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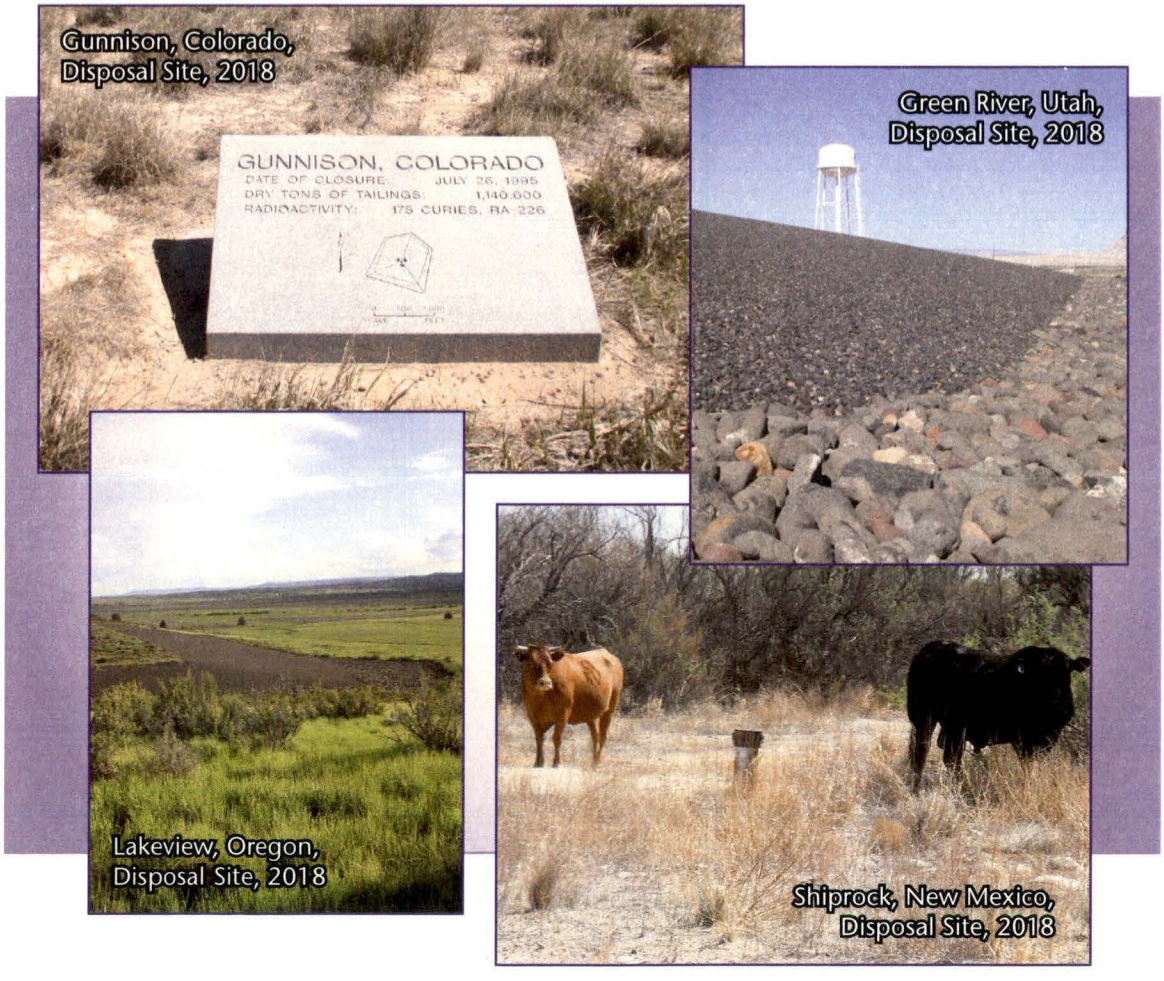
U.S. DEPARTMENT OF ENERGY

Legacy Management

2018 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites

March 2019



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Abbreviations

ACL	alternate concentration limit
AML	Abandoned Mine Lands
BLM	U.S. Bureau of Land Management
BM	boundary monument
CFR	*Code of Federal Regulations*
D_{50}	mean diameter
DOE	U.S. Department of Energy
EDA	energy dissipation area
EPA	U.S. Environmental Protection Agency
ft	feet
FY	fiscal year
GCAP	groundwater compliance action plan
IC	institutional control
IRBP	interim radon barrier protection
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
NECA	Navajo Engineering and Construction Authority
NMED	New Mexico Environment Department
NRC	U.S. Nuclear Regulatory Commission
PL	photograph location
POC	point of compliance
RST	radiation safety technician
SM	survey monument
TCEQ	Texas Commission on Environmental Quality
TP	test pit
UBL	upper baseline limit
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978
USDA	U.S. Department of Agriculture

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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 (LM) in 2018. 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).[1] 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.

LM 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 Public Law 104-259, "An Act to Extend the Authorization of the Uranium Mill Tailings Radiation Control Act of 1978, and for Other Purposes," the open portion will be closed either when the capacity has been reached or in 2023, whichever comes first. Reauthorization of Public Law 104-259 is expected, with an extension of the closure date through 2048.

Long-term surveillance and maintenance activities 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[2] 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[3] occurred in 2018:

- **Multiple sites:** In 2018 at the Maybell, Colorado, Disposal Site and Mexican Hat, Utah, Disposal Site, baseline aerial surveys were performed. Permanent quality control monuments were installed at the sites for LM to verify accuracy and quality of aerial survey data. Permanent quality control monuments were also installed at the Durango, Colorado, Disposal Site and Shiprock, New Mexico, Disposal Site in preparation for baseline aerial surveys.

[1] 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.
[2] The Grand Junction Disposal Site is inspected in accordance with an interim LTSP.
[3] Nonroutine activities are implemented in response to changes in site conditions, regulatory setting, or management structure following a regulatory compliance review.

- **Mexican Hat, Utah, Disposal Site:**

  Depressions in the riprap cover identified during the 2016 annual site inspection continue to be observed along the toe and lower portions of the northeast side slope of the disposal cell. Surface depressions have been visually identified along the lower portions of the north side slope during subsequent follow-up inspections. Follow-up inspections related to previous observations of the depression features in January 2018 included small manual excavations of the rock cover components (test pits) along the lower portions of the northeast and north side slopes. These excavations identified a void structure at one location toward the toe of the northeast side slope and erosional incisements into the radon barrier. These features were in areas beneath depression features on the northeast side slope and to a lesser extent on the north side slope.

  In response to the observed radon barrier degradation on the north and northeast side slopes of the disposal cell, interim radon barrier protection was performed at the test pits in May 2018. Test pits were manually excavated and supplemented with a moisture-conditioned, bentonite-amended granular material to reconstruct the areas where radon barrier material had been eroded. Test pits were intermittently screened for gamma radiation, and no elevated readings were observed.

  No evidence of a breach through the full thickness of the radon barrier has been identified, and the site remains protective of human health and the environment. These determinations are based on visual observations of the degree of erosion at test pit locations and a series of radiological readings that do not exceed ambient background conditions. Efforts to determine the cause(s) of the erosional features are in progress, and work plans for additional investigations are in development. The *Mexican Hat UMTRCA Disposal Cell Side Slope Cover Depressions Evaluation Report, Mexican Hat, Utah,* evaluates the cover degradation features and provides a recommended path forward. A copy of the report was submitted to NRC.

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. 2018 Summary of UMTRCA Title I Site Actions and Issues

Site	Chapter	Page	Actions and Issues
Ambrosia Lake, New Mexico	1	1-2	T-posts installed next to boundary monuments.
		1-6	No best management groundwater monitoring conducted in 2018.
Burrell, Pennsylvania	2	2-2	Entrance gate replaced.
		2-5	Concrete well pads installed.
		2-8	Conducted groundwater monitoring.
		2-12	Conducted vegetation management.
		2-13	Test plot maintained for conservation reuse initiative.
Canonsburg, Pennsylvania	3	3-5	Offsite monitoring well 406A converted to flush-mount completion.
		3-6	Additional no-trespassing signs installed.
		3-8	Conducted a follow-up inspection to evaluate new areas of erosion at Chartiers Creek bank.
		3-9	Conducted groundwater monitoring.
		3-11	Conducted surface water monitoring.
		3-12	Conducted vegetation management.
		3-12	Test plot maintained for conservation reuse initiative.
Durango, Colorado	4	4-2	Moved perimeter sign P45.
		4-2	Removed vegetation from around perimeter sign.
		4-5	Repaired the base of site marker SMK-2.
		4-5	Performed maintenance on boundary monuments and witness corners.
		4-6	Continued to observe a depression along the north toe of the disposal cell and found rocks in the interior of the depression that appeared to have rotated inward.
		4-7	Installed permanent quality control monuments in preparation for a baseline aerial survey.
		4-8	Conducted groundwater monitoring.
		4-12	Conducted vegetation management.
Falls City, Texas	5	5-2	Confirmed landowner compliance with deed restrictions.
		5-5	Repaired perimeter fence.
		5-5	Replaced perimeter signs.
		5-8	Conducted groundwater monitoring.
Grand Junction, Colorado	6	6-7	Conducted groundwater monitoring.
Green River, Utah	7	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.
		8-6	No groundwater monitoring was required for 2018.
Lakeview, Oregon	9	9-7	Conducted riprap gradation monitoring.
		9-10	No groundwater monitoring was required for 2018.
Lowman, Idaho	10	10-2	Entrance sign replaced.
		10-5	Trees removed from the top slope of the disposal cell.
		10-6	No groundwater monitoring required.

Table ES-1. 2018 Summary of UMTRCA Title I Site Actions and Issues (continued)

Site	Chapter	Page	Actions and Issues
Maybell, Colorado	11	11-2	Repaired the perimeter fence.
		11-2	Replaced perimeter sign.
		11-7	Performed baseline aerial survey and installed permanent quality control monuments in support of the survey.
		11-7	No groundwater monitoring required.
		11-7	Conducted vegetation monitoring.
Mexican Hat, Utah	12	12-5	Repaired the fence.
		12-6	Continued to observe depressions along the toe and lower portions of the northeast side slope of the disposal cell and found no significant changes.
		12-7	Observed continued minor erosion in upgradient areas along the southwest portions of the site.
		12-7	Identified voids, cavities, and incisements into the radon barrier surface through small manual excavations (test pits) in areas of the rock cover with depression features on the lower portions of the north and northeast side slopes.
		12-8	Conducted continual depression evaluation activities, including weather monitoring through an onsite meteorological weather station; the performance of semiannual ground based light imaging, detection, and ranging (LIDAR) topographic surveys along the northeast side slope; and semiannual collection of horizontal and vertical GPS-grade survey data at the six settlement plates on the top slope of the disposal cell.
		12-8	Conducted a follow-up inspection in response to an episodic precipitation event.
		12-10	Performed interim radon barrier protection at test pit locations where radon barrier degradation was observed.
		12-11	Performed baseline aerial survey and installed permanent quality control monuments in support of the survey.
		12-12	No groundwater monitoring required.
		12-12	Conducted observational seep monitoring.
Naturita, Colorado	13	13-2	Repaired the perimeter fence.
		13-2	Replaced perimeter sign.
		13-5	Treated vegetation on the disposal cell and apron.
		13-5	Removed vegetation blocking culvert.
		13-6	Observed erosion in County Road EE22 berm.
		13-7	No groundwater monitoring required.
Rifle, Colorado	14	14-2	Mowed access road.
		14-2	Repaired the stock fence.
		14-5	Replaced damaged perimeter signs.
		14-5	Removed orange netting around the evaporation pond.
		14-6	Replaced settlement plate cap.
		14-7	Observed evidence of heavy grazing activity.
		14-8	No groundwater monitoring required.
		14-8	Pumped and evaporated disposal cell pore water and monitored pore-water levels.
		14-9	Exceeded the 6016-foot action level at standpipes 2 and 3.

Table ES-1. 2018 Summary of UMTRCA Title I Site Actions and Issues (continued)

Site	Chapter	Page	Actions and Issues
Salt Lake City, Utah	15	15-5	Conducted visual riprap degradation monitoring on the disposal cell.
		15-7	No groundwater monitoring required.
Shiprock, New Mexico	16	16-2	Removed vegetation from perimeter fence line.
		16-5	Replaced textual and pictorial perimeter signs.
		16-5	Repaired site marker base.
		16-6	Installed permanent quality control monuments in preparation for a baseline aerial survey.
		16-7	Updated evaporation pond entrance sign.
		16-8	Abandoned site features on the top slope of the disposal cell.
		16-8	No disposal cell performance monitoring required.
		16-8	Conducted vegetation monitoring.
Slick Rock, Colorado	17	17-2	Entrance sign replaced.
		17-2	Perimeter signs replaced.
		17-6	No groundwater monitoring required.
Spook, Wyoming	18	18-2	Replaced perimeter signs.
		18-5	No groundwater monitoring required.
Tuba City, Arizona	19	19-5	Updated entrance sign.
		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 10, 2018. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified several minor maintenance needs but found no cause for a follow-up or contingency inspection.

Groundwater monitoring is not required at the site. However, the U.S. Department of Energy (DOE) Office of Legacy Management (LM) 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 LM Long-Term Surveillance Plan (LTSP) (DOE 1996) and in procedures LM 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 10, 2018. The inspection was conducted by A. Kuhlman, J. Cario, and R. Johnson of the Legacy Management Support (LMS) contractor. A. Kleinrath (LM team lead); B. Tsosie (LM site manager); P. Benson (LM); A. Rheubottom and A. Winton (NMED); and N. Gordon (LMS) attended the

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

1.4.1 Site Surveillance Features

Figure 1-1 shows the locations of site features in black, 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 2018 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 at the intersection of the access road and Highway 509. The access road continues east past the site to private mining and grazing interests. The gate and access road are owned by Rio Algom Mining LLC. LM 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 additional warning signs about mining restrictions; several were bent by cattle but remain legible (PL-1). LM will evaluate replacing the signs before the 2019 annual inspection. No other 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. Steel T-posts were installed next to boundary monuments during an April 2018 maintenance trip to help inspectors locate the monuments (PL-3). Erosion has occurred around the base of boundary monument BM-8, but the monument is stable (PL-4). No maintenance needs were identified.

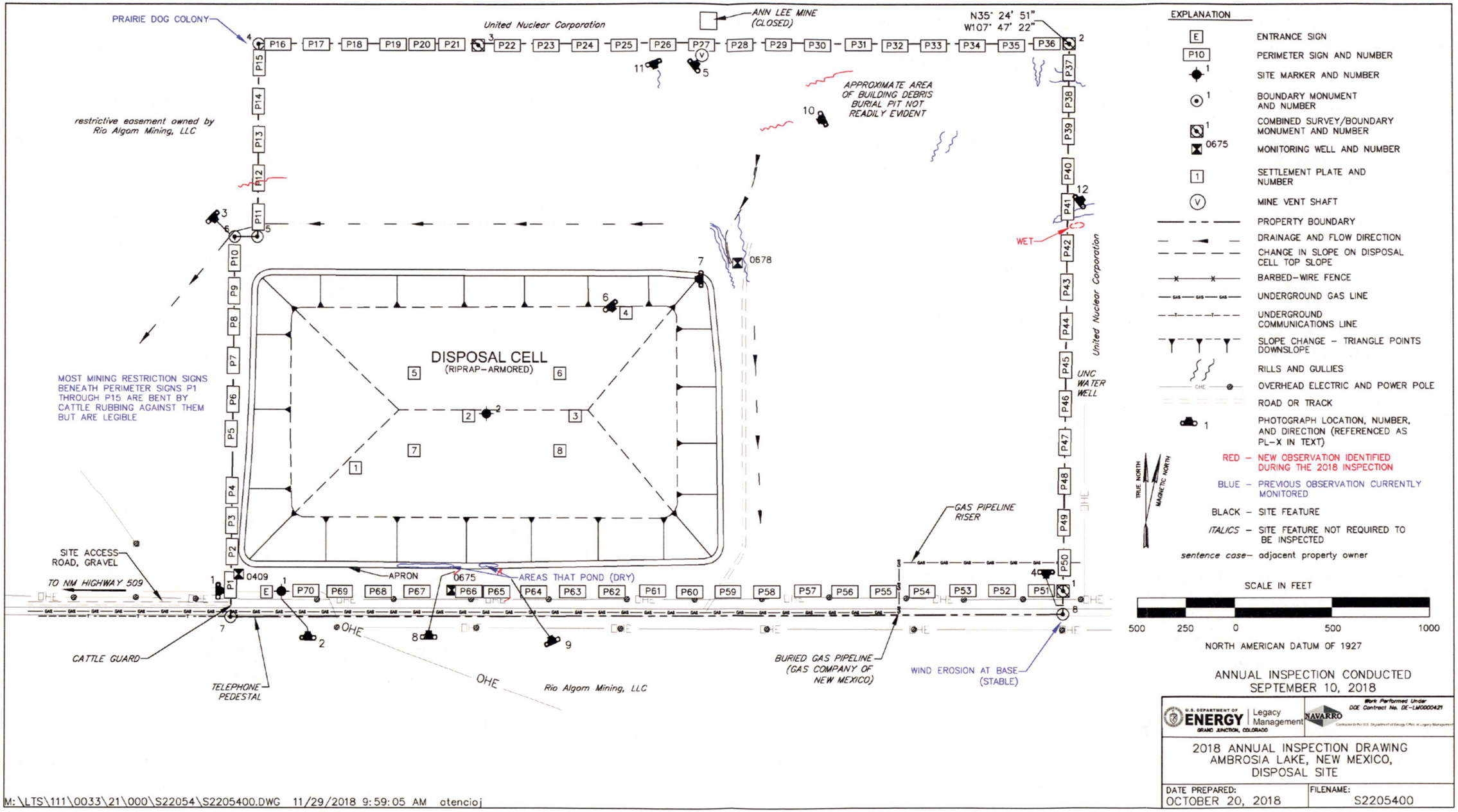

Figure 1-1. 2018 Annual Inspection Drawing for the Ambrosia Lake, New Mexico, Disposal Site

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1.4.1.5 Monitoring Wells

The site has three monitoring wells. A gully formation adjacent to well 0678 appears to be stable, and the well is not affected by the erosion. All wellhead protectors observed during the inspection were undamaged, locked, and properly labeled. No 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 and is armored with basalt riprap to control erosion and deter animal intrusion. 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 annual inspection indicated that very minor settlement may have occurred since the depression was repaired. The area was inspected during the 2018 annual inspection, and although the area was observed to be slightly depressed, settlement was shallow enough that the depth or the extent could not be definitely determined (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. A potential desiccation crack

(PL-8) and formation of small rills, less than 6 inches deep, (PL-9) were observed at the base of the disposal cell in this area. Neither impacts the disposal cell. Inspectors will monitor for further impact or additional erosion 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 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. Several new rills and gullies were observed during the 2018 annual inspection (PL-10 and PL-11). 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. Inspectors will continue to monitor these features to confirm there is no impact to site features. 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. Rills and gullies continue to be observed east of perimeter sign P41 (PL-12). These erosional features do not threaten the long-term integrity of the site because headward erosion is progressing away from the site. Inspectors will continue to monitor these features to ensure there is no impact to site features.

1.5 Follow-Up or Contingency Inspections

LM 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) LM 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

During an April 2018 maintenance trip, LM installed T-posts next to boundary monuments to make them easier to find. During the inspection, warning signs about mining restrictions on the west side of the site were bent. Before the 2019 annual inspection, LM will evaluate replacing these warning signs. 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, LM conducts groundwater monitoring at three wells (0409, 0675, and 0678) as a best management practice at the request of NMED. LM originally agreed to sample these locations triennially for 30 years; however, LM 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. The next sampling event is planned for November 2019.

Well 0675 is completed in weathered Mancos Shale just below its contact with the overlying alluvium, and well 0678 is completed in the Tres Hermanos B Sandstone unit of the Mancos Shale. LM installed well 0409 in May 2011 in support of a regional groundwater investigation being conducted by NMED. Well 0409, 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. All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System website (http://gems.lm.doe.gov/#site=AMB).

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. Environmental Protection Agency, "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	90	Perimeter Sign P1
PL-2	0	Site Marker SMK-1
PL-3	135	Boundary Monument BM-6 and Perimeter Sign P10
PL-4	180	Pedestaling at Base of Boundary Monument BM-8
PL-5	50	Mine Vent Shaft
PL-6	140	Disposal Cell Top Slope near Settlement Plate 4
PL-7	270	Disposal Cell Northern Side Slope
PL-8	0	Potential Desiccation Crack at Base of Disposal Cell Southern Side Slope
PL-9	335	Rills at Base of Disposal Cell Southern Side Slope
PL-10	245	Erosion South of Perimeter Sign P30
PL-11	160	Erosion South of Perimeter Sign P26
PL-12	50	Erosion Outside Site Boundary near P41

PL-1. Perimeter Sign P1

PL-2. Site Marker SMK-1

PL-3. Boundary Monument BM-6 and Perimeter Sign P10

PL-4. Pedestaling at Base of Boundary Monument BM-8

PL-5. Mine Vent Shaft

PL-6. Disposal Cell Top Slope near Settlement Plate 4

PL-7. Disposal Cell Northern Side Slope

PL-8. Potential Desiccation Crack at Base of Disposal Cell Southern Side Slope

PL-9. Rills at Base of Disposal Cell Southern Side Slope

PL-10. Erosion South of Perimeter Sign P30

PL-11. Erosion South of Perimeter Sign P26

PL-12. Erosion Outside Site Boundary near P41

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 10, 2018. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified several minor maintenance needs but found no cause for a follow-up inspection.

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducts groundwater monitoring every 5 years as a best management practice to aid evaluation of the disposal cell's performance. The most recent groundwater sampling event occurred in November 2018. Monitoring results in 2018 for the four target analytes (lead, molybdenum, selenium, and uranium) continue to remain below their respective U.S. Environmental Protection Agency (EPA) maximum concentration limits (MCLs), but all four analytes increased in concentration in one or both of the downgradient monitoring wells. The increases for three of the target analytes (lead, selenium, and uranium) in regards to their respective MCLS are considered insignificant. An increase for molybdenum in one of the downgradient wells is considered potentially significant and will be resampled in 2 years (3years ahead of the required 5-year sampling frequency) to confirm if the increase is persistent.

2.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific LM Long-Term Surveillance Plan (LTSP) (DOE 2000) and in procedures LM 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 10, 2018. The inspection was conducted by K. Broberg and H. Swiger of the Legacy Management Support contractor. C. Carpenter (LM site manager); R. Powell and B. Deboer (NRC); and T. Biller (site herbicide subcontractor Lawn RX) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and determine the need, if any, for maintenance or additional inspection and monitoring.

2.4.1 Site Surveillance Features

Figure 2-1 shows the locations of site features in black, 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 2018 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. Entrance to the site is through a locked gate in the east end of the security fence. Local residents have historically 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 the gate across the access road. The entrance gate was replaced in summer 2018 due to vandalism and was found to be locked and functional. The site entrance sign on the entrance gate was legible. 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, which should prolong the life of the security fence (PL-1). Tree limbs growing toward, or hanging over, the security fence judged to be a future potential threat to the fence were tagged during the inspection with survey ribbon for removal in 2019.

There are 16 perimeter signs attached to the outside of the security fence. Two perimeter signs were missing (P2 and P16) and will be replaced in 2019. Perimeter sign P8 was faded and illegible; it will be replaced in 2019 (PL-2). An information sign that was posted on the personnel gate at the west end of the site was missing and will be replaced in 2019. All other perimeter signs were present and legible. No other maintenance needs were identified.

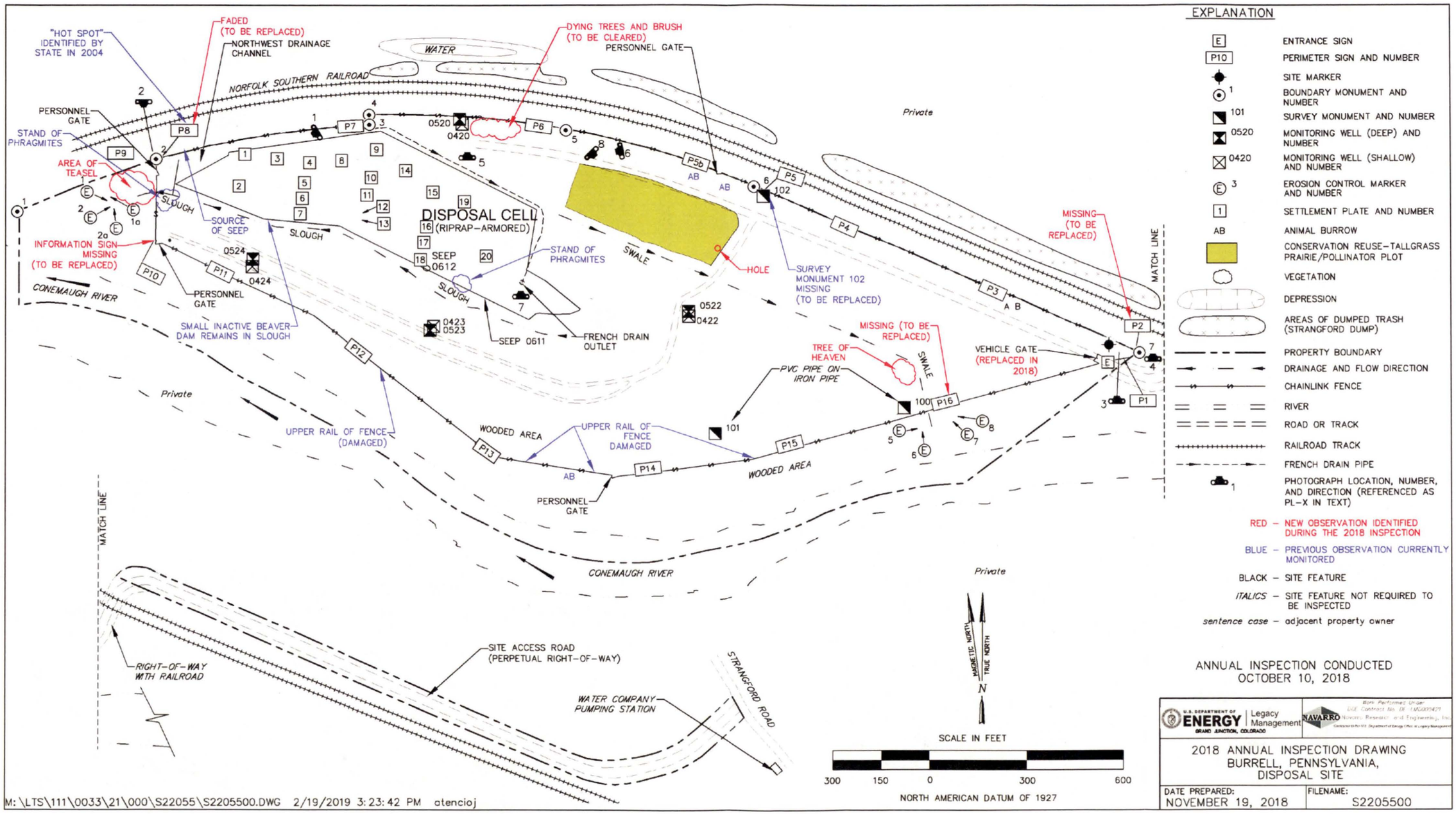

Figure 2-1. 2018 Annual Inspection Drawing for the Burrell, Pennsylvania, Disposal Site

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2.4.1.3 Site Marker

The site has one granite site marker just inside the main entrance gate (PL-3). The concrete pad is cracked but remains functional. No maintenance needs were identified.

2.4.1.4 Survey and Boundary Monuments

The site has three survey monuments and seven boundary monuments (PL-4). Survey monument SM-102 (noted missing during the 2017 annual inspection) was not located and is scheduled to be replaced in 2019. No other maintenance needs were identified.

2.4.1.5 Erosion Control Markers

The site has eight erosion control markers. No maintenance needs were identified.

2.4.1.6 Monitoring Wells

The site has eight monitoring wells that were sampled and inspected in November 2018. As a best management practice, concrete well pads were installed at five monitoring wells (0420, 0520, 0422, 0522, and 0523) during the October 2018 sampling event (PL-5). Monitoring well 0423 already had a concrete well pad. Saturated ground conditions prevented the installation of concrete well pads at monitoring wells 0424 and 0524. Concrete well pads at monitoring wells 0424 and 0524 will be installed in the future. All wellhead protectors that were observed during the annual inspection were locked and undamaged. No immediate maintenance needs were identified.

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 and is armored with riprap to control erosion and deter animal intrusion. 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 by the LTSP (PL-6). A screening-level risk assessment conducted by LM 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; at that time, NRC suggested that LM reevaluate the effects of vegetation on cover performance in 10 or 20 years (i.e., between 2010 and 2020) to confirm performance parameters and predictions. 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. The 2017 inspection report (DOE 2017) noted that LM was planning to conduct the follow-up assessment in fiscal year (FY) 2019. LM has delayed the follow-up assessment planned for FY 2019 to further consult with NRC on the scope of the study. Since NRC initially requested a follow-up study, NRC and LM have been working on joint research to determine disposal cell cap performance and pedogenesis at other UMTRCA sites. LM will work with NRC in 2019 to determine the scope of the Burrell follow-up study in light of the ongoing joint research.

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 (DOE 2008) was issued that included the control of noxious and invasive vegetation on the disposal cell cover to facilitate inspection activities. Vegetation management is 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 parallel to the north slope of the disposal cell in 1998 to prevent the ponding of water next to the cell. The outlet for the drain, in the southeast corner of the disposal cell, was not flowing during the inspection, and no outflow has ever been observed during inspections (PL-7). Water was not ponded anywhere along the French drain, which indicates it was operating properly. Inspectors will continue to monitor the French drain area to verify it continues to operate as designed.

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 2018, 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

An active seep near the north security fence, about 60 feet east of perimeter sign P8 and west of the disposal cell, was found to be flowing during this year's inspection. 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 along the fence line appears to be coming from the bluffs north of the railroad tracks.

An area of dying trees and brush east of monitoring wells 0420 and 0520 will be cleared in 2019 to facilitate ongoing mowing operations. No other 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 activities that could affect the long-term integrity of the site were observed.

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 indicates 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 representative from the Pennsylvania Department of Environmental Protection showed inspectors a "hot spot" (an area 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 LM records 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. LM communicated the results of a records search to the State of Pennsylvania in late 2004. The hot spot was the subject of a follow-up discussion with State representatives in 2006. In October 2018, NRC personnel revisited the hot spot area and measured a gamma radiation level of 200 microrem per hour, which is considerably lower than the 2004 measurement. The area is marked on the site inspection map for future reference.

