Department of Energy
Washington, DC 20585

March 6, 2020

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Deputy Director
Mail Stop T8F5
Washington, DC 20555-0001

Subject: *2019 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*

To Whom It May Concern:

Enclosed are seven copies of the *2019 Annual Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*. The report covers the annual inspections of the 19 Title I disposal sites managed by the U.S. Department of Energy Office of Legacy Management.

This report is submitted in compliance with the reporting requirements set forth in Title 10 *Code of Federal Regulations* Section 40.27, and each inspection was conducted in accordance with the inspection and monitoring requirements contained in the Long-Term Surveillance Plan for each site.

Please contact me at (970) 248-6018 or Mark.Kautsky@lm.doe.gov, if you have any questions. Please send any correspondence to:

U.S. Department of Energy
Office of Legacy Management
2597 Legacy Way
Grand Junction, CO 81503

Sincerely,

Digitally signed by MARK KAUTSKY
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Mark Kautsky
UMTRCA Program Manager

Enclosures

NMSS01

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T. Lancaster, NRC
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D. Miller, Navarro (e)
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U.S. DEPARTMENT OF ENERGY

Legacy Management

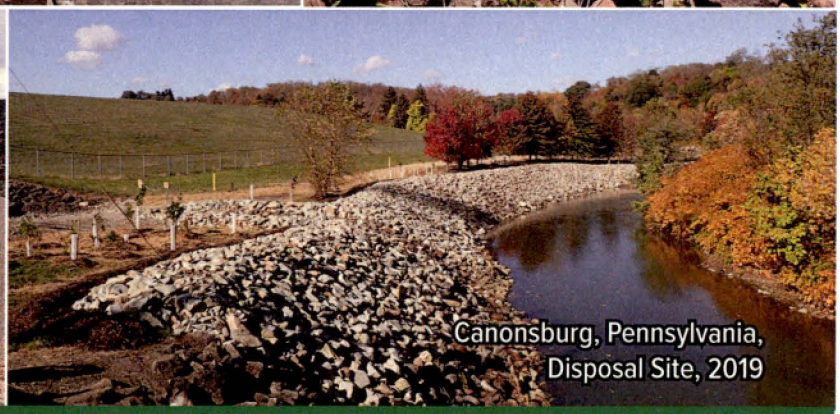
2019 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites

March 2020


Shiprock, New Mexico, Disposal Site, 2019

Lowman, Idaho, Disposal Site, 2019


Naturita, Colorado, Disposal Site, 2019


Canonsburg, Pennsylvania, Disposal Site, 2019

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Contents

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Abbreviations

ACL	alternate concentration limit
AML	Abandoned Mine Lands
BLM	U.S. Bureau of Land Management
BMP	best management practice
BOR	U.S. Bureau of Reclamation
CFR	*Code of Federal Regulations*
CPW	Colorado Parks and Wildlife
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
GSMT	geotechnical sampling and materials testing
IC	institutional control
ICP	interim cover protection
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
µrem/h	microrem per hour
NECA	Navajo Engineering and Construction Authority
NMED	New Mexico Environment Department
NRC	U.S. Nuclear Regulatory Commission
PL	photograph location
POC	point of compliance
RAI	request for additional information
RCT	radiation control technician

SOARS	System Operation and Analysis at Remote Sites
TCEQ	Texas Commission on Environmental Quality
UBL	upper baseline limit
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978
USDA	U.S. Department of Agriculture

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 2019. 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). LM 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 stakeholder relations and administrative, recordkeeping, 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 2019:

- **Multiple sites:** Permanent quality control monuments were installed at several sites in preparation for baseline aerial surveys of the disposal cells. The monuments consist of steel survey markers surrounded by 3-by-3-foot concrete slabs. Permanent quality control monuments were installed at the Rifle, Colorado; Canonsburg and Burrell, Pennsylvania; Ambrosia Lake, New Mexico; Lakeview, Oregon; and Spook, Wyoming, sites.

[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.

- **Canonsburg, Pennsylvania, Disposal Site:** Engineered repairs to the riprap-armored embankment of Chartiers Creek north of the disposal cell were completed. A riparian forest buffer was planted above and along the embankment to further stabilize the area against future stream flooding events and to reduce erosion upgradient of the riprap embankment. Disturbed areas were seeded with a pollinator-friendly native grass and wildflower mix.
- **Mexican Hat, Utah, Disposal Site:** The interim cover protection project was performed as a temporary measure to restore the depressional features identified in 2016 to original design specifications. A series of test pits and one test strip were mechanically excavated and supplemented with a moisture-conditioned, bentonite-amended granular material to reconstruct the areas where radon barrier material had been eroded. All test areas were systematically screened for gamma radiation, and no elevated readings were observed. Geotechnical sampling and materials testing (GSMT) were performed on the disposal cell side slope cover components in 2019. Information obtained through the GSMT will be used to identify possible causes for the cover degradation features that have been observed at the site.

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. 2019 Summary of UMTRCA Title I Site Actions and Issues

Site	Chapter	Page	Actions and Issues
Ambrosia Lake, New Mexico	1	1-2	Replaced several perimeter and mining restriction signs.
		1-7	Conducted best management groundwater monitoring.
Burrell, Pennsylvania	2	2-2	Replaced information sign and perimeter signs.
		2-7	Removed dying trees and brush.
		2-10	Conducted vegetation management.
Canonsburg, Pennsylvania	3	3-7	Conducted stabilization of riprap embankment at Chartiers Creek.
		3-7	Planted riparian forest buffer.
		3-9	Conducted vegetation management.
Durango, Colorado	4	4-2	Replaced entrance sign.
		4-5	Removed vegetation from around perimeter sign and boundary monument.
		4-5	Treated woody vegetation on disposal cell.
		4-8	Conducted groundwater monitoring.
		4-12	Conducted vegetation management.
Falls City, Texas	5	5-7	Conducted minor fence repair.
		5-8	Conducted groundwater monitoring.
Grand Junction, Colorado	6	6-2	Installed new entrance gate.
		6-7	Conducted groundwater monitoring.
Green River, Utah	7	7-2	Repaired minor erosion under perimeter fence.
		7-7	Conducted groundwater monitoring.
Gunnison, Colorado	8	8-2	Repaired broken fence strands.
		8-6	No groundwater monitoring required.

Table ES-1. 2019 Summary of UMTRCA Title I Site Actions and Issues (continued)

Site	Chapter	Page	Actions and Issues
Lakeview, Oregon	9	9-5	Performed minor fence repair.
		9-6	Conducted riprap gradation monitoring.
		9-10	Conducted groundwater monitoring.
Lowman, Idaho	10	10-5	Treated tree seedlings.
		10-6	No groundwater monitoring required.
Maybell, Colorado	11	11-2	Repaired perimeter fence.
		11-7	No groundwater monitoring required.
		11-7	Conducted vegetation monitoring.
Mexican Hat, Utah	12	12-1	Performed geotechnical sampling and materials testing (on disposal cell side slope cover components.
		12-1	Conducted interim cover protection field activity.
		12-5	Performed minor fence repair.
		12-9	No groundwater monitoring required.
		12-9	Conducted observational seep monitoring.
Naturita, Colorado	13	13-2	Conducted minor fence repair.
		13-2	Replaced perimeter signs.
		13-2	Installed pedestrian access gates.
		13-6	Observed erosion from County Road EE22 berm cut.
		13-6	Montrose County repaired road berm cut.
		13-7	No groundwater monitoring required.
Rifle, Colorado	14	14-2	Removed graffiti from entrance gate cover.
		14-5	Added perimeter signs.
		14-8	Installed quality control monuments.
		14-8	Conducted disposal cell pore-water monitoring.
Salt Lake City, Utah	15	15-5	Conducted visual riprap degradation monitoring on disposal cell.
		15-7	No groundwater monitoring required.
Shiprock, New Mexico	16	16-2	Replaced pictorial signs.
		16-2	Repaired gaps under perimeter fence.
		16-2	Conducted minor fence repair.
		16-7	Repaired degraded erosion control fabric on energy dissipation basin.
		16-8	No disposal cell performance monitoring required.
		16-8	Conducted vegetation monitoring.
Slick Rock, Colorado	17	17-2	Removed vegetation from fence line.
		17-6	No groundwater monitoring required.
Spook, Wyoming	18	18-5	Installed quality control monuments.
		18-6	No groundwater monitoring required.
Tuba City, Arizona	19	19-5	Updated entrance signs.
		19-8	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 March 20, 2019. 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). The most recent groundwater sampling event occurred in November 2019. All monitoring results were within the range of historical monitoring results, with the exception of molybdenum levels in well 0678, which were lower than previous monitoring results.

1.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (LTSP) (DOE 1996) in accordance with procedures 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 NRC 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 March 20, 2019. The inspection was conducted by A. Kuhlman, R. Johnson, and D. Traub of the Legacy Management

Support contractor. B. Tsosie (LM site manager); E. Holland (LM FIMS program manager); A. Rheubottom (NMED); and R. Evans and S. Anderson (NRC) 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 evaluate 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, including site surveillance features and inspection areas, in black. 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 2019 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 (PL-1). The text on the entrance sign was cracked but remained legible. Following the inspection, LM replaced the entrance sign. No other 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 remained legible. The text on perimeter signs P1 through P15 was cracked but remained legible (PL-2). Following the annual inspection, LM replaced perimeter signs P1 through P15 and the mining restriction signs. 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, and site marker SMK-2 is on the top slope of the disposal cell (PL-3). No maintenance needs were identified.

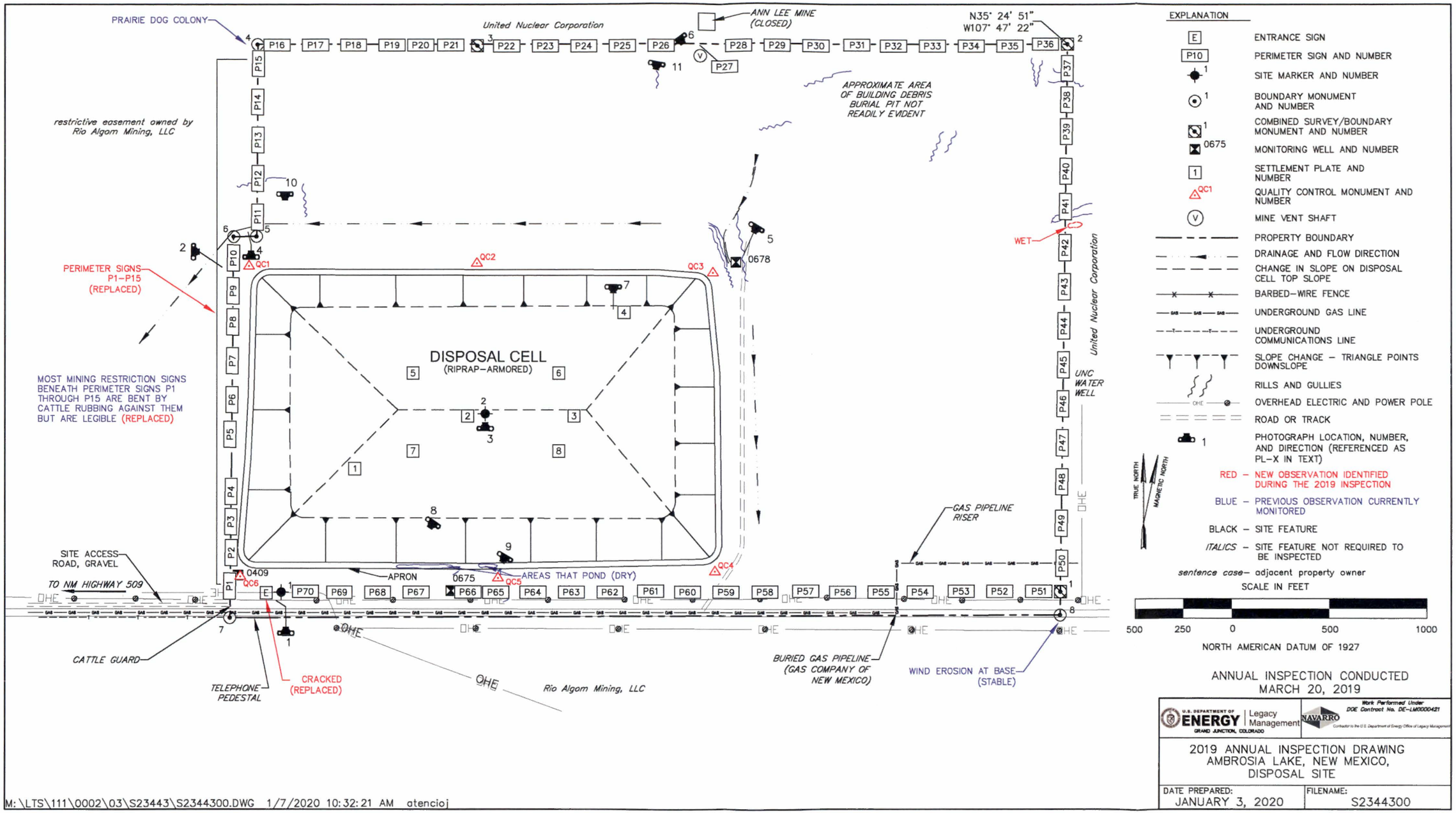

Figure 1-1. 2019 Annual Inspection Drawing for the Ambrosia Lake, New Mexico, Disposal Site

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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 (PL-4). Steel T-posts were installed next to boundary monuments to help inspectors locate the monuments. Erosion has occurred around the base of boundary monument BM-8, but the monument is stable. No maintenance needs were identified.

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 (PL-5). 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 spot-welded cover and a casing that rises approximately 3 feet above the ground. The vent was secure at the time of the inspection (PL-6). 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 and human 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 2019 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 definitively assessed (PL-7). Inspectors will continue to monitor this area.

Scattered annual weeds and perennial grasses and forbs are growing on the disposal cell top. 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. Standing water is occasionally observed in a portion of the south apron, but the area was dry during the inspection (PL-8). This location is the topographic low spot along the base of the disposal cell, and rainfall runoff collects in this area. No significant changes in the potential desiccation crack and small rills at the base of the disposal cell were observed (PL-9). Inspectors will continue to monitor 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 (PL-10). 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.

Onsite rills and gullies north and east of the disposal cell have been visually monitored for several years. While no new rills and gullies were observed during the 2019 annual inspection, existing rills and gullies continued to develop (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 that they do not impact 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. 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 they do not impact 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

Inspectors documented the following minor maintenance and repair needs that were completed after the inspection:

- Replacing the cracked entrance sign
- Replaced perimeter signs P1 through P15 and associated mining restriction signs

In June 2019, six 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 1-1.

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 (Table 1-2 and Figure 1-2) (Kleinrath 2001). LM originally agreed to sample these locations once every 3 years 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 most recent sampling event occurred in November 2019.

Table 1-2. Groundwater Monitoring Network at the Ambrosia Lake, New Mexico, Disposal Site

Monitoring Well	Hydrologic Relationship
0409	Contact between alluvium and Tres Hermanos C unit, downgradient
0675	Weathered Mancos Shale, downgradient
0678	Tres Hermanos B unit, downgradient

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, 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 the sandstone of Unit C of the Tres Hermanos member of the Mancos Shale Formation. 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). In accordance with the LTSP, groundwater monitoring results are included in this report. Wells 0409, 0675, and 0678 were sampled for molybdenum, nitrate, selenium, sulfate, uranium, and field parameters. Consistent with previous sampling events, well 0409 was dry.

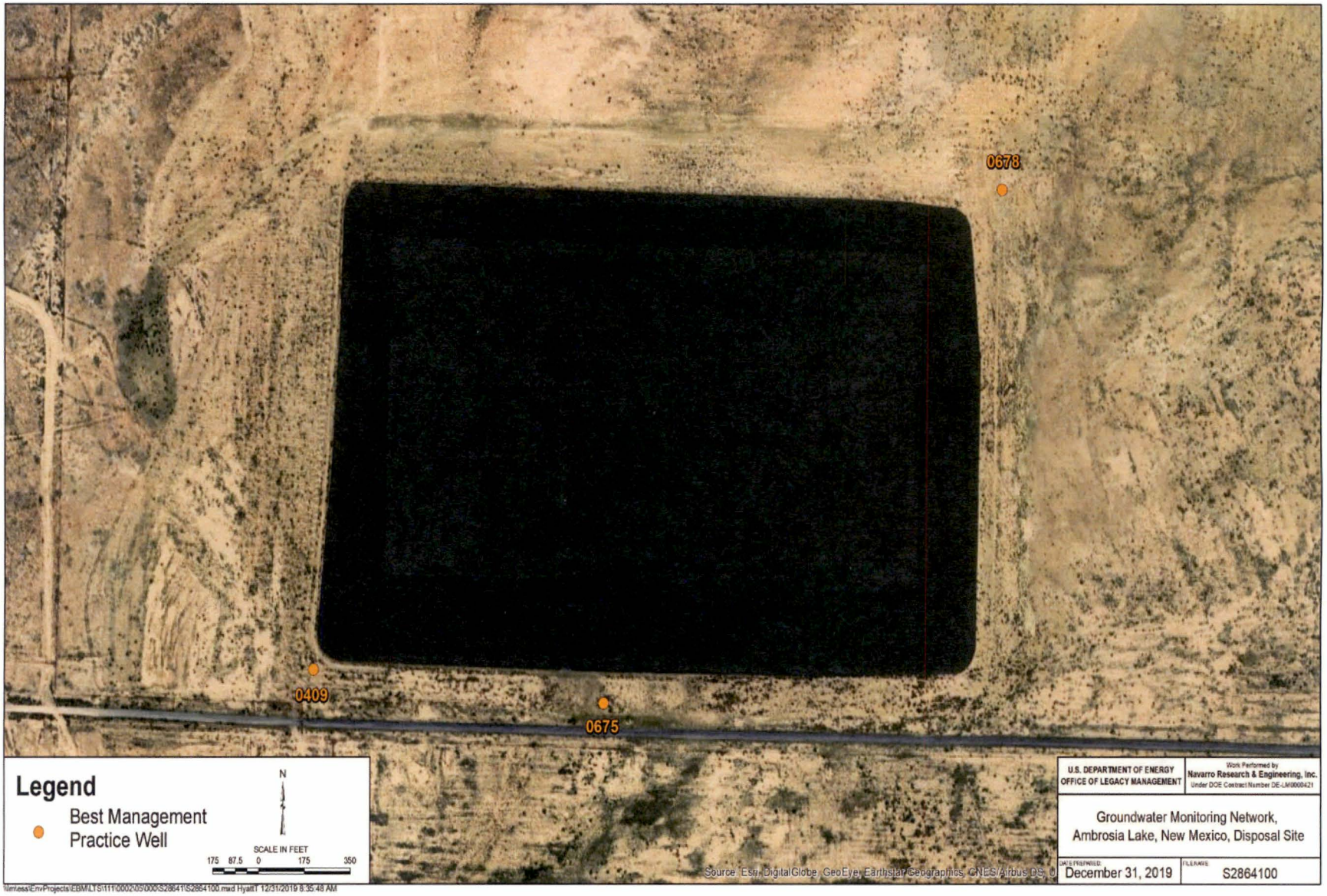


Figure 1-2. Ambrosia Lake, New Mexico, Groundwater Best Practice Monitoring Locations

Figure 1-3 through Figure 1-7 depict time concentration plots for molybdenum, nitrate, selenium, sulfate, and uranium in wells 0675 and 0678. Molybdenum levels in well 0675 had relative highs of 3.96 milligrams per liter (mg/L) in 2001 and 3.3 mg/L in 2015. Molybdenum has since decreased from 3.3 mg/L to 0.6 mg/L in 2019. By comparison, molybdenum levels have been consistently low in well 0678 since 1989.

Nitrate as nitrogen (N) levels in well 0678 were at a maximum of 520 mg/L as N in 2004 and decreased steadily to 170 mg/L 2019. Well 0675 in 2019 had a nitrate as N concentration of 34 mg/L, which was consistent with historical levels at well 0675.

Selenium in well 0678 decreased from 0.7 mg/L in 1992 to background levels in 2019. Selenium concentration in well 0675 was 0.7 mg/L in 2019 and has fluctuated between 1.3 mg/L and 0.17 mg/L since 1991. No apparent historical trend in selenium concentration is present in well 0675.

Sulfate levels have increased steadily in well 0678 from 6240 mg/L in 1989 to 8900 mg/L in 2019. Sulfate in well 0675 has been relatively consistent around the 4000 mg/L concentration value since 1989.

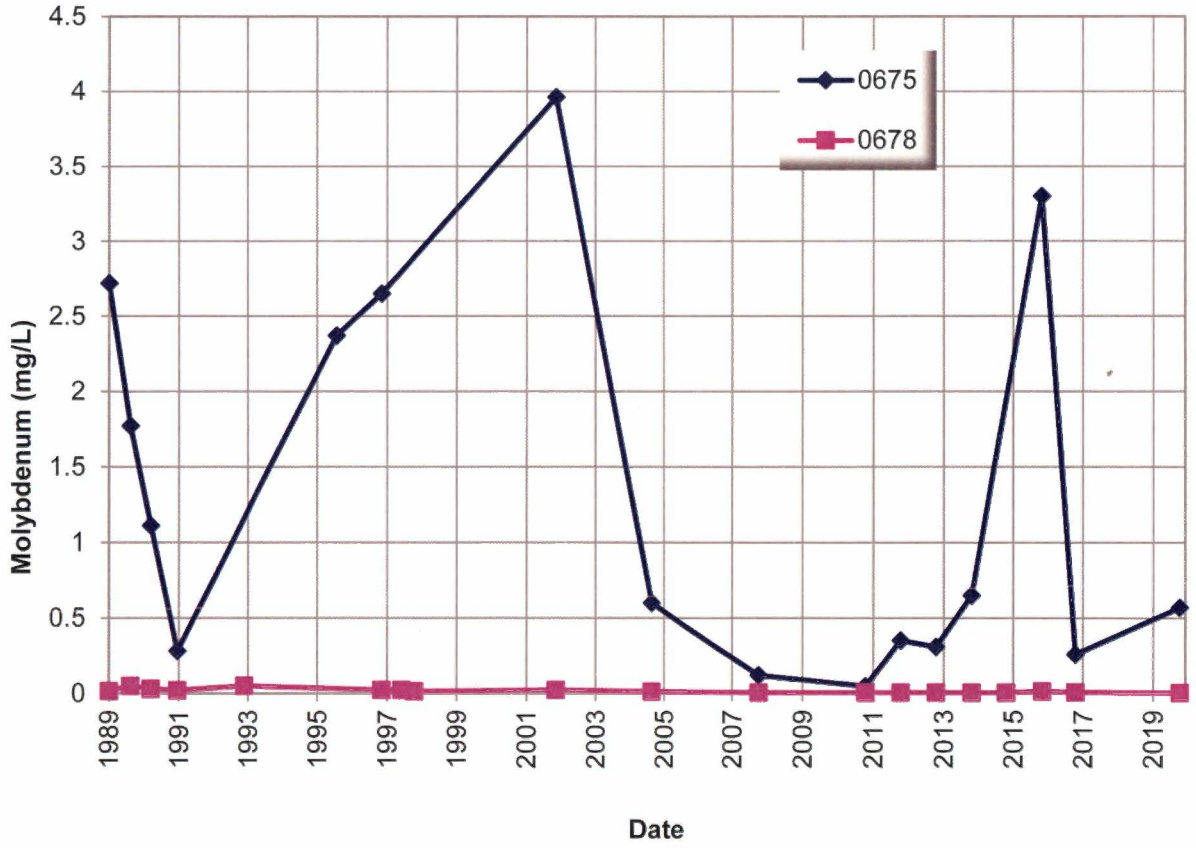


Figure 1-3. Molybdenum in Groundwater at the Ambrosia Lake, New Mexico, Disposal Site

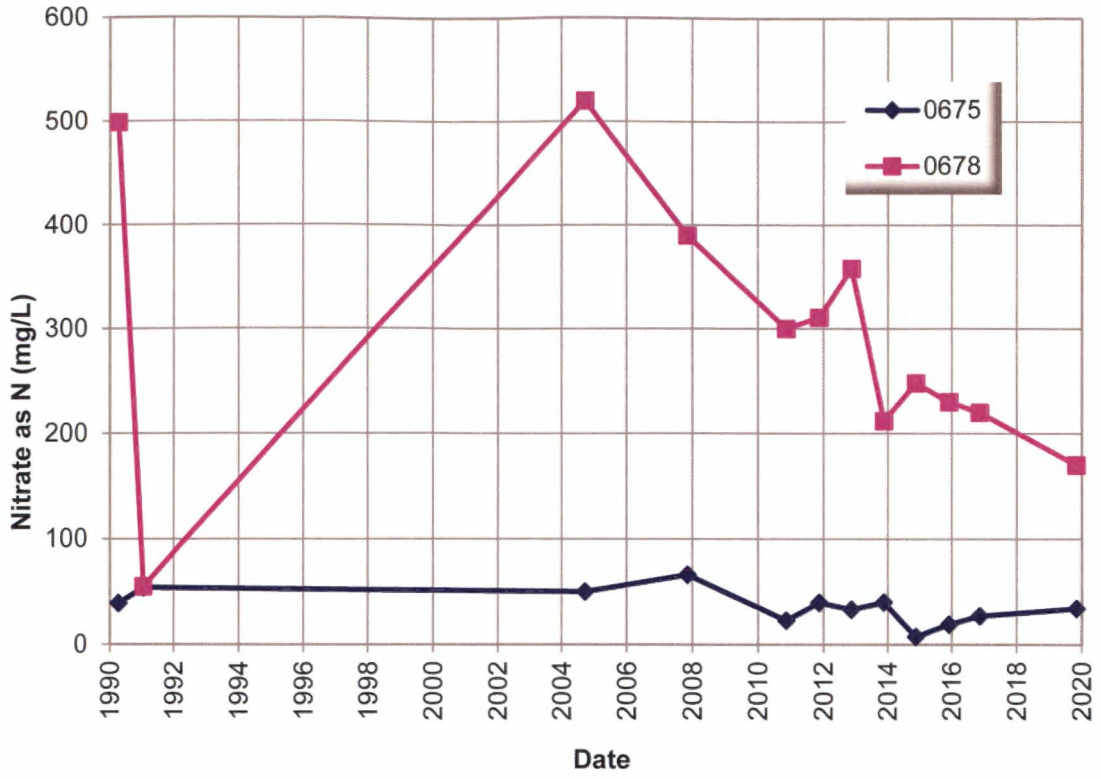


Figure 1-4. Nitrate in Groundwater at the Ambrosia Lake, New Mexico, Disposal Site

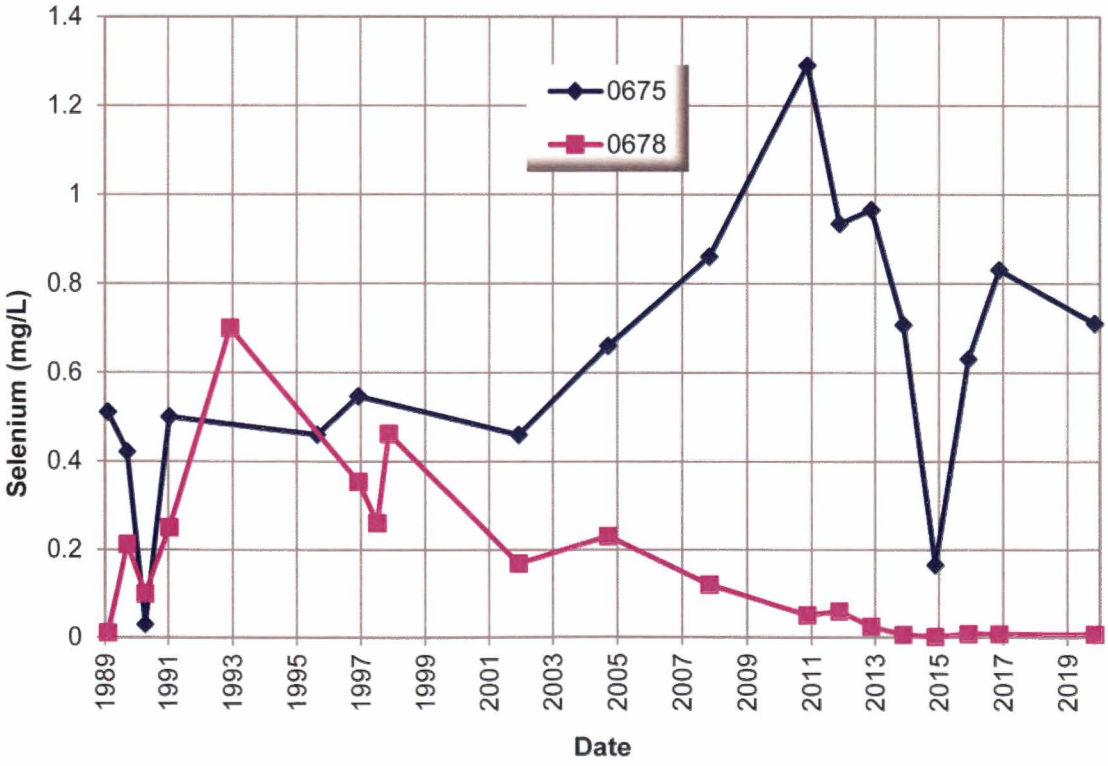


Figure 1-5. Selenium in Groundwater at the Ambrosia Lake, New Mexico, Disposal Site

