results do not indicate that the disposal cell is contributing to the degradation of the uppermost aquifer. The cause of the anomalously high uranium concentrations in groundwater compliance well 0891 since 2008 has not been determined.



Site-related contamination in the uppermost aquifer poses no risk to human health because groundwater from this aquifer is not used for human consumption and is designated as limited use. Potable water is produced locally from the Carrizo Sandstone that lies 2000 ft below the surface near the site. Additionally, a 300-foot-thick aquitard isolates the uppermost aquifer from the better-quality groundwater in deeper aquifers.

DOE evaluated the groundwater monitoring program at the site in 2010 as required by the LTSP. Groundwater monitoring data collected from 2006 through 2010 were compared to previous data (1996 through 2005). The comparison showed that contaminant concentrations continued to fluctuate in the uppermost aquifer, but the fluctuations were within the historical range reported for the aquifer in the area of the site. The comparison also showed no unexpected water level changes. The 2010 evaluation recommended that, after the collection of samples in 2011, groundwater monitoring activities at the site be discontinued. It was proposed that DOE would not plug and abandon the 12 monitoring wells at the site until the nearby UMTRCA Title II Conquista, Texas, Disposal Site transfers to the DOE Office of Legacy Management. The Conquista site is just southeast of the site. Upon transfer of the Conquista site, DOE will assess whether a joint monitoring approach is warranted (either as a one-time event or as periodic monitoring). Once NRC accepts the monitoring strategy for the Conquista site, site wells no longer deemed necessary to a Conquista monitoring effort would be decommissioned. Recommendations made in the 2010 evaluation continue to undergo NRC review.

## 5.9 References

10 CFR 40 Appendix A. U.S. Nuclear Regulatory Commission, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content," *Code of Federal Regulations*.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

40 CFR 192. U.S. Nuclear Regulatory Commission, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations*.

DOE (U.S. Department of Energy), 2008. *Long-Term Surveillance Plan for the U.S. Department of Energy Falls City Uranium Mill Tailings Disposal Site, Falls City, Texas*, DOE-LM/1602-2008, March.



## 5.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	270	Southwest Perimeter Fence Showing Rusting Strands and Post
PL-2	45	Line Brace With Missing End Cap, Northeast Perimeter Fence
PL-3	270	Site Marker SMK-2 on the Top Slope of the Disposal Cell
PL-4	45	View Northeast Along the Top of the Southeast Side Slope
PL-5	0	(a) Riprap at the Base of Post 4—2017 (b) Riprap at the Base of Post 4—2010 Photo for Comparison
PL-6	315	Three T-Posts Installed on the South Corner of the Disposal Cell
PL-7	225	Restoration at TP1
PL-8	0	Restoration at TP6
PL-9	70	Development Across Southeast Perimeter Fence





*PL-1. Southwest Perimeter Fence Showing Rusting Strands and Post*



*PL-2. Line Brace With Missing End Cap, Northeast Perimeter Fence*





*PL-3. Site Marker SMK-2 on the Top Slope of the Disposal Cell*



*PL-4. View Northeast Along the Top of the Southeast Side Slope*





*PL-5. (a) Riprap at the Base of Post 4—2017*



*PL-5. (b) Riprap at the Base of Post 4—2010 Photo for Comparison*





*PL-6. Three T-Posts Installed on the South Corner of the Disposal Cell*



*PL-7. Restoration at TP1*





*PL-8. Restoration at TP6*



*PL-9. Development Across Southeast Perimeter Fence*



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## 6.0 Grand Junction, Colorado, Disposal Site

### 6.1 Compliance Summary

The Grand Junction, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected on December 6, 2017. A portion of the disposal cell remains open to receive low-level radioactive materials from various sources. The open disposal cell and its supporting structures and facilities are not included in the annual inspection. Ongoing disposal cell cover study areas, which include a lysimeter facility adjacent to the disposal cell, are also not inspected. This annual inspection includes the completed portion of the disposal cell and the remaining portions of the disposal site. No changes were observed on the disposal cell or in the associated drainage features. Inspectors did not identify any maintenance needs or cause for a follow-up inspection.

The U.S. Department of Energy (DOE) conducts annual groundwater monitoring as a best management practice. Three monitoring wells are sampled to assess the disposal cell's performance and to verify that groundwater in onsite paleochannels is not affected if seepage (transient drainage) from the disposal cell occurs. Groundwater monitoring was last completed in September 2017. Groundwater monitoring results confirm that groundwater in the paleochannels continues to be unaffected by potential transient drainage from the disposal cell.

### 6.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the completed portion of the disposal cell and the remaining portion of the site are specified in the site-specific DOE *Interim Long-Term Surveillance Plan for the Cheney Disposal Site near Grand Junction, Colorado* (Interim LTSP) (DOE 1998) and in procedures DOE established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 6-1 lists these requirements.

Table 6-1. Interim Requirements for the Grand Junction, Colorado, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Sections 3.0 and 6.2	Section 6.4	(b)(3)
Follow-Up Inspections	Section 3.4	Section 6.5	(b)(4)
Routine Maintenance and Repairs	Sections 2.7.3 and 4.0	Section 6.6	(b)(5)
Corrective Action	Section 5.0	Section 6.7	
Groundwater Monitoring	Section 2.6	Section 6.8	(b)(2)

### 6.3 Institutional Controls

The 360-acre site, identified by the property boundary shown in Figure 6-1, is owned by the United States. The open portion of the disposal cell is projected to remain open until 2023 or until it is filled to its design capacity, whichever comes first. DOE's Office of Legacy Management operates the site under authority of Public Law 104-259 (PL 104-259). Until the disposal cell is closed, it will not be accepted under the general license. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the



following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gate and sign, perimeter fence and signs, boundary monuments, and wellhead protectors.

## **6.4 Inspection Results**

The site, 18 miles south of Grand Junction, Colorado, was inspected on December 6, 2017. The inspection was conducted by S. Woods, K. Roemer, and P. Wetherstein of the DOE Legacy Management Support contractor. R. Bush (DOE); L. Gersey (NRC); and M. Cosby, J. Doebele, and M. Gerber (Colorado Department of Public Health and Environment) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, to identify changes in conditions that might affect conformance with the Interim LTSP, and to determine the need, if any, for maintenance or additional inspection and monitoring.

### **6.4.1 Site Surveillance Features**

Figure 6-1 shows in black the locations of site features, including site surveillance features and inspection areas. Site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue text, and new observations identified during the 2017 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are identified in the text and in Figure 6-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 6.10.

#### **6.4.1.1 Access Road, Entrance Gates, and Entrance Sign**

Access to the site is from U.S. Highway 50. There is a steel double-swing access gate, secured by a locking device, along the highway right-of-way fence. DOE is one of several parties with access to the locking device. A right-of-way grant on federal land, administered by the U.S. Bureau of Land Management (BLM), extends approximately 1.7 miles between Highway 50 and the entrance gate. DOE maintains this right-of-way, including a two-lane asphalt access road. The entrance gate is a double-swing chainlink gate secured by a DOE lock and chain. The entrance gate was locked and functional. The entrance sign is next to the entrance gate. No maintenance needs were identified.

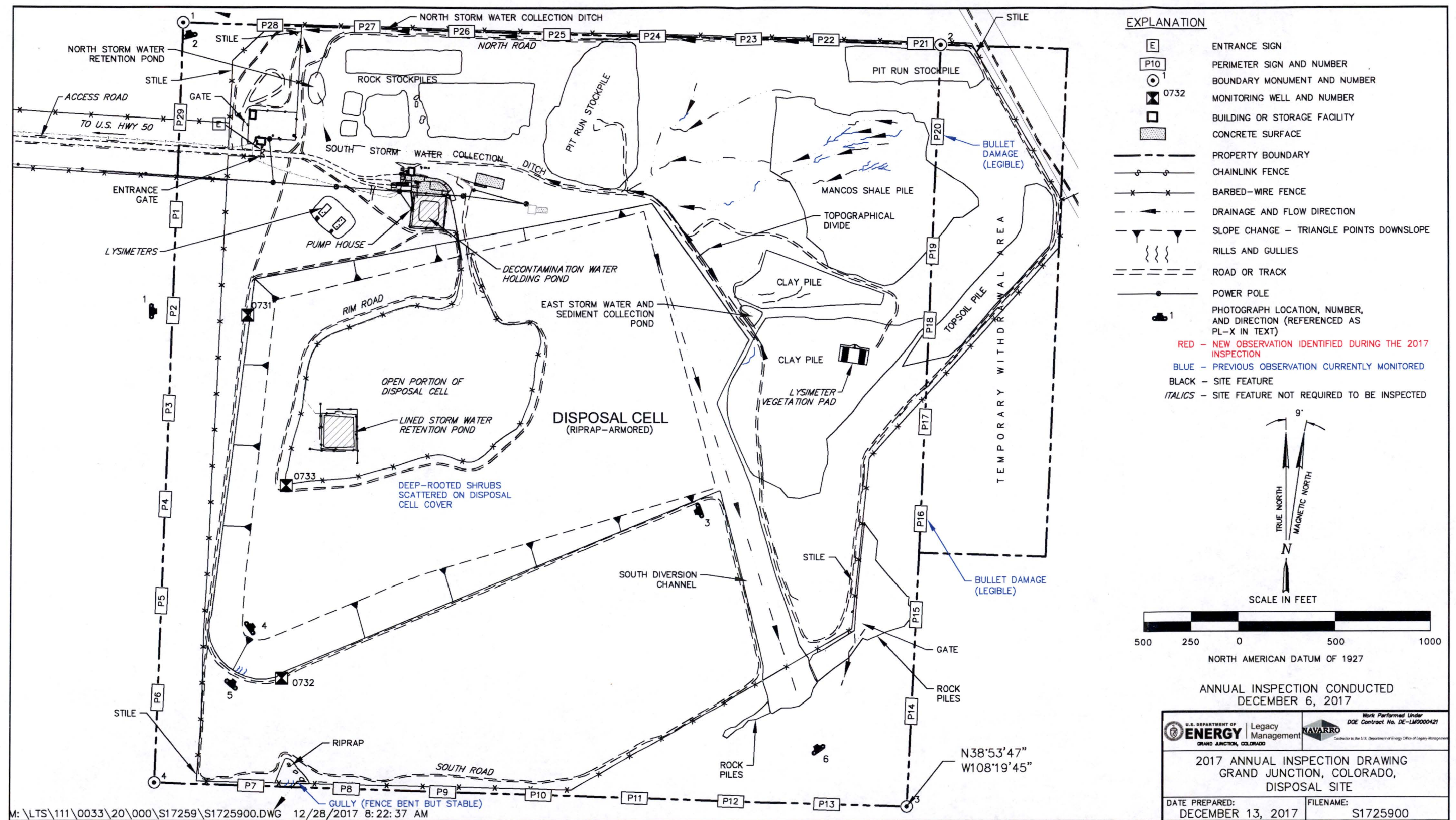
#### **6.4.1.2 Perimeter Fence and Signs**

A perimeter fence encloses the disposal cell features and operations areas. It consists of a standard four-strand barbed-wire fence in some areas and a woven wire fence topped with barbed wire in others. There are 29 perimeter signs attached to steel posts set in concrete, positioned at regular intervals along the property boundary (PL-1). Perimeter signs P16 and P20 have bullet damage but remain legible. No maintenance needs were identified.

#### **6.4.1.3 Site Markers**

Granite site markers similar to those at other UMTRCA sites will not be installed until the disposal cell is closed.







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#### **6.4.1.4    *Boundary Monuments***

Four boundary monuments delineate the corners of the property boundary (PL-2). No maintenance needs were identified.

#### **6.4.1.5    *Monitoring Wells***

The groundwater monitoring network consists of three monitoring wells. All wellhead protectors were locked and undamaged. No maintenance needs were identified.

### **6.4.2    *Inspection Areas***

In accordance with the Interim LTSP, the site is divided into four inspection areas to ensure a thorough and efficient inspection. The inspection areas are (1) the closed portion of the disposal cell, (2) diversion structures and drainage channels, (3) the area between the disposal cell and the site boundary, and (4) the outlying area. Inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with the Interim LTSP requirements.

#### **6.4.2.1    *Closed Portion of the Disposal Cell***

The closed portion of the disposal cell is armored with basalt riprap to control erosion. The rock showed no significant weathering. There was no evidence of erosion, settling, slumping, rock degradation, or other modifying processes that might affect the integrity of the disposal cell (PL-3).

On the disposal cell cover, numerous areas with alkali deposits have been reported during previous inspections and were visible during the 2017 annual inspection. The deposits are thought to be evaporite minerals. There is no indication that the alkali areas are related to the performance of the disposal cell; therefore, these areas are not noted by inspectors.

Grasses and weeds were growing on most of the disposal cell cover (PL-4). Historically, deep-rooted shrubs have been treated with herbicide on the disposal cell top slope. Although treatment is not required by the Interim LTSP, DOE plans to continue controlling the deep-rooted shrubs as needed until more is known about the potential effects of vegetation on the disposal cell cover.

During the 2014 annual inspection, several small erosion channels were noted in soils at the base of the disposal cell's southwestern corner. The channels do not threaten the integrity of the disposal cell, and no significant changes were noted in 2017 (PL-5). No maintenance needs were identified.

#### **6.4.2.2    *Diversion Structures and Drainage Channels***

The south diversion channel is a large, riprap-armored structure that intercepts run-on water from offsite and onsite, as well as runoff from the disposal cell, and conveys the water into a natural drainage that flows away from the site to the southwest. Grasses, weeds, and shrubs grow within the diversion channel, but this vegetation is not expected to degrade the channel's performance. The discharge area of the channel is armored with large-diameter basalt riprap (PL-6).



Other drainage features at the site include north and south storm water collection ditches, the north storm water retention pond, and the east storm water and sediment collection pond. These small drainage features control storm water runoff primarily from the various stockpiles of cover materials. The storm water collection ditches also capture storm water run-on from offsite locations. The diversion channel, ditches, and ponds were functioning as designed. An offsite diversion structure on private property was repaired in 2017. The repair was necessary to prevent water from entering a breached ditch located on BLM-administered land approximately one-half mile upgradient from (northeast of) the site; the breach caused water to flow into the north storm water collection ditch in past years. No maintenance needs were identified.

#### **6.4.2.3     *Area Between the Disposal Cell and the Site Boundary***

There are 11 discrete stockpiles of rock and soil between the disposal cell and the perimeter fence on the north and east sides of the site. Most of these materials eventually will be used to cover and close the open disposal cell. Vegetation and surface rocks generally protect the stockpiles from significant erosion.

Most of the flat areas between the disposal cell and the site (property) boundary are vegetated with native shrubs, scant perennial grasses, and annual weeds. Some localized erosion has occurred along the perimeter road near the east storm water and sediment collection pond. No areas of significant erosion were present that could threaten the integrity of the disposal cell or site features. Erosion rills on the west side of the perimeter road will continue to be monitored. No maintenance needs were identified.

#### **6.4.2.4     *Outlying Area***

The area beyond the site boundary for a distance of 0.25 mile was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. No such changes were identified. Most of the land surrounding the site is rangeland administered by BLM and private property on the west side used primarily for cattle grazing. No land use changes were evident in this area. Outside the site's eastern boundary is a 40-acre temporary withdrawal area of federal land. Some of the withdrawal area is included within the perimeter fence and contains materials stockpiles. This area is not included in the Interim LTSP but is inspected as an offsite area.

### **6.5     Follow-Up Inspections**

DOE will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) DOE is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up inspection was identified.

### **6.6     Maintenance and Repairs**

No maintenance needs were identified.