2.5 Follow-Up Inspections

LM 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) LM 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

In summer 2018, before the inspection, the entrance gate was replaced due to vandalism.

During the inspection, inspectors documented minor maintenance needs that will be addressed in 2019, including:

- Removing tagged tree limbs along the security fence
- Replacing missing perimeter signs P2 and P16
- Replacing faded perimeter sign P8
- Replacing the missing informational sign on the west personnel gate
- Replacing missing survey monument SM-102
- Removing dying trees and brush near monitoring well 0420 and 0520

No other immediate maintenance needs were identified.

2.7 Emergency Measures

Emergency measures are actions LM 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, LM 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 October 2018. 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[a] (mg/L)
Lead	0.05
Molybdenum	0.1
Selenium	0.01
Uranium	0.044

Note:
[a] MCLs as listed in 40 CFR 192, Table 1, Subpart A

Abbreviation:
mg/L = milligrams per liter

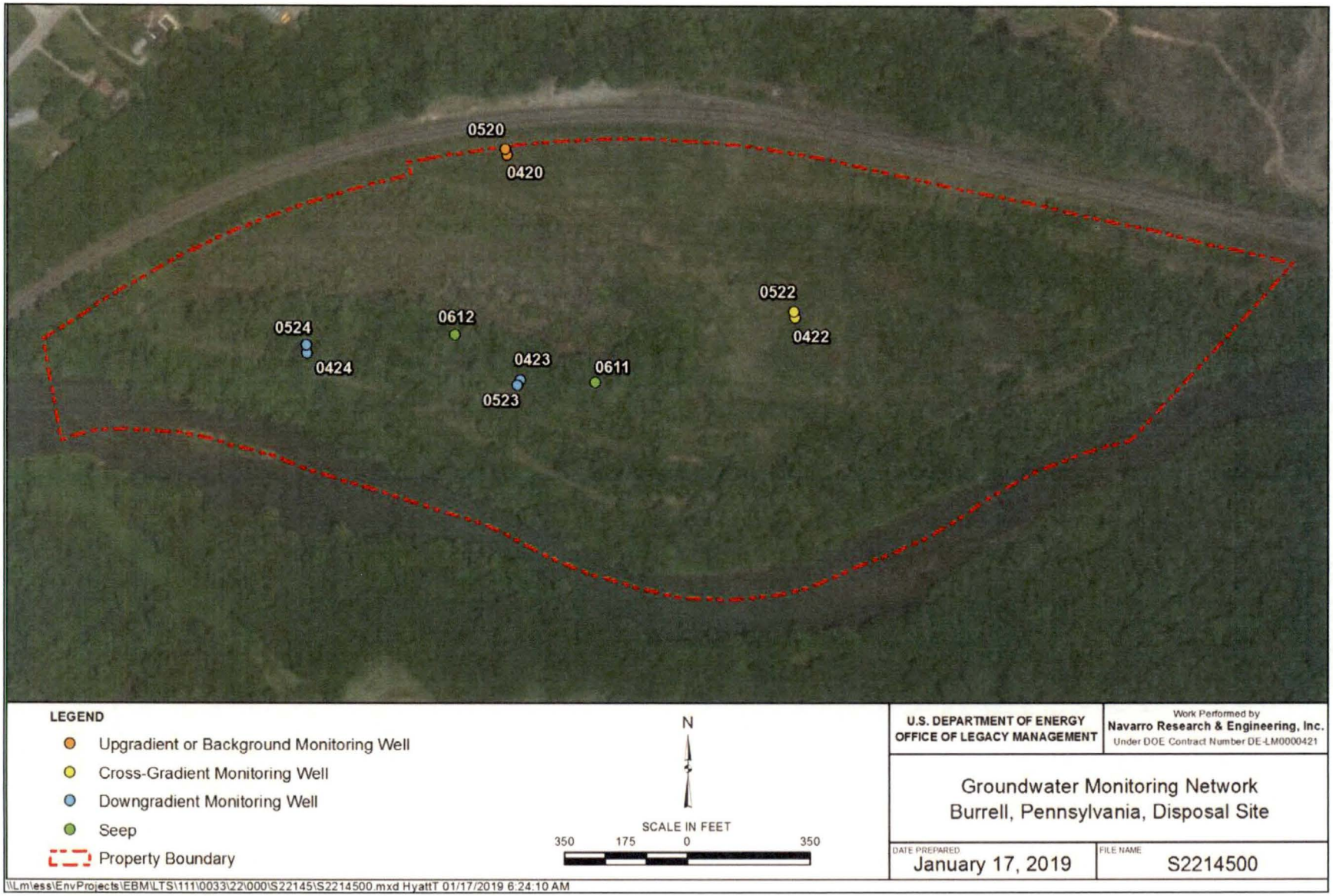


Figure 2-2. Groundwater Monitoring Network for the Burrell, Pennsylvania, Disposal Site

All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System website (http://gems.lm.doe.gov/#site=BUR). Monitoring results in 2018 for the four target analytes continue to remain below their respective MCLs. Concentration versus time graphs for all four constituents are provided in Figures 2-3 through 2-6. Nondetects are represented in Figures 2-3 through 2-6 by the laboratory detection limit concentration.

After each monitoring event, LM reviews the data for trends or significant changes. 2018 results indicate that concentrations of all four target analyte constituents in one or both of the downgradient monitoring wells (0423 and 0424) increased between 2013 and 2018 but remain below the MCL standards. The increases for three of the target analytes (i.e., lead, selenium, and uranium) in regards to their respective MCLs are considered insignificant. The molybdenum increase in monitoring well 0424, though, is judged to be potentially significant (Figure 2-4).

The concentration of molybdenum in well 0424 increased from 0.014 mg/L (2013) to 0.074 mg/L (2018). The MCL for molybdenum is 0.1 mg/L. Based on the increase reported for molybdenum between 2013 and 2018, the concentration could reach the MCL limit in 2 years. Therefore, consistent with the LTSP, LM intends to resample in 2 years rather than wait for the next regularly scheduled 5-year sampling event. This 2-year sampling will be considered a confirmatory sampling event to determine if the increasing molybdenum trend observed between 2013 and 2018 at monitoring well 0424 persisted and the MCL concentration was reached. If the next sampling event verifies that the MCL concentration has been reached, LM will follow the site LTSP. As stated in the site LTSP, if an MCL is exceeded, LM will develop an evaluative monitoring plan and submit it to NRC for review before initiating the evaluative monitoring plan.

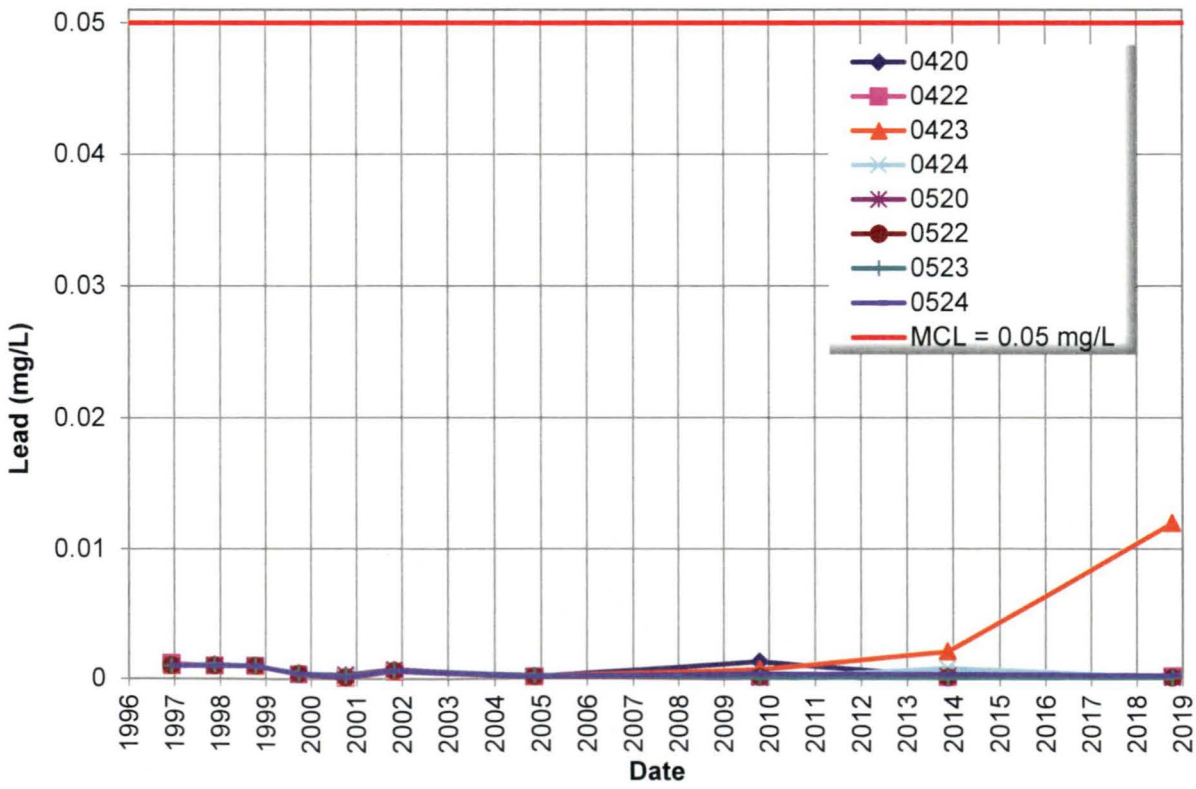


Figure 2-3. Lead in Groundwater at the Burrell, Pennsylvania, Disposal Site

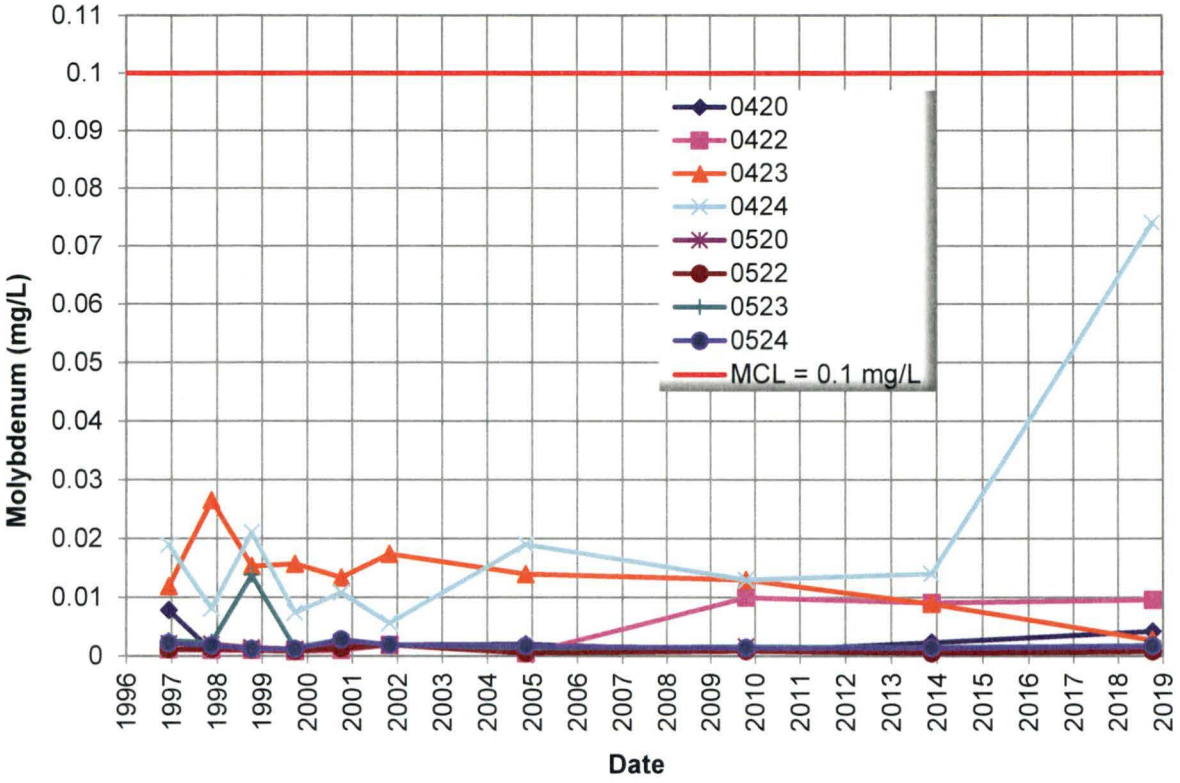


Figure 2-4. Molybdenum in Groundwater at the Burrell, Pennsylvania, Disposal Site

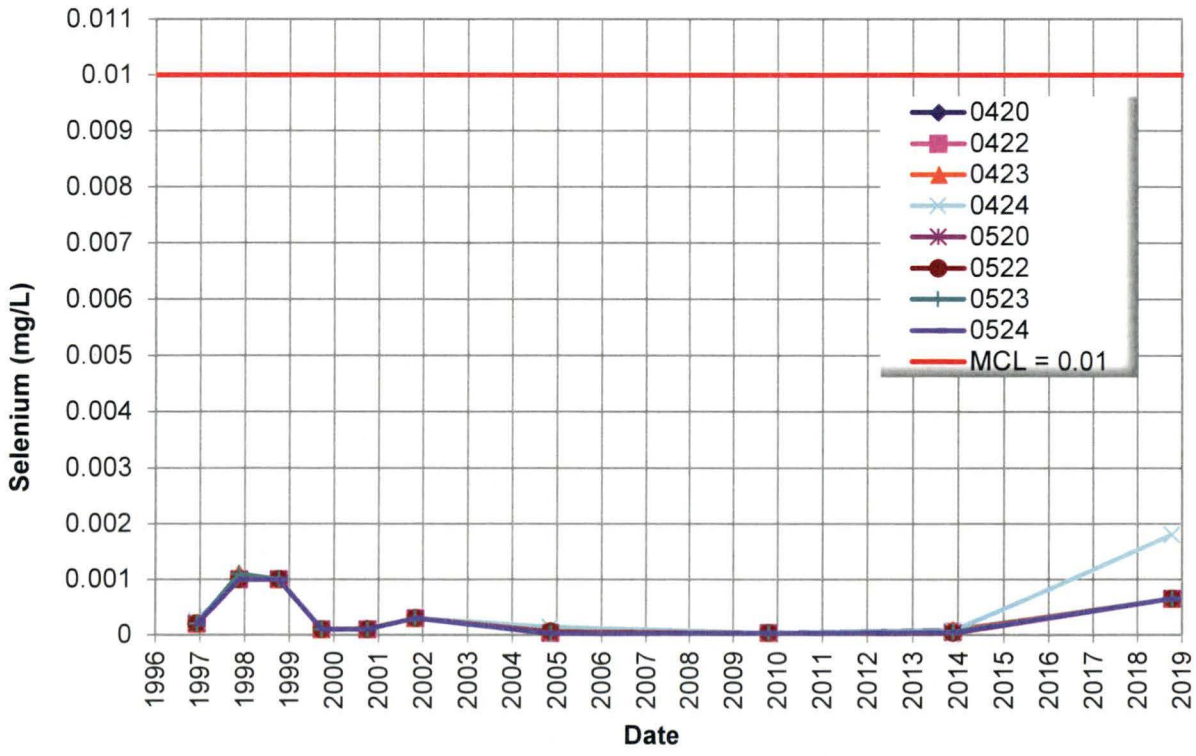


Figure 2-5. Selenium in Groundwater at the Burrell, Pennsylvania, Disposal Site

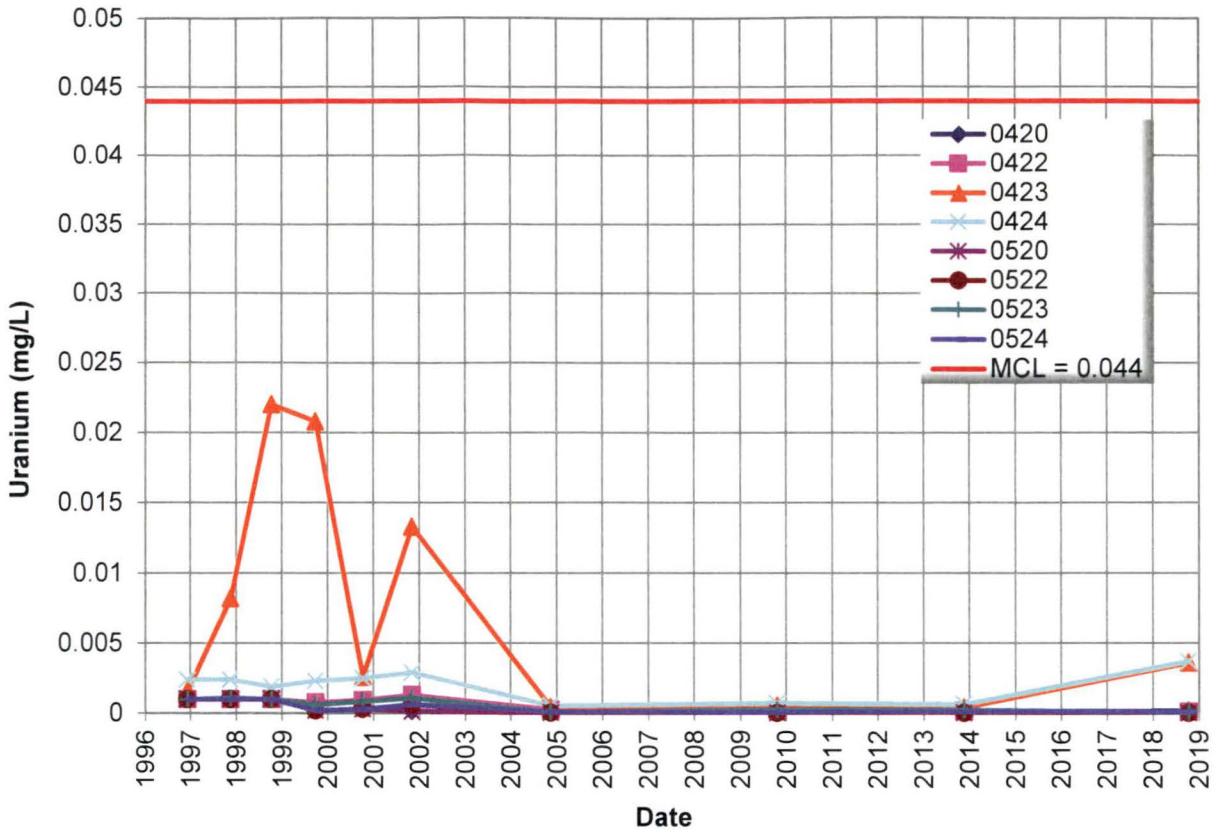


Figure 2-6. Uranium in Groundwater at the Burrell, Pennsylvania, Disposal Site

Table 2-4 provides 2018 sample results for seep 0611 and seep 0612. All concentrations were well below their respective MCLs. Laboratory detection limits are reported for nondetects.

Table 2-4. Seep 0611 and Seep 0612 Sample Results

Constituent	2018 Concentration at Seep 0611 (mg/L)	2018 Concentration at Seep 0612 (mg/L)
Lead	0.000079	0.000079
Molybdenum	0.0091	0.011
Selenium	0.00065	0.00065
Uranium	0.00037	0.00064

2.8.2 Vegetation Management

In accordance with the Vegetation Management Plan, vegetation management activities continue at the site. Vegetation management activities include ensuring the fence line and access paths remain clear of Japanese knotweed (an invasive species), applying herbicides where needed, and frequent mowing. These activities are mostly successful in controlling noxious and invasive plants onsite, with the exception of purple loosestrife, phragmites, and Japanese knotweed.

Purple loosestrife persists 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. Phragmites is present in the swale area south of the disposal cell. Wooded areas remained heavily infested with Japanese knotweed.

A conservation reuse initiative is being pursued at the site that involves the establishment of a tallgrass prairie. In 2017 a 2-acre plot in the mowed field east of the disposal cell was staked out as a test plot. In October 2018 that area was prepped and seeded (PL-8). If the prairie is successful, there is room at the site to expand it.

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. Environmental Protection Agency, "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), 2008. *Burrell, Pennsylvania, Site Vegetation Management Plan*, DOE-LM/1566-2008, January.

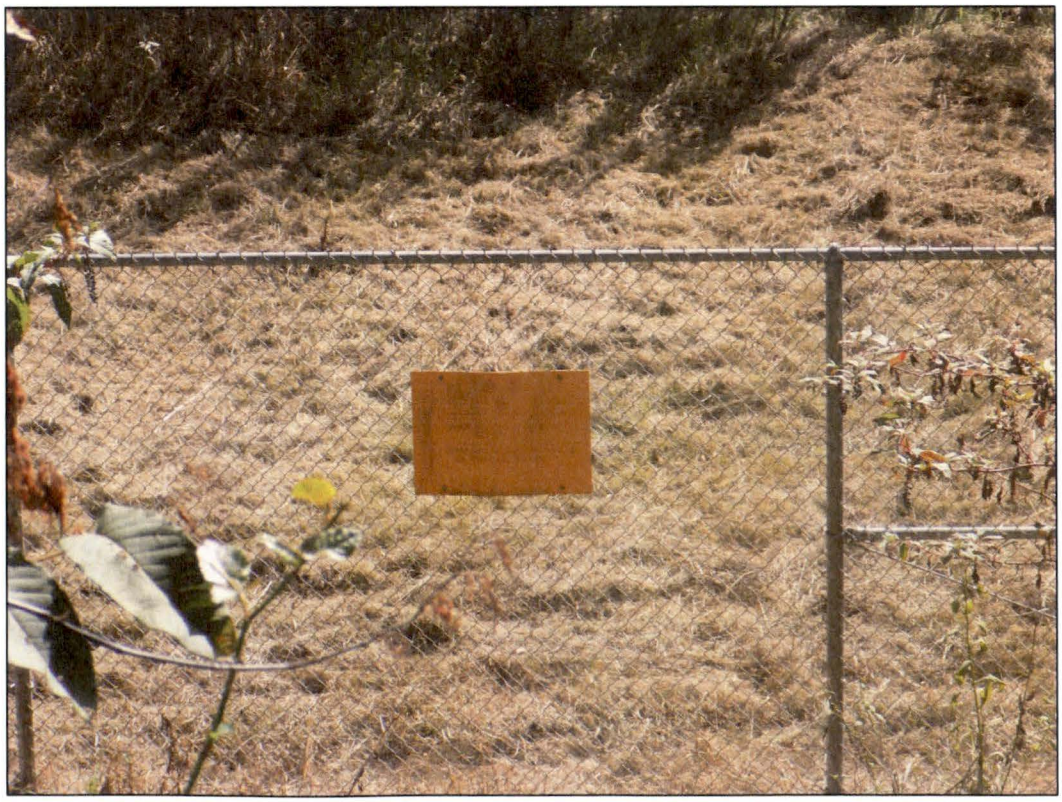
DOE (U.S. Department of Energy), 2014. *2014 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites,* LMS/S12245, March.

DOE (U.S. Department of Energy), 2017. *2017 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites,* LMS/S17252, March.

2.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	290	Security Fence Line
PL-2	180	Faded Perimeter Sign P8 (to Be Replaced)
PL-3	0	Site Marker with Crack in Concrete Pad
PL-4	0	Boundary Monument 7
PL-5	0	Monitoring Wells 0420 and 0520
PL-6	260	Looking Southwest Toward Disposal Cell
PL-7	0	French Drain Outlet
PL-8	135	New Tallgrass Native Reuse Prairie Area

PL-1. Security Fence Line



PL-2. Faded Perimeter Sign P8 (to Be Replaced)

PL-3. Site Marker with Crack in Concrete Pad

PL-4. Boundary Monument 7

PL-5. Monitoring Wells 0420 and 0520

PL-6. Looking Southwest Toward Disposal Cell

PL-7. French Drain Outlet

PL-8. New Tallgrass Native Reuse Prairie Area

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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 11, 2018. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified several minor maintenance needs.

A follow-up inspection was conducted on April 5, 2018, by subject matter experts to evaluate additional erosion along the stream bank identified during the 2017 annual inspection. Repairs to the riprap along the stream bank are required to address the additional erosion and have been scheduled for late summer 2019 when stream flow is seasonally low. Another follow-up inspection by subject matter experts will be conducted in spring 2019 to verify that planned streambank repairs remain adequate.

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducts groundwater and surface water monitoring every 5 years to provide data to document that the site remains protective of human health, safety, and the environment. The most recent sampling event occurred in October 2018. All sampling results were below the uranium site-specific alternate concentration limit (ACL) in groundwater and point of exposure (POE) limit in surface water.

3.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (LTSP) and in procedures LM 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 unrestricted. 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 11, 2018. The inspection was conducted by K. Broberg and H. Swiger of the Legacy Management Support (LMS) contractor. C. Carpenter (LM site manager), R. Powell, and B. Deboer (NRC) and T. Biller (site herbicide contractor Lawn RX) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that may affect conformance with the LTSP, and determine the need, if any, for maintenance or additional inspection and monitoring.

3.4.1 Site Surveillance Features

Figure 3-1 shows the locations of site features in black, 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 2018 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. There are also three personnel access gates. All gates were locked and functional. The entrance sign is posted on the main entrance gate. No maintenance needs were identified.

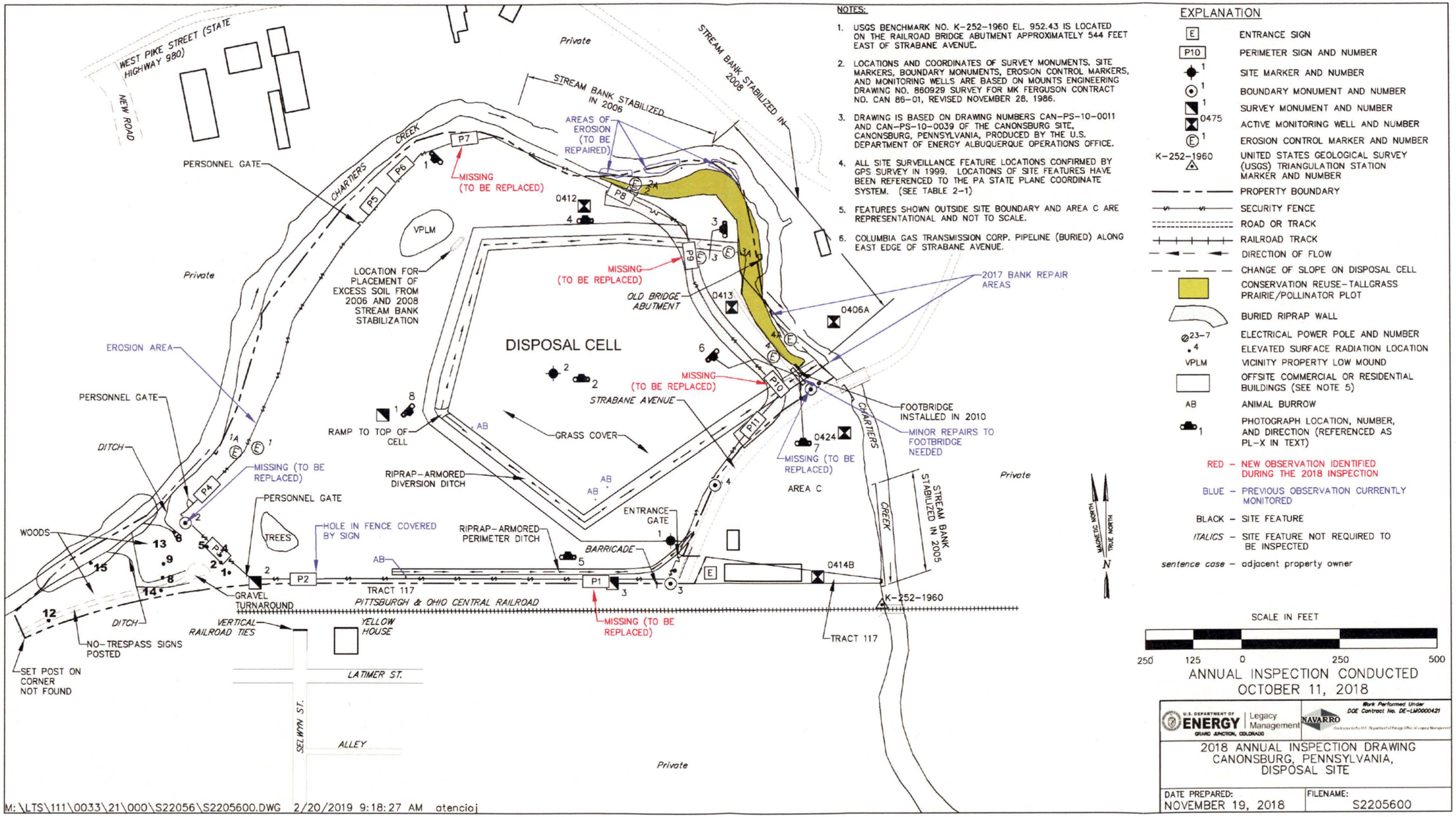

Figure 3-1. 2018 Annual Inspection Drawing for the Canonsburg, Pennsylvania, Disposal Site

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3.4.1.2 Security Fence and Perimeter Signs

A chain-link security fence encloses most of the site. A vegetation-free buffer zone is maintained around the entire security fence (PL-1). 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. Perimeter signs P1, P7, P9, and P10 were missing and will be replaced in 2019. No other maintenance needs were identified.

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-2). No maintenance needs were identified.

3.4.1.4 Survey and Boundary Monuments

The site has three survey monuments and four boundary monuments. Boundary monuments BM-1 and BM-2 (noted missing during the 2017 inspection) were not located and are scheduled to be replaced in 2019. 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-3). No maintenance needs were identified.

3.4.1.6 Monitoring Wells

The site has five groundwater monitoring wells that are inspected when they are sampled (PL-4). Monitoring wells were sampled and inspected in October 2018. All wellhead protectors that were observed during the inspection were undamaged and locked. No maintenance needs were identified.

An off-property well (monitoring well 406A) was converted to a flush-mount completion in October 2018. The conversion resulted from a request by the property owner to have the well removed from his property. The well is located in a parking lot and has interfered with traffic. In order to retain this asset, LM proposed converting the well to a flush-mount completion. The property owner approved of this approach.

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-5). 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 significant 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 (PL-6). Minor repairs to the bridge are needed. A loose vertical handrail support was temporarily repaired in 2017 but requires a more permanent fix (PL-7), and the west end of the south handrail is beginning to rot. 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 (PL-8). 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

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 release criteria were not satisfied for the entire parcel and it 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. LM controls land use through ownership. Inspectors will continue to check the area for evidence of trespassing.

