LMS/S33843

U.S. DEPARTMENT OF ENERGY

Legacy Management

2021 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites

Disposal sites (clockwise, starting left): Lakeview, Oregon; Naturita, Colorado; Maybell, Colorado; and Mexican Hat, Utah

March 2022

This page intentionally left blank

Contents

Page

This page intentionally left blank

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*
D_{50}	mean diameter
DOE	U.S. Department of Energy
EDA	energy dissipation area
EPA	U.S. Environmental Protection Agency
ft	feet
GCAP	Groundwater Compliance Action Plan
GEMS	Geospatial Environmental Mapping System
gpm	gallons per minute
GSMT	geotechnical sampling and materials testing
IC	institutional control
ICP	interim cover 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
NAD22	North American Datum of 2022
NAD27	North American Datum of 1927
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NGS	National Geodetic Survey
NGVD29	National Geodetic Vertical Datum of 1929
NMED	New Mexico Environment Department
NRC	U.S. Nuclear Regulatory Commission
PL	photograph location

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

Executive Summary

This report, in fulfillment of a U.S. Nuclear Regulatory Agency (NRC) 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 2021. These activities occurred at the 19 uranium mill tailings disposal sites established under Title I of the Uranium Mill Tailings Radiation Control Act (UMTRCA)[1] and verified that the UMTRCA Title I disposal sites remain in compliance with license requirements and Long-Term Surveillance Plans (LTSPs). Individual chapters for each site 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 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. 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. In December 2020, Congress passed legislation that will extend the final disposal cell closure date from 2023 to 2031. LM's receipt of radioactive waste at the site will cease in September 2031.

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 for maintenance, follow-up inspections, or corrective action in accordance with the LTSPs.

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 2021:

- Resurveys and datum transformations were completed at 15 sites to prepare for the upcoming Office of Management and Budget Circular A-16, "Coordination of Geographic Information and Related Spatial Data Activities," datum that will be released in 2024. To date, UMTRCA programmatic geospatial information has been reported and maintained in the North American Datum of 1927 (NAD27) and National Geodetic Vertical Datum of 1929 (NGVD29). To be in compliance with the new datum release, the UMTRCA geospatial information required a transformation from NAD27/NGVD29 datums to North American

[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.

Datum of 1983 (NAD83) (2011) and North American Vertical Datum of 1988 (NAVD88) in preparation for the transformation to North American Datum of 2022 (NAD22). The remaining four sites will be transformed in 2022. This software-only datum transformation was performed in 2021, using tools provided by the National Geodetic Survey (NGS) (i.e., NGS Coordinate Conversion and Transformation). By 2024, the data will undergo another transformation to the new NAD 2022. The first step in the compliance process is to transform the data from NAD27/NGVD29 to NAD83 (2011)/NAVD88 and then to NAD22.

The resurveys were performed to establish high accuracy coordinates for control points on the site. This will allow accurate monitoring of the site and allow historical data to be adjusted to match current surveys that are performed.

Travel restrictions continued to be imposed in response to the coronavirus pandemic. These restrictions prevented Grand Junction-based Legacy Management Support (LMS) inspectors from traveling to the Navajo Nation to conduct annual inspections at the Shiprock, New Mexico, and Tuba City, Arizona, disposal sites. LMS staff enlisted the assistance of individuals from tribal organizations that are familiar with Shiprock and Tuba City disposal sites to conduct the inspections at those two sites. The LMS contractor provided online training on the LM inspection process to the assisting parties before the inspections. Additionally, maintenance that has been identified at these sites will be performed when travel restrictions have been lifted.

- A "open, receive, and place" project at the Grand Junction disposal site was completed in October 2021. Approximately 2700 cubic yards of residual radioactive material from the City of Grand Junction's interim storage facility was placed in the disposal cell, and the open portion of the cell was sealed with the Soiltac copolymer at the end of the placement project.
- An evapotranspiration conversion cover pilot study on the cell cover at the Grand Junction disposal cell was conducted in 2021. The purpose of this pilot study is to determine if allowing or enhancing vegetation establishment at a large scale on an in-service disposal cell will provide adequate evapotranspiration to limit percolation without unacceptable increases in risk due to plant uptake of contaminants or radon diffusion. NRC has been involved with the project planning and has approved the study.

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

Table ES-1. 2021 Summary of UMTRCA Title I Site Actions and Issues

Site	Chapter	Page	Actions and Issues
Ambrosia Lake, New Mexico	1	1-7	No groundwater monitoring required
		–	Datum transformation performed
Burrell, Pennsylvania	2	2-2	Replaced perimeter signs P12, P13, and P14
		2-9	2020 groundwater sampling results presented for four downgradient wells
		–	Datum transformation performed
Canonsburg, Pennsylvania	3	3-5	Installed new boundary monument
		3-9	Conducted vegetation management
		–	Datum transformation performed

Table ES-1. 2021 Summary of UMTRCA Title I Site Actions and Issues (continued)

Site	Chapter	Page	Actions and Issues
Durango, Colorado	4	4-7	Conducted groundwater monitoring
		4-11	Conducted vegetation management
		–	Datum transformation and resurvey performed
Falls City, Texas	5	5-5	Replaced missing perimeter sign P56
		5-8	Conducted groundwater monitoring
		–	Datum transformation performed
Grand Junction, Colorado	6	6-5	Replaced perimeter sign P20
		6-5	Treated vegetation surrounding monitoring wells
		6-7	Conducted groundwater monitoring
		–	Datum transformation performed
Green River, Utah	7	7-7	Conducted groundwater monitoring
		–	Datum transformation and resurvey performed
Gunnison, Colorado	8	8-2	Replaced perimeter sign P3 and remaining plastic perimeter signs
		8-5	Repaired concrete base around monitoring well 0709
		8-7	Conducted groundwater monitoring
Lakeview, Oregon	9	9-5	Replaced perimeter signs P10, P11, and P12
		9-8	No groundwater monitoring required
		–	Datum transformation performed
Lowman, Idaho	10	10-6	No maintenance needs identified
		10-8	No groundwater monitoring required
		–	Datum transformation and resurvey performed
Maybell, Colorado	11	11-6	Treated noxious weeds and deep-rooted plants
		11-7	No groundwater monitoring required
Mexican Hat, Utah	12	12-8	No groundwater monitoring required
		12-8	Conducted observational seep monitoring
		–	Datum transformation performed
Naturita, Colorado	13	13-2	Installed aerial survey quality control monuments
		13-5	Treated vegetation around monitoring wells BR95-1, BR95-3, and CM93-1
Rifle, Colorado	14	14-1	Datum transformation and resurvey performed
		14-5	Installed aerial survey quality control monuments
		14-5	Repaired evaporation pond liner
		14-8	Conducted disposal cell pore-water monitoring
Salt Lake City, Utah	15	15-5	Installed aerial survey quality control monuments
		–	Datum transformation and resurvey performed
Shiprock, New Mexico	16	16-7	No disposal cell performance monitoring required
		–	Datum transformation performed
Slick Rock, Colorado	17	17-2	Installed aerial survey quality control monuments
		17-5	Treated vegetation on top of disposal cell
		17-6	No groundwater monitoring required

Table ES-1. 2021 Summary of UMTRCA Title I Site Actions and Issues (continued)

Site	Chapter	Page	Actions and Issues
Spook, Wyoming	18	18-6	No groundwater monitoring required
		–	Datum transformation and resurvey performed
Tuba City, Arizona	19	19-9	Conducted semiannual groundwater monitoring
		–	Datum transformation performed

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 was inspected on March 18, 2021. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified no immediate maintenance needs and 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 every 3 years 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, and results were reported in the 2019 site inspection report. The next groundwater sampling event will be in November 2022.

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 (DOE 1996) (LTSP) 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

Inspection of the site, 25 miles north of Grants, New Mexico, was conducted by J. Cario, D. Ravelojaona, and D. Traub of the Legacy Management Support (LMS) contractor. B. Tsosie (LM site manager), A. Rheubottom (NMED), and J. Bale (LMS contractor) 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 whether maintenance or additional inspection and monitoring are needed.

1.4.1 Site Surveillance Features

Figure 1-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. 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 2021 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 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 phone number on the entrance sign was updated during the annual site inspection. No maintenance needs were identified.

1.4.1.2 Perimeter Signs

There are 70 perimeter signs, attached to steel posts set in concrete, positioned along the unfenced property boundary (PL-2). Posts for perimeter signs P1 through P15 include additional warning signs about mining restrictions. Many of the perimeter signs were cracked and weathered but remain legible. Erosion has occurred around the base of perimeter sign P12, but the perimeter sign is stable (PL-3). A new prairie dog colony was identified between perimeter signs P17 and P18. It does not threaten the integrity of either perimeter sign, no additional action is needed. No maintenance needs were identified.

1.4.1.3 Site Markers

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

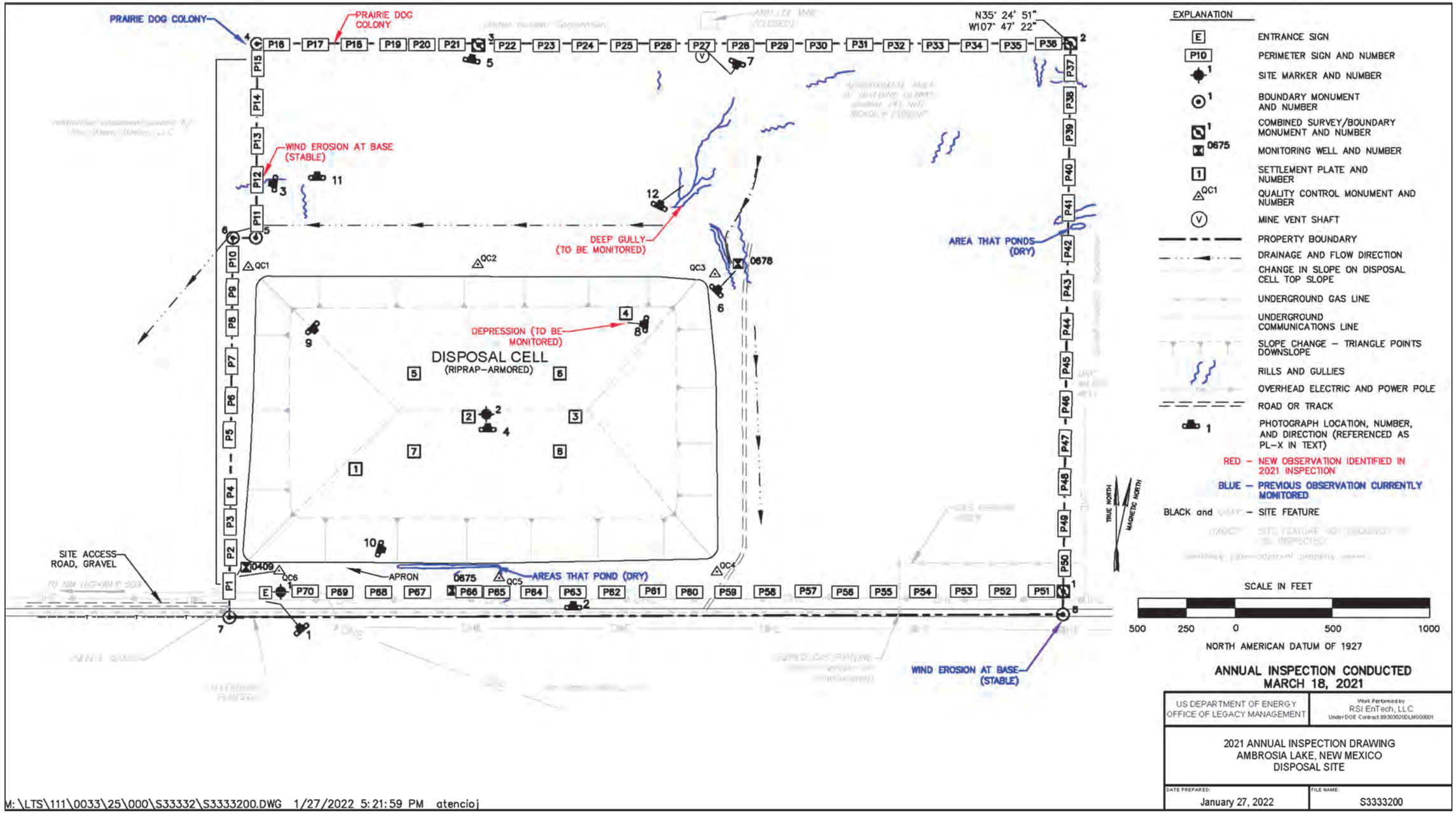


Figure 1-1. 2021 Annual Inspection Drawing for the Ambrosia Lake, New Mexico, Disposal Site

This page intentionally left blank

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-5). Steel T-posts were installed next to boundary monuments to help inspectors locate them. 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 Aerial Survey Quality Control Monuments

Six aerial survey quality control monuments, installed in 2019, were inspected during the 2021 annual inspection. No maintenance needs were identified.

1.4.1.6 Monitoring Wells

The site has three monitoring wells. A gully adjacent to well 0678 appears to be stable, and the well is not affected by the erosion (PL-6). All wellhead protectors observed during the inspection were undamaged, locked, and properly labeled. No maintenance needs were identified.

1.4.1.7 Mine Vent

A mine vent shaft associated with an abandoned underground mine is within the site boundary in the northern portion of the site (PL-7). 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. Inspectors 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 additional settlement may have occurred since the depression was repaired. The area was inspected during the 2021 annual inspection, and settlement was shallow enough that it was determined not to have changed significantly (PL-8). Inspectors will continue to monitor this area.

Scattered annual weeds and perennial grasses and forbs are growing on the disposal cell top (PL-9). 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-10). This location is the topographic low spot along the base of the disposal cell, and stormwater 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. 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-11). 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 2021 annual inspection, existing rills and gullies continued to develop. One gully, northeast of the disposal cell, has grown to a depth of 6–8 feet and a width of 8–10 feet (PL-12). Inspectors collected GPS locations and measurements of this gully and its location has been updated on the inspection map. 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. 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

No 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 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 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. Well 0409 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 (GEMS) website (https://gems.lm.doe.gov/#site=AMB). The *2019 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites* (DOE 2020) reports the most recent monitoring results. Consistent with previous sampling events, well 0409 was dry. Monitoring results for molybdenum, nitrate, selenium, sulfate, and uranium for wells 0675 and 0678 were consistent with historical monitoring results. 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.

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

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.

DOE (U.S. Department of Energy), 2020. *2019 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*, LMS/S26685, March.

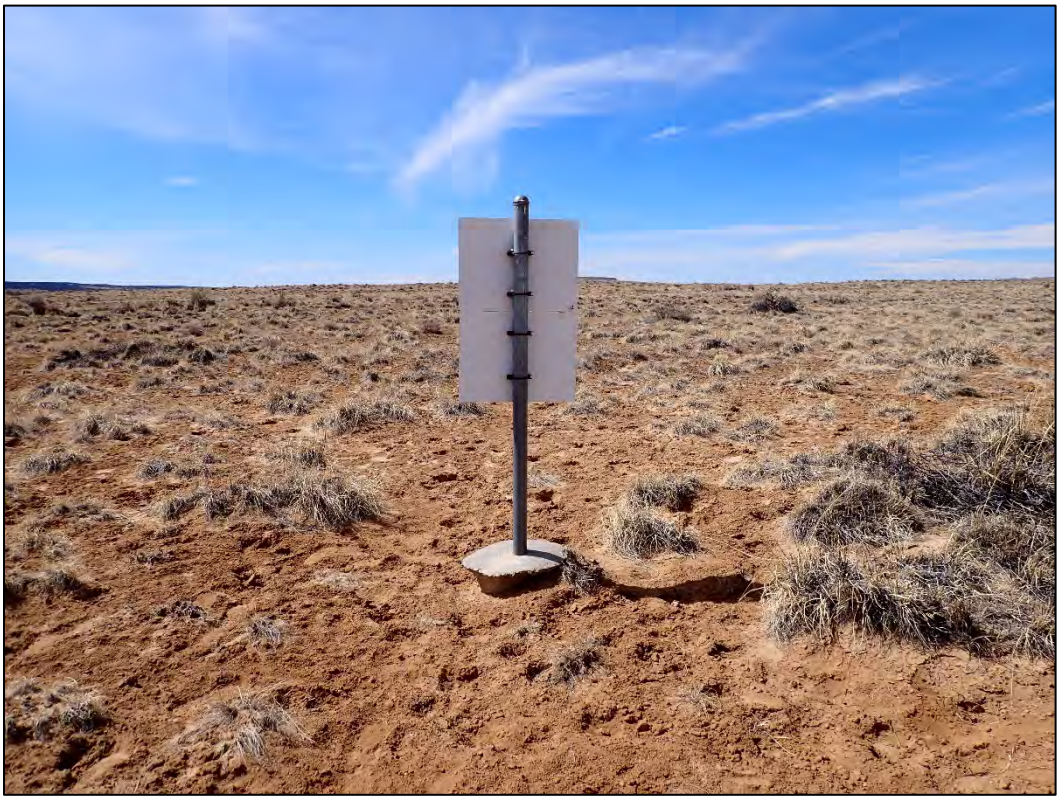
Kleinrath, 2001. Art Kleinrath, program manager, Office of Legacy Management, U.S. Department of Energy, letter (about Contract No. DE-AC13-96GJ87335, "Response to New Mexico Environment Department Regarding Monitor Well Decommissioning and Ongoing Groundwater Monitoring at the Ambrosia Lake UMTRCA Title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

1.10 Photographs

Photograph Location Number	Azimuth (degrees)	Photograph Description
PL-1	320	Entrance Sign
PL-2	0	Perimeter Sign P63
PL-3	275	Erosion Around Base of Perimeter Sign P12 (Stable)
PL-4	0	Site Marker SMK-2
PL-5	10	Survey/Boundary Monument SM/BM-3
PL-6	45	Erosional Rills Around Monitoring Well 0678
PL-7	200	Mine Vent Shaft
PL-8	275	Settlement Plate SP-4 on Disposal Cell Top
PL-9	135	Top Slope of Disposal Cell
PL-10	105	Ponding Area Along South Side Slope of Disposal Cell (Dry)
PL-11	0	Old Stockpile Area Northwest of Disposal Cell
PL-12	25	Erosional Gully Northeast of Disposal Cell

PL-1. Entrance Sign

PL-2. Perimeter Sign P63



PL-3. Erosion Around Base of Perimeter Sign P12 (Stable)

PL-4. Site Marker SMK-2

PL-5. Survey/Boundary Monument SM/BM-3

PL-6. Erosional Rills Around Monitoring Well 0678

PL-7. Mine Vent Shaft

PL-8. Settlement Plate SP-4 on Disposal Cell Top

PL-9. Top Slope of Disposal Cell

PL-10. Ponding Areas Along South Side Slope of Disposal Cell (Dry)

PL-11. Old Stockpile Area Northwest of Disposal Cell

PL-12. Erosional Gully Northeast of Disposal Cell

This page intentionally left blank

2.0 Burrell, Pennsylvania, Disposal Site

2.1 Compliance Summary

The Burrell, Pennsylvania, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on November 3, 2021. 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 routine groundwater monitoring every 5 years as a best management practice to aid evaluation of the disposal cell's performance. The most recent routine groundwater sampling event on all wells was conducted in November 2018. Four downgradient wells were sampled October 19, 2020, ahead of the required 5-year sampling frequency, to observe whether the previously identified increase in molybdenum persisted. Results from the 2020 samples showed that molybdenum did not continue to increase. All sampling results are reported on the LM Geospatial Environmental Mapping System (GEMS) website (https://gems.lm.doe.gov/#site=BUR). The next routine sampling event is scheduled for 2023.

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 (DOE 2000) (LTSP) and 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 the requirements for UMTRCA Title I sites, LM 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, quality control monuments, and wellhead protectors.

2.4 Inspection Results

The site, 1 mile east of Blairsville, Pennsylvania, was inspected on November 3, 2021. The inspection was conducted by K. Broberg and B. Wulker of the Legacy Management Support contractor. C. Carpenter (LM site manager), D. Shearer and K. Mobley (Pennsylvania Department of Environmental Protection), 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 whether maintenance or additional inspection and monitoring are needed.

2.4.1 Site Surveillance Features

Figure 2-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. 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 2021 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 shooting, 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 locked and functional. The site entrance sign was replaced, and three additional information signs were installed (PL-1) on the entrance gate. 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 (PL-2). The site herbicide subcontractor keeps the fence line clear of vegetation, which should prolong the life of the security fence. Trees felled by strong storms have bent the upper rail of the south fence in a few spots, but the fence remains serviceable, and repairs are not required at this time (PL-3).

There are 17 perimeter signs attached to the outside of the security fence. All perimeter signs were present. Perimeter sign P5b on the north fence has some bullet holes but is legible. Three perimeter signs (P12, P13, and P14) along the south fence that were faded and becoming illegible were replaced during the inspection. Perimeter sign P9 that has been faded and worn for some time will be replaced when conditions allow. No other maintenance needs were identified.

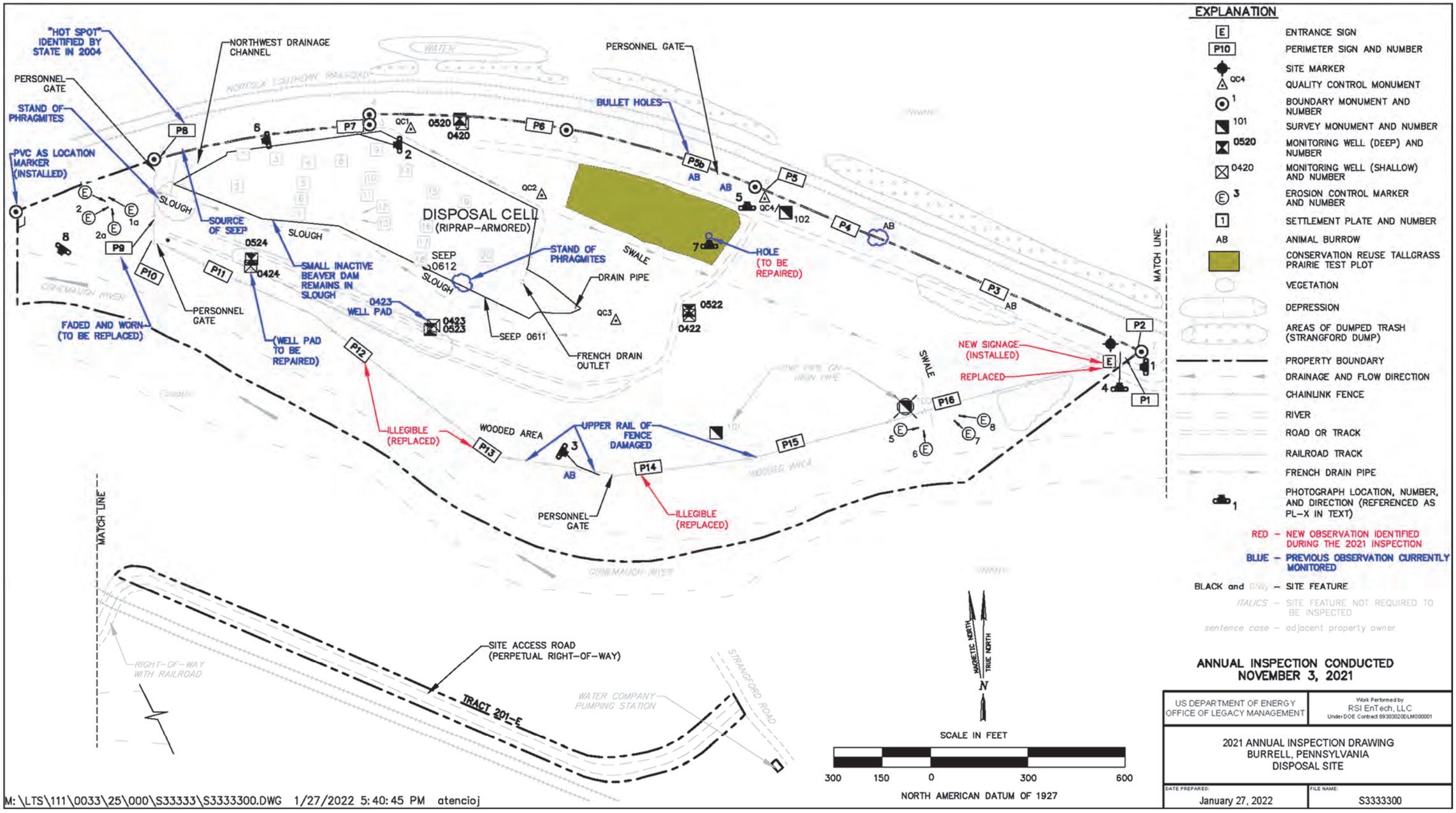


Figure 2-1. 2021 Annual Inspection Drawing for the Burrell, Pennsylvania, Disposal Site

This page intentionally left blank

2.4.1.3 Site Marker

The site has one granite site marker just inside the main entrance gate. The concrete pad is cracked but remains functional. The surface of the marker is stained but remains legible (PL-4). No maintenance needs were identified.

2.4.1.4 Survey and Boundary Monuments

The site has three survey monuments and seven boundary monuments. Survey monument SM-102 was noted as missing in the 2017 and 2018 inspections. Quality control monument QC-4 was installed in 2019 as a replacement for survey monument SM-102 (PL-5).

Five of the seven boundary monuments were located during the inspection. Boundary monuments BM-1 and BM-2 could not be accessed safely because of wet conditions. Grounds maintenance personnel reported that all the monuments, including BM-1 and BM-2, were present and in good condition.

2.4.1.5 Aerial Survey Quality Control Monuments

Four aerial survey quality control monuments, installed in 2019, were inspected during the 2021 annual inspection. No maintenance needs were identified.

2.4.1.6 Erosion Control Markers

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

2.4.1.7 Monitoring Wells

The site has eight monitoring wells that were last sampled and inspected in October 2018 on the 5-year sampling schedule. Only the four downgradient wells were sampled on October 19, 2020. 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 prevented the installation of concrete well pads at monitoring wells 0424 and 0524 in 2018, but these will be installed during the next routine sampling event in 2023. All wellhead protectors that were observed during the annual inspection were locked and undamaged. No new 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 (PL-6). There was no evidence of erosion, settling, slumping, or any other modifying process that might affect the integrity of the disposal cell.

Control of vegetation (including woody vegetation) on the disposal cell is not required by the LTSP. 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 would revisit the issue of vegetation growth on the disposal cell cover to evaluate whether it remains protective of human health and the environment or interferes with the ability of inspectors to assess disposal cell cover stability. LM planned to conduct a follow-up assessment in fiscal year 2019, but LM delayed the assessment to further consult with NRC on the scope of the study. NRC and LM are jointly analyzing disposal cell cover performance and pedogenesis at other UMTRCA sites to either support development of scope for a Burrell site study or conclude that the additional Burrell assessment is not required.

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 effectively limits 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; these conditions indicate 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 need to be removed. In 2021, inspectors observed that the downed tree is not interfering 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 2021, 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.

A hole on the east side of the Conservation Reuse Tallgrass Prairie Test Plot grew larger since the 2020 inspection. Even though the hole is not near the disposal cell and does not threaten disposal cell protectiveness, it is a safety hazard to vegetation management crews and will be filled in with clean clayey soil (PL-7). Given that the Burrell site was once a railroad landfill, the hole is believed to be settlement around some buried railroad landfill debris.

2.4.2.3 Site Perimeter

A seep that has been active in the past is near the north security fence, about 60 feet east of perimeter sign P8 and west of the disposal cell. Access to the seep requires walking down a steep slope of riprap that is difficult to walk on. Due to safety concerns, the inspection team chose not to walk down the riprap-covered slope to observe the seep. During the 2020 inspection the seep was not flowing, but the area around the seep was moist. 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. 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. The south side of the site is bordered by the Conemaugh River (PL-8).

In 2004, a representative from the Pennsylvania Department of Environmental Protection showed inspectors a “hot spot” (an area with gamma radiation levels of 5 millirems 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 property completion report for the Uranium Mill Tailings Remedial Action Project. 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. No maintenance needs were identified.

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 in the 2020 annual inspection and completed in 2021 include the replacement of perimeter signs P12, P13, and P14. Additionally, the site entrance sign was replaced, and three additional information signs were installed on the entrance gate.

Inspectors noted the following maintenance items that will be completed in the future:

- Repairs to the hole in the Conservation Reuse Tallgrass Prairie Test Plot will be completed before the next inspection
- Replacement of perimeter sign P9 when soil conditions dry out

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 routine groundwater monitoring every 5 years as a best management practice to aid evaluation of the disposal cell's performance. The most recent routine 5-year 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 standard water quality indicators and four analytes: lead, molybdenum, selenium, and uranium. The maximum concentration limits (MCLs) for these four 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

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

The November 2018 groundwater sampling results were reported in the *2018 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites* (DOE 2019). The results show that four analytes monitored (i.e., lead, molybdenum, selenium, and uranium) remain below MCLs found in 40 CFR 192 Table 1 Subpart A, but all four analytes increased in concentration in one or both downgradient monitoring wells. The increases for three of the target analytes (lead, selenium, and uranium) in relation to their respective MCLs were considered insignificant because a continuation of the increasing trend would not exceed the MCL for some time, allowing LM an opportunity to investigate the cause before concentrations reach the MCL and to determine if the increase is the result of cell performance. An increase for molybdenum in one of the downgradient wells was considered potentially significant as it could exceed the MCL before the next routine sampling event in 2023 if the trend persisted.

LM resampled the four downgradient wells on October 19, 2020, for molybdenum following the annual inspection. This sampling was 3 years ahead of the required 5-year sampling frequency to confirm if the increase in molybdenum noted previously persists. Samples were also analyzed for lead, selenium, and uranium. These nonroutine sampling results are reported on the GEMS website (https://gems.lm.doe.gov/#site=BUR). A brief summary is provided below.