## 6.7 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192. No need for corrective action was identified.

## 6.8 Groundwater Monitoring

In accordance with the Interim LTSP, DOE conducts annual groundwater monitoring as a best management practice. Groundwater at the site qualifies for supplemental standards because it is designated as "limited use," a designation given to groundwater that is not a current or potential source of drinking water. Groundwater in the uppermost aquifer is designated as "limited use" because total dissolved solids (TDS) exceed 10,000 milligrams per liter (mg/L). Under this designation, groundwater monitoring is not required. Confined groundwater in the uppermost aquifer lies approximately 750 feet (ft) below the ground surface and is geologically isolated from the tailings material by low-permeability mudstones and shales of the Mancos Shale Formation. DOE monitors groundwater from three monitoring wells adjacent to and in the disposal cell to assess the disposal cell's performance and to verify that groundwater in onsite paleochannels is not affected if seepage (transient drainage) from the disposal cell occurs. The most recent sampling event occurred in August 2017.

Two monitoring wells (0731 and 0732) are completed in (or very near) buried alluvial paleochannels adjacent to the disposal cell, and one monitoring well (0733) is in the tailings stored in the disposal cell (Figure 6-2 and Table 6-2). The paleochannel monitoring wells are located along the downgradient edge (west side of the disposal cell) and are screened at the interface between the alluvium and shallow Mancos Shale Formation. The third monitoring well is in the southwest corner of the open portion of the disposal cell and is completed in tailings. Disposal cell construction was initiated by excavating Mancos Shale, which resulted in the base of the disposal cell being below the unconsolidated soil contact with the Mancos Shale. Monitoring well 0733 is primarily used to measure water levels within the disposal cell. As long as water levels in the disposal cell are less than those measured in monitoring wells 0731 and 0732, water within the disposal cell cannot flow out of the disposal cell in the more permeable unconsolidated soil, which includes the adjacent paleochannels.

*Table 6-2. Groundwater Monitoring Network at the Grand Junction, Colorado, Disposal Site*

Monitoring Well	Hydrologic Relationship
0731	Paleochannel, downgradient, edge of disposal cell, north side
0732	Paleochannel, downgradient, edge of disposal cell, south side
0733	Disposal cell, deepest location, downgradient, center





Figure 6-2. Groundwater Monitoring Network for the Grand Junction, Colorado, Disposal Site



### 6.8.1 Groundwater-Level Monitoring

Static water level measurements are obtained from each monitoring well before water quality samples are collected (Figure 6-3). In addition, water levels have been measured continuously at 4-hour increments since September 2006 using a datalogger and transducers installed in each of the monitoring wells. The continuous record shows that the water level in disposal cell monitoring well 0733 has increased approximately 4 ft but has always remained lower than the adjacent water levels in the two paleochannel monitoring wells (Figure 6-3). The lower water level in the disposal cell relative to surrounding water levels prevents outflow of the disposal cell into the adjacent unconsolidated soils.

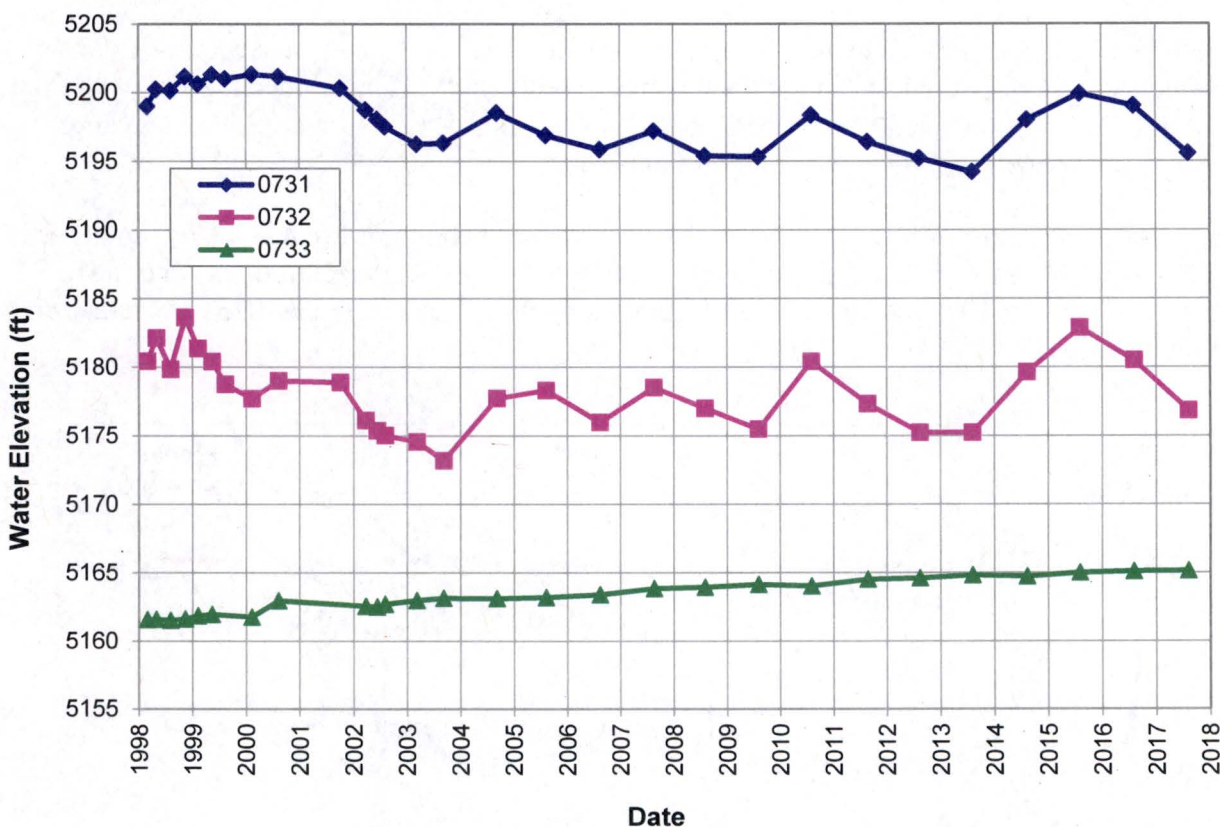


Figure 6-3. Water Level Measurements at the Grand Junction, Colorado, Disposal Site

### 6.8.2 Groundwater Quality Monitoring

Annual groundwater samples are analyzed for standard field parameters and the following indicator analytes: molybdenum, nitrate, selenium, sulfate, TDS, uranium, vanadium, and polychlorinated biphenyls. Key indicator analytes are molybdenum, nitrate, selenium, and uranium. The U.S. Environmental Protection Agency has established maximum concentration limits (MCLs) for these analytes in groundwater (Table 6-3) (40 CFR 192 Table 1 Subpart A). Monitoring results are compared to the MCLs for evaluation only and not for compliance purposes.



Table 6-3. Maximum Concentration Limits for Groundwater at the Grand Junction, Colorado, Disposal Site

Constituent	MCL <sup>a</sup> (mg/L)
Molybdenum	0.1
Nitrate (as nitrogen)	10
Selenium	0.01
Uranium	0.044

**Note:**

<sup>a</sup> MCLs as listed in 40 CFR 192 Table 1 Subpart A.

Molybdenum concentrations in all three monitoring wells have remained steady since 1998; 2017 concentrations were less than or about equal to 0.003 mg/L. Time-concentration plots from 1998 through 2017 for the other key indicator analytes—nitrate (as nitrogen), selenium, and uranium—are shown in Figure 6-4 through Figure 6-6.

Since 1999, nitrate (as nitrogen) concentrations in disposal cell monitoring well 0733 continue to decline, reaching a low of 1.0 mg/L this year (Figure 6-4). Nitrate concentrations continue to exceed the MCL of 10 mg/L in the paleochannel monitoring wells 0731 and 0732 but remain within historical levels (Figure 6-4).

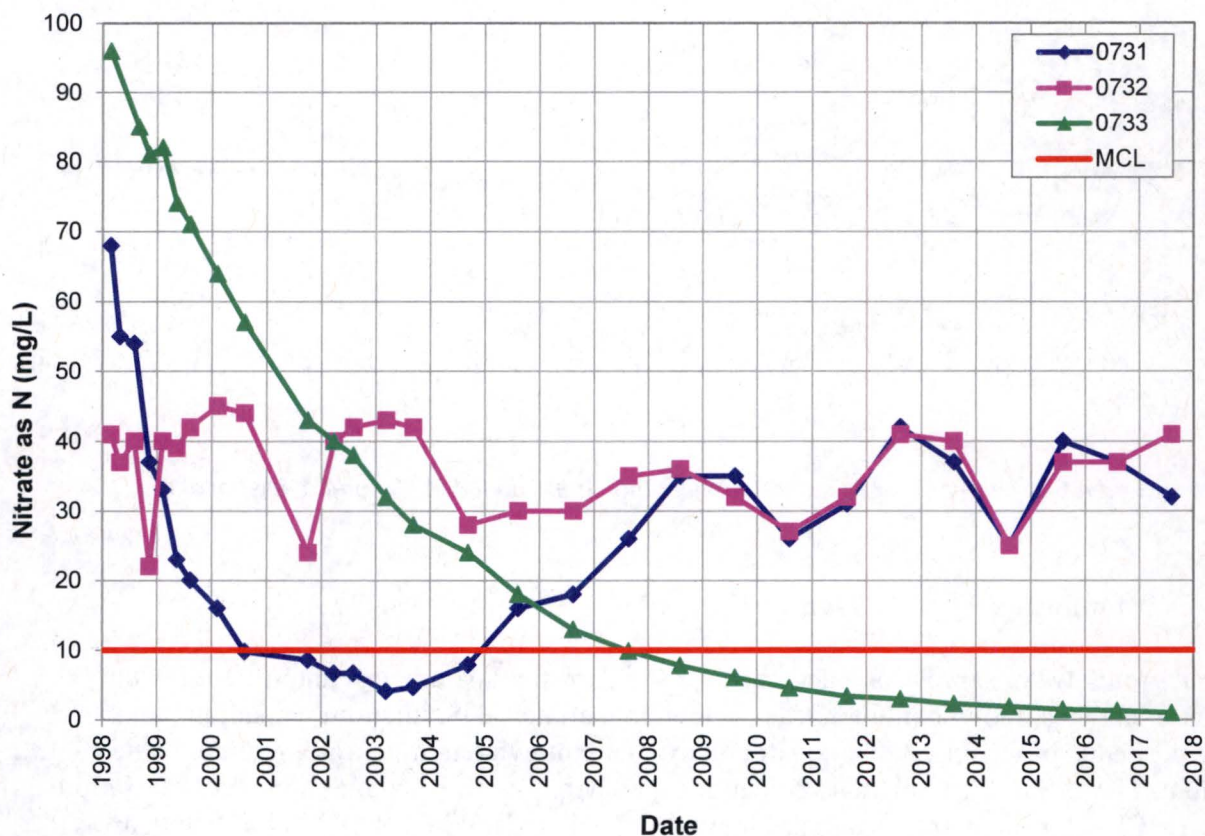


Figure 6-4. Nitrate (as Nitrogen) in Groundwater at the Grand Junction, Colorado, Disposal Site



Selenium concentrations continued to exceed the MCL of 0.01 mg/L in the paleochannel monitoring wells 0731 and 0732, with no apparent trend in either well since 2001 (Figure 6-5). Selenium occurs naturally in the Mancos Shale deposits that underlie the disposal cell at concentrations slightly greater than the MCL of 0.01 mg/L. Paleochannel monitoring wells 0731 and 0732 are screened at the Mancos Shale unconsolidated soil contact. Background groundwater quality in the Mancos Shale is brackish, with elevated TDS levels ranging from 870 to 7010 mg/l; this supports the theory that the shale is the source of the elevated selenium concentrations in both paleochannel monitoring wells. In disposal cell monitoring well 0733, the selenium concentrations remain below the MCL.

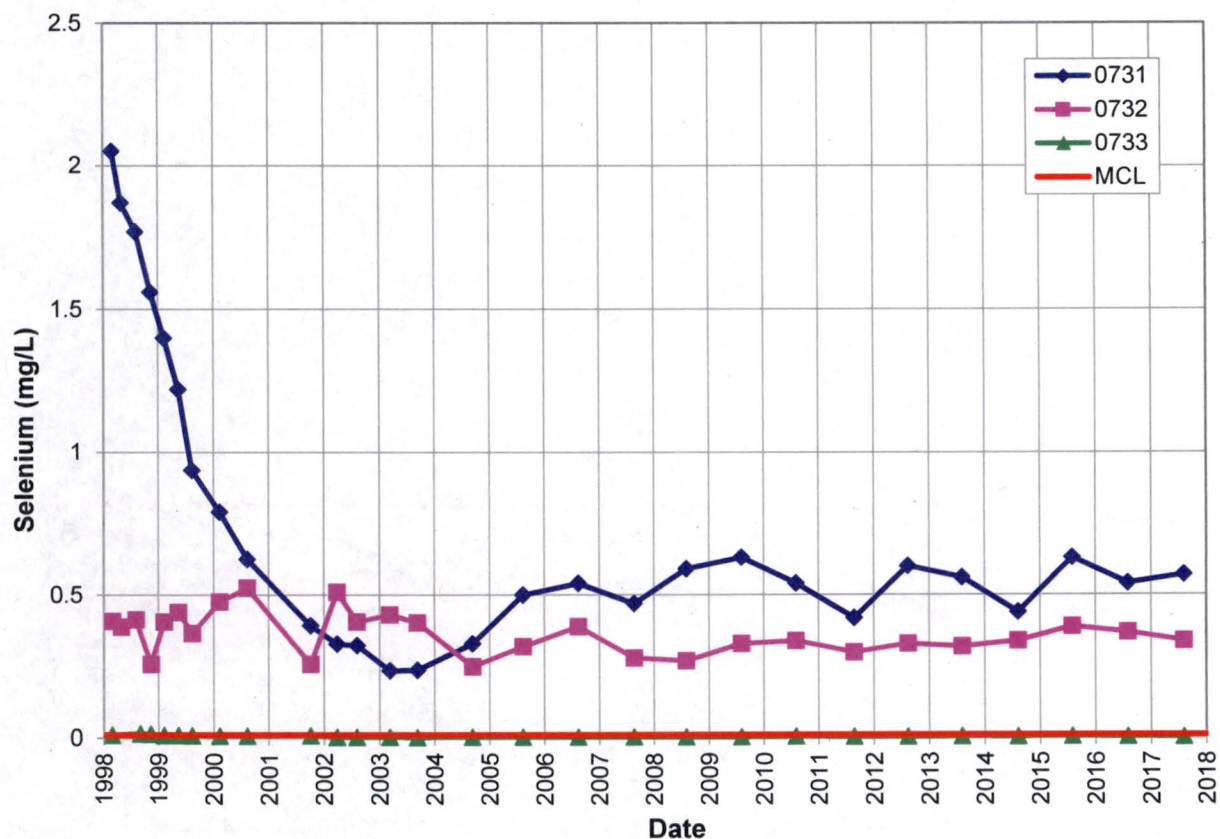


Figure 6-5. Selenium in Groundwater at the Grand Junction, Colorado, Disposal Site



Uranium concentrations in groundwater continued to be below the MCL of 0.044 mg/L in paleochannel monitoring well 0732 in 2017, but they exceeded the MCL in paleochannel monitoring well 0731 for the first time since 2003. Paleochannel monitoring wells 0731 and 0732 have shown an increasing trend since 2011 (Figure 6-6). The uranium concentration in disposal cell monitoring well 0733, screened in the tailings but hydraulically isolated from the surrounding unconsolidated soil by an inward hydraulic gradient, continues to increase with a 2017 concentration of 0.20 mg/L.