During the 2017 annual inspection an abandoned campsite was observed on the southwest corner of the site. The site and associated trash was removed in December 2017 and no-trespassing signs in the area replaced in October 2018. No evidence of recent trespassing was observed during 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 changes to the size of the turnaround were observed in 2018. No 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 appeared to 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 than during previous inspections. A follow-up inspection was conducted by LMS engineering staff in May 2017 when it was determined that repairs were necessary. Repairs to the riprap were completed in September 2017. 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 was discontinued. 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. A follow-up inspection by subject matter experts was completed on April 5, 2018. Repairs were deemed to be necessary. These repairs are planned for the late summer of 2019 when flow in Chartiers Creek is seasonally low.

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 (ft) and utilities excavation deeper than 6 ft. The storage units constructed so far do not violate these ICs.

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 observed during the inspection. No other maintenance needs were identified.

3.5 Follow-Up Inspections

LM 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) LM is notified by a citizen or outside agency that conditions at the site have substantially changed. New areas of erosion along Chartiers Creek were identified during the 2017 annual inspection as requiring a follow-up inspection. Subject matter experts conducted a follow-up inspection in April 2018 to evaluate the new areas of erosion along the Chartiers Creek stream bank north of the disposal cell and to collect design specification for mitigation actions for this new area. The evaluation indicated that 1266 linear ft of the bank needs to be repaired. Repairs have been scheduled to take place during the late summer of 2019 when flow in Chartiers Creek is seasonally low. A follow-up inspection is required in the spring of 2019 to verify that planned repairs remain adequate. Evaluation results of the spring 2019 follow-up inspection and summer 2019 repairs will be reported in the *2019 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*.

3.6 Maintenance

Before the inspection, several maintenance items identified in the *2017 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites* (DOE 2018) were completed. LM removed the campsite observed during the 2017 annual inspection and associated trash in December 2018 and replaced no-trespassing signs in the area in October 2018. LM also converted offsite monitoring well 406A to a flush-mount completion.

During the inspection, inspectors documented minor maintenance needs that will be addressed in 2019, including:

- Replacing missing perimeter signs P1, P7, P9, and P10
- Replacing missing boundary monuments BM-1 and BM-2

Additionally, repairs will be made to erosion along Chartiers Creek in summer 2019. Minor repairs to the pedestrian bridge will be made 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, LM conducts groundwater monitoring every 5 years to (1) evaluate downgradient contaminant trends in groundwater in the shallow unconsolidated materials and in surface water, (2) demonstrate that concentrations of uranium at point of compliance (POC) wells are decreasing as predicted and that the system remains in compliance with the Groundwater Compliance Action Plan, and (3) ensure that remedial actions at the disposal site and Area C continue to protect human health, safety, and the environment. The most recent sampling event occurred in October 2018.

The groundwater monitoring network consists of five monitoring wells, including three 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 ACL is 1.0 milligrams per liter (mg/L) at the POC wells. All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System website (http://gems.lm.doe.gov/#site=CAN).

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

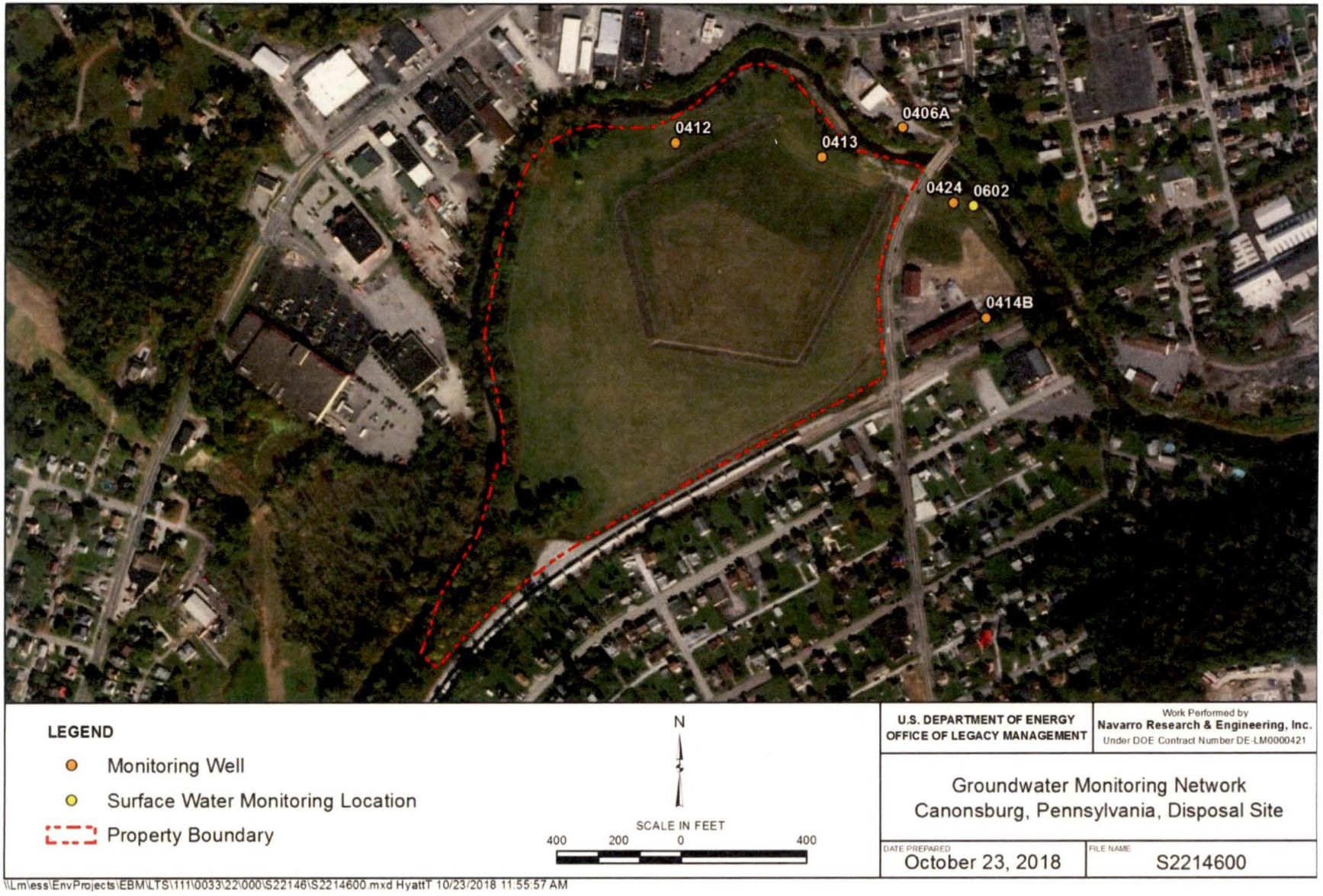

Figure 3-2. Groundwater Monitoring Network for the Canonsburg, Pennsylvania, Disposal Site

Uranium concentrations in 2018 were below the established ACL (Figure 3-3). With the exception of monitoring wells 0412 and 0413, uranium concentrations in 2018 were also below the MCL of 0.044 mg/L.

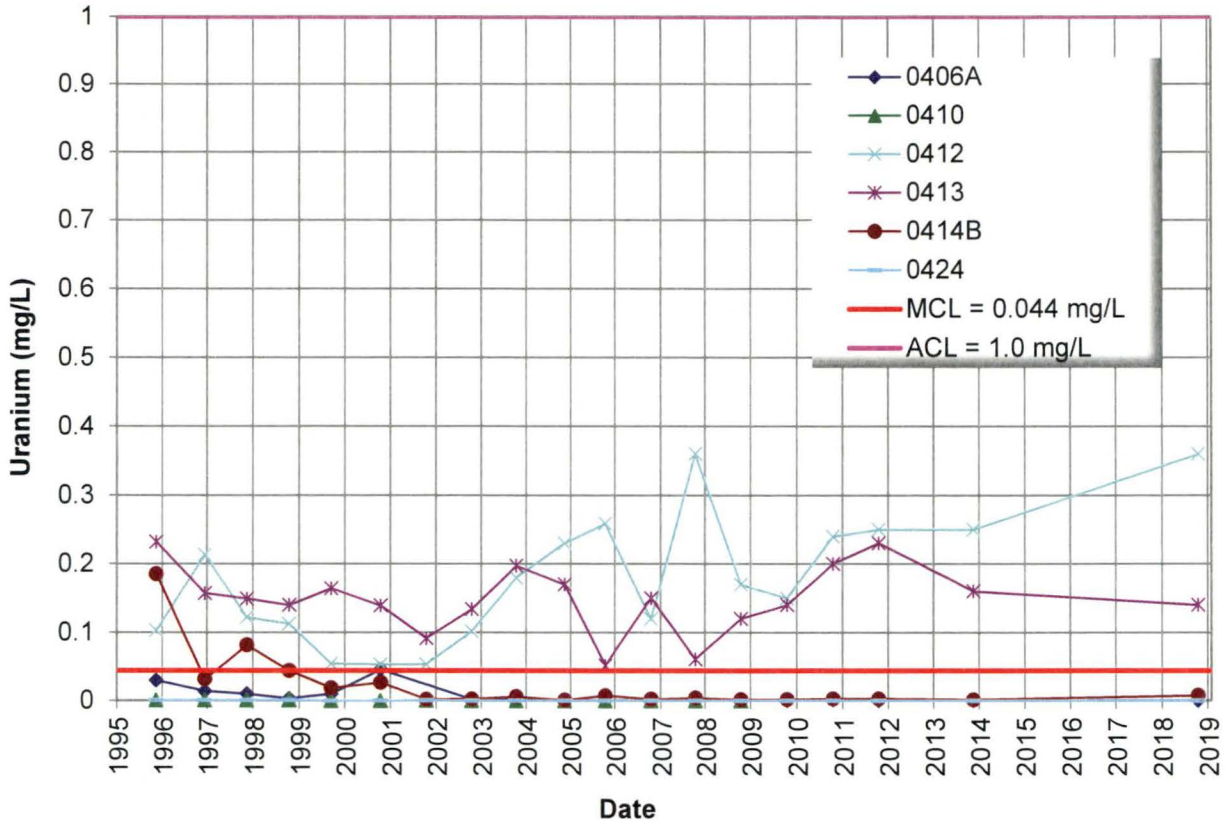

Figure 3-3. Uranium in Groundwater at the Canonsburg, Pennsylvania, Disposal Site

3.7.2 Surface Water Monitoring

In accordance with the LTSP, LM conducts surface water monitoring every 5 years. The most recent sampling event occurred in October 2018.

Only one location, 0602, is sampled in Chartiers Creek. The location is considered a POE for the site and is sampled for uranium; a limit of 0.01 mg/L is applied. Before the LTSP revision in 2008, two additional locations were sampled in Chartiers Creek: 0601 and 0603. These locations are no longer required to be sampled.

All surface water monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System website (http://gems.lm.doe.gov/#site=CAN). The 2018 uranium concentration of surface water at location 0602 remained significantly below the established concentration limit of 0.01 mg/L (Figure 3-4).

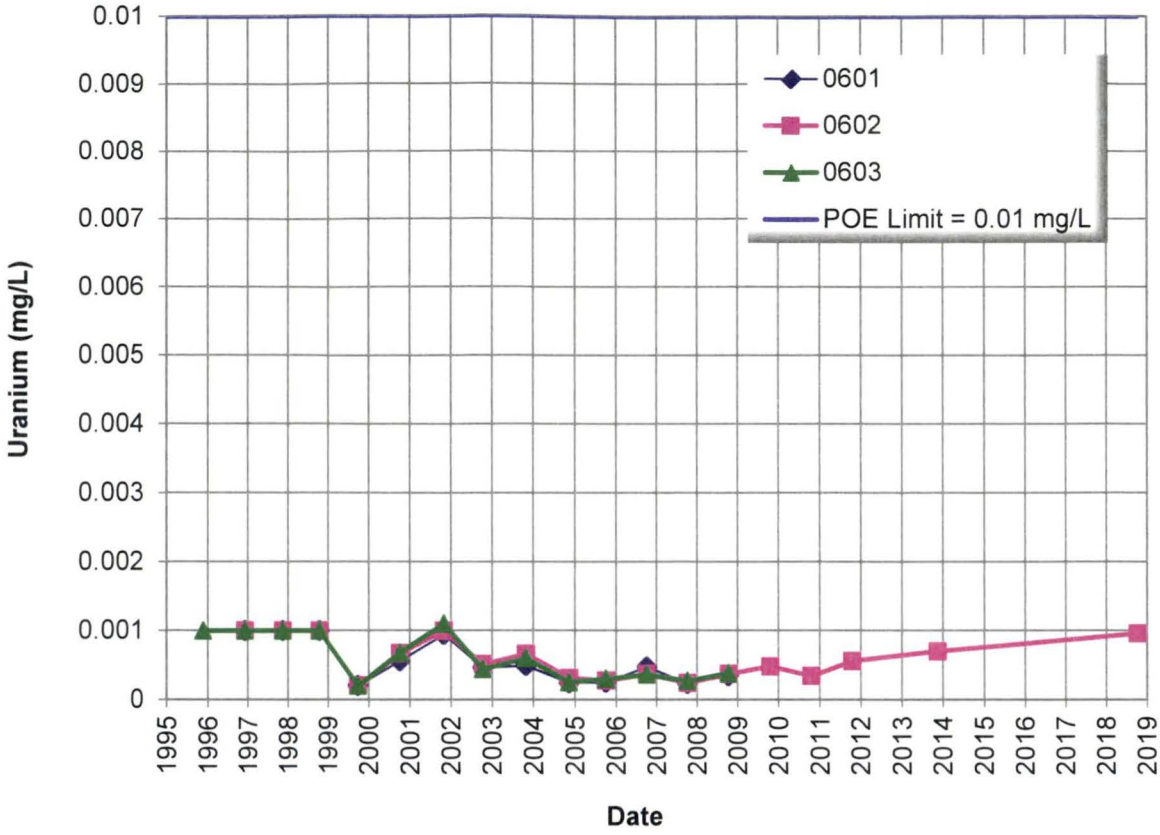

Figure 3-4. Uranium in Surface Water at the Canonsburg, Pennsylvania, Disposal Site

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 LM 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), 2015. *2014 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites,* LMS/S12245, March.

DOE (U.S. Department of Energy), 2018. *2017 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites,* LMS/S17252, March.

3.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	225	Security Fence Line
PL-2	0	Site Marker SMK-2
PL-3	270	Erosion Control Marker EC-3
PL-4	0	Monitoring Well 0412
PL-5	0	Southeast Corner of Disposal Cell
PL-6	135	Pedestrian Footbridge
PL-7	0	Temporary Repair to Pedestrian Footbridge Rail Support
PL-8	135	Riprap-Armored Diversion Ditch

PL-1. Security Fence Line

PL-2. Site Marker SMK-2

PL-3. Erosion Control Marker EC-3

PL-4. Monitoring Well 0412

PL-5. Southeast Corner of Disposal Cell

PL-6. Pedestrian Footbridge

PL-7. Temporary Repair to Pedestrian Footbridge Rail Support

PL-8. Riprap-Armored Diversion Ditch

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4.0 Durango, Colorado, Disposal Site

4.1 Compliance Summary

The U.S Department of Energy (DOE) Office of Legacy Management (LM) conducted the Durango, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) annual site inspection on June 20, 2018 and the annual groundwater monitoring event in May 2018. No cause for a follow-up inspection was identified.

Monitoring of the minor linear depression on the toe of the northeast side slope continues; inspectors noted that there may have been some movement of rocks in the interior of the linear depression (rotated inward) on the toe of the northeast side slope. Monitoring of the depression will continue to help LM understand its cause(s) and mitigate any problems that may arise as a result. No changes were observed on the top of the disposal cell or in the associated drainage features. Inspectors identified several minor maintenance needs and have already addressed a few.

The most recent groundwater results indicate concentrations in point-of-compliance (POC) wells are below site-specific thresholds. One best management practice monitoring well (0618) continues to be sampled more frequently in response to variable uranium concentrations typically above site-specific thresholds for the POC wells. Well 0618 is not a POC well, and the concentrations in this well do not affect compliance with the site-specific LM Long-Term Surveillance Plan (LTSP) (DOE 2015) and do not pose a risk to human health and the environment.

4.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the LTSP and in procedures LM 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 June 20, 2018. The inspection was conducted by M. Kastens and D. Atkinson of the Legacy Management Support (LMS) contractor. J. Dayvault (LM site manager) and D. Miller and J. Lobato (LMS) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and determine the need, if any, for maintenance or additional inspection and monitoring.

4.4.1 Site Surveillance Features

Figure 4-1 shows the locations of site features in black, 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 2018 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 via 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. The entrance sign is at the original entrance gate within the property boundary. No maintenance needs were identified.

4.4.1.2 Perimeter Signs

There are 82 perimeter signs attached to steel posts set in concrete that delineate the property boundary. Perimeter signs are inspected for legibility and position to ensure they are functioning. Two additional perimeter signs, P83 and P84, also attached to steel posts, were installed in 2014 inside the property boundary along the east perimeter of Ditch No. 1. These recent additions act as surrogates for perimeter signs P40–P43 because perimeter signs P40–P43 are on a steep densely wooded hillside. Perimeter signs P40–P43 are not routinely inspected unless the dense vegetation recedes.

The concrete bases of several perimeter signs have been and continue to be undercut (PL-1), but the position of the signs remain uncompromised. The concrete base of perimeter sign P45, located in the natural drainage on the north end of the site, was almost entirely free-standing (PL-2). Following the inspection, LM moved perimeter sign P45 approximately 25 feet (ft) to the east, a location less prone to erosion. Vegetation was encroaching on perimeter sign P51 (PL-3) and was removed in fall 2018 following the inspection. No other maintenance needs were identified.

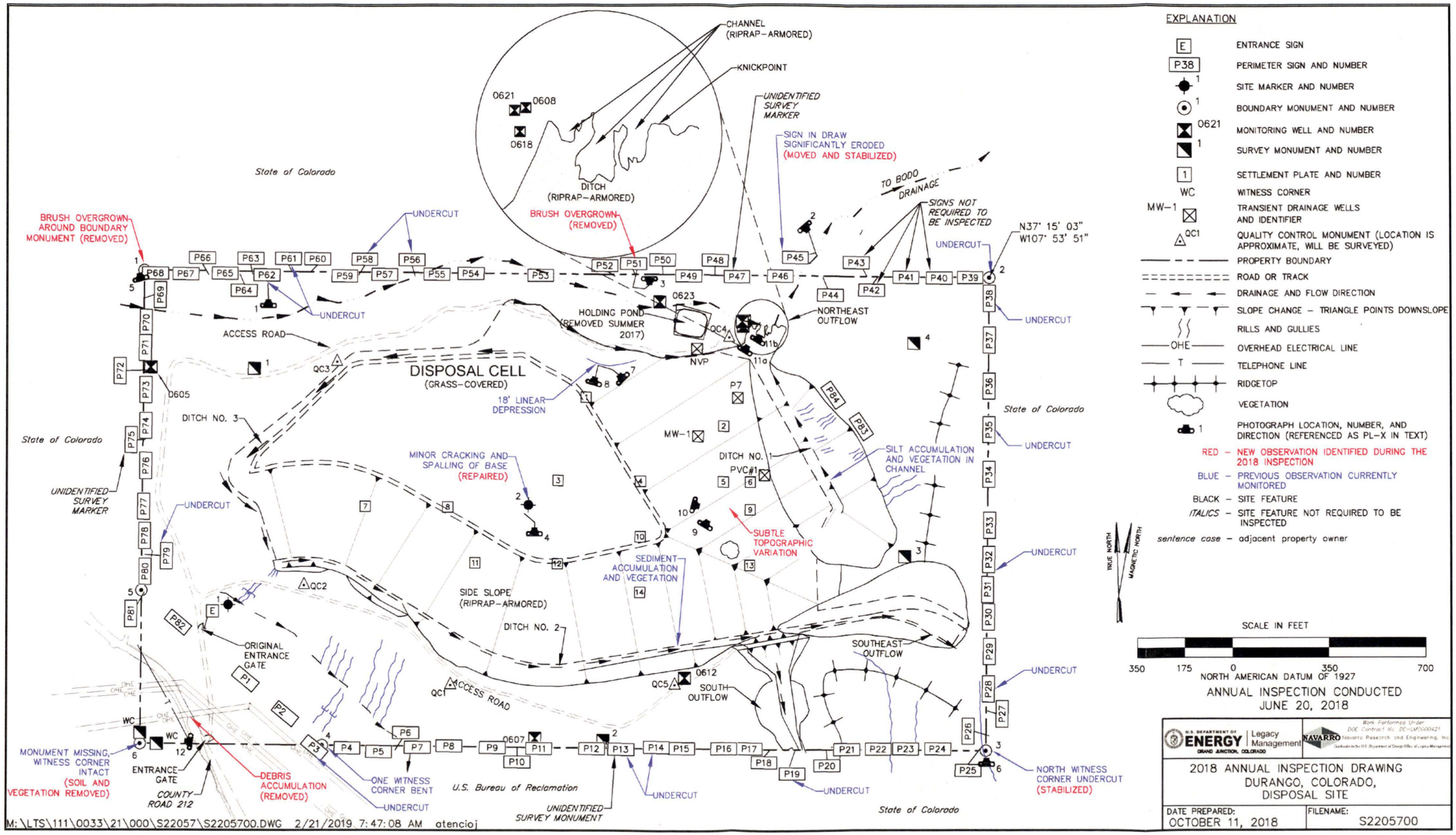

Figure 4-1. 2018 Annual Inspection Drawing for the Durango, Colorado, Disposal Site

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4.4.1.3 Site Markers

The site has two 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 exhibited minor cracking and spalling along its edges (PL-4) and soil had eroded or subsided approximately 1–3 inches around the base. Following the inspection, LM repaired and stabilized the site marker SMK-2 base. No other 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. Boundary monument BM-6 has been missing since the adjacent U.S. Bureau of Reclamation pipeline was installed, bringing the current number of boundary monuments to five. However both witness corners were present, although the southeast witness corner was beginning to be covered with soil and the northwest witness corner was blocked by vegetation. Replacement of boundary monument BM-6 is not warranted at this time. Boundary monument BM-1 was almost completely covered by vegetation (PL-5). The north witness corner for boundary monument BM-3 had been undercut by erosion (PL-6) and needed stabilization. Boundary monument BM-3 also was undercut, although not as significantly. Following the inspection, LM removed soil from the southeast witness corner to boundary monument BM-6, removed vegetation from boundary monument BM-1 and the northwest witness corner to boundary monument BM-6, and stabilized boundary monument BM-3 and its north witness corner. No other maintenance needs were identified.

4.4.1.5 Monitoring Wells

The site has seven monitoring wells. 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. It has a vegetated cover consisting 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 throughout the top; however, none were observed in 2018. No maintenance needs were identified.

4.4.2.2 Side Slopes of Disposal Cell

The side slopes of the disposal cell are armored with rock riprap. Along the north toe of the disposal cell, rock has moved, resulting in a linear depression approximately 18 ft long, first observed in 2015. Inspectors noted that some of the rocks in the interior of the depression that were previously marked appeared to have rotated inward (PL-7 and PL-8). Inspectors will continue to monitor this area.

Inspectors observed a subtle topographic variation in the surface of the northeast side slope (PL-9 and PL-10). Inspectors found no evidence of significant erosion around the variation, which would prompt concern, and determined that the variation did not pose a concern regarding disposal cell integrity. Inspectors will continue to monitor the variation.

Subtle topographic variations observed on the disposal cell south side slope during the 2017 annual inspection were observed again during the 2018 annual inspection. The variations were determined to be artifacts of disposal cell construction. 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 these ditches and conveyed away from the site into natural drainages. The 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 ditches, depositing sediment in 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-11). 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

The holding pond and fence associated with the site's transient drainage system in the northeast corner of the site were removed in 2017. Inspectors noted that the former holding pond area was revegetated; no evidence of erosion or damage to the newly vegetated area was observed. No maintenance needs were identified.

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). Inspectors noted no new activities or changes to the site boundary area, with the exception of debris accumulation near the southwest corner of the site near boundary monument BM-6 (PL-12). The debris was removed following the inspection. 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

LM 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) LM 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

Inspectors documented minor maintenance needs that were addressed following the inspection, including:

- Moving perimeter sign P45 from the arroyo in the northeast drainage to a location approximately 25 ft to the east
- Removing vegetation from around perimeter sign P51 and boundary monument BM-1
- Repairing cracks in the concrete base of site marker SMK-2 and stabilizing the surrounding soil
- Reinforcing and stabilizing the bases of boundary monument BM-3 and its north witness corner
- Removing brush and soil from around the witness corners of boundary monument BM-6
- Removing trash from the southwest corner of the site, near boundary monument BM-6
- Treating woody species on the side slopes

In August 2018, following the inspection, five permanent quality-control monuments were installed at the site in preparation for a baseline aerial survey of the disposal cell. The quality control monument locations are shown in Figure 4-1. No other maintenance needs were identified.

4.7 Emergency Measures

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

4.8 Environmental Monitoring

4.8.1 Groundwater Monitoring

In accordance with the LTSP, LM conducts annual groundwater sampling and analysis to monitor disposal cell performance. Several best management monitoring wells are sampled more frequently to evaluate variable uranium concentrations, such as best management practice well 0618. The most recent annual sampling event occurred at the site in May 2018. LM inspected the monitoring wells during the sampling event, and no maintenance needs were identified.

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 LTSP describes the Cliff House/Menefee aquifer as the uppermost aquifer because of the limited area of the alluvial system saturation under natural conditions beneath the disposal cell. Previous annual site inspections have not identified any discharge of alluvial groundwater to the surface, and discharge of alluvial groundwater to the surface was not detected in 2018. Table 4-2 and Figure 4-2 show the current groundwater monitoring network at the site.

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)

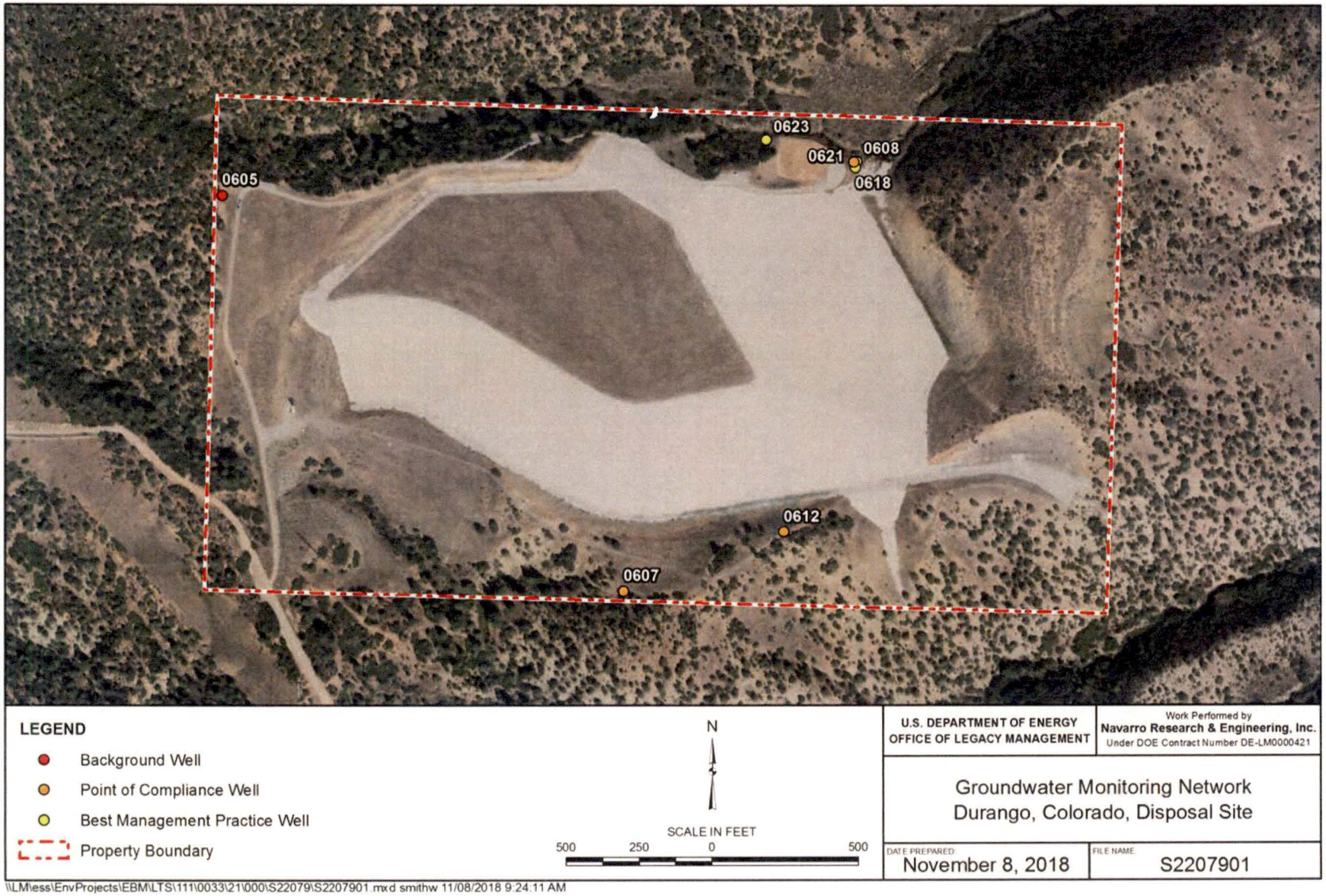

Figure 4-2. Groundwater Monitoring Network for the Durango, Colorado, Disposal Site

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 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. All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System website (http://gems.lm.doe.gov/#site=DUD).