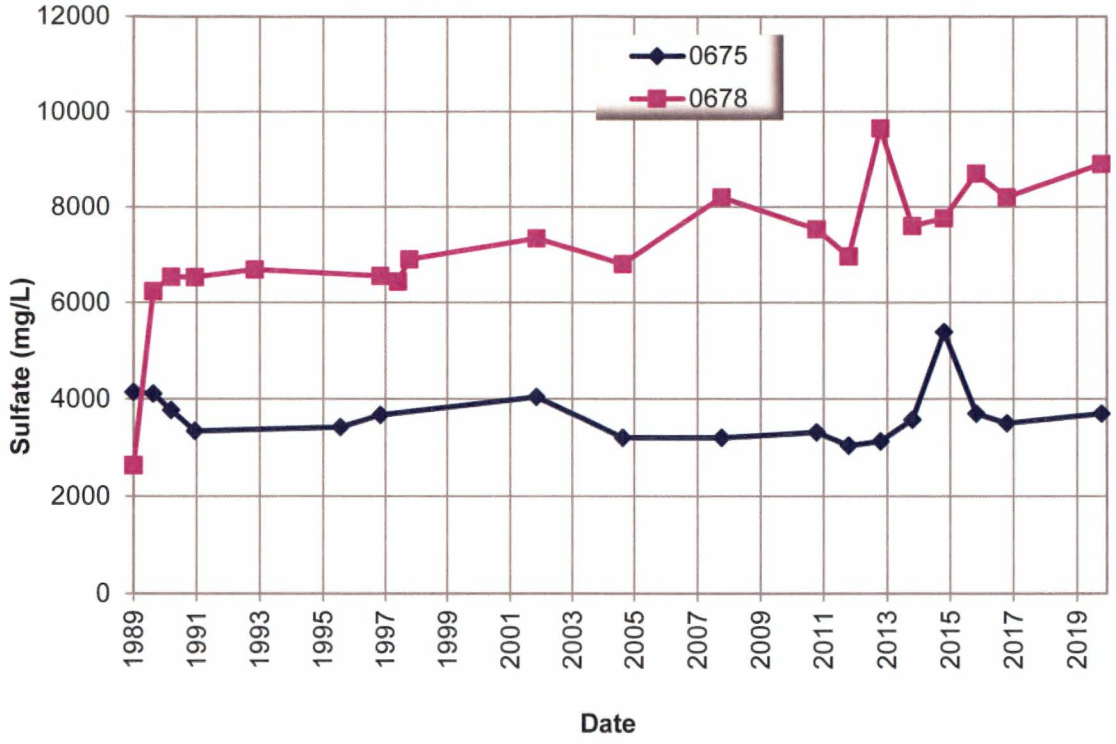


Figure 1-6. Sulfate in Groundwater at the Ambrosia Lake, New Mexico, Disposal Site

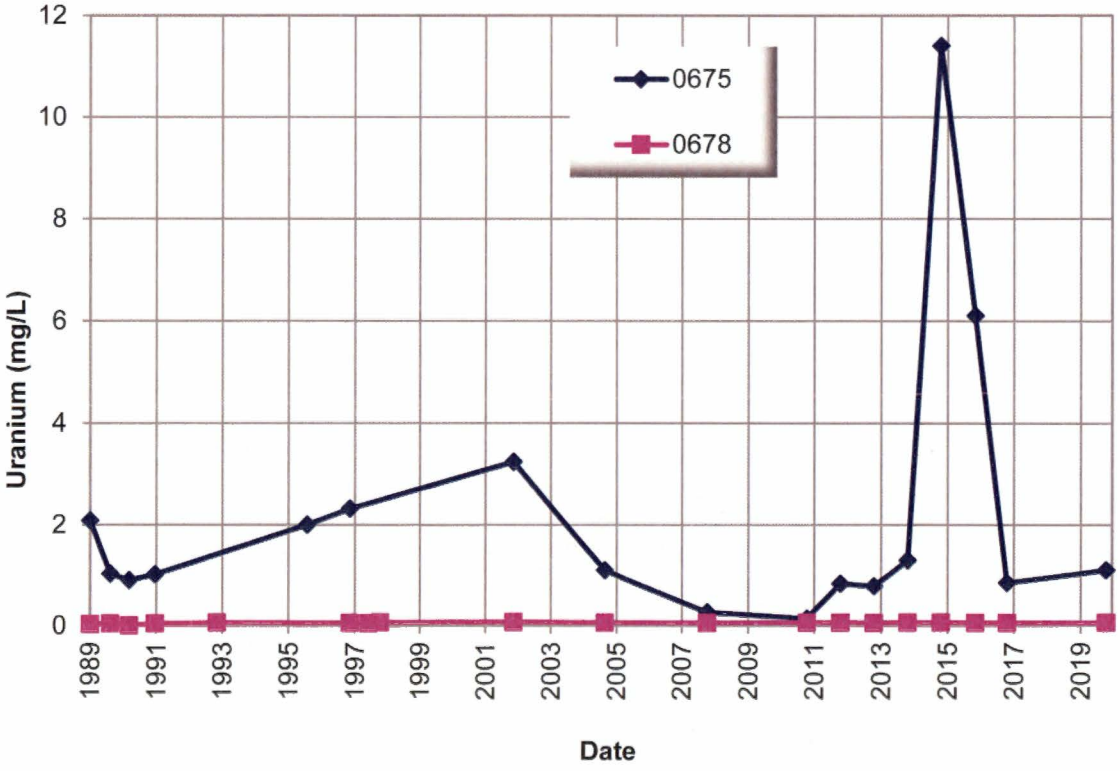


Figure 1-7. Uranium in Groundwater at the Ambrosia Lake, New Mexico, Disposal Site

In 2019, uranium in well 0678 was 0.052 mg/L, which was consistent with historical levels. Well 0675 had an anomalously high uranium concentration of 11.4 mg/L in 2014; uranium levels have since decreased to 1.1 mg/L in 2019.

In accordance with its agreement with NMED, LM will continue to monitor groundwater at the Ambrosia Lake site every 3 years until 2031. The next sampling event will be in November 2022.

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.

Kleinrath, 2001. Art Kleinrath, Program Manager, Office of Legacy Management, U.S. Department of Energy, letter (about Contract No. DE-AC13-96GJ87335, "Response to New Mexico Environment Department Regarding Monitor Well Decommissioning and Ongoing Groundwater Monitoring at the Ambrosia Lake UMTRCA Title I Disposal Site") to Marcy Leavitt, Branch Chief, New Mexico Environment Department, Groundwater Quality Bureau, August 29.

1.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	0	Entrance Sign and Site Marker SMK-1
PL-2	90	Perimeter Sign P10 and Mining Restriction Sign (Replaced Following Inspection)
PL-3	0	Site Marker SMK-2
PL-4	—	Boundary Monument BM-5
PL-5	210	Monitoring Well 0678 with Disposal Cell in Background
PL-6	185	Mine Vent Shaft
PL-7	180	Minor Settlement near Settlement Plate SP-4
PL-8	215	South Side Slope of Disposal Cell and Area That Ponds (Dry)
PL-9	210	Rills at Southern Base of Disposal Cell
PL-10	180	Bare Spot North of Disposal Cell with Minor Rills
PL-11	190	Erosion North of Disposal Cell

Note:
— = Photograph taken vertically from above.

PL-1. Entrance Sign and Site Marker SMK-1

PL-2. Perimeter Sign P10 and Mining Restriction Sign (Replaced Following Inspection)

PL-3. Site Marker SMK-2

PL-4. Boundary Monument BM-5

PL-5. Monitoring Well 0678 with Disposal Cell in Background

PL-6. Mine Vent Shaft

PL-7. Minor Settlement near Settlement Plate SP-4

PL-8. South Side Slope of Disposal Cell and Area That Ponds (Dry)

PL-9. Rills at Southern Base of Disposal Cell

PL-10. Bare Spot North of Disposal Cell with Minor Rills

PL-11. Erosion North of Disposal Cell

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 22, 2019. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified 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, and results were reported in the 2018 site inspection report.

2.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (LTSP) (DOE 2000) in accordance with procedures 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 NRC 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 22, 2019. The inspection was conducted by K. Broberg and J. Homer of the Legacy Management Support (LMS) contractor. C. Carpenter (LM site manager); D. Shearer and J. Timcik (Pennsylvania Department of Environmental Protection); M. Dombrowski (LMS contractor); 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 evaluate 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 2019 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.

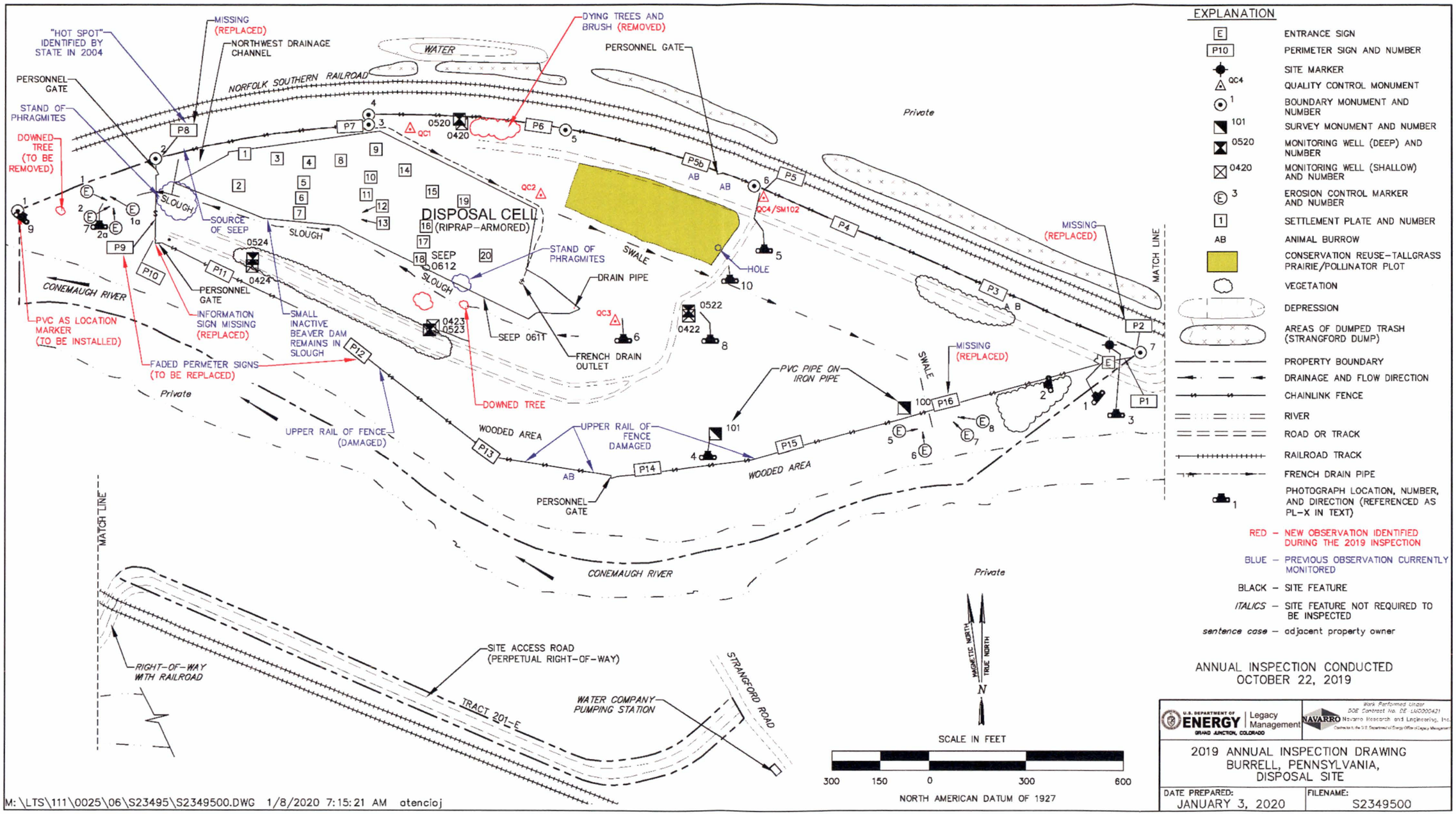
2.4.1.1 Access Road, Entrance Gate, and Entrance Sign

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 found to be locked and functional. The site entrance sign on the entrance gate was legible (PL-1). 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-2). Tree limbs growing toward, or hanging over, the security fence tagged during the 2018 inspection were removed in 2019 before the inspection. An information sign that was posted on the personnel gate at the west end of the site was identified as missing during the 2018 inspection and was replaced in 2019 before the inspection.

There are 16 perimeter signs attached to the outside of the security fence. All 16 perimeter signs were present. All perimeter signs noted as missing or faded in the 2018 inspection were replaced before the 2019 inspection. Perimeter signs P9 and P12 are faded and will be replaced in 2020. No other maintenance needs were identified.



EXPLANATION

- E — ENTRANCE SIGN
- P10 — PERIMETER SIGN AND NUMBER
- SITE MARKER
- QC4 — QUALITY CONTROL MONUMENT
- 1 — BOUNDARY MONUMENT AND NUMBER
- 101 — SURVEY MONUMENT AND NUMBER
- 0520 — MONITORING WELL (DEEP) AND NUMBER
- 0420 — MONITORING WELL (SHALLOW) AND NUMBER
- E 3 — EROSION CONTROL MARKER AND NUMBER
- 1 — SETTLEMENT PLATE AND NUMBER
- AB — ANIMAL BURROW
- CONSERVATION REUSE–TALLGRASS PRAIRIE/POLLINATOR PLOT
- VEGETATION
- DEPRESSION
- AREAS OF DUMPED TRASH (STRANGFORD DUMP)
- PROPERTY BOUNDARY
- DRAINAGE AND FLOW DIRECTION
- CHAINLINK FENCE
- RIVER
- ROAD OR TRACK
- RAILROAD TRACK
- FRENCH DRAIN PIPE
- 1 — PHOTOGRAPH LOCATION, NUMBER, AND DIRECTION (REFERENCED AS PL-X IN TEXT)

RED – NEW OBSERVATION IDENTIFIED DURING THE 2019 INSPECTION

BLUE – PREVIOUS OBSERVATION CURRENTLY MONITORED

BLACK – SITE FEATURE

ITALICS – SITE FEATURE NOT REQUIRED TO BE INSPECTED

sentence case – adjacent property owner

ANNUAL INSPECTION CONDUCTED
OCTOBER 22, 2019

U.S. DEPARTMENT OF ENERGY | Legacy Management
GRAND JUNCTION, COLORADO

Work Performed Under DOE Contract No. DE-LM0000421
NAVARRO Navarro Research and Engineering, Inc.
Contractor to the U.S. Department of Energy Office of Legacy Management

2019 ANNUAL INSPECTION DRAWING
BURRELL, PENNSYLVANIA,
DISPOSAL SITE

DATE PREPARED: JANUARY 3, 2020

FILENAME: S2349500

Figure 2-1. 2019 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, Boundary Monuments

The site has three survey monuments (PL-4) and seven boundary monuments (PL-5). Survey monument SM-102 was noted as missing in the 2017 and 2018 inspections. In 2019, before the annual inspection, four new baseline aerial survey quality control monuments were installed at the site (PL-6). Quality control monument QC-4 will serve as a replacement for survey monument SM-102.

Boundary monument BM-1 is difficult to locate because it is buried by dirt, and a downed tree was blocking the path to the expected location. DOE plans to install a 4-foot-tall, 4-inch PVC pipe around and over boundary monument BM-1 in 2020 to aid in locating the monument and removing the tree to clear the path. No other maintenance needs were identified.

2.4.1.5 Erosion Control Markers

The site has eight erosion control markers (PL-7). No maintenance needs were identified.

2.4.1.6 Monitoring Wells

The site has eight monitoring wells that were last 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. 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 in 2018, but these will be installed in the future. All wellhead protectors that were observed during the annual inspection were locked and undamaged (PL-8). 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 (PL-9).

Control of vegetation (including woody vegetation) on the disposal cell is not required by the LTSP. A screening-level risk assessment conducted by DOE from 1996 to 1997 concluded

that plant succession on the disposal cell does not present significant or credible risk to human health or the environment and, due to reduced hydraulic flux through the cover from evapotranspiration, may 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 evaluate whether it remains protective of human health and the environment and whether it interferes with the ability of inspectors to assess disposal cell cover stability. The 2017 inspection report (DOE 2018) noted that LM was planning to conduct a follow-up assessment in fiscal year 2019. LM delayed the assessment to further consult with NRC on the scope of the study. Currently, NRC and LM are working on joint research to analyze disposal cell cover performance and pedogenesis at other UMTRCA sites that will support development of the scope for the Burrell site study.

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 French drain, on the south slope of the disposal cell, was not flowing during the inspection, and no outflow has ever been observed during inspections. Water was not ponded anywhere along the French drain, and no wetland vegetation was observed, which indicates it is operating properly. Inspectors will continue to monitor the French drain area to verify that it continues to operate as designed.

A large tree fell in the slough south of the disposal cell in 2019. Given the way the tree fell, and its location on a steep slope, it may not be necessary to remove it at this time. In 2020, DOE will ensure that this downed tree does not interfere with drainage in the slough.

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 2019, as no evidence of recent activity was observed around the dam (e.g., animal tracks, new cuts). In its current state, it does not interfere with the flow of water enough to warrant action. 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 observed 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 that was observed east of monitoring wells 0420 and 0520 was successfully cleared in 2019 to facilitate seasonal 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. LM communicated the results of a records search to the Commonwealth of Pennsylvania in late 2004. The hot spot was the subject of a follow-up discussion with Pennsylvania 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. The area is not on DOE property; the Commonwealth of Pennsylvania is the responsible authority.

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

Minor maintenance needs identified by the inspectors during the 2018 annual inspection and completed in 2019, include:

- Information sign replacement
- Removal of dying trees and brush
- Replacement of perimeter signs P2, P8, and P16
- Regular maintenance to treat or remove woody vegetation and noxious weeds

During the 2019 inspection, inspectors documented maintenance needs that will be addressed in 2020, including:

- Installing 4-inch PVC pipe over boundary monument BM-1 for easier identification
- Removing a downed tree across the path leading to boundary monument BM-1
- Replacing faded and worn perimeter signs P9 and P12

In 2019, four 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 2.1. As a best management practice, concrete pads surrounding monitoring wells 0424 and 0524 will be installed in the future. No other 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 four sets of monitoring wells (eight monitoring wells total) and two seeps (Table 2-2 and Figure 2-2). Each set of wells consists of a shallow well completed in unconsolidated fill and alluvium (400-series wells) and a deeper well completed in the bedrock of the Casselman Formation (500-series wells). Groundwater is sampled for four analytes: lead, molybdenum, selenium, and uranium. The maximum concentration limits (MCLs) for these analytes in groundwater (40 CFR 192 Table 1 Subpart A) are listed in 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

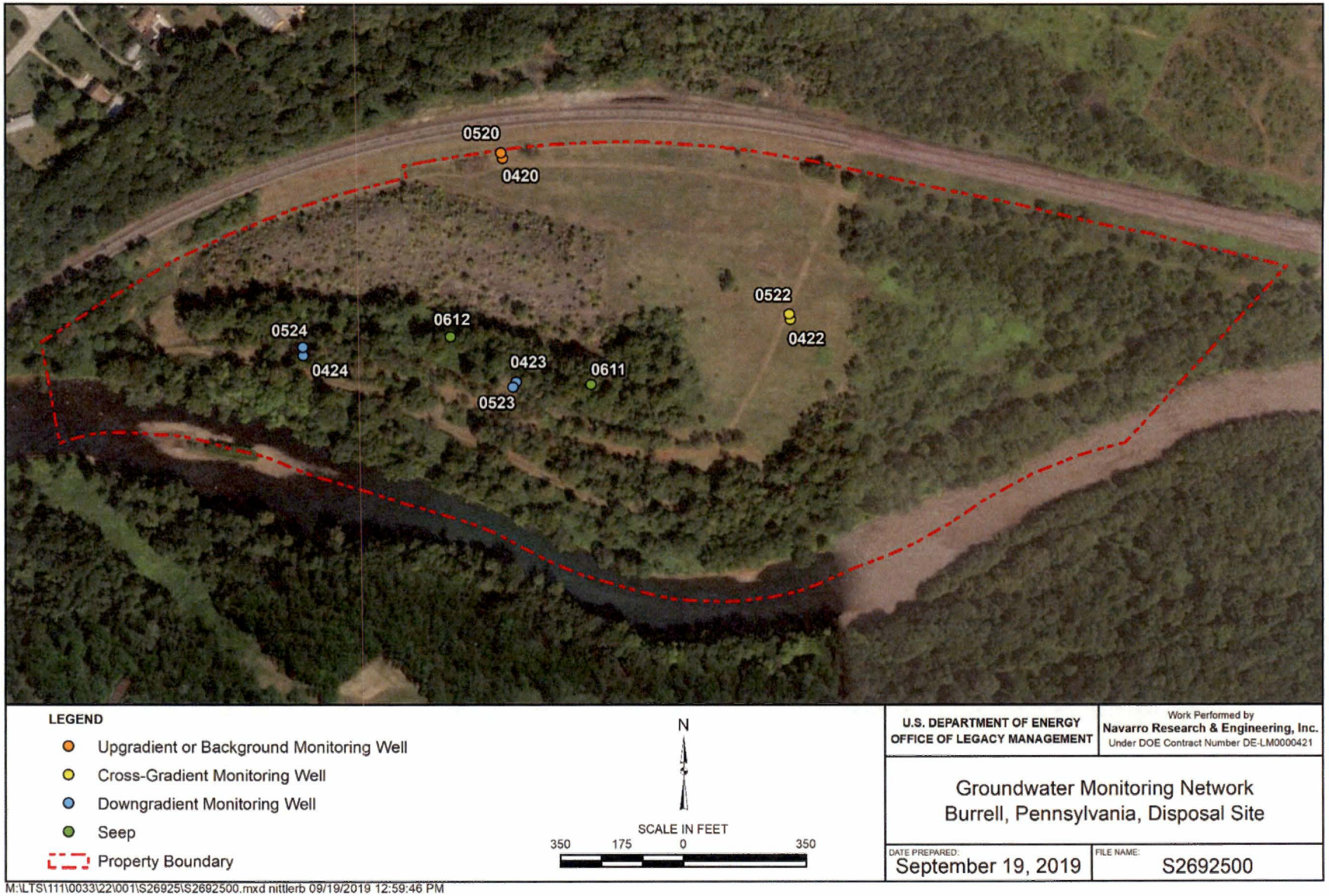


Figure 2-2. Groundwater Monitoring Network for the Burrell, Pennsylvania, Disposal Site

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

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). The *2018 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites* (DOE 2019) reports the most recent monitoring results. The four analytes monitored (lead, molybdenum, selenium, and uranium) continue to remain below the MCLs identified in 40 CFR 192 Table 1 Subpart A, 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 regard to their respective MCLs are considered insignificant in that the concentrations would not exceed the MCL for some time if the trend continues. This will allow LM time to investigate the cause and assess if the increase is the result of cell performance. The increase in molybdenum identified in one of the downgradient wells is considered potentially significant in that it may exceed the MCL before the next regularly scheduled sampling event in 2023. Consequently, LM will resample in fall of 2020, 3 years ahead of the required 5-year sampling frequency.

2.8.2 Vegetation Management

In accordance with the Vegetation Management Plan, mowing and spot herbicide application continues. Vegetation management activities include ensuring the fence line and access paths remain clear of Japanese knotweed (an invasive species), applying herbicides where needed, and regularly mowing open areas of the site. These activities have been successful in controlling Pennsylvania-listed noxious weeds onsite. Pennsylvania-listed noxious weeds purple loosestrife, poison hemlock, and multiflora rose were not observed in 2019, except for sporadic resprouts following mowing. Additional invasive species that were identified in 2018 have been addressed as well, including teasel and tree of heaven. Several other invasive plants persist, including Japanese knotweed and common reed. A stand of common reed that was identified during previous inspections appears to have expanded at the west end of the disposal cell. This stand is very difficult to access because of the presence of standing water and its location adjacent to the perimeter fence. Wooded areas remained heavily vegetated with Japanese knotweed. Privet is an invasive shrub that was observed in several areas. Pursuant to the Vegetation Management Plan, access paths to monitoring wells and the fence line have been effectively maintained.

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. Maintenance through 2019

included mowing that helped prevent the establishment of unwanted vegetation. Several seeded wildflowers were observed during the 2019 inspection, and the prairie plot appeared to be progressing as planned after 1 year of growth (PL-10). Prairie grasses and wildflowers are long-lived perennials that take their first couple of growing seasons to establish roots. A diverse flowering community is not expected for several years. Following the 2019 inspection, field personnel broadcast Indian grass to augment the 2018 seeding effort.

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), 2018. *2017 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites,* LMS/S17252, March.

DOE (U.S. Department of Energy), 2019. *2018 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites,* LMS/S22053, March.

2.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	310	Sign at Entrance Gate
PL-2	260	Southeast Fence Line
PL-3	—	Site Marker
PL-4	—	Survey Monument SM-101
PL-5	—	Boundary Monument BM-6
PL-6	—	Quality Control Monument QC-3
PL-7	—	Erosion Control Marker ECM-2a
PL-8	—	Monitoring Well 0422
PL-9	35	South Slope of Disposal Cell with Vegetative Cover
PL-10	0	East Side of Test Prairie

Note:
— = Photograph taken vertically from above.

PL-1. Sign at Entrance Gate

PL-2. Southeast Fence Line

PL-3. Site Marker

PL-4. Survey Monument SM-101

PL-5. Boundary Monument BM-6

PL-6. Quality Control Monument QC3

PL-7. Erosion Control Marker ECM-2a

PL-8. Monitoring Well 0422

PL-9. South Slope of Disposal Cell with Vegetative Cover

PL-10. East Side of Test Prairie

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 23, 2019. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified several minor maintenance needs.

Engineered repairs were completed to the riprap-armored embankment of Chartiers Creek north of the disposal cell just before the 2019 inspection. A riparian forest buffer was also planted above and along the embankment. Disturbed areas were seeded with a pollinator-friendly native grass and wildflower mix. This riparian forest buffer corridor will work with the engineered riprap embankment to further stabilize the area against future stream flooding events and to reduce erosion upgradient of the riprap embankment. The Commonwealth of Pennsylvania has a goal to establish 95,000 acres of forest riparian buffer by 2025. The Commonwealth was notified of the streambank project so the newly planted acreage could be counted toward its goal.

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 site-specific alternate concentration limit (ACL) for uranium in groundwater and the 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) (DOE 2013) in accordance with procedures established to comply with 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 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 NRC general license in 1996. 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.