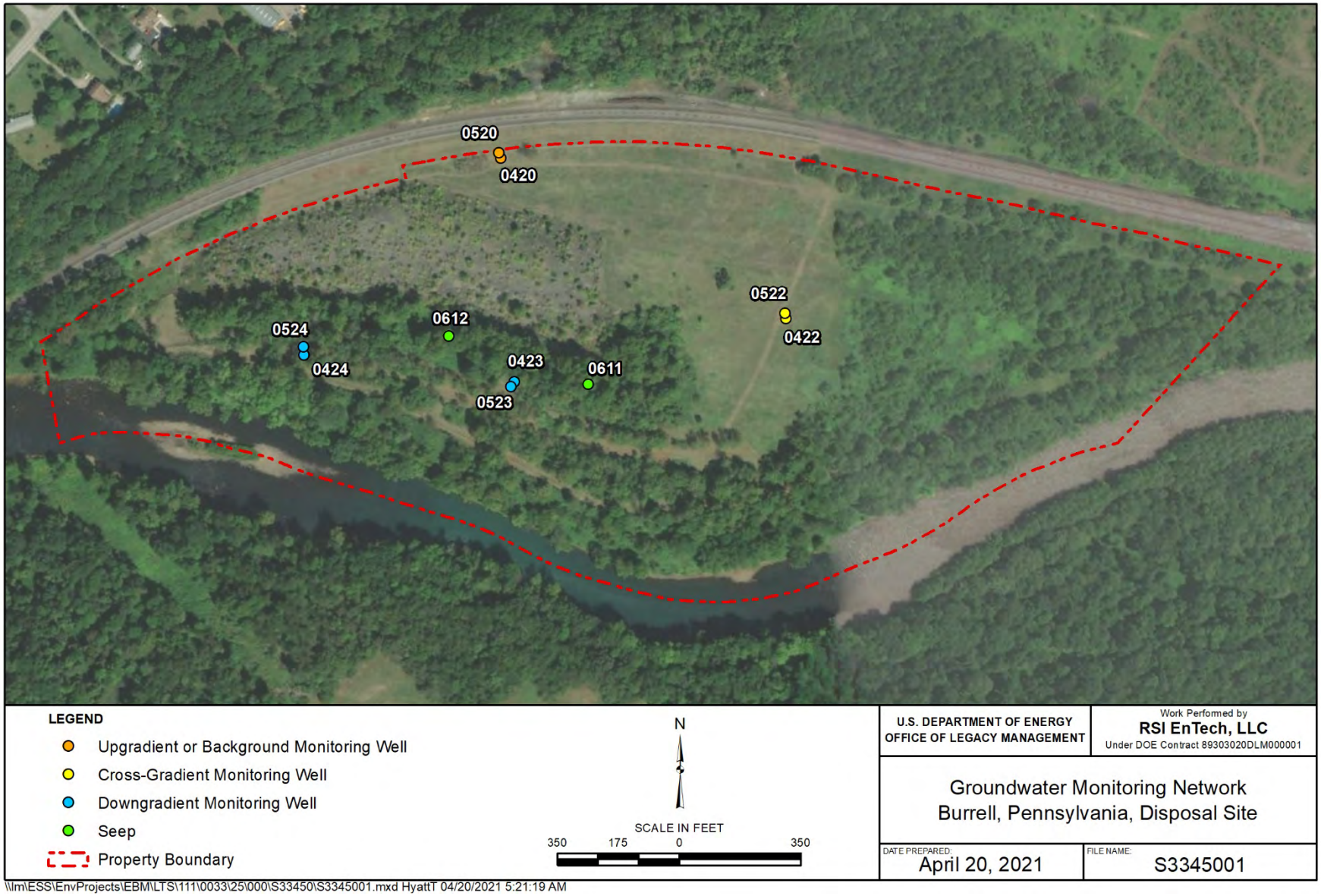
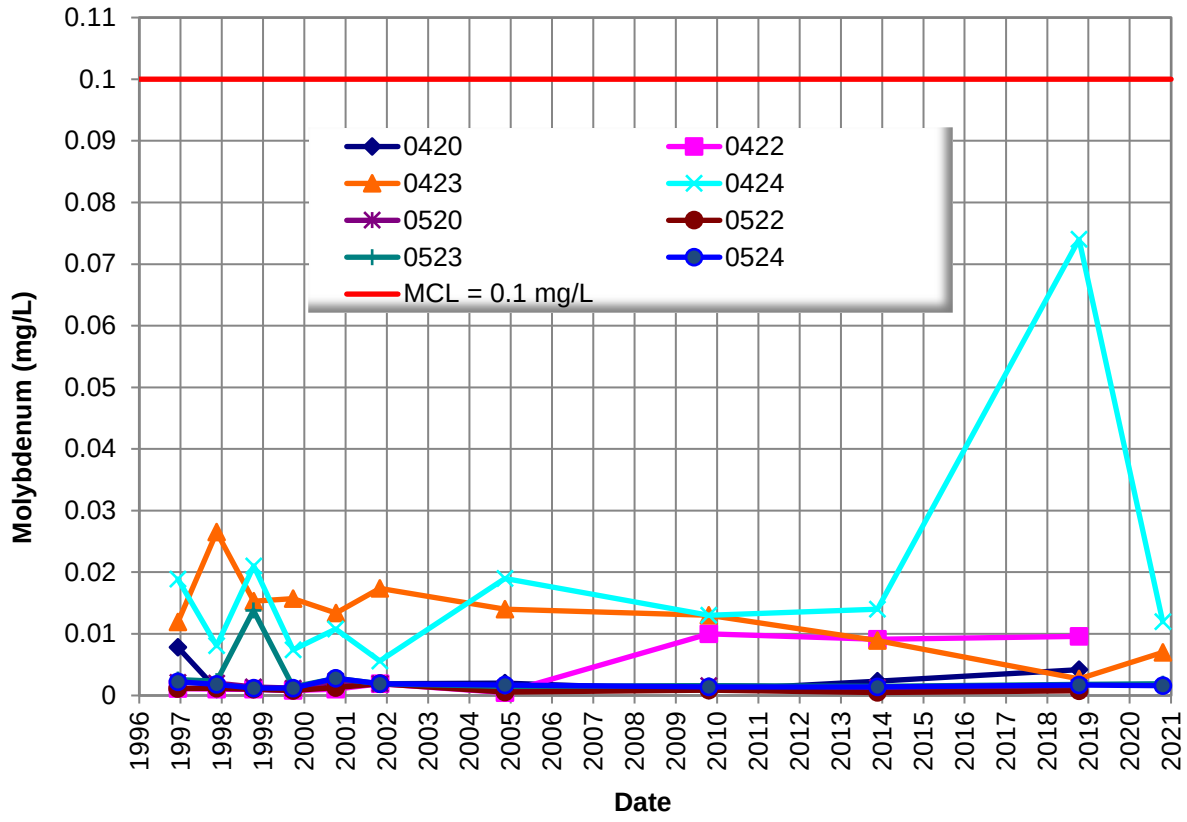


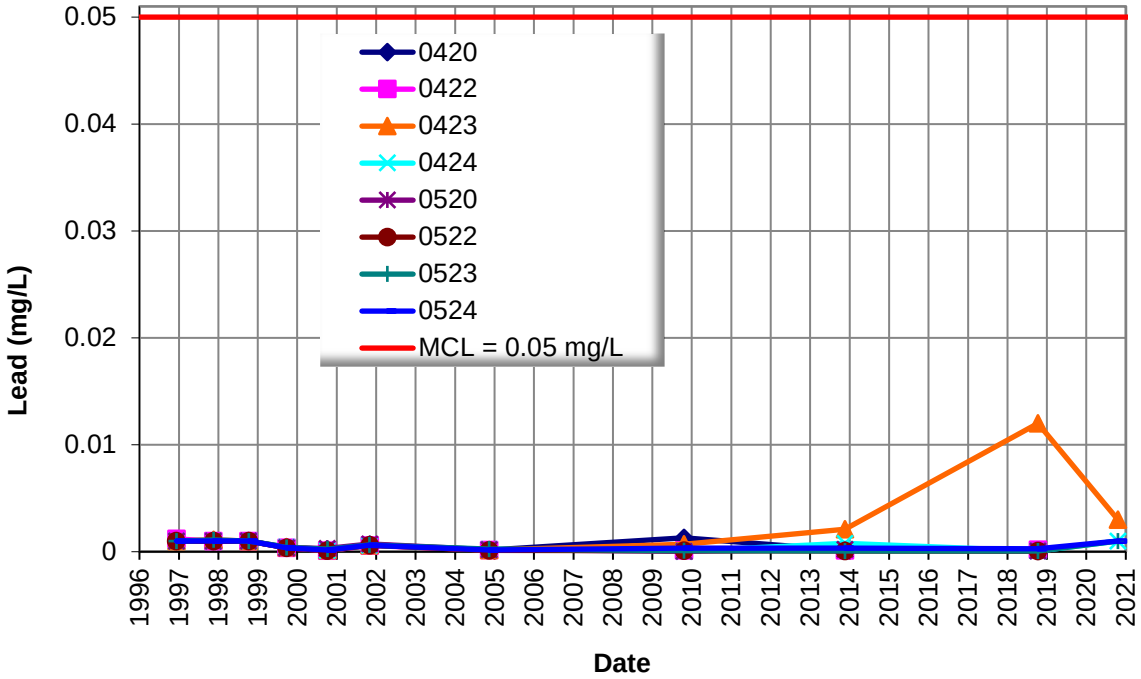
Figure 2-2. Groundwater Monitoring Network for the Burrell, Pennsylvania, Disposal Site

The molybdenum concentration measured in monitoring well 0424 in 2020 was 0.012 milligrams per liter (mg/L), which shows that the potentially significant increasing trend between 2013 and 2018 was not persistent (Figure 2-3). Concentrations for lead, selenium, and uranium measured in 2020 were all well below their respective MCLs (Figure 2-4, Figure 2-5, and Figure 2-6). Lead showed a downward trend in well 0423 (Figure 2-4) and uranium showed a downward trend in wells 0423 and 0424 (Figure 2-6). Selenium has an upward trend for all wells, but concentrations remain below the respective MCL (Figure 2-5). Selenium trends will be evaluated again in 2023 after the next schedule 5-year sampling event.



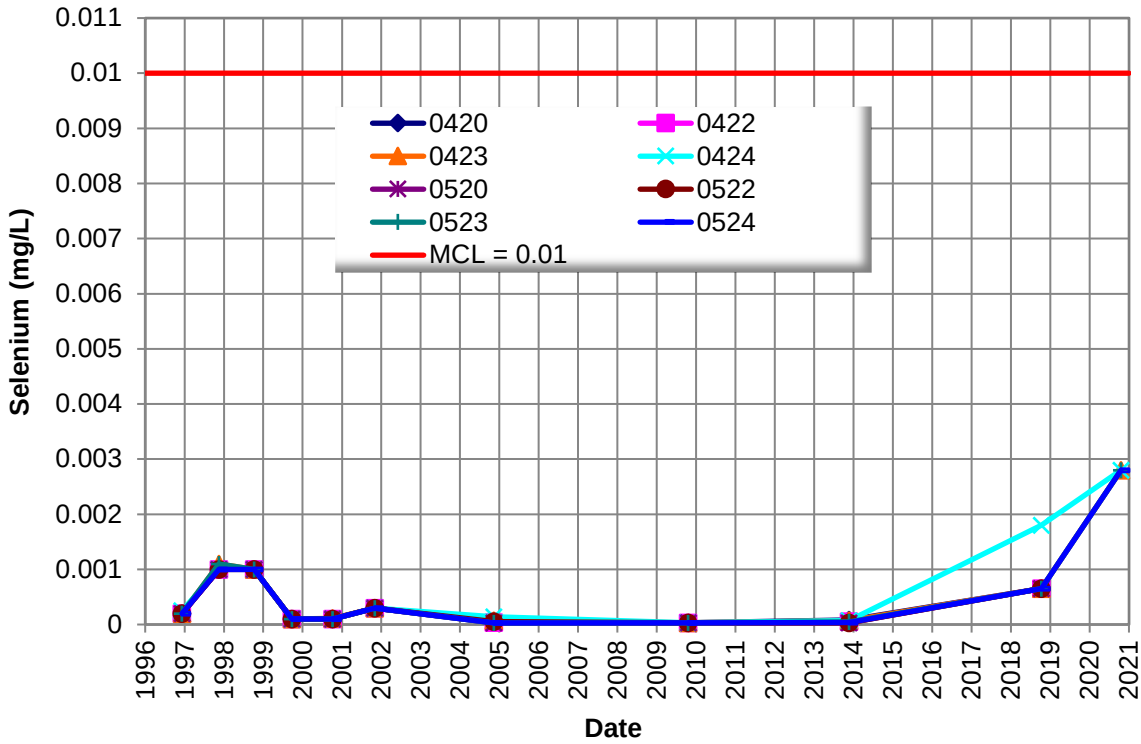
Note: Results include validated data only; results below the detection limit are presented at the laboratory reported value.

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



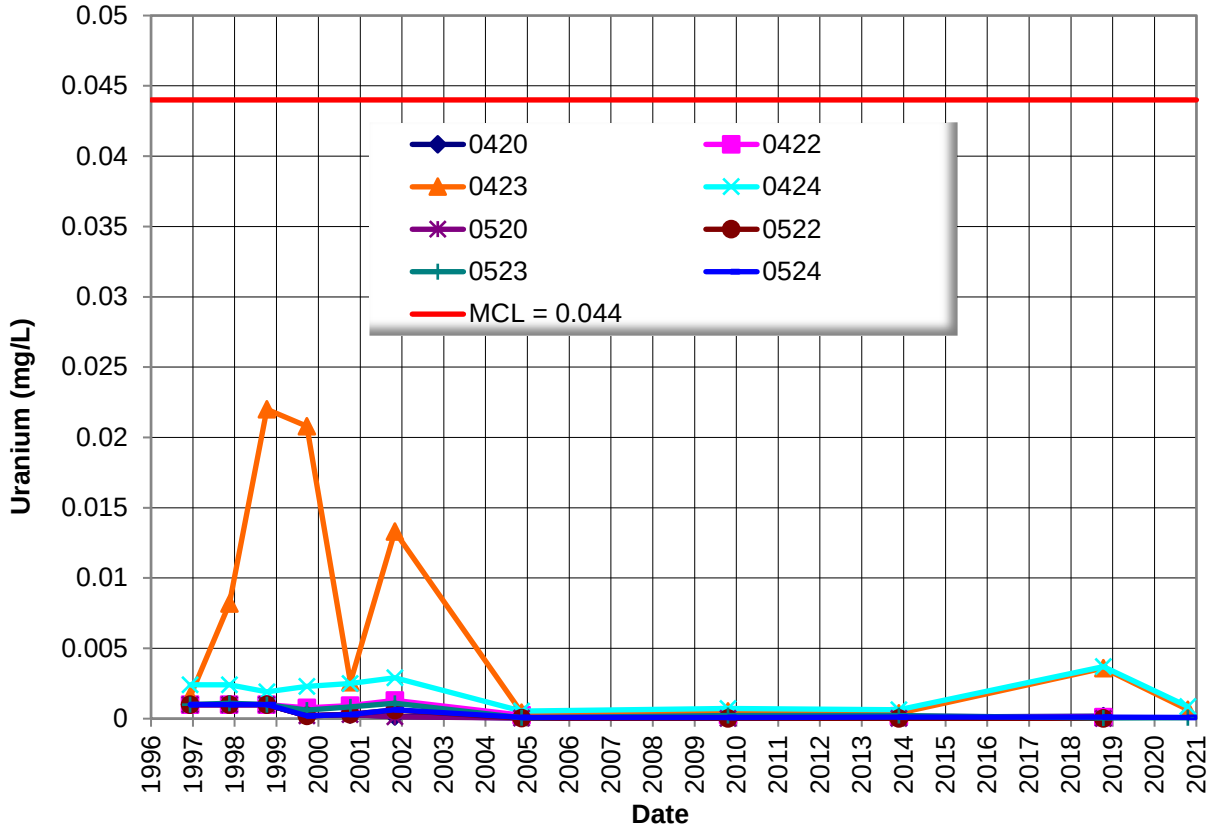
Note: Results include validated data only; results below the detection limit are presented at the laboratory reported value.

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



Note: Results include validated data only; results below the detection limit are presented at the laboratory reported value.

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



Note: Results include validated data only; results below the detection limit are presented at the laboratory reported value.

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

2.8.2 Vegetation Management

In accordance with the Vegetation Management Plan, mowing and spot herbicide application continue. Vegetation management activities include ensuring the fence line and access paths remain clear of the invasive species Japanese knotweed (*Reynoutia japonica*), 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 (*Lythrum salicaria*), poison hemlock (*Conium maculatum*), and multiflora rose (*Rosa multiflora*) were not observed in 2021, except for sporadic resprouts following mowing. Several other invasive plants, including Japanese knotweed and common reed (*Phragmites australis*) persist. A stand of common reed that was identified during previous inspections remains at the west end of the disposal cell and has spread along the southern edge of the disposal cell. This stand is very difficult to access because of standing water and its location adjacent to the perimeter fence. Wooded areas remained heavily vegetated with Japanese knotweed. Privet (*Ligustrum sp.*) is an invasive shrub that was observed in several areas. Oriental bittersweet (*Celastrus orbiculatus*) is an invasive vine listed as a noxious weed in Pennsylvania. It was observed in several wooded areas and growing on the cell cap. 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. Following the 2019 inspection, field personnel broadcast Indiangrass (*Sorghastrum nutans*) to augment the 2018 seeding effort. The prairie was not mowed in 2021.

Few seeded wildflowers and grasses were observed during the 2021 inspection, and the prairie plot appears to be mostly nonnative and nontarget species. A follow-up inspection of this area during the growing season may determine whether additional seeding is needed to meet the goals of this reuse initiative. A diverse flowering community is not expected for several years.

In 2022, the cool-season grasses and clovers in the prairie will need to be controlled to help native grasses and forbs establish, and reseeding may be necessary. It is recommended that the prairie be mowed while flowers are on the cool-season grasses and clovers and before they set seed. Mowing the last 2 weeks of May or the first week of June should prevent the cool-season grasses from seeding out and will open the canopy for the native species when they are beginning to leaf out.

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), 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	270	Front Gate with New Signage
PL-2	270	North Fence Line
PL-3	120	Fence Damage
PL-4	—	Site Marker
PL-5	0	Quality Control Monument QC-4 and Survey Monument SM-102
PL-6	260	North Side of Disposal Cell
PL-7	0	Hole on East End of Test Prairie
PL-8	215	Conemaugh River

Note:
— = Photograph taken vertically from above.

PL-1. Front Gate with New Signage

PL-2. North Fence Line

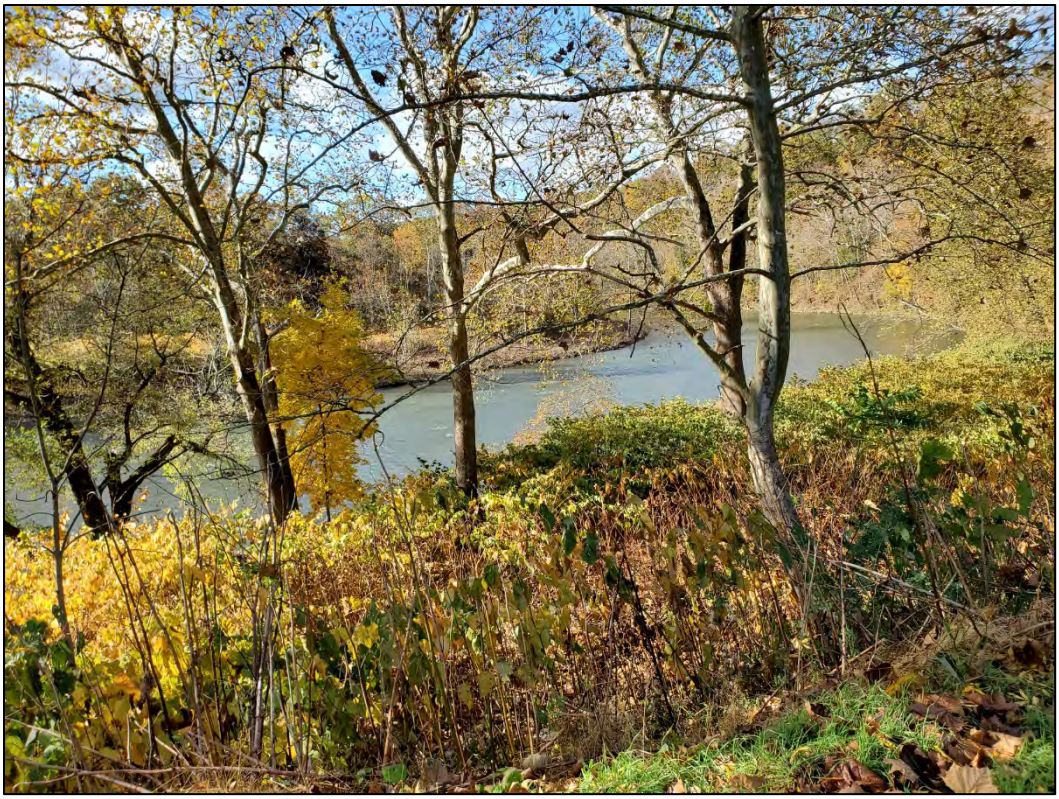
PL-3. Fence Damage

PL-4. Site Marker

PL-5. Quality Control Monument QC-4 and Survey Monument SM-102

PL-6. North Side of Disposal Cell

PL-7. Hole on East End of Test Prairie



PL-8. Conemaugh River

This page intentionally left blank

3.0 Canonsburg, Pennsylvania, Disposal Site

3.1 Compliance Summary

The Canonsburg, Pennsylvania, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on November 2, 2021. No changes were observed on the disposal cell or in the associated drainage features. Evidence of site trespassing was noted beneath the west fence at an erosional area under the fence. Metal slats preventing entry had been removed, allowing a trespasser to crawl under the fence. Inspectors replaced the slats. No cause for a follow-up inspection was identified.

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 (DOE 2013) (LTSP) 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, LM 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, quality 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, both of which are southeast of Strabane Avenue. Area C (3.1 acres) was sold and transferred to a private owner in 2005, and the east portion of Tract 117 (0.431 acre) was sold and transferred in 2009 to the same buyer. 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 restrict excavation, prohibit disturbance of the streambank, ensure continued 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 November 2, 2021. The inspection was conducted by K. Broberg and B. Wulker of the Legacy Management Support (LMS) contractor. C. Carpenter (LM site manager); D. Shearer, W. Carson, B. Perego, and C. Rajkovid (Pennsylvania Department of Environmental Protection); 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 might affect conformance with the LTSP, and evaluate whether maintenance or additional inspection and monitoring are needed.

3.4.1 Site Surveillance Features

Figure 3-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. 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 2021 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are included in the following subsections. Photographs to support specific observations are identified in the text and in Figure 3-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 3.10.

3.4.1.1 Site Access, Entrance Gates, and Entrance Sign

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. Three additional information signs were also posted on the main entrance gate during the inspection (PL-1). No maintenance needs were identified.

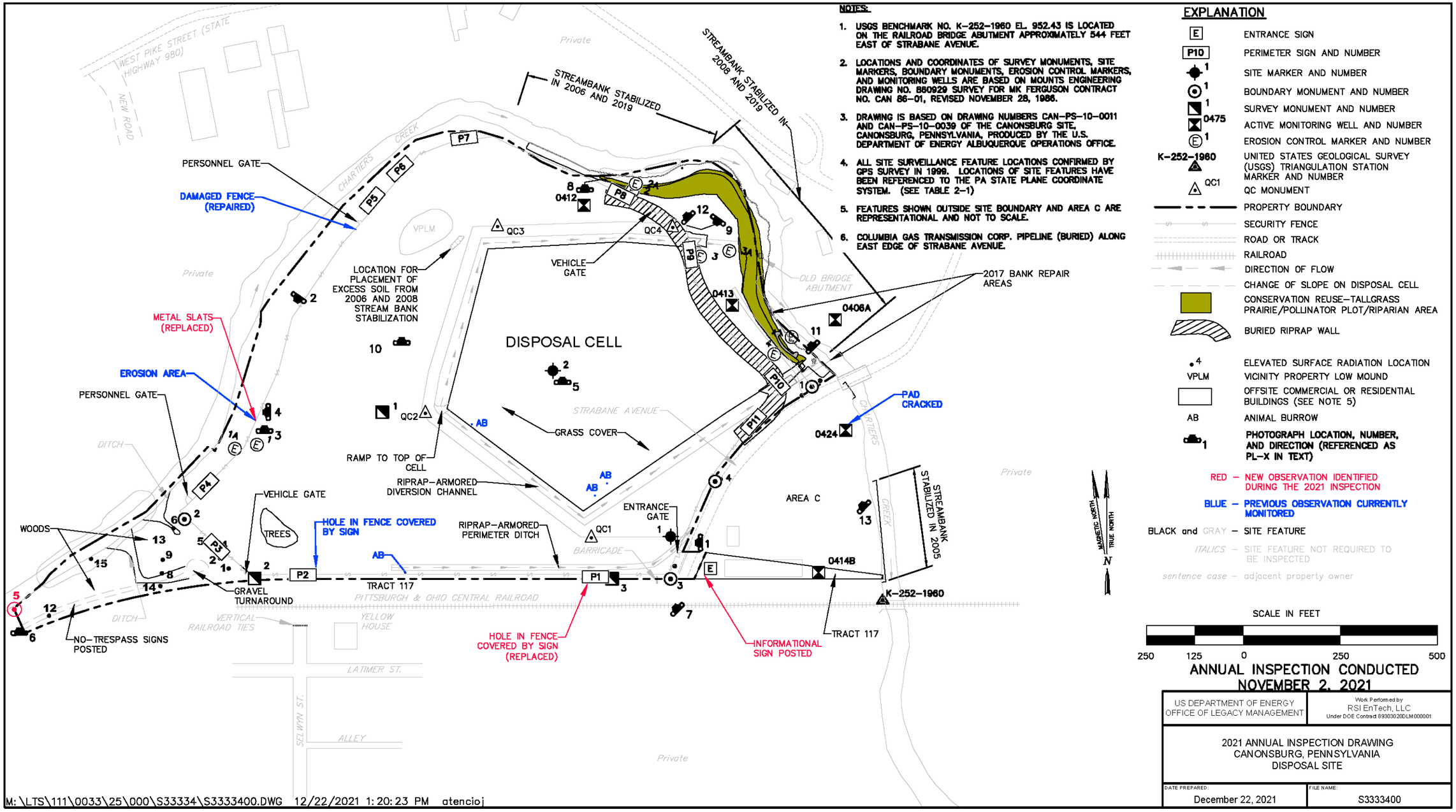


Figure 3-1. 2021 Annual Inspection Drawing for the Canonsburg, Pennsylvania, Disposal Site

This page intentionally left blank

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 (PL-2). An eroded area remains under the west security fence. The area appears to be stable; the erosion area has not expanded in several years. For added security, slats were installed in 2016 in the area beneath the fence to help close the gap. Inspectors noted that several of the slats had been removed, allowing enough space for someone to crawl under the fence (PL-3). Inspectors replaced the slats (PL-4) during the inspection.

There are 11 perimeter signs attached to the security fence. Theft of perimeter signs from the south fence line that borders the railroad tracks is an ongoing challenge. Since the 2020 inspection, two signs have been cut out of the fence fabric. With the replacement of perimeter sign P1 during the inspection, all signs were accounted for. No other maintenance needs were identified.

3.4.1.3 Site Markers

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

3.4.1.4 Survey and Boundary Monuments

Before 2021, the site had three survey monuments and four boundary monuments. In 2021, a fifth boundary monument was installed at the southwest corner of the property (PL-6). All five boundary monuments were located during the inspection. Boundary monuments BM-1, BM-2, and BM-3 have all sunk approximately 6 inches below the present grade of the ground surface. A surveying crew located them in summer 2021 using GPS coordinates on file. Rather than raise the boundary monuments, it was decided to mark their locations with a section of PVC pipe filled with pea gravel (PL-7). No other maintenance needs were identified.

3.4.1.5 Aerial Survey Quality Control Monuments

Four aerial survey quality control monuments, installed in 2019, were inspected during the 2021 annual inspection. No maintenance needs were identified.

3.4.1.6 Erosion Control Markers

The site has four pairs of erosion control markers along the bank of Chartiers Creek. No maintenance needs were identified (PL-8).

3.4.1.7 Monitoring Wells

The site has five groundwater monitoring wells; the insides of these wells are inspected when they are sampled. Monitoring wells were last sampled and inspected in October 2018. During the 2021 inspection, the areas outside the wells were inspected, and the wellhead protectors were found to be undamaged and locked. There is a crack in the well pad of monitoring well 0424.

The pad remains serviceable. It will be evaluated for replacement or repair during the next regularly scheduled sampling. No other 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-9). 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. No new significant burrows were noted on the disposal cell during the inspection. Inspectors will continue to monitor the location and significance of burrows. 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. Seeded fescues and crown vetch are the most prevalent species. 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 (PL-10). No maintenance needs were identified.

3.4.2.3 Diversion Channels and Perimeter Ditches

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

3.4.2.4 Site Perimeter

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. No evidence of recent trespassing was observed in this area during the 2021 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 2021. 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.

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. Years of flow 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 conditions. The work consisted of minor grading, replacing geotextile filter fabric, and importing and placing 2-foot-thick R6 riprap slopes (PL-11).

As part of that project, a riparian forest buffer was 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 reduce erosion along the top edge of the riprap embankment. No concerns with the riprap embankment were noted during the inspection. Plantings in the riparian forest buffer experienced a 2-year survival rate of approximately 90%. The main challenge for the young plants is being damaged by deer (PL-12).