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

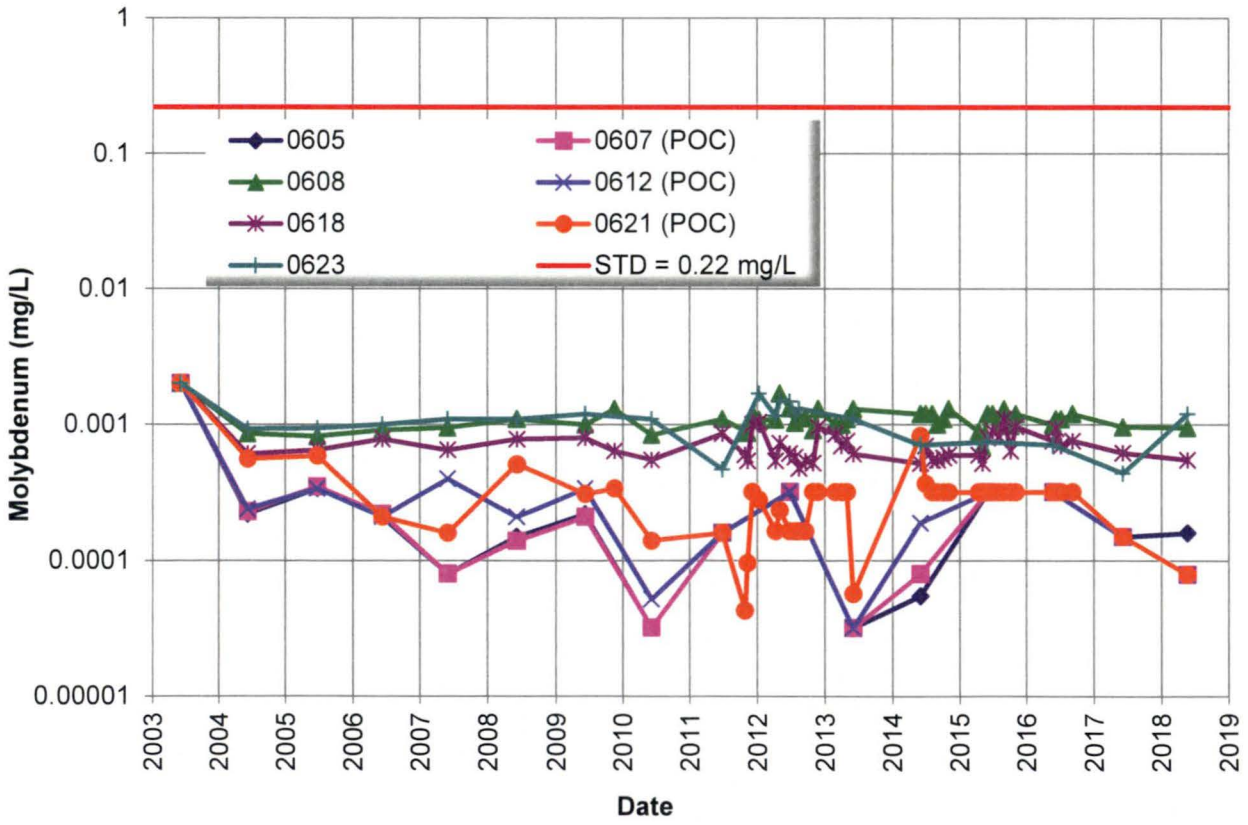

Figure 4-3. Molybdenum in Groundwater at the Durango, Colorado, Disposal Site

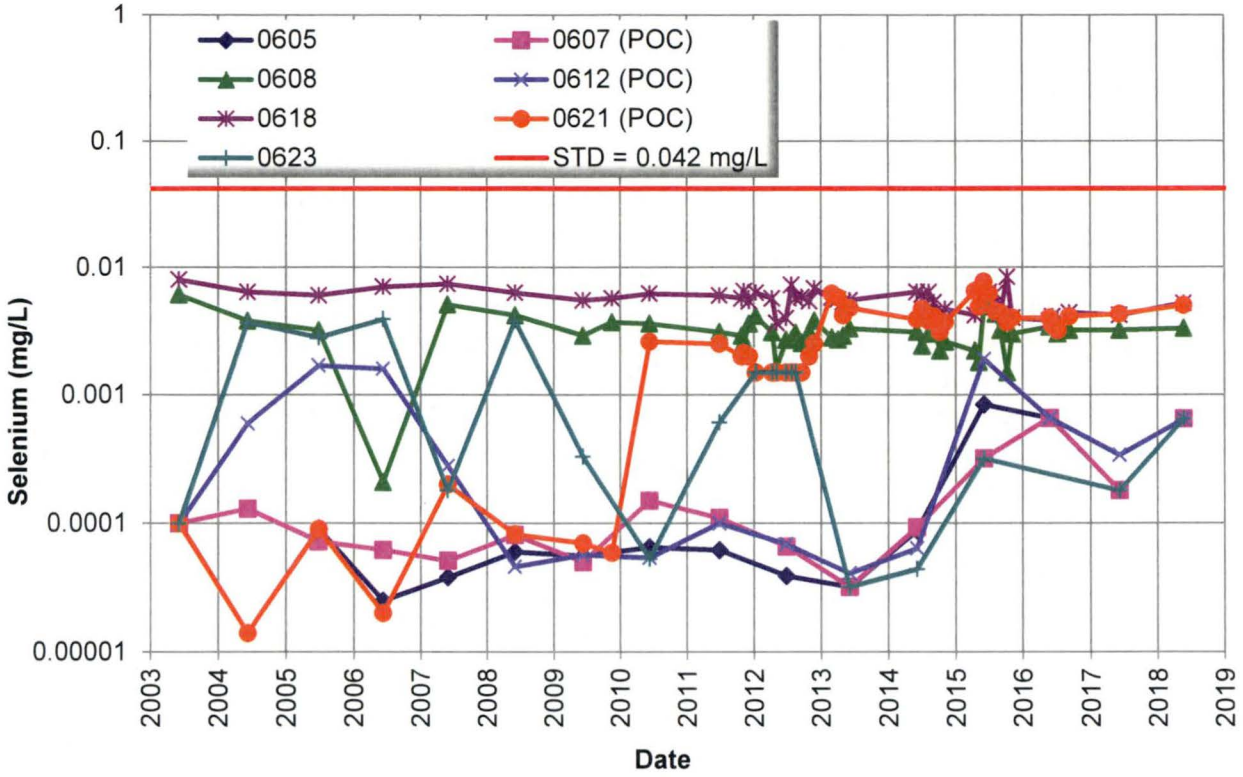

Figure 4-4. Selenium in Groundwater at the Durango, Colorado, Disposal Site

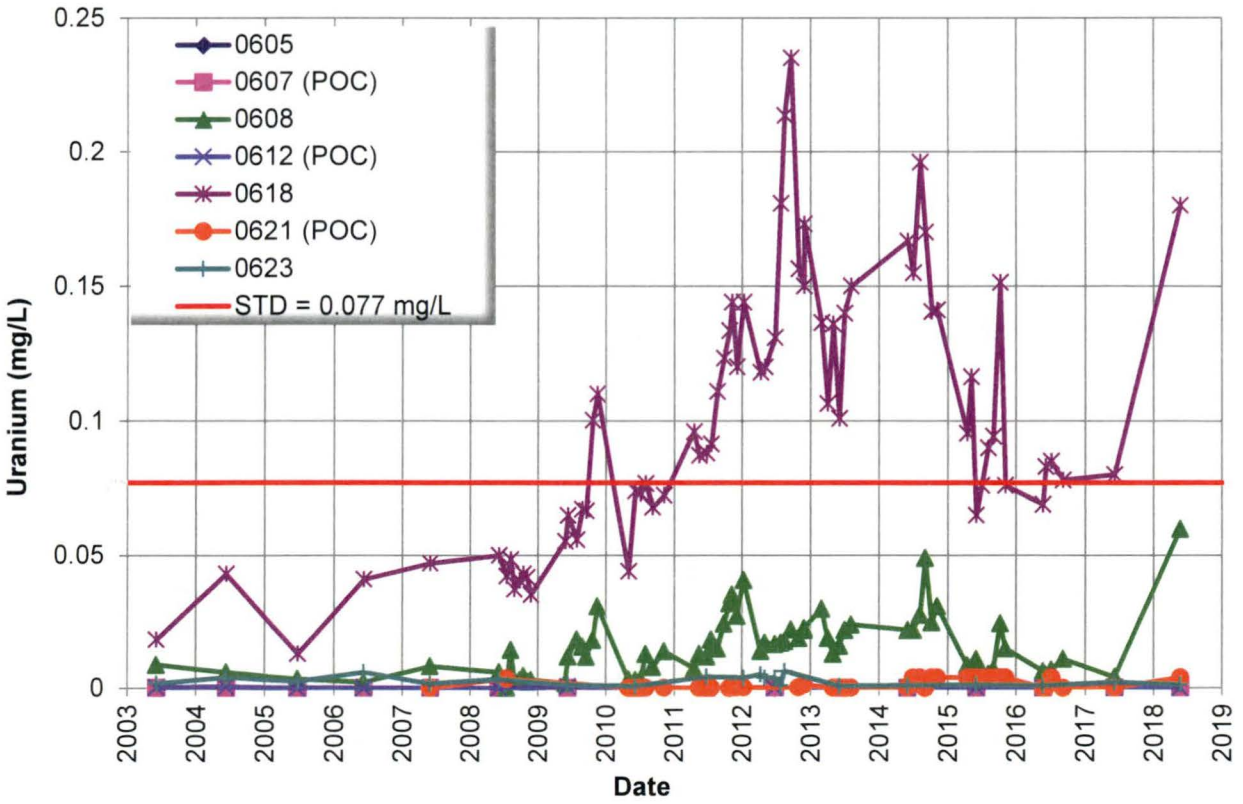

Figure 4-5. Uranium in Groundwater at the Durango, Colorado, Disposal Site

Molybdenum, selenium, and uranium concentrations in POC wells (0607, 0612, and 0621) in the uppermost aquifer are below the respective standards. Therefore, disposal cell performance remains unaffected.

Wells completed in the alluvium are sampled as a best management practice. Uranium concentrations in well 0618 have consistently been higher than concentrations in the other wells onsite. To monitor and compare the elevated and variable uranium concentrations observed in this well, wells 0608, 0618, and 0621 are sampled monthly as weather permits. Figure 4-5 shows an overall decreasing trend in uranium concentrations in well 0618 from 2014 to 2017, with concentrations varying around 0.08 milligrams per liter (mg/L). In 2018, uranium concentrations in well 0618 increased from 0.08 mg/L to 0.18 mg/L, which is within the range of measured historical concentrations. Compliance with the LTSP is not affected by this increase or exceedance of the site-specific standard because well 0618 is not a POC well. Investigating the cause of this variability continues.

4.8.2 Vegetation Monitoring

Vegetation on top of the disposal cell remains healthy. The LTSP requires plants on the disposal cell cover to be removed by either selective spraying or mechanical removal when their shoot height equals or exceeds 3.5 ft. 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 shoots for woody species were found on the side slopes and will be treated with herbicide before the 2019 annual inspection.

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	0	Base of Perimeter Sign P62 (Undercut)
PL-2	140	Perimeter Sign P45 in Arroyo (Sign Moved Following Inspection)
PL-3	180	Vegetation Encroaching on Perimeter Sign P51 (Removed Following Inspection)
PL-4	0	Site Marker SMK-2 on Top of Disposal Cell (Repaired and Stabilized Following Inspection)
PL-5	345	Brush Overgrown Around Boundary Monument BM-1 (Removed Following Inspection)
PL-6	0	Erosion of North Witness Corner of Boundary Monument BM-3 (Addressed Following Inspection)
PL-7	315	18-Foot Linear Depression (Rocks Have Rotated Inward and Downward)
PL-8	15	18-Foot Linear Depression (Rocks Have Rotated Inward and Downward)
PL-9	30	Topographic Variation on Northeast Side Slope of Disposal Cell
PL-10	105	Topographic Variation on Northeast Side Slope of Disposal Cell
PL-11	30	(a) Northeast Outflow, 2018 (b) Northeast Outflow, 2006 Photo for Comparison
PL-12	275	Debris near Site Entrance Gate (Removed Following Inspection)

PL-1. Base of Perimeter Sign P62 (Undercut)

PL-2. Perimeter Sign P45 in Arroyo
(Sign Moved Following Inspection)

PL-3. Vegetation Encroaching on Perimeter Sign P51
(Removed Following Inspection)

PL-4. Site Marker SMK-2 on Top of Disposal Cell
(Repaired and Stabilized Following Inspection)

PL-5. Brush Overgrown Around Boundary Monument BM-1
(Removed Following Inspection)

PL-6. Erosion of North Witness Corner of Boundary Monument BM-3
(Addressed Following Inspection)

PL-7. 18-Foot Linear Depression (Rocks Have Rotated Inward and Downward)

PL-8. 18-Foot Linear Depression (Rocks Have Rotated Inward and Downward)

PL-9. Topographic Variation on Northeast Side Slope of Disposal Cell

PL-10. Topographic Variation on Northeast Side Slope of Disposal Cell

PL-11 (a). Northeast Outflow, 2018

PL-11 (b). Northeast Outflow, 2006 Photo for Comparison

PL-12. Debris near Site Entrance Gate
(Removed Following Inspection)

5.0 Falls City, Texas, Disposal Site

5.1 Inspection Summary

The Falls City, Texas, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected on February 6, 2018. No changes were observed in the disposal cell or associated drainage features. Inspectors identified and addressed several minor maintenance needs but found no cause for a follow-up inspection.

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducts annual groundwater monitoring as a best management practice. The most recent sampling event occurred in February 2018. 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 Inspection Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific LM Long-Term Surveillance Plan (LTSP) (DOE 2008) and in procedures that LM 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 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 NRC general license (10 CFR 40.27) 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 Texas Commission on Environmental Quality (TCEQ) and LM 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. LM confirmed that the deed restrictions remained in recorded real property documents. The two landowners have agreed to seek approval from LM and the State for any future construction.

5.4 Inspection Results

The site, 8 miles southwest of Falls City, Texas, was inspected on February 6, 2018. The inspection was conducted by M. Widdop and K. Broberg of the Legacy Management Support (LMS) contractor. T. Jasso (LM site manager), P. Robinson (LM), K. Tu, T. Gonzalez, N. Traphan, and M. Kawasmi (Uranium and Technical Assessments Section, Radioactive Materials Division, TCEQ); R. Lyssy (site maintenance subcontractor); and C. McKay (Tetra Tech, the ConocoPhillips technical support contractor for the Conquista site) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and determine the need, if any, for maintenance or additional inspection and monitoring.

5.4.1 Site Surveillance Features

Figure 5-1 shows the locations of site features in black, 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 2018 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. The entrance sign is next to the main entrance gate. No maintenance needs were identified.

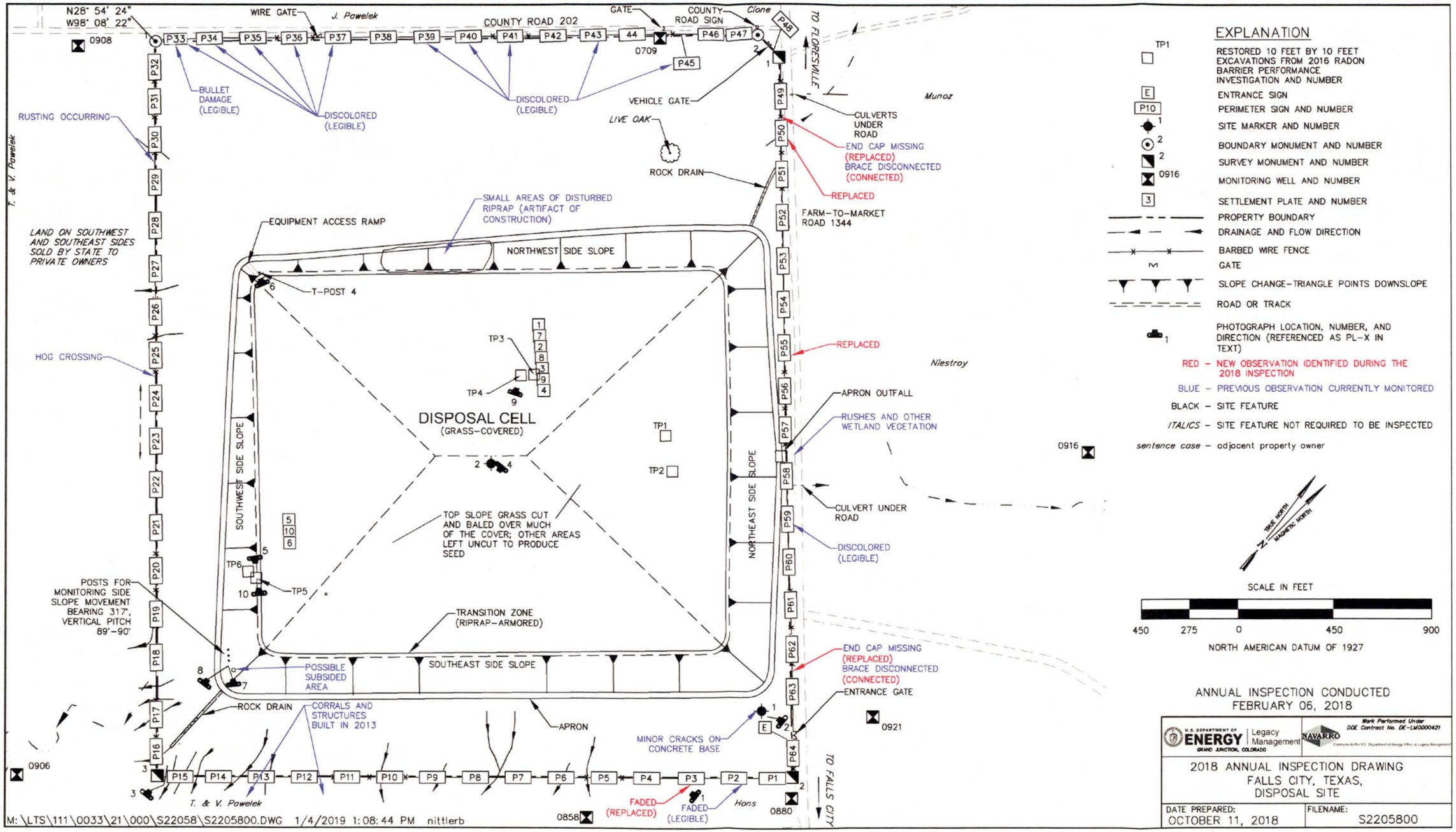

Figure 5-1. 2018 Annual Inspection Drawing for the Falls City, Texas, Disposal Site

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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 except along the northwest side, where the fence was replaced in 2006. Groundwater samplers tightened the top strand of the perimeter fence south of the main entrance gate in 2017. The site maintenance subcontractor recommends that LM 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. End caps were disconnected at three braces along the perimeter fence line. Following the inspection, the end caps were reconnected.

There are 64 perimeter signs, attached to steel posts set in concrete, positioned along the property boundary, set back 5 feet (ft). Perimeter sign P33 has bullet damage but remains legible. Additional perimeter signs are fading but remain legible. Two discolored and faded perimeter signs identified in the 2017 annual inspection were replaced by the maintenance subcontractor before the 2018 annual inspection (P50 and P55). Perimeter sign P3 was faded (PL-1) and was replaced following the inspection. No other maintenance needs were identified.

5.4.1.3 Site Markers

The site has two site markers. Site marker SMK-1 is just inside the entrance gate. The corners of the concrete base around the marker are cracked (PL-2). The cracks appear to be unchanged from last year, and repairs are not needed at this time. Site marker SMK-2 is on the top slope of the disposal cell. No 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 (PL-3). All monuments were located. 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 February 2018 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. Two cuttings around the cell and one partial cutting on the top slope were completed in 2017. The maintenance subcontractor let a portion of the grass on the top slope set seed (PL-4). The maintenance subcontractor will spot-spray woody vegetation that inspectors found distributed sporadically in the uncut grass. 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 top 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 top of the disposal cell during the 2018 inspection.

The disposal cell side slopes are armored with riprap (PL-5). LM has monitored several small depressions on the northwest side slope of the disposal cell since 2010. These depressions do not compromise the protectiveness of the riprap 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-6). These photos were compared to photos taken in previous years 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, LM 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 degrees to monitor side slope movement. Each post was installed at a vertical pitch of 90 degrees. 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-7 and PL-8).

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.

There were no issues with the vegetation management on top of the disposal cell and on side slopes. Much of the vegetation observed on the side slopes 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. No additional maintenance concerns were noted on the top and side slopes of the disposal cell.

LM participated 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 standard. Test pit (TP) locations TP1 and TP2 were not found during the 2018 inspection, but vegetation was well established in 2017. Vegetation has reestablished at TP3 and TP4 on top of the disposal cell (PL-9). Locations TP5 and TP6 are on the southwest side slope of the disposal cell within the riprap (PL-10). LM will continue to monitor these locations to confirm that positive drainage is preserved and vegetation continues to thrive at the grass-covered test pits.

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 2018 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 fence, along rock drains, and around some 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 2018 inspection. An area where hogs enter the site was observed, but no resultant perimeter fence damage was observed; the area 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 adjacent 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. LM contacted the owners and determined that the owners had received a letter that LM wrote to the previous owner granting approval for construction of ranching-related structures. In 2017, LM sent follow-up letters to the property

owners informing them that they need to request approval from LM and the State of Texas in the future for all new construction.

Karnes County Road 202 runs along the northwest side of the property boundary. Public access to the road was restricted by a locked gate before 2011. The road has been open since then, but this has not led to increased vandalism or trespassing at the site.

5.5 Follow-Up Inspections

LM 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) LM 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

Two discolored and faded perimeter signs (P50 and P55) identified during the 2017 annual inspection were replaced by the maintenance subcontractor before the 2018 annual inspection. One discolored and faded perimeter sign (P3) was replaced during the February 2018 sampling event. End caps on several fence braces had become disconnected and were reconnected during the February 2018 sampling event. No other maintenance needs were identified.

5.7 Emergency Response

Emergency response is action LM 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). LM conducts groundwater monitoring as a best management practice. The most recent sampling event occurred in February 2018.

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.

Table 5-2 and Figure 5-2 present the groundwater monitoring network at the site, which consists of five groundwater compliance monitoring wells and seven disposal cell performance monitoring wells. 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.

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.

LM has determined that pH and uranium concentrations do not correlate (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 or buffering of low-pH groundwater. Therefore, increasing uranium levels at a monitoring well without an attendant drop in pH might still 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.

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]).

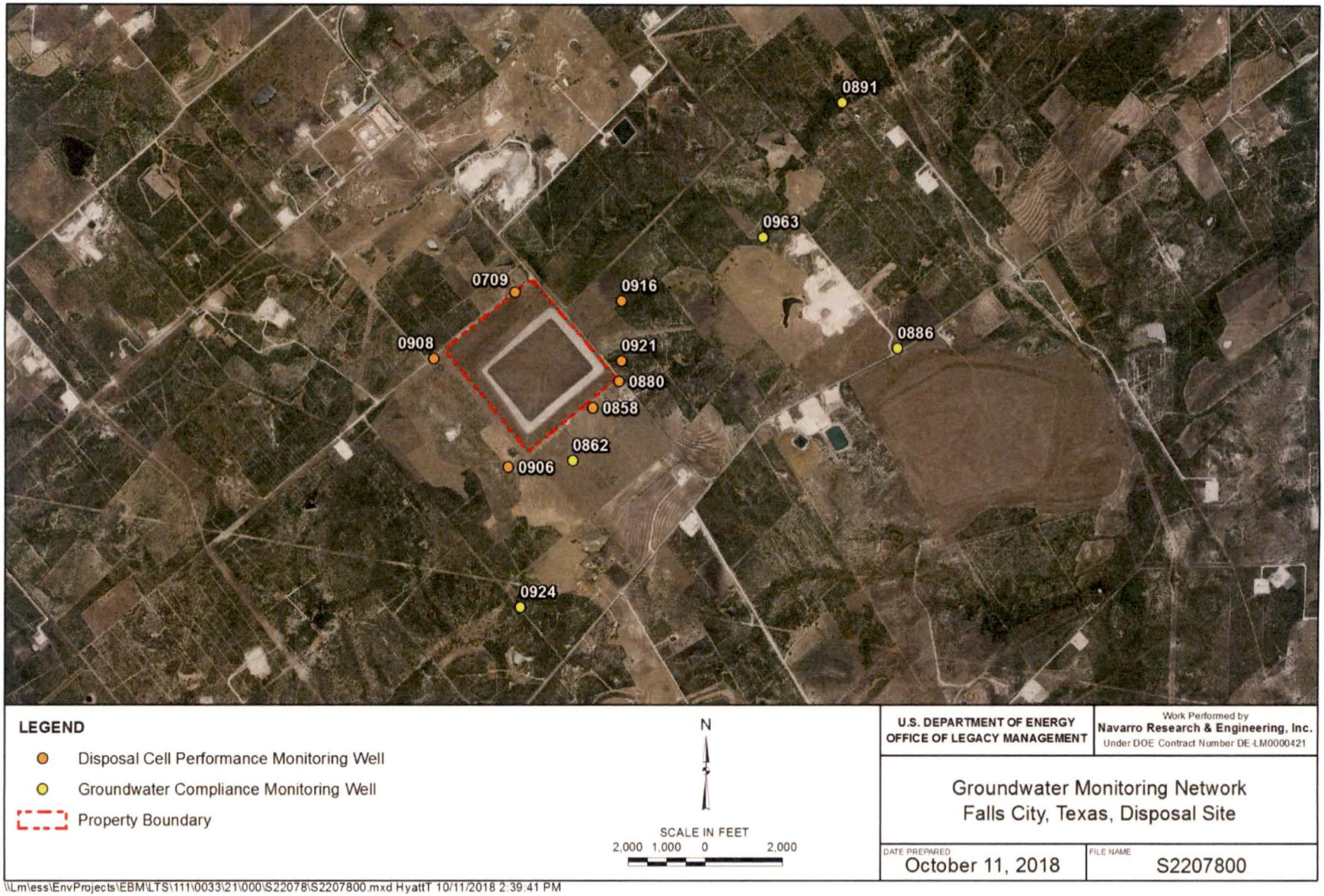


Figure 5-2. Groundwater Monitoring Well Network at the Falls City, Texas, Disposal Site

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. All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System website (http://gems.lm.doe.gov/#site=FCT).

5.8.2 Groundwater Level Monitoring Results

Since 1996, groundwater levels in the disposal cell performance monitoring wells have decreased overall, with decreases ranging from approximately 3 to 12 ft (Figure 5-3). In 2018, water level trends in monitoring wells 0709, 0858, and 0906 continued to increase slightly from recent lows (Figure 5-3), while trends in monitoring well 0921 continue downward. Monitoring wells 0880 showed a slight decrease. 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. The reason why 0906 fluctuates more than other wells is unknown. 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 or (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.

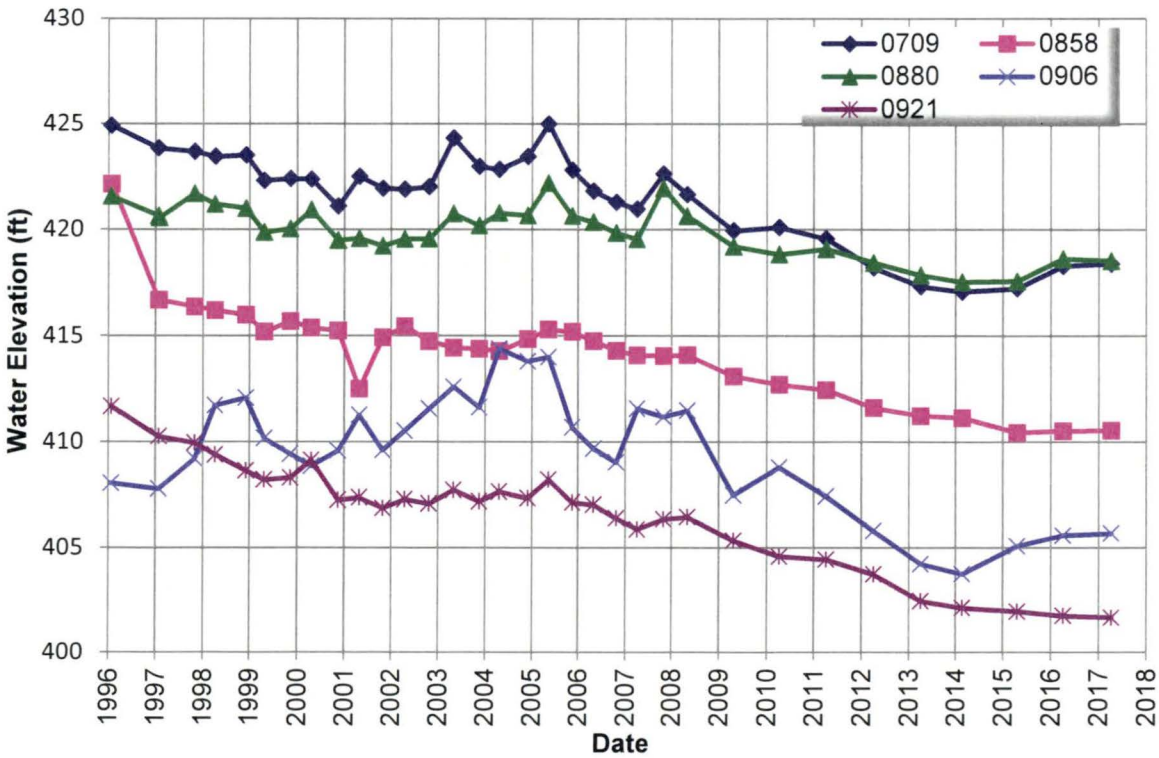


Figure 5-3. Water-Level Measurements at Disposal Cell Performance Monitoring Wells at the Falls City, Texas, Disposal Site

Water level trends vary in the groundwater compliance monitoring wells (Figure 5-4). The 2018 data show a slight upward trend in monitoring wells 0862 and 0886; overall, these water levels have increased about 4 ft since 1996. Slight decreases were observed in monitoring wells 0891, 0924, and 0963, which have fluctuated over time. Water levels in monitoring well 0891 and 0963 are approximately 2.5 ft and 5 ft higher than 1996 levels. Water levels in monitoring well 0924 have decreased approximately 1.3 ft since 1996 levels.