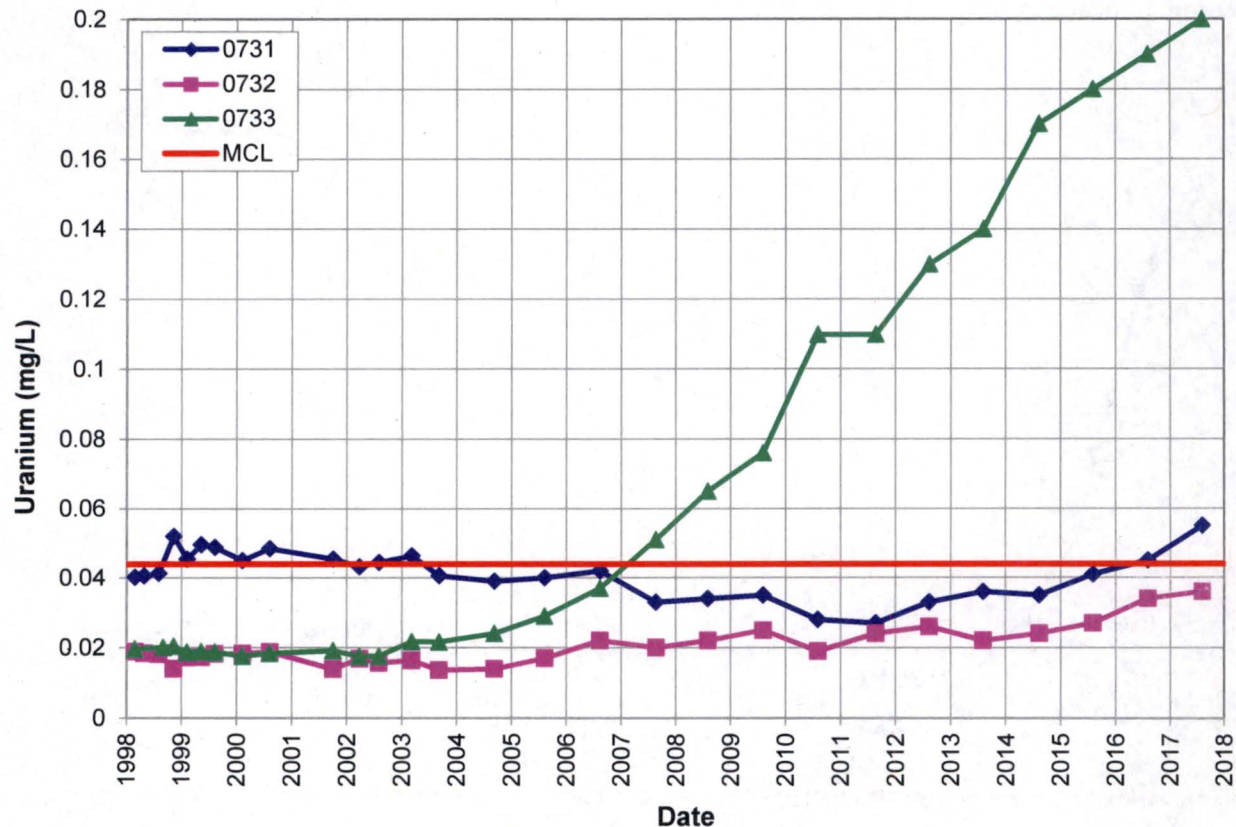


Figure 6-6. Uranium in Groundwater at the Grand Junction, Colorado, Disposal Site

Comparison of the disposal cell water level with the paleochannel water levels shows an inward hydraulic gradient between the disposal cell and the surrounding unconsolidated soils, which effectively isolates the disposal cell from adjacent unconsolidated soils.

## 6.9 References

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

40 CFR 192. U.S. Nuclear Regulatory Commission, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations*.



40 CFR 192 Table 1 Subpart A. U.S. Nuclear Regulatory Commission, "Maximum Concentration of Constituents for Groundwater Protection," *Code of Federal Regulations*. DOE (U.S. Department of Energy), 1998. *Interim Long-Term Surveillance Plan for the Cheney Disposal Site near Grand Junction, Colorado*, DOE/AL/62350-243, Rev. 1, April.

PL 104-259. "An Act to Extend the Authorization of the Uranium Mill Tailings Radiation Control Act of 1978, and for Other Purposes," Public Law.

## 6.10 Photographs

Photo Location Number	Azimuth	Photograph Description
PL-1	90	Perimeter Sign P2
PL-2	345	Boundary Monument BM-1
PL-3	250	East End of the South Side Slope of Disposal Cell
PL-4	55	Top of Southwest Corner of Disposal Cell
PL-5	40	Erosion Rills at Bottom of Southwest Corner of Disposal Cell
PL-6	325	South Diversion Channel at Southeast Corner of Site





*PL-1. Perimeter Sign P2*



*PL-2. Boundary Monument BM-1*





*PL-3. East End of the South Side Slope of Disposal Cell*



*PL-4. Top of Southwest Corner of Disposal Cell*





*PL-5. Erosion Rills at Bottom of Southwest Corner of Disposal Cell*



*PL-6. South Diversion Channel at Southeast Corner of Site*



## 7.0 Green River, Utah, Disposal Site

### 7.1 Compliance Summary

The Green River, Utah, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected on March 21, 2017. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified several routine maintenance needs but found no cause for a follow-up or contingency inspection.

The U.S. Department of Energy (DOE) conducts annual groundwater monitoring to monitor disposal cell performance. Groundwater monitoring was last completed in June 2017. The LTSP concentration limits were exceeded at multiple point of compliance (POC) wells.

### 7.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific DOE Long-Term Surveillance Plan (LTSP) (DOE 1998) and in procedures DOE established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 7-1 lists these requirements.

Table 7-1. License Requirements for the Green River, Utah, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 6.0	Section 7.4	(b)(3)
Follow-Up or Contingency Inspections	Section 7.0	Section 7.5	(b)(4)
Maintenance and Repairs	Section 8.0	Section 7.6	(b)(5)
Groundwater Monitoring	Section 5.2	Section 7.7	(b)(2)
Corrective Action	Section 9.0	Section 7.8	

### 7.3 Institutional Controls

The 25-acre site, identified by the property boundary shown in Figure 7-1, is owned by the United States and was accepted under the general license in 1998. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gate and sign, security fence around the disposal cell, perimeter signs, site markers, survey and boundary monuments, and wellhead protectors.

### 7.4 Inspection Results

The site, 1 mile southeast of Green River, Utah, was inspected on March 21, 2017. The inspection was conducted by R. Johnson, J. Price, and E. Tyrrell of the DOE Legacy Management Support contractor. J. Linard (DOE site manager); H. Mickelson (Utah Department



of Environmental Quality); and L. Gersey and C. Grossman (NRC) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, to identify changes in conditions that might affect conformance with the LTSP, and to determine the need, if any, for maintenance or additional inspection and monitoring.

#### **7.4.1 Site Surveillance Features**

Figure 7-1 shows in black the locations of site features, including site surveillance features and inspection areas. Site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue text, and new observations identified during the 2017 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are identified in the text and in Figure 7-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 7.10.

##### ***7.4.1.1 Access Road, Entrance Gate, and Entrance Sign***

Access to the site is from either U.S. Highway 6 and 50 heading east from the town of Green River or from U.S. Interstate 70 via Street 1600 East. The paved access road crosses property owned by the State of Utah and the U.S. Army. Access has been granted to DOE through right-of-way agreements with both entities. Entrance to the site is through a locked steel gate in the paved road right-of-way fence; DOE does not own the gate or the right-of-way fence. Past this gate, a dirt road leads across State land to the site. The access road divides at the security fence, with one branch entering the security fence that encloses the disposal cell and the other providing access around the outside of the security fence. The entrance sign is next to the access road where it enters the site (PL-1). No maintenance needs were identified.

##### ***7.4.1.2 Security Fence and Perimeter Signs***

A chainlink security fence encloses the portion of the site that contains the disposal cell. Two vehicle gates are at the south and east corners of the security fence line, and a personnel gate is at the north corner of the security fence line. The security fence was intact and the gates were locked.

There are 17 perimeter signs, attached to steel posts set in concrete, positioned along the unfenced property boundary. Perimeter sign P12 has bullet damage but remains legible. Perimeter sign P6 was missing and was replaced during the inspection (PL-2); no other maintenance needs were identified.

##### ***7.4.1.3 Site Markers***

The site has two granite markers. Site marker SMK-1 is inside the security fence near the southwest corner of the site. Its concrete base has several minor cracks, but they do not compromise the integrity of the base, and repairs are not necessary at this time. Site marker SMK-2 is on the crest of the disposal cell (PL-3). No maintenance needs were identified.



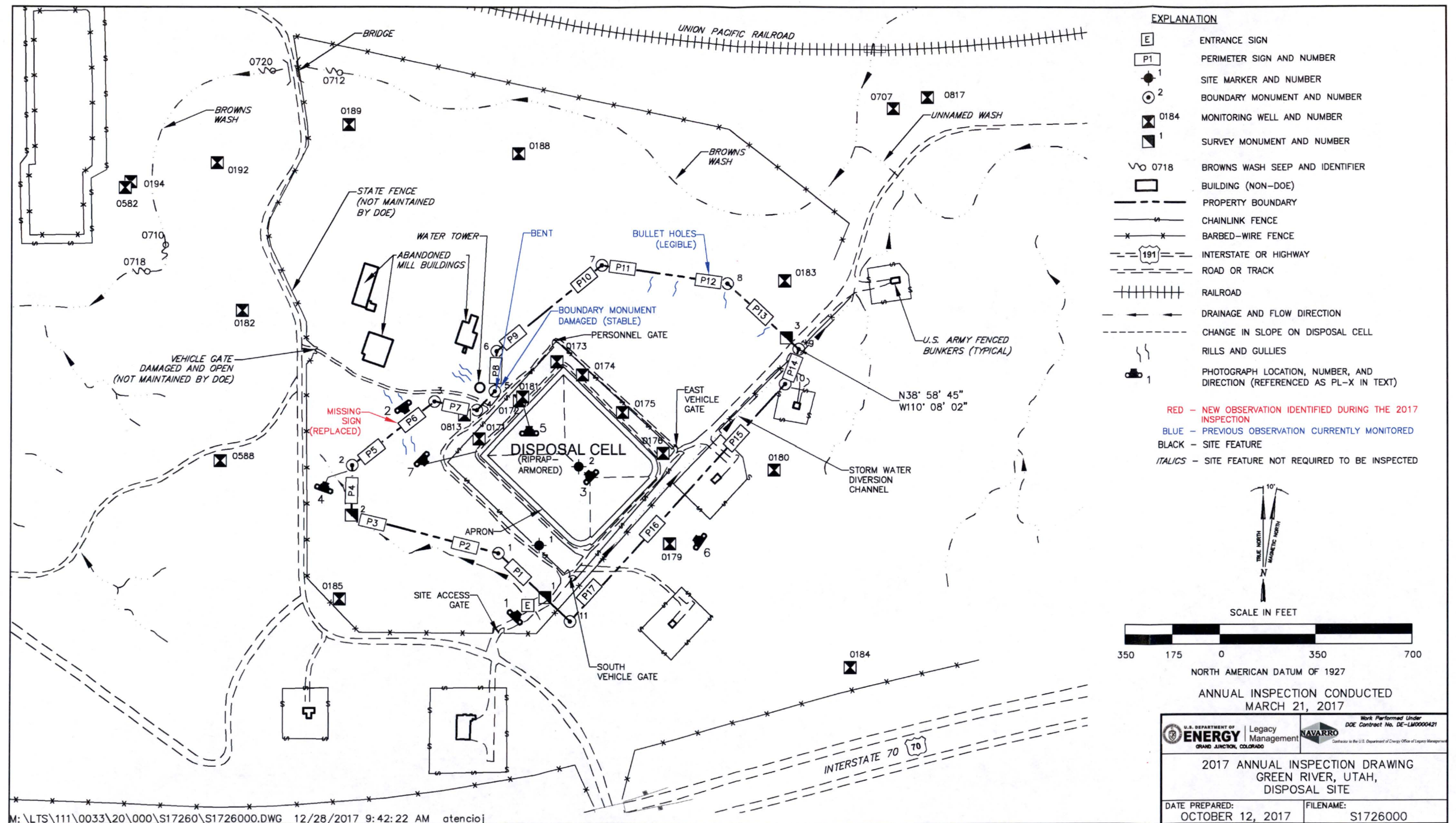


Figure 7-1. 2017 Annual Inspection Drawing for the Green River, Utah, Disposal Site



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#### **7.4.1.4 Survey and Boundary Monuments**

Eleven boundary monuments (PL-4) and three survey monuments delineate the property boundary. Boundary monument BM-5 is damaged (it is bent due to being hit by a vehicle), but its condition does not require repair. No maintenance needs were identified.

#### **7.4.1.5 Monitoring Wells**

There are 22 monitoring wells on or near the site. Monitoring wells were inspected during the June 2017 sampling event. All wellhead protectors observed during the inspection were undamaged and locked. Some of the concrete monitoring well collars are cracked (PL-5), but the wellhead protectors are stable and repairs are not necessary. No maintenance needs were identified.

#### **7.4.2 Inspection Areas**

In accordance with the LTSP, the site is divided into three inspection areas to ensure a thorough and efficient inspection. The inspection areas are (1) the disposal cell and adjacent area inside the security fence, (2) the site perimeter between the security fence and the site boundary, and (3) the outlying area. Inspectors examined specific site surveillance features within each area and looked for evidence of settlement, erosion, or other modifying processes that might affect the site's conformance with LTSP requirements.

##### **7.4.2.1 Disposal Cell and Adjacent Area Inside the Security Fence**

The disposal cell, completed in 1989, occupies 6 acres. The slopes of the disposal cell cover are armored with riprap, consisting primarily of competent basalt with a small fraction of sedimentary rocks, to control erosion (PL-6). A small percentage of the rock, including basalt and sedimentary rocks, has degraded, but the riprap cover is functioning as designed. There was no evidence of settling, slumping, erosion, or any other modifying process that might affect the integrity of the disposal cell.

A boulder-filled trench, known as an apron, surrounds the disposal cell (PL-7). The apron was intact and stable, with no observed erosion along the base of the side slopes. Small erosion rills are present along portions of the outside edge of the apron. The rills form as storm water runoff along the disposal cell perimeter road drains into the disposal cell apron. This occurrence is not a concern because the erosion is minor and sedimentation in the apron has not adversely affected the performance of the apron (the sediment has not filled the apron or become visible in the apron). Inspectors will continue to monitor the area.

The area between the disposal cell and the security fence consists of the disposal cell perimeter dirt road, several monitoring wells, and sparsely vegetated open space. The road was passable, and there was no indication of erosion or trespassing in the open space. No maintenance needs were identified.

##### **7.4.2.2 Site Perimeter Between the Security Fence and the Site Boundary**

The area between the security fence and the site boundary is primarily open space but includes access roads, a storm water diversion channel, and a monitoring well. The site (property)



boundary is not fenced, and trespassing occurs on the site from several access points through State of Utah land. Unauthorized access to the site primarily is from the west through a former mill access gate that has broken off its hinges; DOE is not responsible for the gate or associated fence. The site is also accessible through remote unfenced open access points north and east of the site. The site will continue to be monitored for adverse public use typically indicated by trash, tire ruts, and vandalism. The missing perimeter sign was the only indication of vandalism.

Signs of erosion are present in multiple areas in the site perimeter. Erosional rills are present on the west side of the site; some appeared to show recent erosion but were not impacting any site surveillance features. Rills and gullies are also present along the escarpment northeast of the disposal cell in the area between boundary monument BM-7 and survey monument SM-3. Maximum gully depth in this area is approximately 3 feet (ft), but the erosion appears to be stabilizing. A portion of the storm water diversion channel along the southeast side of the site continues to erode to a minor extent. These erosional features could eventually damage site surveillance features (i.e., perimeter signs, boundary monuments, and the security fence). Inspectors will continue to monitor this area. No immediate maintenance needs were identified.

#### **7.4.2.3 Outlying Area**

The area beyond the site boundary for a distance of 0.25 mile was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. No such impacts were observed. Abandoned buildings and a water tower associated with the former milling activities are northwest of the site. The buildings are not maintained and are in a state of disrepair, and debris tends to blow from the buildings onto the site (e.g., shingles, siding, plastic). Accumulation of windblown debris was minor, but it will continue to be monitored, and debris will be removed as it accumulates.