The riparian forest buffer is also recognized as a means to improve stream quality. This effort is part of the Commonwealth's 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. No concerns with the riprap embankment were noted during the inspection. Plantings in the riparian forest buffer experienced a 1-year survival rate of 97%. The 2-year survival rate was estimated to be around 90%. The general long-term health of the young plants in the riparian buffer area is uncertain due to deer damage. During the 2021 inspection, deer rub damage to the tree trunks was observed on numerous planted trees. The current use of deer tubes held up by wooden stakes is not adequate to protect the trees from browsing or rubbing. Cages made from welded wire fencing mounted on metal T-posts can be more durable and offer better protection than plastic deer tubes and wooden stakes. The planted herbaceous cover can be better evaluated in the growing season.

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 that were put in place to address land use and site access requirements. There was no evidence that any of the ICs in place for Area C and Tract 117 had been violated.

Additional control of invasive vegetation on Area C between Strabane Avenue and monitoring well 0424 began in 2021 to enhance the health of the riparian corridor being established along Chartiers Creek north of the disposal cell (PL-13). Mowing and spraying in this area limits the spread of invasive vegetation from Area C to the recently planted riparian buffer area.

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

Inspectors documented the following minor maintenance activities that were performed before or during the 2021 inspection:

- Marked location of boundary monuments BM-1, BM-2, and BM-3
- Installed new property boundary monument BM-5
- Replaced perimeter sign P1
- Replaced metal fence slats

The well pad at monitoring well 0424 will be replaced or repaired during the next sampling event.

3.7 Environmental Monitoring

3.7.1 Groundwater Monitoring

In accordance with the LTSP, LM conducts groundwater monitoring every 5 years to (1) evaluate downgradient contaminant trends in groundwater in the shallow, unconsolidated materials and in surface water; (2) demonstrate that concentrations of uranium at point-of-compliance (POC) wells are decreasing as predicted and that the system remains in compliance with the *Ground Water Compliance Action Plan for the Canonsburg, Pennsylvania, UMTRA Project Site* (DOE 2000); and (3) ensure that remedial actions at the disposal site and Area C continue to protect human health, safety, and the environment. The most recent sampling occurred in October 2018.

The groundwater monitoring network consists of five monitoring wells—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 milligram per liter (mg/L) for groundwater 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	POC
0413	Downgradient	POC
0414B	Cross gradient	POC
0424	Downgradient	Best management practice

All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System (GEMS) website (https://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. The next routine sampling event is scheduled for 2023.

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 surface water monitoring location, 0602, is the POE for Chartiers Creek and is sampled and analyzed for uranium. In 2018, the uranium concentration from surface water monitoring location 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. The next routine sampling event is scheduled for 2023.

3.7.3 Vegetation Management

Vegetation management continues at the site in accordance with the LTSP. Activities include spot-treating invasive species, physically removing plants, using spot application of herbicides to target woody vegetation in diversion channels and perimeter ditches, and using the spray-and-mow approach. These activities were mostly successful. Noxious weeds observed within the fenced area during this year's inspection included crown vetch (*Securigera varia*). These areas are limited to resprouting seedlings that were observed in portions of mowed areas. No changes to the current vegetation management approach are recommended, other than around and inside the riparian buffer area as discussed in previous sections.

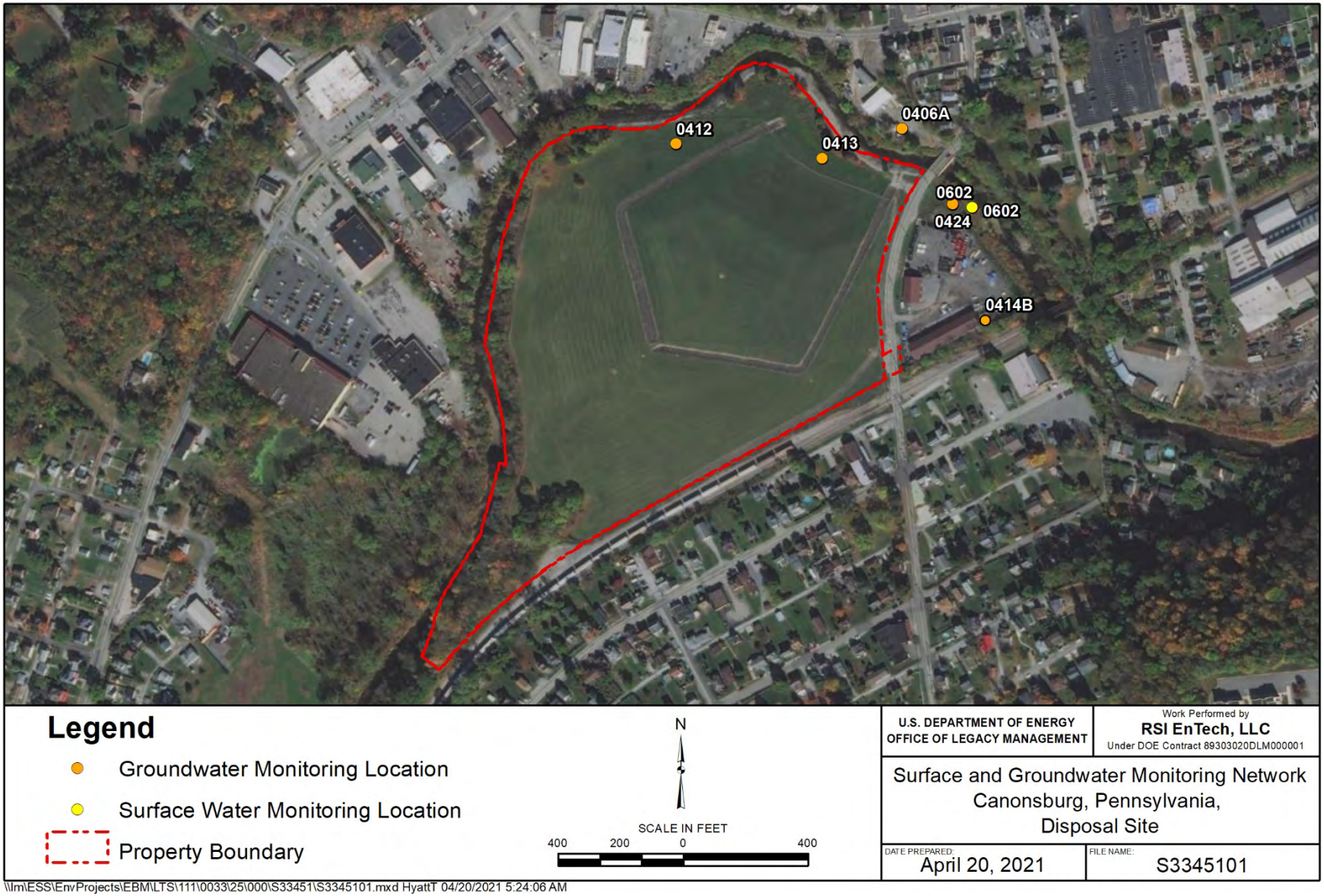


Figure 3-2. Groundwater and Surface Water Monitoring Network for the Canonsburg, Pennsylvania, Disposal Site

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.

DOE (U.S. Department of Energy), 2000. *Ground Water Compliance Action Plan for the Canonsburg, Pennsylvania, UMTRA Project Site*, LMS/U0035901, February.

3.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	270	Signage on Entrance Gate
PL-2	215	West Fence Line
PL-3	0	Erosion Area Under West Fence
PL-4	—	New Slats in Fence at Erosion Area
PL-5	0	Site Marker SMK-2
PL-6	—	New Southwest Boundary Monument BM-5
PL-7	315	Boundary Monument BM-3
PL-8	—	Erosion Control Markers 2 and 2A
PL-9	215	Northwest Side of Disposal Cell
PL-10	-—	West Side of Disposal Cell
PL-11	315	Riparian Area and Riprap-Armored Streambank
PL-12	315	Edge of Tall Grass Prairie and Riparian Area
PL-13	315	Monitoring Well 0424

Note:
— = Photograph taken vertically from above.

PL-1. Signage on Entrance Gate

PL-2. West Fence Line

PL-3. Erosion Area Under West Fence

PL-4. New Slats in Fence at Erosion Area

PL-5. Site Marker SMK-2

PL-6. New Southwest Boundary Monument BM-5

PL-7. Boundary Monument BM-3

PL-8. Erosion Control Markers 2 and 2A

PL-9. Northwest Side of Disposal Cell

PL-10. West Side of Disposal Cell

PL-11. Riparian Area and Riprap-Armored Streambank

PL-12. Edge of Tall Grass Prairie and Riparian Area

PL-13. Monitoring Well 0424

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 annual inspection on June 15, 2021, and the annual groundwater monitoring event in June 2021. No cause for a follow-up inspection was identified.

Inspectors noted no change in depth or length of the linear depression on the toe of the northeast side slope. LM will continue monitoring the linear depression to understand its cause and potential impacts. No changes were observed on the top of the disposal cell or associated drainage features. Inspectors identified several maintenance needs that will be 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 June 2021. 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. 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 determine if removing the holding pond and closing the transient drainage system will affect water quality values.

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 (DOE 2019) (LTSP) 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, LM is responsible for the

custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gates, warning or no-trespassing signs (entrance and perimeter signs), site markers, survey and boundary monuments, and wellhead protectors.

4.4 Inspection Results

The site, 3.5 miles southwest of Durango, Colorado, was inspected on June 15, 2021. The inspection was conducted by D. Holbrook and D. Atkinson of the Legacy Management Support (LMS) contractor. J. Dayvault (LM site manager); M. Cosby (Colorado Department of Public Health and Environment); A. Denny, O. Bustillo, and E. Rojas (LM); and M. Williams (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 whether maintenance or additional inspection and monitoring are needed.

4.4.1 Site Surveillance Features

Figure 4-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. 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 2021 annual inspection are shown in red font. 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 that is accessed via a locked gate along La Plata County Road 210. Entrance to the site is through the locked steel entrance gate along County Road 212 and an older, original entrance gate. All gates were locked and functional. The entrance sign is located at the older entrance gate inside the property boundary.

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 additions act as surrogates for perimeter signs P40−P43, which are on a steep, densely wooded hillside. Perimeter signs P40–P43 are not routinely inspected because of their location and surrounding vegetation.

Inspectors noted that perimeter sign P26 is surrounded by vegetation that was treated after the inspection. The concrete bases of several perimeter signs continue to be undercut, but the positions of the signs remain uncompromised. No other maintenance needs were identified.

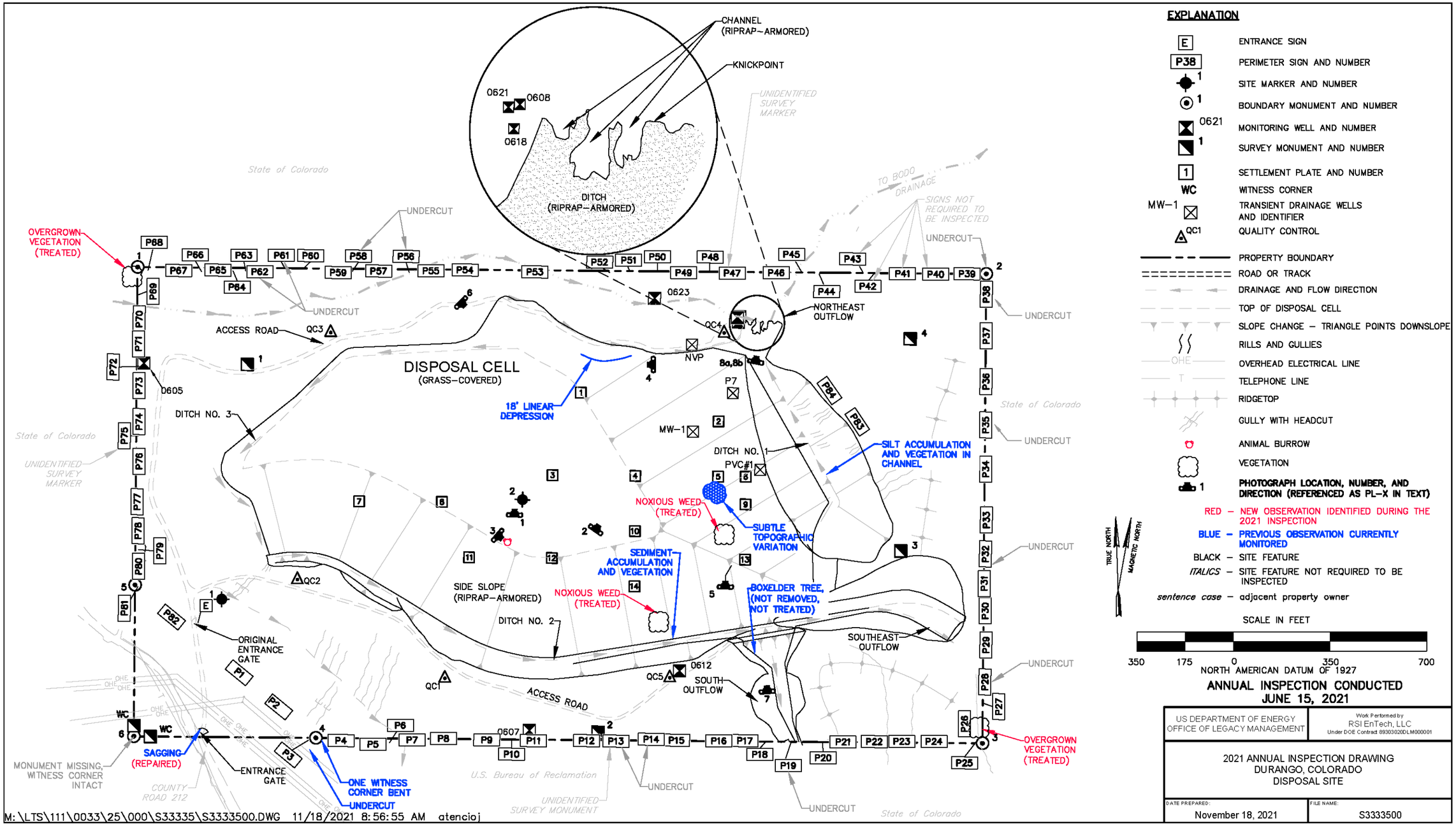


Figure 4-1. 2021 Annual Inspection Drawing for the Durango, Colorado, Disposal Site

This page intentionally left blank

4.4.1.3 Site Markers

The site has two site markers. Site marker SMK-1 is just inside the original entrance gate and was in good condition. Site marker SMK-2 (PL-1) is on the top slope of the disposal cell. No new 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, so replacement of boundary monument BM-6 is not warranted at this time. Boundary monument BM-1 was obscured by vegetation that was treated following the inspection. No other maintenance needs were identified.

4.4.1.5 Aerial Survey Quality Control Monuments

Five aerial survey quality control monuments were inspected during the 2021 annual inspection. No maintenance needs were identified during the inspection.

4.4.1.6 Monitoring Wells

The site has seven monitoring wells and two transient drainage 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 (PL-2). 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. Several small animal burrows were observed on the cell top-slope (PL-3) but are shallow and do not require repairs. Several noxious weeds were found on the top slope and will be treated following the inspection. 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. Rock has moved along the north toe of the disposal cell, resulting in a linear depression approximately 18 feet (ft) long (PL-4) that first was observed in 2015 and continues to be monitored. Inspectors did not observe 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 2021. The variation does not pose a concern for disposal cell integrity at this time, as no evidence of erosion or subsidence was found during the 2021 inspection. Inspectors will continue to monitor the variation.

Inspectors found several young volunteer trees and several noxious weeds growing on the side slopes. The noxious weeds were treated after the inspection. Inspectors noted several points on the side slopes that had sustained lightning strikes (PL-5). No other maintenance needs were identified.

4.4.2.3 Drainage Ditches

Rock-armored drainage ditches are constructed at the toes of the side slopes on the east (Ditch No. 1), south (Ditch No. 2), and northwest and west (Ditch No. 3) sides of the disposal cell (PL-6). Stormwater is directed into these ditches and conveyed away from the site into natural drainages. The ditches have sufficient depth and rock protection to carry stormwater 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 sediment favors plant establishment but does not adversely affected the performance of the ditches, so maintenance is not needed at this time.

The riprap-covered outflows of the drainage ditches were designed to self-armor over time. The outflows and drainage channels below them are monitored annually. A larger boxelder tree is growing along the edge of the south outflow channel but does not affect the stability or effectiveness of the channel. A large arroyo has formed below the southeast outflow (PL-7), which indicates the drainage ditch is functioning properly. The uplands above the northeast outflow are steadily eroding (PL-8(a) and PL-8(b)), but this is not affecting the stability or effectiveness of the outflow area. No maintenance needs were identified.

4.4.2.4 Holding Pond

Inspectors noted that the former holding pond area, removed in 2017, is revegetating successfully and contains several species of native, pollinator-friendly wildflowers. No evidence of erosion or damage to the newly vegetated area was observed. Several noxious weeds were identified in the area and were treated following the inspection. No other maintenance needs were identified.

4.4.2.5 Site Boundary

Boundary monuments and perimeter signs delineate the site 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. 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 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 changes or new features were identified. Colorado Parks and Wildlife 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, hikers, 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 noted the sagging entrance gate identified in the 2020 inspection was repaired before this year's inspection. The following minor maintenance needs were addressed following the 2021 inspection:

- Removed vegetation around perimeter sign P26 and boundary monument BM-1
- Treated noxious weeds on the side and top slopes of the disposal cell

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. BMP monitoring wells 0608, 0618, and 0623 are sampled more frequently to support the evaluation of variable uranium concentrations observed in well 0618 (DOE 2019). The most recent annual sampling event occurred at the site in June 2021. 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) because of the limited extent of saturated alluvium underlying the site. A background well is also completed in the uppermost aquifer.

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 (LTSP)
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)

Groundwater is sampled annually from POC wells and more frequently from BMP wells for three constituents: molybdenum, selenium, and uranium. The site-specific concentration limits or standards for the three constituents represent the respective maximum observed background concentrations reported in groundwater samples collected from wells completed in the bedrock aquifer, as identified in Table 4 of the LTSP. Table 4-3 provides these site-specific standards. Figure 4-3 through Figure 4-5 show the time-concentration plots for the three constituents, along with corresponding site-specific standards. All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System (GEMS) website (https://gems.lm.doe.gov/#site=DUD).

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

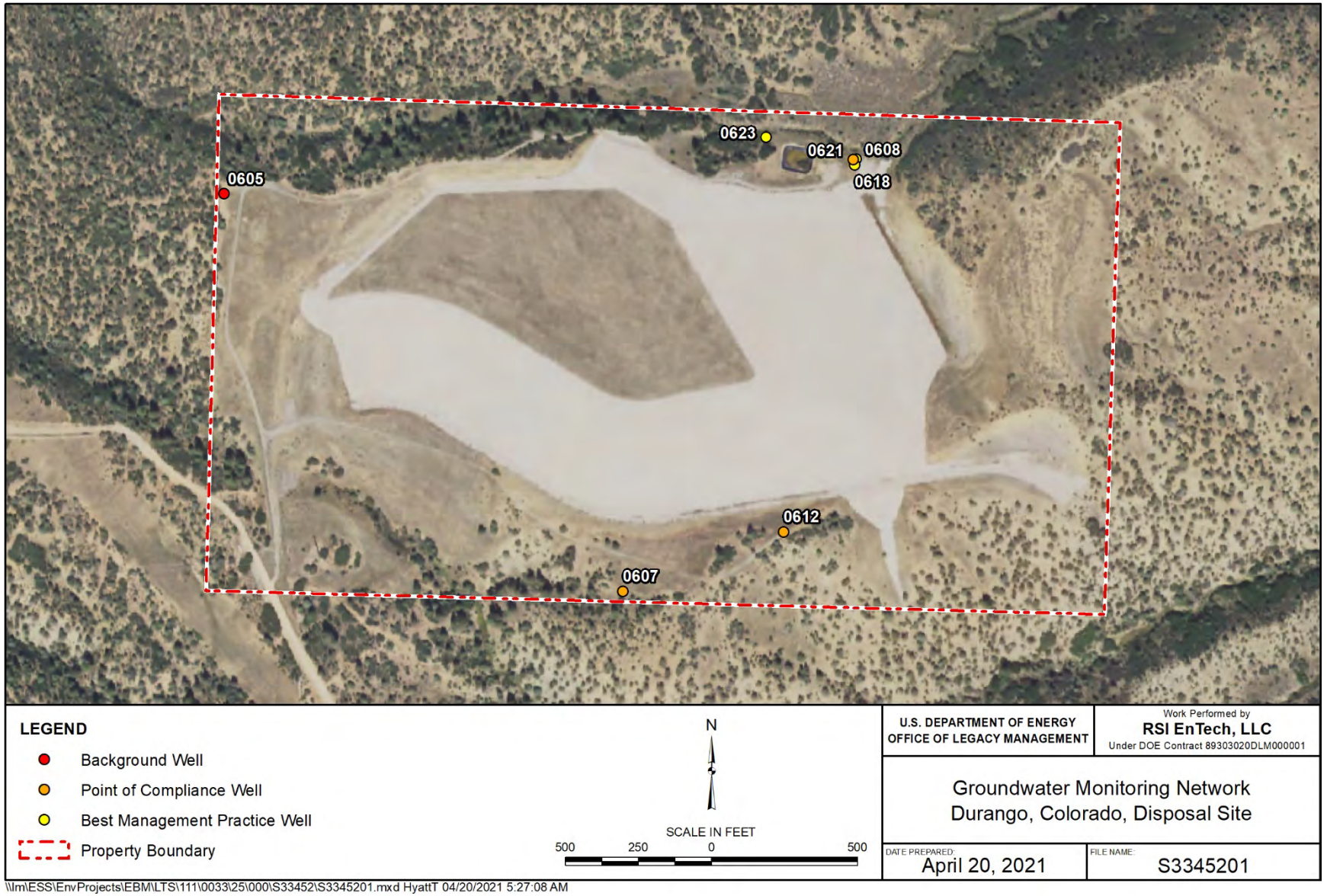
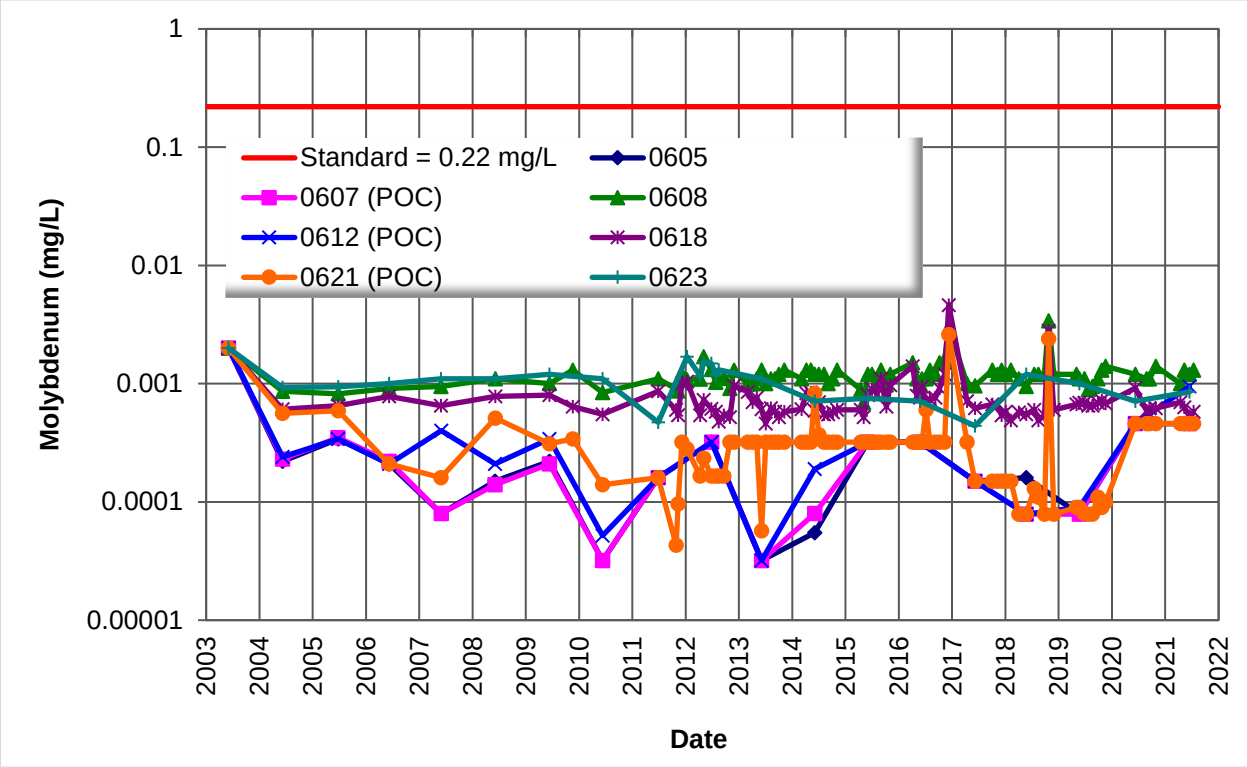
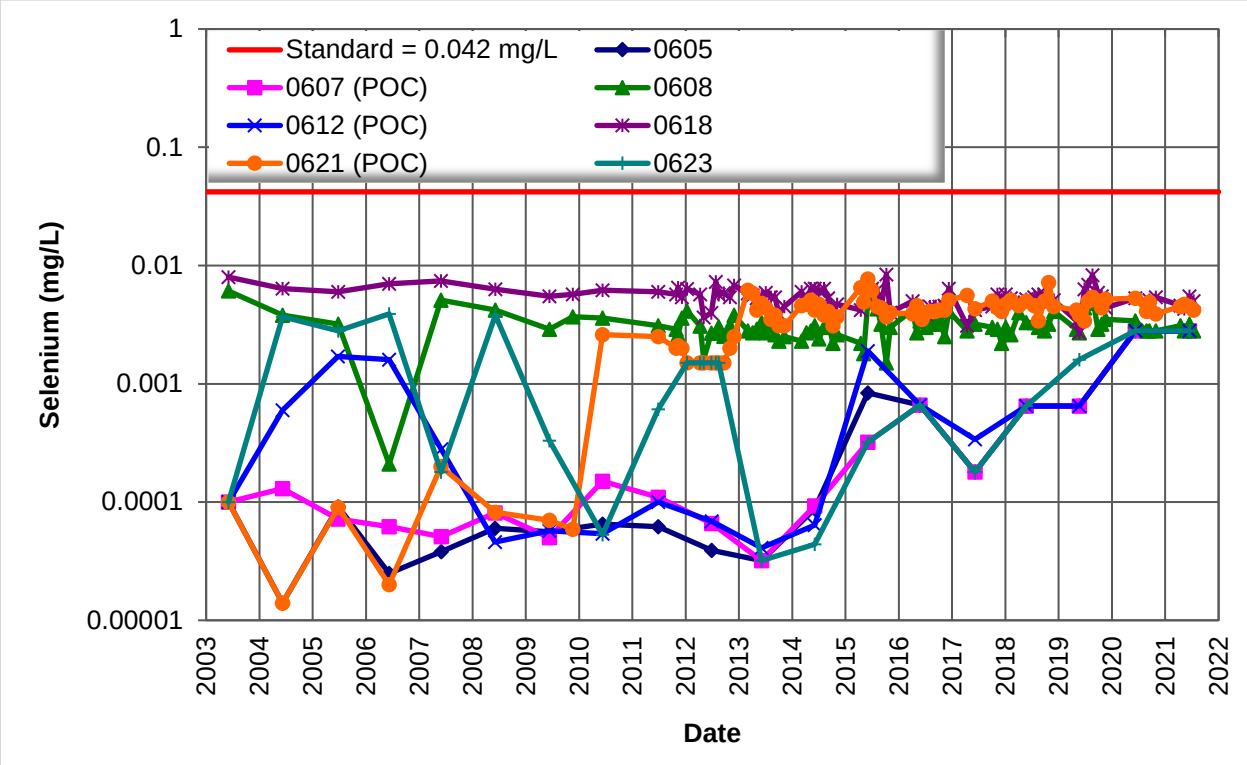


Figure 4-2. Groundwater Monitoring Network for the Durango, Colorado, Disposal Site



Note: Results include validated data only; results below the detection limit are presented at the laboratory reported value.

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



Note: Results include validated data only; results below the detection limit are presented at the laboratory reported value.