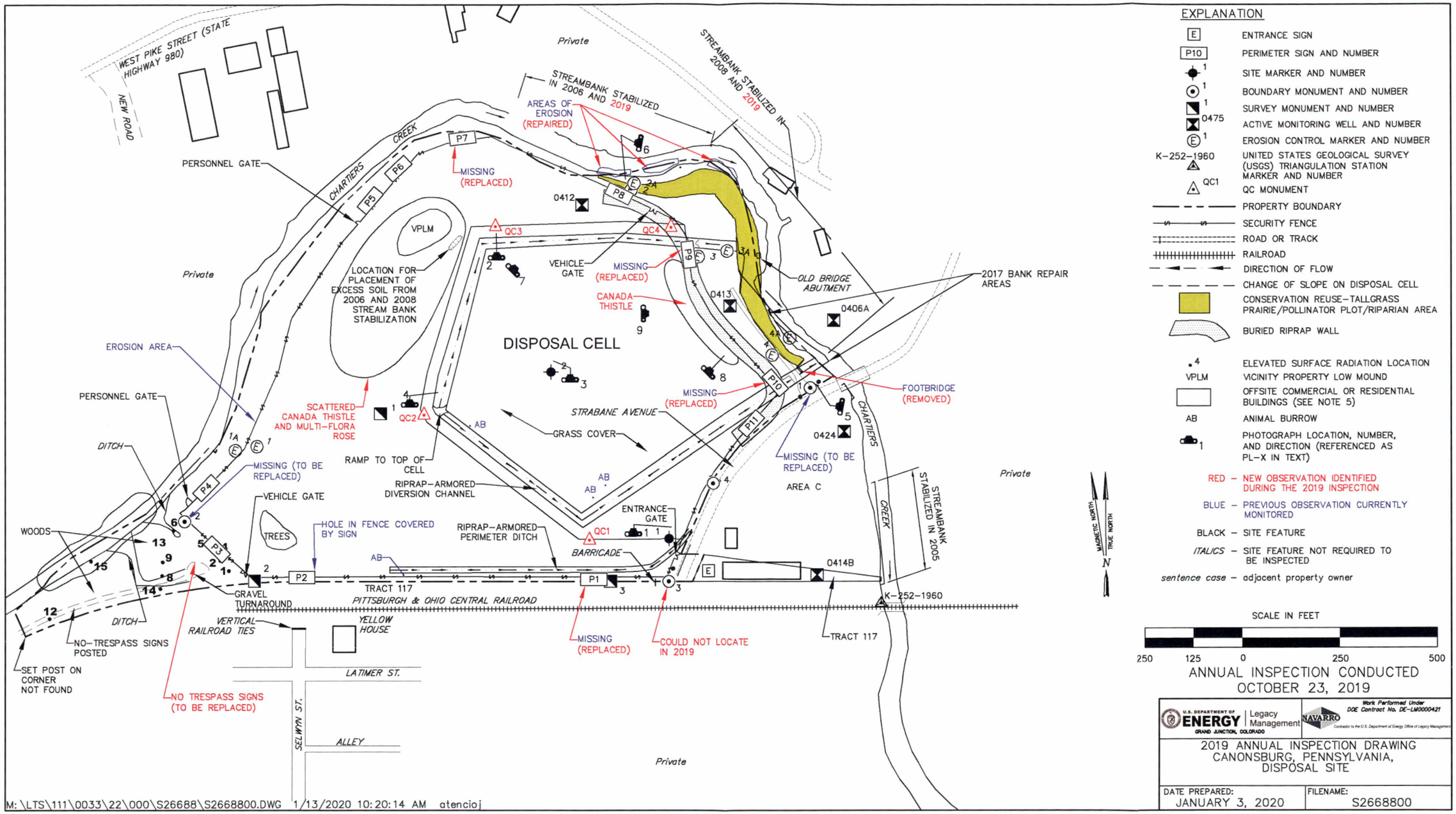
In addition to the area within the property boundary, separate ICs are applied to Area C and the east portion of Tract 117, which are southeast of Strabane Avenue. Area C (3.1 acres) was sold and transferred in 2005, and the east portion of Tract 117 (0.431 acre) was sold and transferred in 2009 to the 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 deeds for Area C and Tract 117 establish restrictions to limit excavation, prohibit the disturbance of the streambank, maintain access for monitoring and streambank maintenance, and prevent 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, in Canonsburg, Pennsylvania, was inspected on October 23, 2019. The inspection was conducted by K. Broberg and J. Homer of the Legacy Management Support (LMS) contractor. C. Carpenter (LM site manager), D. Shearer (Pennsylvania Department of Environmental Protection), C. Shrontz (representing 48th District Representative Tim O'Neal), M. Dombrowski (LMS contractor), 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 evaluate 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 2019 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.



EXPLANATION

- ENTRANCE SIGN
- PERIMETER SIGN AND NUMBER
- SITE MARKER AND NUMBER
- BOUNDARY MONUMENT AND NUMBER
- SURVEY MONUMENT AND NUMBER
- ACTIVE MONITORING WELL AND NUMBER
- EROSION CONTROL MARKER AND NUMBER
- UNITED STATES GEOLOGICAL SURVEY (USGS) TRIANGULATION STATION MARKER AND NUMBER
- QC MONUMENT
- PROPERTY BOUNDARY
- SECURITY FENCE
- ROAD OR TRACK
- RAILROAD
- DIRECTION OF FLOW
- CHANGE OF SLOPE ON DISPOSAL CELL
- CONSERVATION REUSE-TALLGRASS PRAIRIE/POLLINATOR PLOT/RIPARIAN AREA
- BURIED RIPRAP WALL
- ELEVATED SURFACE RADIATION LOCATION
- VPLM VICINITY PROPERTY LOW MOUND
- OFFSITE COMMERCIAL OR RESIDENTIAL BUILDINGS (SEE NOTE 5)
- AB ANIMAL BURROW
- PHOTOGRAPH LOCATION, NUMBER, AND DIRECTION (REFERENCED AS PL-X IN TEXT)

RED – NEW OBSERVATION IDENTIFIED DURING THE 2019 INSPECTION

BLUE – PREVIOUS OBSERVATION CURRENTLY MONITORED

BLACK – SITE FEATURE

ITALICS – SITE FEATURE NOT REQUIRED TO BE INSPECTED

sentence case – adjacent property owner

MAGNETIC NORTH / TRUE NORTH

SCALE IN FEET

250 125 0 250 500

ANNUAL INSPECTION CONDUCTED OCTOBER 23, 2019

U.S. DEPARTMENT OF ENERGY | Legacy Management — GRAND JUNCTION, COLORADO

Work Performed Under DOE Contract No. DE-LM0000421 — NAVARRO — Contractor to the U.S. Department of Energy Office of Legacy Management

2019 ANNUAL INSPECTION DRAWING
CANONSBURG, PENNSYLVANIA,
DISPOSAL SITE

DATE PREPARED: JANUARY 3, 2020

FILENAME: S2668800

Figure 3-1. 2019 Annual Inspection Drawing for the Canonsburg, Pennsylvania, Disposal Site

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3.4.1.1 Site Access, Entrance Gates, and Entrance Sign

Main access to the site is from Strabane Avenue. There are three vehicle gates: the main entrance gate at the southeast corner of the site along Strabane Avenue, a vehicle access gate at the southwest corner of the site, and a vehicle access gate north of the disposal cell between perimeter signs P8 and P9. There are also two personnel access gates. All gates were locked and functional. The entrance sign is posted on the main entrance gate. No maintenance needs were identified.

3.4.1.2 Security Fence and Perimeter Signs

A chainlink security fence encloses most of the site. A vegetation-free buffer zone is maintained around the entire security fence. An area of erosion under the west security fence remains. The area appears to be stable and has not grown in several years. For added security, slats were installed in 2016 across the area beneath the fence to help fill in the gap.

There are 11 perimeter signs attached to the security fence. Perimeter signs P1, P7, P9, and P10 were replaced following the 2018 inspection. All perimeter signs were accounted for and legible in 2019. No 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 (PL-1), and site marker SMK-2 is on the top slope of the disposal cell. No maintenance needs were identified.

3.4.1.4 Survey, Boundary Monuments

The site has three survey monuments, four boundary monuments, and four baseline aerial survey quality control monuments (PL-2). Boundary monuments BM-1 and BM-2 (noted as missing during the 2017 inspection) were not located and are scheduled to be replaced in 2020. Boundary monument BM-3 was not located in 2019. A metal detector will be used to try to locate it in 2020. 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. 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. Monitoring wells were last sampled and inspected in October 2018. All wellhead protectors that were observed during the inspection were undamaged and locked. No maintenance needs were identified.

3.4.2 Inspection Areas

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

3.4.2.1 Disposal Cell

The disposal cell, completed in 1985, occupies 6.8 acres and is covered in grass (PL-3). 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 biointrusion 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 being prevalent. 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.

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-4). Periodic physical removal and spot herbicide applications have been effective at reducing woody vegetation and will continue to be conducted as needed.

A pedestrian footbridge was installed northeast of the disposal cell in 2010. It was removed in 2019 as part of the erosion repair project along the streambank. Removal of the bridge better fits the long-term plans for the area by discouraging the public from accessing and disturbing the newly planted riparian forest buffer. 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 the 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 were removed in December 2017, and "no trespassing" signs were posted. Two of these signs are worn and will be replaced in 2020. No evidence of recent trespassing was observed during the 2019 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 now posted around this area to prevent unauthorized expansion of the turnaround. 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 2019. 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 streambank west of the site indicate that the bank of that creek is stable after numerous stabilization projects completed over the past 2 decades.

Between 2001 and 2008, several streambank-stabilization projects were conducted north and east of the site. The projects consisted of installing riprap armoring along the streambanks. Age and heavy flow events in Chartiers Creek in late 2017 and early 2018 damaged those riprap installations. In late summer 2019, the entire length of the riprap embankment along Chartiers Creek north of the disposal cell (approximately 1200 linear feet) was repaired during low streamflow. The work consisted of minor grading, replacing geotextile filter fabric, and importing and placing 2-feet-thick R6 riprap slopes (PL-5 and PL-6).

A conservation reuse initiative was included as part of the streambank stabilization repair project. A riparian forest buffer was planted following the riprap slope repair; it consisted of 525 new native trees and shrubs within a 1.7-acre corridor adjacent to Chartiers Creek. Disturbed areas were then seeded with a pollinator-friendly native grass and wildflower mix (PL-7 and PL-8). This corridor will further protect the Chartiers Creek streambank and help prevent erosion above the riprap embankment. The riparian forest buffer is recognized as a means to improve stream quality. The Commonwealth of Pennsylvania has a goal to establish 95,000 acres of riparian forest buffer by 2025. The Pennsylvania Department of Conservation and Natural Resources was notified of the project.

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 (PL-9). There was no evidence that any of the ICs in place for Area C and Tract 117 had been violated.

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. 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. No need for a follow-up inspection was identified.

3.6 Maintenance

The Chartiers Creek project, executed in 2019, included engineered repairs to the riprap-armored embankment north of the disposal cell and areas of erosion identified in the 2018 inspection. A riparian forest buffer was planted above and along the embankment to help stabilize the bank. Additional minor maintenance needs identified by the inspectors during the 2018 annual inspection and completed in 2019 include:

- Replacing of perimeter signs P1, P7, P9, P10
- Regular maintenance to treat or remove woody vegetation and noxious weeds
- Removing the footbridge over the riprap-armored diversion ditch

Inspectors documented minor maintenance needs that will be addressed in 2020, including:

- Replacing two "no trespassing" signs in the southwest corner of the site
- Locating boundary monument BM-3
- Replacing boundary monuments BM-1 and BM-2

In 2019, four 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 3-1. 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) to 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) to 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 and analyzed for the one constituent of concern, uranium. The ACL is 1.0 milligram per liter (mg/L) at the POC wells. With the exception of monitoring wells 0412 and 0413,

uranium concentrations in 2018 were also below the UMTRCA maximum concentration limit (MCL) of 0.044 mg/L.

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

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). Additionally, the *2018 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites* (DOE 2019) presents the comprehensive monitoring results for 2018.

3.7.2 Surface Water Monitoring

In accordance with the LTSP, LM also conducts surface water monitoring every 5 years. The most recent sampling event occurred in October 2018. Uranium concentrations in surface water sampled in 2018 were below the established ACL of 0.01 mg/L.

One location, 0602, is the point-of-exposure (POE) location for Chartiers Creek and is sampled and analyzed for uranium. The 2018 uranium concentration of 0602 had a concentration of 0.00096 mg/L, significantly below the MCL.

The *2018 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites* (DOE 2019) presents the comprehensive monitoring results for 2018. Additionally, all monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System website (http://gems.lm.doe.gov/#site=CAN).

3.7.3 Vegetation Management

Vegetation management activities continue to be conducted at the site in accordance with the LTSP; they include spot-treating tree of heaven (an invasive species), physical removal, spot-application of herbicides to target 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.

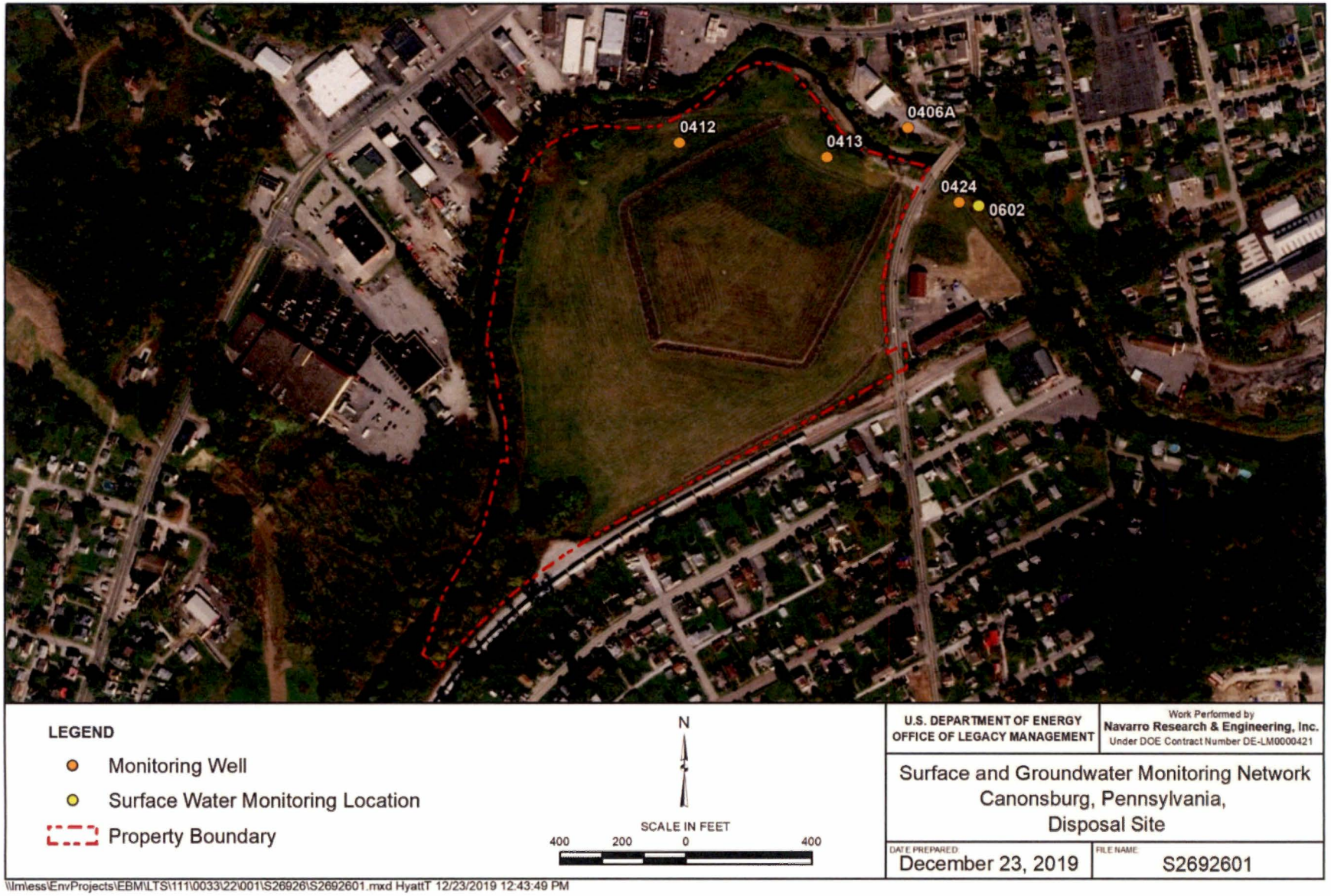

Figure 3-2. Groundwater Monitoring Network for the Canonsburg, Pennsylvania, Disposal Site

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), 2019. *2018 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites,* LMS/S22053, March.

3.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	—	Site Marker SMK-1
PL-2	—	Quality Control Monument QC3
PL-3	0	North Side of Disposal Cell
PL-4	0	West Section of Riprap-Armored Diversion Ditch
PL-5	280	Newly Repaired Riprap Embankment
PL-6	280	West End of Riprap Embankment
PL-7	45	Newly Planted Riparian Area
PL-8	45	Newly Planted Riparian Area
PL-9	90	Area C from Disposal Cell

Note:
— = Photograph taken vertically from above.

PL-1. Site Marker SMK-1

PL-2. Quality Control Monument QC3

PL-3. North Side of Disposal Cell

PL-4. West Section of Riprap-Armored Diversion Ditch

PL-5. Newly Repaired Riprap Embankment

PL-6. West End of Riprap Embankment

PL-7. Newly Planted Riparian Area

PL-8. Newly Planted Riparian Area

PL-9. Area C from Disposal Cell

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 inspection on May 13, 2019, and the annual groundwater monitoring event in May 2018. No cause for a follow-up inspection was identified.

Monitoring of the 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 depression (rotated inward). However, no change in depth or length of the feature was observable. Monitoring of the linear depression will continue to understand its cause and address issues. No changes were observed on the top of the disposal cell or in the associated drainage features. Inspectors identified several minor maintenance needs that have been addressed.

LM conducts annual groundwater sampling and analysis to monitor potential contaminant migration downgradient from the disposal cell. The most recent annual sampling event occurred in May 2019. Concentrations in the three point-of-compliance (POC) wells are below site-specific thresholds. In addition, LM monitors one background well and three best management practice (BMP) wells or noncompliance wells. BMP well 0618 is monitored more frequently in response to variable uranium concentrations that are typically above site-specific thresholds. Increased monitoring of BMP well 0618 will continue to assess any influence from the holding pond removal and transient drainage system closure.

4.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (LTSP) (DOE 2015) in accordance with procedures 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 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 NRC general license in 1996. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gates, warning or no-trespassing signs (entrance and perimeter signs), site markers, survey and boundary monuments, and wellhead protectors.

4.4 Inspection Results

The site, 3.5 miles southwest of Durango, Colorado, was inspected on May 13, 2019. The inspection was conducted by M. Kastens and D. Atkinson of the Legacy Management Support (LMS) contractor. J. Dayvault (LM site manager); M. Cosby (Colorado Department of Public Health and Environment); and D. Miller, D. Holbrook, C. Jarchow, and A. Blackford (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 evaluate 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 by the LTSP 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 2019 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. The entrance sign showed outdated information and was replaced following the inspection. No other 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.

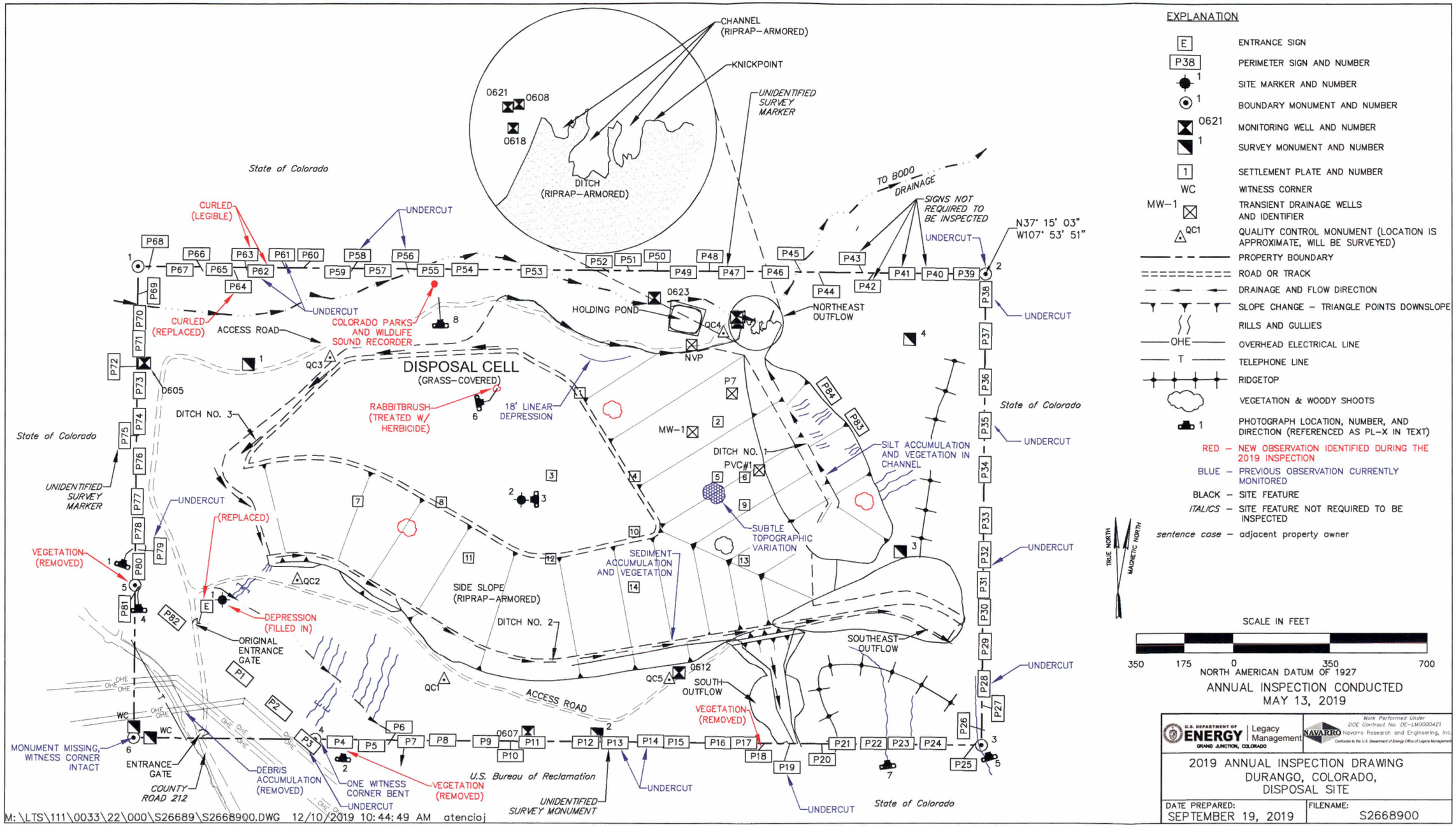

Figure 4-1. 2019 Annual Inspection Drawing for the Durango, Colorado, Disposal Site

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The concrete bases of several perimeter signs have been and continue to be undercut, but the positions of the signs remain uncompromised (PL-1). Following the 2018 inspection, perimeter sign P45 was moved approximately 25 feet (ft) to the east, a location less prone to erosion. Vegetation was encroaching on perimeter sign P4 (PL-2) and P18 and was removed in 2019 following the inspection. Perimeter sign P64 was a plastic sign and had faded and curled and was replaced in 2019 following the inspection. Perimeter signs P62 and P63 are also plastic and somewhat curled but still legible at this time. No other maintenance needs were identified.

4.4.1.3 Site Markers

The site has two site markers. Site marker SMK-1 is just inside the original entrance gate; a deep depression to the side of SMK-1 was filled in after the inspection. Site marker SMK-2 is on the top slope of the disposal cell; minor cracking and spalling along the concrete base edges was repaired in 2018 (PL-3). 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 (BOR) pipeline was installed, bringing the current number of boundary monuments to five. However, both witness corners to boundary monument BM-6 were present. Replacement of boundary monument BM-6 is not warranted at this time. Boundary monument BM-5 (PL-4) and one of its witness corners was covered with vegetation, which was removed following the inspection. The north witness corner of boundary monument BM-3 was reinforced and stabilized as identified in the 2018 annual inspection (PL-5). 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 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 2019. A single volunteer rabbitbrush shoot (a woody species) (PL-6) was observed growing on the disposal cell top and was treated with herbicide in 2019. No other 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 that first was observed in 2015. Inspectors did not observe any significant changes to the depression. Inspectors will continue to monitor this area.

A subtle topographic variation in the surface of the northeast side slope, first observed during the 2018 annual inspection, was observed again in 2019. The variation does not pose a concern for disposal cell integrity at this time as no evidence of significant erosion was found during the 2019 inspection. Inspectors will continue to monitor the variation. 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 (PL-7). 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 enhance wildlife habitat. 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. 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 was removed in 2017. Inspectors in 2019 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 a Colorado Parks and Wildlife (CPW) sound recording device placed near the road along the north side of the disposal cell (PL-8). The device was placed onsite without the

knowledge of LM or LMS personnel. LM discussed the issue with CPW. 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. CPW manages land to the north, west, and east of the site, and BOR 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:

- Removing vegetation from around perimeter signs P4 and P18 and boundary monument BM-5
- Replacing plastic perimeter sign P64, which had curled
- Filling in and stabilizing the soil around site marker SMK-1
- Treating woody species on the side and top slopes of the disposal cell
- Replacing the entrance sign, which showed outdated information
- Removing vegetation from around boundary monument BM-5 and one of its witness corners

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 BMP monitoring wells, such as BMP well 0618, are sampled more frequently to evaluate variable uranium concentrations. The most recent annual sampling event occurred at the site in May 2019. 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 BMP. 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.

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	POC	Downgradient (uppermost aquifer)
0608	BMP	Downgradient (alluvium)
0612	POC	Downgradient (uppermost aquifer)
0618	BMP	Downgradient (alluvium)
0621	POC	Downgradient (uppermost aquifer)
0623	BMP	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).

Molybdenum, selenium, and uranium concentrations in POC wells (0607, 0612, and 0621) in the uppermost aquifer are below their respective standards.