Areas of erosion noted during previous inspections include the natural drainage near the southwest side of the site and rills and gullies northwest of the water tower. Evidence of continued erosion in these areas was apparent but currently does not threaten the integrity of the disposal cell or site surveillance features. Inspectors will continue to monitor these erosional features.

### **7.5 Follow-Up or Contingency Inspections**

DOE will conduct follow-up or contingency inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) DOE is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up or contingency inspection was identified.

### **7.6 Maintenance and Repairs**

A missing perimeter sign was replaced during the inspection. No other maintenance needs were identified.



## 7.7 Groundwater Monitoring

In accordance with the LTSP, annual groundwater monitoring is conducted to evaluate the performance of the disposal cell. DOE developed a draft Groundwater Compliance Action Plan (GCAP) to update the LTSP groundwater compliance strategy in 2011 (DOE 2011). The draft GCAP expands the scope of the monitoring network and proposes alternate concentration limits (ACLs) and supplemental standards. The draft GCAP was approved by the State of Utah and is currently in review by NRC. The most recent sampling event occurred in June 2017.

The LTSP establishes POC wells at the site for postclosure groundwater monitoring. The four POC wells represent the intersection of a vertical plane with the uppermost aquifer (the middle sandstone unit of the Cedar Mountain Formation) underlying the site, located at the hydraulically downgradient limit of the disposal cell. The LTSP included monitoring well 0172. However, its construction integrity was suspect, so monitoring well 0181 was installed next to it in 2001; monitoring well 0181 has been monitored as the replacement POC well since 2001. Table 7-2 and Figure 7-2 show the current groundwater monitoring network at the site.

*Table 7-2. Groundwater Monitoring Network for the Green River, Utah, Disposal Site*

<b>Groundwater Monitoring Purpose</b>	<b>Monitoring Wells</b>
Point of compliance (POC) well	0171, 0173, 0181, 0813
Water level monitoring well	0176, 0179, 0182, 0183, 0184, 0185, 0582, 0588, 0817

Water levels are measured in the POC wells and additional monitoring wells, mostly in the deeper sandstone unit aquifer included in the draft GCAP. The water level monitoring identifies aquifer flows in the contaminated middle sandstone unit of the Cedar Mountain Formation and in the formation's deeper and uncontaminated basal sandstone unit. In addition to water level measurements, POC monitoring wells are sampled for nitrate, sulfate, and uranium.

### 7.7.1 Water Level Monitoring

The hydraulic gradients and corresponding flow directions in the two Cedar Mountain Formation aquifers underlying the disposal cell are monitored using water level measurements from several monitoring wells adjacent to the disposal cell. Water levels have been manually measured annually in these monitoring wells since 1991. Groundwater elevation data derived from the existing groundwater monitoring network are adequate to determine that flow direction in the upper aquifer is toward the west-northwest, while flow direction in the lower aquifer is toward the southwest. The data also suggest that there is a neutral gradient between the two aquifers that neither induces nor retards contaminant migration from the contaminated upper aquifer to the uncontaminated lower aquifer (DOE 2011).



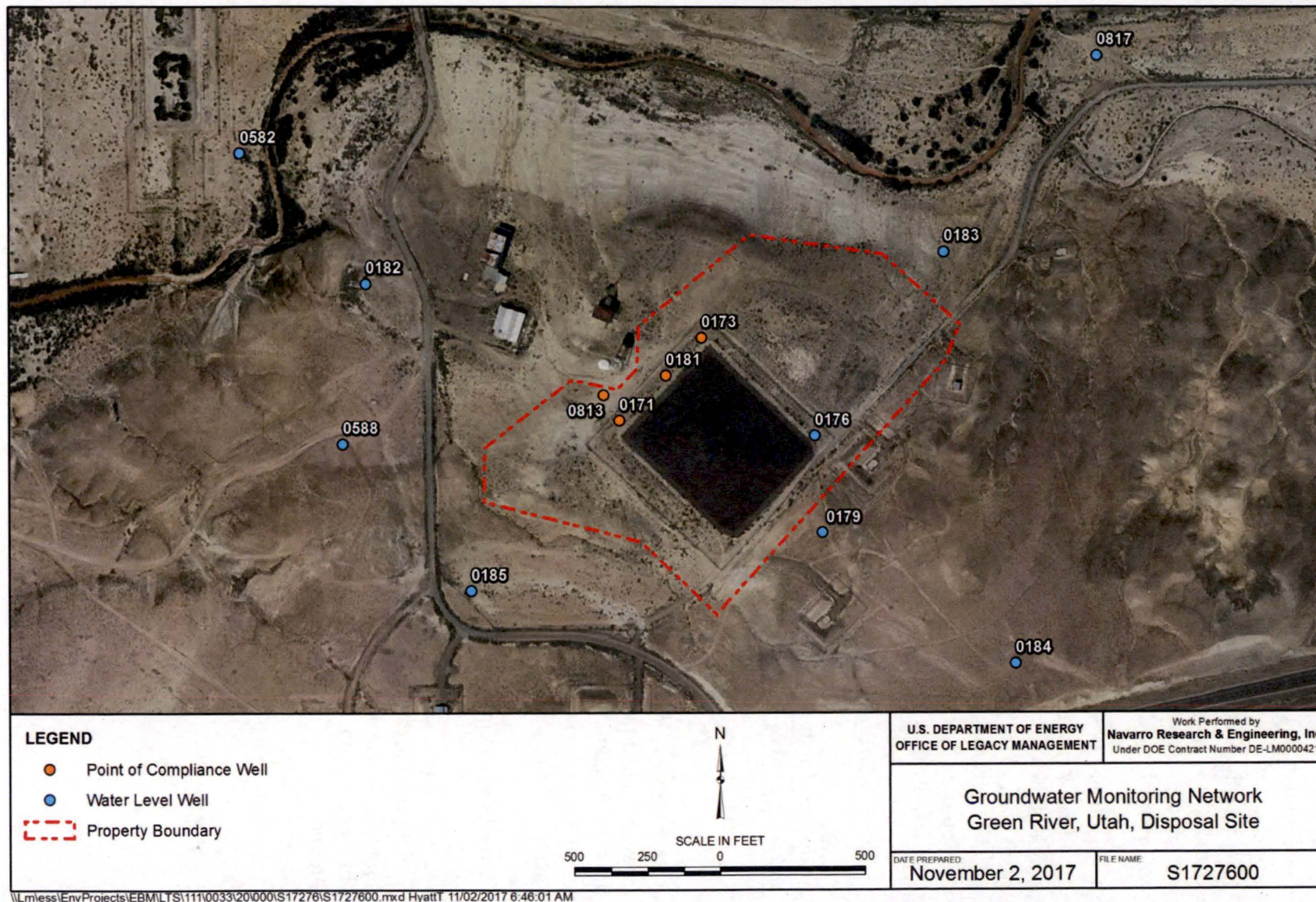


Figure 7-2. Groundwater Monitoring Network at the Green River, Utah, Disposal Site



Water levels in the POC wells have increased steadily since 2014, returning to 2007 levels. Historically, the groundwater levels in these wells decreased approximately 3 ft overall from 1998 through 2004 and then increased approximately 8 ft between 2004 and 2007. Water level decreases ranged from 4 to 5 ft from 2007 through 2014. Since 2014, water levels have increased approximately 5 ft (Figure 7-3). The higher water levels are not believed to result from liquid releases from the disposal cell. Rather, general increases in river stage and hydraulic heads in upgradient parts of the middle sandstone aquifer are considered more likely causes of the apparent rise in groundwater elevation.

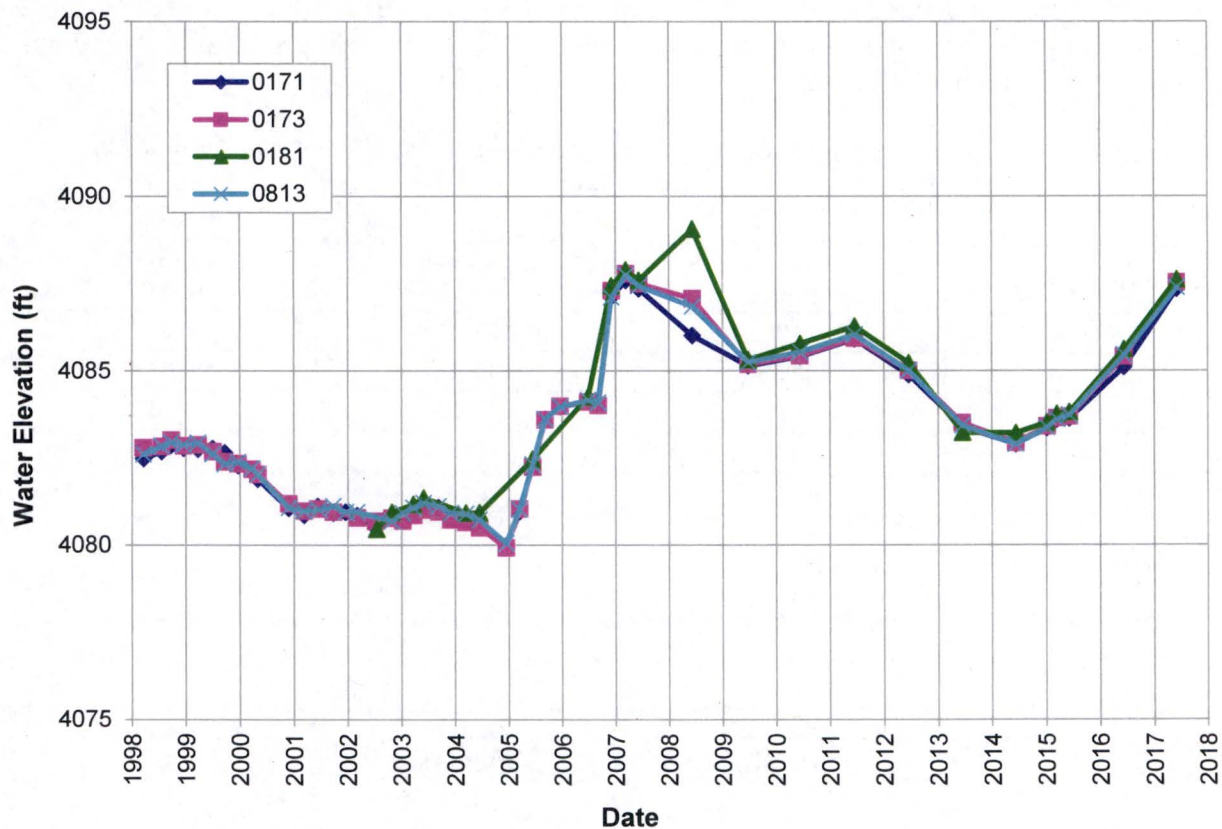


Figure 7-3. Groundwater Elevations at the Green River, Utah, Disposal Site



## 7.7.2 Disposal Cell Performance Monitoring

The LTSP establishes concentration limits for POC wells (Table 7-3). These values were developed on the basis of background water quality data before construction of the disposal cell (DOE 1998) and reflect the spatial variability between POC wells. The LTSP concentration limits for nitrate and uranium are equal to or greater than the U.S. Environmental Protection Agency maximum concentration limits (MCLs) (40 CFR 192 Table 1 Subpart A). There is no MCL for sulfate. Risk-based ACLs are proposed for nitrate (1000 milligrams per liter [mg/L]) and uranium (4.4 mg/L) in the draft GCAP; no concentration limit is proposed for sulfate. Table 7-4 provides the analytical results at POC wells for the June 2017 sampling event. Figure 7-4 through Figure 7-6 show the time-concentration plots for nitrate, sulfate, and uranium along with corresponding MCLs.

Table 7-3. LTSP Concentration Limits for Point of Compliance Wells at the Green River, Utah, Disposal Site

Monitoring Well	Nitrate (mg/L)	Sulfate (mg/L)	Uranium (mg/L)
0171	10 <sup>a</sup>	3334	0.044 <sup>a</sup>
0173	10 <sup>a</sup>	4000	0.044 <sup>a</sup>
0181	102	4985	0.067
0813	10 <sup>a</sup>	4440	0.069

Note:

<sup>a</sup> MCL (40 CFR 192 Table 1 Subpart A).

Table 7-4. 2017 Analytical Results for Point of Compliance Wells at the Green River, Utah, Disposal Site

Monitoring Well	Nitrate <sup>a</sup> (mg/L)	Sulfate (mg/L)	Uranium (mg/L)
0171	46	4200	0.13
0173	200	11,000	0.044
0181	67	8600	0.017
0813	0.003	4200	0.031

Notes:

<sup>a</sup> Nitrate = nitrate plus nitrite as nitrogen.

Red = equal to or exceeds LTSP concentration limit.



Nitrate concentrations continued to exceed the LTSP concentration limits in POC wells 0171 and 0173 but are below the GCAP proposed risk-based ACL of 1000 mg/L. The 2017 nitrate concentrations were within the range of historical values for all POC wells (Figure 7-4).

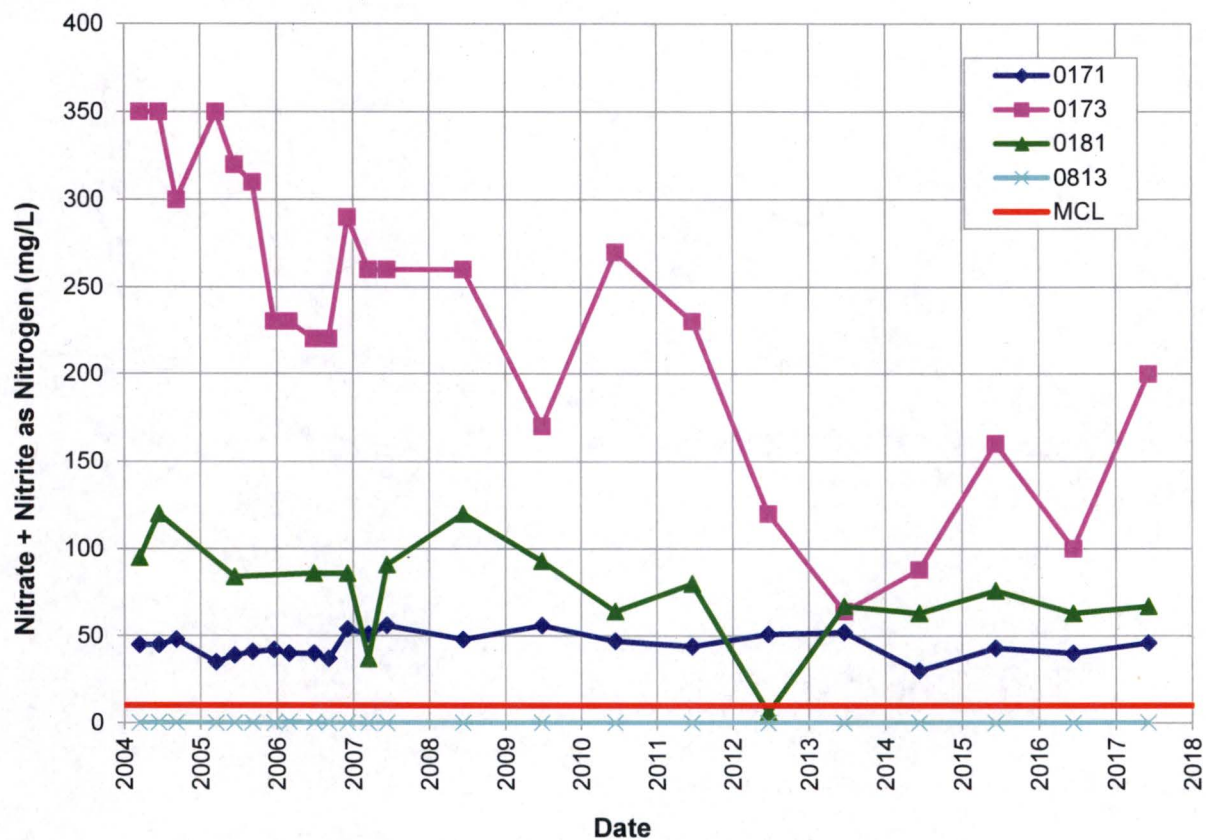


Figure 7-4. Nitrate at Point of Compliance Wells at the Green River, Utah, Disposal Site



Sulfate concentrations exceeded the LTSP concentration limits in all POC wells except POC well 0813. The 2017 sulfate concentrations exceed historical values in POC wells 0173 and 0181 (Figure 7-5).