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

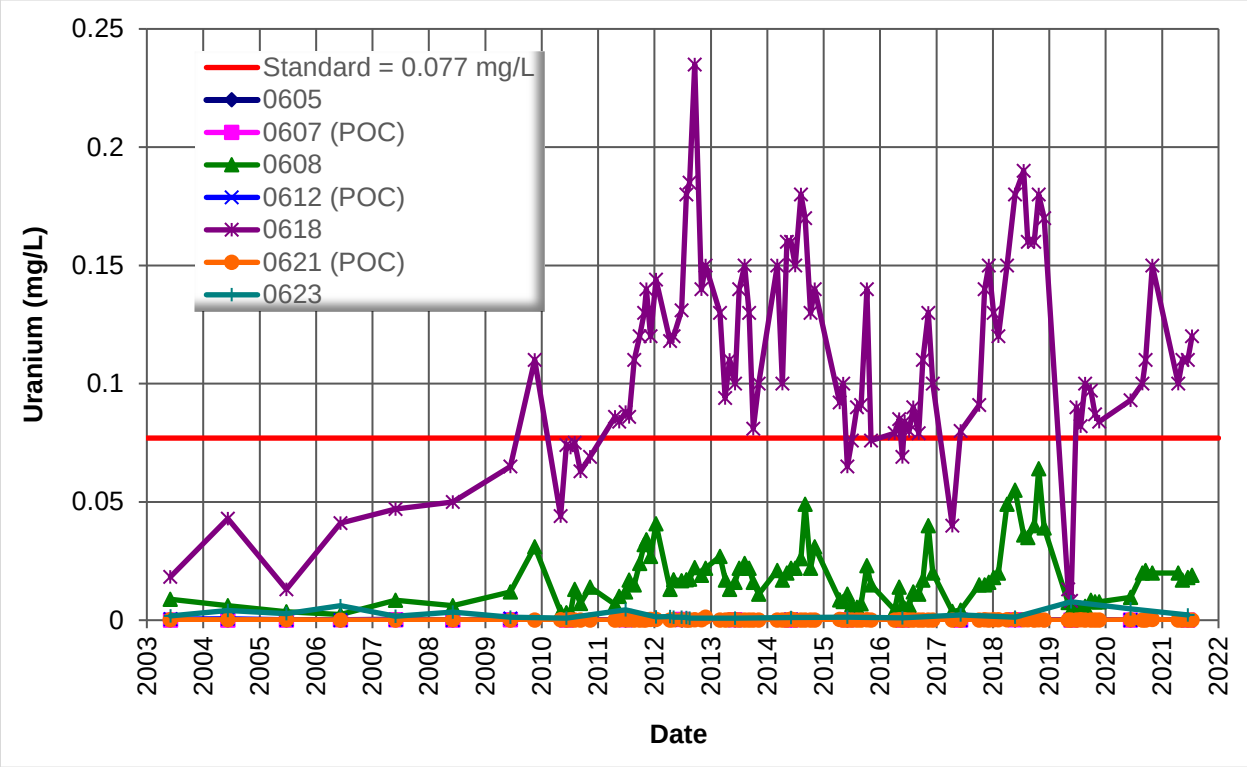


Figure 4-5. Uranium Concentrations in Groundwater at the Durango, Colorado, Disposal Site

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

Wells completed in the alluvium are sampled as a BMP. Uranium concentrations in well 0618 have consistently been higher than concentrations in the other onsite wells. To monitor and compare the elevated and variable uranium concentrations observed in this well, BMP wells 0608, 0618, and 0621 are sampled monthly as weather permits. Figure 4-5 shows variable uranium concentrations between 0.0082 milligrams per liter (mg/L) and 0.235 mg/L in well 0618 beginning in 2009 and continuing to the present. Uranium concentrations in well 0618 were measured at 0.12 mg/L in July 2021, which is within the range of measured historical concentrations. The cause of the variability in uranium concentration at well 0618 will be a focus of further investigation.

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 and side slopes to be eliminated by either selective spraying or mechanical removal when their shoot height equals or exceeds 3.5 ft. Several noxious weeds identified at the time of the inspection were treated following the 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), 2019. *Long-Term Surveillance Plan for the Durango, Colorado, Disposal Site*, LMS/DUD/S06297, May.

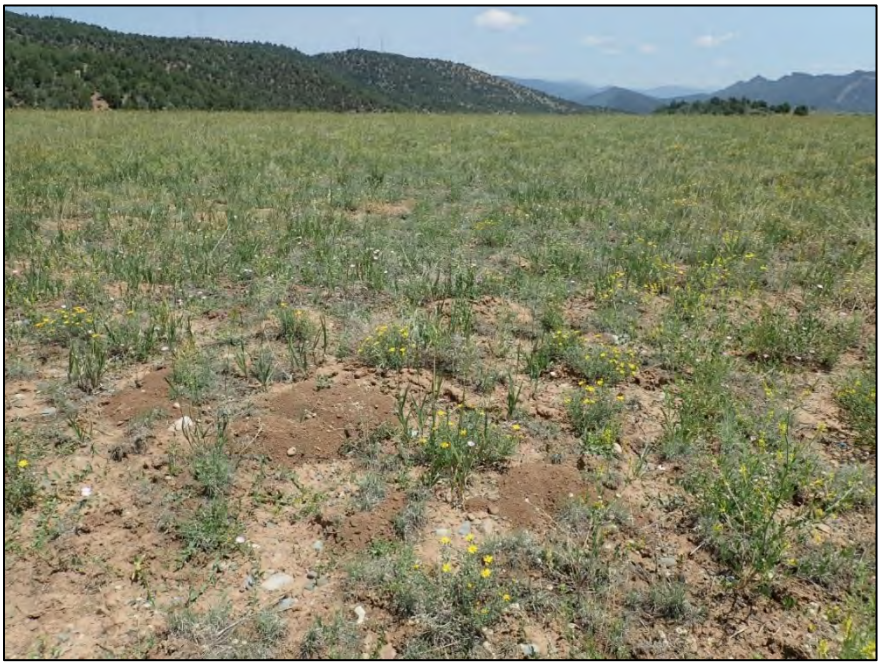
4.11 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	—	Site Marker SMK-2
PL-2	35	Diverse Vegetation on Top Slope
PL-3	130	Animal Burrows on Top Slope
PL-4	270	Monitoring Grid over Linear Depression
PL-5	—	Lightning Strike on Side Slope
PL-6	135	Northeast Drainage Channel
PL-7	355	Southeast Outflow
PL-8	10	(a) Northeast Outflow in 2021 (b) Northeast Outflow in 2006 (Photo for Comparison)

Note:
— = Photograph taken vertically from above.

PL-1. Site Marker SMK-2

PL-2. Diverse Vegetation on Top Slope



PL-3. Animal Burrows on Top Slope

PL-4. Monitoring Grid over Linear Depression

PL-5. Lightning Strike on Side Slope

PL-6. Northeast Drainage Channel

PL-7. Southeast Outflow

Photos continued on next page.

PL-8(a). Northeast Outflow in 2021

PL-8(b). Northeast Outflow in 2006 (Photo for Comparison)

This page intentionally left blank

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 was visited on March 24, 2021. No changes were observed in the disposal cell or associated drainage features, and personnel found no cause for a follow-up inspection.

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducts annual groundwater monitoring as a best management practice. The most recent sampling event occurred on February 10 and 11, 2021. The compliance strategy for groundwater protection at the site, which is designated as limited use, is no further remediation and application of supplemental standards because of widespread ambient contamination that is not due to milling and is not reasonably treatable. Therefore, no concentration limits or points of compliance (POCs) 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.

Through 2005, DOE fulfilled the environmental monitoring requirements for disposal cell performance and groundwater compliance as specified in the in the site-specific Long-Term Surveillance Plan (DOE 2008) (LTSP) and the Groundwater Compliance Action Plan; however, DOE continued to monitor the current network of wells annually through 2010. DOE submitted the *Groundwater Monitoring Assessment, Falls City, Texas, Disposal Site* to the U.S. Nuclear Regulatory Commission (NRC) in 2010 (DOE 2010). In the 2010 report, DOE evaluated groundwater monitoring results from 2006 to 2010 and compared them to previous results. DOE recommended termination of the monitoring program based on the requirements specified in the LTSP[1], and requested concurrence from the NRC for groundwater monitoring activities to be discontinued at the site (Dayvault 2010). Because DOE has not received concurrence from the NRC regarding the request, annual best management practice groundwater monitoring continues to be conducted.

5.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific LTSP (DOE 2008) 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 5-1 lists these requirements.

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

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

[1] Monitoring results do not vary significantly from current conditions, or variances from current conditions can be shown to be attributable to naturally occurring processes in the site groundwater systems (DOE 2008).

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 not to 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 affect 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 will 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 24, 2021, by D. Traub and B. Mays of the Legacy Management Support (LMS) contractor. R. Lyssy (LMS 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 whether maintenance or additional inspection and monitoring are needed.

5.4.1 Site Surveillance Features

Figure 5-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. 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 2021 annual inspection are shown in red. 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.

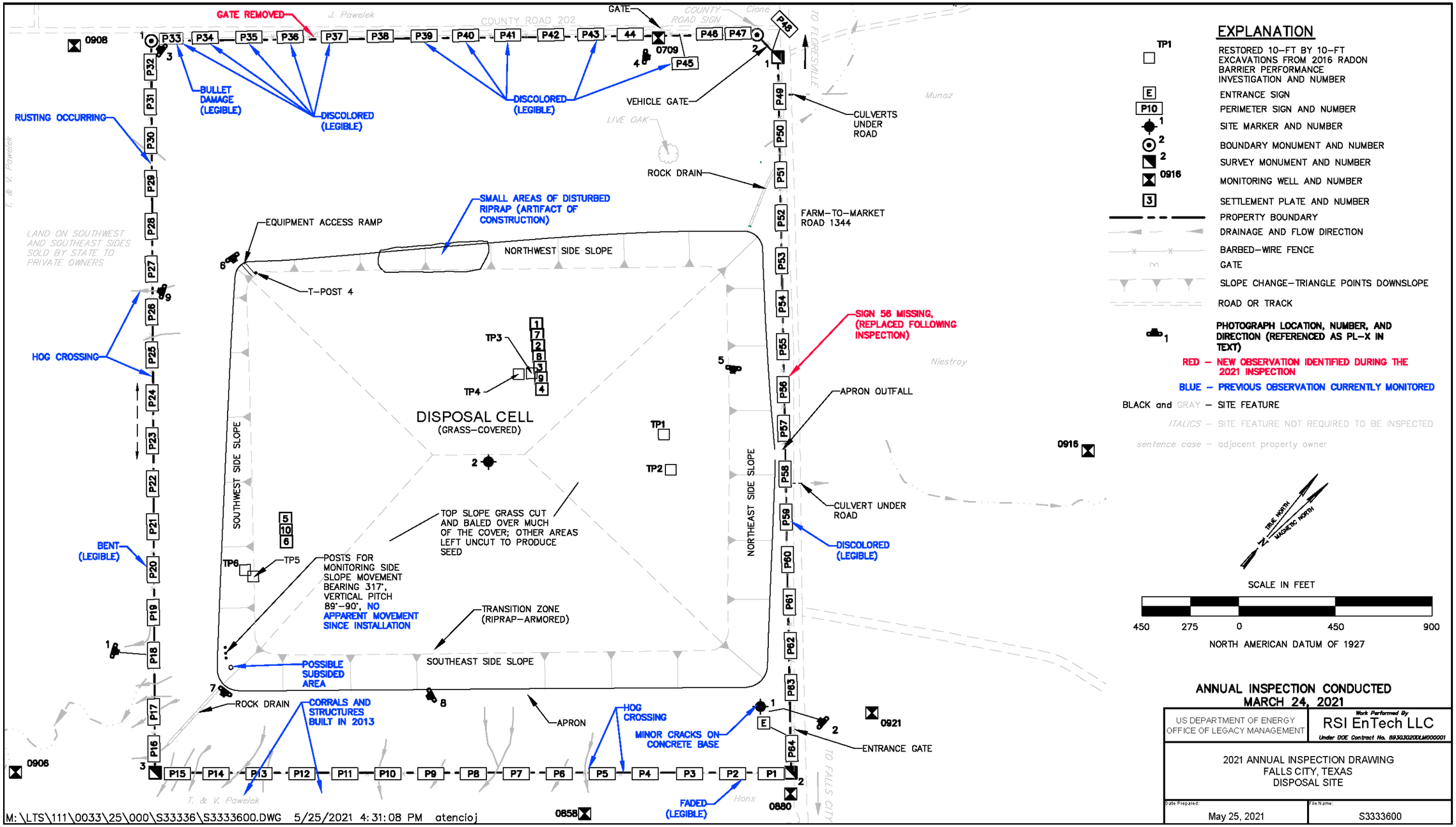


Figure 5-1. 2021 Annual Inspection Drawing for the Falls City, Texas, Disposal Site

This page intentionally left blank

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. The LMS maintenance subcontractor removed the wire gate between perimeter signs P36 and P37 because it is no longer used.

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 P56 was reported missing before the inspection and was replaced following the inspection. Perimeter sign P33 has bullet damage but remains legible. Additional perimeter signs are fading but remain legible (PL-1). No additional 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 (PL-2). The corners of the concrete base around the marker are cracked. The cracks are unchanged since the last inspection, and repairs are not needed at this time. Site marker SMK-2 is on the top slope of the disposal cell. No maintenance needs were identified.

5.4.1.4 Survey and Boundary Monuments

Three survey monuments and two boundary monuments delineate the corners of the property (PL-3). All monuments were located. No maintenance needs were identified.

5.4.1.5 Monitoring Wells

There is one monitoring well onsite; 11 monitoring wells are offsite. All monitoring wells were inspected during the February 2021 sampling event, and wellhead protectors were undamaged and locked (PL-4). 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. The site, including the disposal cell, is managed for hay production, which ensures that turf vitality is maintained. The LMS maintenance subcontractor can take as many as three cuttings of hay each year from the site. The LMS maintenance subcontractor spot-sprayed woody vegetation that

inspectors found distributed in the uncut grass. At the time of the March 2021 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. No areas of ponded water or areas of settlement were observed on top of the disposal cell during the March 2021 inspection.

Riprap armors the disposal cell side slopes and a transition zone where the top slope meets the side slopes (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. If the number of fractured rocks appears to be increasing, LM will establish a more quantitative monitoring program.

An equipment access ramp to the top of the disposal cell is at the west corner of the side slope (PL-6). 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.

Vegetation management is conducted 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. 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 (PL-7). Willows that grow along the south drain are periodically removed by the LMS 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 stormwater runoff and to reduce soil erosion. 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 (PL-8). 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 dig under the perimeter fence line in some areas (PL-9). Their crossings are filled in by the LMS maintenance subcontractor, as they can potentially compromise the integrity of the perimeter fence or damage haying equipment. 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

The wire gate between perimeter signs P36 and P37 was removed before the inspection because it is no longer used. Perimeter sign P56 was replaced 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 (DOE 2008), annual groundwater monitoring is conducted as a best management practice. The compliance strategy for groundwater protection at the site is no further remediation and application of supplemental standards in accordance with 40 CFR 192.21(g). The most recent sampling event occurred in February 2021.

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 higher-quality groundwater in deeper aquifers (DOE 2008). Samples are collected from 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

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.

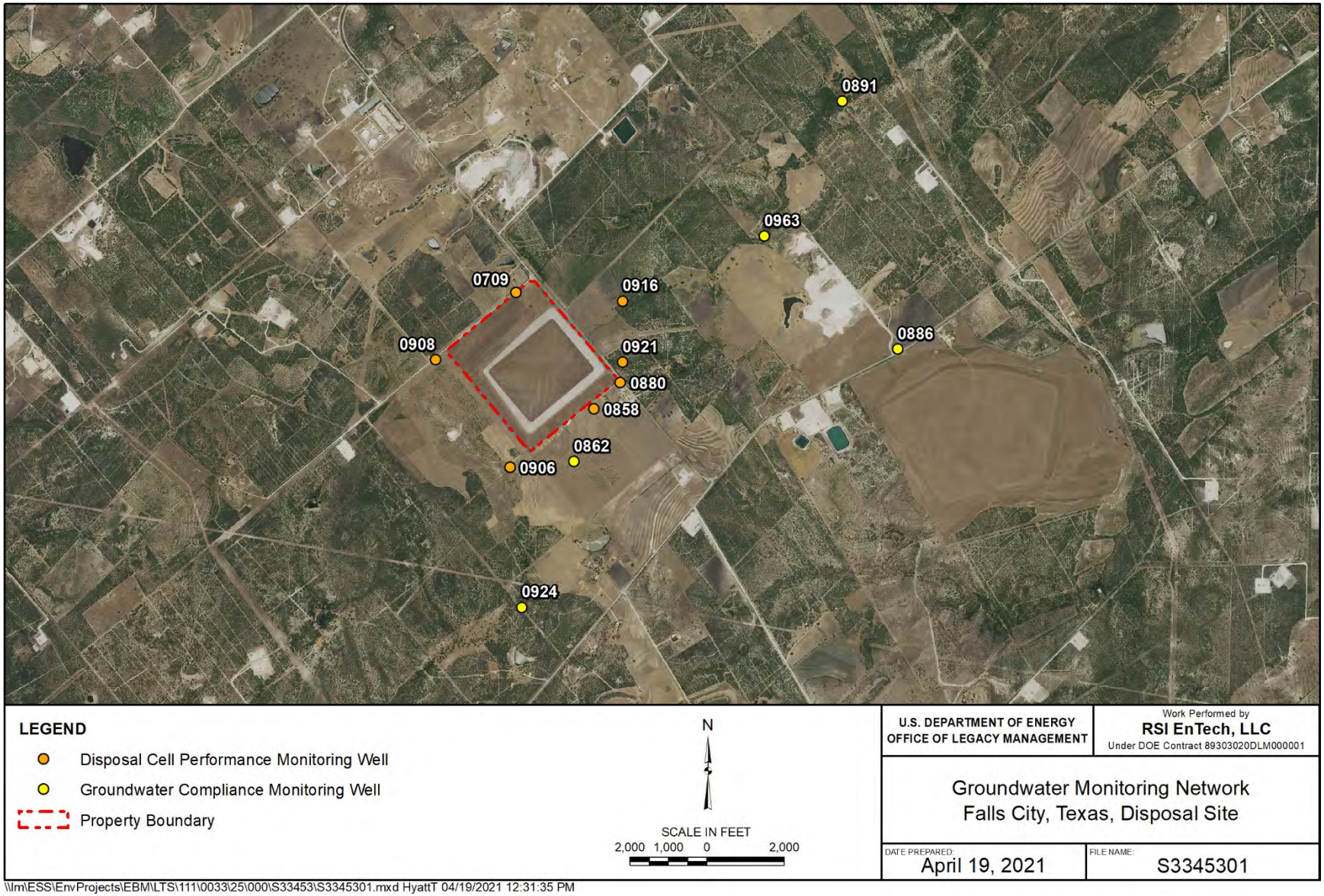


Figure 5-2. Groundwater Monitoring Well Network at the Falls City, Texas, Disposal Site

Monitoring results indicate that pH is not an indicator of contaminant concentrations at the site (DOE 2008). 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 POCs 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 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 (GEMS) website (https://gems.lm.doe.gov/#site=FCT).

5.8.2 Groundwater Level Monitoring Results

Water levels in all disposal cell performance wells had decreasing trends from 1996 to 2014 based on Mann-Kendall trend analyses (Figure 5-3). Water levels in these wells appear to have stabilized by 2014, but wells 0709, 0880, and 0906 have had increases in water level since 2014, which are more subtle in wells 0858 and 0921 (Figure 5-3). Groundwater compliance wells 0862, 0886, and 0963 had significant increasing water level trends since 1996, and wells 0891 and 0924 had no statistically significant trend (Figure 5-4). Wells with increasing water level trends each had a water elevation increase of about 5 ft since 1996.

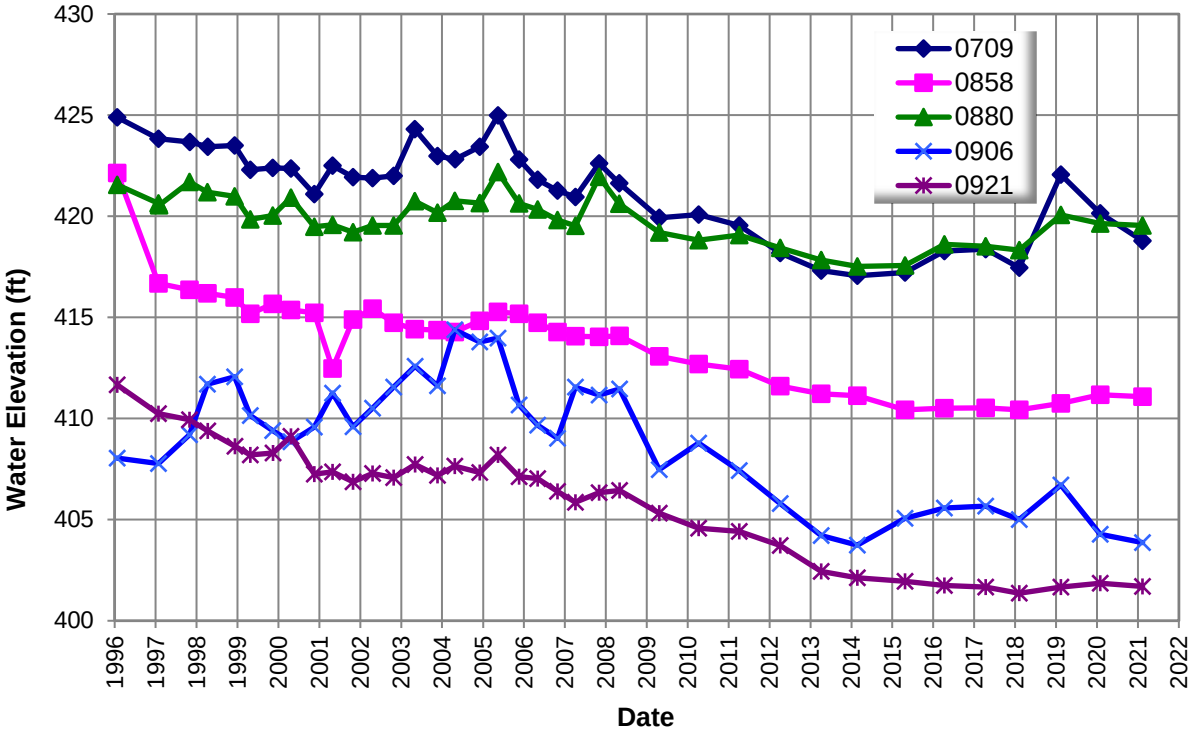


Figure 5-3. Water-Level Measurements at Disposal Cell Performance Monitoring Wells at the Falls City, Texas, Disposal Site

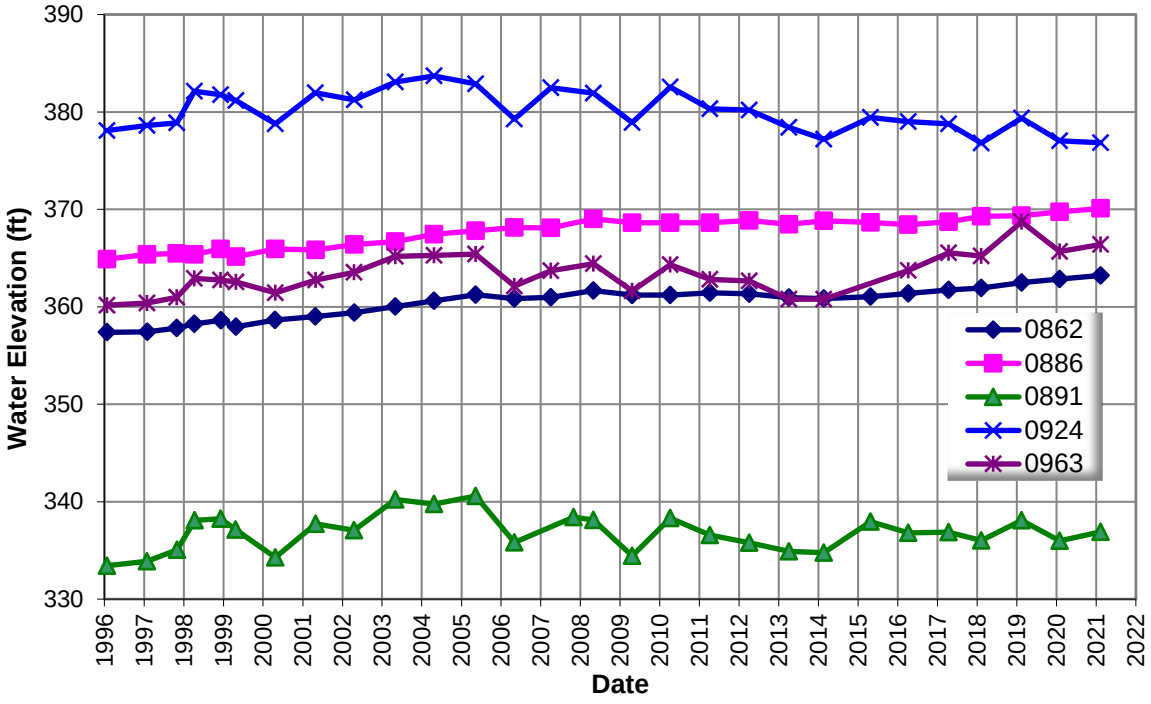
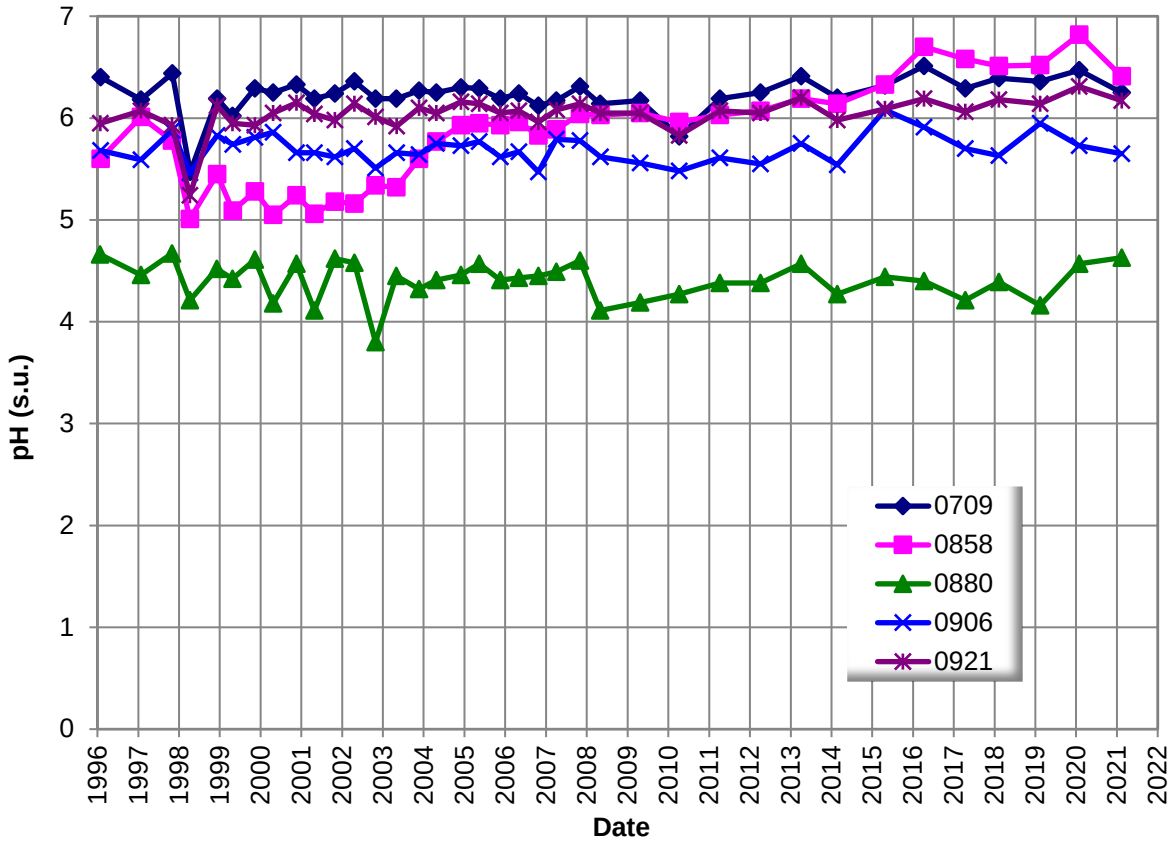


Figure 5-4. Water-Level Measurements at Groundwater Compliance Monitoring Wells at the Falls City, Texas, Disposal Site

5.8.3 Groundwater Quality Monitoring Results

pH: Wells 0858 and 0921 had significant increasing pH trends since 1996, based on Mann-Kendall trend analyses, and all other disposal cell performance wells had no significant trend. 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). The 2021 pH levels were within the range of historical values for all disposal cell performance monitoring wells (Figure 5-5).

For compliance monitoring wells, statistically significant increasing trends in pH have been seen in wells 0886, 0891, and 0924 since 1996, with no significant trends in wells 0862 and 0963 (Figure 5-6). The 2021 pH levels were within the range of historical values for all groundwater compliance monitoring wells. The pH in monitoring well 0963 historically has been lower than at the other groundwater compliance wells, with a pH of 3.6 in 2021 compared to between 6.0–7.0 in the other wells. Overall, groundwater in well 0963 had a similar pH to that of the tailings pore fluids, even compared to the wells adjacent to the disposal cell.