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

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

Abbreviation:
mg/L = milligrams per liter

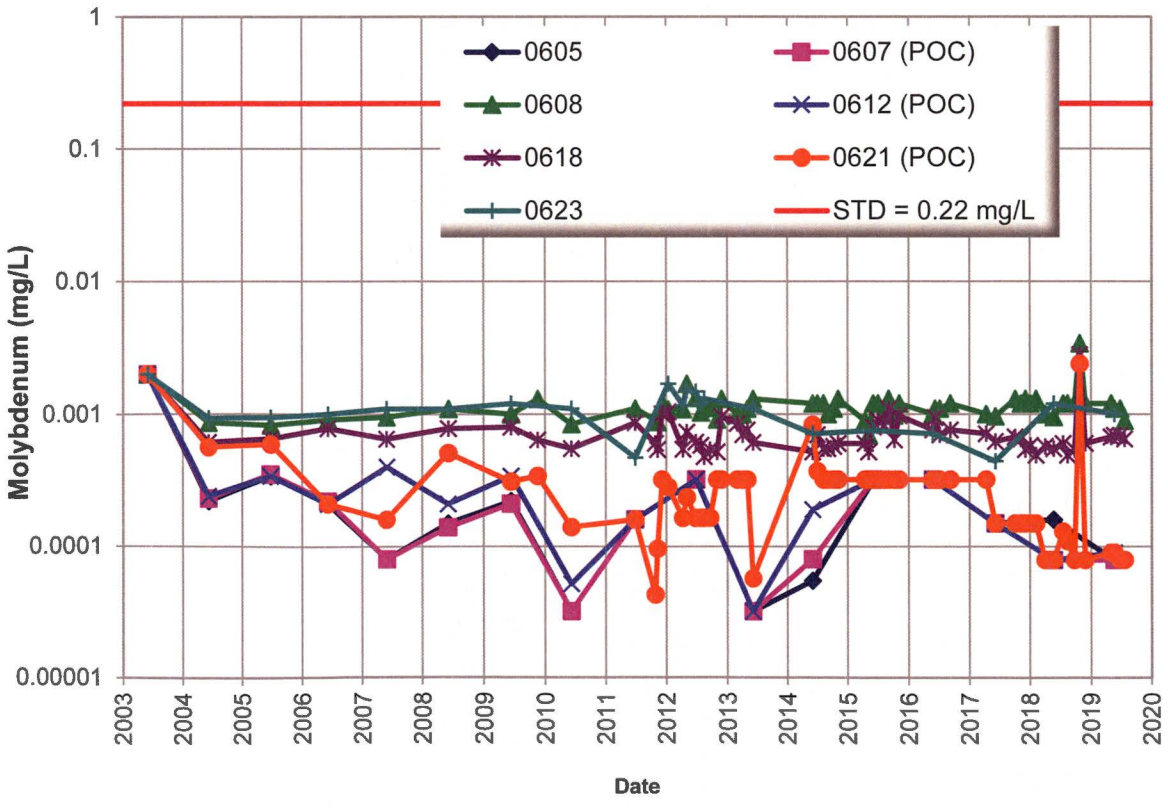


Figure 4-3. Molybdenum in Groundwater at the Durango, Colorado, Disposal Site

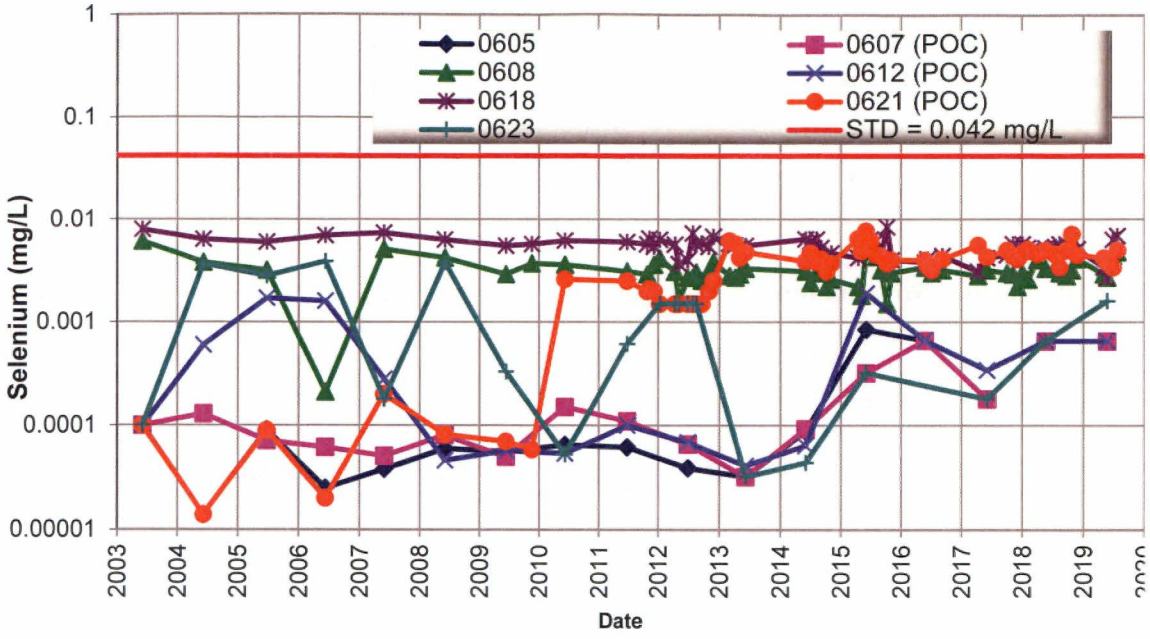


Figure 4-4. Selenium in Groundwater at the Durango, Colorado, Disposal Site

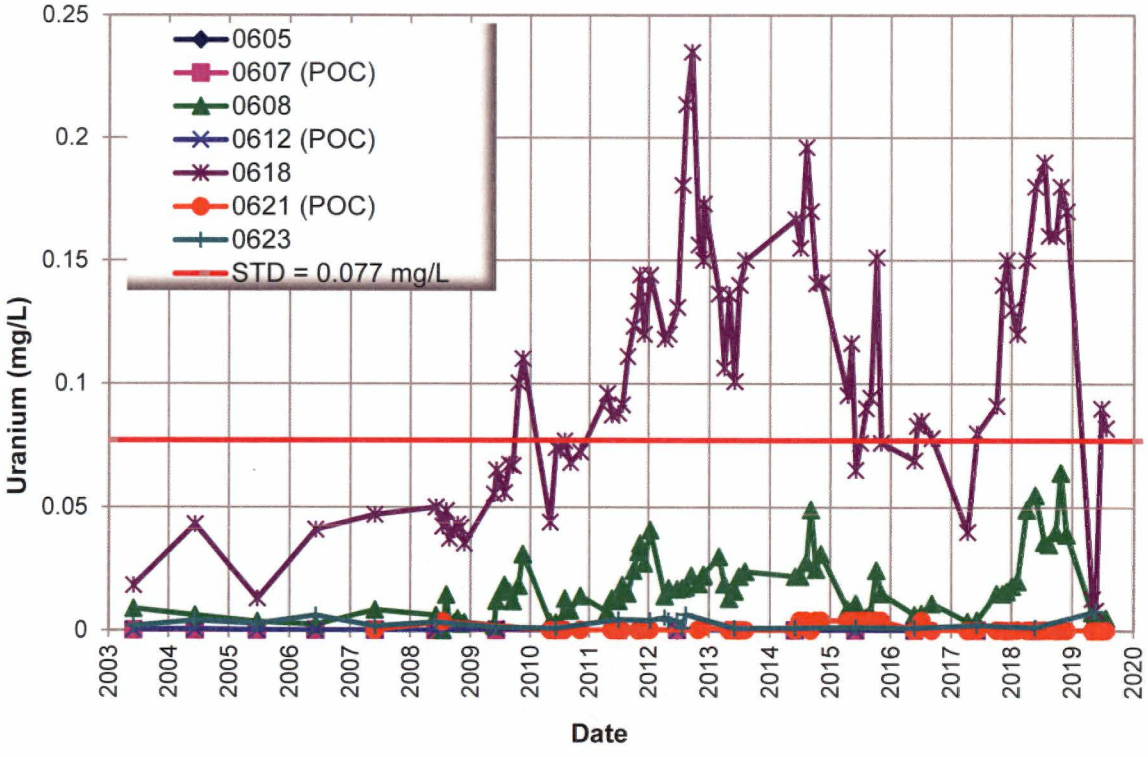


Figure 4-5. Uranium in Groundwater at the Durango, Colorado, Disposal Site

Wells completed in the alluvium are sampled as a BMP. 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 variable uranium concentrations between 0.04 milligrams per liter (mg/L) and 0.24 mg/L in well 0618 beginning in 2009 and continuing to the present. In 2019, uranium concentrations in well 0618 decreased from 0.18 mg/L to 0.02 mg/L—a value slightly below the minimum measured concentration—and then increased to 0.09 mg/L, which is within the range of measured historical concentrations. Investigating the cause of this variability at well 0618 continues.

4.8.2 Vegetation Monitoring

Vegetation on top of the disposal cell remains healthy. The LTSP requires deep-rooted 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 of woody species were found on the side slopes and were removed following the site 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*.

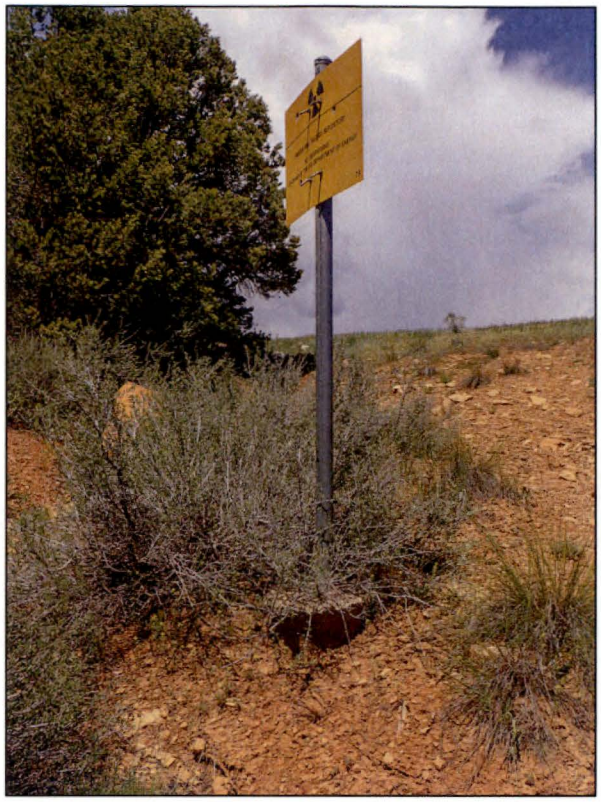
10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

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	20	Concrete Base of Perimeter Sign P79 (Undercut by Erosion)
PL-2	5	Vegetation Blocking Perimeter Sign P4 (Removed Following Inspection)
PL-3	270	2018 Repairs to Base of Site Marker SMK-2
PL-4	—	Vegetation Blocking Boundary Monument BM-5
PL-5	325	Boundary Monument BM-3
PL-6	80	Rabbitbrush on Disposal Cell Top
PL-7	355	Water Flowing in Natural Drainage Near Perimeter Sign P23
PL-8	—	Colorado Parks and Wildlife Sound Recorder Near Small Pull-out in Road

Note:
— = Photograph taken vertically from above.



PL-1. Concrete Base of Perimeter Sign P79 (Undercut by Erosion)

PL-2. Vegetation Blocking Perimeter Sign P4 (Removed Following Inspection)

PL-3. 2018 Repairs to Base of Site Marker SMK-2

PL-4. Vegetation Blocking Boundary Monument BM-5

PL-5. Boundary Monument BM-3

PL-6. Rabbitbrush on Disposal Cell Top

PL-7. Water Flowing in Natural Drainage Near Perimeter Sign P23

PL-8. Colorado Parks and Wildlife Sound Recorder near Small Pull-out in Road

5.0 Falls City, Texas, Disposal Site

5.1 Compliance Summary

The Falls City, Texas, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected on March 6, 2019. No changes were observed in the disposal cell or associated drainage features, and inspectors 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 (BMP). The most recent sampling event occurred in February 2019. The compliance strategy for groundwater protection at the site, which is designated as limited use, is no further remediation and application of supplemental standards due to widespread ambient contamination that is not due to milling and is not reasonably treatable. Therefore, no concentration limits or points of compliance have been established. Site-related contamination in the uppermost aquifer poses no risk to human health because groundwater from this aquifer is not used for human consumption and is designated as limited use.

5.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific LM Long-Term Surveillance Plan (LTSP) (DOE 2008) in accordance with procedures 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 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 structures, 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 March 6, 2019. The inspection was conducted by M. Widdop and C. Boger of the Legacy Management Support contractor. T. Jasso (LM site manager); R. Thomas, M. Kawasmi, F. Abbaszadea, K. Tu, and A. Ozain-Poterie (TCEQ); and R. Lyssy (site maintenance 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 evaluate 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 2019 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.

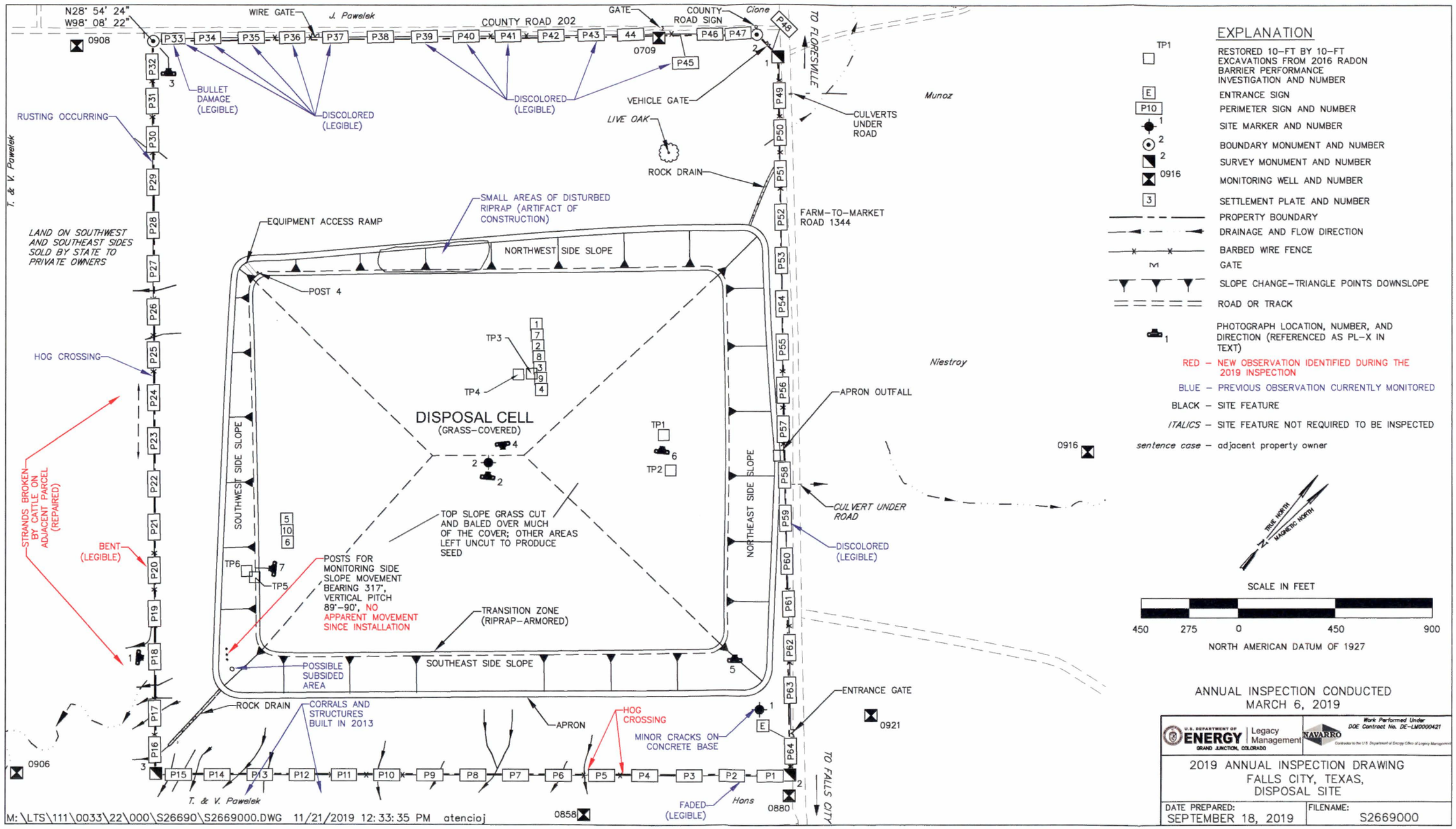


Figure 5-1. 2019 Annual Inspection Drawing for the Falls City, Texas, Disposal Site

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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. Broken strands along the southwest side were identified during the inspection and were repaired by the maintenance subcontractor following the inspection.

There are 64 perimeter signs, attached to steel posts set in concrete, positioned along the property boundary and set back 5 feet (ft). Perimeter sign P33 has bullet damage but remains legible. Additional perimeter signs are fading but remain legible (PL-1). Perimeter sign P20 was bent but remains legible. 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. 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 (PL-2). 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; 11 monitoring wells are offsite. All monitoring wells were inspected during the February 2019 sampling event, and 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 Bermudagrass and kleingrass, with other species interspersed (PL-4). 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. 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. This year, as 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 areas of ponded water or areas of settlement were observed on top of the disposal cell during the 2019 inspection.

The disposal cell side slopes and a transition zone where the top slope meets the 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 appears stable. LM periodically takes photos of riprap at the base of T-post 4 on the west corner of the disposal cell. On the basis of a qualitative evaluation of the photos in 2018, there is no indication that the riprap is degrading, but its durability will continue to be monitored. Because of the stable condition of the riprap indicated by these photos, no photo was taken in 2019, but photos should continue to be taken periodically. 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.

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. Because deep roots of woody vegetation could penetrate the radon barrier, 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 (EPA) standard. In 2019, vegetation was well established at all test pit (TP) locations (PL-6). Locations TP5 and TP6 are on the southwest side slope of the disposal cell within the riprap (PL-7). 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 2019 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 Bermudagrass. 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. Two new areas where hogs enter the site were found along the southeast fence line during the 2019 inspection, and hogs continue to enter the site along the northwest side. No resultant perimeter fence damage was observed, and the areas 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.

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

Broken fence strands were identified during the inspection and repaired by the maintenance subcontractor following the inspection. 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 BMP. 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). The most recent sampling event occurred in February 2019.

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 consists of 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/Conquista and the Dilworth groundwater units.

Table 5-2 and Figure 5-2 describe and illustrate the groundwater monitoring network at the site, which includes the groundwater compliance monitoring wells and the 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

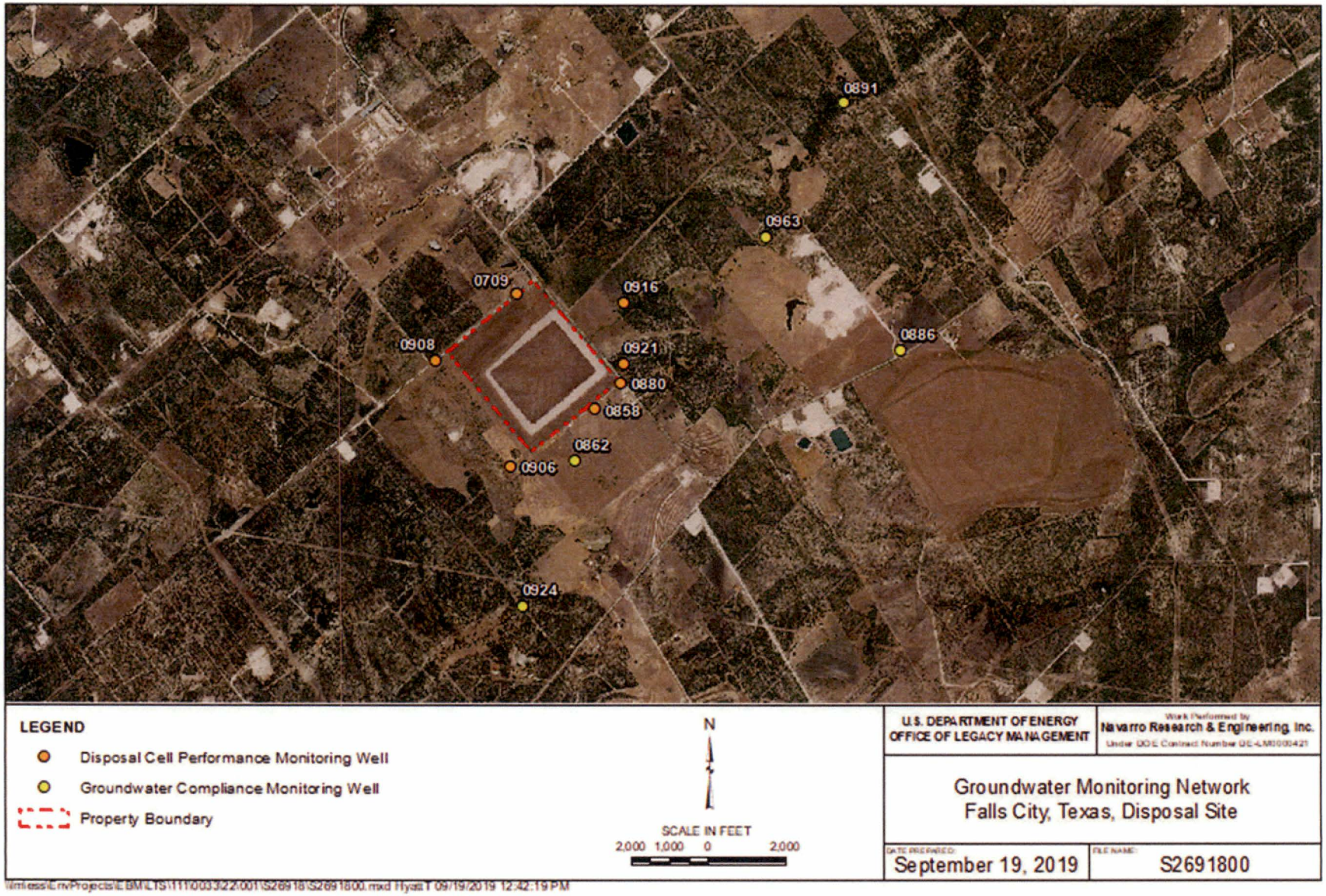

Figure 5-2. Groundwater Monitoring Well Network at the Falls City, Texas, Disposal Site

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. Because tailings pore fluids were lower in pH than background groundwater, changes in geochemical conditions might also indicate leachate movement from the disposal cell into the uppermost aquifer. However, because pH levels and other signature contaminants in tailings pore fluids are essentially indistinguishable from processing-related contamination, it is difficult to assess whether contamination comes from the disposal cell or from legacy processing activities.

LM has concluded that pH and uranium concentrations do not correlate (DOE 2008). This is an indication that other factors, such as natural redistribution of uranium in this active ore-forming environment or buffering of low-pH groundwater, contribute to uranium distribution in the uppermost aquifer. 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 by changes in the oxidation state within the formation.

Because narrative supplemental standards apply to the uppermost aquifer at the site, no concentration limits or points of compliance have been established. Groundwater in the uppermost aquifer beneath the site meets the EPA definition of limited use (Class III) because it is not currently or potentially a source of drinking water due to widespread ambient contamination that cannot be cleaned up using methods reasonably employed by public water supply systems (40 CFR 192.11[e]).

Background groundwater quality in the uppermost aquifer varies by orders of magnitude in the area because it is in contact with naturally occurring uranium mineralization. Figure 5-3 and Figure 5-4 show the water level measurements over time at both the disposal cell performance monitoring wells and the groundwater compliance monitoring wells. Figure 5-5 through Figure 5-8 show the time-concentration plots for pH and uranium at both disposal cell performance monitoring wells and groundwater compliance monitoring wells. 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 2019, water levels in monitoring wells 0709, 0880, and 0906 increased at a steeper rate of change than has occurred in recent years (Figure 5-3), while water levels in monitoring wells 0858 and 0921 increased less abruptly. 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.

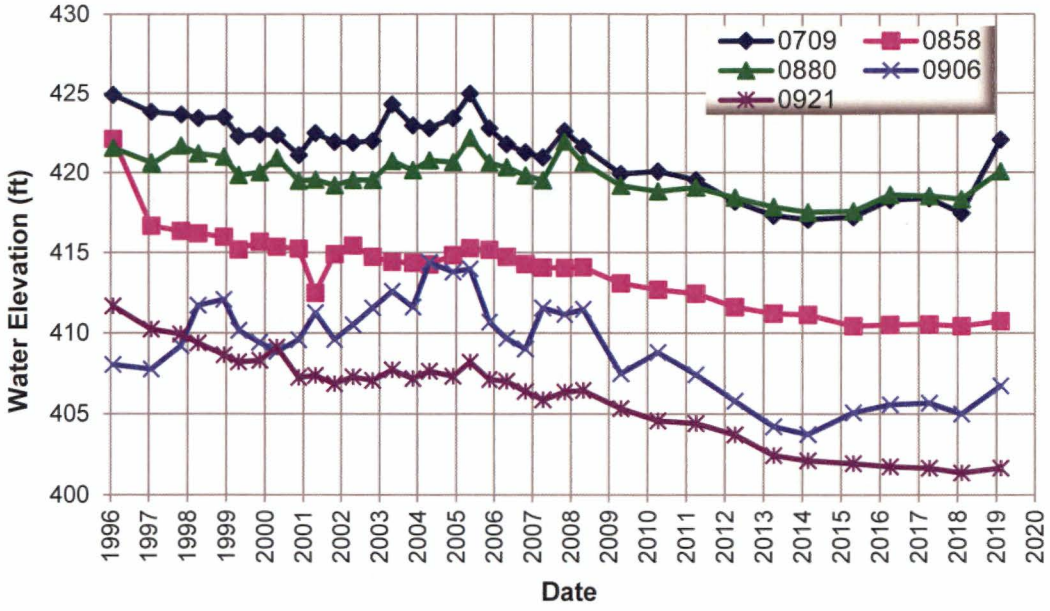

Figure 5-3. Water-Level Measurements at Disposal Cell Performance Monitoring Wells at the Falls City, Texas, Disposal Site

Mann-Kendall testing indicates water level trends are generally increasing in the groundwater compliance monitoring wells 0862, 0886, 0891, and 0963 (Figure 5-4). Overall, these water levels have increased about 4 ft since 1996. Mann-Kendall testing indicates no trend in water levels at monitoring well 0924.

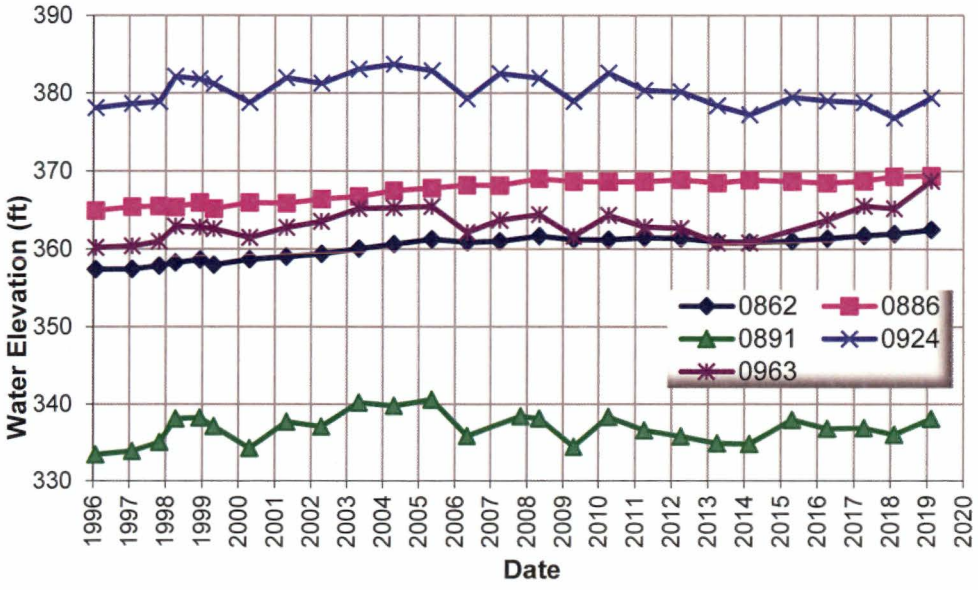

Figure 5-4. Water-Level Measurements at Groundwater Compliance Monitoring Wells at the Falls City, Texas, Disposal Site

5.8.3 Groundwater Quality Monitoring Results

pH: At the disposal cell performance monitoring wells, pH levels have historically been greater than the pH in tailings pore fluids (pH level of 2.93), with no significant upward or downward trends. Mann-Kendall testing indicates no trend in pH values at monitoring wells 0709 and 0906, an increasing trend at monitoring wells 0858 and 0921, and a decreasing trend at monitoring well 0880. In 2019, the pH levels in monitoring wells 0709, 0880, and 0921 decreased slightly, while the pH levels for monitoring well 0858 and 0906 increased slightly. The 2019 pH levels were within the range of historical values for all disposal cell performance monitoring wells (Figure 5-5).

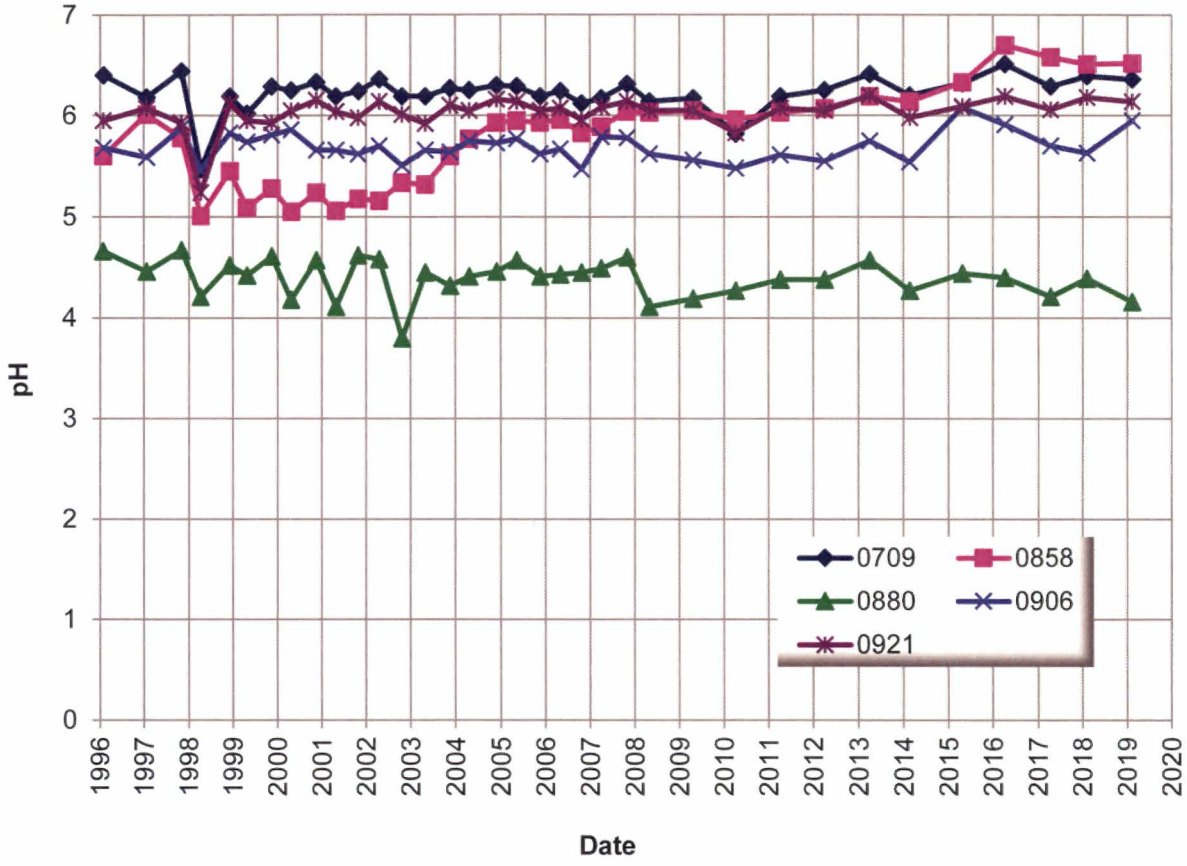

Figure 5-5. pH at Disposal Cell Performance Monitoring Wells at the Falls City, Texas, Disposal Site

At the groundwater compliance monitoring wells, pH levels have historically been greater than the pH in groundwater contaminated by processing activities, with no significant upward or downward trends. Mann-Kendall testing indicates no trend in pH values at monitoring wells 0862, 0886, and 0963 and an increasing trend at monitoring wells 0891 and 0924. In 2019, the pH levels for monitoring wells 0886 and 0963 increased, while the pH levels for monitoring wells 0862, 0891, and 0924 slightly decreased (Figure 5-6). The 2019 pH levels were within the range of historical values for all groundwater compliance monitoring wells except monitoring well 0963, where the pH has increased above the historical maximum. The pH in monitoring

well 0963 historically has been lower than at the other locations, and in 2019 it remains similar to the pH in the tailings pore fluids.