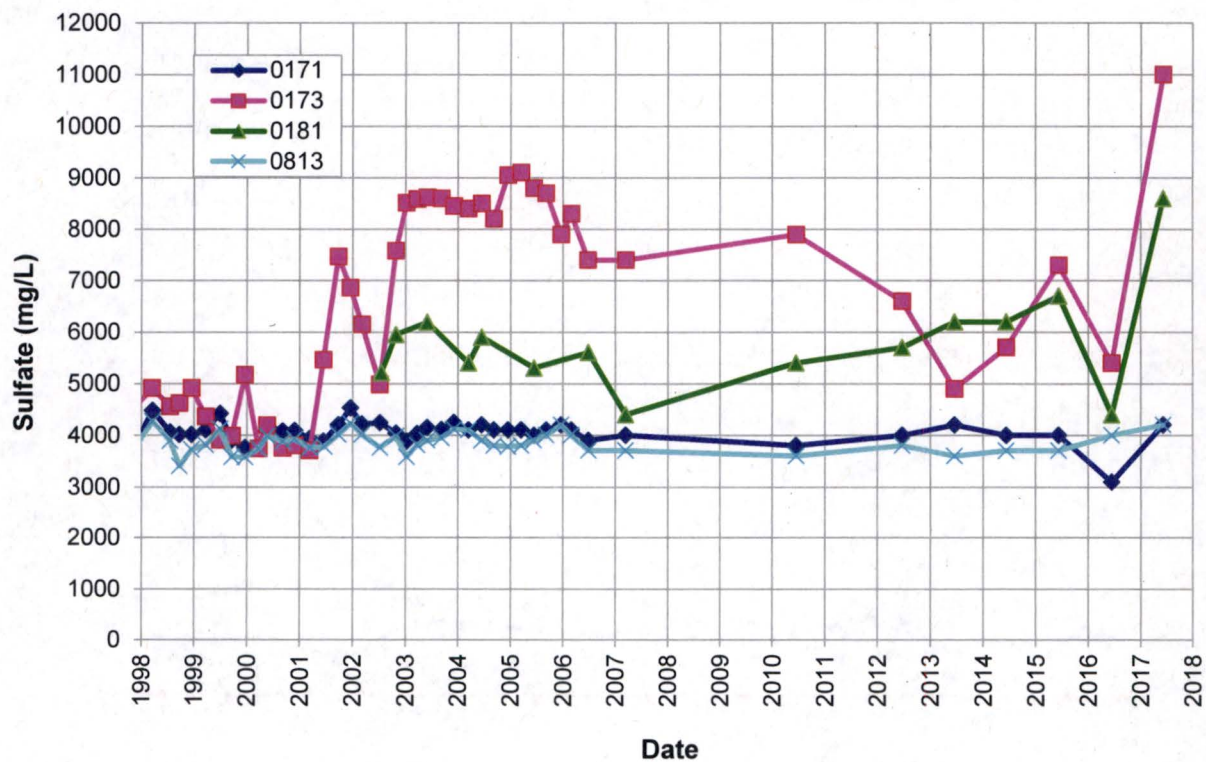


Figure 7-5. Sulfate at Point of Compliance Wells at the Green River, Utah, Disposal Site



Uranium concentrations remain below the LTSP concentration limits in all POC wells except POC wells 0171 and 0173 and below the GCAP proposed risk-based ACL of 4.4 mg/L in all POC wells (Figure 7-6). Uranium concentrations at POC well 0171 have varied considerably, ranging from a low of 0.0184 mg/L in 1999 to a high of 0.14 mg/L in 2016. No conclusions have been reached regarding the variability of uranium concentrations in POC well 0171. The 2017 uranium concentrations were within the range of historical values for all POC wells with the exception of POC well 0173, where uranium concentrations increased to 0.044 mg/L from a concentration of 0.02 mg/L in 2016.

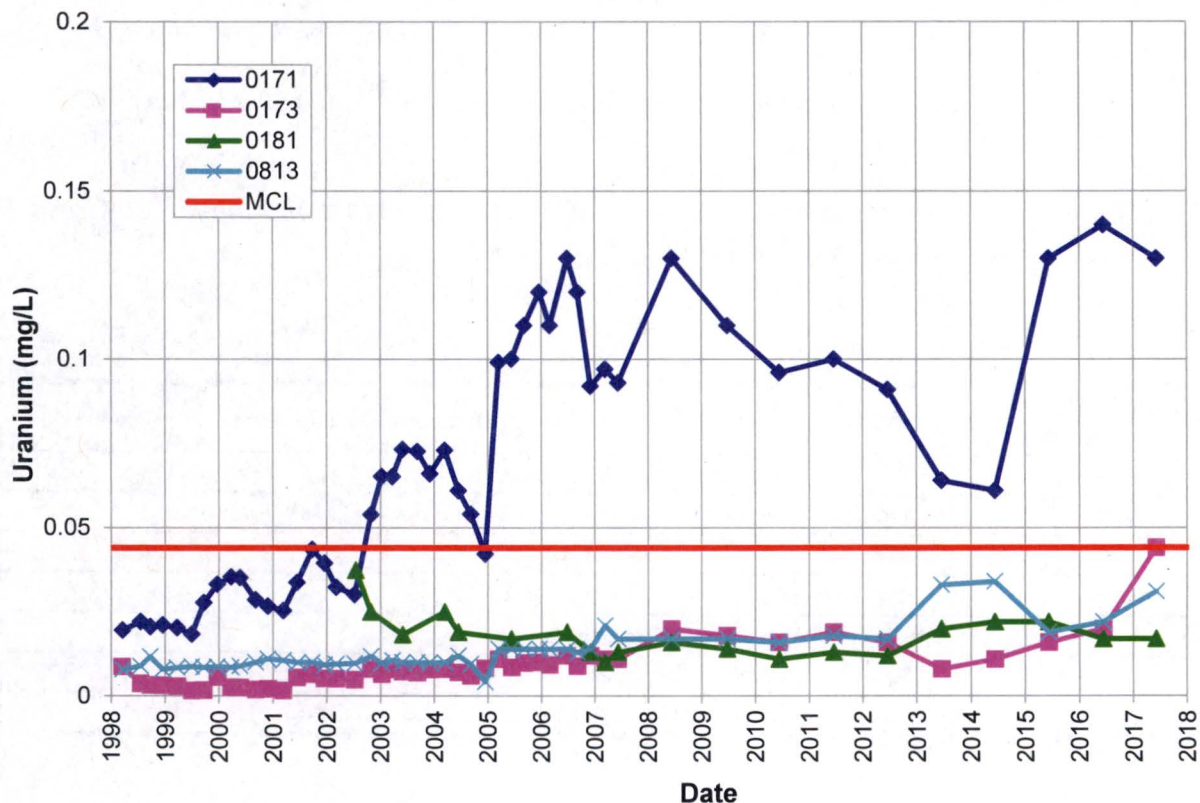


Figure 7-6. Uranium at Point of Compliance Wells at the Green River, Utah, Disposal Site

Groundwater monitoring results were within the range of historical values at all POC wells for nitrate, sulfate (with the exception of POC wells 0173 and 0181), and uranium (with the exception of POC well 0173). At this time there is no evidence that elevated concentrations are a reflection of disposal cell performance. Groundwater monitoring and disposal cell performance evaluation will continue at the site under the LTSP and the GCAP upon NRC concurrence.

## 7.8 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192. No need for corrective action was identified.



## 7.9 References

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

40 CFR 192. U.S. Nuclear Regulatory Commission, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings" *Code of Federal Regulations*.

40 CFR 192 Table 1 Subpart A. U.S. Nuclear Regulatory Commission, "Maximum Concentration of Constituents for Groundwater Protection" *Code of Federal Regulations*.

DOE (U.S. Department of Energy), 1998. *Long-Term Surveillance Plan for the Green River, Utah, Disposal Site*, DOE/AL/62350-89, Rev. 2, July.

DOE (U.S. Department of Energy), 2011. *Groundwater Compliance Action Plan for the Green River, Utah, Disposal Site*, LMS/GRN/S07892, December.

## 7.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	45	Entrance Sign
PL-2	145	Replaced Perimeter Sign P6 (Sign Was Missing)
PL-3	315	Site Marker SMK-2
PL-4	20	Boundary Monument BM-2
PL-5	0	Monitoring Well 0181
PL-6	305	Disposal Cell
PL-7	135	Apron Along Southwest Side of Disposal Cell





*PL-1. Entrance Sign*



*PL-2. Replaced Perimeter Sign P6 (Sign Was Missing)*





*PL-3. Site Marker SMK-2*



*PL-4. Boundary Monument BM-2*





*PL-5. Monitoring Well 0181*



*PL-6. Disposal Cell*





*PL-7. Apron Along Southwest Side of Disposal Cell*



## 8.0 Gunnison, Colorado, Disposal Site

### 8.1 Compliance Summary

The Gunnison, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected on June 22, 2017. No changes were observed on the disposal cell or in the associated diversion channels. Six riprap test areas on the disposal cell apron and diversion channels were visually inspected and photographed; no rock degradation was noted when compared to 2012 photos. Inspectors identified several routine maintenance needs but found no cause for a follow-up inspection.

The U.S. Department of Energy (DOE) conducts groundwater monitoring every 5 years to demonstrate compliance with U.S. Environmental Protection Agency (EPA) groundwater protection standards and to demonstrate that the disposal cell is performing as designed. The most recent sampling event occurred in July 2016. Groundwater monitoring results were below the site-specific uranium action level in all point of compliance (POC) wells.

### 8.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific DOE Long-Term Surveillance Plan (LTSP) (DOE 1997) and in procedures DOE established to comply with the requirements of the U.S. Nuclear Regulatory Commission general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 8-1 lists these requirements.

Table 8-1. License Requirements for the Gunnison, Colorado, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 3.0	Section 8.4	(b)(3)
Follow-Up Inspections	Section 3.5	Section 8.5	(b)(4)
Maintenance and Repairs	Section 5.0	Section 8.6	(b)(5)
Groundwater Monitoring	Section 4.0	Section 8.7	(b)(2)
Corrective Action	Section 6.0	Section 8.8	

### 8.3 Institutional Controls

The 92-acre site, identified by the property boundary shown in Figure 8-1, is owned by the United States and was accepted under the general license in 1997. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated diversion channel, entrance gate and sign, perimeter fence and signs, site markers, survey and boundary monuments, and wellhead protectors.

### 8.4 Inspection Results

The site, 6 miles southeast of Gunnison, Colorado, was inspected on June 22, 2017. The inspection was conducted by R. Johnson, S. Campbell, and C. Boger of the DOE Legacy



Management Support contractor. J. Linard (DOE site manager), P. Robinson and K. Kiilehua (DOE), and M. Cosby and J. Doebele (Colorado Department of Public Health and Environment) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, to identify changes in conditions that might affect conformance with the LTSP, and to determine the need, if any, for maintenance or additional inspection and monitoring.

#### **8.4.1 Site Surveillance Features**

Figure 8-1 shows in black the locations of site features, including site surveillance features and inspection areas. Site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue text, and new observations identified during the 2017 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are included in the following subsections. Photographs to support specific observations are identified in the text and in Figure 8-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 8.10.

##### ***8.4.1.1 Site Access, Entrance Gate, and Entrance Sign***

Access to the site is from Gunnison County Road 42 onto U.S. Bureau of Land Management (BLM) Road 3068. The road to the site is a gravel road maintained by BLM. Entrance to the site is through a locked gate that is part of the perimeter fence. The entrance gate was locked and functional (PL-1). The entrance sign is bolted to a perimeter fence post next to the entrance gate (PL-2). The entrance sign has bullet damage but remains legible. No maintenance needs were identified.

##### ***8.4.1.2 Perimeter Fence and Signs***

A three-strand barbed-wire perimeter fence encloses the site; most of it is set along the property boundary. The perimeter fence was intact except for three locations with broken strands that were repaired during the inspection (PL-3). Two barbed-wire gates—one on the north fence line and the other on the east fence line—provide access to offsite monitoring wells; both gates were locked. There are 45 perimeter signs bolted to the perimeter fence posts. Several perimeter signs (P3, P6, P38, and P43) have bullet damage but remain legible. Perimeter sign P45 was damaged, and perimeter sign P42 was faded; replacement signs were installed during the inspection (PL-4). No other maintenance needs were identified.

##### ***8.4.1.3 Site Markers***

The site has two granite site markers. Site marker SMK-1 is just inside the entrance gate (PL-5), and site marker SMK-2 is on the top slope of the disposal cell (PL-6). No maintenance needs were identified.

##### ***8.4.1.4 Survey and Boundary Monuments***

Three combined survey and boundary monuments and eight additional boundary monuments delineate the property boundary (PL-7). No maintenance needs were identified.



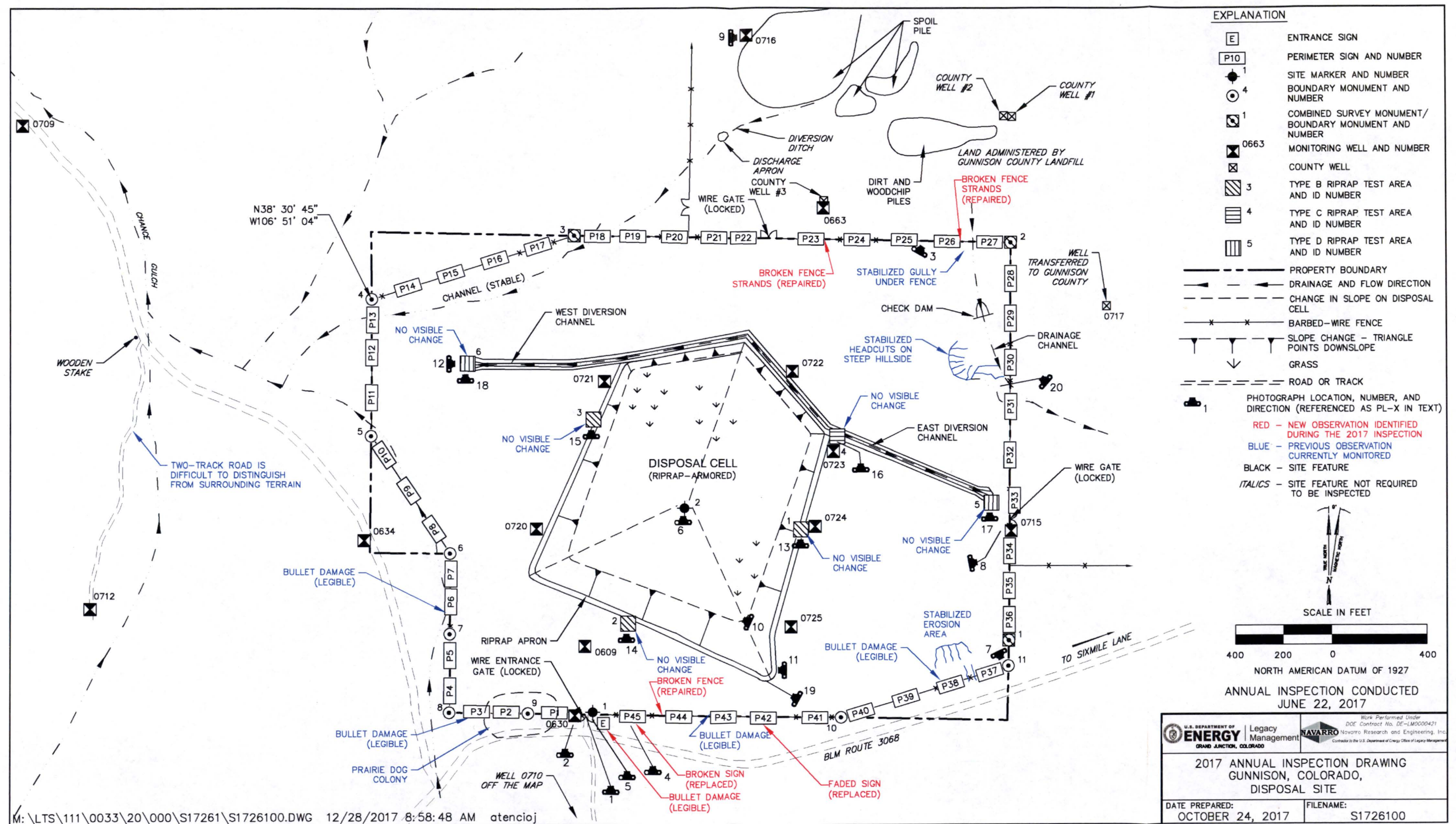


Figure 8-1. 2017 Annual Inspection Drawing for the Gunnison, Colorado, Disposal Site



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#### **8.4.1.5 Monitoring Wells**

The site has 16 groundwater monitoring wells. The wellhead protectors were undamaged, properly labeled, and locked (PL-8). The Gunnison County landfill operators have placed concrete barriers to protect monitoring well 0716, which is on landfill property, from landfill activities (PL-9). The edge of an adjacent spoil pile, although close to the concrete barriers, does not impair access to monitoring well 0716. No maintenance needs were identified.