Abbreviation: s.u. = standard unit

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

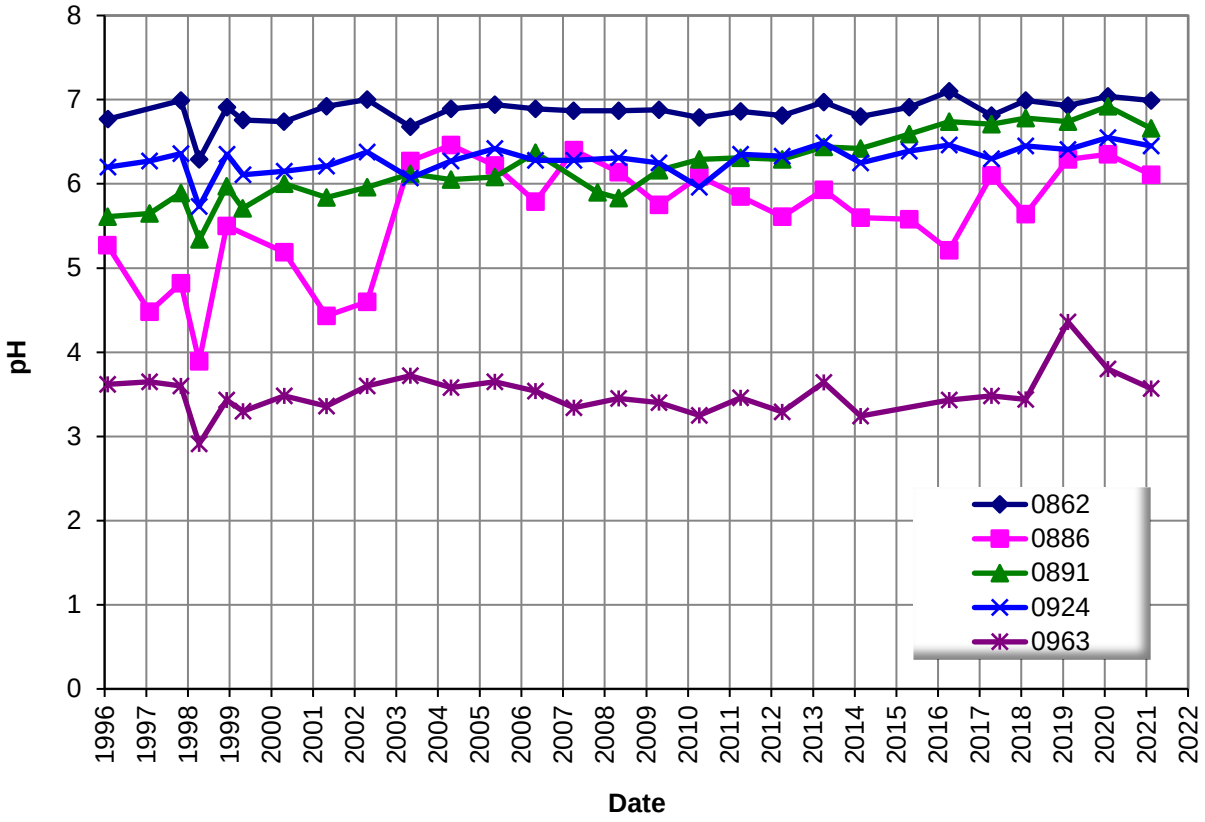
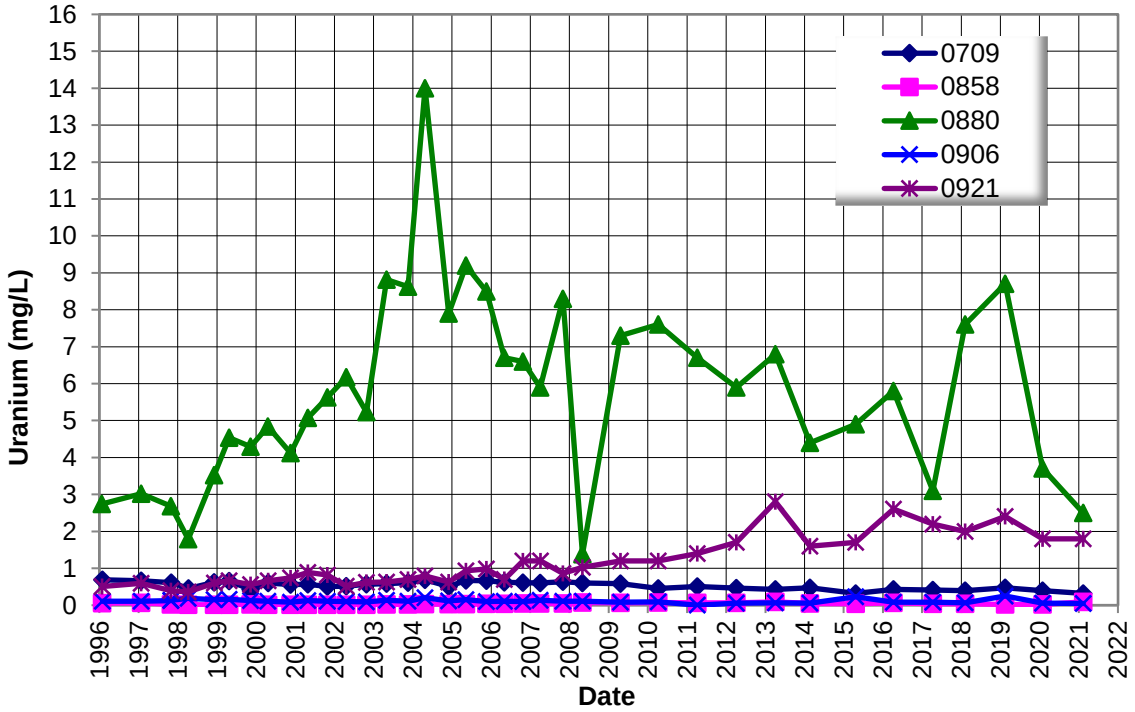


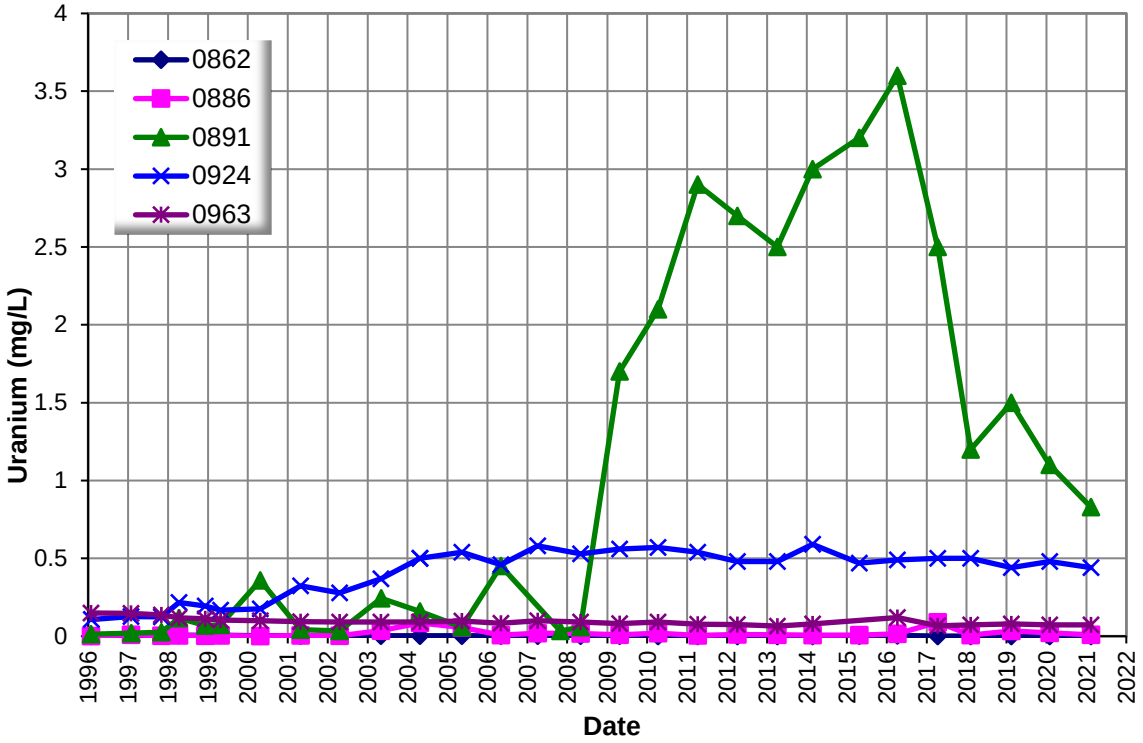
Figure 5-6. pH at Groundwater Compliance Monitoring Wells at the Falls City, Texas, Disposal Site

Uranium: The 2021 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 2021, the uranium concentrations for monitoring wells 0709, 0906, and 0858 remained generally constant when compared with previous results. The uranium concentration in monitoring wells 0921 and 0880 decreased. Uranium concentrations in monitoring well 0880 show considerable variation, ranging from a high of 14 milligrams per liter (mg/L) in 2004 to a low of 1.38 mg/L in 2008 The 2021 uranium concentrations for groundwater compliance monitoring wells were within the range of historical values for all groundwater compliance monitoring wells (Figure 5-8).



Note: Results include validated data only; results below the detection limit are presented at the laboratory reported value.

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



Note: Results include validated data only; results below the detection limit are presented at the laboratory reported value.

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

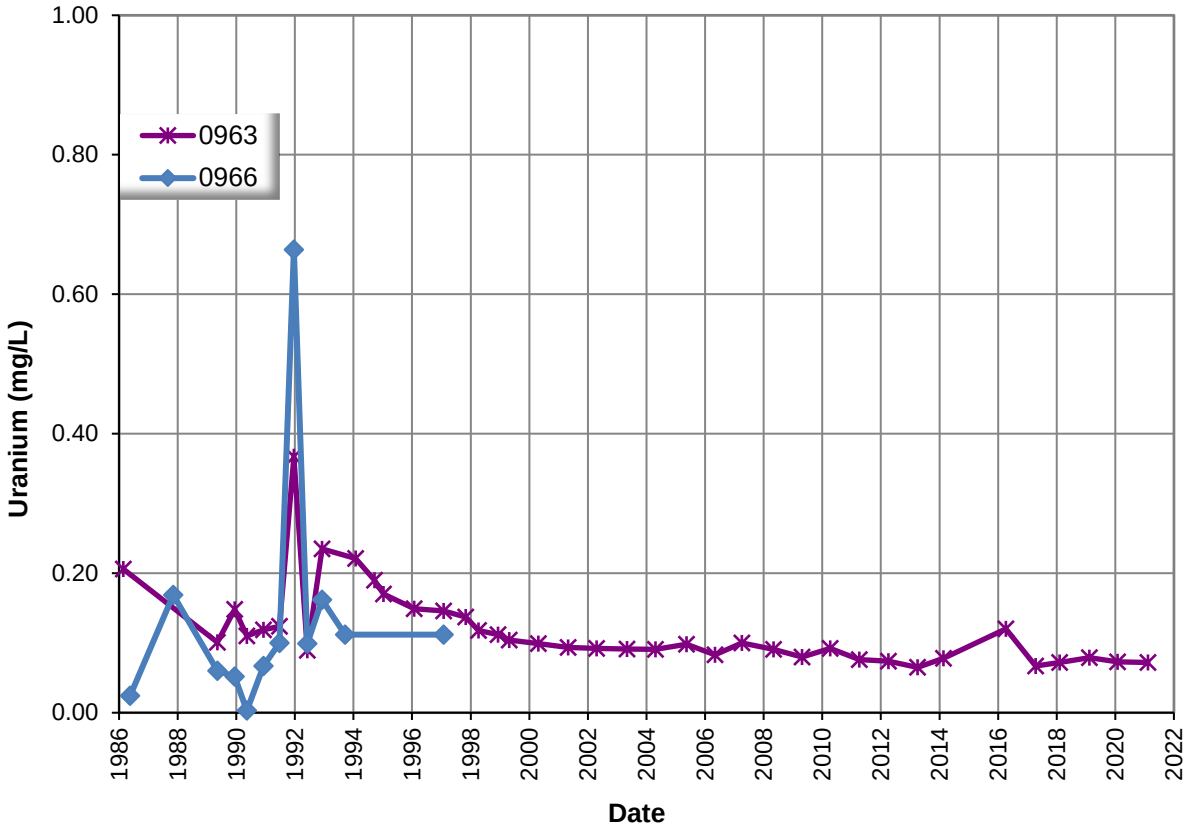
The uranium concentration at monitoring wells 0862, 0886, and 0963 remains less than 0.2 mg/L. The uranium concentration at monitoring well 0924 has been relatively stable since 2004, fluctuating between 0.4 mg/L and 0.6 mg/L. Since 2008, the uranium concentrations measured at monitoring well 0891 have 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 2021 uranium result (0.83 mg/L) at monitoring well 0891 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 1994). This suggests that groundwater with elevated uranium has flowed past this location.

5.8.4 Evaluation of Groundwater Monitoring

Uranium concentrations in disposal cell performance monitoring well 0880 have varied considerably since 1996, ranging from 14 mg/L in 2004 to 1.38 mg/L in 2008 (Figure 5-7). The uranium concentration was 2.5 mg/L in 2021. 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 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 local conditions, 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, trending downward since 2016, likely reflects the passage of a 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 the natural buffering capacity (DOE 2008; Figure 2-7; Figure 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 groundwater containing processing-related constituents.



Note: Results include validated data only; results below the detection limit are presented at the laboratory reported value.

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 higher-quality groundwater in deeper aquifers.

LM evaluated the groundwater monitoring program at the site in 2010 (DOE 2010) as required by the LTSP. Groundwater monitoring data collected from 2006 through 2010 were compared to previous data (1996 through 2005). The comparison showed that contaminant concentrations continued to fluctuate in the uppermost aquifer, but the fluctuations were within the historical range reported for the aquifer near the site. The comparison also showed no unexpected water level changes. The 2010 evaluation recommended that groundwater monitoring activities at the site be discontinued after the collection of samples in 2011. 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, Texas, Disposal 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.*

Dayvault, 2010. Jalena Dayvault, U.S. Department of Energy Office of Legacy Management, letter (transmittal of *Groundwater Monitoring Assessment Report for the Falls City, Texas, Disposal Site, December 2010*) to the deputy director, U.S. Nuclear Regulatory Commission, December 23.

DOE (U.S. Department of Energy), 1994. *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 Report for the Falls City, Texas, Disposal Site, December 2010,* LMS/FCT/S07069, December 23.

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	70	Perimeter Sign P18
PL-2	275	Site Marker SMK-1
PL-3	270	Boundary Monument BM-1
PL-4	60	Monitoring Well 0709
PL-5	150	Northeast Side Slope
PL-6	110	Equipment Access Ramp
PL-7	180	Rock Drain on South Corner of Disposal Cell
PL-8	205	Cut and Baled Grass Between Disposal Cell and Perimeter Fence
PL-9	250	Hog Crossing Under Southwest Fence Line

PL-1. Perimeter Sign P18

PL-2. Site Marker SMK-1

PL-3. Boundary Monument BM-1

PL-4. Monitoring Well 0709

PL-5. Northeast Side Slope

PL-6. Equipment Access Ramp

PL-7. Rock Drain on South Corner of Disposal Cell

PL-8. Cut and Baled Grass Between Disposal Cell and Perimeter Fence

PL-9. Hog Crossing Under Southwest Fence Line

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 was inspected on December 7, 2021. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified minor maintenance needs that will be handled during the next routine maintenance event, but no cause for a follow-up inspection was identified.

A portion of the disposal cell remains open to receive low-activity 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 cover studies on top of the disposal cell and on lysimeter facilities adjacent to the north and east sides of the disposal cell, are 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 at the site as a best management practice. Two monitoring wells are sampled to verify that groundwater in onsite paleochannels are not affected by potential seepage from the disposal cell. A third monitoring well is within the disposal cell. Groundwater monitoring of all three wells was completed July 29, 2021.

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 (DOE 1998) (LTSP) in accordance with procedures LM established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 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), (b)(3)

In December 2020, Congress passed legislation that will extend the final disposal cell closure date from 2023 to 2031. LM's operations to receive radioactive waste at the site will cease in September 2031. Following final closure of the disposal cell, the Interim LTSP (DOE 1998) for the site will be revised and finalized; with NRC acceptance of the final LTSP, the site will come under NRC's general license.

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-activity radioactive waste will be received until the disposal cell's legally mandated closure date or until it is filled to capacity, whichever comes first. 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 signs, 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 7, 2021. The inspection was conducted by J. Lobato, D. Atkinson, H. Petrie, and C. Garcia of the Legacy Management Support (LMS) contractor. S. Woods and N. Olin from LM also 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 whether maintenance or additional inspection and monitoring are needed.

6.4.1 Site Surveillance Features

Figure 6-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. 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 2021 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 Signs

Access to the site is from U.S. Highway 50 by a right-of-way grant on federal land that is administered by the U.S. Bureau of Land Management (BLM). A steel double-swing access gate along the highway right-of-way fence provides access within the BLM-administered right-of-way. The access gate is secured by a locking device that was locked and functional at the time of the inspection. LM is one of several parties with access to the locking device.

Although it is not required by the Interim LTSP, LM maintains the site access road and associated right-of-way. The right-of-way is bounded by two barbed wire fences that parallel the north and south sides of the site access road, with two stock gates included in each fence. No maintenance needs were identified.

The site entrance gate was locked and functional, and site entrance signs on and next to the entrance gate were in good condition (PL-1). No maintenance needs were identified.

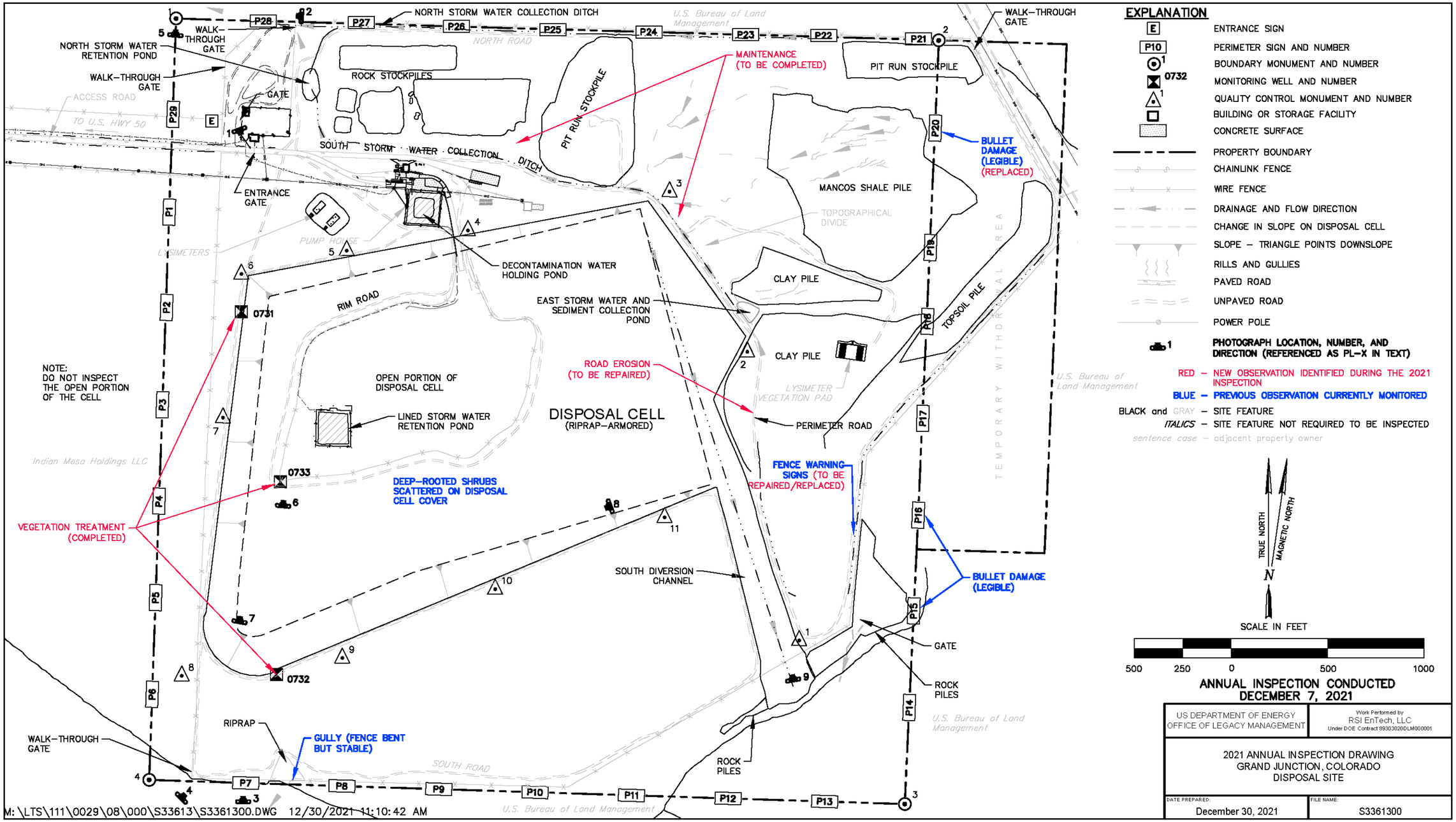


Figure 6-1. 2021 Annual Inspection Drawing for the Grand Junction, Colorado, Disposal Site

This page intentionally left blank

6.4.1.2 Perimeter Fence and Signs

A perimeter fence encloses the disposal cell features and operations areas (PL-2). It consists of a standard four-strand, barbed-wire fence in some areas and a woven wire fence topped with barbed wire in others. The perimeter fence does not match the property boundary in several areas. There are 29 perimeter signs attached to steel posts set in concrete positioned at regular intervals along the property boundary (PL-3). Several perimeter signs along the south property boundary are faded or peeling but remain legible. Perimeter signs P15 and P16 have bullet damage but remain legible. Perimeter sign P20, previously reported with bullet damage, was replaced. In addition to the perimeter signs, the perimeter fence also has warning signs ("No Trespassing" and "Controlled Area" signs). Several warning signs on the southeast perimeter fences reported in 2020 as damaged or detached will be repaired or replaced before the next inspection (PL-4). No other maintenance needs were identified.

6.4.1.3 Site Markers

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

6.4.1.4 Boundary Monuments

Four boundary monuments delineate the corners of the property boundary (PL-5). All were present and in good condition during the inspection. No maintenance needs were identified.

6.4.1.5 Aerial Survey Quality Control Monuments

Eleven aerial survey quality control monuments installed in December 2020 were inspected during the 2021 inspection. No maintenance needs were identified.

6.4.1.6 Monitoring Wells

The groundwater monitoring network consists of three monitoring wells (0731, 0732, and 0733) (PL-6). Vegetation treatment was completed in a large radius around each wellhead. All wellhead protectors were locked and undamaged. Roots were found in monitoring wells 0731 and 0732; they will be removed and the wells redeveloped before the next inspection. No other 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 property boundary or site perimeter fence, 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 integrity of the disposal cell and 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-7). 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-8). Historically, deep-rooted shrubs on top of the disposal cell have been treated with herbicide. Although treatment is not required by the Interim LTSP, LM plans to continue controlling the deep-rooted shrubs as needed. 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 stormwater runoff from the disposal cell, and conveys the water into a natural drainage that flows away from the site to the southwest (PL-9). Grasses, weeds, and shrubs growing within the diversion channel is not expected to affect 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 stormwater collection ditches, the north stormwater retention pond, and the east stormwater and sediment collection pond. These small drainage features control stormwater runoff primarily from the various stockpiles of disposal cell cover materials. The stormwater collection ditches also capture stormwater run-on from offsite locations. Maintenance (cleaning out) of several parts of the site stormwater collection ditches is ongoing and is expected to continue into 2022. The diversion channel, ditches, and ponds were functioning as designed. No other maintenance needs were identified.

6.4.2.3 Area Between the Disposal Cell and the Site Boundary or Perimeter Fence

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 portion of the 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. Localized erosion is present at two locations on the perimeter road adjacent to the east side of the disposal cell (Figure 6-1). Repairs to these areas will be completed with the ongoing maintenance of site stormwater collection ditches (Section 6.4.2.2). No other maintenance needs were identified.

6.4.2.4 Outlying Area

The area beyond the site boundary for 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 is used primarily for cattle grazing. No land use changes were evident in that area. Outside the site's eastern boundary is a 40-acre temporary

withdrawal area that was issued by BLM to DOE for stockpiled materials. Some of the withdrawal area is included within the site perimeter fence and contains stockpiled materials. 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

Vegetation was treated around wells 0731, 0732, and 0733, and perimeter sign P20 was replaced before the annual inspection. Inspectors identified maintenance items that will be addressed before the next inspection. These include the following:

- Replacement or repair of warning signs on the southeast perimeter fences
- Maintenance to the site stormwater collection ditches
- Repairs to the two eroded areas on the site perimeter road adjacent to the east side of the disposal cell
- Root removal and well redevelopment for monitoring wells 0731 and 0732

No other 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 with no numerical concentration limits for hazardous constituents identified at the site (DOE 1998); this 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 (i.e., transient drainage) from the disposal cell. The most recent sampling event occurred on July 29, 2021.

Monitoring wells 0731 and 0732 are screened within the alluvial paleochannels adjacent to the disposal cell and extend 5 to 7.5 ft into weathered Mancos Shale. These wells are in two separate paleochannel systems 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 (GEMS) website (https://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 generally increased approximately 4 ft since 1998 and have 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. The 2020 sampling occurred in late May, whereas every previous sampling since 2003 occurred in August or early September. Consequently, water level measurements in 2020 may have a seasonal influence in relation to the historical data. 2021 groundwater levels in wells 0731 and 0732 are not reported, as both wells were filled with roots.

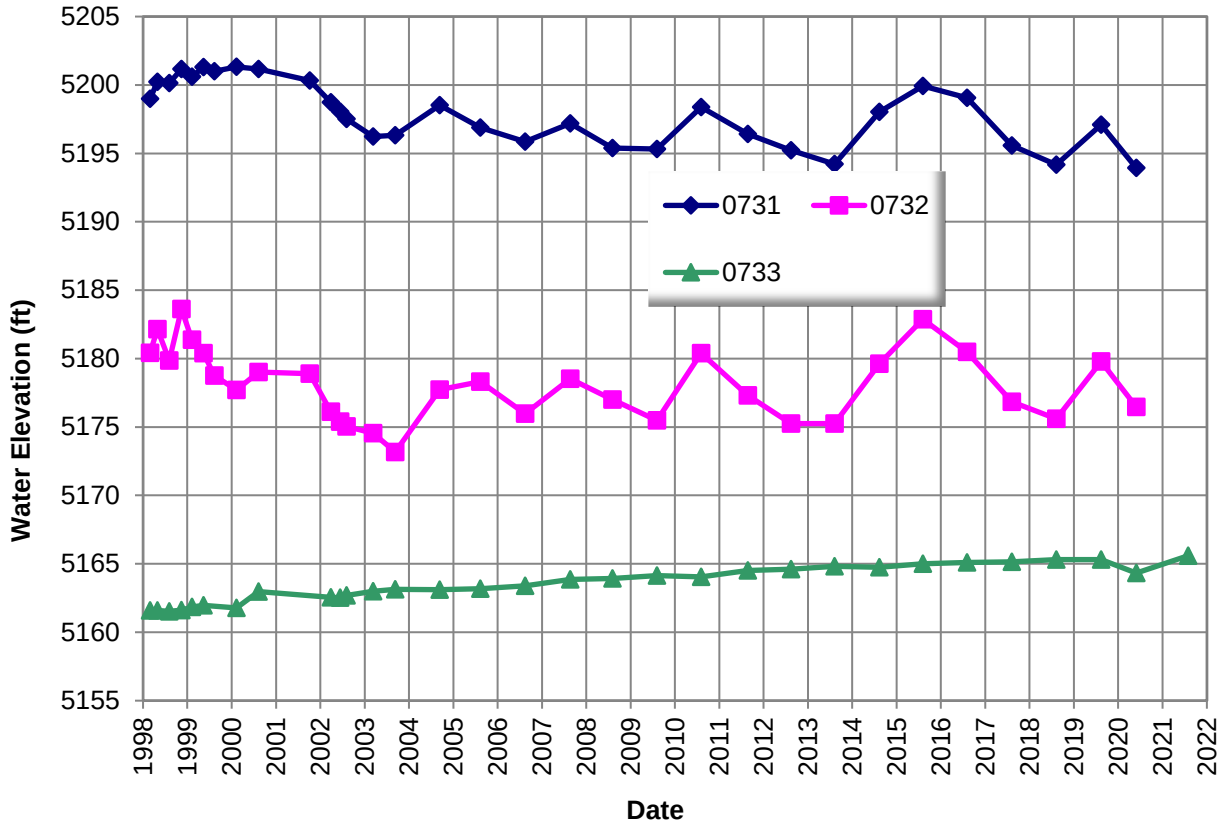


Figure 6-3. Water Level Measurements at the Grand Junction, Colorado, Disposal Site

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 key indicator analytes are compared to U.S. Environmental Protection Agency established maximum concentration limits (MCLs) (40 CFR 192 Table 1 Subpart A), background groundwater concentrations from the alluvial groundwater, and background groundwater concentration from Mancos Shale groundwater (Table 6-3). Monitoring well concentration data

are compared to the highest of the three values in Table 6-3 as a best management practice to determine if there is any potential seepage from the disposal cell. MCLs are listed for comparison evaluation only and not for compliance purposes.

Table 6-3. Maximum Concentration Limits and Maximum Background Concentrations for Alluvial and Mancos Shale Groundwater at the Grand Junction, Colorado, Disposal Site

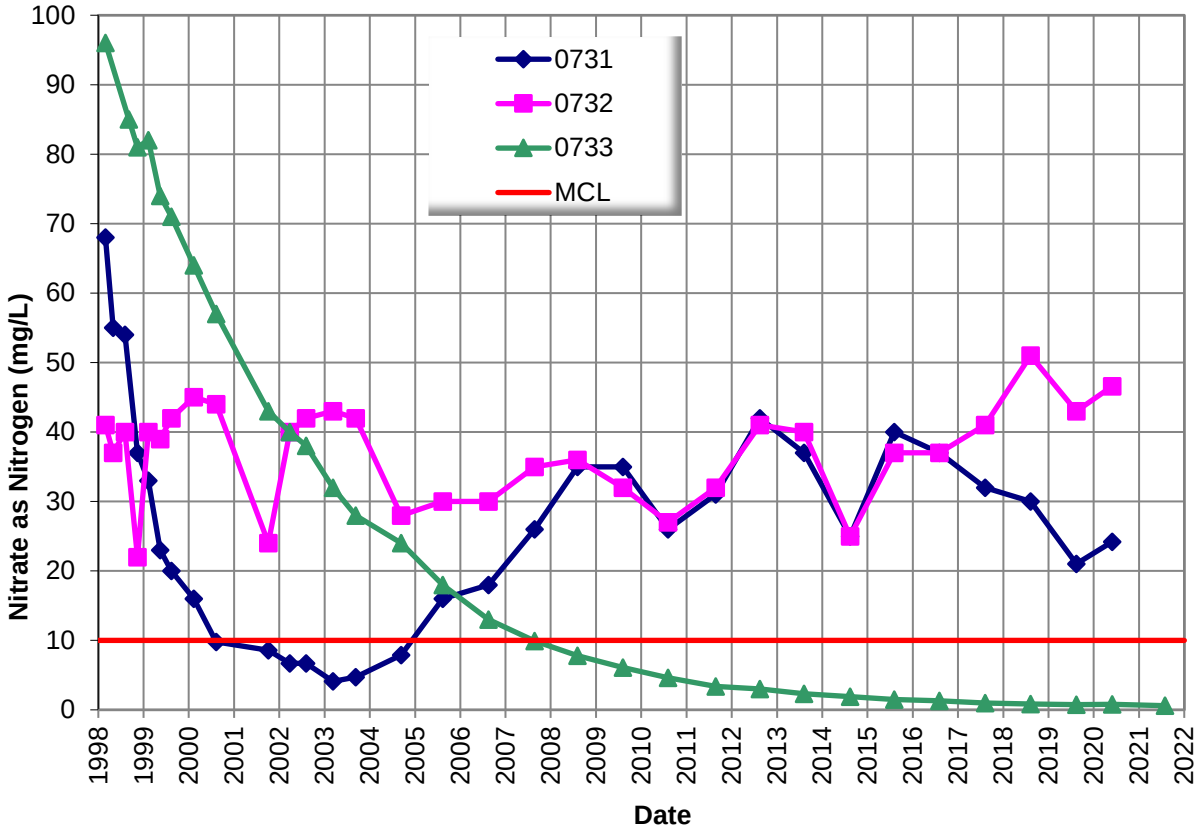
Constituent	MCL[a] in mg/L	Maximum Concentration in Background Alluvial Groundwater (mg/L)	Maximum Concentration in Background Mancos Shale Groundwater (mg/L)
Molybdenum	0.1	0.070	0.12
Nitrate (as nitrogen)	10	1.1	0.80
Selenium	0.01	0.019	0.11
Uranium	0.044	0.074	0.011

Notes:
[a] MCLs as listed in 40 CFR 192 Table 1 Subpart A.
Data are from Table 3.34 for background alluvial groundwater and Table 3.37 for Mancos Shale Groundwater in Attachment 3 of DOE 1991.