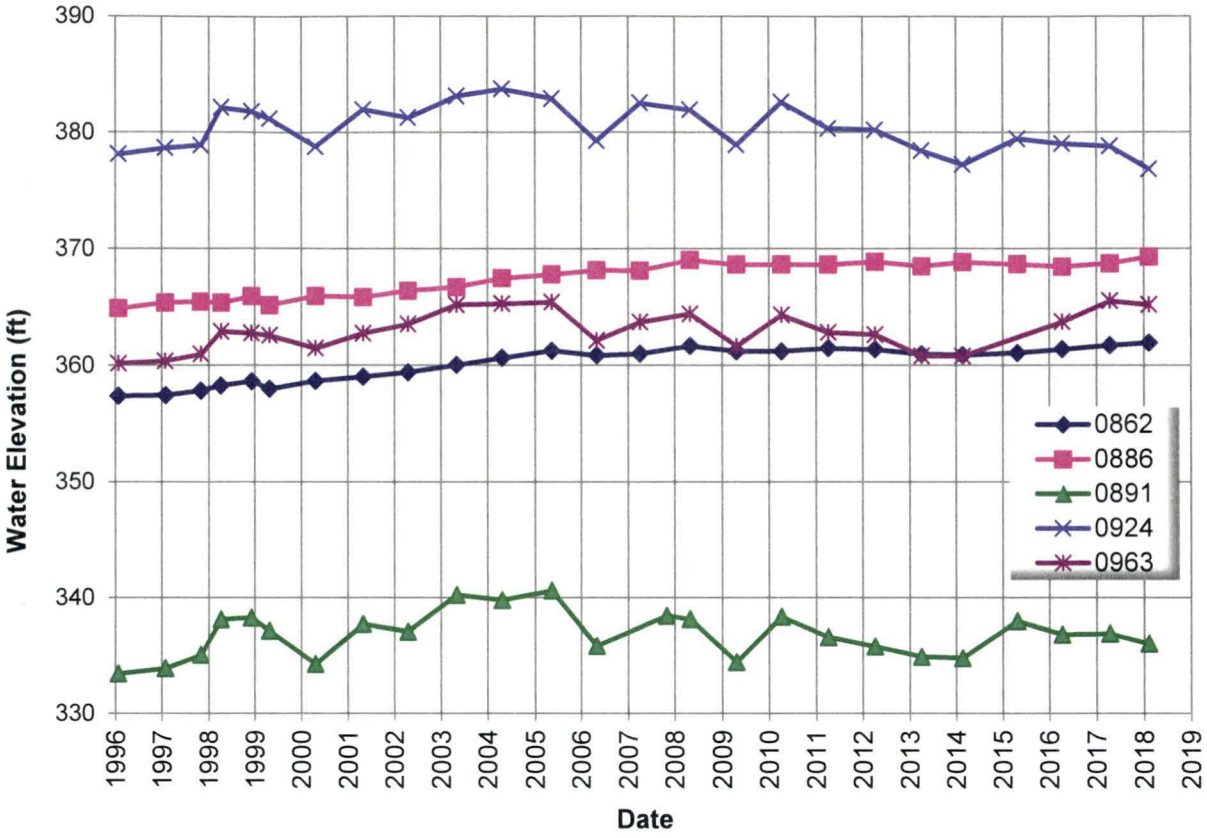


Figure 5-4. Water-Level Measurements at Groundwater Compliance Monitoring Wells at the Falls City, Texas, Disposal Site

5.8.3 Groundwater Quality Monitoring Results

pH: At the disposal cell performance monitoring wells, pH levels have historically been higher than the pH in tailings pore fluids (pH level of 2.93), with no significant upward or downward trends. In 2018, the pH levels in monitoring wells 0858 and 0906 decreased slightly, while the pH levels for monitoring wells 0709, 0880, and 0921 increased slightly. The 2018 pH levels were within the range of historical values for all disposal cell performance monitoring wells (Figure 5-5).

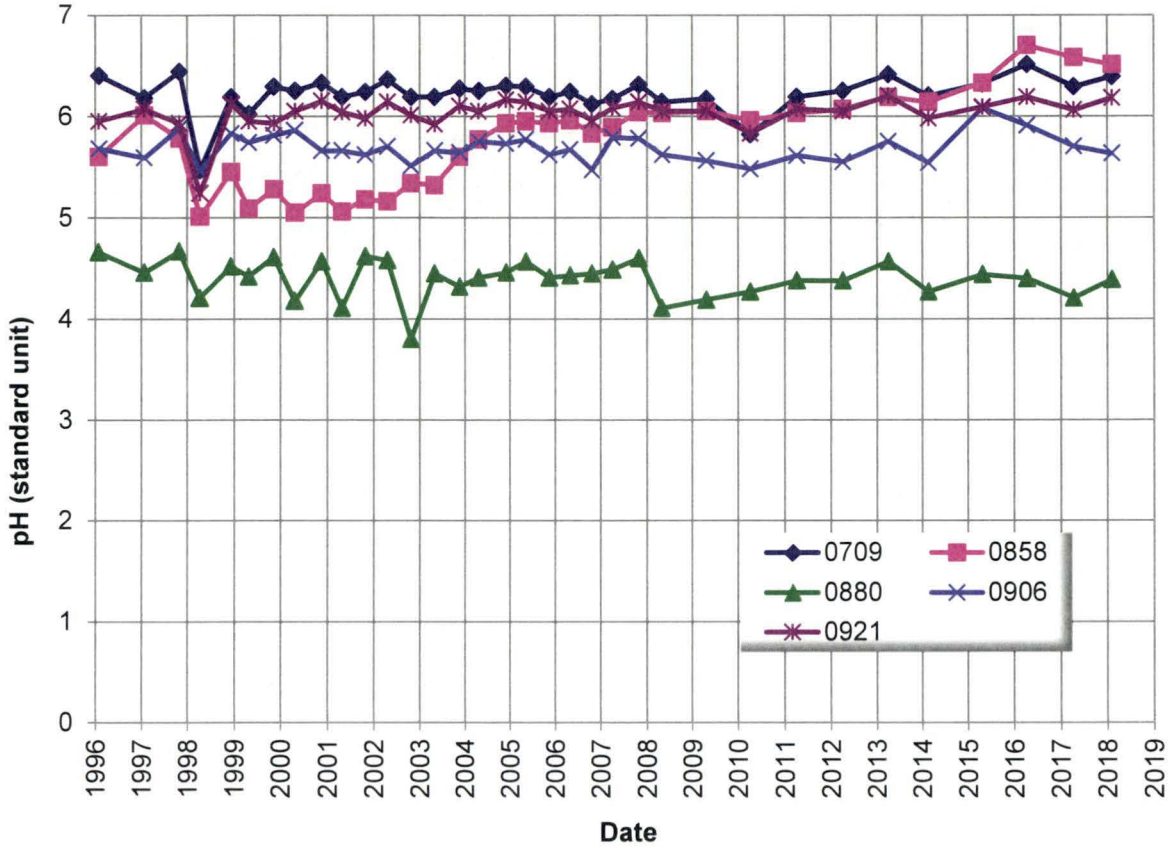


Figure 5-5. pH at Disposal Cell Performance Monitoring Wells at the Falls City, Texas, Disposal Site

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 2018, the pH levels for monitoring wells 0862, 0891, and 0924 increased, while the pH levels for monitoring wells 0886 and 0963 slightly decreased (Figure 5-6). The 2018 pH levels were within the range of historical values for all groundwater compliance monitoring wells, and the pH in groundwater at monitoring well 0891 has been near the historical maximum from 2016. The pH in monitoring well 0963 historically has been lower than at the other locations and in 2018 it remains similar to the pH in the tailings pore fluids.

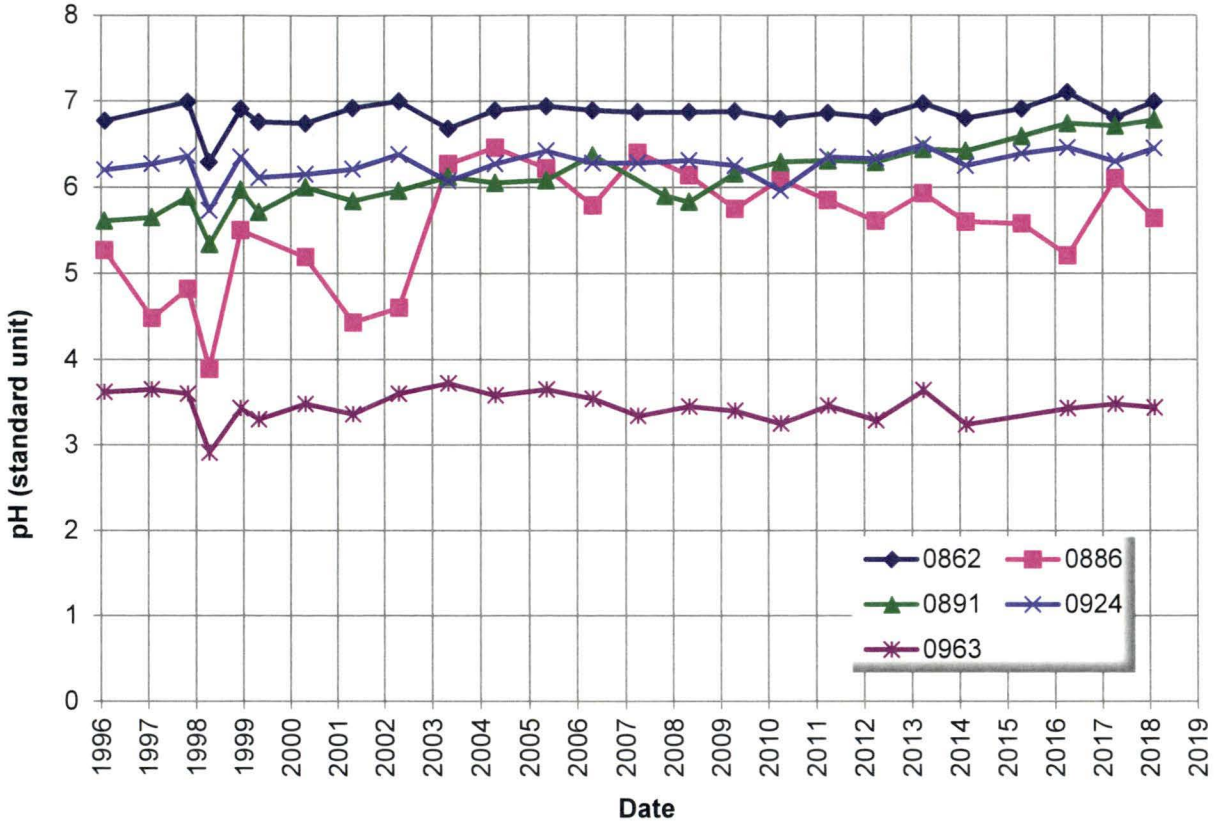


Figure 5-6. pH at Groundwater Compliance Monitoring Wells at the Falls City, Texas, Disposal Site

Uranium: The 2018 uranium concentrations for disposal cell performance monitoring wells were within the range of historical values for all groundwater compliance monitoring wells (Figure 5-7). In 2018, the uranium concentrations for monitoring wells 0709, 0906, and 0921 decreased, while the uranium concentrations in monitoring well 0858 increased slightly. Monitoring well 0880 increased from 3.1 milligrams per liter (mg/L) to 7.6 mg/L. A downward trend has occurred in monitoring well 0880 since 2004, with considerable variation, ranging from a low of 1.38 mg/L in 2008 to a high of 14 mg/L in 2004. The 2018 uranium result may be a continuation of that variability.

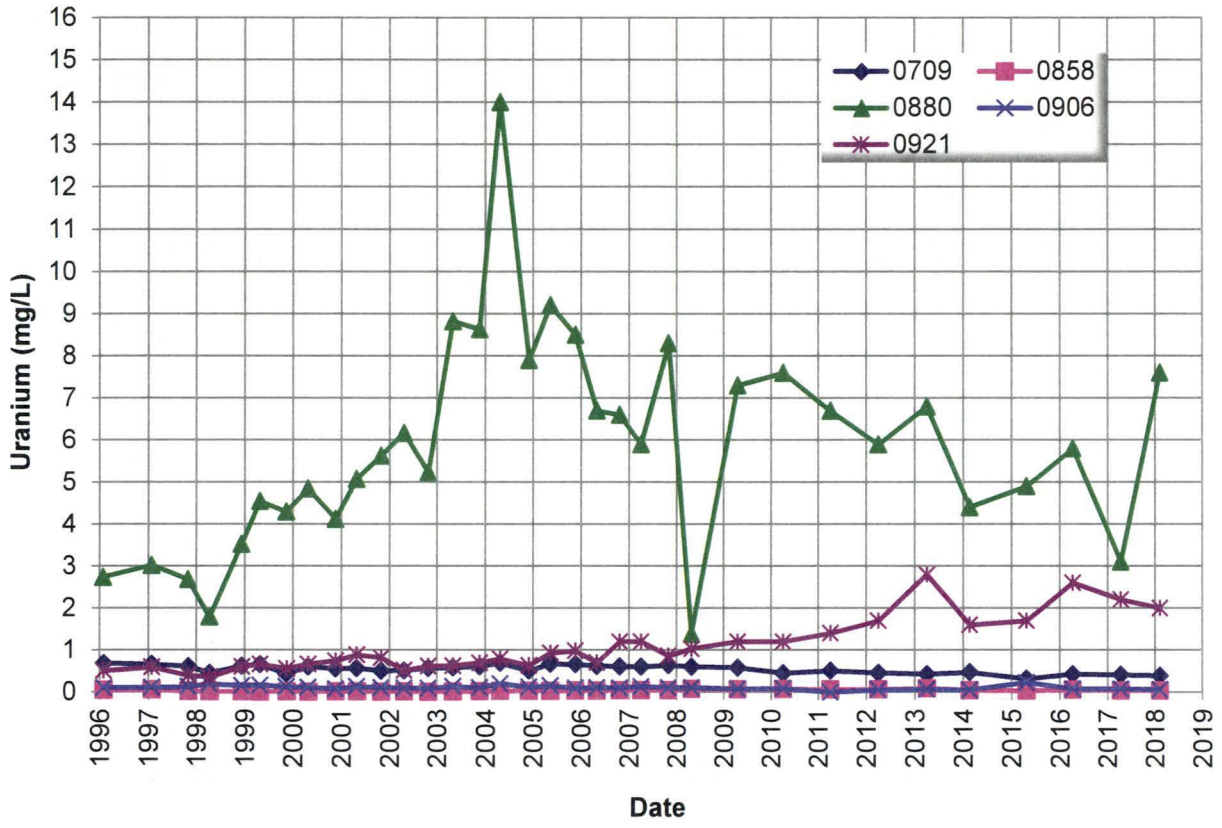


Figure 5-7. Uranium Concentrations at Disposal Cell Performance Monitoring Wells at the Falls City, Texas, Disposal Site

The 2018 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 greater than at other monitoring wells. The 2018 uranium result (1.2 mg/L) at monitoring well 0891 is a decrease from the 2017 uranium result (2.5 mg/L), remaining below the value used in the risk assessment for the Dilworth groundwater (3.04 mg/L). This suggests that a slug of groundwater with elevated uranium has flowed past this location.

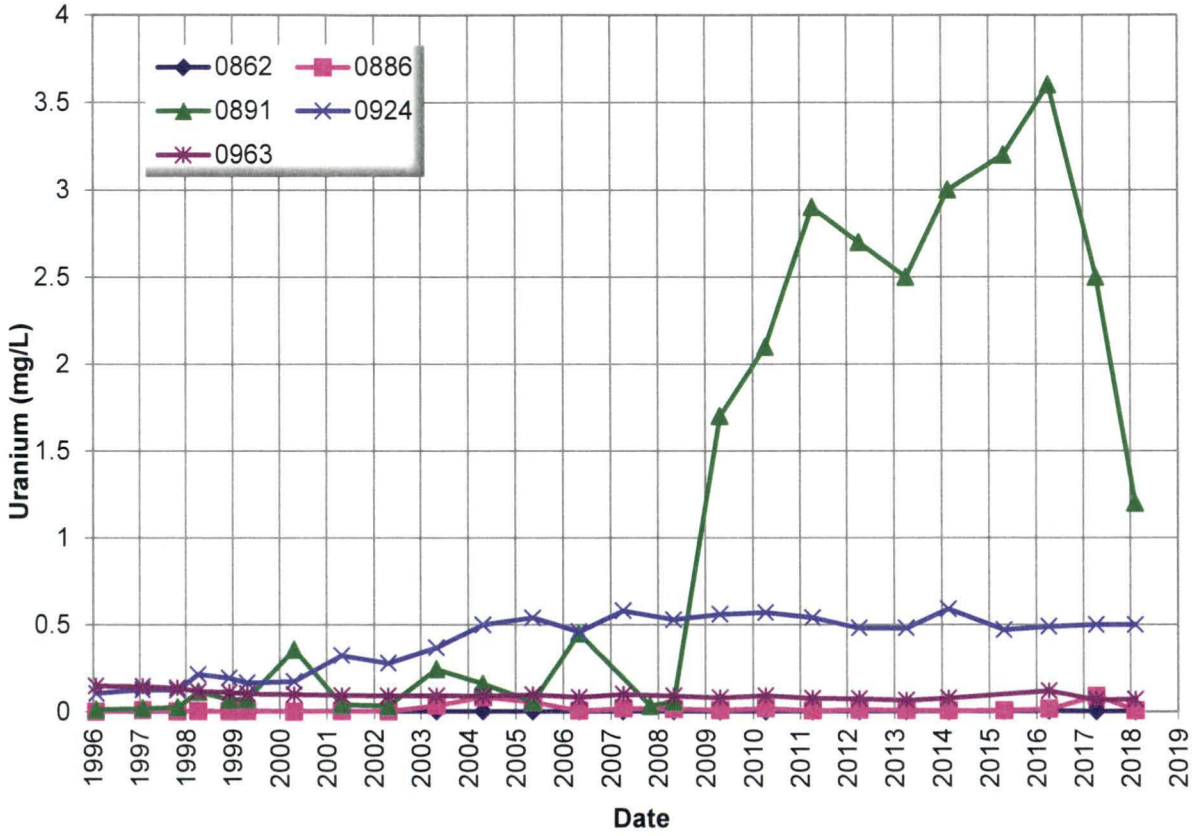


Figure 5-8. Uranium Concentrations in Groundwater Compliance Monitoring Wells at the Falls City, Texas, Disposal Site

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 1.2 mg/L in 2017 (Figure 5-7). The pH at this location is less 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 2018 (Figure 5-3). These results suggest that the interaction among the disposal cell (located on a groundwater divide and near the formation subcrop), a 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 monitoring well 0891 since 2008, which have been decreasing since 2015, likely reflects the passage of a slug of groundwater with elevated uranium flowing from the direction of the former processing site.

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.

LM 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 LM would not plug and abandon the 12 monitoring wells at the site until the nearby UMTRCA Title II Conquista, Texas, Disposal Site transfers to LM. The Conquista site is just southeast of the site. Upon transfer of the Conquista site, LM will assess whether a joint monitoring approach is warranted (either as a one-time event or as periodic monitoring). Once NRC accepts the Conquista site monitoring strategy, 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. Environmental Protection Agency, "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	Perimeter Sign P3 (Replaced Following Inspection)
PL-2	270	Site Marker SMK-1
PL-3	0	Survey Monument SM-3
PL-4	180	View Across Disposal Cell from Site Marker SMK-2
PL-5	135	Southwest Side Slope
PL-6	300	Riprap Condition at T-Post 4
PL-7	315	Looking Down Line of T-Posts
PL-8	340	Measuring Orientation of T-Post
PL-9	340	Test Pits TP3 and TP4
PL-10	315	Test Pit TP6

PL-1. Perimeter Sign P3 (Replaced Following Inspection)

PL-2. Site Marker SMK-1

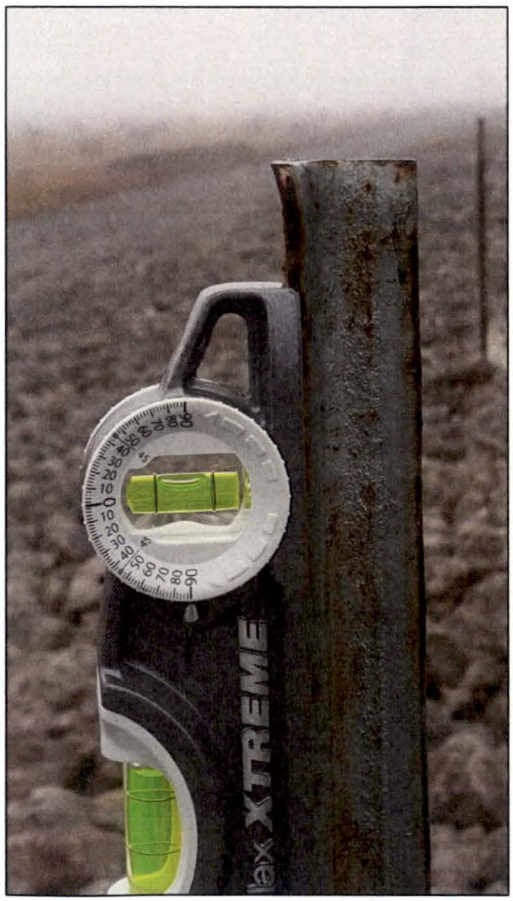
PL-3. Survey Monument SM-3

PL-4. View Across Disposal Cell from Site Marker SMK-2

PL-5. Southwest Side Slope

PL-6. Riprap Condition at T-Post 4

PL-7. Looking Down Line of T-Posts



PL-8. Measuring Orientation of T-Post

PL-9. Test Pits TP3 and TP4

PL-10. Test Pit TP6

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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, 2018. 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 immediate maintenance needs or find cause for a follow-up inspection.

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducts annual groundwater monitoring as a best management practice. Three monitoring wells are sampled to verify that groundwater in onsite paleochannels is not affected by seepage (transient drainage) from the disposal cell. Groundwater monitoring was last completed in August 2018. 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 LM Interim Long-Term Surveillance Plan (LTSP) (DOE 1998) and in procedures LM 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 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)
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. Low-level radioactive waste will be received until the disposal cell's legally mandated closure date or until it is filled to capacity. Under Public Law 104-259, which authorizes LM's operation of the site, the cell will close in 2023. Reauthorization of Public Law 104-259 is expected, with an extension of the closure date through 2048. 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, 2018. The inspection was conducted by S. Woods, K. Roemer, D. Popham, and P. Wetherstein of the Legacy Management Support contractor. B. Frazier (LM site manager), J. Doebele (Colorado Department of Public Health and Environment), and Kyle Brown and Bruce Akers (LM) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the Interim LTSP, and determine the need, if any, for maintenance or additional inspection and monitoring.

6.4.1 Site Surveillance Features

Figure 6-1 shows the locations of site features in black, 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 2018 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 that provides access to a right-of-way and access road. LM 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. LM maintains this right-of-way, including a two-lane asphalt access road. The entrance gate is a double-swing chainlink gate secured by a LM lock and chain (PL-1). 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-2). Perimeter signs P13, P15, 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.

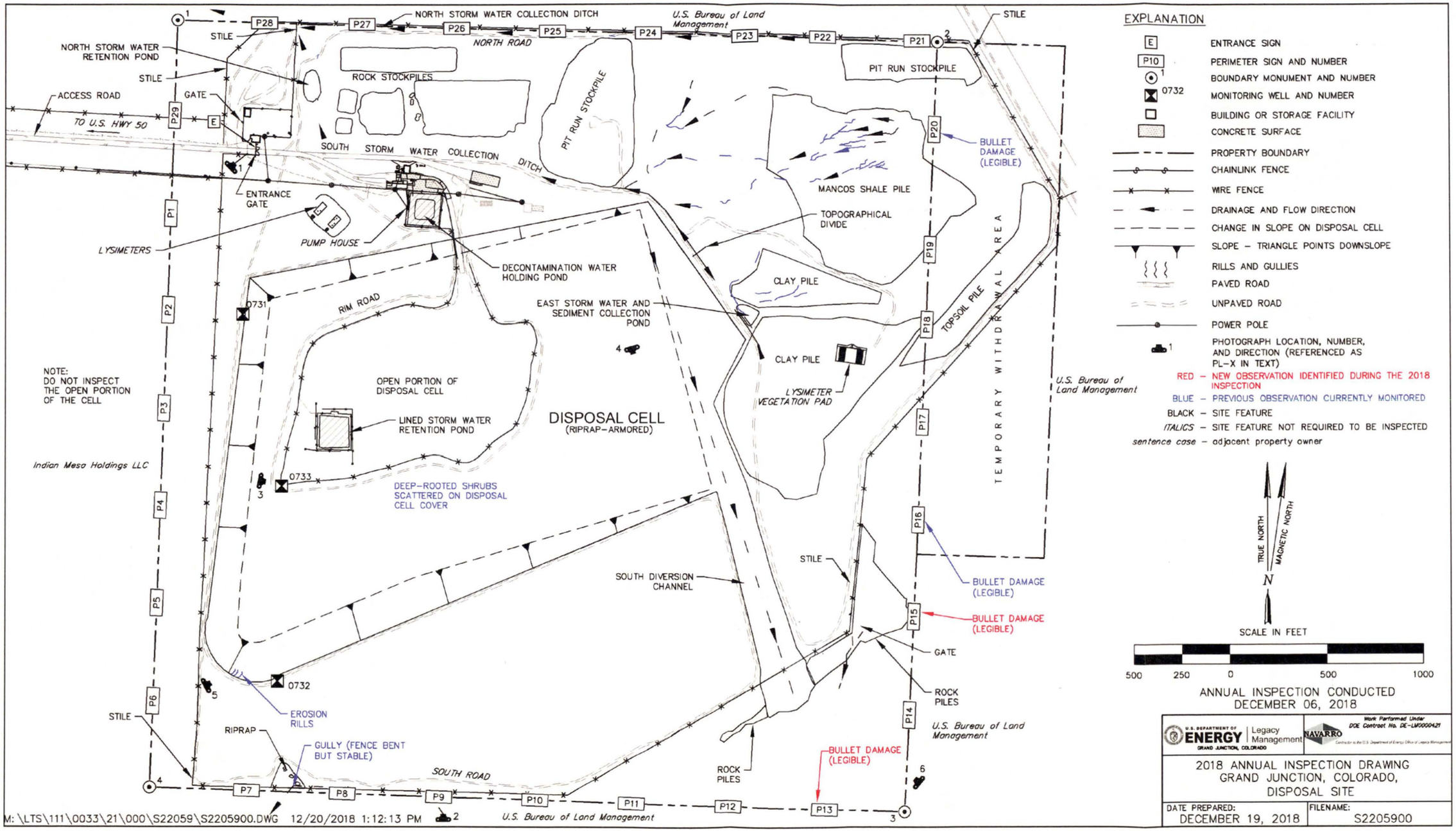

Figure 6-1. 2018 Annual Inspection Drawing for the Grand Junction, Colorado, Disposal Site

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6.4.1.4 Boundary Monuments

Four boundary monuments delineate the corners of the property boundary. No maintenance needs were identified.

6.4.1.5 Monitoring Wells

The groundwater monitoring network consists of three monitoring wells (PL-3). 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.

On the disposal cell cover, numerous areas with alkali deposits have been reported during previous inspections and were visible during the 2018 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, LM 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 (PL-5). The channels do not threaten the integrity of the disposal cell, and no significant changes were noted in 2018. 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 (PL-6). 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.

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. 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 and maintenance performed as necessary.

In addition to the perimeter signs, the perimeter fence also has warning signs. One of the warning signs near P7 was illegible and will be replaced in the future. No immediate 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

LM 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) LM 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 immediate 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, LM 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). 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. LM monitors groundwater from three monitoring wells adjacent to and in the disposal cell to verify that groundwater in onsite paleochannels is not affected by seepage (transient drainage) from the disposal cell. The most recent sampling event occurred in August 2018.

Two monitoring wells (0731 and 0732) are completed in 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 (DOE 1998). The third monitoring well is in the southwest corner of the open portion of the disposal cell and is completed in tailings, below the adjacent paleochannels (DOE 1998). Disposal cell construction was initiated by excavating Mancos Shale, which resulted in the base of the disposal cell being below the weathered Mancos Shale horizon. Monitoring well 0733 is primarily used to measure water levels within the disposal cell. All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System website (http://gems.lm.doe.gov/#site=GRJ).

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). This 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.

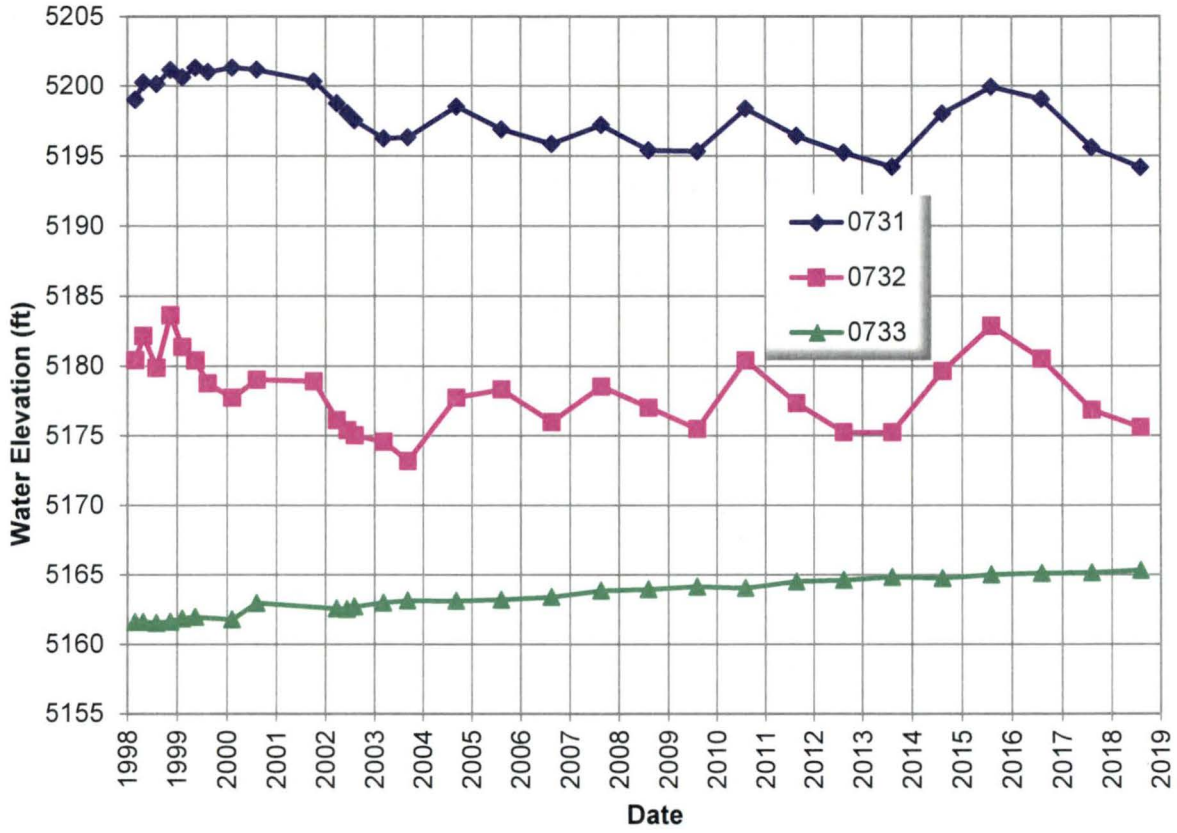

Figure 6-3. Water Level Measurements at the Grand Junction, Colorado, Disposal Site

6.8.2 Groundwater Quality Monitoring

Annual groundwater samples are analyzed for standard field parameters and the following indicator analytes: molybdenum, nitrate, polychlorinated biphenyls, selenium, sulfate, TDS, uranium, and vanadium. 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[a] (mg/L)
Molybdenum	0.1
Nitrate (as nitrogen)	10
Selenium	0.01
Uranium	0.044

Note:
[a] MCLs as listed in 40 CFR 192 Table 1 Subpart A.