#### **8.4.2 Inspection Areas**

In accordance with the LTSP, the site is divided into four inspection areas to ensure a thorough and efficient inspection. The inspection areas are (1) the top of the disposal cell; (2) the disposal cell side slopes, apron, and diversion channels; (3) the area between the disposal cell and the site boundary; and (4) the outlying area. Inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with LTSP requirements.

##### **8.4.2.1 Top of the Disposal Cell**

The disposal cell, completed in 1995, occupies 29 acres. The disposal cell is armored with basalt riprap to control erosion. There was no evidence settling, slumping, erosion, or any other modifying process that might affect the integrity of the top of the disposal cell. Several isolated patches of grass have established on the top slope; however, these shallow-rooted plants do not degrade the performance of the radon barrier. No maintenance needs were identified.

##### **8.4.2.2 Disposal Cell Side Slopes, Apron, and Diversion Channels**

The disposal cell side slopes (PL-10), an apron to collect and divert precipitation runoff from the disposal cell (PL-11), and two diversion channels to protect the disposal cell from precipitation run-on (PL-12) are all armored with basalt riprap. There was no evidence of settling, slumping, erosion, or any other modifying process that might affect the integrity of the disposal cell side slopes, apron, or diversion channels. Six rock-monitoring test areas, each approximately 1 square meter in area (the corners are marked with orange paint), are in critical flow path locations in the apron and diversion channels. Annual photographing and comparing of these test areas was performed through 2002 in accordance with the LTSP; after that, the LTSP requires the test areas to be photographed every 5 years, with the final set of photographs taken in 2017. The riprap in all of the test areas showed no rock degradation. When the rocks were compared to the photos taken of them in 2012, there was no evidence that individual rocks had split or otherwise been degraded (PL-13 through PL-18A). No rock degradation has been observed in the test areas since monitoring began in 1998; therefore, in accordance with the LTSP, the test areas will no longer be monitored.

Precipitation runoff from the disposal cell occasionally ponds in a low-lying area at the southeast corner of the disposal cell; standing water was not present at the time of the inspection (PL-19). The riparian-type vegetation that has become established there indicates that the area retains moisture. Water collection in this area does not pose a problem because the disposal cell is designed to drain to the southeast, and any water that ponds there is below the elevation of the encapsulated tailings material. No maintenance needs were identified.



#### **8.4.2.3    *Area Between the Disposal Cell and the Site Boundary***

Reclaimed and undisturbed areas comprise the area between the disposal cell and the site boundary. In general, the vegetation in the reseeded, reclaimed areas consists of well-established grass; native plants are much less abundant and less diverse in reclaimed areas than they are in undisturbed areas. Former erosion areas continue to be stable and are naturally revegetating with native plant species (PL-20). No maintenance needs were identified.

#### **8.4.2.4    *Outlying Area***

The area beyond the site boundary for a distance of 0.25 mile was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. Gunnison County owns the land that adjoins the site boundary to the north and east and uses the land for a municipal landfill. The nearest landfill operations continue to be approximately 400 feet north of the site. Although landfill activities do not impact the site, inspectors will continue to monitor the level of activity occurring near the site boundary and surveillance features (e.g., fences and monitoring wells). The proximity of the spoil pile to monitoring well 0716 is the only current concern for activities that could impact a site asset. Inspectors will continue to monitor this area.

### **8.5    Follow-Up or Contingency Inspections**

DOE will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) DOE is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up inspection was identified.

### **8.6    Maintenance and Repairs**

Three perimeter fence locations with broken strands were repaired, and two perimeter signs were replaced during the inspection; no other maintenance needs were identified.

### **8.7    Groundwater Monitoring**

In accordance with the LTSP, DOE conducts groundwater monitoring every 5 years to demonstrate compliance with EPA groundwater protection standards in 40 CFR 192.03 and to demonstrate that the disposal cell is performing as designed. Groundwater was sampled and groundwater levels were measured annually from 1998 through 2001. Following the 2001 sampling event, the monitoring frequency changed to once every 5 years. The most recent sampling event occurred in July 2016.

The groundwater monitoring network consists of 16 monitoring wells, including six POC wells to monitor disposal cell performance, two monitoring wells to monitor background groundwater quality, and eight wells to monitor groundwater levels (Table 8-2 and Figure 8-2). The indicator analyte for disposal cell performance is uranium, which was selected because of its presence in tailings pore fluid, its relatively high mobility in groundwater, and its low concentration in upgradient (background) groundwater. The site-specific screening monitoring action level (action level) concentration for uranium is 0.013 milligram per liter (mg/L). The basis for this



action level is the maximum observed concentration of uranium in background samples determined before long-term surveillance and maintenance activities began. The EPA established a maximum concentration limit for uranium of 0.044 mg/L in groundwater (40 CFR 192, Subpart A, Table 1).

Table 8-2. Groundwater Monitoring Network for the Gunnison, Colorado, Disposal Site

Point of Compliance (POC) and Background Wells	Groundwater Level Wells
0720 (POC)	0630
0721 (POC)	0634
0722 (POC)	0663
0723 (POC)	0709
0724 (POC)	0710
0725 (POC)	0712
0609 (background)	0714
0716 (background)	0715

As reported in the *2016 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites* (DOE 2016), the 2016 monitoring results were consistent with historical results, indicating no significant change in general water chemistry. The uranium concentration was below the action level (0.013 mg/L) in all POC wells. Samples also were analyzed for major anions (chloride and sulfate) and cations (calcium, magnesium, potassium, and sodium), metals (iron and manganese), and total dissolved solids as indicators of general water quality. The consistent general water quality, along with uranium concentrations below the action level, indicates that the disposal cell continues to perform as an effective containment system.



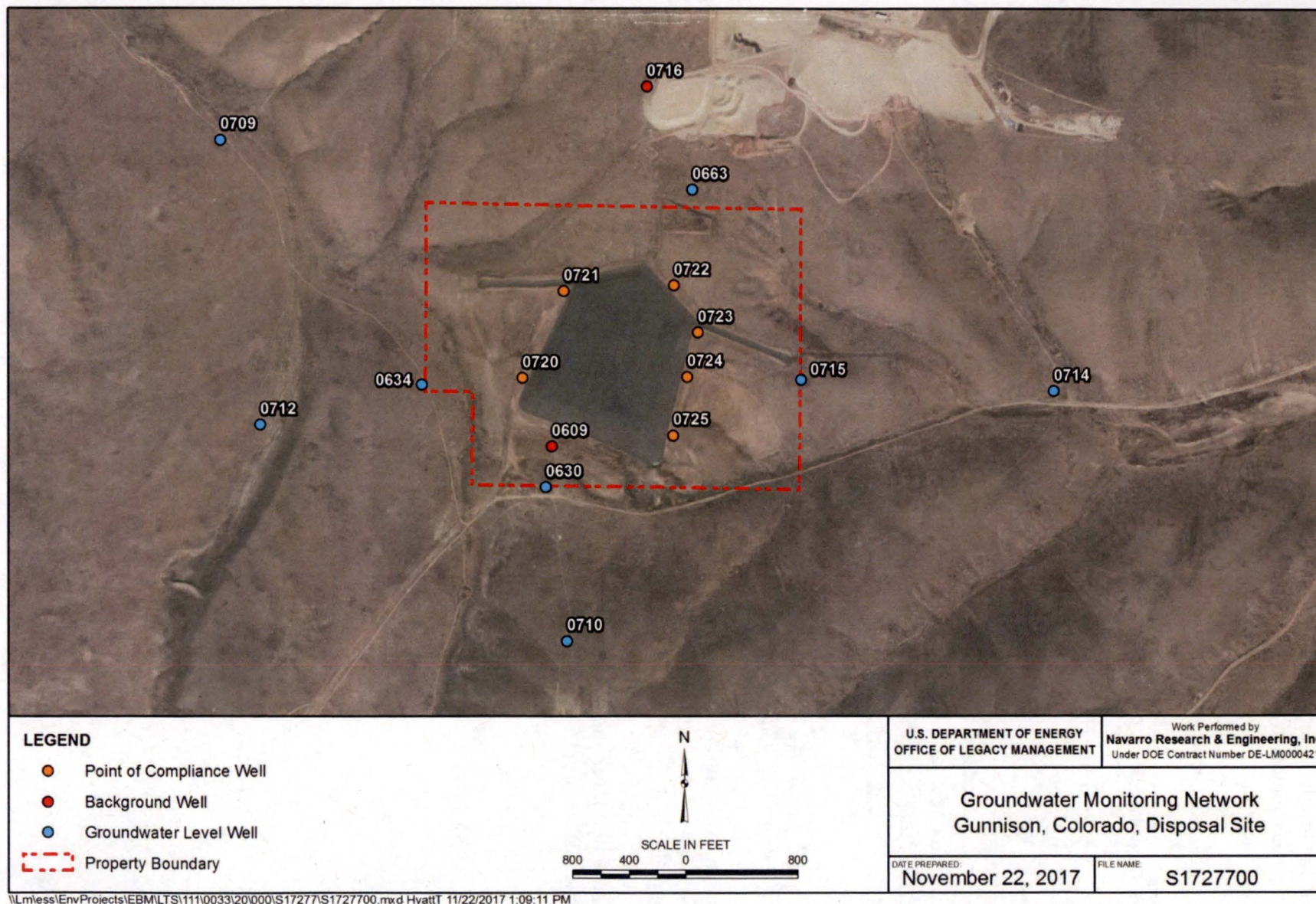


Figure 8-2. Groundwater Monitoring Network at the Gunnison, Colorado, Disposal Site



## 8.8 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192.04. No need for corrective action was identified.

## 8.9 References

10 CFR 40, Appendix A. U.S. Nuclear Regulatory Commission, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content," *Code of Federal Regulations*.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

40 CFR 192.03. U.S. Nuclear Regulatory Commission, "Monitoring," *Code of Federal Regulations*.

40 CFR 192.04. U.S. Nuclear Regulatory Commission, "Corrective Action," *Code of Federal Regulations*.

DOE (U.S. Department of Energy), 1997. *Long-Term Surveillance Plan for the Gunnison, Colorado, Disposal Site*, DOE/AL/62350-222, Rev. 2, April.

DOE (U.S. Department of Energy), 2016. *2016 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*, LMS/S15036, March.



## 8.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	0	Entrance Gate
PL-2	0	Entrance Sign
PL-3	30	Broken Perimeter Fence Strands; Subsequently Repaired
PL-4	0	New Perimeter Sign P45
PL-5	0	Site Marker SMK-1
PL-6	0	Site Marker SMK-2
PL-7	155	Boundary Monument BM-11
PL-8	80	Monitoring Well 0715
PL-9	90	Monitoring Well 0716 on County Landfill Property
PL-10	295	Disposal Cell Top and Southwest Side Slope
PL-11	270	Apron at Southeast Corner of Disposal Cell
PL-12	90	West Diversion Channel
PL-13	0	(a) Riprap Test Area No. 1 (Type B Riprap) on the Disposal Cell's East Apron—June 22, 2017 (b) Riprap Test Area No. 1 (Type B Riprap) on the Disposal Cell's East Apron—June 4, 2012, Photo for Comparison
PL-14	0	(a) Riprap Test Area No. 2 (Type B Riprap) on the Disposal Cell's South Apron—June 22, 2017 (b) Riprap Test Area No. 2 (Type B Riprap) on the Disposal Cell's South Apron—June 4, 2012, Photo for Comparison
PL-15	0	(a) Riprap Test Area No. 3 (Type B Riprap) on the Disposal Cell's Northwest Apron—June 22, 2017 (b) Riprap Test Area No. 3 (Type B Riprap) on the Disposal Cell's Northwest Apron—June 4, 2012, Photo for Comparison
PL-16	0	(a) Riprap Test Area No. 4 (Type C Riprap) in the East Diversion Channel—June 22, 2017 (b) Riprap Test Area No. 4 (Type C Riprap) in the East Diversion Channel—June 4, 2012, Photo for Comparison
PL-17	0	(a) Riprap Test Area No. 5 (Type D Riprap) at the East Diversion Channel Outlet—June 22, 2017 (b) Riprap Test Area No. 5 (Type D Riprap) at the East Diversion Channel Outlet—June 4, 2012, Photo for Comparison
PL-18	0	(a) Riprap Test Area No. 6 (Type D Riprap) at the West Diversion Channel Outlet—June 22, 2017 (b) Riprap Test Area No. 6 (Type D Riprap) at the West Diversion Channel—June 4, 2012, Photo for Comparison
PL-19	300	Apron at Southeast Corner of Disposal Cell
PL-20	310	Stabilized Headcuts on Steep Hillside





*PL-1. Entrance Gate*



*PL-2. Entrance Sign*





*PL-3. Broken Perimeter Fence Strands; Subsequently Repaired*



*PL-4. New Perimeter Sign P45*





PL-5. Site Marker SMK-1



PL-6. Site Marker SMK-2





*PL-7. Boundary Monument BM-11*



*PL-8. Monitoring Well 0715*





*PL-9. Monitoring Well 0716 on County Landfill Property*



*PL-10. Disposal Cell Top and Southwest Side Slope*





*PL-11. Apron at Southeast Corner of Disposal Cell*



*PL-12. West Diversion Channel*





PL-13. (a) Riprap Test Area No. 1 (Type B Riprap) on the Disposal Cell's East Apron—June 22, 2017



PL-13. (b) Riprap Test Area No. 1 (Type B Riprap) on the Disposal Cell's East Apron—June 4, 2012, Photo for Comparison





PL-14. (a) Riprap Test Area No. 2 (Type B Riprap) on the Disposal Cell's South Apron—June 22, 2017



PL-14. (b) Riprap Test Area No. 2 (Type B Riprap) on the Disposal Cell's South Apron—June 4, 2012, Photo for Comparison





*PL-15. (a) Riprap Test Area No. 3 (Type B Riprap) on the Disposal Cell's Northwest Apron—June 22, 2017*



*PL-15. (b) Riprap Test Area No. 3 (Type B Riprap) on the Disposal Cell's Northwest Apron—June 4, 2012, Photo for Comparison*





PL-16. (a) Riprap Test Area No.4 (Type C Riprap) in the East Diversion Channel–June 22, 2017



PL-16. (b) Riprap Test Area No. 4 (Type C Riprap) in the East Diversion Channel–  
June 4, 2012, Photo for Comparison





PL-17. (a) Riprap Test Area No. 5 (Type D Riprap) at the East Diversion Channel Outlet–June 22, 2017



PL-17. (b) Riprap Test Area No. 5 (Type D Riprap) at the East Diversion Channel Outlet–June 4, 2012, Photo for Comparison





PL-18. (a) Riprap Test Area No. 6 (Type D Riprap) at the West Diversion Channel Outlet–June 22, 2017



PL-18. (b) Riprap Test Area No. 6 (Type D Riprap) at the West Diversion Channel Outlet–June 4, 2012, Photo for Comparison





*PL-19. Apron at Southeast Corner of Disposal Cell*



*PL-20. Stabilized Headcuts on Steep Hillside*



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## 9.0 Lakeview, Oregon, Disposal Site

### 9.1 Compliance Summary

The Lakeview, Oregon, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected September 6, 2017. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified no immediate maintenance needs or cause for a follow-up inspection.