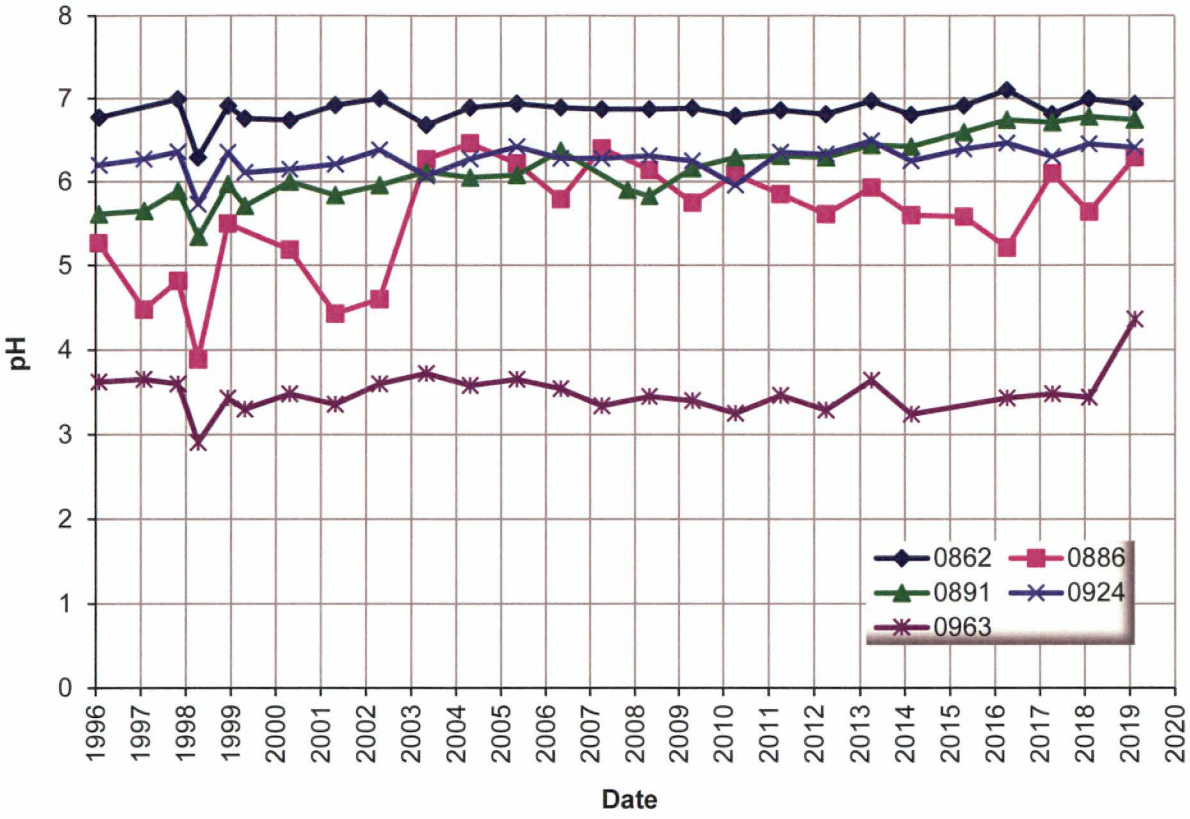

Figure 5-6. pH at Groundwater Compliance Monitoring Wells at the Falls City, Texas, Disposal Site

Uranium: The 2019 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 2019, the uranium concentrations for monitoring wells 0709, 0906, and 0858 remained generally constant when compared with previous results. The uranium concentration in monitoring well 0921 increased slightly, maintaining a generally increasing trend. The concentration in monitoring well 0880 increased from 7.6 milligrams per liter (mg/L) to 8.7 mg/L. Uranium concentrations in monitoring well 0880 show considerable variation, ranging from a low of 1.38 mg/L in 2008 to a high of 14 mg/L in 2004, and the 2019 uranium concentration is within the range of historical concentrations.

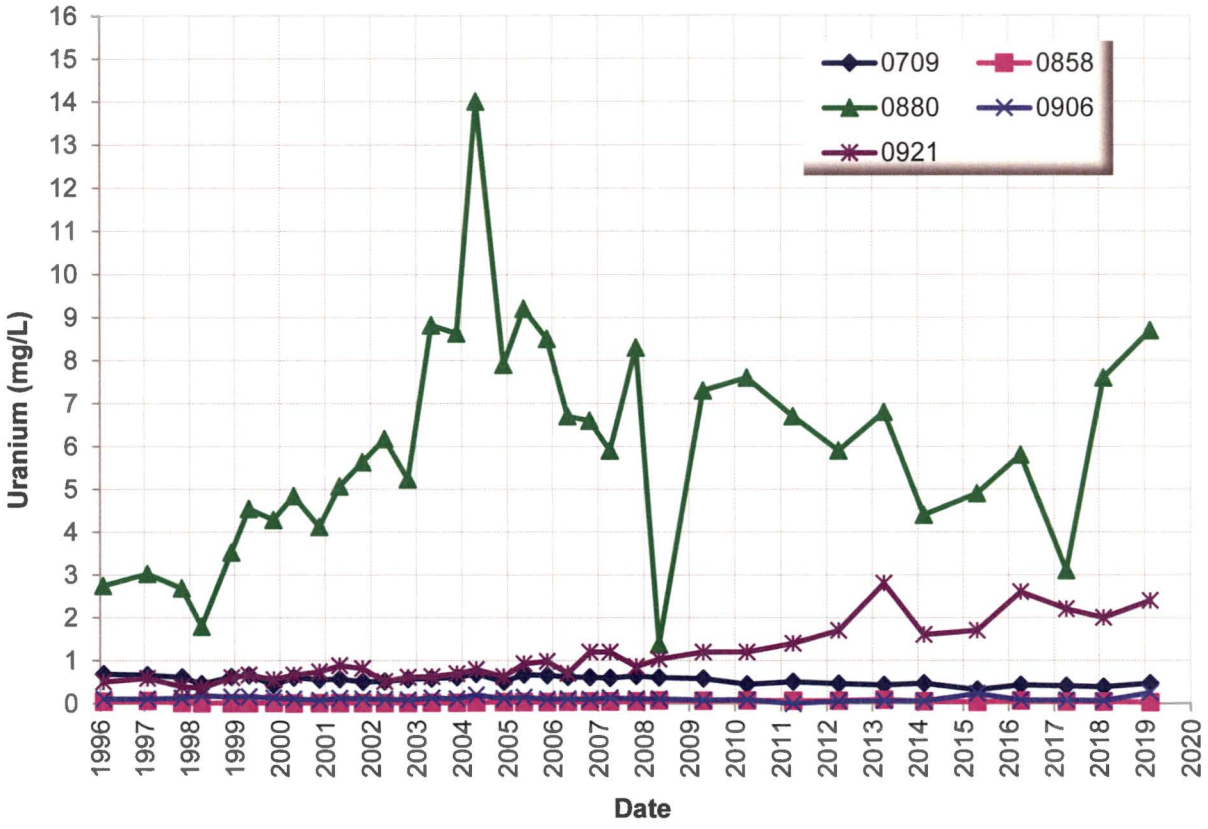

Figure 5-7. Uranium Concentrations at Disposal Cell Performance Monitoring Wells at the Falls City, Texas, Disposal Site

The 2019 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 and are currently elevated when compared to the historical range for the well but not for the historical range of the aquifer (DOE 2010). The 2019 uranium result (1.5 mg/L) at monitoring well 0891 is slightly greater than the 2018 result at this location (1.2 mg/L) but remains significantly less than the 2016 uranium result of 3.7 mg/L and less than the uranium concentration value used for groundwater in the Dilworth aquifer in the *Baseline Risk Assessment of Ground Water*

Contamination at the Uranium Mill Tailings Site Near Falls City, Texas (3.04 mg/L) (DOE 1995). This suggests that a slug of groundwater with elevated uranium has flowed past this location.

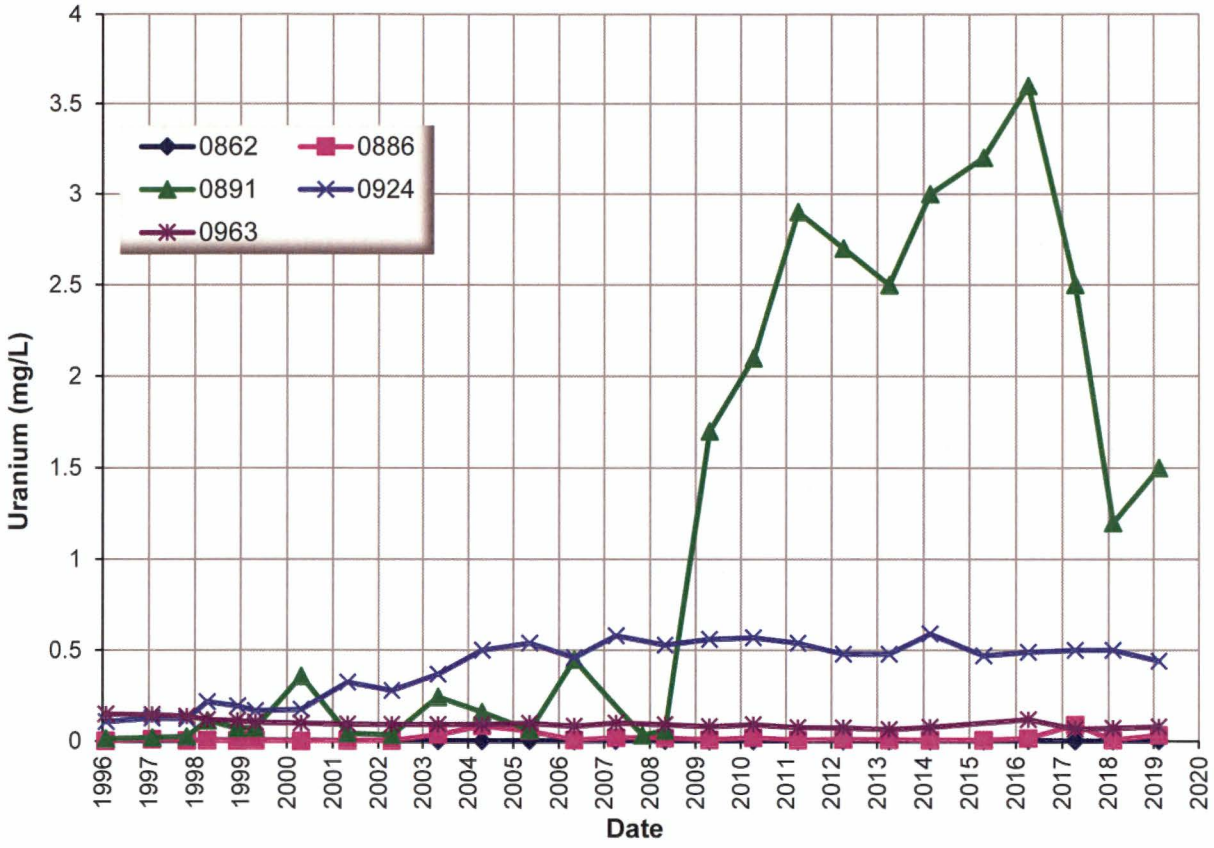

Figure 5-8. Uranium Concentrations in Groundwater Compliance Monitoring Wells at the Falls City, Texas, Disposal Site

5.8.4 Evaluation of Groundwater Monitoring

Uranium concentrations in disposal cell performance monitoring well 0880 have varied considerably since 1996, ranging from 1.38 mg/L in 2008 to 14 mg/L in 2004 (Figure 5-7). The uranium concentration was 8.7 mg/L in 2019. The pH at this location is less than at other disposal cell performance monitoring wells. Water levels at all the cell performance monitoring wells trended lower from 2007 until 2016, then increased in recent years (Figure 5-3). Because the uranium concentrations at some of the cell performance monitoring wells have been steady and concentrations vary at other locations, local conditions are likely influencing uranium concentrations. This is reasonable because (1) the disposal cell is located on tailings that were placed in existing open pit mines, (2) subeconomic ore remains in unmined areas, (3) the uppermost aquifer beneath the cell is oxidized and near the aquifer recharge area, and (4) uranium mineralization processes, which involve redistributing and concentrating uranium in the formation materials, are ongoing. Given the local conditions listed above, it is difficult to assess whether elevated uranium concentrations in the uppermost aquifer are a result of disposal cell performance or existing background conditions.

The high uranium concentrations in groundwater compliance well 0891 since 2008, have been trending downward since 2015, likely reflects the passage of a slug of groundwater with elevated uranium flowing from the direction of the former processing site. Historical data from upgradient monitoring wells that were abandoned in 2001 show a uranium anomaly moved past them (Figure 5-9) (DOE forthcoming). LM defined the groundwater flow directions in the Deweesville and the Dilworth aquifers and identified areas of low pH where tailings-derived fluids have consumed all of the natural buffering capacity (DOE 2008, Figures 2-7 and 2-8). Monitoring well 0891 is completed in the Dilworth aquifer. Monitoring well 0963 (completed in the Deweesville Sandstone) is in a zone of low pH where groundwater in the Deweesville aquifer flows into the underlying Dilworth aquifer. Monitoring well 0966 is the next downgradient Dilworth aquifer well.

Figure 5-9 shows uranium concentration spikes in both wells (0963 and 0966) in 1992, with slowly declining uranium concentrations in 0963 over time (data for monitoring well 0966 are limited). This is likely due to an initial release of uranium and low pH tailings fluids during tailings deposition and subsequent acid leaching, with tailings removal by 1994 (DOE forthcoming). Monitoring well 0891 is the next Dilworth well directly downgradient of the low pH zone. Additionally, the elevated uranium at monitoring well 0891 is accompanied by elevated alkalinity and chloride, which also supports the conclusion that the elevated uranium is the result of passage of a slug of groundwater containing processing-related constituents.

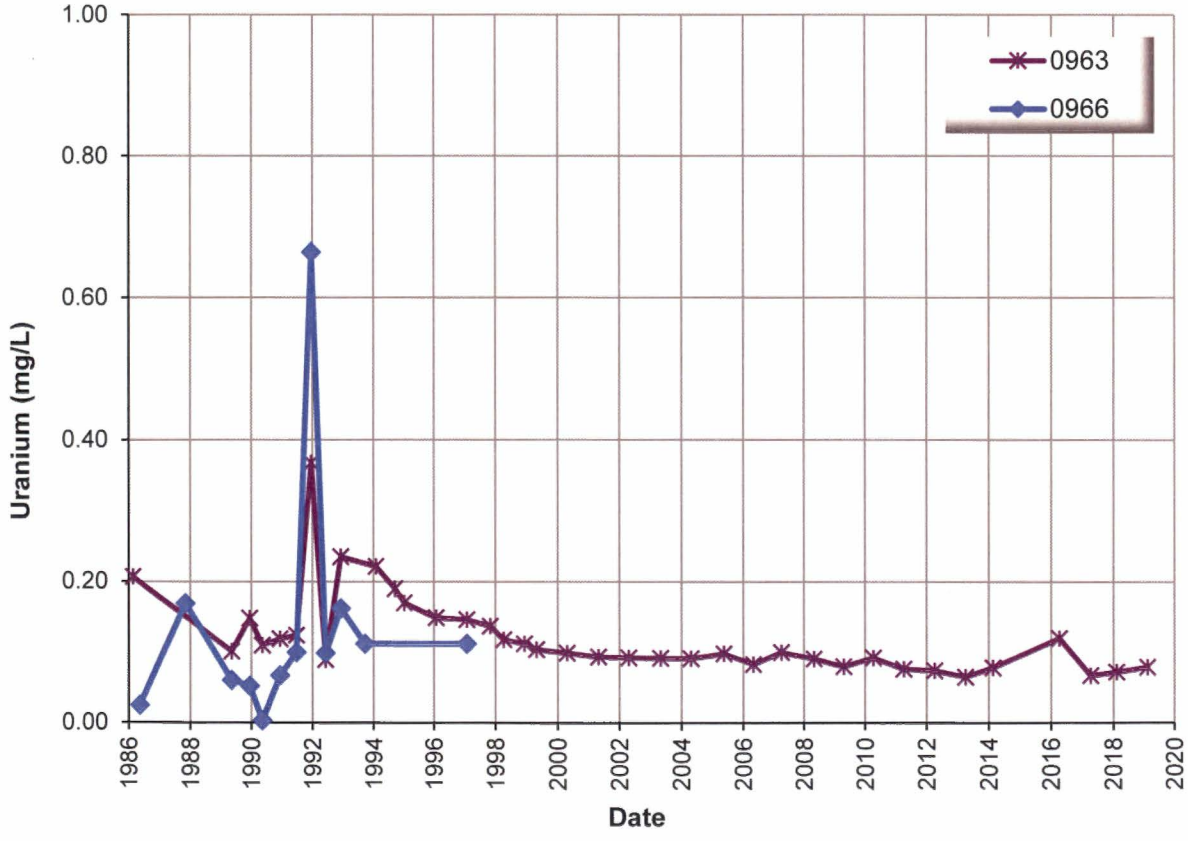

Figure 5-9. Uranium Concentrations in Monitoring Wells 0963 (in the Deweesville Aquifer) and 0966 (in the Dilworth Aquifer)

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 beneath 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 (DOE 2010). 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 near 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. Recommendations made in the 2010 evaluation continue to undergo NRC review. In 2016, NRC received comments on the 2010 report from TCEQ, which concurred that monitoring could be halted at all Falls City wells except (1) monitoring well 0891 until a horizontal or decreasing trend is observed (this condition has been met, as shown in Figure 5-8) and (2) monitoring wells 0880 and 0886, which are completed in the Deweesville Sandstone and should be retained until the groundwater remedy for the downgradient Conquista site is established.

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), 1995. *Baseline Risk Assessment of Ground Water Contamination at the Uranium Mill Tailings Site Near Falls City, Texas*, DOE/AL/62350-64, Rev. 1, Environmental Restoration Division, Albuquerque, New Mexico, September.

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.

DOE (U.S. Department of Energy), 2010. *Groundwater Monitoring Assessment, Falls City, Texas, Disposal Site*, LMS/FCT/S07069, December.

DOE (U.S. Department of Energy), forthcoming. *Groundwater Monitoring Assessment and Chronology of Groundwater Compliance Activities at the Falls City, Texas, UMTRCA Title I Disposal Site,* LMS/FCT/s25289, Office of Legacy Management, to be published.

5.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	50	Perimeter Sign P18
PL-2	320	Site Marker SMK-2
PL-3	320	Boundary Monument BM-1
PL-4	130	Looking East Across Disposal Cell Top Slope
PL-5	270	Northeast Side Slope
PL-6	320	Restored Excavation Test Pit TP1 from 2016 Radon Barrier Performance Investigation
PL-7	230	Restored Excavation Test Pit TP6 from 2016 Radon Barrier Performance Investigation

PL-1. Perimeter Sign P18

PL-2. Site Marker SMK-2

PL-3. Boundary Monument BM-1

PL-4. Looking East Across Disposal Cell Top Slope

PL-5. Northeast Side Slope

PL-6. Restored Excavation Test Pit TP1 from 2016 Radon Barrier Performance Investigation

PL-7. Restored Excavation Test Pit TP6 from 2016 Radon Barrier Performance Investigation

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 12, 2019. 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.

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 lysimeter facilities adjacent to the north and east sides of 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.

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 2019. 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 interim Long-Term Surveillance Plan (LTSP) (DOE 1998) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 6-1 lists these requirements.

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

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Sections 3.0 and 6.2	Section 6.4	(b)(3)
Follow-Up Inspections	Section 3.4	Section 6.5	(b)(4)
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, whichever comes first. Under legislation authorizing LM's operation of the site (PL 104-259), the cell is scheduled to stop receiving

radioactive waste in September 2023. Congress is considering legislation to keep the disposal cell open until 2031. Once the disposal cell is closed, it will be accepted under the NRC 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 southeast of Grand Junction, Colorado, was inspected on December 12, 2019. The inspection was conducted by S. Woods, K. Roemer, and P. Wetherstein of the Legacy Management Support contractor. B. Frazier (LM site manager) and J. Doebele (Colorado Department of Public Health and Environment) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the interim LTSP, and evaluate the need, if any, for maintenance or additional inspection and monitoring.

6.4.1 Site Surveillance Features

Figure 6-1 shows in black the locations of site features, including site surveillance features and inspection areas. Site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue text, and new observations identified during the 2019 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. A steel double-swing access gate, secured by a locking device, in the highway right-of-way fence provides access to a right-of-way and an 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 double-swing chainlink entrance gate was replaced in 2019 before the inspection with a solar-powered chainlink gate as part of a green initiative (PL-1); the gate's solar-powered system includes battery storage. The entrance gate was locked and functional. The entrance sign is next to the entrance gate. No maintenance needs were identified.

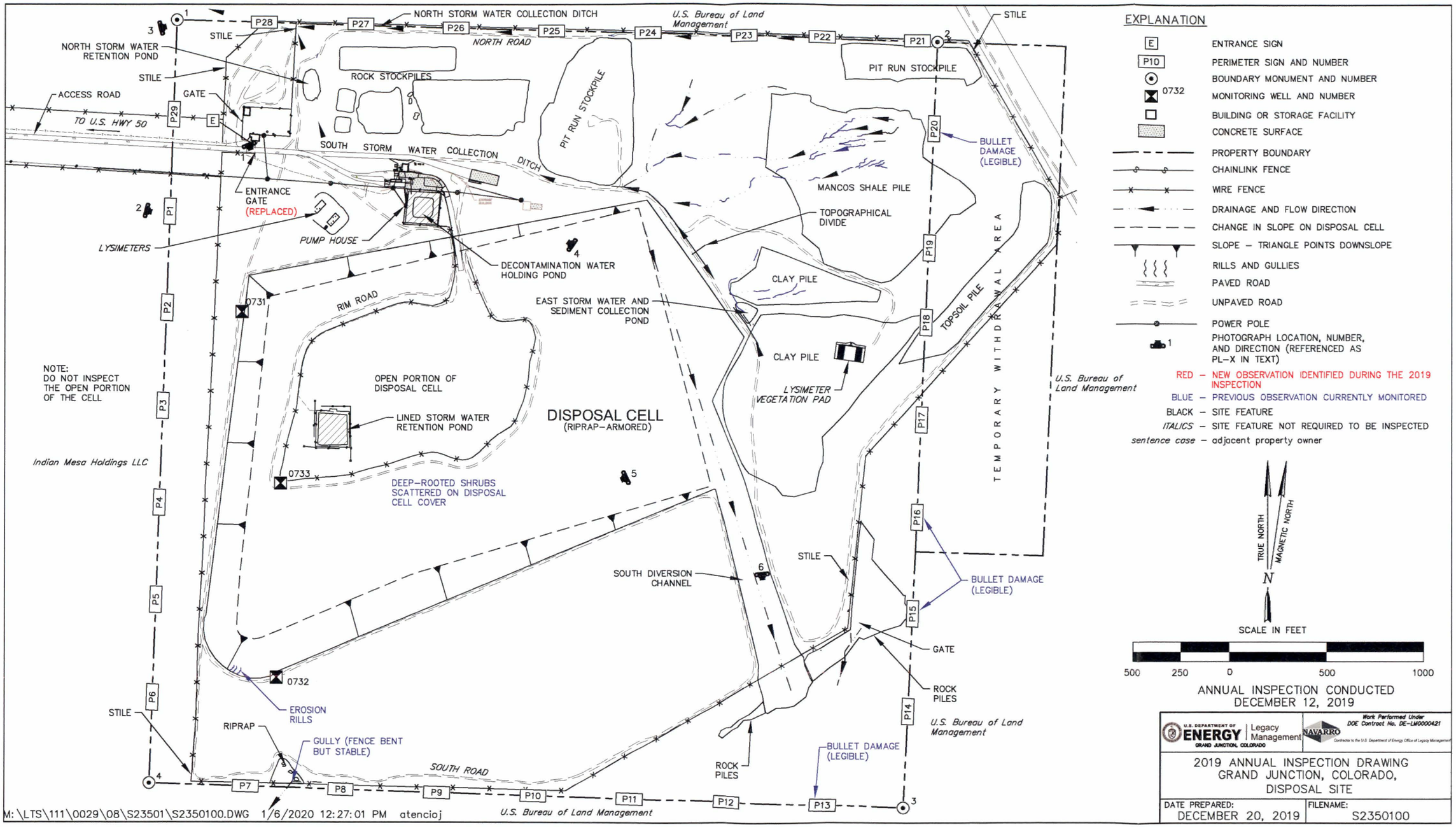

Figure 6-1. 2019 Annual Inspection Drawing for the Grand Junction, Colorado, Disposal Site

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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, P16, and P20 have bullet damage but remain legible. All three signs will be replaced in the future.

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.

6.4.1.4 Boundary Monuments

Four boundary monuments delineate the corners of the property boundary (PL-3). No maintenance needs were identified.

6.4.1.5 Monitoring Wells

The groundwater monitoring network consists of three monitoring wells (0731, 0732, and 0733). 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 in 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 (PL-4). 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.

Grasses and weeds were growing on most of the disposal cell cover (PL-5). 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. The channels do not threaten the integrity of the disposal cell, and no significant changes were noted in 2019. 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 will be performed as necessary.

In addition to the perimeter signs, the perimeter fence also has warning signs ("no trespassing" and "controlled area" signs). 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 federal land withdrawal area. 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

A green initiative was undertaken in 2019 before the inspection to replace the double-swing chainlink entrance gate with a solar-powered electric chainlink gate secured by an electronic keypad and a backup battery. 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. The disposal cell is underlain by 5 to 40 feet (ft) of alluvium. Beneath the alluvium is approximately 700 ft of Mancos Shale, which overlies the uppermost aquifer at the site, the Dakota Sandstone. Groundwater in the site area occurs in thin paleochannels within lower portions of alluvium deposits and in the confined Dakota Sandstone unit. Groundwater in the Dakota Sandstone is designated as limited use because total dissolved solids (TDS) exceed 10,000 milligrams per liter (mg/L). LM monitors groundwater from three monitoring wells adjacent to and in the disposal cell to verify that groundwater in onsite alluvial paleochannels is not affected by seepage (transient drainage) from the disposal cell. The most recent sampling event occurred in August 2019.

Monitoring wells 0731 and 0732 are screened across the alluvial paleochannels adjacent to the disposal cell and extend 5 to 7.5 ft into weathered Mancos Shale. The wells are in two separate paleochannel systems, each downgradient from the disposal cell (DOE 1998). Monitoring well 0733 is screened below the paleochannel monitoring wells in the lower tailings in the disposal cell (Table 6-2 and Figure 6-2). 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). Water levels in disposal cell monitoring well 0733 increased approximately 4 ft since 1998 and has remained lower than the adjacent water levels in the two paleochannel monitoring wells. Groundwater levels in wells 0731 and 0732 remained relatively constant with the same apparent trend in variability, suggesting the two paleochannel systems are influenced by the same upgradient recharge mechanisms.