Molybdenum concentrations in all three monitoring wells have remained steady since 1998; 2018 concentrations were less than or equal to 0.003 mg/L. Time-concentration plots from 1998 through 2018 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 0.86 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. Note: concentrations in monitoring well 0732 show an increase in nitrate concentrations exceeding historic levels. More data is needed to determine if this is an isolated occurrence or trend.

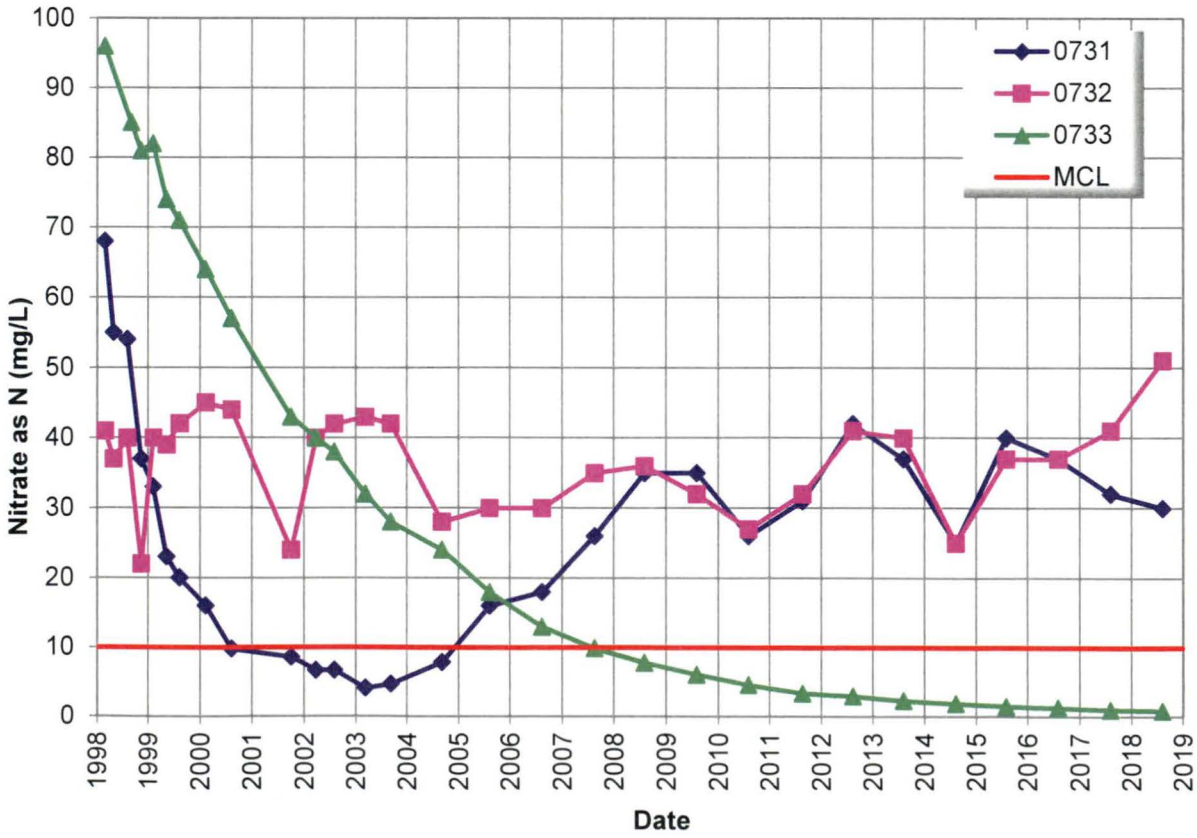

Figure 6-4. Nitrate (as Nitrogen) in Groundwater at the Grand Junction, Colorado, Disposal Site

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 with the alluvium. Background groundwater quality in these wells 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.

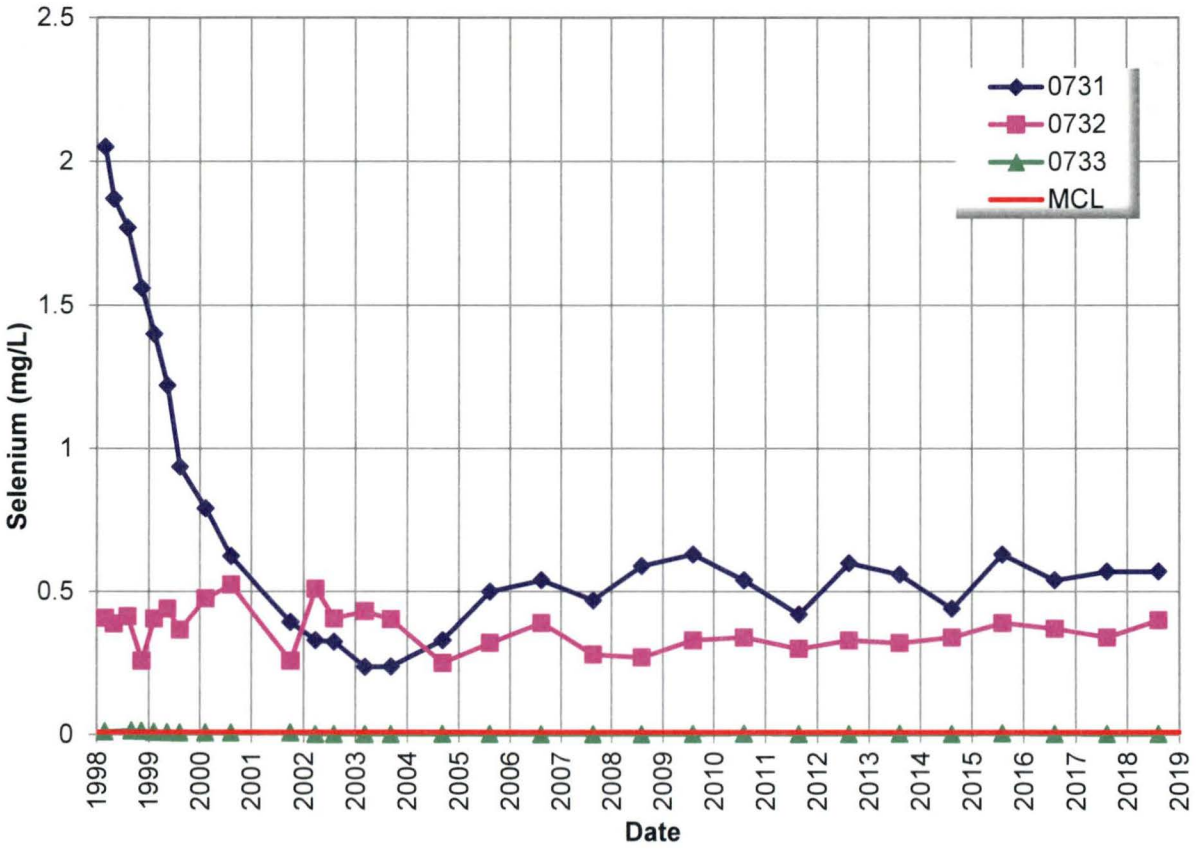

Figure 6-5. Selenium in Groundwater at the Grand Junction, Colorado, Disposal Site

Uranium concentrations in groundwater slightly exceed the MCL of 0.044 mg/L in both paleochannel monitoring wells. Paleochannel monitoring wells 0731 and 0732 have shown a consistent trend at or near the MCL concentration since 2011 (Figure 6-6). The uranium concentration in disposal cell monitoring well 0733 continues to increase with a 2018 concentration of 0.22 mg/L.

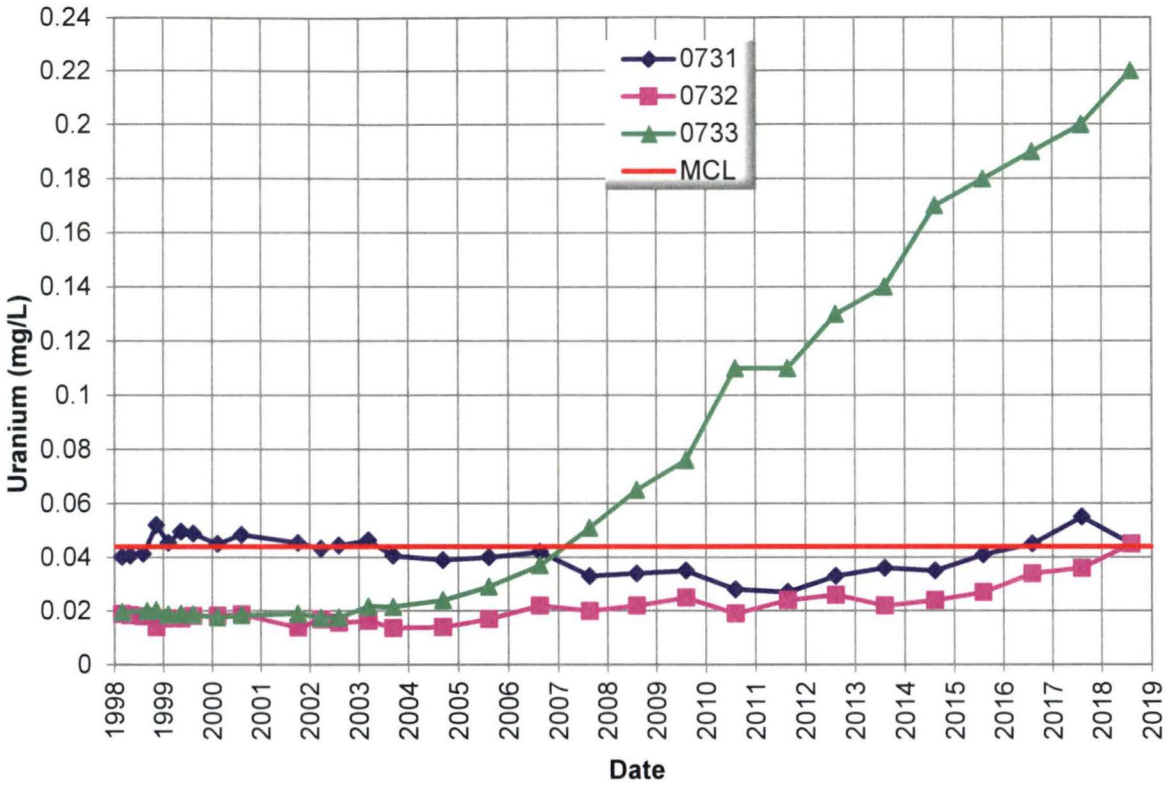

Figure 6-6. Uranium in Groundwater at the Grand Junction, Colorado, Disposal Site

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. Environmental Protection Agency, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations*.

40 CFR 192 Table 1 Subpart A. U.S. Environmental Protection Agency, "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, Environmental Restoration Division, UMTRA Project Team, Albuquerque, New Mexico, April.

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

6.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	45	Site Access Gate
PL-2	0	Perimeter Sign P9
PL-3	100	Monitoring Well 0733
PL-4	165	Disposal Cell Top Slope with Vegetation Growth
PL-5	60	Erosion Rills at Base of Southwest Corner of Disposal Cell
PL-6	310	South Diversion Channel

PL-1. Site Access Gate

PL-2. Perimeter Sign P9

PL-3. Monitoring Well 0733

PL-4. Disposal Cell Top Slope with Vegetation Growth

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

PL-6. South Diversion Channel

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 27, 2018. No changes were observed on the disposal cell or in the associated drainage features. Inspectors did not identify any maintenance needs or find cause for a follow-up or contingency inspection.

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducts annual groundwater monitoring to track disposal cell performance. Groundwater monitoring was last completed in June 2018. The site-specific LM Long-Term Surveillance Plan (LTSP) (DOE 1998) concentration limits were exceeded at multiple point-of-compliance (POC) wells. In 2011, LM developed a draft Groundwater Compliance Action Plan (GCAP) to update the groundwater monitoring requirements (DOE 2011). The draft GCAP expands the scope of the monitoring network and proposes alternate concentration limits (ACLs) and supplemental standards. In 2011, LM expanded the monitoring network per the draft GCAP, while continuing to meet the monitoring requirements of the LTSP. The draft GCAP has been approved by the State of Utah. LM received Requests for Additional Information from the U.S. Nuclear Regulatory Commission (NRC) in December 2018 and is planning to respond by April 2019.

7.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the LTSP and in procedures LM established to comply with the requirements of the 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 27, 2018. The inspection was conducted by R. Johnson, J. Price, and C. Dembinski of the LM Legacy Management Support contractor. J. Linard (former LM site manager) and H. Mickelson and C. Bishop (Utah Department of Environmental Quality) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and determine the need, if any, for maintenance or additional inspection and monitoring.

7.4.1 Site Surveillance Features

Figure 7-1 shows the locations of site features in black, 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 2018 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 either from 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 LM 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; LM 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. No maintenance needs were identified.

7.4.1.2 Security Fence and Perimeter Signs

A chain link 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 (PL-1), and a personnel gate is at the north corner of the security fence line. The security fence (PL-2) 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 P5 was faded but remains legible. No maintenance needs were identified.

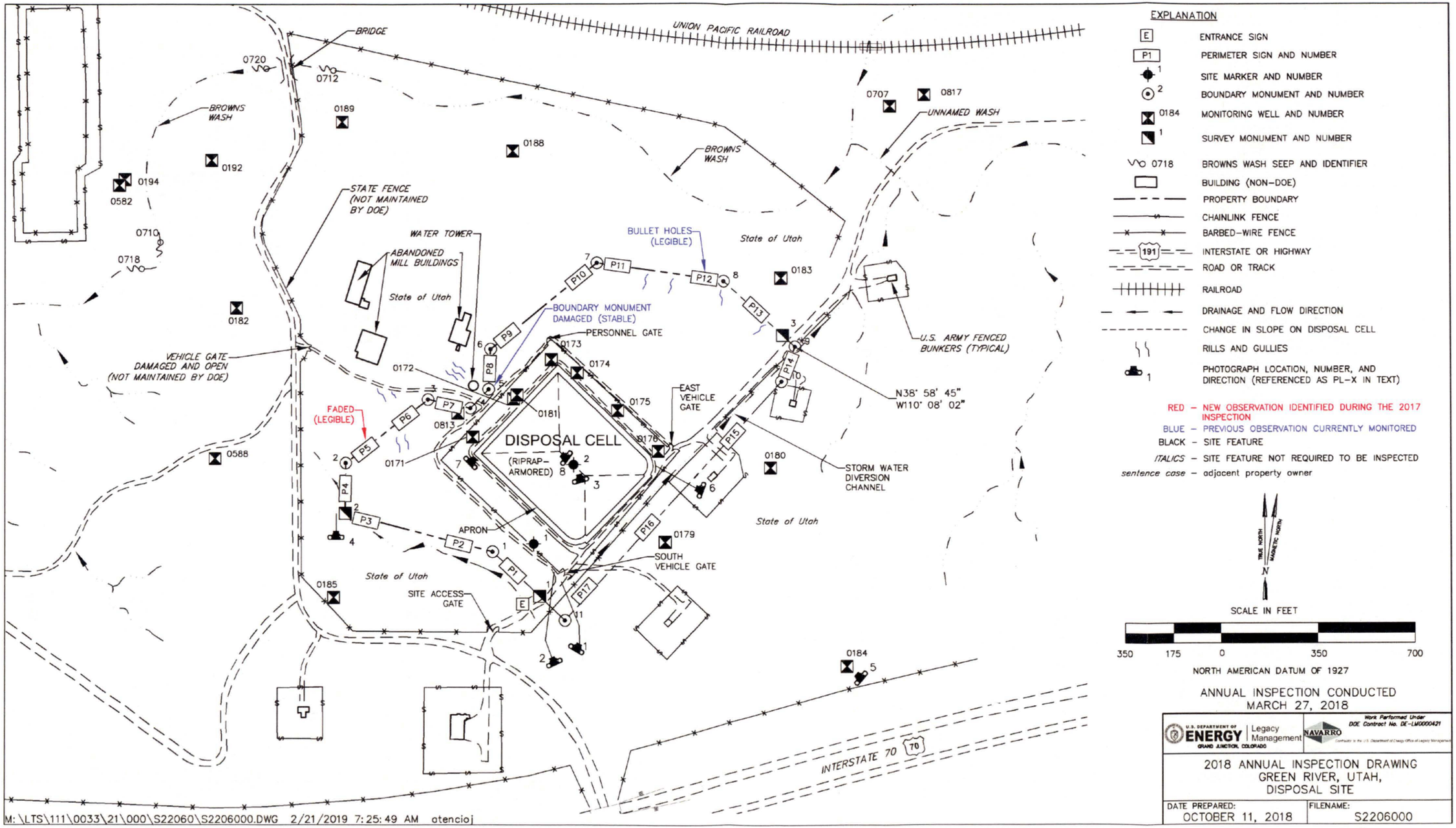

Figure 7-1. 2018 Annual Inspection Drawing for the Green River, Utah, Disposal Site

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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.

7.4.1.4 Survey and Boundary Monuments

Eleven boundary monuments and three survey monuments (PL-4) delineate the property boundary. Boundary monument BM-5 is damaged (it is bent from 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 2018 sampling event. All wellhead protectors observed during the inspection were undamaged and locked (PL-5). Some of the concrete monitoring well collars are cracked, 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 rock, 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 Perimeter Area In-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 is primarily from the west through a former mill access gate that has broken off its hinges; LM 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. Inspectors did not find any 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 but are 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 (approximately 400 feet [ft] from the base of the disposal cell). Maximum gully depth in this area is approximately 3 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 slowly. These erosional features could eventually damage site surveillance features (i.e., perimeter signs, boundary monuments, and the security fence). The closest erosional features are approximately 300 ft from the disposal cell and do not pose a risk to the integrity of the disposal cell. Inspectors will continue to monitor the erosion features. 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 (PL-8). The buildings are not maintained and are in 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

LM 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) LM 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

No 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. In 2011, LM developed a draft GCAP to update the groundwater monitoring requirements (DOE 2011). The draft GCAP expands the scope of the monitoring network and proposes ACLs and supplemental standards. The draft GCAP has been approved by the State of Utah. LM received Requests for Additional Information from NRC in December 2018 and is planning to respond by April 2019. The most recent sampling event occurred in June 2018.

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 hydrologic downgradient limit of the disposal cell. The LTSP included monitoring well 0172, but its construction integrity was suspect; monitoring well 0181 was installed next to it in 2001 and 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

Groundwater Monitoring Purpose	Monitoring Wells
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 nine additional monitoring wells, mostly in the deeper sandstone unit aquifer included in the draft GCAP. Water level monitoring is used to identify the groundwater flow direction in the contaminated middle sandstone unit of the Cedar Mountain Formation and in the formation's deeper and uncontaminated basal sandstone unit. Besides being measured for water level, POC wells are sampled for nitrate, sulfate, and uranium. All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System website (http://gems.lm.doe.gov/#site=GRN).

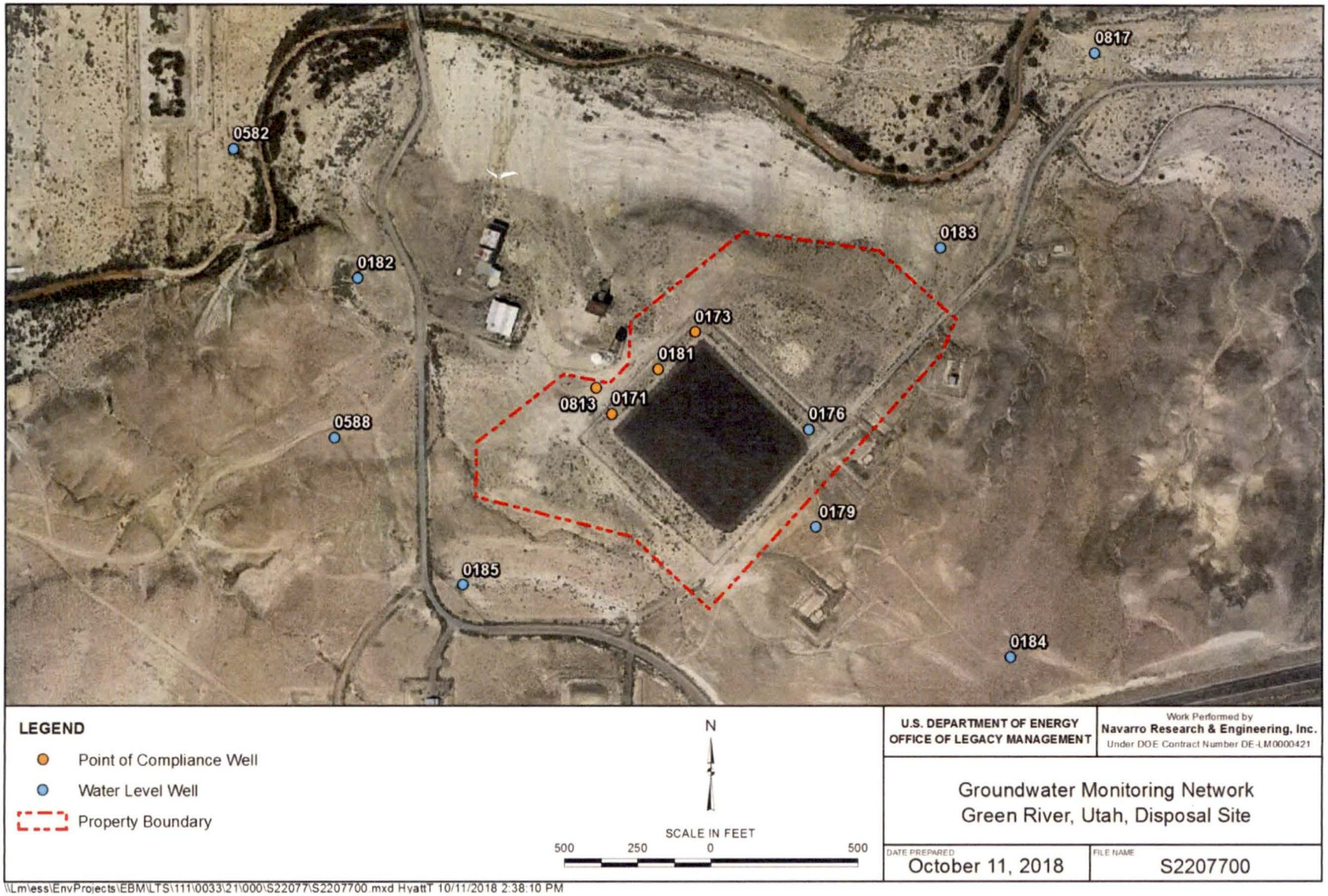


Figure 7-2. Groundwater Monitoring Network at the Green River, Utah, Disposal Site

7.7.1 Water Level Monitoring

The hydraulic gradients and corresponding groundwater flow directions in the two Cedar Mountain Formation aquifers underlying the disposal cell are monitored using water level measurements from several wells adjacent to the disposal cell. Water levels have been manually measured annually in these 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 (DOE 2011). 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).

Water levels in the POC wells decreased slightly from 2017 to 2018 (Figure 7-3). 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. Then from 2014 to 2017, water levels increased approximately 5 ft, returning to 2007 levels. The higher water levels are not believed to result from liquid releases from the disposal cell. Rather, general increases and decreases in hydraulic heads in upgradient parts of the middle sandstone aquifer are considered more likely reflective of regional groundwater trends.

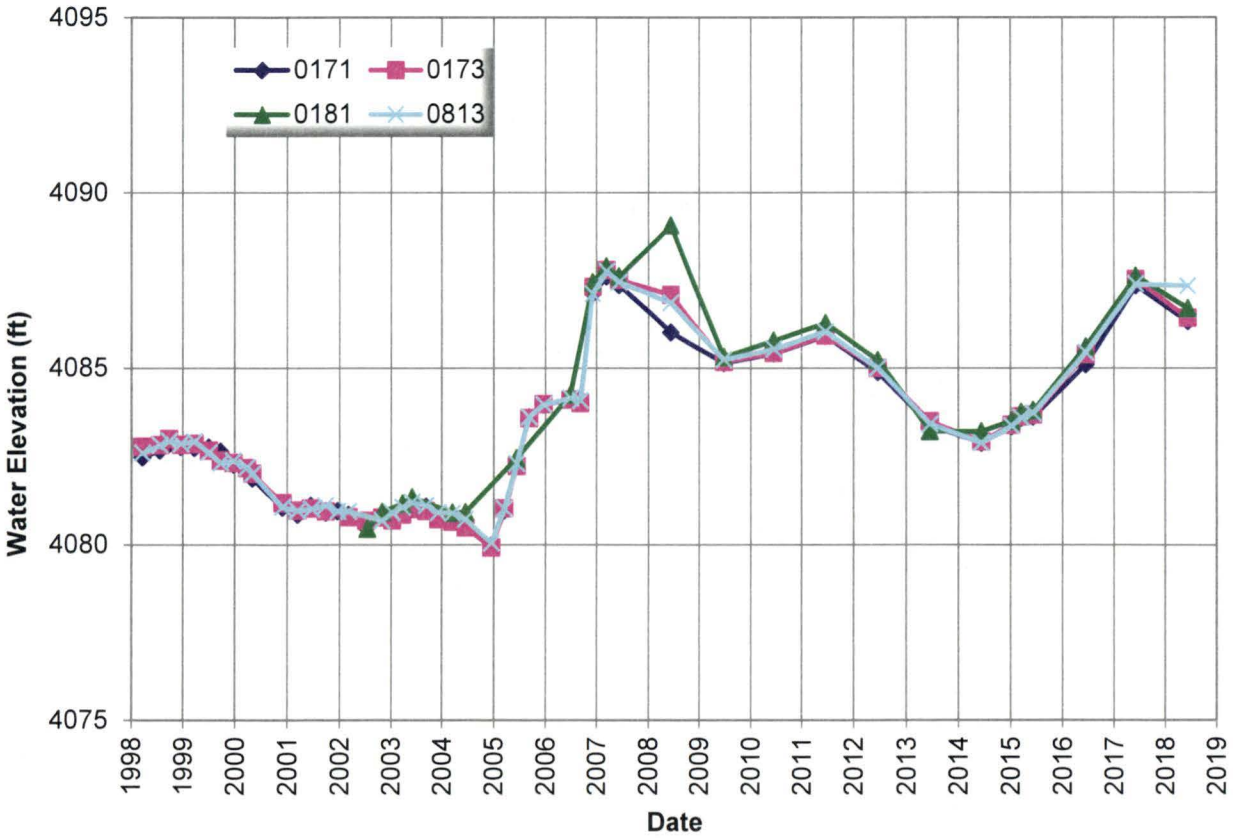


Figure 7-3. Groundwater Elevations at the Green River, Utah, Disposal Site

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 2018 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[a]	3334	0.044[a]
0173	10[a]	4000	0.044[a]
0181	102	4985	0.067
0813	10[a]	4440	0.069

Note:
[a] MCL (40 CFR 192 Table 1 Subpart A)

Table 7-4. 2018 Analytical Results for Point of Compliance Wells at the Green River, Utah, Disposal Site

Monitoring Well	Nitrate[a] (mg/L)	Sulfate (mg/L)	Uranium (mg/L)
0171	60	4000	0.12
0173	140	6900	0.049
0181	60	6800	0.022
0813	0.003	3900	0.037

Notes:
Red = equal to or exceeding LTSP concentration limit.
[a] Nitrate = nitrate plus nitrite as nitrogen.

Nitrate concentrations continued to exceed the LTSP concentration limits (MCL) in POC wells 0171 and 0173 but are below the GCAP proposed risk-based ACL of 1000 mg/L. The 2018 nitrate concentrations were within the range of historical values for all POC wells, with the exception of POC well 0171, which exceeded the historical maximum of 56 mg/L in 2007 and 2009 (Figure 7-4).

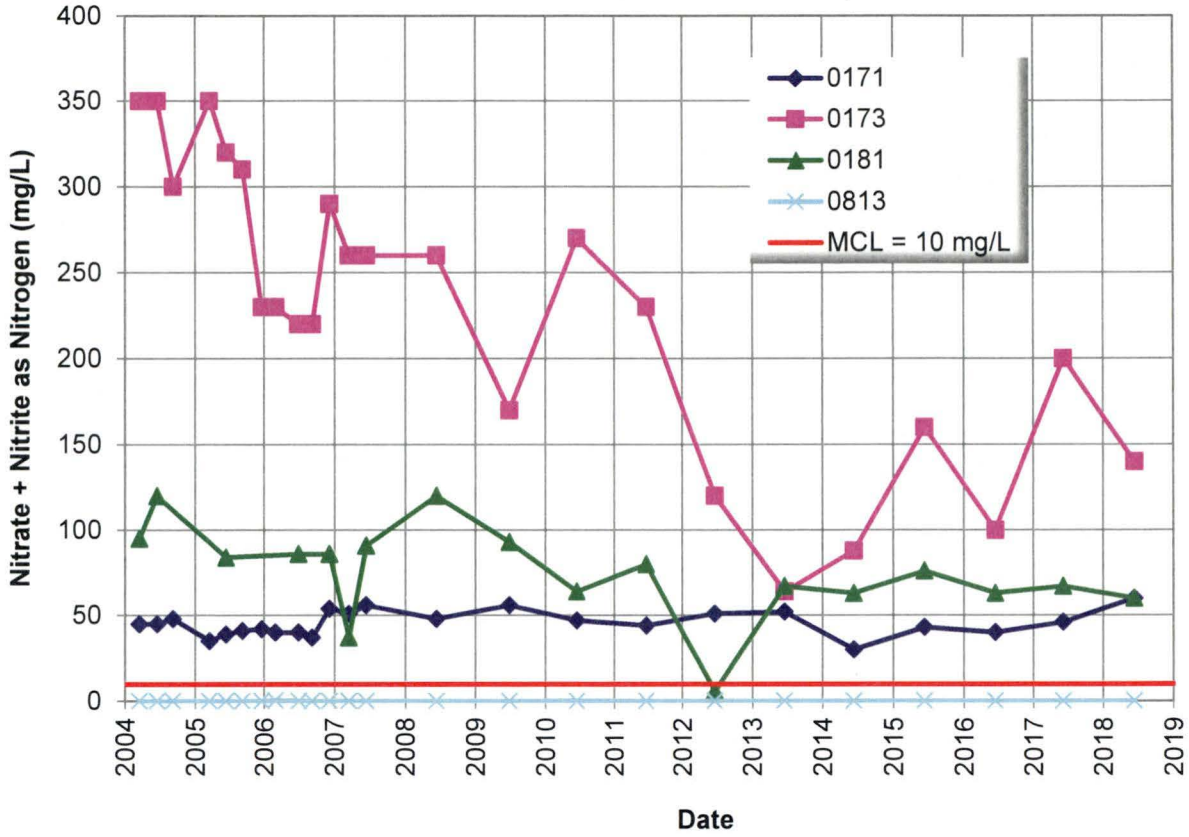


Figure 7-4. Nitrate at Point of Compliance Wells at the Green River, Utah, Disposal Site

Sulfate concentrations exceeded the LTSP concentration limits in all POC wells except POC well 0813. The 2018 sulfate concentrations were within the range of historical values for all POC wells (Figure 7-5).