Disposal cell riprap gradation monitoring has been performed annually since 1997 at random locations on the west side slope due to concerns over premature rock degradation. The disposal cell design called for placement of specifically sized rock (riprap) to ensure continued long-term protection of the disposal cell from erosion during a severe precipitation event. The riprap gradation monitoring is performed to determine if the mean diameter ( $D_{50}$ ) value of the riprap on the west side slope continues to meet design specifications. The  $D_{50}$  value measured during the 2017 gradation monitoring is 2.29 inches, which is below the original  $D_{50}$  design size range of 2.7–3.9 inches for the Type B size side slope riprap. In previous years, the measured  $D_{50}$  value has been both above and below the design specifications.

The U.S. Department of Energy (DOE) conducts groundwater monitoring every 5 years to demonstrate that the disposal cell is not leaching contaminants into the groundwater above established groundwater quality protection standards. The most recent sampling event occurred in May 2014. Groundwater monitoring results were below the U.S. Environmental Protection Agency (EPA) designated maximum concentration limits (MCLs) in all monitoring wells.

### 9.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific DOE LTSP and in procedures DOE established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 9-1 lists these requirements.

Table 9-1. License Requirements for the Lakeview, Oregon, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 6.0	Section 9.4	(b)(3)
Follow-Up or Contingency Inspections	Section 7.0	Section 9.5	(b)(4)
Maintenance and Repairs	Section 8.0	Section 9.6	(b)(5)
Groundwater Monitoring	Section 5.3	Section 9.7	(b)(2)
Corrective Action	Section 9.0	Section 9.8	

### 9.3 Institutional Controls

The 40-acre site, identified by the property boundary shown in Figure 9-1, is owned by the United States and was accepted under the general license in 1995. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the



property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gate and sign, perimeter fence and signs, site markers, survey and boundary monuments, and wellhead protectors.

## **9.4 Inspection Results**

The site, 16 miles northwest of Lakeview, Oregon, was inspected on September 6, 2017. The inspection was conducted by C. Goodknight and S. Hall of the DOE Legacy Management Support contractor. J. Linard (DOE site manager), L. Brookhart (NRC), G. Smith (Geo-Smith Engineering LLC), and D. Engstrom (Oregon Department of Energy) participated in the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, to identify changes in conditions that might affect conformance with the LTSP, and to determine the need, if any, for maintenance or additional inspection and monitoring.

### **9.4.1 Site Surveillance Features**

Figure 9-1 shows in black the locations of site features, including site surveillance features and inspection areas. Site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue text, and new observations identified during the 2017 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are included in the following subsections. Photographs that support specific observations are identified in the text and in Figure 9-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 9.10.

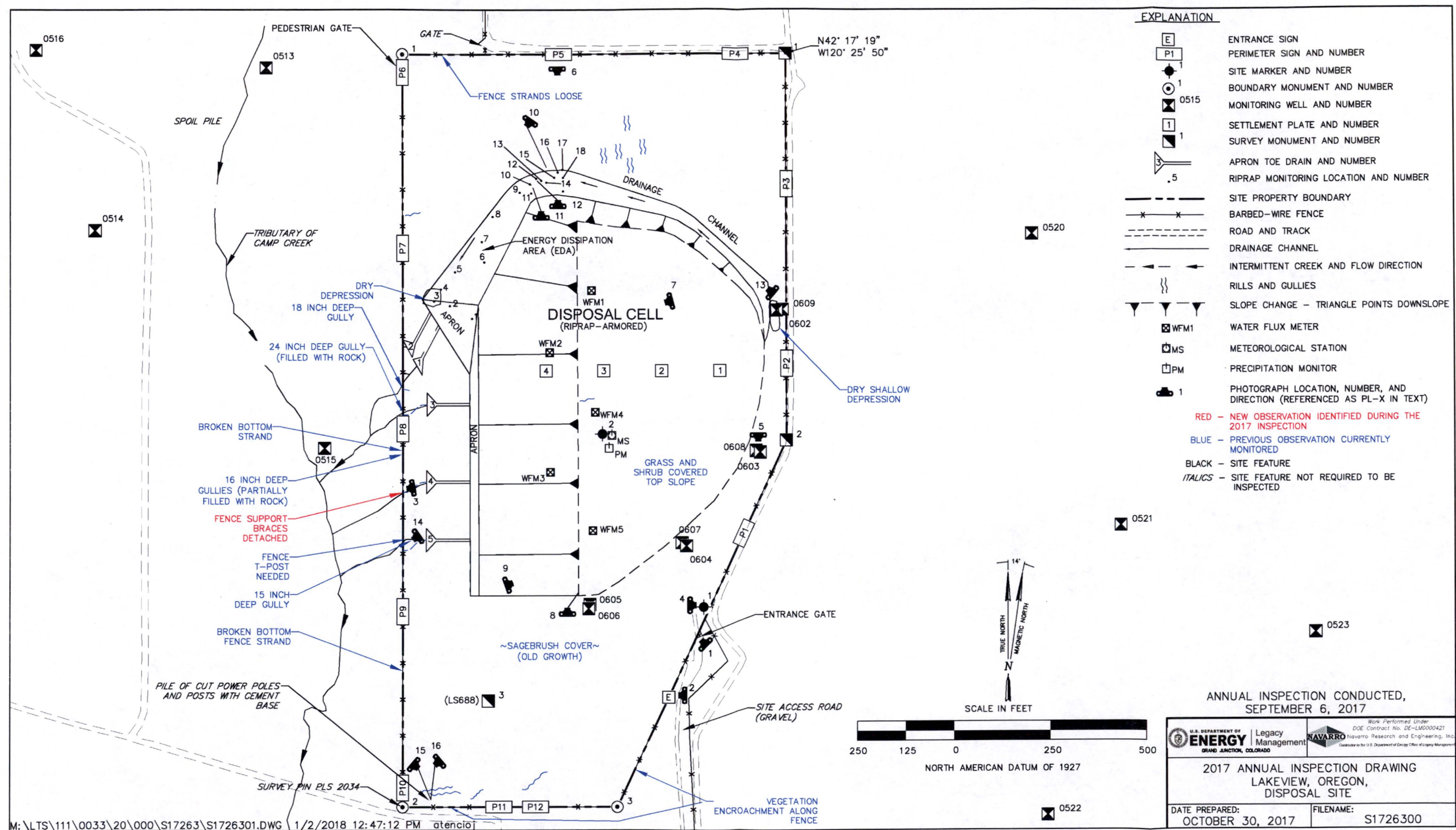
#### **9.4.1.1 Access Road, Entrance Gate, and Entrance Sign**

Access to the site is from a gravel road that heads west from Lake County Road 2-16B. DOE was granted a perpetual easement on the approximately 1.2-mile access road between the county road and the property boundary. A lockable gate across the access road on the adjacent privately owned land limits access to the site. The entrance gate to the site is in the southeast corner of the perimeter fence (PL-1). The entrance gate and pedestrian gate were locked and undamaged. The entrance sign is attached to steel posts set in concrete along the access road (PL-2). No maintenance needs were identified.

#### **9.4.1.2 Perimeter Fence and Signs**

A four-strand barbed-wire perimeter fence (five-strand along much of the west boundary) encloses the site. The perimeter fence was intact except for two broken bottom fence strands between perimeter signs P8 and P10. Perimeter fence strands were loose between perimeter signs P5 and P6 where a T-post is needed. Support braces were detached between perimeter signs P8 and P9 (PL-3). Some vegetation is growing near, and entangled in, the perimeter fence line. However, the perimeter fence remains functional, and inspectors will continue to monitor it and make repairs when warranted. There are 12 perimeter signs, attached to steel posts set in concrete, positioned along the property boundary. No immediate maintenance needs were identified.







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#### **9.4.1.3 Site Markers**

The site has two granite site markers. Site marker SMK-1 is just inside the entrance gate (PL-4), and site marker SMK-2 is on the top slope of the disposal cell. No maintenance needs were identified.

#### **9.4.1.4 Survey and Boundary Monuments**

Two survey monuments and three boundary monuments delineate the property boundary. No maintenance needs were identified.

#### **9.4.1.5 Monitoring Wells**

The site has eight groundwater monitoring wells (PL-5) and one upgradient groundwater monitoring well offsite to the west of the site. The wellhead protectors were locked and undamaged. No maintenance needs were identified.

### **9.4.2 Inspection Areas**

In accordance with the LTSP, the site is divided into three inspection areas to ensure a thorough and efficient inspection. The inspection areas are (1) the top of the disposal cell; (2) the side slopes of the disposal cell and adjacent drainage channel, aprons, and trench drains; and (3) the site perimeter and the outlying area. The inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with LTSP requirements.

#### **9.4.2.1 Top of Disposal Cell**

The disposal cell, completed in 1988, occupies 16 acres. At the time of disposal cell construction, the entire top slope of the disposal cell was covered in 12 inches of Type B size riprap. At the request of the State of Oregon, 4 inches of soil was added over the riprap to allow a vegetative cover to be established and help minimize the visual effects of the disposal cell (PL-6). The design for the top of the disposal cell has created conditions that favor the growth of deep-rooted plants. The growth of shrubs on the disposal cell top slope is favored by movement of precipitation through the riprap, bedding, and compacted soil (radon barrier) layers. Grasses and forbs growing on the top slope have gradually increased over the years, but some areas remain sparsely vegetated, consistent with surrounding offsite areas. Riprap was observed through the soil on the top slope in several small areas during the inspection (PL-7). These areas are sporadic across the top slope and are likely caused by the soil infilling the riprap-void spaces. No structural or disposal cell performance concerns are associated with the riprap becoming visible on the top slope.

The incipient development of checkerboard soil erosion patterns was observed in some of the more sparsely vegetated areas on the top slope (consistent with similar areas offsite); no changes were noted during the inspection. This minor erosion pattern is likely a natural process but could also indicate that water on the top slope is beginning to channelize, or it could be due to soil settling into the riprap voids. No structural or disposal cell performance concerns are associated with this condition, because the riprap rock cover is continuous beneath the top slope soil cover, slope crests, and side slopes. Inspectors will continue to monitor this condition.



The contact boundary between the disposal cell top and side slopes (PL-8) was inspected and generally appears stable and uniform except at the northwest corner of the disposal cell top slope, where erosion has transported some soil from the top slope. No structural or disposal cell performance concerns are associated with this minor erosion, because the riprap rock cover is continuous beneath the top slope soil cover, slope crests, and side slopes. No erosion was observed during the inspection at the crest of the west side slope and the disposal cell top slope, which appears to be stable. Inspectors will continue to monitor the transition zone between the disposal cell top slope and the west side slope. There was no evidence of settling, slumping, erosion, or any other modifying process on the top of the disposal cell that might affect the integrity of the disposal cell.

DOE is participating in an NRC-sponsored project to investigate the effect of soil-forming processes on the performance of the radon barrier on UMTRCA disposal cells. In October 2017, researchers excavated through the cover materials (soil, riprap, and underlying radon barrier) at six locations on the disposal cell (five on the top slope, one on the side slope) to support the study. DOE will monitor the restored locations to confirm that positive drainage is preserved and vegetation reestablishes. No maintenance needs were identified.

#### ***9.4.2.2 Disposal Cell Side Slopes and Adjacent Drainage Channel, Apron, and Trench Drains***

Deterioration of the basalt riprap armoring the disposal cell side slopes is a result of physical and chemical weathering processes. Deterioration monitoring at the site consists of rock gradation monitoring on the side slopes and photographic monitoring in the energy dissipation area (EDA) in accordance with the LTSP. Addendums to the LTSP commit the DOE to annually determine the mean diameter ( $D_{50}$ ) value of the riprap on the west side slope through gradation monitoring to ensure the riprap is large enough to protect the disposal cell from erosion during a major precipitation event.

The riprap gradation monitoring has inherent limitations and has produced variable and uncertain sampling results. This monitoring method measures the number of rocks retained according to sieve size. Sampling locations are randomly selected across the entire west side slope before each monitoring event. Particle size distribution by rock count was collected at 20 locations, and approximately 25 rocks were sampled at each location. The standard method for determining  $D_{50}$  in the laboratory is by weight, not by rock count. Also, only the upper portion of the 12-inch riprap layer is sampled, as the method requires that the first rock directly below the sampling grid is measured. The more exposed surface rocks may be more susceptible to accelerated weathering, thus conservatively skewing the data (i.e., providing a smaller  $D_{50}$  result). Furthermore, this sampling method measures the minimum rock dimension in sieve analysis, which also conservatively skews the data.

In 2015, DOE proposed to replace the annual gradation monitoring with more rigorous and focused inspection of all rills that may form along the interface between the vegetated soil and rock top slope and the rock-covered west side slope (Dayvault 2015). Focusing on these areas will enable DOE to more proactively assess and mitigate vulnerability of potential failure points along the side slope. This proposal is currently being reviewed by NRC.

In 2017, riprap gradation monitoring was performed for the 21st consecutive year. Riprap gradation monitoring on the west side slope is shown in photograph PL-9. An evaluation of the



2017 rock size (gradation) measurement data indicates that the west side slope riprap  $D_{50}$  is 2.29 inches with a 95% confidence interval between 2.15 and 2.43 inches. The 2017  $D_{50}$  value of 2.29 inches is within the range of  $D_{50}$  values (2.26–2.88 inches) previously monitored on the side slope during the 21 years of monitoring.

Figure 9-2 is a graph that shows the results of the gradation monitoring since 1997. (Note: During the 2015 annual inspection, the rock monitoring approach deviated from the normal procedure, at NRC's request, by using a preestablished monitoring grid in a subset area of the west side slope. This changed the sampling approach from random to biased, thus potentially compromising data comparability. Therefore, the 2015 data were not included on the graph of historical riprap gradation monitoring  $D_{50}$  values.)