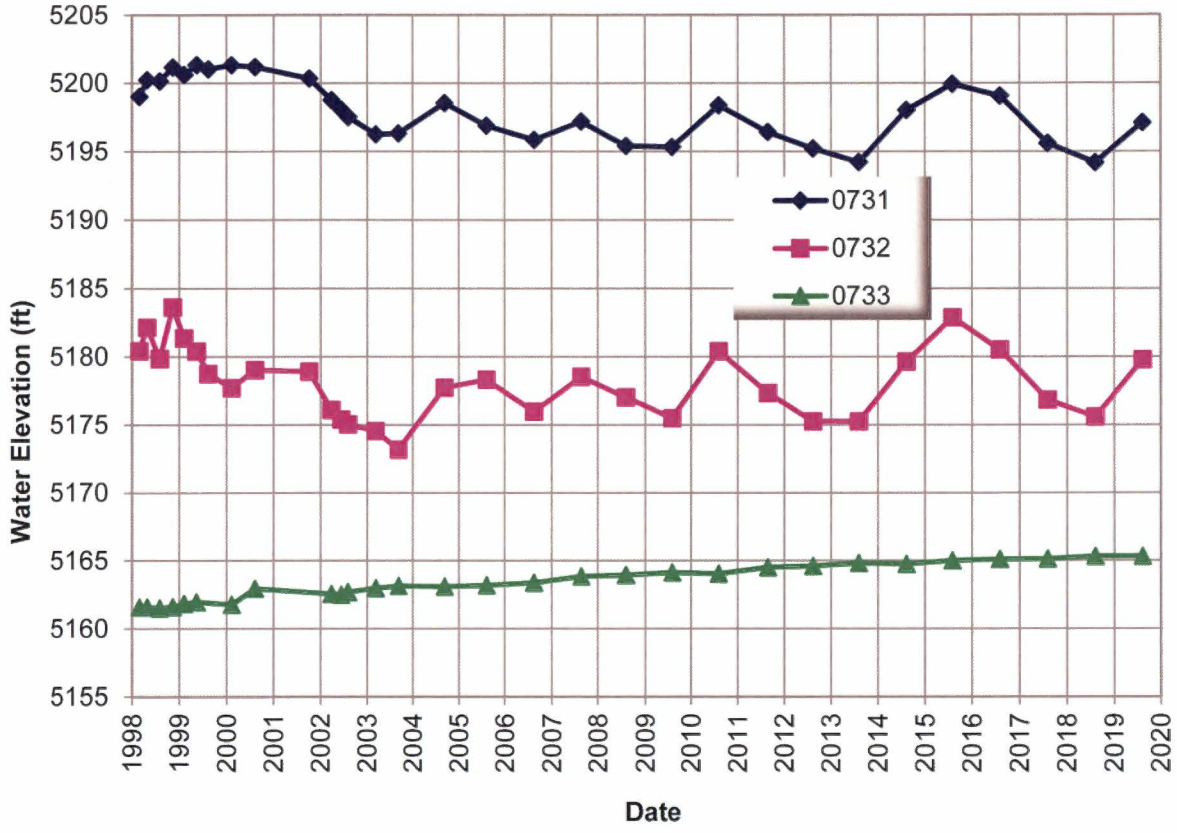


Figure 6-3. Water Level Measurements at the Grand Junction, Colorado, Disposal Site

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; 2019 concentrations were less than or equal to 0.003 mg/L. Time-concentration plots from 1998 through 2019 for the other key indicator analytes—nitrate (as nitrogen [N]), selenium, and uranium—are shown in Figure 6-4 through Figure 6-6.

Since 1999, nitrate (as N) concentrations in disposal cell monitoring well 0733 continued to decline, reaching a low of 0.74 mg/L in 2019 (Figure 6-4). Nitrate concentrations continued to exceed the MCL of 10 mg/L in the paleochannel monitoring wells 0731 and 0732. Mann-Kendall trend tests for nitrate concentrations in monitoring well 0732 showed a statistically significant increasing trend from 2003 to 2019 and a historic high value in 2018.

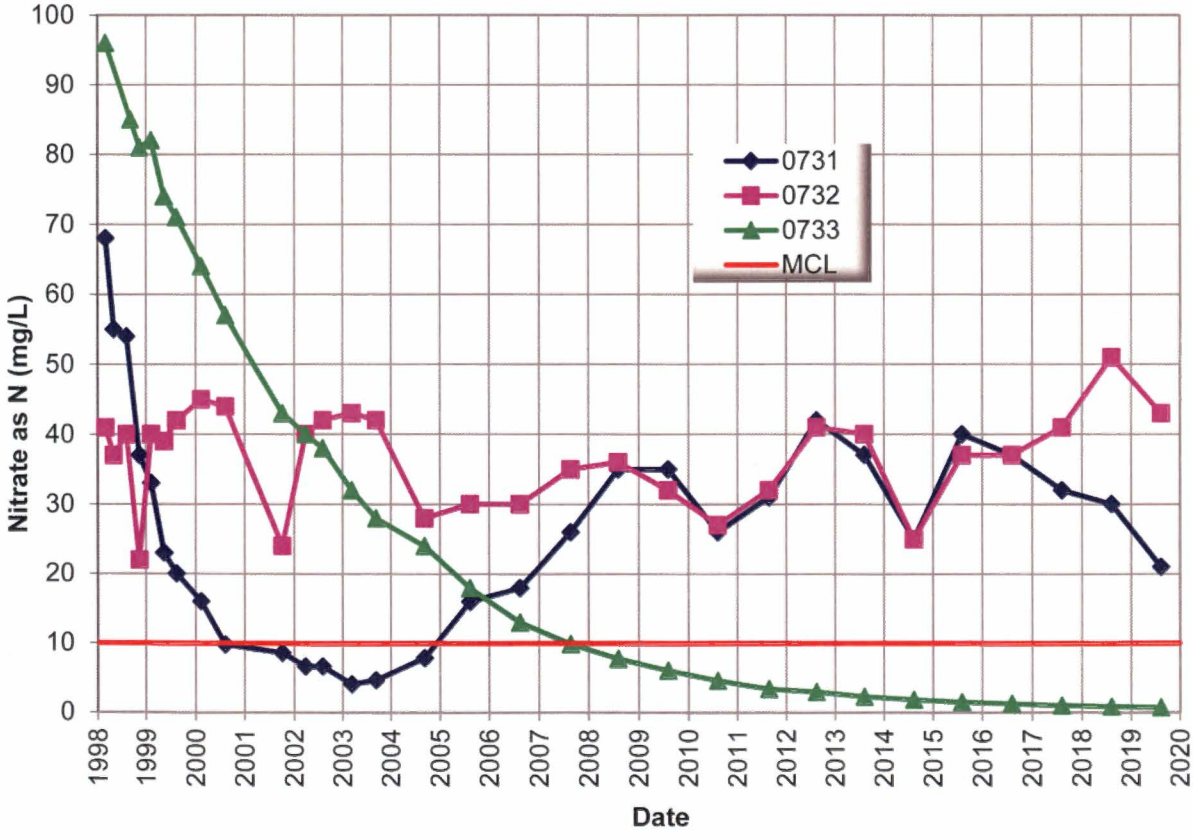


Figure 6-4. Nitrate (as N) in Groundwater at the Grand Junction, Colorado, Disposal Site

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 contact of the Mancos Shale unconsolidated soil and 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. Disposal cell monitoring well 0733 is not screened in the weathered Mancos Shale, and selenium concentrations remain below the MCL.

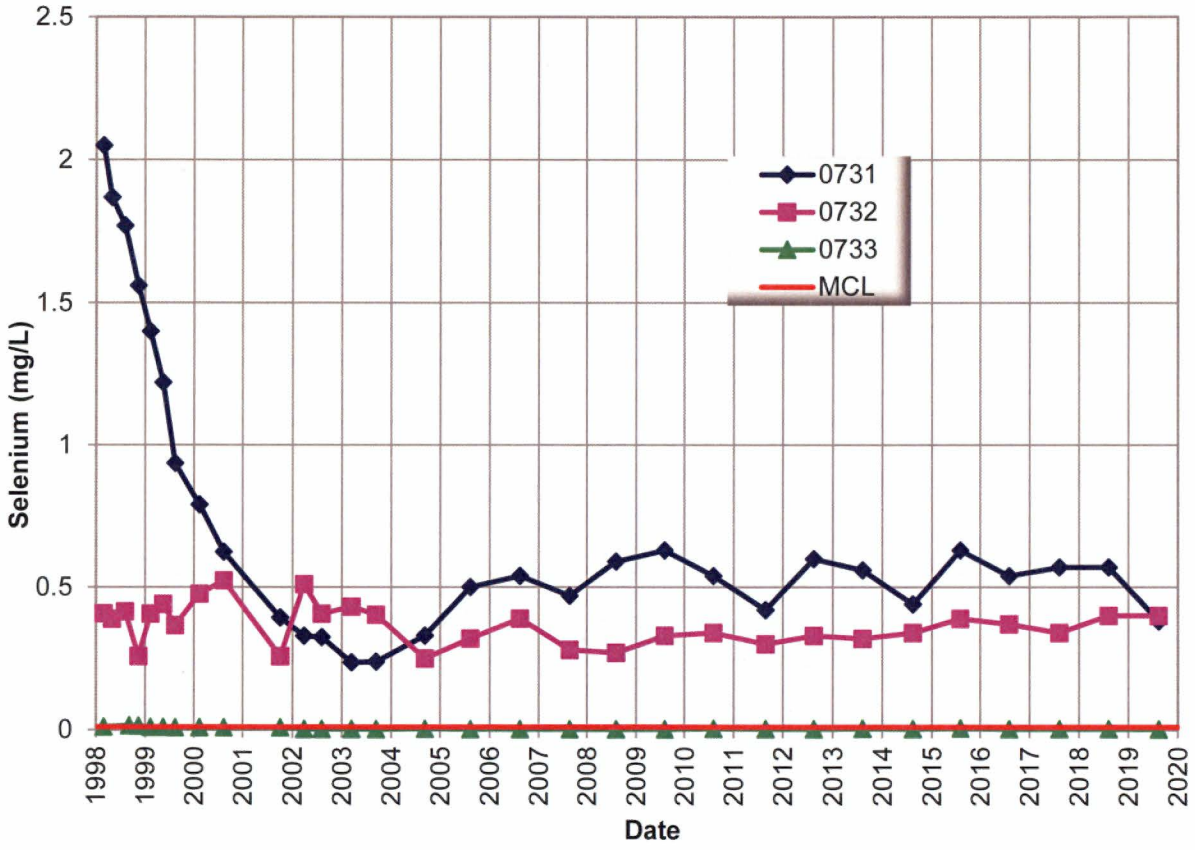


Figure 6-5. Selenium in Groundwater at the Grand Junction, Colorado, Disposal Site

Uranium concentrations in groundwater slightly exceeded the MCL of 0.044 mg/L in both paleochannel monitoring wells in 2018 and remained near the MCL in 2019. Mann-Kendall trend tests for uranium concentrations show a statistically increasing trend for all three wells from 2010 to 2019. Wells 0732 and 0733 also had statistically increasing trends since 2003, according to Mann-Kendall (Figure 6-6). Uranium concentrations in disposal cell monitoring well 0733 have increased from 0.02 mg/L in 2002 to 0.22 mg/L in 2019. Increasing uranium beneath the disposal cell is coinciding with the addition of residual radioactive material to the open cell. Relatively high concentrations of uranium and other constituents are expected for a well screened in the disposal cell tailings. Constituents of concern and water levels in well 0733 are not subject to compliance goals and are monitored solely for information-gathering purposes.

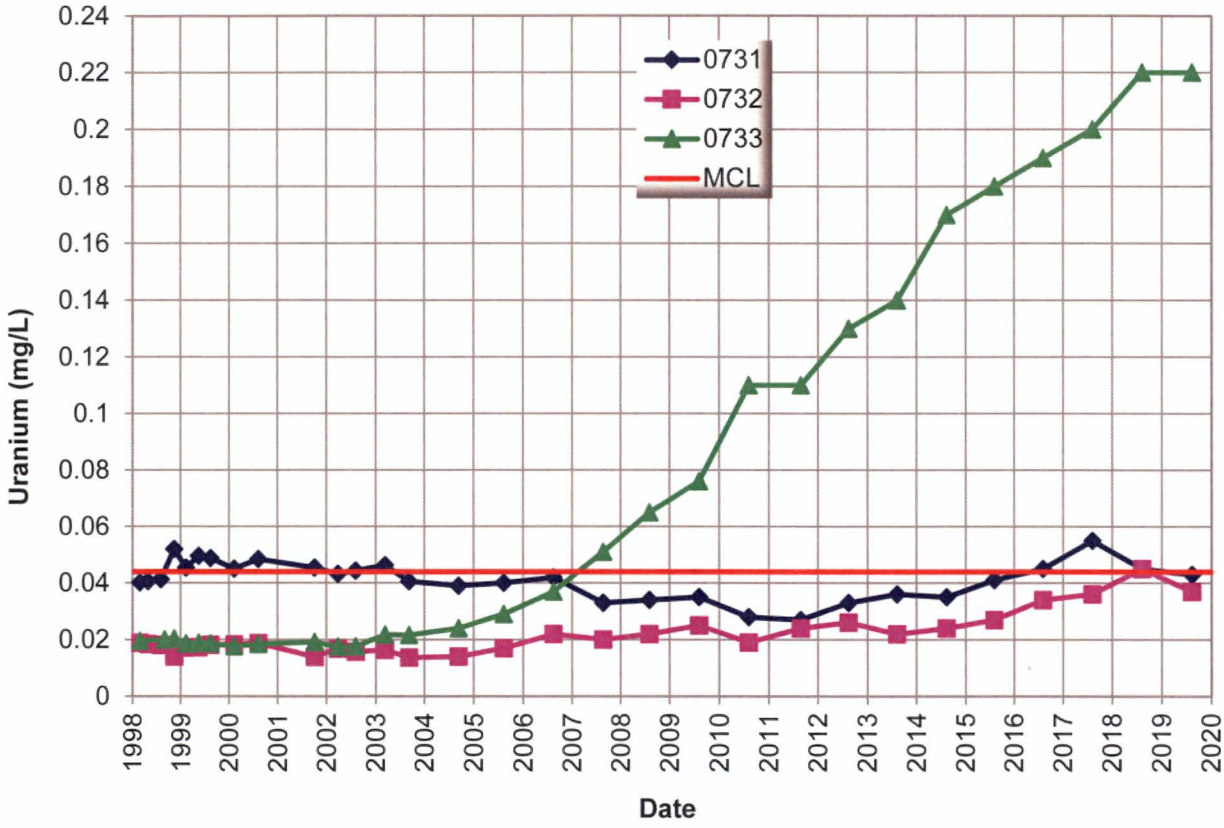


Figure 6-6. Uranium in Groundwater at the Grand Junction, Colorado, Disposal Site

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*.

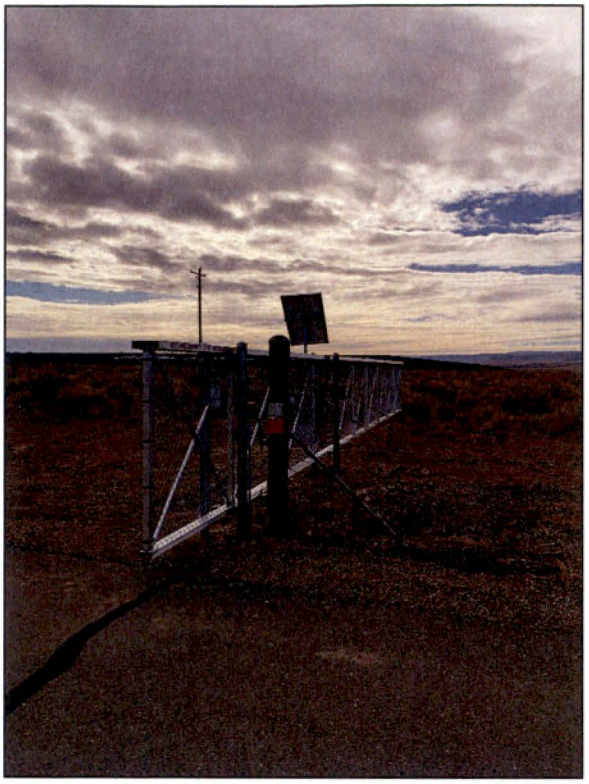
DOE (U.S. Department of Energy), 1998. *Interim Long-Term Surveillance Plan for the Cheney Disposal Site near Grand Junction, Colorado*, DOE/AL/62350-243, Rev. 1, Environmental Restoration Division, UMTRA Project Team, Albuquerque, New Mexico, April.

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

6.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	160	Solar-Powered Entrance Gate
PL-2	105	Perimeter Sign P1
PL-3	—	Boundary Monument BM-1
PL-4	305	Disposal Cell–North Side Slope; Operations Area Facilities in Background
PL-5	245	Top of Disposal Cell–South
PL-6	175	South Diversion Channel

Note:
— = Photograph taken vertically from above.

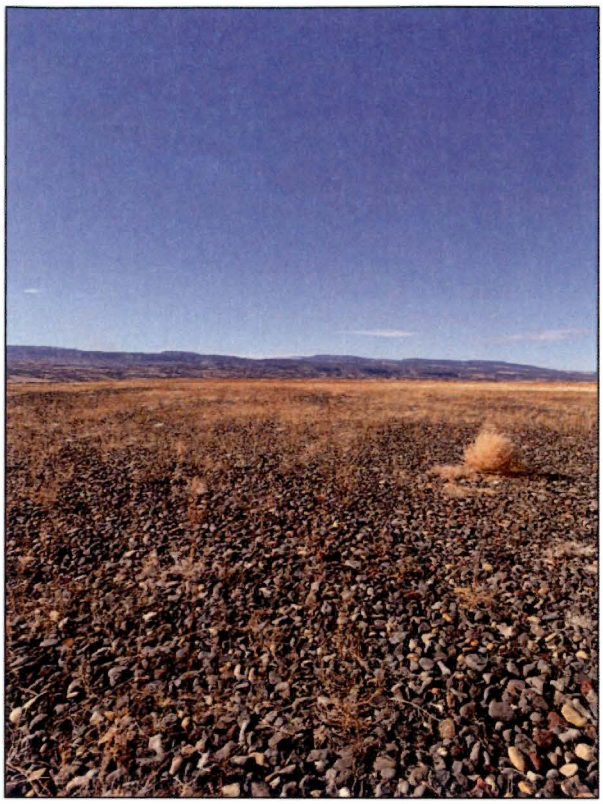


PL-1. Solar-Powered Entrance Gate

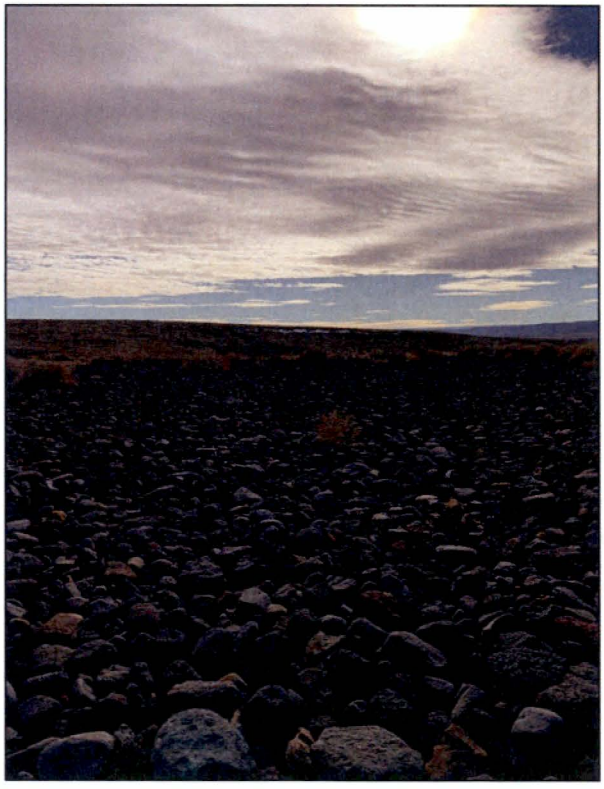
PL-2. Perimeter Sign P1

PL-3. Boundary Monument BM-1

PL-4. Disposal Cell–North Side Slope; Operations Area Facilities in Background



PL-5. Top of Disposal Cell–South



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 19, 2019. No changes were observed on the disposal cell or in the associated drainage features. Inspectors did not identify any maintenance items that required 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 in accordance with the LM Long-Term Surveillance Plan (LTSP) (DOE 1998). Groundwater monitoring was last completed in June 2019. The UMTRCA maximum concentration limits (MCLs), which the LTSP specified as the groundwater standards for the site, 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) as specified in the LTSP. The draft GCAP has been approved by the State of Utah but has not been accepted (to date) by the U.S. Nuclear Regulatory Commission (NRC). LM has received a request for additional information (RAI) from the NRC and is addressing the NRC comments. Groundwater analytical results are evaluated with respect to LTSP requirements until a GCAP is finalized.

7.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the LTSP and in accordance with procedures 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 NRC 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, one mile southeast of Green River, Utah, was inspected on March 19, 2019. The inspection was conducted by J. Price, C. Wentz, and K. Lott of the Legacy Management Support contractor. A. Denny (LM site manager) 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 evaluate 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, and new observations identified during the 2019 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.

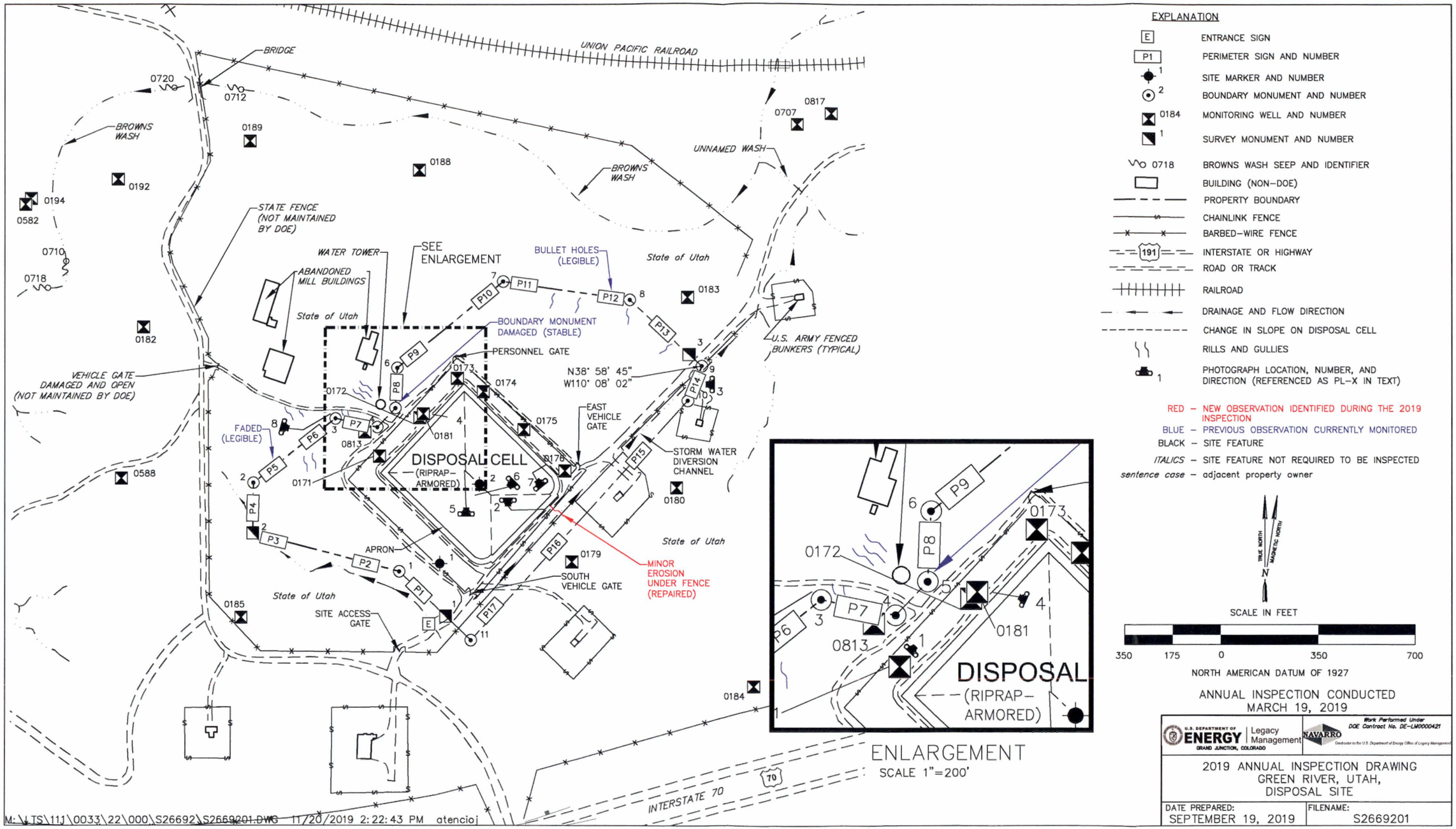
7.4.1.1 Access Road, Entrance Gate, and Entrance Sign

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 chainlink security fence encloses the portion of the site that contains the disposal cell. Two vehicle gates are at the south and east corners of the security fence line, and a personnel gate is at the north corner of the security fence line. The security fence (PL-1) was intact, and the gates were locked. Minor erosion was identified under the southeast fence line (PL-2), but it does not compromise the integrity of the fence at this time. The erosion was repaired at the time of the inspection.

There are 17 perimeter signs (PL-3), attached to steel posts set in concrete, positioned along the unfenced property boundary. Perimeter sign P5 was faded but remains legible. No other maintenance needs were identified.



EXPLANATION

- E — ENTRANCE SIGN
- P1 — PERIMETER SIGN AND NUMBER
- 1 — SITE MARKER AND NUMBER
- 2 — BOUNDARY MONUMENT AND NUMBER
- 0184 — MONITORING WELL AND NUMBER
- 1 — SURVEY MONUMENT AND NUMBER
- 0718 — BROWNS WASH SEEP AND IDENTIFIER
- BUILDING (NON-DOE)
- PROPERTY BOUNDARY
- CHAINLINK FENCE
- BARBED-WIRE FENCE
- 191 — INTERSTATE OR HIGHWAY
- ROAD OR TRACK
- RAILROAD
- DRAINAGE AND FLOW DIRECTION
- CHANGE IN SLOPE ON DISPOSAL CELL
- RILLS AND GULLIES
- 1 — PHOTOGRAPH LOCATION, NUMBER, AND DIRECTION (REFERENCED AS PL-X IN TEXT)

RED – NEW OBSERVATION IDENTIFIED DURING THE 2019 INSPECTION
BLUE – PREVIOUS OBSERVATION CURRENTLY MONITORED
BLACK – SITE FEATURE
ITALICS – SITE FEATURE NOT REQUIRED TO BE INSPECTED
sentence case – adjacent property owner

TRUE NORTH
MAGNETIC NORTH
N

SCALE IN FEET
350 175 0 350 700

NORTH AMERICAN DATUM OF 1927

ANNUAL INSPECTION CONDUCTED MARCH 19, 2019

U.S. DEPARTMENT OF ENERGY | Legacy Management
GRAND JUNCTION, COLORADO

NAVARRO — Work Performed Under DOE Contract No. DE-LM0000421
Contractor to the U.S. Department of Energy Office of Legacy Management

2019 ANNUAL INSPECTION DRAWING
GREEN RIVER, UTAH,
DISPOSAL SITE

DATE PREPARED:	FILENAME:
SEPTEMBER 19, 2019	S2669201

Figure 7-1. 2019 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. No maintenance needs were identified.

7.4.1.4 Survey and Boundary Monuments

Eleven boundary monuments and three survey monuments 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 2019 sampling event. All wellhead protectors observed during the inspection were undamaged and locked (PL-4). 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-5). A small percentage of the rock, including basalt and sedimentary rock, has degraded, but the riprap cover is functioning as designed (PL-6). 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 erosional 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. The buildings are not maintained and are in disrepair, and debris tends to blow onto the site from surrounding buildings (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 (PL-8). 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. No maintenance needs were identified.

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

Minor erosion was identified under the southeast fence line and repaired at the time of the inspection. No other maintenance needs were identified.

7.7 Groundwater Monitoring

In accordance with the LTSP, annual groundwater monitoring is conducted to evaluate the performance of the disposal cell. In 2011, LM developed a draft GCAP that was approved by the State of Utah. As a best management practice, LM implemented the draft GCAP to expand the groundwater monitoring requirements (i.e., additional monitoring wells and analytes), and propose a groundwater compliance strategy. The most recent sampling event occurred in June 2019 and the results are presented below.

The LTSP establishes four POC wells at the site for postclosure groundwater monitoring. The 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, which is at the hydrologic downgradient limit of the disposal cell. The LTSP included monitoring well 0172, but its construction integrity was suspect and the well was replaced with monitoring well 0181 in 2001. It 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
POC well	0171, 0173, 0181, 0813

POC wells are sampled for nitrate, sulfate, and uranium. Groundwater monitoring results 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

Water levels have been manually measured annually in the POC wells since 1991.

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. From 2014 to 2019, the water levels increased to elevations near the 2007 levels.