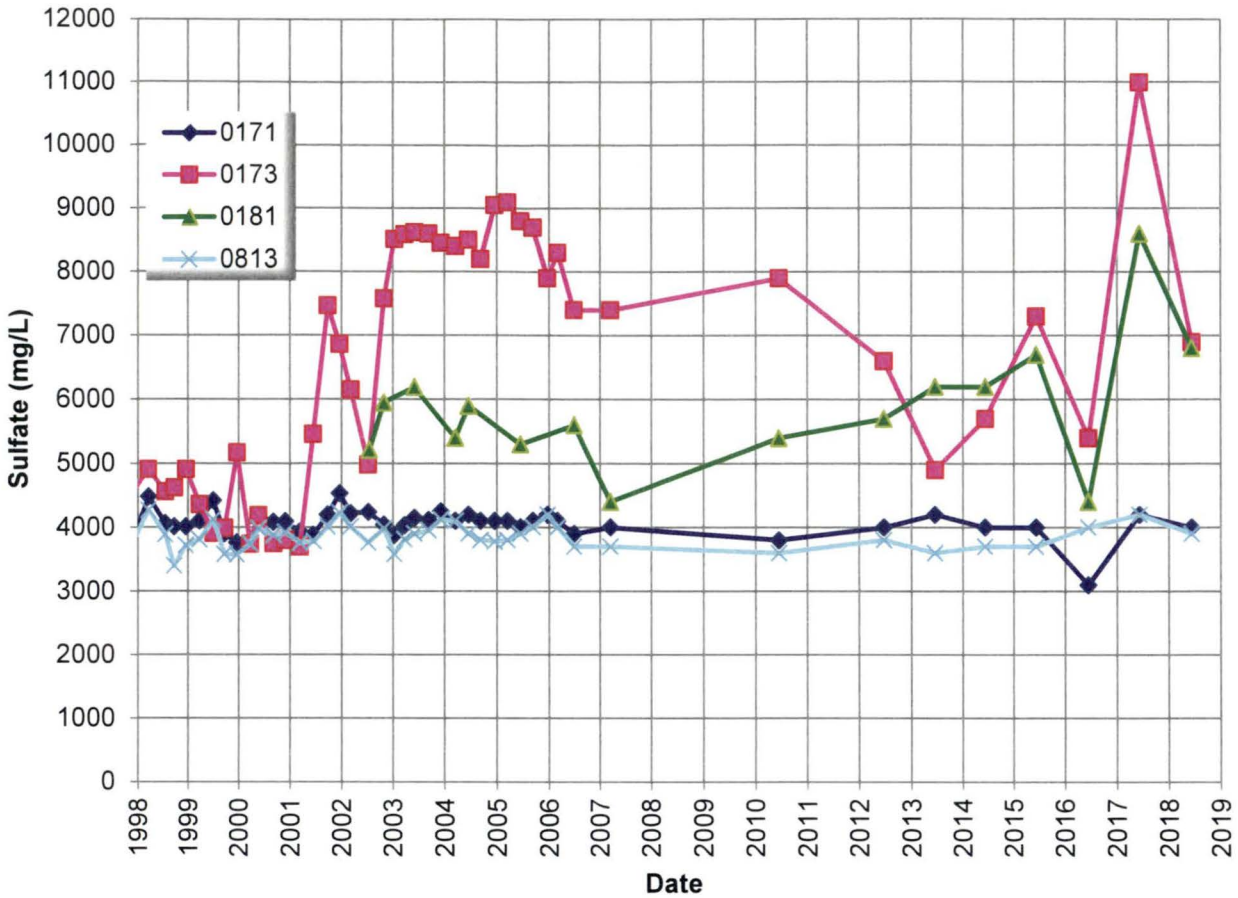


Figure 7-5. Sulfate at Point of Compliance Wells at the Green River, Utah, Disposal Site

Uranium concentrations remain below the LTSP concentration limits (MCL) in wells 0181 and 0813 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 2018 uranium concentrations were within the range of historical values for POC wells 0171 and 0181. The 2018 uranium concentrations exceeded historical maximums in POC wells 0173 (0.049 mg/L compared to 0.044 mg/L in 2017) and 0813 (0.037 mg/L compared to 0.034 mg/L in 2014), but remain below the proposed risk-based ACL of 4.4 mg/L.

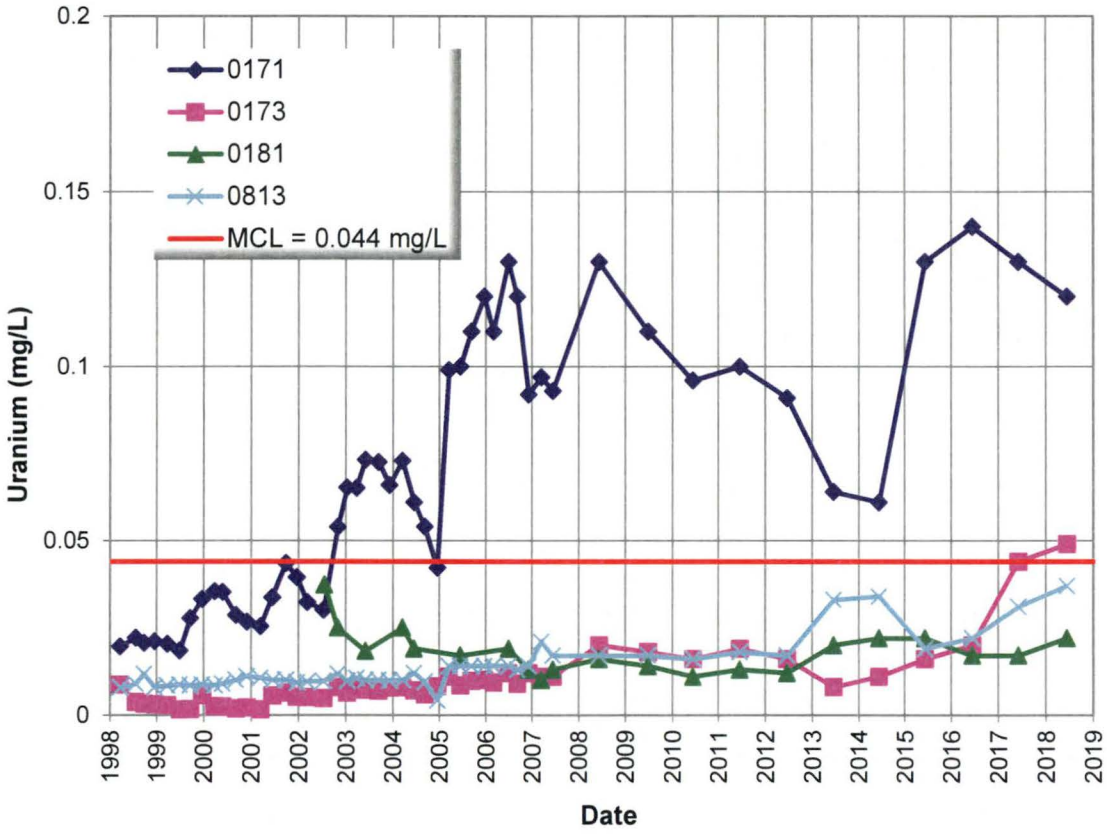


Figure 7-6. Uranium at Point of Compliance Wells at the Green River, Utah, Disposal Site

Groundwater monitoring results were within the range of historical values at all POC wells for nitrate (with the exception of POC wells 0171), sulfate, and uranium (with the exception of POC wells 0173 and 0813). 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. Environmental Protection Agency, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations.*

40 CFR 192 Table 1 Subpart A. U.S. Environmental Protection Agency, "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	30	South Vehicle Gate
PL-2	335	Southwest Security Fence (Disposal Cell and Water Tower in Background)
PL-3	340	Site Marker SMK-2
PL-4	0	Survey Monument SM-2
PL-5	310	Monitoring Well 0184 (Disposal Cell in Background)
PL-6	290	Northeast Side Slope and Apron of Disposal Cell
PL-7	45	Apron Along Northwest Side of Disposal Cell
PL-8	305	Mill Buildings and Water Tower from Top of Disposal Cell

PL-1. South Vehicle Gate

PL-2. Southwest Security Fence (Disposal Cell and Water Tower in Background)

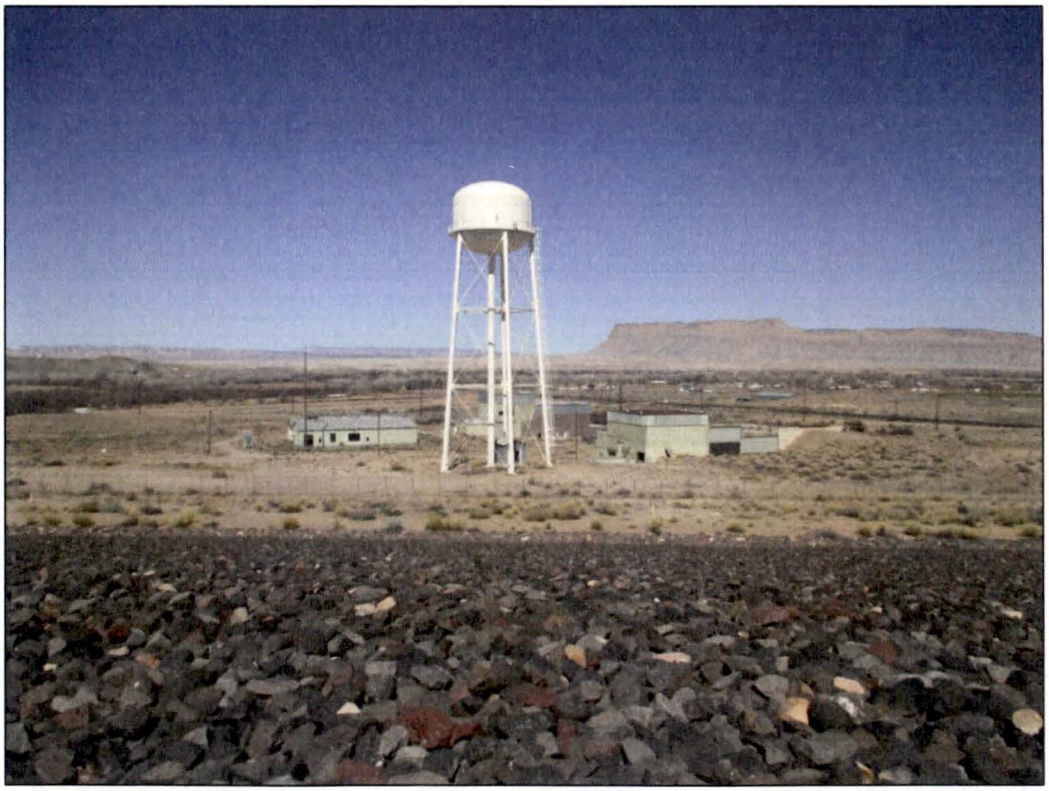
PL-3. Site Marker SMK-2

PL-4. Survey Monument SM-2

PL-5. Monitoring Well 0184 (Disposal Cell in Background)

PL-6. Northeast Side Slope and Apron of Disposal Cell

PL-7. Apron Along Northwest Side of Disposal Cell



PL-8. Mill Buildings and Water Tower from Top of Disposal Cell

8.0 Gunnison, Colorado, Disposal Site

8.1 Compliance Summary

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducted the Gunnison, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) annual site inspection on July 31, 2018 and the five-year groundwater monitoring event in July 2016. No cause for a follow-up inspection was identified.

No changes were observed on the disposal cell or in the associated diversion channels. Inspectors identified several minor maintenance needs and addressed most during the inspection.

The most recent 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 LM Long-Term Surveillance Plan (LTSP) (DOE 1997) and in procedures LM 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 July 31, 2018. The inspection was conducted by R. Johnson, J. Lobato, and J. Cario of the Legacy Management

Support contractor. J. Dayvault (LM site manager) and M. Cosby (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, identify changes in conditions that might affect conformance with the LTSP, and determine the need, if any, for maintenance or additional inspection and monitoring. The results of the inspection are reported in the remainder of Section 8.4.

8.4.1 Site Surveillance Features

Figure 8-1 shows the locations of site features in black, 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 2018 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 8.9.

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) Route 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. The entrance sign is bolted to a perimeter fence post next to the entrance gate. 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 one location with a broken strand that was repaired during the inspection (PL-1). Two barbed-wire gates—one on the north fence line and the other on the east fence line—provide egress from the site to offsite monitoring wells; both gates were locked.

There are 45 perimeter signs bolted to the perimeter fence posts. Several perimeter signs have bullet damage but remain legible. Perimeter signs P2, P38, and P43 were faded or damaged; replacement signs were installed during the inspection (PL-2). Perimeter signs P4–P13 along the west perimeter fence line are becoming illegible due to fading and should be replaced within the next couple of years. 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-3), and site marker SMK-2 is on the top slope of the disposal cell. 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-4). No maintenance needs were identified.

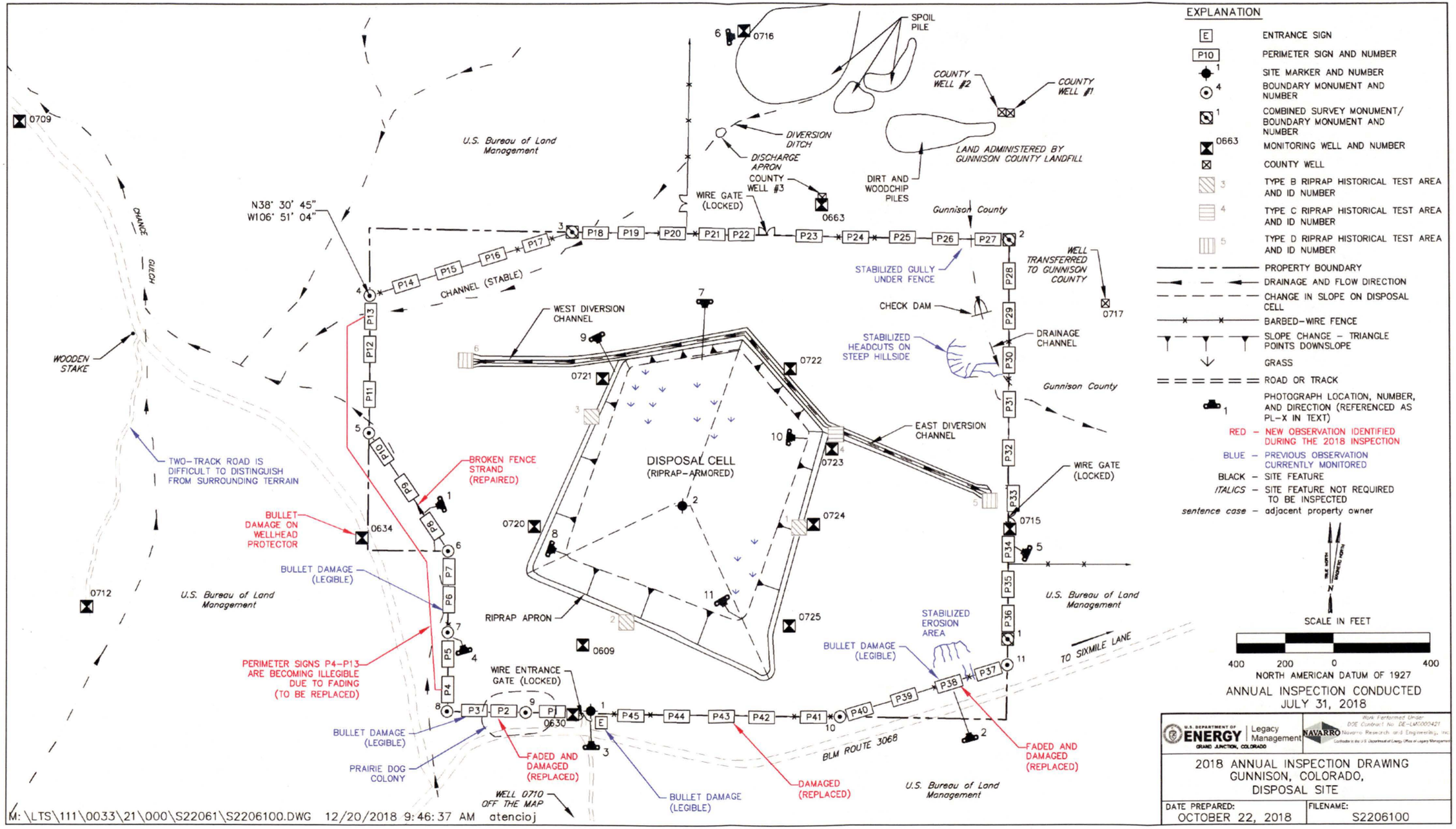


Figure 8-1. 2018 Annual Inspection Drawing for the Gunnison, Colorado, Disposal Site

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8.4.1.5 Monitoring Wells

The site has 16 groundwater monitoring wells. The wellhead protectors were locked and properly labeled (PL-5). The wellhead protector for monitoring well 0634 had bullet damage but was secure. Gunnison County landfill operators have placed concrete barriers to protect monitoring well 0716, which is on landfill property, from landfill activities (PL-6). 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 and is armored with basalt riprap to control erosion. There was no evidence of settling, slumping, erosion, or any other modifying process that might affect the integrity of the top slope of the disposal cell (PL-7). 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 component of the disposal cell's engineered cover. No maintenance needs were identified.

8.4.2.2 Disposal Cell Side Slopes, Apron, and Diversion Channels

The disposal cell side slopes (PL-8), an apron to collect and divert precipitation runoff from the disposal cell (PL-9), and two diversion channels to protect the disposal cell from precipitation run-on (PL-10) 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 were last inspected during the 2017 annual inspection; monitoring is no longer required in accordance with the LTSP because no rock degradation had been observed.

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-11). 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 surfaces are designed to drain to the southeast, and any water that ponds there is below the elevation of tailings placed under the engineered cover. 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. No maintenance needs were identified.

8.4.2.4 Outlying Area

In accordance with the LTSP, a drainage feature from the southeast corner of the site and along BLM Route 3068 was checked for indications of seepage from the vadose zone. The feature, which follows the borrow ditch along the road, was dry and showed no signs of seepage.

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). With regard to groundwater flow, the landfill operations are upgradient from the disposal cell. The proximity of the spoil pile to monitoring well 0716 (see Figure 8-1) 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

LM 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) LM 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

A broken fence strand was repaired, and faded or damaged perimeter signs P2, P38, and P43 were replaced during the inspection. Perimeter signs P4–P13 along the west fence line are becoming illegible due to fading and should be replaced within the next couple of years. No other maintenance needs were identified.

8.7 Groundwater Monitoring

In accordance with the LTSP, LM conducts groundwater monitoring every 5 years to demonstrate the site-specific uranium action level has not been exceeded. 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, 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 U.S. Environmental Protection Agency established a maximum concentration limit for uranium of 0.044 mg/L in groundwater (40 CFR 192, Subpart A, Table 1). Samples are also collected 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.

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

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

All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System website (http://gems.lm.doe.gov/#site=GUD). The *2016 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites* (DOE 2016) shows the most recent monitoring results. The report shows uranium concentration was below the action level (0.013 mg/L) in all POC wells and indicates continued groundwater compliance at the Gunnison 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.

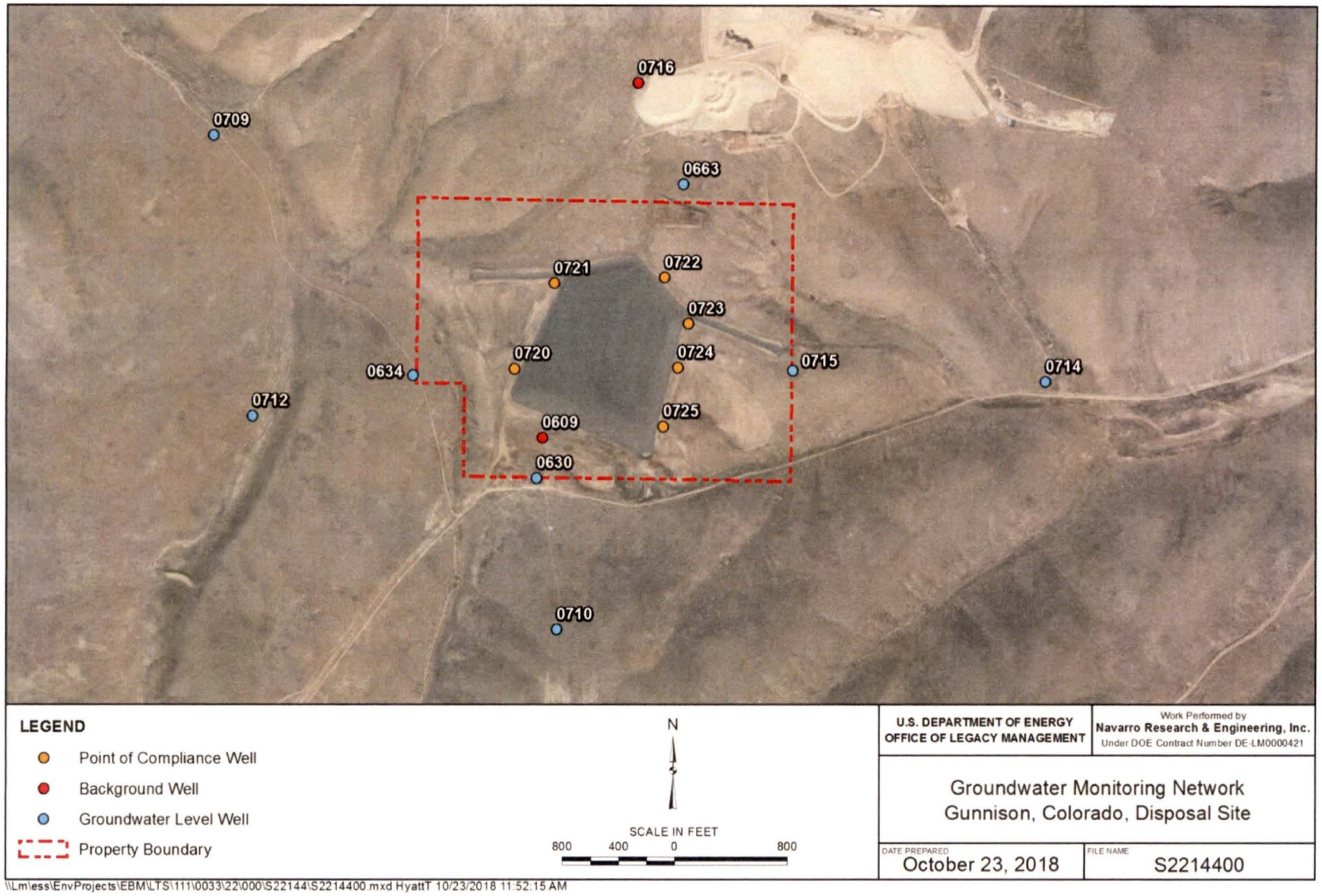


Figure 8-2. Groundwater Monitoring Network at the Gunnison, Colorado, Disposal Site

8.9 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 192.03. U.S. Environmental Protection Agency, "Monitoring," *Code of Federal Regulations*.

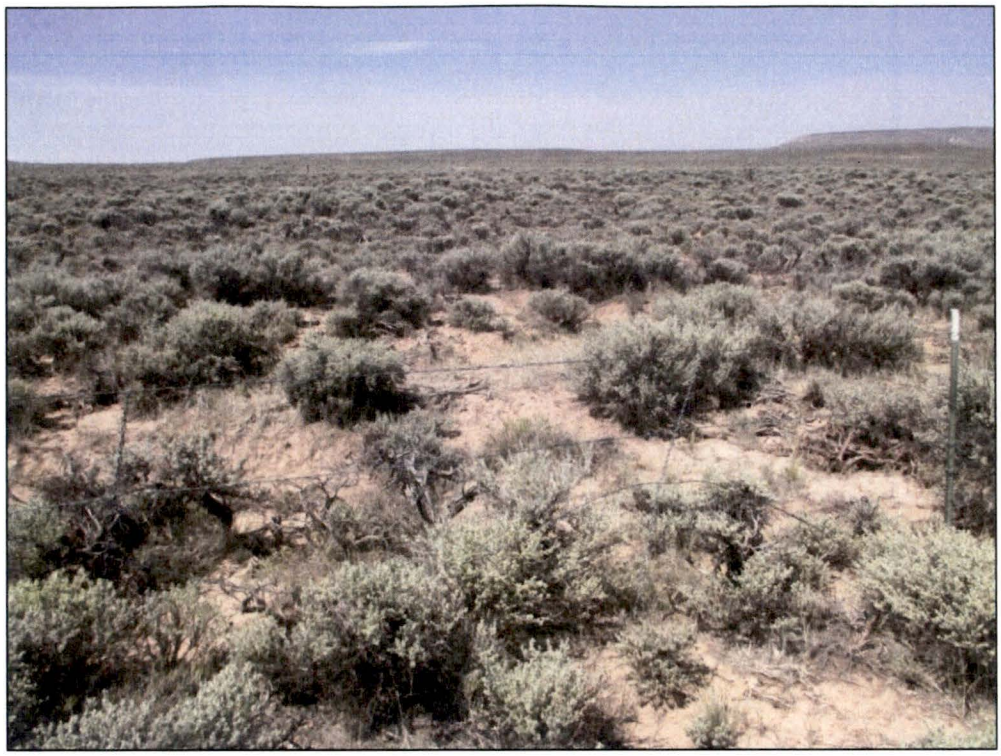
40 CFR 192.04. U.S. Environmental Protection Agency, "Corrective Action," *Code of Federal Regulations*.

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, Office of Legacy Management, March.

8.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	250	Broken Fence Strand near Perimeter Sign P8 (Repaired During Inspection)
PL-2	345	Faded and Damaged Perimeter Sign P38 (Replaced During Inspection)
PL-3	0	Site Marker SMK-1
PL-4	345	Boundary Monument BM-7
PL-5	295	Monitoring Well 0715
PL-6	85	Monitoring Well 0716 and County Landfill Spoil Pile
PL-7	180	Top Slope of Disposal Cell
PL-8	110	Southwest Side Slope of Disposal Cell
PL-9	155	Northwest Side Slope of Disposal Cell and Apron
PL-10	95	East Diversion Channel and Monitoring Well 0723
PL-11	150	Southeast Corner of Disposal Cell



PL-1. Broken Fence Strand near Perimeter Sign P8 (Repaired During Inspection)

PL-2. Faded and Damaged Perimeter Sign P38 (Replaced During Inspection)

PL-3. Site Marker SMK-1

PL-4. Boundary Monument BM-7

PL-5. Monitoring Well 0715

PL-6. Monitoring Well 0716 and County Landfill Spoil Pile

PL-7. Top Slope of Disposal Cell

PL-8. Southwest Side Slope of Disposal Cell

PL-9. Northwest Side Slope of Disposal Cell and Apron

PL-10. East Diversion Channel and Monitoring Well 0723

PL-11. Southeast Corner of Disposal Cell

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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 May 22 and May 23, 2018. 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 or contingency 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 meets design specifications. The D_{50} value measured during the 2018 gradation monitoring is 2.53 inches, which is below the D_{50} design size range of 2.7–3.9 inches for the Type B size side slope riprap but within the historical range of measured values. In 22 years of monitoring, the measured D_{50} value has varied above and below design specifications. During the 2018 annual 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 cell.

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducts groundwater monitoring every 5 years to demonstrate compliance with 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 LM Long-Term Surveillance Plan (LTSP) (DOE 1994) and in procedures LM 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 May 22 and 23, 2018. The inspection was conducted by C. Wentz, C. Goodknight, and S. Hall of the Legacy Management Support contractor. J. Linard (former LM site manager), J. Nguyen (current LM site manager), 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, identify changes in conditions that might affect conformance with the LTSP, and determine the need, if any, for maintenance or additional inspection and monitoring.

9.4.1 Site Surveillance Features

Figure 9-1 shows the locations of site features in black, 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 2018 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 was locked and undamaged. The entrance sign is attached to steel posts set in concrete along the access road. A pedestrian gate in the northwest corner of the site could not be unlocked during the inspection (PL-2). Following the inspection, the pedestrian gate lock was replaced with a new lock. No other maintenance needs were identified.