Wells 0731 and 0732 were sampled in 2021, but both wells were filled with roots, causing the field and laboratory results to be outliers. All field and lab results for 0731 and 0732 were rejected and are not acceptable to be reported. For that reason, only results from 0733 are shown for the 2021 sampling event. Data for wells 0731 and 0732 from the 2020 sampling event are presented here and are identical to the ones reported in the 2020 report (DOE 2021). Both wells 0731 and 0732 will be redeveloped before the next sampling event which will include root removal.

Molybdenum concentrations in all three monitoring wells have remained steady since 1998; 2021 concentrations were less than or equal to the MCL of 0.1 mg/L and thus less than the background molybdenum concentration in the Mancos Shale of 0.12 mg/L. Time-concentration plots from 1998 through 2021 for the other key indicator analytes—nitrate (as nitrogen), selenium, and uranium—are shown in Figure 6-4 through Figure 6-6.

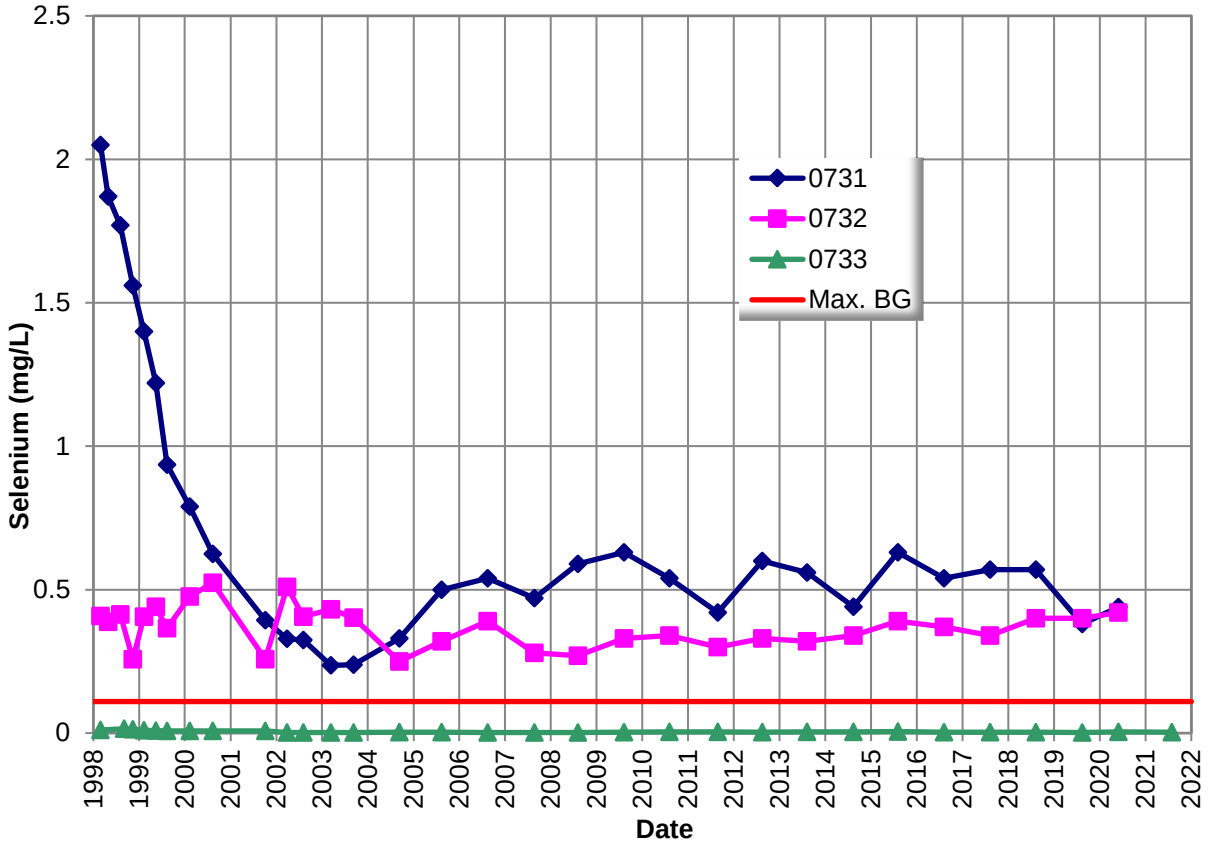
Nitrate (as nitrogen) concentrations in disposal cell monitoring well 0733 continued to decline from 96 mg/L in 1998 to 0.6 mg/L in 2021; the 2021 numbers are significantly below the MCL of 10 mg/L (Figure 6-4). This is possibly due to increased reducing conditions (less oxygen) over time at the bottom of the disposal cell, creating denitrification (conversion of nitrate to nitrogen gas). Past concentrations of elevated nitrate (as nitrogen) in paleochannel monitoring wells 0731 and 0732 (compared to background nitrate concentrations up to 1.1 mg/L) may be the result of these wells adding oxygen to the Mancos Shale within the well screen and releasing nitrate.



Note: Well 0733 is screened in the disposal cell tailings.

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

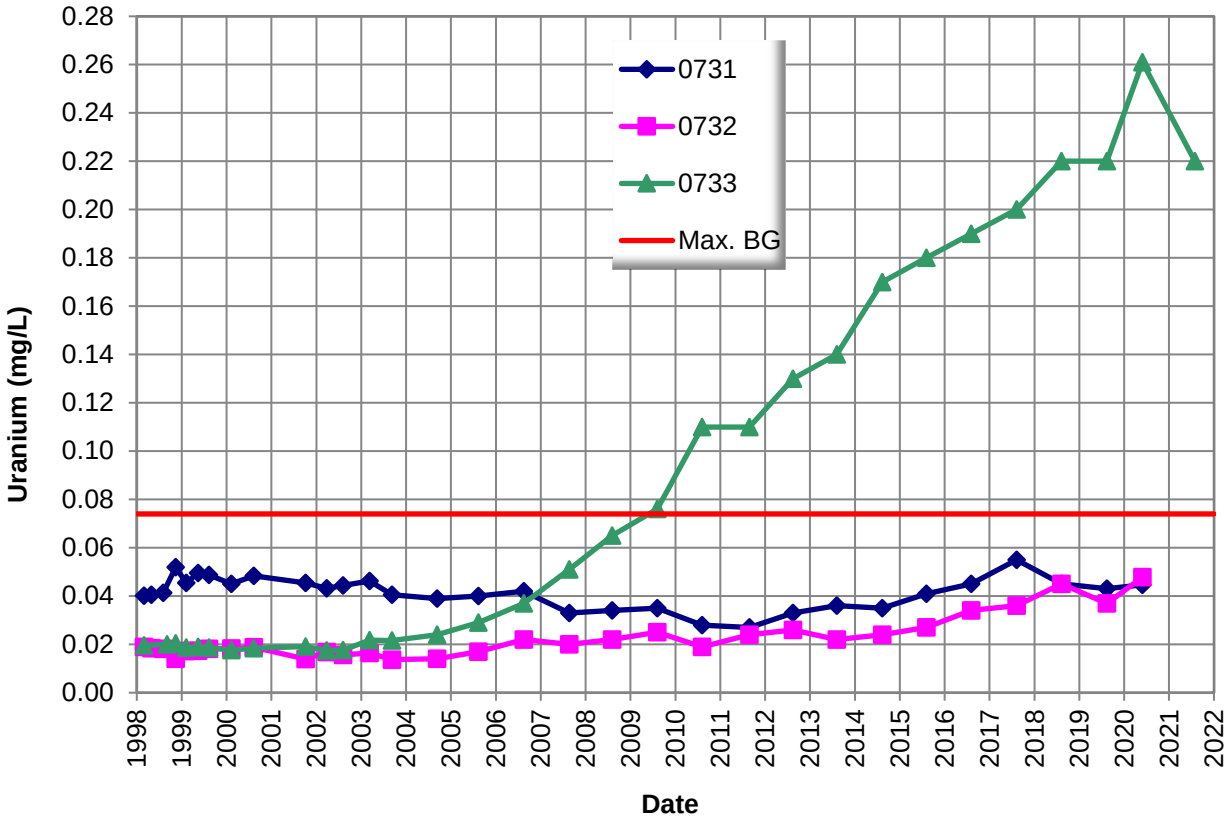
Selenium occurs naturally in the Mancos Shale deposits that underlie the disposal cell (DOE 1991). Background groundwater concentrations in the Mancos Shale are at 0.11 mg/L, which exceeds the MCL of 0.01 mg/L (Table 6-3). As with nitrate, the addition of oxygen into the Mancos Shale because of the installation of these monitoring wells may contribute to the release of selenium from the Mancos Shale. Disposal cell monitoring well 0733 is not screened in the weathered Mancos Shale, and selenium concentrations remain below maximum background concentrations (Figure 6-5).



Note: Well 0733 is screened in the disposal cell tailings. "Max. BG" stands for maximum background concentration. Results include validated data only; results below the detection limit are presented at the laboratory reported value.

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

Uranium concentrations in wells 0731 and 0732 have shown an apparent, gradually increasing trend since 2011 (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 2021. 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.



Note: Well 0733 is screened in the disposal cell tailings. "Max. BG" stands for maximum background concentration. Results include validated data only; results below the detection limit are presented at the laboratory reported value.

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

Wells 0731 and 0732 will not be sampled again until 2022 to ensure that any disturbances after root removal have passed. In 2022, the slightly increasing trends in uranium (albeit below maximum background concentrations) will be reevaluated. To assist in the determination of a Mancos Shale influence on nitrate and selenium in these two wells, duplicate samples will be collected 2 ft below the top of the water table in addition to the current sampling depth. Sampling just below the top of the water table will ensure that samples are from the alluvial groundwater only, resulting in less potential interference from reactions occurring within the top of the Mancos Shale that might release nitrate and selenium.

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), 1991. *Remedial Action Plan and Site Design for Stabilization of the Inactive Uranium Mill Tailings Site at Grand Junction, Colorado,* DOE/AL/050505.0000, UMTRA Project Team, September.

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, April.

DOE (U.S. Department of Energy), 2021. *2020 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites,* LMS/S30146, March.

6.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	160	Solar-Powered Site Entrance Gate
PL-2	275	North Perimeter Fence
PL-3	0	Perimeter Sign P7
PL-4	45	Unsecured Perimeter Fence Sign
PL-5	5	Boundary Monument BM-1
PL-6	5	Monitoring Well 0733
PL-7	10	West Side Slope Disposal Cell
PL-8	250	Disposal Cell Top and Side Slope
PL-9	350	South Diversion Channel

PL-1. Solar-Powered Site Entrance Gate

PL-2. North Perimeter Fence

PL-3. Perimeter Sign P7

PL-4. Unsecured Perimeter Fence Sign

PL-5. Boundary Monument BM-1

PL-6. Monitoring Well 0733

PL-7. West Side Slope Disposal Cell

PL-8. Disposal Cell Top and Side Slope

PL-9. 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 was inspected on March 18, 2021. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified several minor maintenance issues at the site but did not identify concerns 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 site-specific Long-Term Surveillance Plan (DOE 1998) (LTSP). 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 had not been accepted at the time of this report's publication by the U.S. Nuclear Regulatory Commission (NRC). LM received a request for additional information from NRC and is addressing the commission's comments. Groundwater analytical results presented in this report are evaluated with respect to LTSP requirements until the GCAP is finalized. Groundwater monitoring was last completed in June 2021. 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. No cause for a follow-up inspection was identified.

7.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the LTSP 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, LM is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gate and sign,

security fence around the disposal cell, perimeter signs, site markers, survey and boundary monuments, and wellhead protectors.

7.4 Inspection Results

The site, 1 mile southeast of Green River, Utah, was inspected on March 18, 2021. The inspection was conducted by P. Lemke and M. Williams of the Legacy Management Support (LMS) contractor. A. Denny (LM site manager) and H. Mickelson (State of Utah representative) 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 whether maintenance or additional inspection and monitoring are needed.

7.4.1 Site Surveillance Features

Figure 7-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. 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 2021 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 S 1600 E Street. The paved access road crosses property owned by the state and the U.S. Army. Access was 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, Perimeter Signs, and Warning Signs

A chainlink security fence encloses the portion of the site that contains the disposal cell. Vehicle gates are at the south and east corners of the security fence, and a personnel gate is at the north corner of the security fence. The security fence (PL-1 and PL-2) was intact, and the gates were operable and locked at the time of the inspection.

Seventeen perimeter signs, attached to steel posts set in concrete, are positioned along the unfenced property boundary. All perimeter signs were legible, although inspectors noted that perimeter sign P6 contained graffiti (PL-3). Because the sign is legible, it will not be replaced at this time.

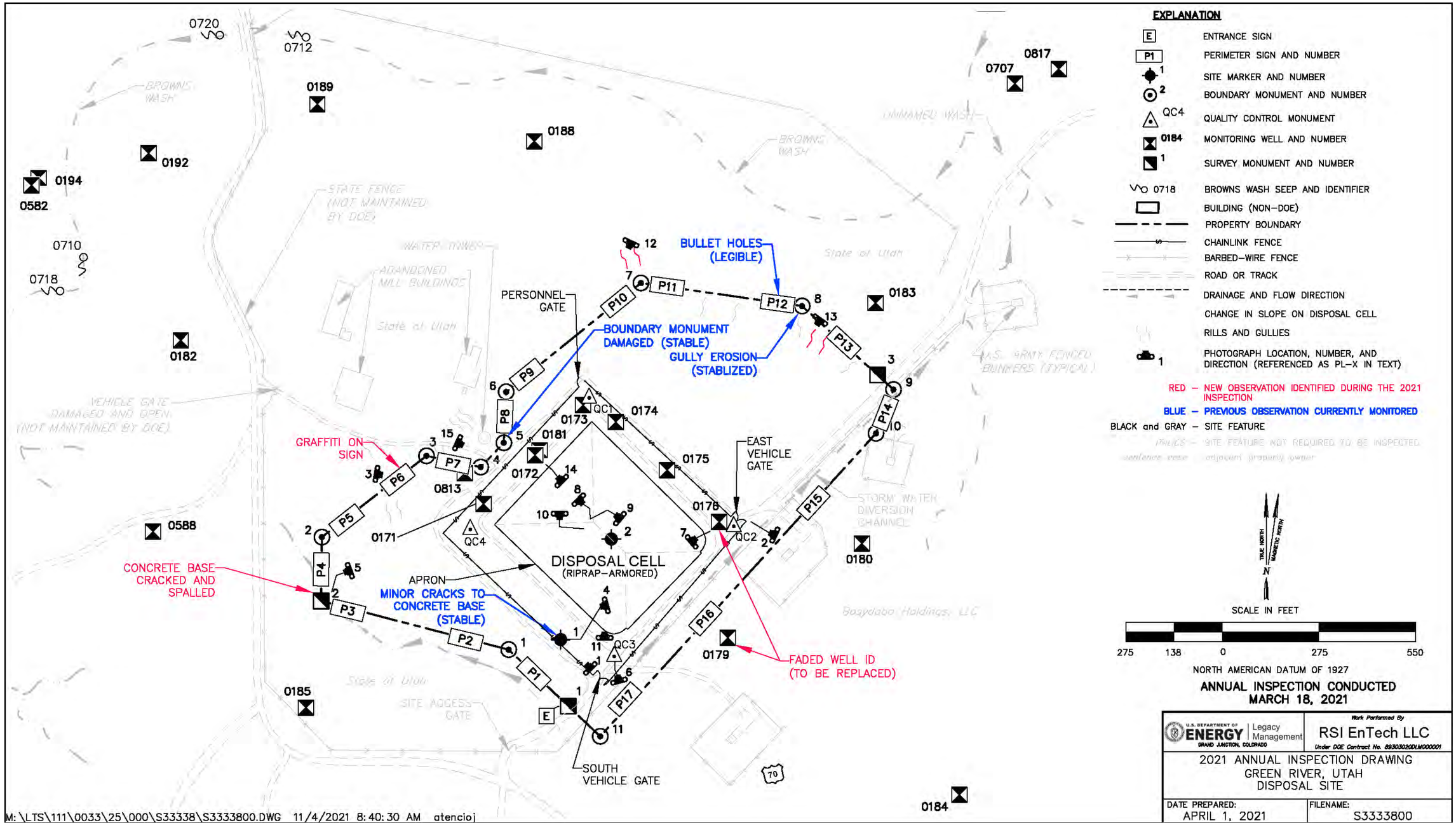


Figure 7-1. 2021 Annual Inspection Drawing for the Green River, Utah, Disposal Site

This page intentionally left blank

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, and SMK-2 is on the crest of the disposal cell. The concrete base of SMK-1 has several minor cracks (PL-4), but they do not compromise the integrity of the base, and repairs are not necessary at this time.

7.4.1.4 Survey and Boundary Monuments

Eleven boundary monuments and three survey monuments delineate the property boundary. Boundary monument BM-5 is bent from being hit by a vehicle, and the concrete base around survey monument SM-2 is cracked and spalled on the ground (PL-5). Repairs of these monuments are not needed at this time.

7.4.1.5 Aerial Survey Quality Control Monuments

Four aerial survey quality control monuments were installed near the four corners of the disposal cell in October 2020 (PL-6). No maintenance needs were identified.

7.4.1.6 Monitoring Wells

Twenty-two monitoring wells are on or near the site. The LTSP establishes four POC wells at the site for postclosure groundwater monitoring. All wellhead protectors observed during the inspection were undamaged and locked. Some of the concrete monitoring well collars were cracked, but the wellhead protectors were stable, and repairs are not necessary. Well identification numbers were faded or missing on several wells (PL-7). Well identification numbers will be reapplied before the next inspection.

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. A small percentage of the rock, including basalt and sedimentary rock, has degraded, but the riprap cover is functioning as designed. Inspectors found no evidence of settling, slumping, erosion, or other modifying process that might affect the integrity of the disposal cell (PL-8, PL-9, and PL-10).

A boulder-filled trench, known as an apron, surrounds the disposal cell. The apron was intact and stable, with no observed erosion along the base of the side slopes. Small erosion rills and soil

piping features (PL-11) were present along portions of the outside edge of the apron. The rills and piping features form as stormwater runoff along the 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 contains the 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 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 stormwater diversion channel, and monitoring wells. The site property boundary is not fenced, and trespassing occurs on the site from several access points through state- and privately-owned 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 to the north and east. The site will continue to be monitored for adverse public use typically indicated by trash, tire ruts, and vandalism. Inspectors did not find new trash dumps or indications of vandalism (except for graffiti on perimeter sign P6) during the inspection.

Signs of erosion appear in multiple areas in the site perimeter. Erosional rills are present on the west side of the site but are not affecting site surveillance features. Rills and gullies are also present along the escarpment northeast of the disposal cell between boundary monument BM-7 and survey monument SM-3 (approximately 400 feet [ft] from the base of the disposal cell) (PL-12 and PL-13). Maximum gully depth in this area is approximately 3 ft, but the erosion appears to be stabilizing. A portion of the stormwater 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 its integrity. Inspectors will continue to monitor these features. No immediate maintenance needs were identified.

7.4.2.3 Outlying Area

The area beyond the site boundary for a distance of 0.25 mile was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. No such impacts were observed. Abandoned buildings and a water tower associated with the former milling activities are northwest of the site (PL-14). 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 is minor; it will continue to be monitored, and trash will be removed.

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-15). Evidence of continued erosion in these areas was apparent but 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

No maintenance needs were identified at the time of the inspection. Well ID numbers will be reapplied before the next inspection.

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 but has yet to receive NRC's concurrence. As a best management practice, LM implemented provisions of the draft GCAP to expand the groundwater monitoring requirements (i.e., additional monitoring wells and analytes). The most recent sampling event occurred in June 2021.

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. The LTSP included monitoring well 0172, but its construction integrity was suspect, and the well was replaced with monitoring well 0181 in 2001 (PL-14). Well 0181 has been monitored as the replacement POC well since 2001. Table 7-2 and Figure 7-2 show the current groundwater monitoring network at the site.

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

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 (GEMS) website (https://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 in the POC wells have been measured manually every year since 1991. The groundwater levels as measured from 1998 to present range from 4085 ft to 4090 ft, with two spikes of 4092.2 ft in 2006 and 2008. (Figure 7-3). The sharp drop in water levels shown in 2004 may have been due to instrument error or human error in recording the original field record. While it is likely this outlier is a result of an error, there is no definitive evidence of error and the data as shown are consistent with available documentation.

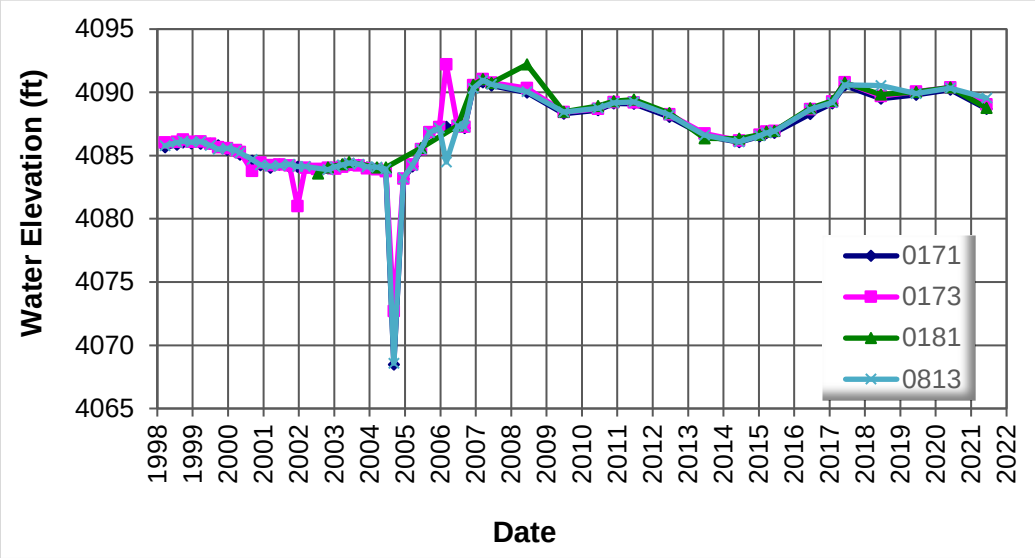


Figure 7-3. Groundwater Elevations at the Green River, Utah, Disposal Site

7.7.2 Disposal Cell Performance Monitoring

Table 7-3 presents the concentration limits in milligrams per liter (mg/L) for POC wells established in the LTSP. The concentration limits determined 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 total dissolved solids 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). Table 7-4 provides the analytical results at the POC wells for the June 2021 sampling event.

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

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

Note:
[a] Nitrate = nitrate plus nitrite as nitrogen.
[b] MCL (40 CFR 192 Table 1 Subpart A).

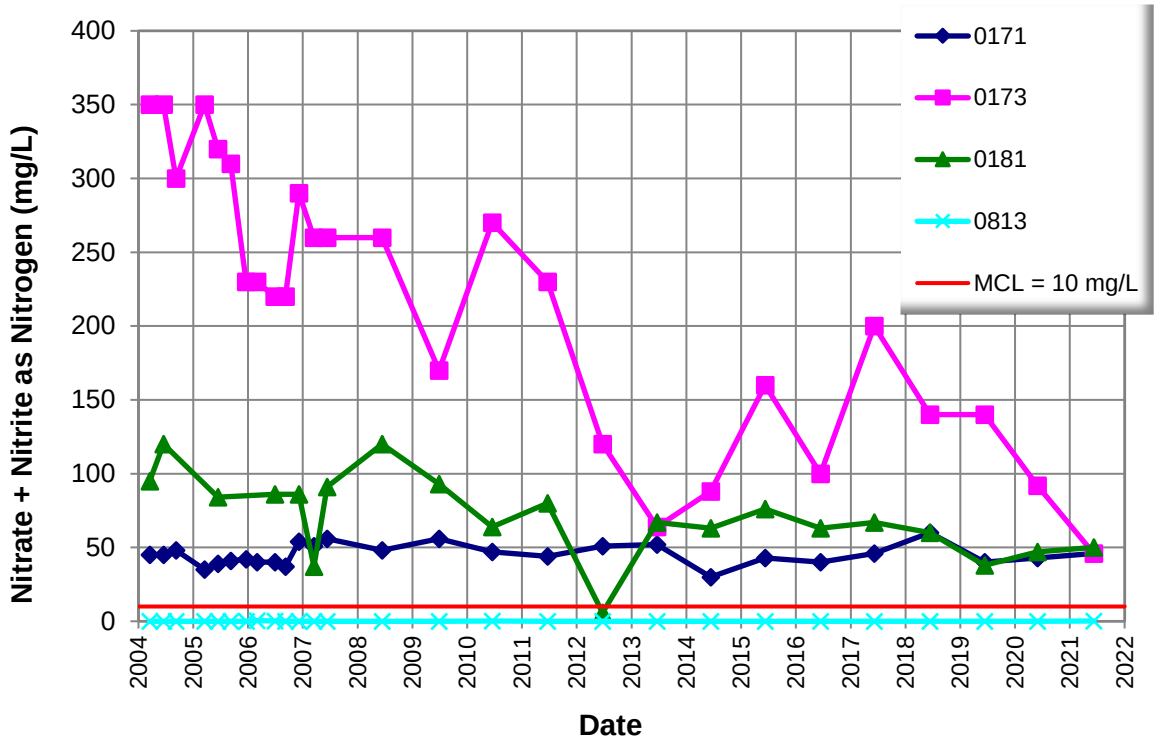
Table 7-4. 2021 Analytical Results for POC Wells at the Green River, Utah, Disposal Site

Monitoring Well	Nitrate[a] (mg/L)	Sulfate (mg/L)	Uranium (mg/L)
0171	46	4200	0.099
0173	46	5300	0.012
0181	50	7500	0.029
0813	0.056 U	3900	0.051

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

Abbreviation:
U = not detected

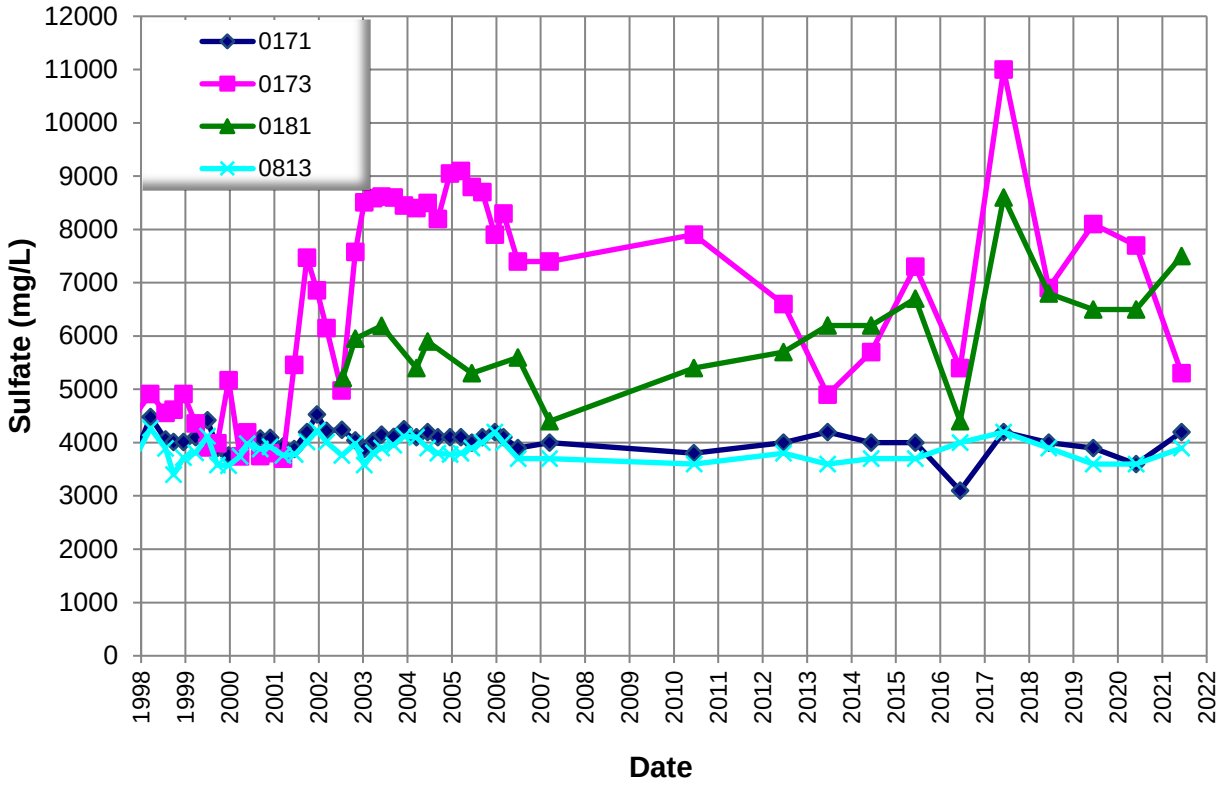
Figure 7-4 through Figure 7-6 show the time-concentration plots for nitrate, sulfate, and uranium along with corresponding MCLs. Nitrate concentrations continue to exceed the MCL in POC wells 0171, 0173, and 0181. The 2021 nitrate concentrations were within the range of historical values for all POC wells (Figure 7-4).