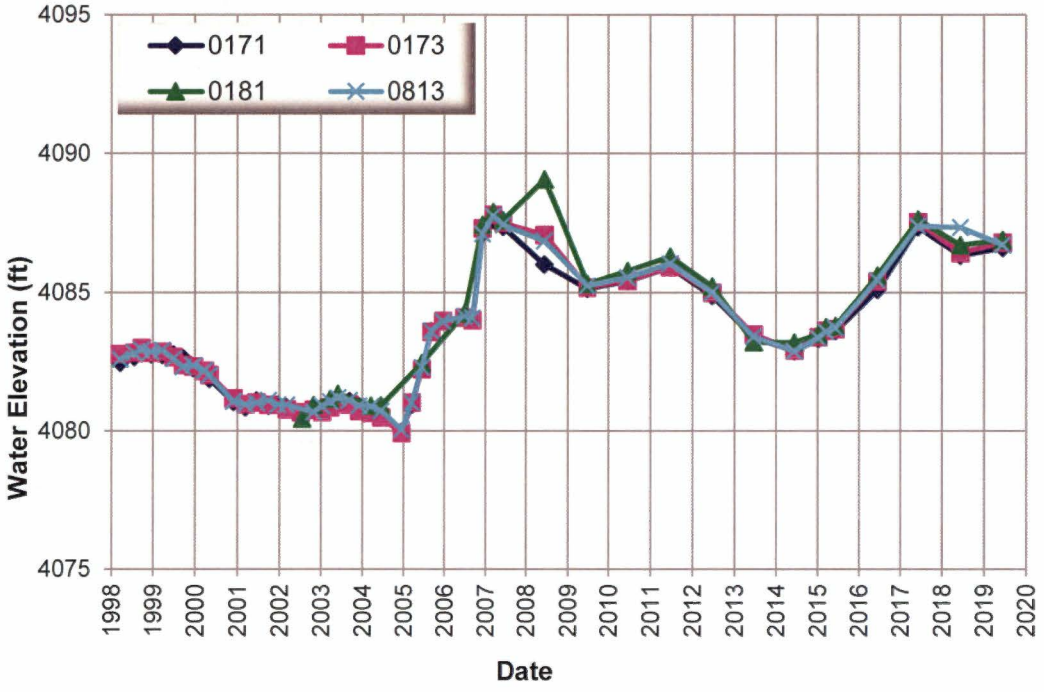


Figure 7-3. Groundwater Elevations at the Green River, Utah, Disposal Site

7.7.2 Disposal Cell Performance Monitoring

Table 7-3 presents the concentration limits for POC wells established in the LTSP. The concentration limits chosen for uranium and nitrate were the higher value from either the U.S. Environmental Protection Agency MCLs (40 CFR 192 Table 1 Subpart A) or the background concentration levels present before construction of the disposal cell (DOE 1998). The background water quality in the Cedar mountain formation is characterized by high TDS and concentrations of sulfate that exceed national primary and secondary drinking water regulations (DOE 1998). In accordance with the LTSP, sulfate results are compared to well-specific background concentration limits (Table 7-3). ACLs are proposed as a component of the compliance strategy in the draft GCAP after it became clear that groundwater concentrations were unlikely to meet the levels specified in the LTSP (DOE 2002). ACLs are proposed for nitrate (1000 milligrams per liter [mg/L]) and uranium (4.4 mg/L) in the draft GCAP.

Table 7-4 provides the analytical results at the POC wells for the June 2019 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. 2019 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	40	3900	0.1
0173	140	8100	0.039
0181	38	6500	0.019
0813	0.003	3600	0.03

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

Nitrate concentrations continue to exceed the MCL in POC wells 0171 and 0173. The 2019 nitrate concentrations were within the range of historical values for all POC wells (Figure 7-4).

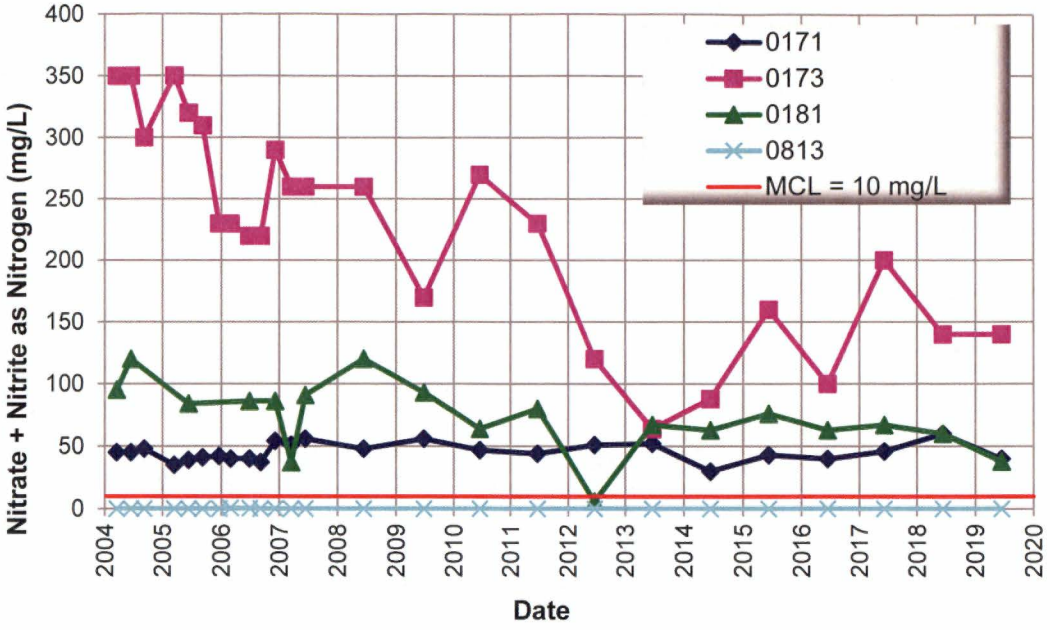


Figure 7-4. Nitrate at Point of Compliance Wells at the Green River, Utah, Disposal Site

Sulfate concentrations exceeded the LTSP background concentrations in all POC wells (Table 7-3) except POC well 0813. The 2019 sulfate concentrations were within the range of historical values for all POC wells (Figure 7-5).

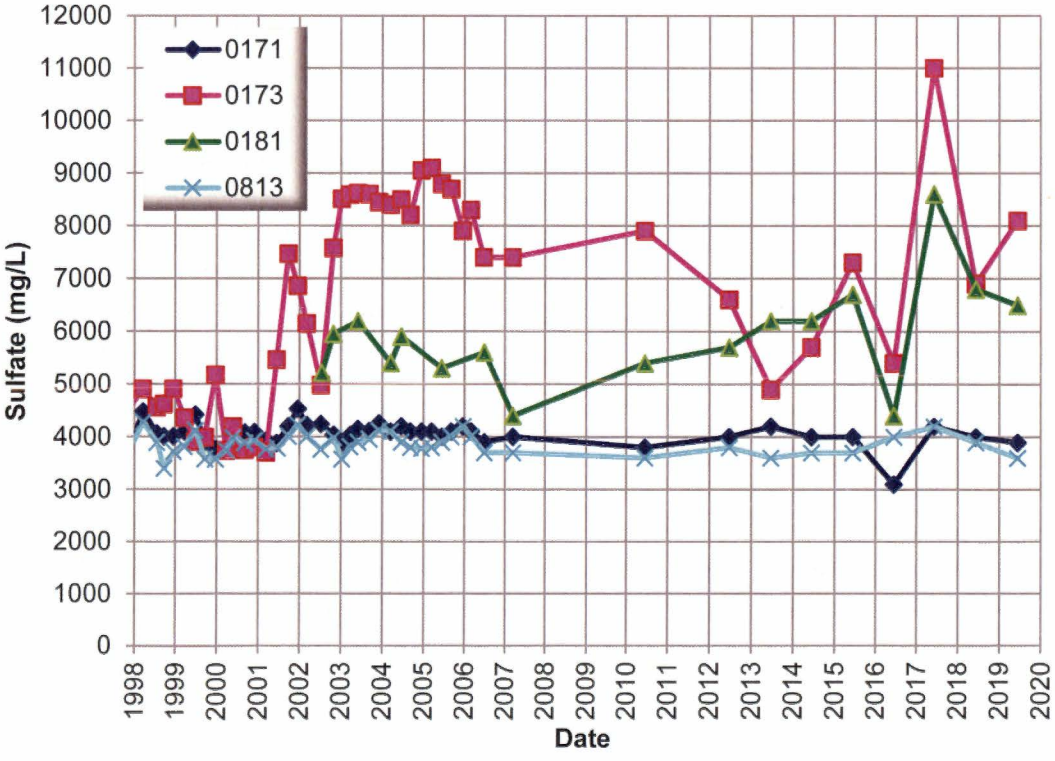


Figure 7-5. Sulfate at Point of Compliance Wells at the Green River, Utah, Disposal Site

Uranium concentrations in POC well 0171 routinely exceed the UMTRCA and LTSP concentration limits, while the other POCs remain mostly below the MCL. Well 0173 exceeded 0.044mg/L once in 2018 (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. The 2019 uranium concentrations were within the range of historical values for all POC wells.

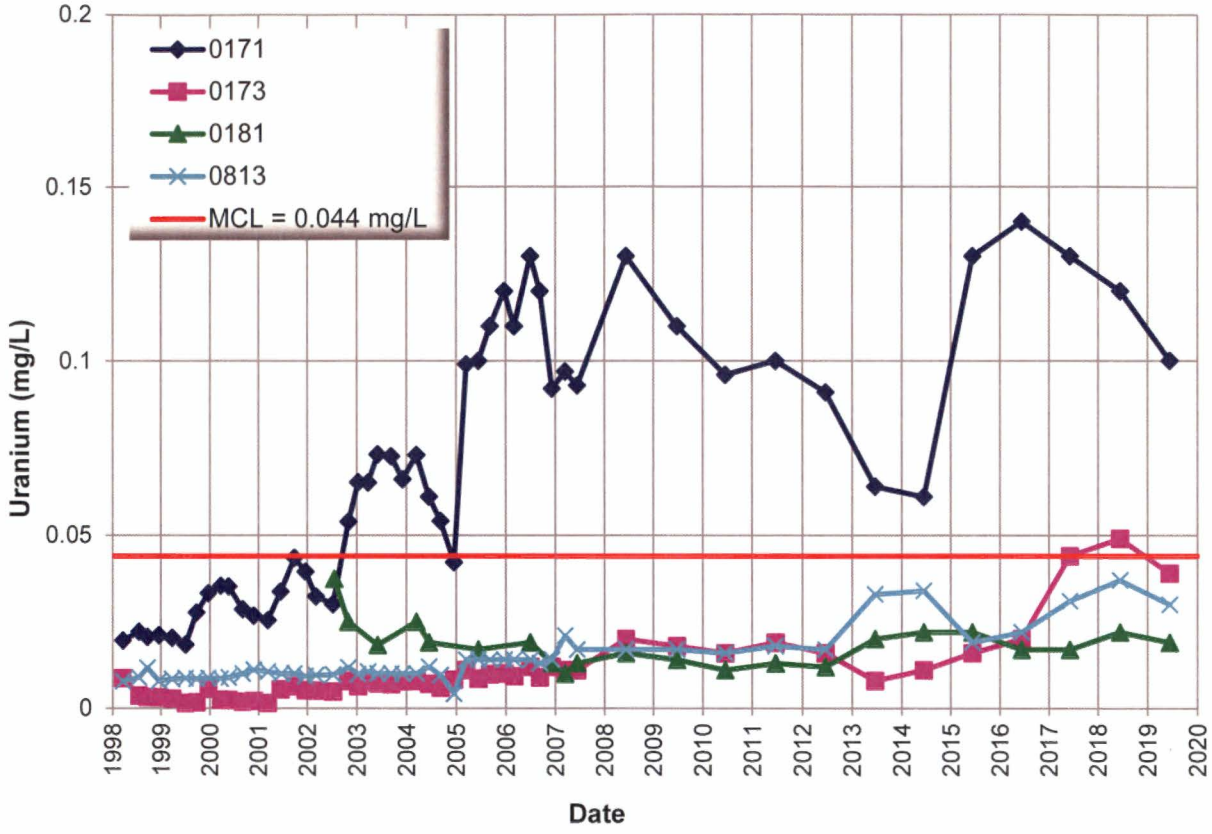


Figure 7-6. Uranium at Point of Compliance Wells at the Green River, Utah, Disposal Site

In summary, groundwater monitoring results were within the range of historical values at all POC wells with the exception of nitrate in well 0171. Groundwater monitoring and disposal cell performance evaluation will continue at the site under the requirements set forth in the LTSP until the GCAP has been finalized.

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), 2002. *Final Site Observational Work Plan for the Green River, Utah, UMTRA Project Site,* GJO-2002-356-TAC, Grand Junction, Colorado, September.

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

7.10 Photographs

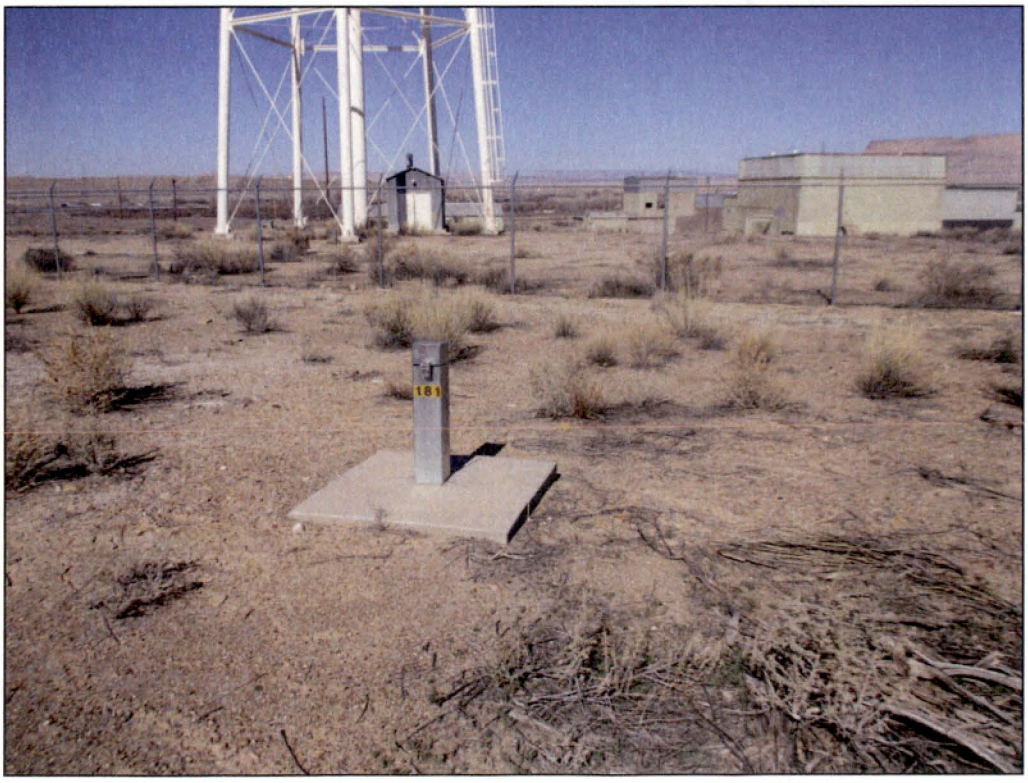
Photograph Location Number	Azimuth	Photograph Description
PL-1	40	Northwest Security Fence Line
PL-2	180	Minor Erosion Under Southeast Security Fence Line (Repaired)
PL-3	270	Perimeter Sign P14 (Disposal Cell in Background)
PL-4	295	Monitoring Well 0181 (Abandoned Mill Buildings in Background)
PL-5	—	North Corner of Disposal Cell
PL-6	225	Southwest Side Slope of the Disposal Cell
PL-7	320	Apron Along Northeast Side of Disposal Cell
PL-8	105	Gullies Near Water Tower and Boundary Monument BM-3

Note:
— = Photograph taken vertically from above.

PL-1. Northwest Security Fence Line

PL-2. Minor Erosion Under Southeast Security Fence Line (Repaired)

PL-3. Perimeter Sign P14 (Disposal Cell in Background)



PL-4. Monitoring Well 0181 (Abandoned Mill Buildings in Background)

PL-5. North Corner of Disposal Cell

PL-6. Southwest Side Slope of the Disposal Cell

PL-7. Apron Along Northeast Side of Disposal Cell

PL-8. Gullies Near Water Tower and Boundary Monument BM-3

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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) inspection on September 4, 2019. 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 site inspection.

The most recent sampling event occurred in July 2016. The next scheduled monitoring event will occur in 2020. 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 Long-Term Surveillance Plan (LTSP) (DOE 1997) in accordance with procedures 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 September 4, 2019. The inspection was conducted by J. Lobato and D. Atkinson 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 evaluate 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 2019 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are included in the following subsections. Photographs to support specific observations are identified in the text and in Figure 8-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 8.10.

8.4.1.1 Site Access, Entrance Gate, and Entrance Sign

Access to the site is from Gunnison County Road 42 onto U.S. Bureau of Land Management (BLM) Route 3068, 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. A sticker with the new UMTRCA web address will be placed on the entrance sign during the next inspection. 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 (PL-1). The perimeter fence was intact except for one location along the north fence line (near boundary sign P24) with a broken strand that was repaired during the inspection.

Two barbed-wire gates—one on the east fence line and the other on the north 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 P36, P37, P39, and P42 are constructed of plastic and should be replaced with metal signs. Perimeter signs P4–P13 along the west perimeter fence line are becoming illegible due to fading. Perimeter signs that are damaged and showing wear will be replaced over the next 2 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-2), and site marker SMK-2 is on the top slope of the disposal cell. The base of SMK-2 has a small, insignificant crack and remains stable (PL-3). No maintenance needs were identified.

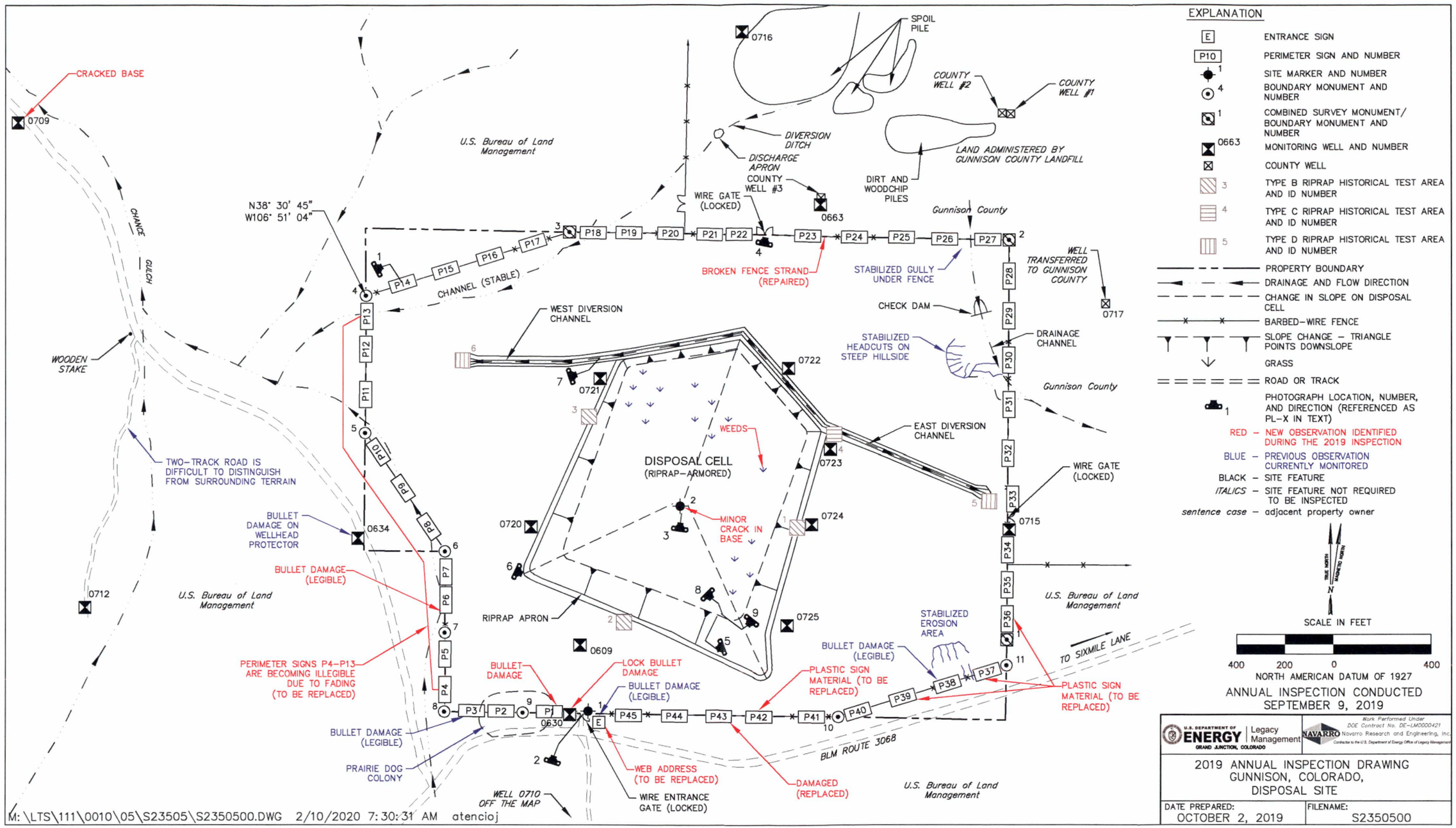

Figure 8-1. 2019 Annual Inspection Drawing for the Gunnison, Colorado, Disposal Site

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8.4.1.4 Survey and Boundary Monuments

Three combined survey and boundary monuments and eight additional boundary monuments delineate the property boundary. No maintenance needs were identified.

8.4.1.5 Monitoring Wells

The site has 16 groundwater monitoring wells. The wellhead protectors were locked and properly labeled. Bullet damage is present on the lock of monitoring well 0630 and on the wellhead protector of monitoring well 0634. However, both wells are secure, and no maintenance is required. Gunnison County landfill operators have placed concrete barriers to protect monitoring well 0716, which is on landfill property, from landfill activities. The edge of an adjacent spoil pile (PL-4), although close to the concrete barriers, does not impair access to monitoring well 0716. The base of monitoring well 709 is cracked but remains stable. Inspectors will continue to monitor these features. 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. 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

Basalt riprap armors the disposal cell side slopes (PL-5), an apron to collect and divert precipitation runoff from the disposal cell (PL-6), and two diversion channels to protect the disposal cell from precipitation run-on (PL-7). 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-8). 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 (PL-9). 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 (PL-4). 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 along the north fence line (near boundary sign P24) was identified and repaired during the inspection. Perimeter signs P42, P39, P37, and P36 are constructed of plastic and will be replaced with metal signs at the next inspection. Perimeter signs P4–P13 along the west fence line are becoming illegible due to fading and will 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 that 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. That total includes 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 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).

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.

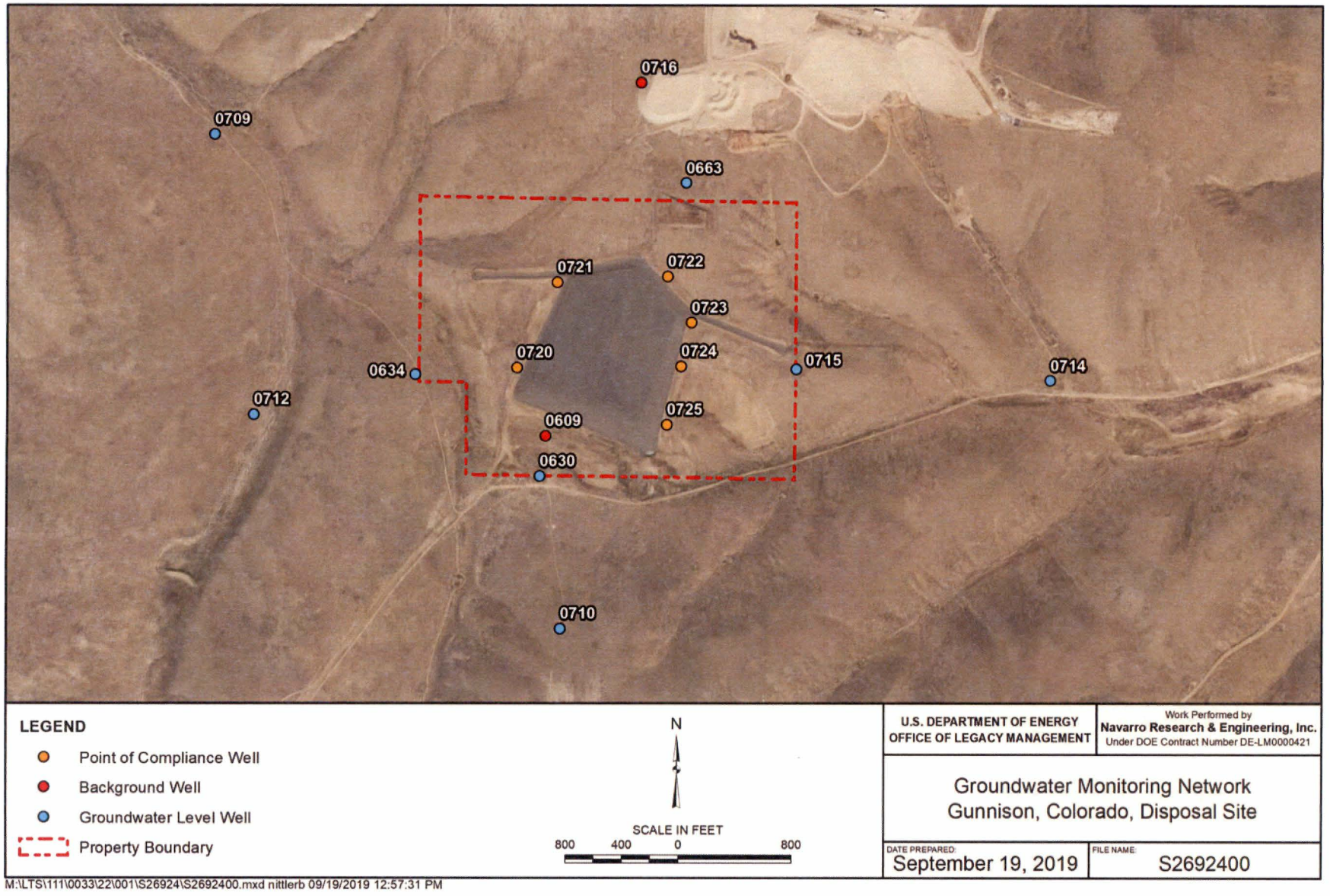


Figure 8-2. Groundwater Monitoring Network at the Gunnison, Colorado, Disposal Site

8.8 Corrective Action

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

8.9 References

10 CFR 40.27. 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 Subpart A Table 1. U.S. Environmental Protection Agency, "Maximum Concentration of Constituents for Groundwater Protection," *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	60	North Fence Line
PL-2	20	Site Marker SMK-1
PL-3	10	Small Crack in Base of Site Marker SMK-2
PL-4	10	Gunnison County Landfill Operations
PL-5	250	South Side Slope of Disposal Cell
PL-6	115	South Riprap Apron
PL-7	70	West Diversion Channel
PL-8	140	Southeast Corner of Disposal Cell
PL-9	220	Reclaimed Area Along South Fence Line

PL-1. North Fence Line

PL-2. Site Marker SMK-1

PL-3. Small Crack in Base of Site Marker SMK-2

PL-4. Gunnison County Landfill Operations

PL-5. South Side Slope of Disposal Cell

PL-6. South Riprap Apron

PL-7. West Diversion Channel

PL-8. Southeast Corner of Disposal Cell

PL-9. Reclaimed Area Along South Fence Line

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 June 24 and June 25, 2019. 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 assess 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 2019 gradation monitoring is 2.56 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 23 years of monitoring, the measured D_{50} value has varied above and below design specifications. During the 2019 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 2019. 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 Long-Term Surveillance Plan (LTSP) (DOE 1994) in accordance with procedures 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 NRC 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

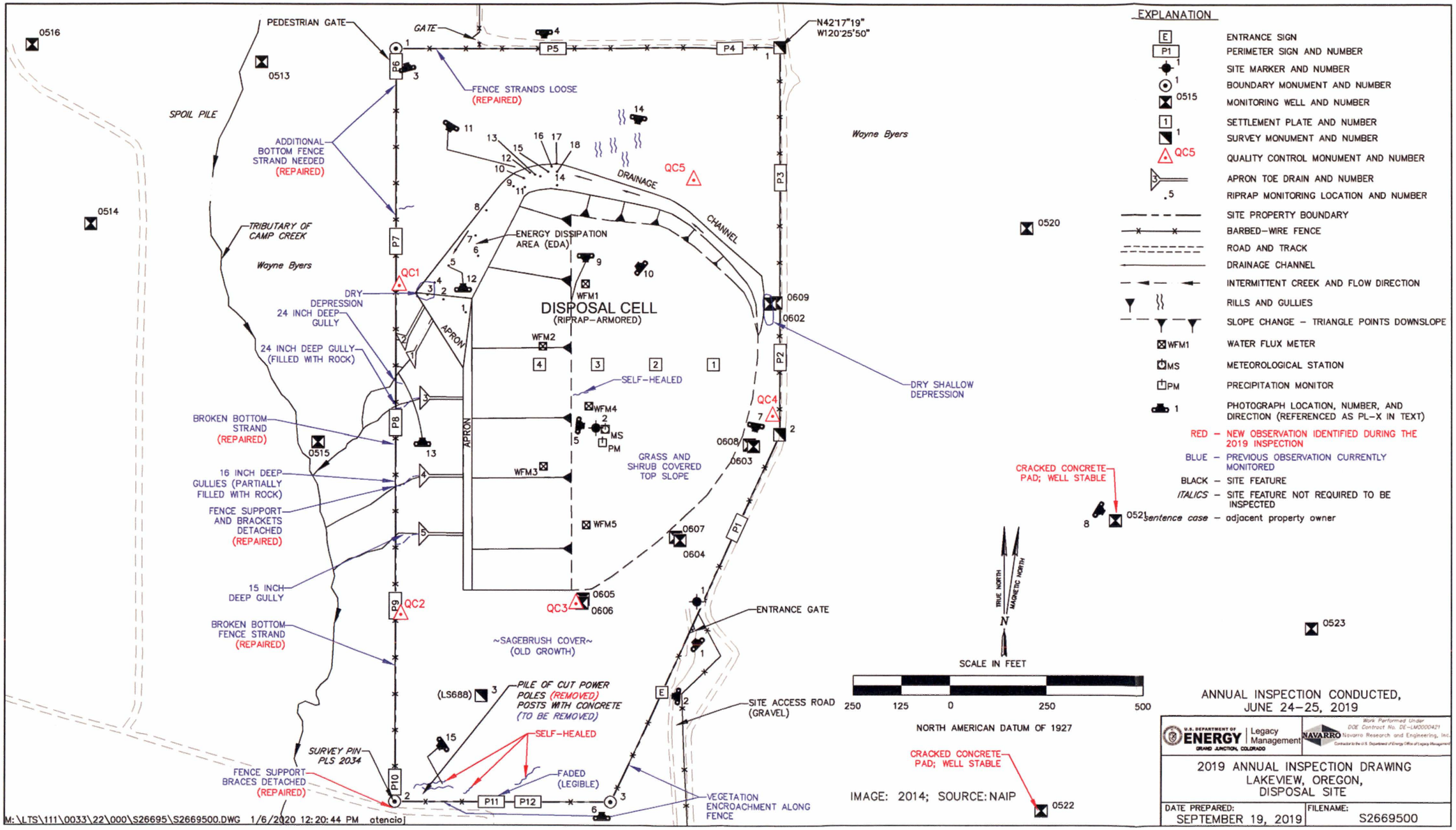
The site, approximately 7 miles northwest of Lakeview, Oregon, was inspected on June 24 and June 25, 2019. The inspection was conducted by C. Wentz, C. Goodknight, and S. Hall of the Legacy Management Support (LMS) contractor. J. Nguyen (LM site manager), C. Mueller (LMS), G. Smith (Geo-Smith Engineering LLC), and T. Sicilia (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 evaluate 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 2019 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 a steel post set in concrete along the access road and was undamaged (PL-2). A pedestrian gate in the northwest corner of the site was locked and undamaged (PL-3). No maintenance needs were identified.