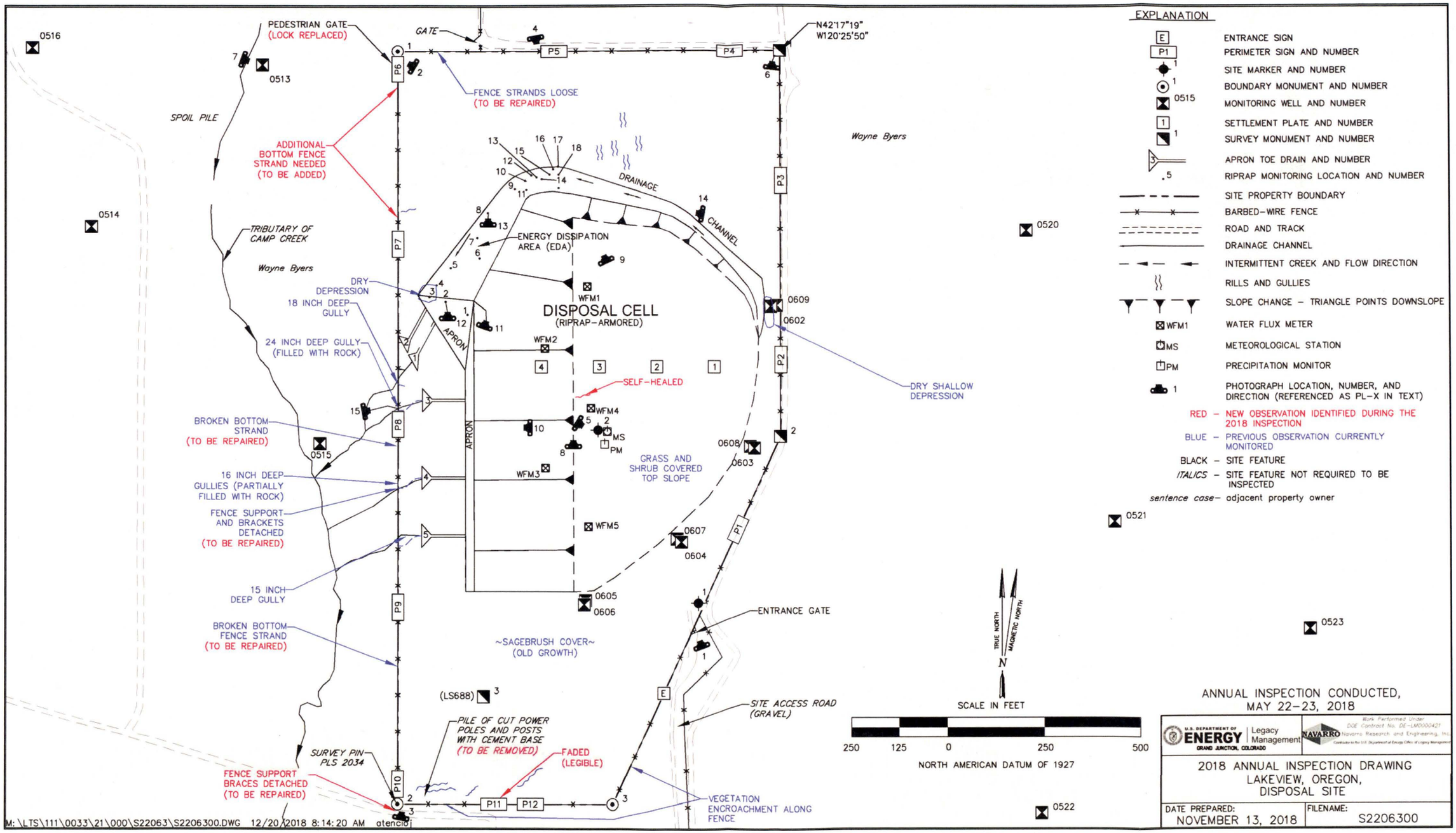

Figure 9-1. 2018 Annual Inspection Drawing for the Lakeview, Oregon, Disposal Site

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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, and an additional bottom strand should be added between perimeter strand P6 and P7. Support braces were detached between perimeter signs P8 and P9 and at the southwest corner, but the fence appeared stable (PL-3). Some vegetation is growing near, and entangled in, the perimeter fence line. Repairs to the perimeter fence will be made in 2019.

There are 12 perimeter signs, attached to steel posts set in concrete, positioned along the property boundary (PL-4). Perimeter sign P11 was faded but remains legible. No other maintenance needs were identified.

9.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside the entrance gate, and site marker SMK-2 (PL-5) 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 (PL-6) and three boundary monuments delineate the property boundary (PL-2). No maintenance needs were identified.

9.4.1.5 Monitoring Wells

The site has 12 downgradient groundwater monitoring wells (PL-7) and four upgradient groundwater monitoring wells offsite to the west of the site. A few of the concrete bases were cracked but stable. 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. In 1989, 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 impact of the disposal cell. 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 topsoil, riprap, and bedding layers; the compacted soil (radon barrier) inhibits root growth. 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. 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). A previously identified shallow rill on the top slope could not be found and was assumed to be self-healed from natural weather processes. No additional 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 for erosion development. 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.

LM 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, bedding material, and underlying radon barrier) at six locations on the disposal cell (five on the top slope, one on the west side slope) to support the study. Areas restored and reseeded in 2017 as part of the study were observed to have vegetation growth (PL-9). Inspectors 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 Toe 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 west side slope and photographic monitoring in the energy dissipation area (EDA) in accordance with the LTSP. Addendums to the LTSP commit LM to annually determine the mean diameter (D_{50}) value of the riprap on the west side slope through gradation monitoring to ensure the riprap remains large enough to protect the disposal cell from erosion during a major precipitation event. The thickness of the riprap on the west side slope was doubled during construction due to concerns over the quality of the rock.

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. Riprap measurement 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, with approximately 25 rocks measured at each location. The standard method for determining D_{50} in the laboratory is by weight, not by rock gradation measurement. Also, only the upper portion of the 12-inch riprap layer is measured at each location, as the method requires that the first rock directly below the grid point 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 riprap gradation determination method measures the minimum rock dimension in sieve analysis, which also conservatively skews the data.

In 2015, LM 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 LM to more proactively assess and mitigate vulnerability of potential failure points along the side slope. This proposal is currently being reviewed by NRC.

In 2018, riprap gradation monitoring was performed for the 22nd consecutive year. Riprap gradation monitoring on the west side slope is shown in PL-10. An evaluation of the 2018 rock size (gradation) measurement data indicates that the west side slope riprap D_{50} is 2.53 inches with a 95% confidence interval between 2.32 and 2.74 inches. The 2018 D_{50} value of 2.53 inches is within the range of D_{50} values (2.26–2.88 inches) previously monitored on the side slope during the 22 years of monitoring. The D_{50} design size range is 2.7–3.9 inches for the Type B size side slope riprap.

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 measurement 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 22 years of observation.

Minor rock degradation has been observed in the EDA (PL-11) 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 2018 inspection. Some of the numbered rocks had faded labels, and the label was completely worn off at photo monitoring location 3. These labels will be repainted during the 2019 annual inspection. The rock at photo monitoring locations 2 and 8 are shown in PL-12 and PL-13, respectively. No significant degradation of the EDA rock has been observed since monitoring began.

*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 have been omitted.

Figure 9-2. Riprap Gradation Monitoring D_{50} Values (1997–2018)

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 this process as other rock types present on the disposal cell. Dry conditions were observed in the EDA depression during the inspection.

Small amounts of vegetation (primarily grass) have encroached on the riprap on the side slopes, on the upper (eastern) portion of the surface water drainage channel (i.e., diversion channel), and on the west side slope's apron. The relatively sparse plant growth in these features will not affect their performance (i.e., channels were designed to control surface water runoff from impacting encapsulated materials within the disposal cell). There are a few small shrubs in the upper (eastern) portion of the drainage channel, but they will not obstruct water flow (PL-14). Should flow obstruction become a concern in the future, maintenance will be performed. There is an area of dense, high grass near toe 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 other maintenance needs were identified.

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 toe 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-15). Several small gullies have been observed offsite in the heavily grazed areas downslope of the perimeter fence line onto the private property west of the site. Several small rills and shallow gullies were also observed onsite on the slope 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 2018. 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 and signposts with cement bases in the southwest corner of the site. This debris was identified during previous annual inspections and does not impact site integrity; however, it will be removed in 2019. No maintenance needs were identified.

9.5 Follow-Up or Contingency Inspections

LM 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) LM 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

Inspectors documented minor maintenance needs to be addressed in 2019, including:

- Repairing the perimeter fence
- Repainting the rock monitoring labels
- Removing the power poles and posts from the southwest corner of the site

No other maintenance needs were identified.

9.7 Groundwater Monitoring

In accordance with the LTSP, LM conducts groundwater monitoring every 5 years to demonstrate compliance with established groundwater quality protections standards. The most recent sampling event occurred in May 2014, and the next event will occur in 2019.

The groundwater monitoring network consists of nine monitoring wells, including eight downgradient point-of-compliance (POC) wells and one upgradient background monitoring well (Figure 9-3 and Table 9-2). Seven additional LM-owned monitoring wells (0513, 0514, 0516, 0520, 0521, 0522, and 0523) are located on private property adjacent to the site but are no longer required to be sampled as identified in the LTSP. 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) (Table 9-3).

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

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

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

Constituent	MCL[a] (mg/L)
Arsenic	0.05
Cadmium	0.01
Uranium	0.044

Note:
[a] MCL (40 CFR 192, Table 1, Subpart A)

Abbreviation:
mg/L = milligrams per liter

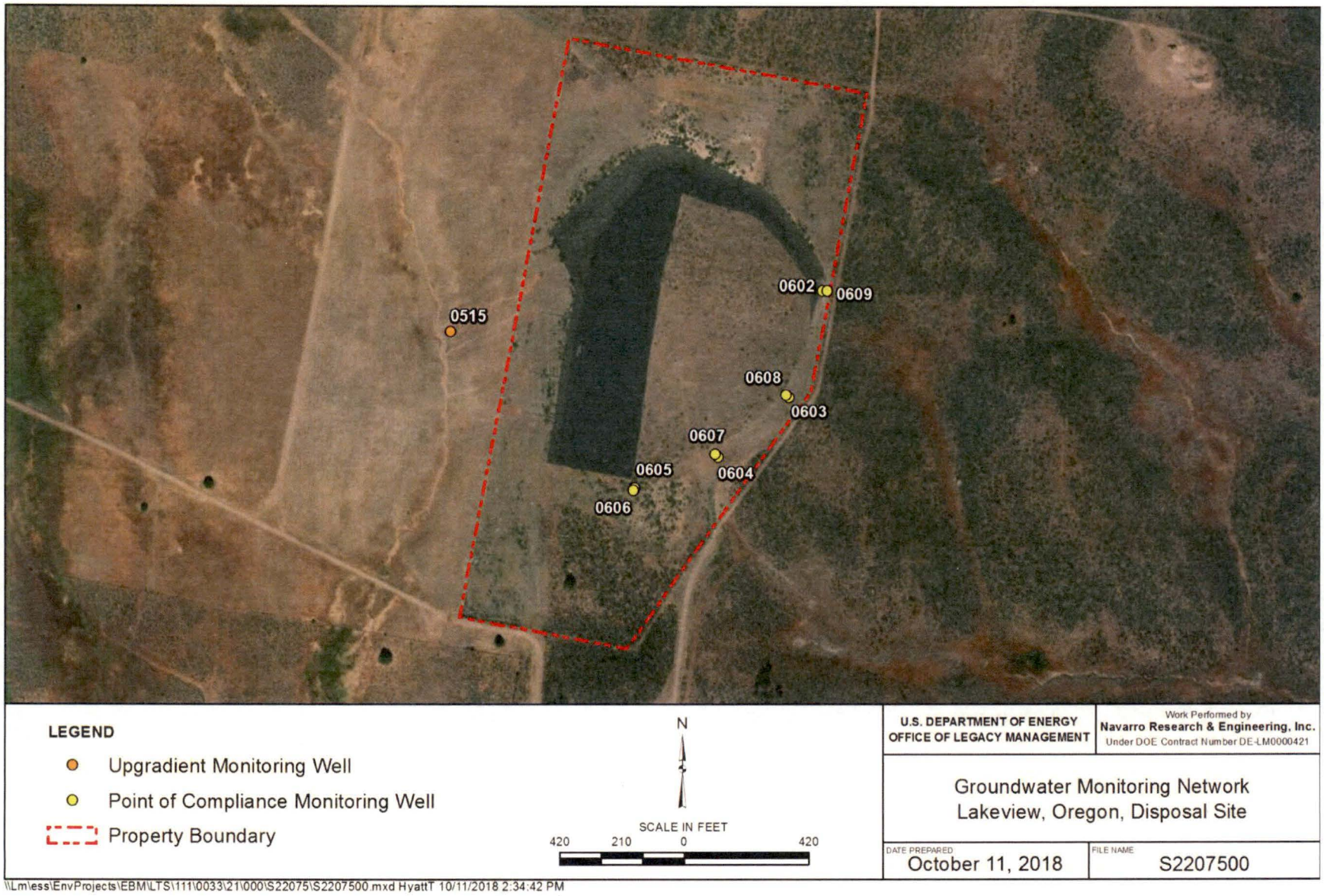


Figure 9-3. Groundwater Monitoring Network Lakeview, Oregon, Disposal Site

All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System website (http://gems.lm.doe.gov/#site=LKD). 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 at the site 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, which showed a slight increase but remains below the MCL. 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. Environmental Protection Agency, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations*.

40 CFR 192 Table 1 Subpart A. U.S. Environmental Protection Agency, "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	340	Site Entrance Gate
PL-2	300	Pedestrian Gate and Boundary Monument BM-1
PL-3	10	Southwest Corner of Fence with Detached Bracket and Encroaching Vegetation
PL-4	170	Perimeter Sign P5 with Disposal Cell in Background
PL-5	120	Site Marker SMK-2 and Meteorological Station
PL-6	5	Survey Monument SM-1
PL-7	110	Monitoring Well 0513 with Disposal Cell in Background
PL-8	0	Looking North Along Disposal Cell Top–Side Slope Transition
PL-9	335	Restored Cover Study Test Pit DC11SW
PL-10	270	Rock Riprap Gradation Monitoring on West Side Slope of Disposal Cell
PL-11	20	Intersection of West Side Slope with Energy Dissipation Area
PL-12	0	(a) Riprap Monitoring Location Number 2 in Energy Dissipation Area–2018 (b) Riprap Monitoring Location Number 2 in Energy Dissipation Area–2004 Photo for Comparison
PL-13	0	(a) Riprap Monitoring Location Number 8 in Energy Dissipation Area–2018 (b) Riprap Monitoring Location Number 8 in Energy Dissipation Area–2004 Photo for Comparison
PL-14	280	Diversion Channel North of Disposal Cell
PL-15	80	Small Gully Along Perimeter Fence Downgradient of Apron Toe Drain No. 3

PL-1. Site Entrance Gate

PL-2. Pedestrian Gate and Boundary Monument BM-1

PL-3. Southwest Corner of Fence with Detached Bracket and Encroaching Vegetation

PL-4. Perimeter Sign P5 with Disposal Cell in Background

PL-5. Site Marker SMK-2 and Meteorological Station

PL-6. Survey Monument SM-1

PL-7. Monitoring Well 0513 with Disposal Cell in Background

PL-8. Looking North Along Disposal Cell Top–Side Slope Transition

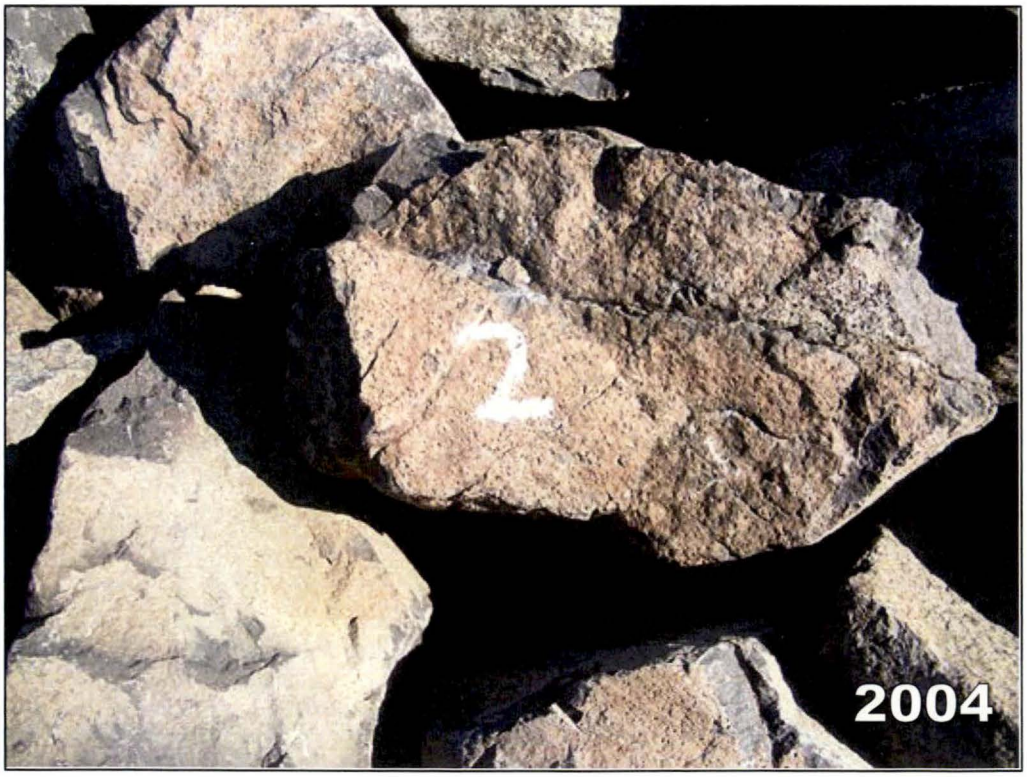
PL-9. Restored Cover Study Test Pit DC11SW

PL-10. Rock Riprap Gradation Monitoring on West Side Slope of Disposal Cell

PL-11. Intersection of West Side Slope with Energy Dissipation Area

Photos continue on the next page

PL-12. (a) Riprap Monitoring Location Number 2 in Energy Dissipation Area–2018



PL-12. (b) Riprap Monitoring Location Number 2 in Energy Dissipation Area–2004 Photo for Comparison

PL-13. (a) Riprap Monitoring Location Number 8 in Energy Dissipation Area–2018

PL-13. (b) Riprap Monitoring Location Number 8 in Energy Dissipation Area–2004 Photo for Comparison

PL-14. Diversion Channel North of Disposal Cell

PL-15. Small Gully Along Perimeter Fence Downgradient of Apron Toe Drain No. 3

10.0 Lowman, Idaho, Disposal Site

10.1 Compliance Summary

The Lowman, Idaho, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected on May 8, 2018. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified several minor maintenance needs but found no cause for a follow-up inspection. Groundwater monitoring is not required and was discontinued in 2004.

10.2 Compliance Requirements

Requirements for long-term surveillance and maintenance of the site are specified in the site-specific U.S. Department of Energy (DOE) Office of Legacy Management (LM) Long-Term Surveillance Plan (LTSP) (DOE 2005) and in procedures LM 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 10-1 lists these requirements.

Table 10-1. License Requirements for the Lowman, Idaho, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 3.3	Section 10.4	(b)(3)
Follow-Up Inspections	Section 3.4	Section 10.5	(b)(4)
Maintenance	Section 3.5	Section 10.6	(b)(5)
Emergency Response	Section 3.6	Section 10.7	(b)(5)
Environmental Monitoring	Section 3.7	Section 10.8	(b)(2)

10.3 Institutional Controls

The 18-acre site, identified by the property boundary shown in Figure 10-1, is owned by the United States and was accepted under the general license in 1994. 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 signs, site markers, and survey and boundary monuments.

10.4 Inspection Results

The site, 0.5 mile east of Lowman, Idaho, was inspected on May 8, 2018. The inspection was conducted by M. Kastens, D. Traub, C. Boger, and C. Dembinski of the Legacy Management Support contractor. T. Jasso (LM site manager), G. Cummings (LM asset manager), D. Nygard (Idaho Department of Environmental Quality), and P. Rekow (vegetation control subcontractor) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and determine the need, if any, for maintenance or additional inspection and monitoring.

10.4.1 Site Surveillance Features

Figure 10-1 shows the locations of site features in black, 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 2018 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 10-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 10.10.

10.4.1.1 Access Road, Entrance Gate, and Entrance Sign

Access to the site is at the end of a hard-packed gravel road about 650 feet (ft) north of Idaho Highway 21. Entrance to the site is through a locked steel gate on the site access road about 150 ft from the highway. The site is not fenced, but the topography and forest vegetation prevent vehicle access around the entrance gate and along the property boundary. The entrance gate was locked and functional, and the access road was passable. The entrance sign, at the southwest property boundary, had bullet damage and was replaced during the inspection (PL-1). No other maintenance needs were identified.

10.4.1.2 Perimeter Signs

There are 18 perimeter signs, attached to steel posts set in concrete, positioned along the unfenced property boundary. Several perimeter signs (P2, P3, P4, P13, and P15) have bullet damage but remain legible. Inspectors noted that perimeter sign P3 was rotated about 90 degrees from its original position, but it continues to be legible and noticeable. Perimeter sign P7 is slightly bent from tree fall but remains legible. No maintenance needs were identified.

10.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside the southwest property boundary, and site marker SMK-2 (PL-2) is on the top slope of the disposal cell. Lichen is growing on the surface of both site markers, but it is easily removable by hand and does not detract from the legibility of the markers. No maintenance needs were identified.

10.4.1.4 Survey and Boundary Monuments

Three combined survey and boundary monuments and four boundary monuments delineate the property boundary. Steel T-posts are installed next to the survey and boundary monuments to help inspectors find the monuments. Several years ago, the U.S. Department of Agriculture (USDA) conducted a survey of its lands and placed its own boundary monuments along the shared DOE–USDA border, and inspectors noted that the USDA survey monuments were about 5 to 15 ft outside the DOE survey monuments (PL-3). No maintenance needs were identified.

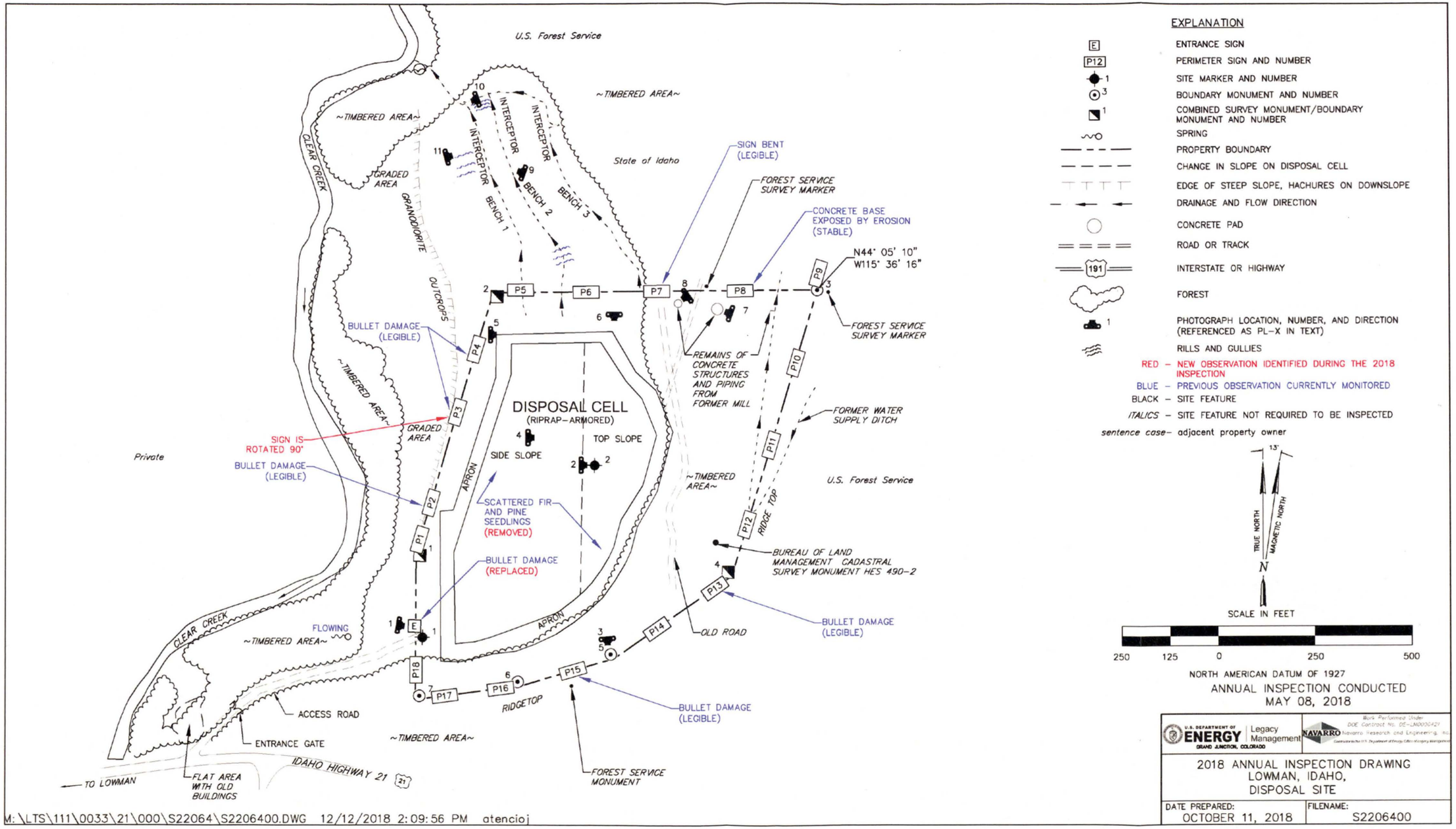


Figure 10-1. 2018 Annual Inspection Drawing for the Lowman, Idaho, Disposal Site

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10.4.2 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 slope of the disposal cell, (2) the area between the disposal cell and the site boundary, and (3) the outlying area. Inspectors examined the 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.

10.4.2.1 Top and Side Slope of the Disposal Cell

The disposal cell, completed in 1991, occupies 8.29 acres. The disposal cell top and side slope are armored with basalt riprap to control erosion (PL-4). An apron of larger riprap surrounds the disposal cell on all sides (PL-5). There was no evidence of erosion, settling, slumping, rock degradation, or other modifying processes that might affect the integrity of the disposal cell.

Natural vegetation continues to encroach on the top and side slopes of the disposal cell (PL-6). Although the LTSP states that control of vegetation growth on the cell is not needed, LM determined that controlling the growth of conifers—primarily ponderosa pine—would be a best management practice. Unlike the shrubs and other vegetation growing on the disposal cell, mature conifers could potentially become uprooted during windstorms and damage the surface of the disposal cell. Numerous ponderosa pine trees were observed on the disposal cell top and side slopes and were removed in September 2018 following the inspection. Other plants growing on the disposal cell were not removed, as they do not present a physical threat to the integrity of the disposal cell. No other maintenance needs were identified.

10.4.2.2 Area Between the Disposal Cell and the Site Boundary

The steep slopes east and south of the disposal cell are stable and vegetated with well-established ponderosa pines, shrubs, and grasses. Several features from the historical mining operations remain on the steep hillside east of the disposal cell, including a water-supply ditch and the remains of a water piping system (PL-7 and PL-8). The slopes north and west of the disposal cell were highly disturbed during site remediation, but they are now stable and vegetated. No maintenance needs were identified.

10.4.2.3 Outlying Area

The area within 0.25 mile of the site boundary was inspected for evidence of construction, development, logging, or changes in land use that might affect the site. No changes were observed in the area across Clear Creek to the west, where there are several summer cabins and campsites. The U.S. Forest Service, an office of USDA, manages the areas east and south of the site, and those areas remain visually unchanged from previous inspections. The area along Highway 21 east of the site does not show evidence of new development.

The reclaimed area north of the disposal cell and outside the site boundary is owned by the State of Idaho. The area is steep and was once highly eroded; today it is slowly becoming revegetated. Three interceptor benches were installed across the steep slope in this area by LM in 1998 to intercept runoff, collect it in an armored collection ditch, and route it offsite into Clear Creek.

Over the years, minor erosion has breached the benches in several locations, and LM has conducted repairs on numerous occasions, most recently in October 2016. The three interceptor benches (PL-9) and collection ditch (PL-10) are inspected annually to ensure that erosion in this area does not affect overall site stability. In 2018, inspection of the 2016 repairs showed they remain intact, and LM will continue to inspect as the vegetation continues to establish (PL-11).

10.5 Follow-Up Inspections

LM 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) LM is notified by a citizen or outside agency that conditions at the site have substantially changed. No need for a follow-up inspection was identified.

10.6 Maintenance

The entrance sign was replaced during the inspection. Numerous ponderosa pine trees on the disposal cell were removed in September 2018. No other maintenance needs were identified.

10.7 Emergency Response

Emergency response is action LM 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 an emergency response was identified.

10.8 Environmental Monitoring

In accordance with the LTSP, groundwater monitoring is not required and was discontinued in 2004. Groundwater monitoring is not required because (1) the disposal cell is performing as designed, and (2) the groundwater monitoring program demonstrated that the site is in compliance with groundwater protection standards and that no site-related contamination exists in groundwater near the site. All monitoring wells at the site were decommissioned in 2006.

10.9 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), 2005. *Long-Term Surveillance Plan for the U.S. Department of Energy Lowman, Idaho, (UMTRCA Title I) Disposal Site,* DOE-LM/GJ771-2005, Rev. 2, January.

10.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	100	Old and New Entrance Sign Before Replacement
PL-2	90	Site Marker SMK-2
PL-3	175	DOE's Boundary Monument BM-5 in Foreground and USDA Boundary Markers in Background, About 12 Feet Apart
PL-4	90	Riprap Armoring on Disposal Cell Side Slope (Close-Up)
PL-5	90	Apron Along North Side of Disposal Cell
PL-6	180	Vegetation Encroachment on Disposal Cell and Apron
PL-7	290	Remnants of Water Piping System Associated with Former Mill
PL-8	235	Remnants of Concrete Structure and Piping Associated with Former Mill
PL-9	290	Interceptor Bench 1
PL-10	250	View Downslope of Collection Ditch Just Above Interceptor Bench 1
PL-11	75	View Upslope of Repaired Rills on Interceptor Bench 1

PL-1. Old and New Entrance Sign Before Replacement

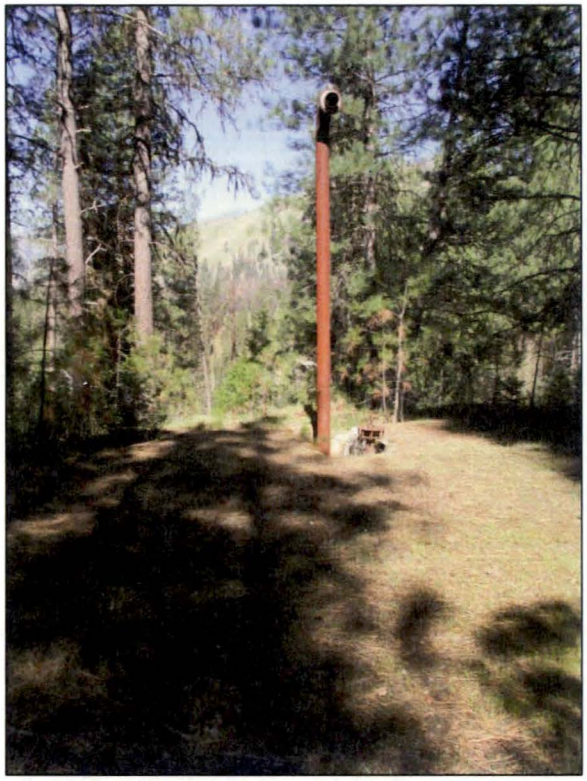
PL-2. Site Marker SMK-2

PL-3. DOE's Boundary Monument BM-5 in Foreground and USDA Boundary Markers in Background, About 12 Feet Apart

PL-4. Riprap Armoring on Disposal Cell Side Slope (Close-Up)

PL-5. Apron Along North Side of Disposal Cell

PL-6. Vegetation Encroachment on Disposal Cell and Apron



PL-7. Remnants of Water Piping System Associated with Former Mill

PL-8. Remnants of Concrete Structure and Piping Associated with Former Mill

PL-9. Interceptor Bench 1

PL-10. View Downslope of Collection Ditch Just Above Interceptor Bench 1

PL11. View Upslope of Repaired Rills on Interceptor Bench 1

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