Notes: Results include validated data only; results below the detection limit are presented at the laboratory reported value. Well 0813 is plotted at the detection limit of 0.056 mg/L.

Figure 7-4. Nitrate Concentrations at POC Wells at the Green River, Utah, Disposal Site

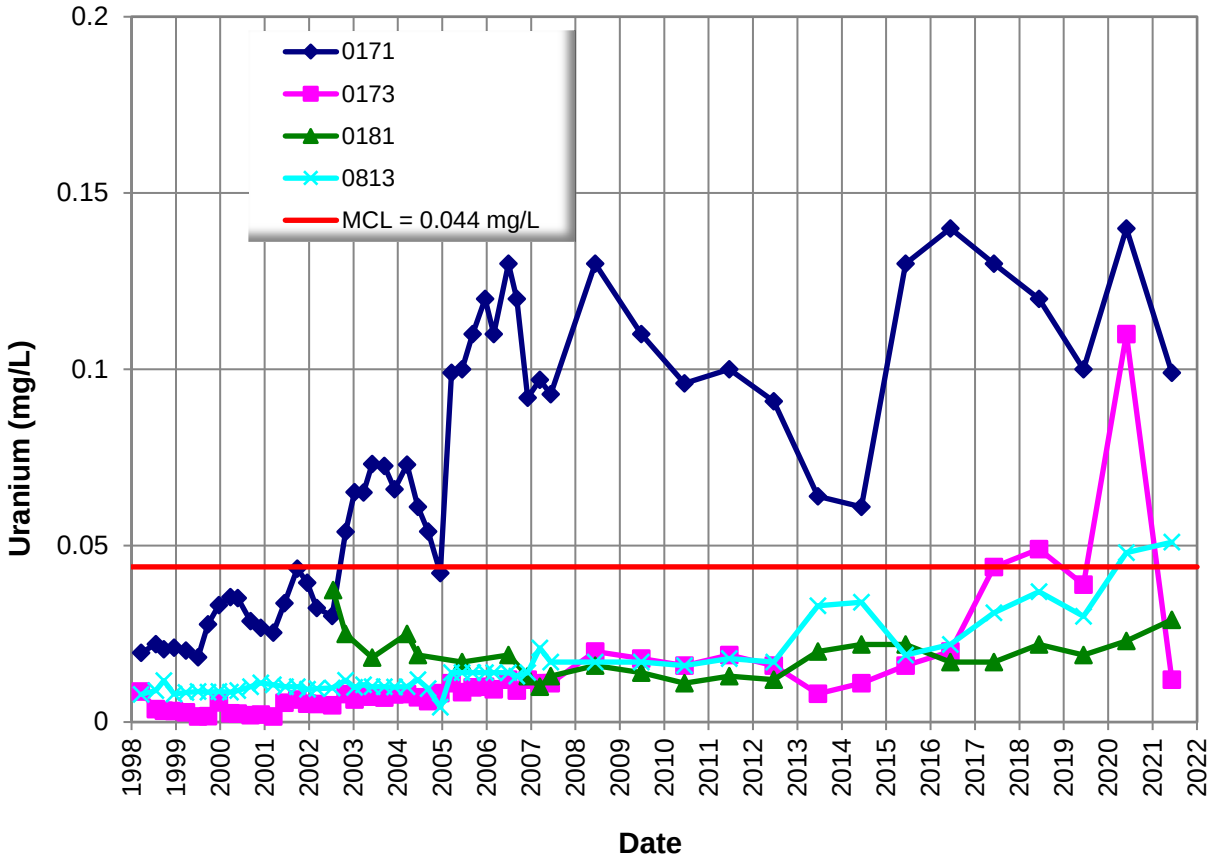
Sulfate concentrations exceeded the LTSP background concentrations in all POC wells except POC well 0813. The 2021 sulfate concentrations were within the range of historical values for all POC wells (Figure 7-5).



Note: Results include validated data only; results below the detection limit are presented at the laboratory reported value.

Figure 7-5. Sulfate Concentrations at POC 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 the MCL of 0.044 mg/L in 2018 and 2020 (Figure 7-6). Well 0181 remains below the uranium concentration limit. The uranium concentration at well 0813 exceeded the standard for the first time in the 2020 and again in the 2021 event. Uranium concentrations in 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 2021 uranium concentrations are within the range of historical values in POC wells 0171, 0173, and 0181 and exceed the highest historical values in POC well 0813.



Note: Results include validated data only; results below the detection limit are presented at the laboratory reported value.

Figure 7-6. Uranium Concentrations at POC 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 uranium (well 0813). 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), 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	315	Chainlink Security Fence and Site Marker SMK-1 in Background
PL-2	295	East Vehicle Gate and Fence
PL-3	100	Graffiti on Perimeter Sign P6
PL-4	255	Minor Cracks in the Base of Site Marker SMK-1
PL-5	250	Cracked and Spalled Concrete Around Survey Monument SM-2
PL-6	345	Aerial Survey Quality Control Monument
PL-7	50	Faded Identification Numbers on Monitoring Well 0176
PL-8	135	Site Marker SMK-2 on Disposal Cell Top Slope
PL-9	310	Disposal Cell Northwest Side Slope
PL-10	180	Disposal Cell Southwest Side Slope
PL-11	0	Soil Piping on Edge of Rock Apron
PL-12	205	Soil Erosion by Boundary Monument BM-7 (Offsite)
PL-13	215	Soil Erosion by Boundary Monument BM-8 (Onsite)
PL-14	315	Monitoring Wells 0172 and 0181 (Onsite) and Abandoned Mill Buildings (Offsite)
PL-15	115	Soil Erosion (Offsite)

PL-1. Chainlink Security Fence and Site Marker SMK-1 in Background

PL-2. East Vehicle Gate and Fence

PL-3. Graffiti on Perimeter Sign P6

PL-4. Minor Cracks in the Base of Site Marker SMK-1

PL-5. Cracked and Spalled Concrete Around Survey Monument SM-2

PL-6. Aerial Survey Quality Control Monument

PL-7. Faded Identification Numbers on Monitoring Well 0176

PL-8. Site Marker SMK-2 on Disposal Cell Top Slope

PL-9. Disposal Cell Northwest Side Slope

PL-10. Disposal Cell Southwest Side Slope

PL-11. Soil Piping on Edge of Rock Apron

PL-12. Soil Erosion by Boundary Monument BM-7 (Offsite)

PL-13. Soil Erosion by Boundary Monument BM-8 (Onsite)

PL-14. Monitoring Wells 0172 and 0181 (Onsite) and Abandoned Mill Buildings (Offsite)

PL-15. Soil Erosion (Offsite)

This page intentionally left blank

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 inspection on September 7, 2021. 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 items that were addressed following the annual inspection.

The most recent groundwater sampling event occurred in July 2021. The next scheduled monitoring event will occur in 2026. Groundwater monitoring results were below the site-specific uranium action level in the six 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 (DOE 1997) (LTSP) 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 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 NRC general license in 1997. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, LM 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 channels, 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 7, 2021. The inspection was conducted by J. Lobato and D. Atkinson of the Legacy Management Support contractor. J. Dayvault (LM), M. Hurt (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 whether maintenance or additional inspection and monitoring are needed. 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, including site surveillance features and inspection areas, in black and gray font. 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 2021 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 with bullet damage identified in 2020 was replaced before the inspection. No other 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. In 2019, fence flagging (PL-1) was added to protect sage-grouse and antelope that occupy the area. The perimeter fence was intact.

Two gates—one on the east fence line and the other on the north fence line—provide access 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 sign P3 was missing, and other perimeter signs constructed of plastic were faded and curling and were replaced following the inspection. Bullet damage to perimeter sign P1, identified in 2019, was replaced after the 2021 inspection. No other maintenance needs were identified.

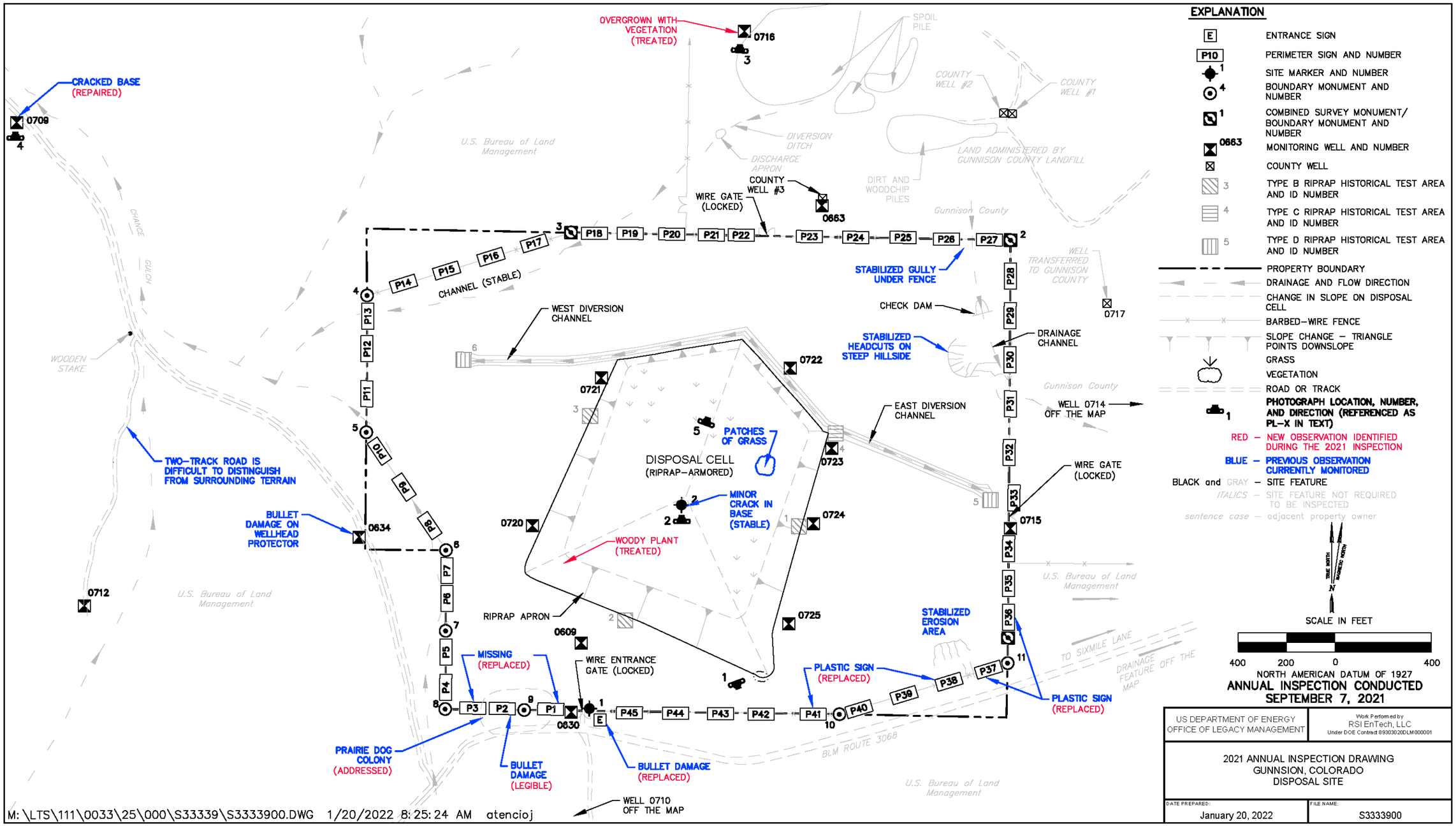


Figure 8-1. 2021 Annual Inspection Drawing for the Gunnison, Colorado, Disposal Site

This page intentionally left blank

8.4.1.3 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-2) is on the top slope of the disposal cell. The base of site marker SMK-2 has a small, insignificant crack and remains stable. No maintenance needs were identified.

8.4.1.4 Survey and Boundary Monuments

Three combined survey and boundary monuments and eight additional boundary monuments delineate the property boundary. 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 wellhead protector of monitoring wells 0634 and 0712, but the well casings are not impacted and remain functional. The bullet-damaged locks reported in the 2020 inspection report (wells 0630 and 0712) will be replaced before the next inspection. The well casing at well 0709 had a cracked base and was repaired following the 2021 inspection.

Gunnison County landfill operators have placed concrete barriers to protect monitoring well 0716, which is on landfill property, from landfill activities. Vegetation near well 0716 was beginning to overgrow the well (PL-3) and was treated following the inspection. The cracked base of monitoring well 0709 (PL-4) was repaired. No other 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

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. Several small grasses were discovered on the cell top slope (PL-5). This vegetation was treated as necessary following the inspection. No other maintenance needs were identified.

8.4.2.2 Disposal Cell Side Slopes, Apron, and Diversion Channels

The disposal cell, completed in 1995, occupies 29 acres and is armored with basalt riprap to control erosion. Basalt riprap armors the disposal cell side slopes, the apron that collects and diverts stormwater runoff from the disposal cell, and the two diversion channels that protect the disposal cell from precipitation run-on. 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. A small woody plant growing on the side slope was identified and was treated following the inspection.

Stormwater runoff from the disposal cell occasionally ponds in a low-lying area at the southeast corner of the disposal cell apron. 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; any water that ponds there is below the elevation of tailings placed under the engineered cover. No other maintenance needs were identified.

8.4.2.3 Area Between the Disposal Cell and the Site Boundary

Reclaimed and undisturbed areas comprise the area between the disposal cell and the site boundary. In general, the vegetation in the reseeded, reclaimed areas consists of well-established grass; native plants are much less abundant and less diverse in reclaimed areas than they are in undisturbed areas. Former erosion areas are stable and 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. A prairie dog colony that has been observed along the southwestern boundary of the site has grown to a size that may affect the disposal site. The holes in the colony were plugged following the inspection.

Gunnison County owns the land that adjoins the site boundary to the north and east and uses the land for a municipal landfill. The nearest landfill operations continue to be approximately 400 feet north of the site. Although landfill activities do not affect 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 cross gradient from the disposal cell. The only current concern for activities that could affect a site asset is a spoil pile near monitoring well 0716 (Figure 8-1 and PL-3). Inspectors will continue to monitor this area. No other maintenance needs were identified.

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

Below is a summary of Gunnison site maintenance activities that were completed following the inspection:

- Treated vegetation on top slope and side slope of disposal cell
- Replaced remaining plastic perimeter signs
- Replaced entrance sign and perimeter signs P1 and P3
- Treated vegetation around monitoring well 0716
- Repaired concrete base around monitoring well 0709
- Plugged prairie dog colony holes

Damaged wellhead protector locks will be replaced before the next inspection. No other maintenance needs were identified.

8.7 Environmental Monitoring

8.7.1 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 2021. Groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System (GEMS) website https://gems.lm.doe.gov/#site=GUD.

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, relatively high mobility in groundwater, and low concentration in background groundwater samples (DOE 1997) (Figure 2.5). 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). Water levels are measured at each monitoring well during groundwater monitoring events.

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

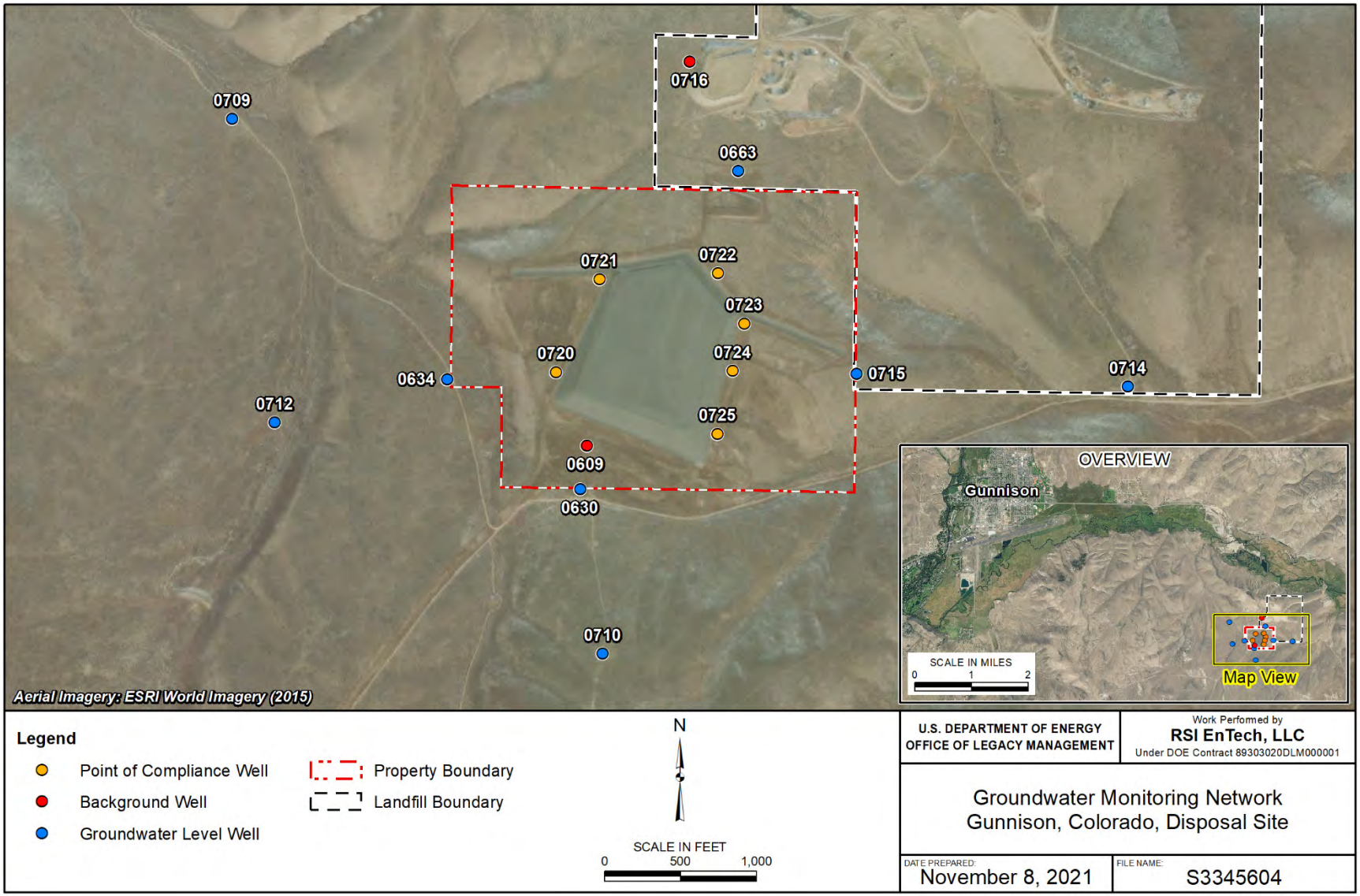
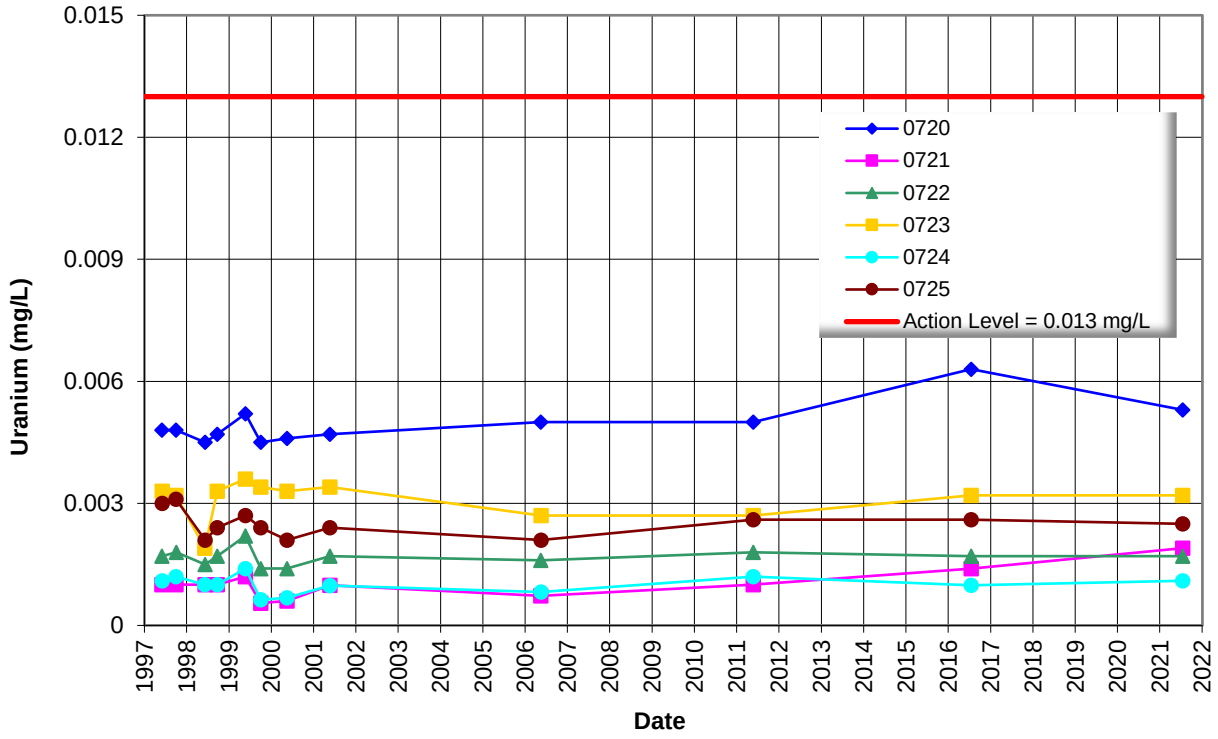


Figure 8-2. Groundwater Monitoring Network at the Gunnison, Colorado, Disposal Site

The concentrations of uranium in samples collected from POC wells ranged from 0.001 mg/L to 0.005 mg/L as shown in Table 8-3 and in a time-versus-concentration graph (Figure 8-3). Uranium concentrations were consistent with historical results in wells 0720, 0722, 0723, 0724, and 0725; however, they slightly exceeded the historical maximum in well 0721. Uranium results from the POC wells were below the action level of 0.013 mg/L.

Table 8-3. July 2021 Uranium Concentrations in POC Wells

Analyte	Action Level (mg/L)	Location	Concentration (mg/L)
Uranium	0.013	0720	0.005
		0721	0.002
		0722	0.002
		0723	0.003
		0724	0.001
		0725	0.003

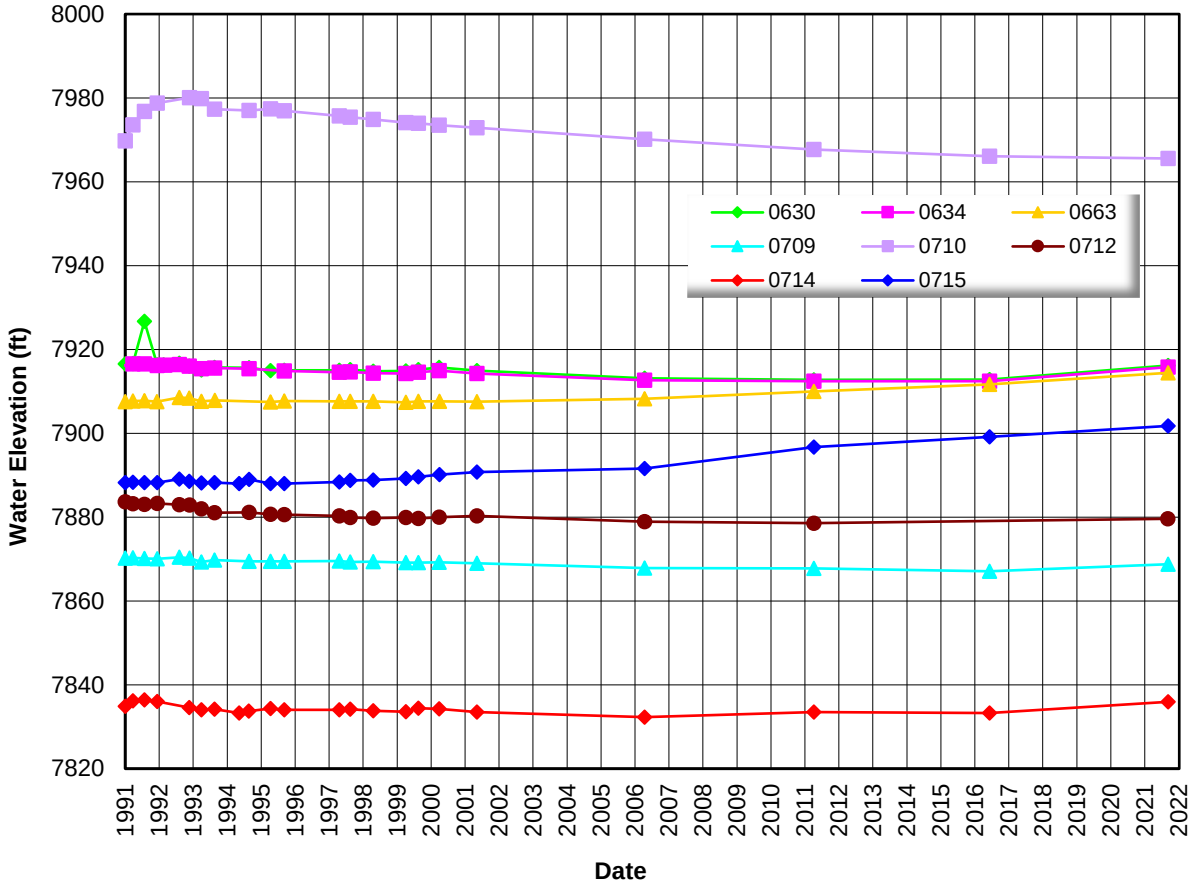


Note: Results include validated data only; results below the detection limit are presented at the laboratory reported value.

Figure 8-3. Uranium in Groundwater at POC Wells at the Gunnison, Colorado, Disposal Site

Additionally, samples were analyzed for major anions (chloride and sulfate) and cations (calcium, magnesium, potassium, and sodium), metals (iron and manganese), and total dissolved solids as indicators of general water quality. These results were consistent with historical results, indicating no significant change in general water chemistry. The consistent general water quality, along with uranium concentrations below the action level, indicates that the disposal cell continues to perform as an efficient containment system.

Groundwater elevations from the entire monitoring network were measured in July 2021. In general, the measurements for groundwater elevations in groundwater level monitoring wells (Figure 8-4) show a gradual groundwater elevation decrease before and after completion of the disposal cell in 1995. Wells 0663 and 0715 are the exception, with groundwater elevations having increased approximately 6.7 and 14 feet, respectively, since 1995. In addition, with the exception of well 0710, the groundwater elevation in each well increased from 2016 to 2021 (Figure 8-4 and Figure 8-5).



Notes: Well 0712 was not sampled in 2016 due to a broken riser. Well 0715 is shown on both graphs for comparison purposes.

Figure 8-4. Groundwater Elevations at Selected Monitoring Wells at the Gunnison Disposal Site

Groundwater elevations from wells 0663 and 0715 are plotted along with the POC wells (0720 through 0725) and the background wells (0609 and 0716) for comparison (Figure 8-5). Similar increases in groundwater elevations are seen for these other wells, except for wells 0609 and 0720, located just beyond the southwestern corner of the cell (Figure 8-2). A cause for the increasing groundwater elevations at wells 0663, 0715, 0716, and 0721 through 0725 has not been determined, but further evaluation is planned in 2022. Water level trends in these wells will continue to be monitored to determine if observed trends become a basis of concern.