EXPLANATION

- E — ENTRANCE SIGN
- P1 — PERIMETER SIGN AND NUMBER
- 1 — SITE MARKER AND NUMBER
- 1 — BOUNDARY MONUMENT AND NUMBER
- 0515 — MONITORING WELL AND NUMBER
- 1 — SETTLEMENT PLATE AND NUMBER
- 1 — SURVEY MONUMENT AND NUMBER
- QC5 — QUALITY CONTROL MONUMENT AND NUMBER
- 3 — APRON TOE DRAIN AND NUMBER
- .5 — RIPRAP MONITORING LOCATION AND NUMBER
- SITE PROPERTY BOUNDARY
- BARBED-WIRE FENCE
- ROAD AND TRACK
- DRAINAGE CHANNEL
- INTERMITTENT CREEK AND FLOW DIRECTION
- RILLS AND GULLIES
- SLOPE CHANGE – TRIANGLE POINTS DOWNSLOPE
- WFM1 — WATER FLUX METER
- MS — METEOROLOGICAL STATION
- PM — PRECIPITATION MONITOR
- 1 — PHOTOGRAPH LOCATION, NUMBER, AND DIRECTION (REFERENCED AS PL-X IN TEXT)

RED – NEW OBSERVATION IDENTIFIED DURING THE 2019 INSPECTION

BLUE – PREVIOUS OBSERVATION CURRENTLY MONITORED

BLACK – SITE FEATURE

ITALICS – SITE FEATURE NOT REQUIRED TO BE INSPECTED

sentence case – adjacent property owner

ANNUAL INSPECTION CONDUCTED,
JUNE 24–25, 2019

U.S. DEPARTMENT OF ENERGY | Legacy Management
GRAND JUNCTION, COLORADO

Work Performed Under DOE Contract No. DE-LM0000421
NAVARRO Navarro Research and Engineering, Inc.
Contractor to the U.S. Department of Energy Office of Legacy Management

2019 ANNUAL INSPECTION DRAWING
LAKEVIEW, OREGON,
DISPOSAL SITE

DATE PREPARED: SEPTEMBER 19, 2019

FILENAME: S2669500

Figure 9-1. 2019 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 western boundary) encloses the site. Repairs to the perimeter fence identified in the 2018 annual inspection were made in June 2019. During the 2019 annual inspection, inspectors confirmed the necessary repairs were made. Some vegetation is growing near, and entangled in, the perimeter fence line, but the fence appeared stable and remains functional.

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 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 and three boundary monuments delineate the property boundary (PL-6). 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 the wellhead protectors remain stable (PL-8). 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 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 from reaching the tailings. 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 was inspected and generally appears stable and uniform except at the northwest corner of the disposal cell, where erosion has been observed along 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 (PL-9). 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 and 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-10). Inspectors will monitor the restored locations to confirm that no settlement is occurring, 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 assess the 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, as it was designed to do. 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 (i.e., riprap) 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.

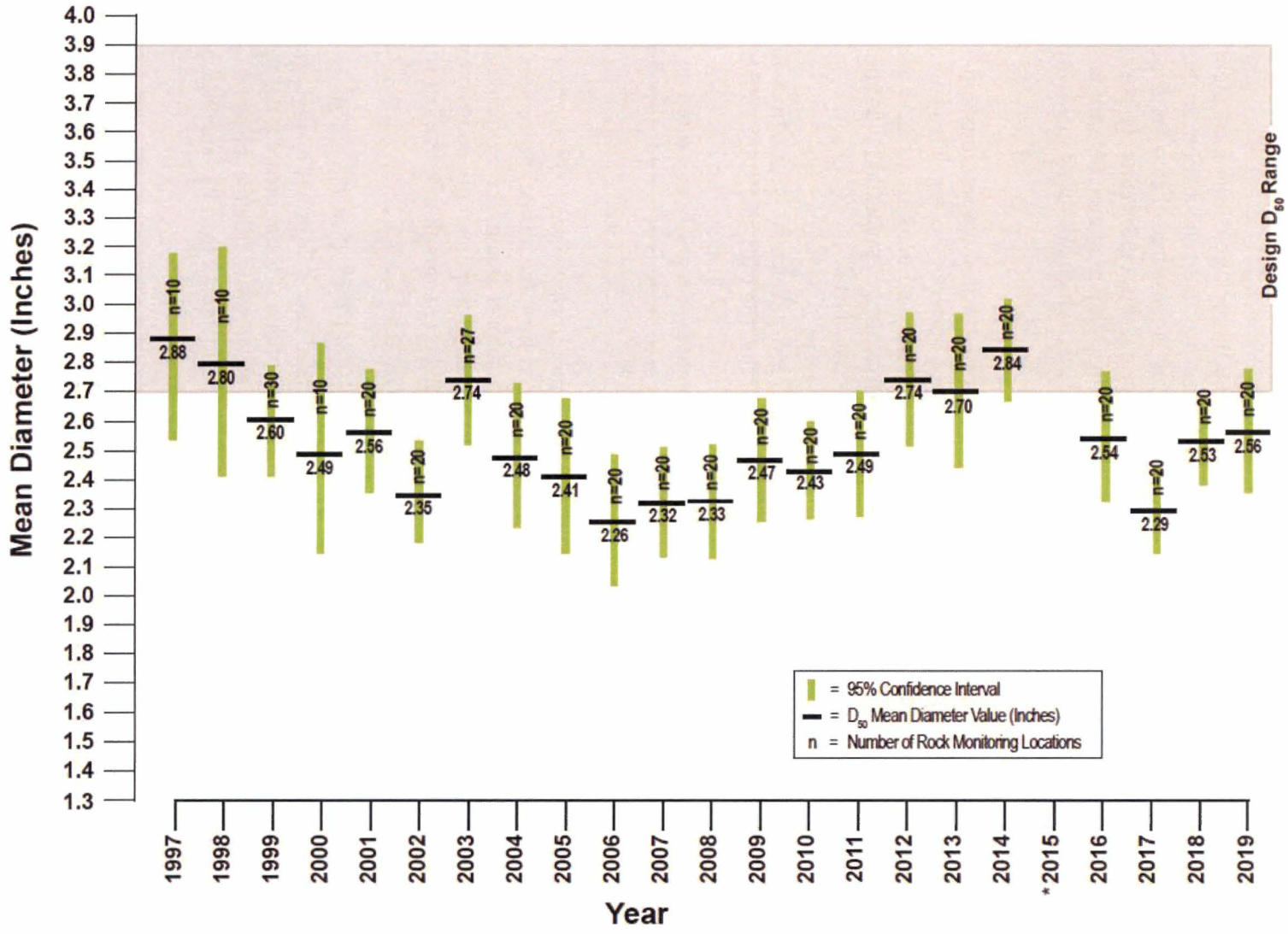
In 2015, LM proposed to replace the annual gradation monitoring with more rigorous and focused inspection of all rills that may form along the interface between the vegetated soil and rock top slope and the rock-covered west side slope (Dayvault 2015). Focusing on these areas will enable LM to more proactively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

In 2019, riprap gradation monitoring was performed for the 23rd consecutive year. An evaluation of the 2019 rock size (gradation) measurement data indicates that the west side slope riprap D_{50} is 2.56 inches with a 95% confidence interval between 2.32 and 2.82 inches. The 2019 D_{50} value of 2.56 inches is within the range of D_{50} values (2.26–2.88 inches) previously measured on the side slope during the 23 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. 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 evaluate 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 23 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. Annual photographic monitoring of the 18 locations for long-term rock monitoring was conducted during the 2019 inspection. In 2018, it was observed that some of the numbered rocks had faded labels, and they were repainted before the 2019 annual inspection. Location 15 was missed and will be repainted next year. The rock at photo monitoring location 5 is shown in PL-12. 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 (1997–2019)

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. Should flow obstruction become a concern in the future, maintenance will be performed. There is an area of dense, tall 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. Increased erosion was observed near the fence line near Toe Drain 3 (PL-13). 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 adjacent private property onto DOE property, some minor headcutting is still evident. Several small gullies have been observed on the private property directly west of the site in the heavily grazed areas downslope of the perimeter fence line. Several rills and shallow gullies were also observed onsite on the slope north of the disposal cell where grass reestablishment has been limited (PL-14), 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 but appear to be self-healed as no significant changes were observed in 2019. The gullies do not pose a threat to disposal cell integrity, and inspectors will continue to monitor these areas. In previous years inspectors also observed a pile of cut telephone poles and signposts with concrete bases in the southwest corner of the site. The cut telephone poles were removed in June 2019; however, the signposts with cement bases were too heavy to remove by hand (PL-15). This remaining debris does not impact site integrity; however, it will be removed in the future. No other 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

Before the inspection, several maintenance items identified in the *2018 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites* (DOE 2019) were completed including:

- Repairing loose fence strands
- Repairing detached fence brackets and braces
- Removing cut telephone poles

Inspectors documented minor maintenance to be addressed in the future, including:

- Repainting the rock monitoring label at location number 15
- Removing the signposts with concrete bases from the southwest corner of the site

In August 2019, following the inspection, eight 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 9-1. 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 on June 13, 2019, and the next event will occur in 2024.

The groundwater monitoring network consists of nine monitoring wells, including eight downgradient point of compliance (POC) wells and one upgradient background monitoring well (Table 9-2 and Figure 9-3). Four of the nine monitoring wells were observed to be dry on June 13, 2019, and could not be sampled. Seven additional LM-owned monitoring wells (0513, 0514, 0516, 0520, 0521, 0522, and 0523) are on private property adjacent to the site but are no longer required to be sampled as identified in the LTSP (Figure 9-1). The hazardous constituents monitored in site groundwater are arsenic, cadmium, and uranium. EPA established MCLs for these analytes in groundwater in 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

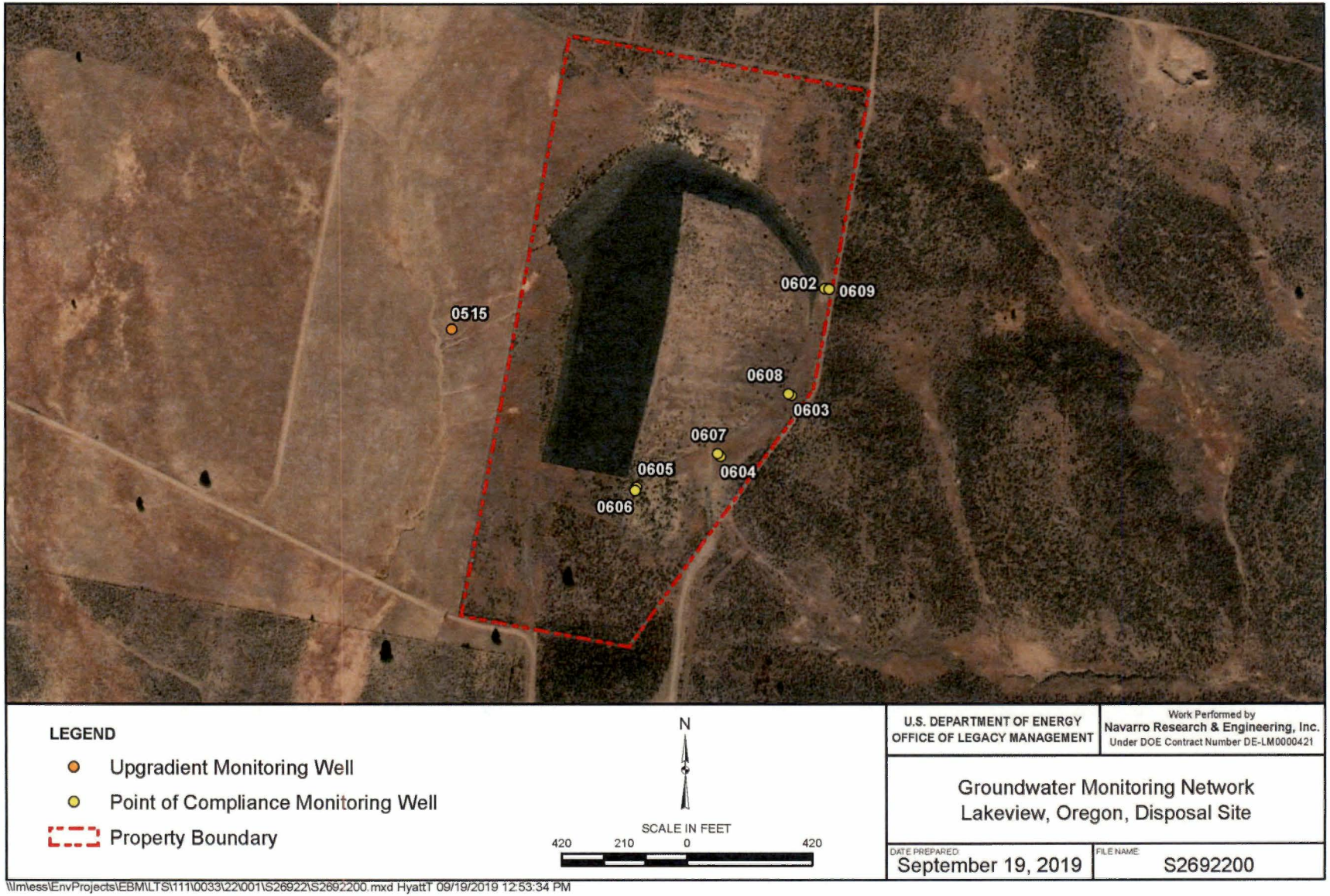


Figure 9-3. Groundwater Monitoring Network Lakeview, Oregon, Disposal Site

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

Concentrations of these constituents continued to remain significantly below their respective MCLs in 2019. Arsenic concentrations were similar to the prior 2014 results (Figure 9-4), all cadmium concentration results were below the laboratory detection limit of 0.000083 mg/L, and uranium concentrations remained stable or have slightly increased (Figure 9-5). The next disposal cell performance monitoring is scheduled for 2024.

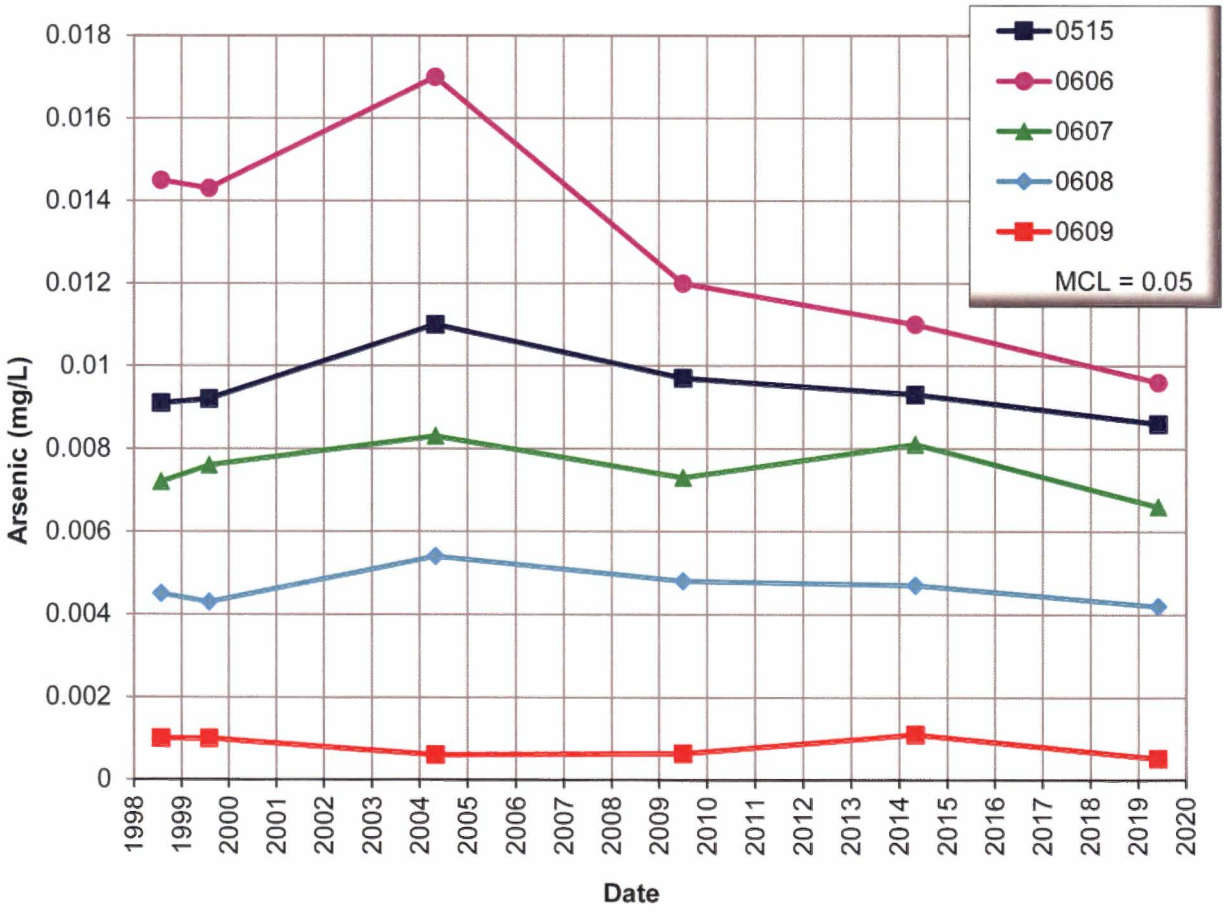


Figure 9-4. Arsenic in Groundwater at the Lakeview Disposal Site (Arsenic MCL is not Shown Because the MCL is Significantly Higher Than Groundwater Monitoring Concentrations)

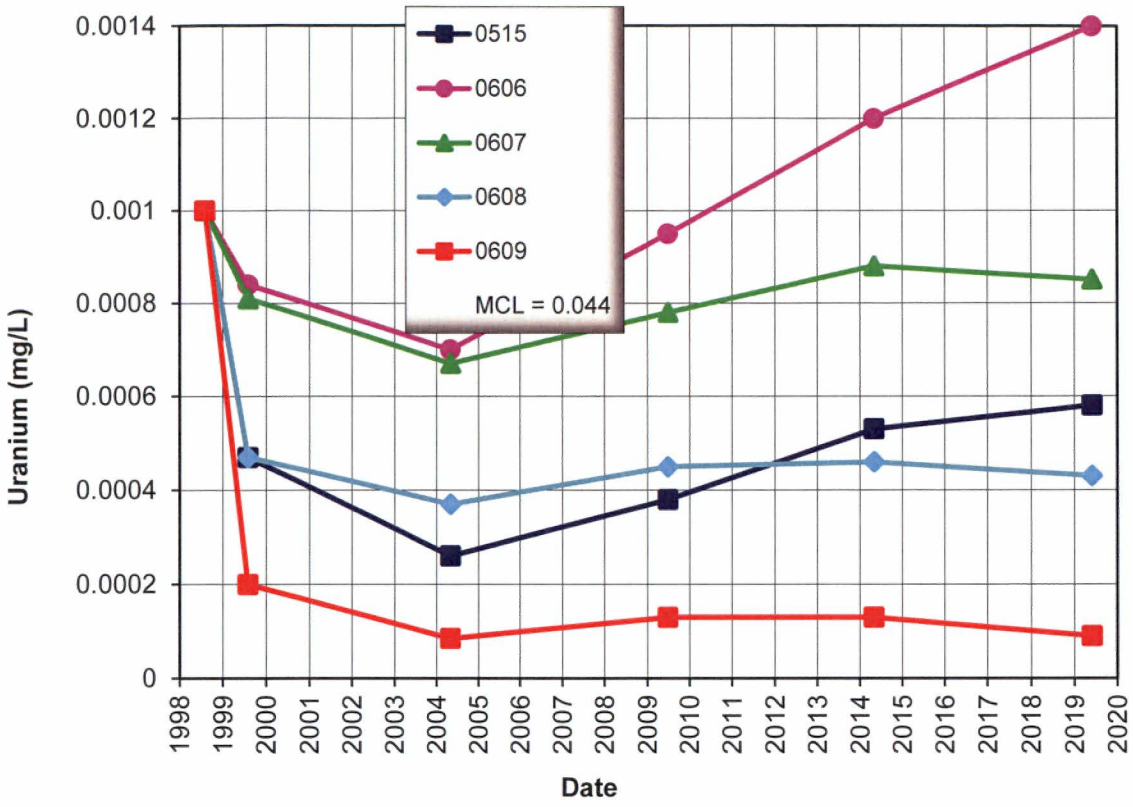


Figure 9-5. Uranium in Groundwater at the Lakeview Disposal Site (Uranium MCL is not Shown Because the MCL is Significantly Higher Than Groundwater Monitoring Concentrations)

All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System (GEMS) website (http://gems.lm.doe.gov/#site=LKD). 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 quality 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, U.S. Department of Energy 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), 2019. *2018 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites,* LMS/S22053, March.

9.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	315	Entrance Gate
PL-2	275	Entrance Sign
PL-3	345	Boundary Monument BM-1 and Pedestrian Gate
PL-4	180	Perimeter Sign P5 with Disposal Cell in Background
PL-5	95	Site Marker SMK-2 with Meteorological Station in Background
PL-6	—	Boundary Monument BM-3
PL-7	190	Monitoring Wells 0603 and 0608
PL-8	120	Monitoring Well 0521 with Cracked Concrete Base
PL-9	180	Top Edge of West Side Slope
PL-10	310	Reclaimed Cover Study Test Plot
PL-11	210	Energy Dissipation Area Downstream of Drainage Channel North of Disposal Cell
PL-12	—	(a) Riprap Monitoring Location Number 5 in Energy Dissipation Area—2019 (b) Riprap Monitoring Location Number 5 in Energy Dissipation Area—2004 Photo for Comparison
PL-13	—	Gully Downgradient of Toe Drain 3
PL-14	190	Erosion Rills North of Disposal Cell
PL-15	235	Abandoned Metal Signposts with Concrete Bases

Note:
— = Photograph taken vertically from above.

PL-1. Entrance Gate

PL-2. Entrance Sign

PL-3. Boundary Monument BM-1 and Pedestrian Gate

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

PL-5. Site Marker SMK-2 with Meteorological Station in Background

PL-6. Boundary Monument BM-3

PL-7. Monitoring Wells 0603 and 0608

PL-8. Monitoring Well 0521 with Cracked Concrete Base

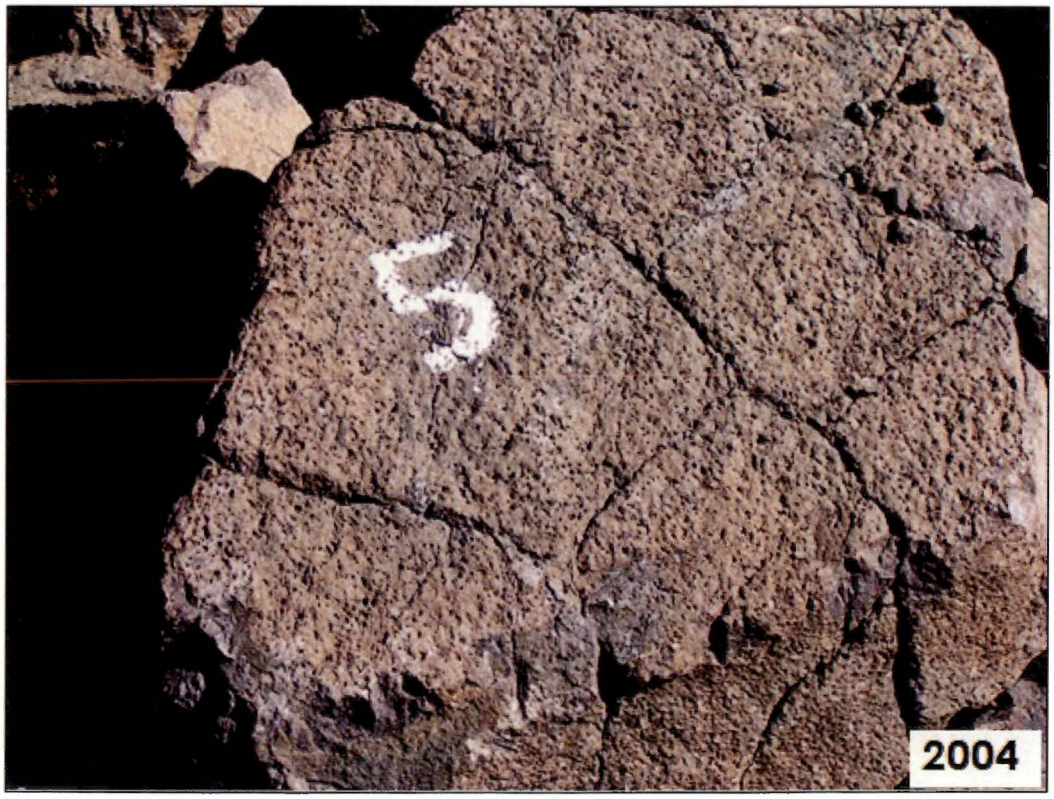
PL-9. Top Edge of West Side Slope

PL-10. Reclaimed Cover Study Test Plot

PL-11. Energy Dissipation Area Downstream of Drainage Channel North of Disposal Cell

Photos continue on the next page.

PL-12. (a) Riprap Monitoring Location Number 5 in Energy Dissipation Area—2019



PL-12. (b) Riprap Monitoring Location Number 5 in Energy Dissipation Area—2004 Photo for Comparison

PL-13. Gully Downgradient of Toe Drain 3

PL-14. Erosion Rills North of Disposal Cell

PL-15. Abandoned Metal Signposts with Concrete Bases

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