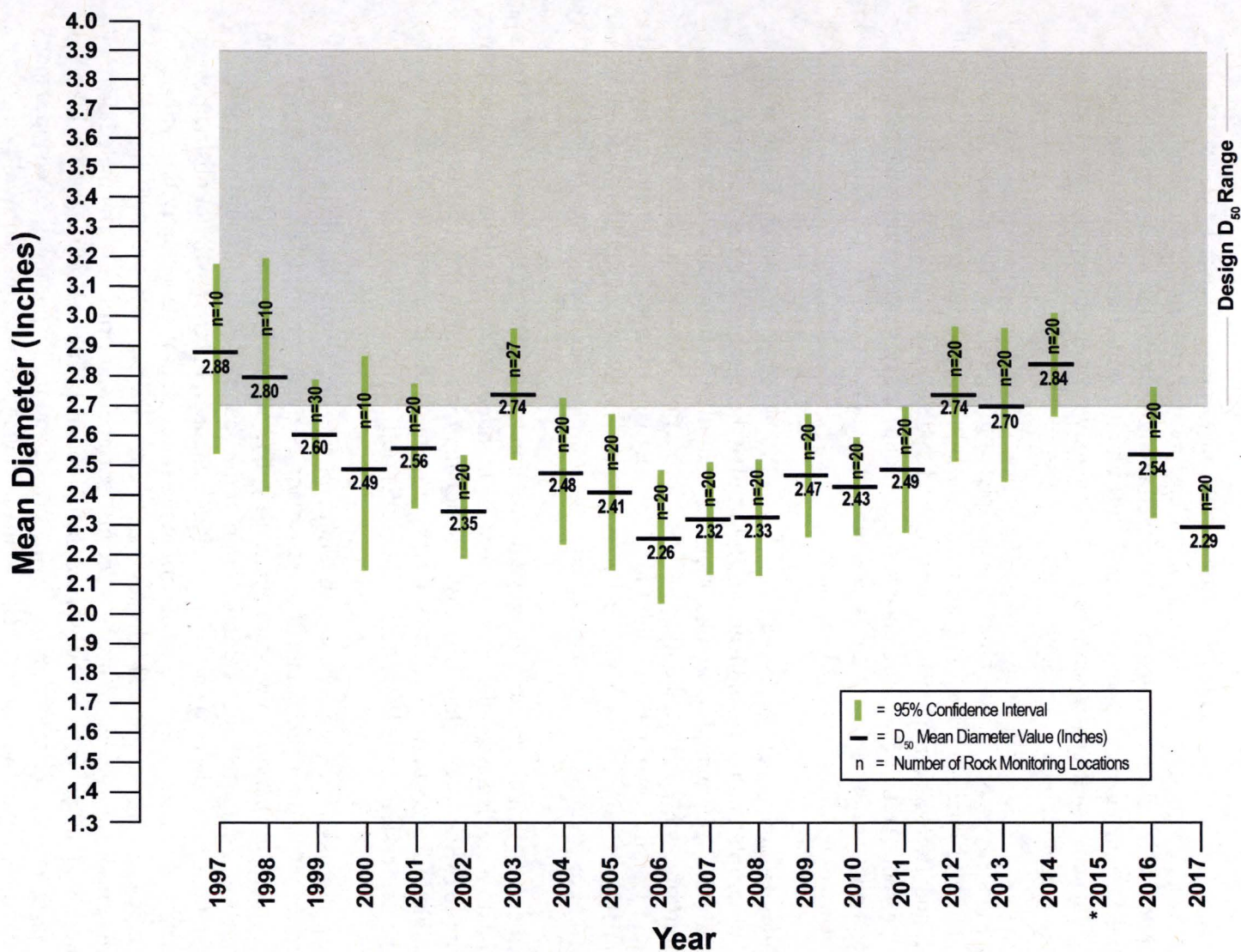
A statistical trend analysis of the  $D_{50}$  values was completed using EPA's ProUCL 5.1 statistical software (last updated June 20, 2016) (<https://www.epa.gov/land-research/proucl-software>). Both Mann-Kendall and Theil-Sen trend tests were performed to determine if a significant trend in rock size was present. At the 95% confidence level, no trend was observed. While the lack of a significant trend does not indicate a static  $D_{50}$  value, it does indicate that the  $D_{50}$  value has not significantly decreased in 21 years of observation.

Minor rock degradation has been observed in the EDA (PL-10) since monitoring began at the original 10 photograph locations established in 1997 and at the eight additional locations established in 2000. The annual photographic monitoring of the 18 photograph locations for long-term rock monitoring was conducted during the 2017 inspection. The rock at photo monitoring locations 10 and 12 are shown in PL-11 and PL-12, respectively. The rock used in the EDA and drainage channel areas is much more homogeneous than the varied rock used on the side slopes, and no significant degradation has been observed.

In the past, water has been observed in the large depression in the EDA at the lower end of the drainage channel. Water is a potential concern because inundation may accelerate deterioration of the large riprap by the freeze–thaw process, although the rock used in the EDA is apparently not as susceptible to freeze–thaw as other rock types present on the disposal cell. No water was observed in the depression in the EDA during the inspection.

Small amounts of grass have encroached on the riprap on the side slopes, on the upper (eastern) part of the surface water drainage channel (i.e., diversion channel), on the EDA at the lower end of the drainage channel, and on the western apron area. The relatively sparse plant growth in the drainage channel will not affect the design function of the channel (PL-13). There are a few small bushes in the upper (eastern) part of the drainage channel, but they will not obstruct water flow. Should flow obstruction become a concern in the future, maintenance activities will be performed. There is an area of dense, high grass near trench drains 1 and 3, which suggests that conditions are periodically wetter in this area because surface water runoff is channeled there by control features. No ponded water was observed during the inspection. There was no evidence of settling, slumping, erosion, or any other modifying process on the disposal cell side slopes that might affect the integrity of the disposal cell. No maintenance needs were identified.





\*During the 2015 inspection, the rock monitoring approach deviated from the normal procedure, at NRC's request. This changed the sampling approach from random to biased, thus potentially compromising data comparability. Therefore, the 2015 data has been omitted.

Figure 9-2. Historical Riprap Gradation Monitoring  $D_{50}$  Values



#### **9.4.2.3 Site Perimeter and Outlying Area**

The area beyond the site boundary for a distance of 0.25 mile was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. This includes the seeded grass area extending from the disposal cell to the site boundary and the site perimeter fence. No such impacts were observed.

Gullies that formed in seeded areas extending west of trench drains 1 through 5 were filled with rock in 2000. Although the rock has generally arrested the headcutting that was advancing eastward from the private property onto DOE property, some minor headcutting is still evident but did not appear to be recent (PL-14). Several small gullies have been observed offsite in the heavily grazed areas downslope of the perimeter fence line onto the private property. Several small rills and shallow gullies were also observed onsite in the area north of the disposal cell where grass reestablishment has been limited, in a drainage area on the site north of perimeter sign P7, and in the southwest corner of the site. These gullies and rills were identified during previous annual inspections, and no significant changes were observed in 2017. The gullies do not pose a threat to disposal cell integrity, and inspectors will continue to monitor these areas. Inspectors also observed a pile of cut telephone poles (PL-15) and signposts with cement bases (PL-16) in the southwest corner of the site. These were identified during the 2016 annual inspection and do not impact site integrity. No maintenance needs were identified.

### **9.5 Follow-Up or Contingency Inspections**

DOE will conduct follow-up or contingency inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) DOE is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up or contingency inspection was identified.

### **9.6 Maintenance and Repairs**

No immediate maintenance needs were identified.

### **9.7 Groundwater Monitoring**

In accordance with the LTSP, DOE conducts groundwater monitoring every 5 years to demonstrate that the disposal cell is not leaching contaminants into the uppermost aquifer. The most recent sampling event occurred in May 2014.

The groundwater monitoring network consists of nine monitoring wells, including eight point of compliance wells and one upgradient monitoring well (Figure 9-3 and Table 9-2). Seven additional DOE-owned monitoring wells (0513, 0514, 0516, 0520, 0521, 0522, and 0523) exist on privately owned property near the site but are not sampled because they are not part of the groundwater compliance monitoring network. Groundwater is sampled for arsenic, cadmium, and uranium. EPA established MCLs for these analytes in groundwater in 40 CFR 192 Table 1 Subpart A (40 CFR 192 Table 1 Subpart A).



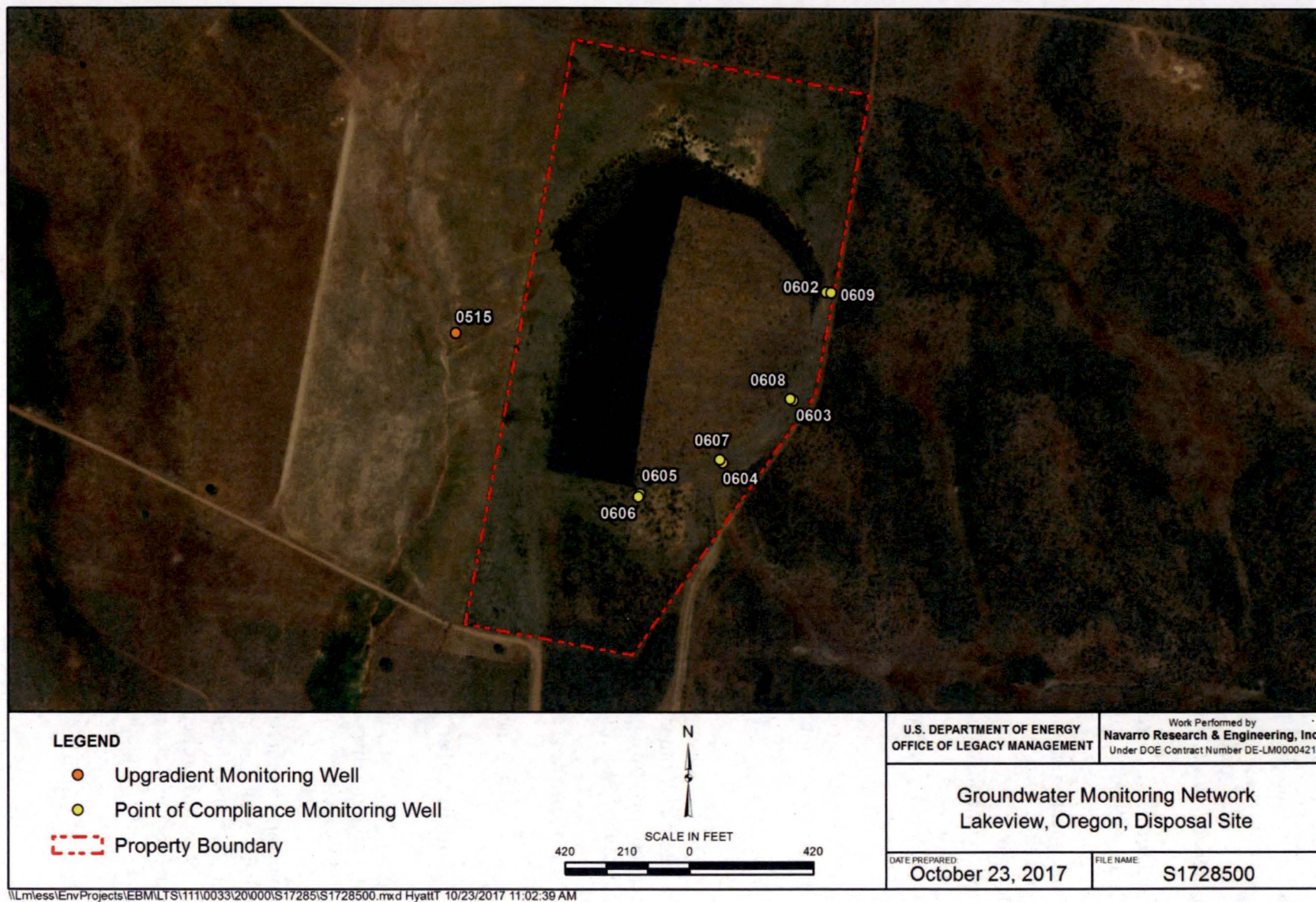


Figure 9-3. Groundwater Monitoring Network Lakeview, Oregon, Disposal Site



Table 9-2. Groundwater Monitoring Network for the Lakeview, Oregon, Disposal Site

Groundwater Monitoring Purpose	Monitoring Wells
Paired point of compliance wells	0602/0609
Paired point of compliance wells	0603/0608
Paired point of compliance wells	0604/0607
Paired point of compliance Wells	0605/0606
Upgradient	0515

Table 9-3. Maximum Concentration Limits for Groundwater at the Lakeview, Oregon, Disposal Site

Constituent	MCL <sup>a</sup> (mg/L)
Arsenic	0.05
Cadmium	0.01
Uranium	0.044

**Note:**

<sup>a</sup> MCL (40 CFR 192 Table 1 Subpart A).

**Abbreviation:**

mg/L = milligrams per liter

As reported in the 2014 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites (DOE 2014), the monitoring results for arsenic, cadmium, and uranium continue to remain below their respective MCLs. All monitoring results were within the range of historical monitoring results, with the exception of the uranium concentration at monitoring well 0606. Based on the monitoring results to date, there is no indication of any degradation of groundwater near the site.

## 9.8 Corrective Action

In accordance with the LTSP, corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192. No need for corrective action was identified.

## 9.9 References

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

40 CFR 192. U.S. Nuclear Regulatory Commission, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations*.

40 CFR 192 Subpart A. U.S. Nuclear Regulatory Commission, "Maximum Concentration of Constituents for Groundwater Protection," *Code of Federal Regulations*.



Dayvault, 2015. Jalena Dayvault, UMTRCA site manager, DOE Office of Legacy Management, letter (about Lakeview, Oregon, Uranium Mill Tailings Radiation Control Act [UMTRCA] Title I Disposal Site's west side slope rock degradation assessment) to U.S. Nuclear Regulatory Commission, March 2.

DOE (U.S. Department of Energy), 1994. *Long-Term Surveillance Plan for the Collins Ranch Disposal Site, Lakeview, Oregon*, DOE/AL/62350-19F, Rev. 3, August.

DOE (U.S. Department of Energy), 2014. *2014 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*, LMS/S12245, March.

## 9.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	315	Entrance Gate
PL-2	270	Entrance Sign
PL-3	260	Perimeter Fence Support Braces Detached
PL-4	90	Site Marker SMK-1
PL-5	180	Monitoring Wells 0603 and 0608
PL-6	180	Disposal Cell
PL-7	255	Exposed Riprap on Disposal Cell Top Slope
PL-8	0	Intersection of Disposal Cell Top Slope and West Side Slope
PL-9	70	Rock Riprap Gradation Monitoring on West Side Slope of Disposal Cell
PL-10	215	Energy Dissipation Area Outlet
PL-11	0	(a) Riprap Monitoring Location No. 10 in the Energy Dissipation Area – 2017 (b) Riprap Monitoring Location No. 10 in the Energy Dissipation Area – 2004, Photo for Comparison
PL-12	0	(a) Riprap Monitoring Location No. 12 in the Energy Dissipation Area – 2017 (b) Riprap Monitoring Location No. 12 in the Energy Dissipation Area – 2004, Photo for Comparison
PL-13	310	Drainage Channel North of Disposal Cell
PL-14	235	Small Gully Along Perimeter Fence Downgradient of Apron Toe Drain No. 5
PL-15	130	Old Wooden Power Pole Sections Inside Perimeter Fence
PL-16	230	Abandoned Posts With Concrete Bases Near Southwest Corner of Site





*PL-1. Entrance Gate*



*PL-2. Entrance Sign*





*PL-3. Perimeter Fence Support Braces Detached*



*PL-4. Site Marker SMK-1*





*PL-5. Monitoring Wells 0603 and 0608*



*PL-6. Disposal Cell*





*PL-7. Exposed Riprap on Disposal Cell Top Slope*



*PL-8. Intersection of Disposal Cell Top Slope and West Side Slope*





*PL-9. Rock Riprap Gradation Monitoring on West Side Slope of Disposal Cell*



*PL-10. Energy Dissipation Area Outlet*





PL-11. (a) Riprap Monitoring Location No. 10 in the Energy Dissipation Area–2017



PL-11. (b) Riprap Monitoring Location No. 10 in the Energy Dissipation Area–  
2004 Photo for Comparison





*PL-12. (a) Riprap Monitoring Location No. 12 in the Energy Dissipation Area–2017*



*PL-12. (b) Riprap Monitoring Location No. 12 in the Energy Dissipation Area–  
2004 Photo for Comparison*





*PL-13. Drainage Channel North of Disposal Cell*



*PL-14. Small Gully Along Perimeter Fence Downgradient of Apron Toe Drain No.5*





*PL-15. Old Wooden Power Pole Sections Inside Perimeter Fence*



*PL-16. Abandoned Posts With Concrete Bases Near Southwest Corner of Site*



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