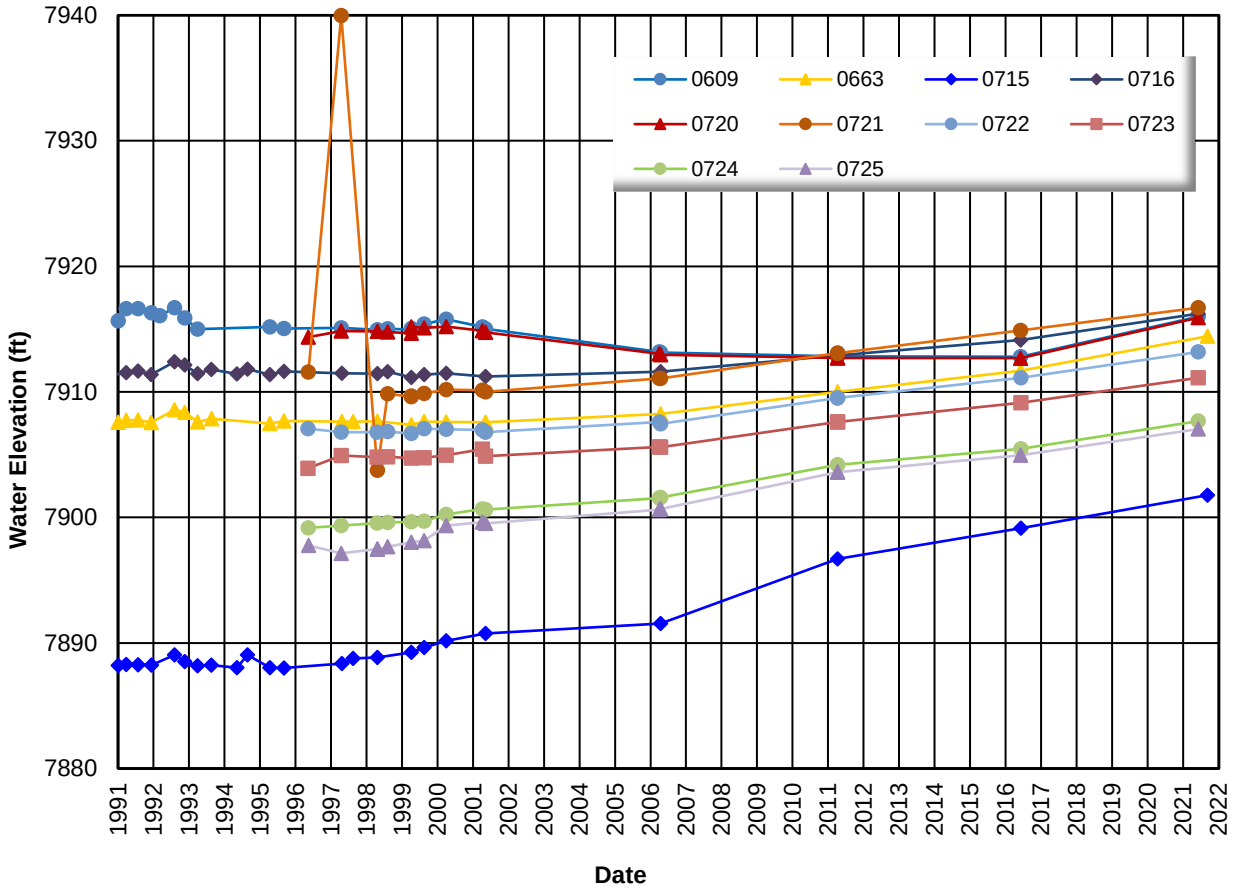


Figure 8-5. Groundwater Elevations at POC Wells, Background Monitoring Wells, and Wells 0715 and 0663 at the Gunnison Disposal Site

8.8 Corrective Action

Corrective actions may be warranted to address hazardous conditions that create a potential health and safety problem or conditions that may affect the integrity of the disposal cell or compliance with 40 CFR 192.04. No need for corrective action was identified as part of this inspection.

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.

8.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	160	Southeast Perimeter Fence with Flagging
PL-2	—	Site Marker SMK-2
PL-3	5	Well 0716 Overgrown with Vegetation and Nearby Spoil Pile
PL-4	0	Cracked Base of Well 0709
PL-5	20	Vegetation on Disposal Cell Top Slope

Note:
— = Photograph taken vertically from above.

PL-1. Southeast Perimeter Fence with Flagging

PL-2. Site Marker SMK-2

PL-3. Well 0716 Overgrown with Vegetation and Nearby Spoil Pile

PL-4. Cracked Base of Well 0709

PL-5. Vegetation on Disposal Cell Top Slope

This page intentionally left blank

9.0 Lakeview, Oregon, Disposal Site

9.1 Compliance Summary

The Lakeview, Oregon, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected June 30, 2021. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified minor maintenance needs but no 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. With the approval of the U.S. Nuclear Regulatory Commission (NRC) in 2019 to discontinue rock gradation monitoring at the site (Mandeville 2019), rock gradation monitoring was not performed in 2021. The 2021 annual inspection found 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 June 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 (DOE 1994) (LTSP) 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 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, LM 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 30, 2021. The inspection was conducted by C. Wentz and D. Traub of the Legacy Management Support (LMS) contractor. P. Jagim (LMS site engineer) 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 whether maintenance or additional inspection and monitoring are needed.

9.4.1 Site Surveillance Features

Figure 9-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. 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 2021 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 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. The entrance gate was locked and undamaged (PL-1). The entrance sign is attached to a steel post set in concrete along the access road and was undamaged. A pedestrian gate in the northwest corner of the site was locked and undamaged. No maintenance needs were identified.

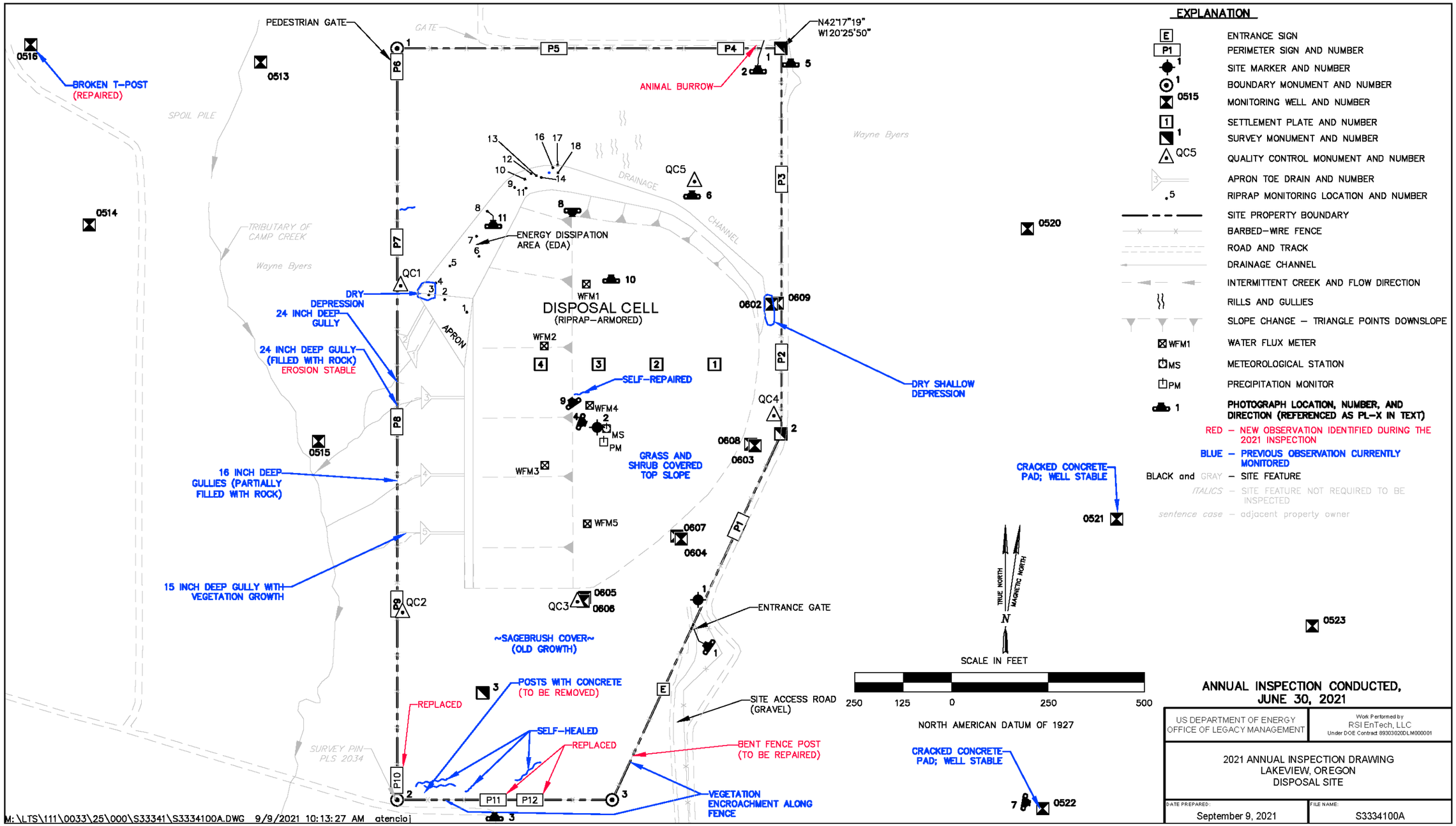


Figure 9-1. 2021 Annual Inspection Drawing for the Lakeview, Oregon, Disposal Site

This page intentionally left blank

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. Some vegetation is growing near, and entangled in, the perimeter fence line, but the fence appeared stable and remains functional. A bent fence post was observed near the southeast corner of the site and will be fixed during the next maintenance event. A small animal burrow (PL-2) was identified near the northeast corner of the fence line, but it is not a concern to the security or integrity of the fence.

There are 12 perimeter signs, attached to steel posts set in concrete, positioned along the property boundary. Perimeter signs P10, P11, and P12, identified in the 2020 inspection as faded, were replaced with new signs (PL-3). No new 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-4) is on the top slope of the disposal cell. No maintenance needs were identified.

9.4.1.4 Survey and Boundary Monuments

Three survey monuments (PL-5) and three boundary monuments delineate the property boundary. No maintenance needs were identified.

9.4.1.5 Aerial Survey Quality Control Monuments

In August 2019, five aerial survey quality control monuments (PL-6) were installed at the site in preparation for a baseline aerial survey of the disposal cell. These quality control monuments were inspected in 2021. No maintenance needs were identified.

9.4.1.6 Monitoring Wells

The site has 12 downgradient groundwater monitoring wells with four wells offsite to the east. Four upgradient wells are offsite to the west. A few of the concrete bases were cracked (PL-7), but the wellhead protectors remain stable. The wellhead protectors were locked and undamaged. The broken T-post adjacent to well 0516 observed during the 2020 inspection was removed during the 2021 inspection. No additional 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, adjacent drainage channel, and aprons; 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-repaired from natural weather processes. No additional changes were noted during the inspection. 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 (PL-8 and PL-9). No erosion was observed during the inspection at the crest of the west side slope and the disposal cell top slope, which appears to be stable. Inspectors will continue to monitor the transition zone between the disposal cell top slope and the west side slope for erosion development. There was no evidence of settling, slumping, erosion, or any other modifying process on the top of the disposal cell that might affect the integrity of the disposal cell.

LM is participating in an NRC-sponsored project to investigate the effect of soil-forming processes on the performance of the radon barrier on UMTRCA disposal cells. In October 2017, researchers excavated through the cover materials (soil, riprap, bedding material, and underlying radon barrier) at six locations on the disposal cell (five on the top slope 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 that armors 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 mean diameter (D_{50}) value of the riprap on the west side slope through gradation monitoring to ensure the riprap remains large enough to protect the disposal cell from

erosion during a major precipitation event, as designed. The thickness of the riprap on the west side slope was doubled during construction due to concerns over rock quality.

In 2015, LM proposed to replace annual gradation monitoring with inspection of 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 allows LM to assess conditions that may indicate the development of potential failure points along the side slope. In 2019, NRC concurred with the discontinuation of rock gradation monitoring (Mandeville 2019); therefore, it was not performed in 2021. DOE is updating the LTSP to reflect this change. No rills or erosional features were observed along the interface between the vegetated soil and rock top slope during the inspection (PL-8 and PL-9).

Minor rock degradation has been observed in the EDA since monitoring began at the original 10 photograph locations established in 1997 and at the 8 additional locations established in 2000. Annual photographic monitoring of the 18 locations for long-term rock monitoring was conducted during the 2021 inspection (PL-11). In 2018, it was observed that some of the numbered rocks had faded labels, and they were repainted in 2019. No significant degradation of the EDA rock has been observed since monitoring began.

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. 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 stormwater 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 stormwater runoff from affecting 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. An area of dense, tall grass near Toe Drains 1 and 3 suggests that conditions are periodically wetter in this area because stormwater runoff is channeled there by control features. No ponded water was observed during the inspection. Minor erosion was observed near the fence line near Toe Drain 3. 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 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, in a drainage area on the site north of perimeter sign P7, north of perimeter sign P8, and in the southwest corner of the site. These gullies and rills were identified during previous annual inspections but appear to be self-repaired and stable, as no significant changes were observed in 2021. 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 fence posts with cement bases were too heavy to remove by hand. Though this remaining debris does not affect site integrity, 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

During the inspection, two maintenance items identified during the 2020 inspection were completed:

- Removed broken T-post at well 0516
- Replaced faded perimeter signs P10, P11, P12

Inspectors documented minor maintenance to be addressed in the future:

- Replacement of a bent fence post near the southeast corner of the site
- Removing the signposts with concrete bases from the southwest corner of the site

No other maintenance needs were identified.

9.7 Groundwater Monitoring

In accordance with the LTSP, LM conducts groundwater monitoring every 5 years to demonstrate compliance with established groundwater quality protections standards. The most recent sampling event occurred 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 9-2). 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 (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 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

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 2014 results, all cadmium concentration results were below the laboratory detection limit of 0.000083 milligrams per liter, and uranium concentrations remained stable or have slightly increased (DOE 2020).

All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System (GEMS) website (https://gems.lm.doe.gov/#site=LKD). The *2019 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites* (DOE 2020) shows the most recent monitoring results. 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. The next disposal cell groundwater monitoring event is scheduled for 2024.

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.

Figure 9-2. Groundwater Monitoring Network, Lakeview, Oregon, Disposal Site

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), 2020. *2019 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites,* LMS/S26685, March.

Mandeville, 2019. Doug Mandeville, project manager, U.S. Nuclear Regulatory Commission, letter (about Lakeview Rock Degradation Monitoring Program) to Jason Nguyen, UMTRCA site manager, U.S. Department of Energy Office of Legacy Management, October 11.

9.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	305	Site Entrance Gate
PL-2	—	Animal Burrow near Northeast Corner of Site
PL-3	—	New Perimeter Sign P11
PL-4	110	Granite Site Marker 2
PL-5	—	Survey Monument 1
PL-6	—	Quality Control Monument QC5
PL-7	100	Monitoring Well 0522
PL-8	180	Top Edge of West Side Slope
PL-9	325	Top Edge of West Side Slope
PL-10	—	Reclamation of 2018 Soil Cover Study Test Area
PL-11	—	Riprap Monitoring Location No. 8 in the Energy Dissipation Area

Note:
— = Photograph taken vertically from above.

PL-1. Site Entrance Gate

PL-2. Animal Burrow near Northeast Corner of Site

PL-3. New Perimeter Sign P11

PL-4. Granite Site Marker 2

PL-5. Survey Monument 1

PL-6. Quality Control Monument QC5

PL-7. Monitoring Well 0522

PL-8. Top Edge of West Side Slope

PL-9. Top Edge of West Side Slope

PL-10. Reclamation of 2018 Soil Cover Study Test Area

PL-11. Riprap Monitoring Location No. 8 in the Energy Dissipation Area

This page intentionally left blank

10.0 Lowman, Idaho, Disposal Site

10.1 Compliance Summary

The Lowman, Idaho, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on August 18, 2021. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified no maintenance needs and found no cause for a follow-up inspection. Groundwater monitoring is not required and was discontinued in 2004.

10.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 2005) (LTSP) in accordance with procedures established to comply with the requirements of Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 10-1 lists these requirements.

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

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

10.3 Institutional Controls

The 18-acre site, identified by the property boundary shown in Figure 10-1, is owned by the United States and was accepted under the U.S. Nuclear Regulatory Commission general license in 1994. The U.S. Department of Energy (DOE) is the licensee and, in accordance with the requirements for UMTRCA Title I sites, the Office of Legacy Management (LM) is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gate and sign, perimeter signs, site markers, and survey and boundary monuments.

10.4 Inspection Results

The site, 0.5 mile east of Lowman, Idaho, was inspected on August 18, 2021. The inspection was conducted by B. Mays and D. Traub of the Legacy Management Support (LMS) contractor. K. Kreie and P. Kerl of LM attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate whether maintenance or additional inspection and monitoring are needed.

10.4.1 Site Surveillance Features

Figure 10-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Site features that are present but not required to be inspected are shown in italic font, and new observations identified during the 2021 annual inspection are shown in red. Inspection results are described in the following subsections. Photographs to support specific observations are identified in the text and in Figure 10-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 10.10.

10.4.1.1 Access Road, Entrance Gate, and Entrance Sign

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

10.4.1.2 Perimeter Signs

There are 18 perimeter signs attached to steel posts set in concrete positioned along the unfenced property boundary (PL-2). Several perimeter signs (P2, P3, P4, P13, and P15) have bullet damage but remain legible. Perimeter sign P3 was rotated about 90 degrees from its original position but was repaired during the inspection. Perimeter sign P7 is slightly bent from tree fall but remains legible. No maintenance needs were identified.

10.4.1.3 Site Markers

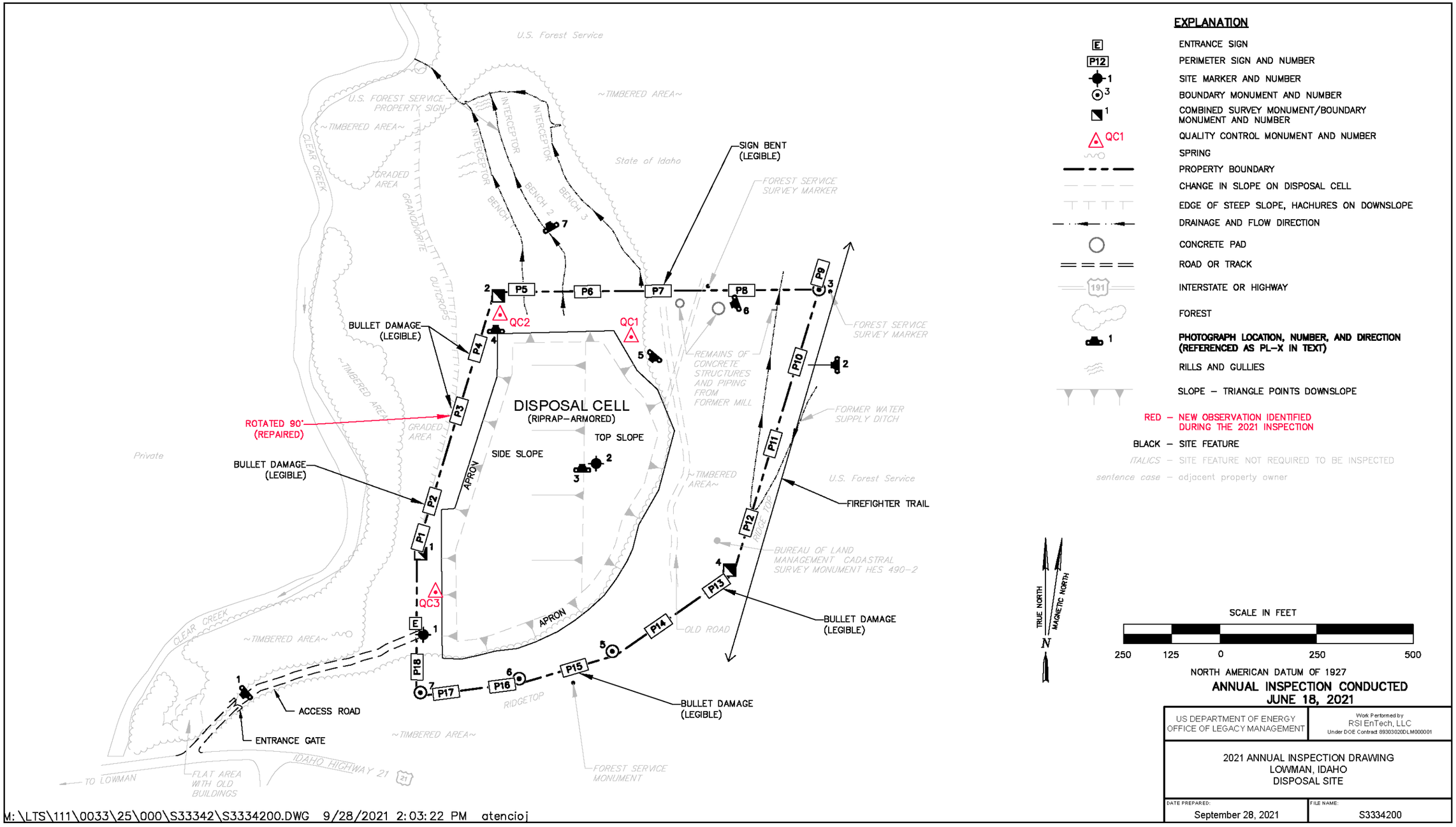
The site has two granite site markers. Site marker SMK-1 is just inside the southwest property boundary, and site marker SMK-2 (PL-3) is on the top slope of the disposal cell. Lichen is growing on the surface of both site markers, but it is easily removable by hand and does not detract from the legibility of the markers. No maintenance needs were identified.

10.4.1.4 Survey and Boundary Monuments

Three combined survey and boundary monuments and four boundary monuments delineate the property boundary. Steel T-posts are installed next to the survey and boundary monuments to help inspectors locate them. Several years ago, the U.S. Department of Agriculture (USDA) surveyed its lands managed by the U.S. Forest Service (USFS) and placed boundary monuments along the shared DOE-USDA (USFS) border. Inspectors noted that the survey monuments were about 5 to 15 ft outside DOE survey monuments. No maintenance needs were identified.

10.4.1.5 Aerial Survey Quality Control Monuments

Three aerial survey quality control monuments, installed in October 2020, provide ground truth for aerial surveys at the site (PL-4). The quality control monuments were inspected during the 2021 annual inspection. No maintenance needs were identified.



EXPLANATION

- E — ENTRANCE SIGN
- P12 — PERIMETER SIGN AND NUMBER
- 1 — SITE MARKER AND NUMBER
- 3 — BOUNDARY MONUMENT AND NUMBER
- 1 — COMBINED SURVEY MONUMENT/BOUNDARY MONUMENT AND NUMBER
- QC1 — QUALITY CONTROL MONUMENT AND NUMBER
- SPRING
- PROPERTY BOUNDARY
- CHANGE IN SLOPE ON DISPOSAL CELL
- EDGE OF STEEP SLOPE, HACHURES ON DOWNSLOPE
- DRAINAGE AND FLOW DIRECTION
- CONCRETE PAD
- ROAD OR TRACK
- 191 — INTERSTATE OR HIGHWAY
- FOREST
- 1 — **PHOTOGRAPH LOCATION, NUMBER, AND DIRECTION (REFERENCED AS PL–X IN TEXT)**
- RILLS AND GULLIES
- SLOPE – TRIANGLE POINTS DOWNSLOPE

RED – NEW OBSERVATION IDENTIFIED DURING THE 2021 INSPECTION

BLACK – SITE FEATURE

ITALICS – SITE FEATURE NOT REQUIRED TO BE INSPECTED

sentence case – adjacent property owner

TRUE NORTH
MAGNETIC NORTH
N

SCALE IN FEET

250 125 0 250 500

NORTH AMERICAN DATUM OF 1927

ANNUAL INSPECTION CONDUCTED JUNE 18, 2021

US DEPARTMENT OF ENERGY OFFICE OF LEGACY MANAGEMENT	Work Performed by RSI EnTech, LLC Under DOE Contract 89303020DLM000001

2021 ANNUAL INSPECTION DRAWING
LOWMAN, IDAHO
DISPOSAL SITE

DATE PREPARED:	FILE NAME:
September 28, 2021	S3334200

Figure 10-1. 2021 Annual Inspection Drawing for the Lowman, Idaho, Disposal Site

This page intentionally left blank

10.4.2 Inspection Areas

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

10.4.2.1 Top and Side Slopes of the Disposal Cell

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

Natural vegetation continues to encroach on the top and side slopes of the disposal cell. Although the LTSP states that control of vegetation growth on the cell is not needed, LM concluded that controlling the growth of conifers—primarily ponderosa pine—would be a best management practice. Unlike the shrubs and other vegetation growing on the disposal cell, mature conifers could potentially become uprooted during windstorms and damage the surface of the disposal cell. Numerous ponderosa pine trees were observed on the disposal cell top and side slopes and were cut down and left in place in September 2018. Other plants growing on the disposal cell were not removed, as they do not present a physical threat to the integrity of the disposal cell (PL-5). No maintenance needs were identified.

10.4.2.2 Area Between the Disposal Cell and the Site Boundary

The steep slopes east and south of the disposal cell are stable and vegetated with well-established ponderosa pines, shrubs, and grasses. Several features from historical milling operations remain on the steep hillside east of the disposal cell, including a water-supply ditch and the remains of a water piping system from former milling operations (PL-6). The slopes north and west of the disposal cell were highly disturbed during site remediation, but they are now stable and vegetated. No maintenance needs were identified.

10.4.2.3 Outlying Area

The area within 0.25 mile of the site boundary was inspected for evidence of construction, development, logging, or changes in land use that might affect the site. No changes were observed in the area across Clear Creek to the west, where there are several cabins and campsites. USFS manages the areas east and south of the site, and those areas remain visually unchanged from previous inspections. The area along Highway 21 east of the site does not show evidence of new development. A wildland firefighter trail was identified during the 2020 inspection outside the site boundary along the ridgeline east of the site. The trail does not affect the integrity of the site.

The reclaimed area north of the disposal cell and outside the site boundary is a steep area owned by the state. LM installed three interceptor benches across the steep slope in this area in 1998 to

intercept stormwater runoff and route it offsite into Clear Creek. Over the years, minor erosion has breached the benches in several locations, and LM has repaired such erosion on numerous occasions, most recently in October 2016. The three interceptor benches (PL-7) and a collection ditch are inspected annually to ensure that erosion in this area does not affect overall site stability. During this year's inspection, the 2016 repairs appeared intact, and LM will continue to monitor the area as the vegetation continues to establish.

10.5 Follow-Up Inspections

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

10.6 Maintenance

No maintenance needs were identified.

10.7 Emergency Response

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

10.8 Environmental Monitoring

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

10.9 References

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

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

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

10.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	230	Disposal Site Entrance Gate
PL-2	270	Perimeter Sign P10
PL-3	—	Site Marker SMK-2
PL-4	—	Quality Control Monument QC-2
PL-5	220	Disposal Cell Cover
PL-6	250	Remains of Concrete and Piping from Former Milling Operations
PL-7	330	Interceptor Bench 2

Note:
— = Photograph taken vertically from above.

PL-1. Disposal Site Entrance Gate

PL-2. Perimeter Sign P10

PL-3. Site Marker SMK-2

PL-4. Quality Control Monument QC-2

PL-5. Disposal Cell Cover

PL-6. Remains of Concrete and Piping from Former Milling Operations

PL-7. Interceptor Bench 2

11.0 Maybell, Colorado, Disposal Site

11.1 Compliance Summary

The Maybell, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on September 2, 2021. Standing water was observed in the disposal cell apron on the eastern toe slope. Inspectors identified several minor maintenance needs but found no cause for a follow-up inspection. Groundwater monitoring is not required.

11.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 2008) (LTSP) 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 11-1 lists these requirements.

Table 11-1. License Requirements for the Maybell, Colorado, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Sections 3.3 and 3.4	Section 11.4	(b)(3)
Follow-Up Inspections	Section 3.5	Section 11.5	(b)(4)
Maintenance	Section 3.6	Section 11.6	(b)(5)
Emergency Measures	Section 3.6	Section 11.7	(b)(5)
Environmental Monitoring	Section 3.7	Section 11.8	(b)(2)

11.3 Institutional Controls

The 251-acre site, identified by the property boundary shown in Figure 11-1, is owned by the United States and was accepted under the NRC general license in 1999. The U.S. Department of Energy (DOE) is the licensee and, in accordance with the requirements for UMTRCA Title I sites, the Office of Legacy Management (LM) 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 perimeter (warning) signs, site markers, and survey and boundary monuments.

11.4 Inspection Results

The site, 25 miles west of Craig, Colorado, was inspected on September 2, 2021. The inspection was conducted by J. Cario and B. Mays of the Legacy Management Support contractor. 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 whether maintenance or additional inspection and monitoring are needed.

11.4.1 Site Surveillance Features

Figure 11-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. 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 2021 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 11-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 11.10.

11.4.1.1 Access Road, Entrance Gate, and Entrance Sign

Access to the site is from the gravel-surfaced Moffat County Road 53, which runs north from U.S. Highway 40 approximately 8 miles east of Maybell, Colorado. County Road 53 ends at an unlocked gate near the northeast corner of the site (approximately 3 miles from the highway). The road continues west as a dirt two-track road directly north of the site. From the end of County Road 53 to the site entrance gate (and beyond, to the UMTRCA Title II Maybell West, Colorado, Disposal Site), LM is responsible for road maintenance under a U.S. Bureau of Land Management right-of-way permit. Entrance to the site is through two locked, metal stock gates in the perimeter fence. One is the entrance gate (PL-1), which is adjacent to the site marker and entrance sign. The second gate is between perimeter signs P3 and P4 in the northwest corner of the property. Both gates were locked and functional. The entrance sign is near the entrance gate and is mounted on a T-post in the perimeter fence (PL-2). The entrance sign has bullet damage but remains legible. No maintenance needs were identified.

11.4.1.2 Perimeter Fence and Signs

To facilitate LM's land management, a four-strand barbed-wire perimeter fence encloses the disposal cell, drainage structures, and much of the site. The site is in wintering grounds frequented by big-game animals (primarily pronghorn, deer, and elk) and is also surrounded by open range used to graze cattle. Minor damage to the perimeter fence from animal contact periodically occurs. On July 27, 2021, plastic fence flags were attached to the top strand of the perimeter fence to alert wildlife and reduce animal entanglements or strikes against fence lines (PL-3).

There are 26 perimeter signs. On the north, west, and south sides of the site, perimeter signs are attached to T-posts in the perimeter fence. On the east side of the site, perimeter signs are attached to steel posts set in concrete and are inside the property boundary approximately midway between the disposal cell and the perimeter fence (PL-4). Several of the perimeter signs along the dirt road north and west of the site (P5, P6, P8, and P11) have bullet damage but remain legible. Perimeter sign P16 is faded, and perimeter sign P26 was missing. Perimeter signs P16 and P26 will be replaced during the next routine maintenance event. No other maintenance needs were identified.

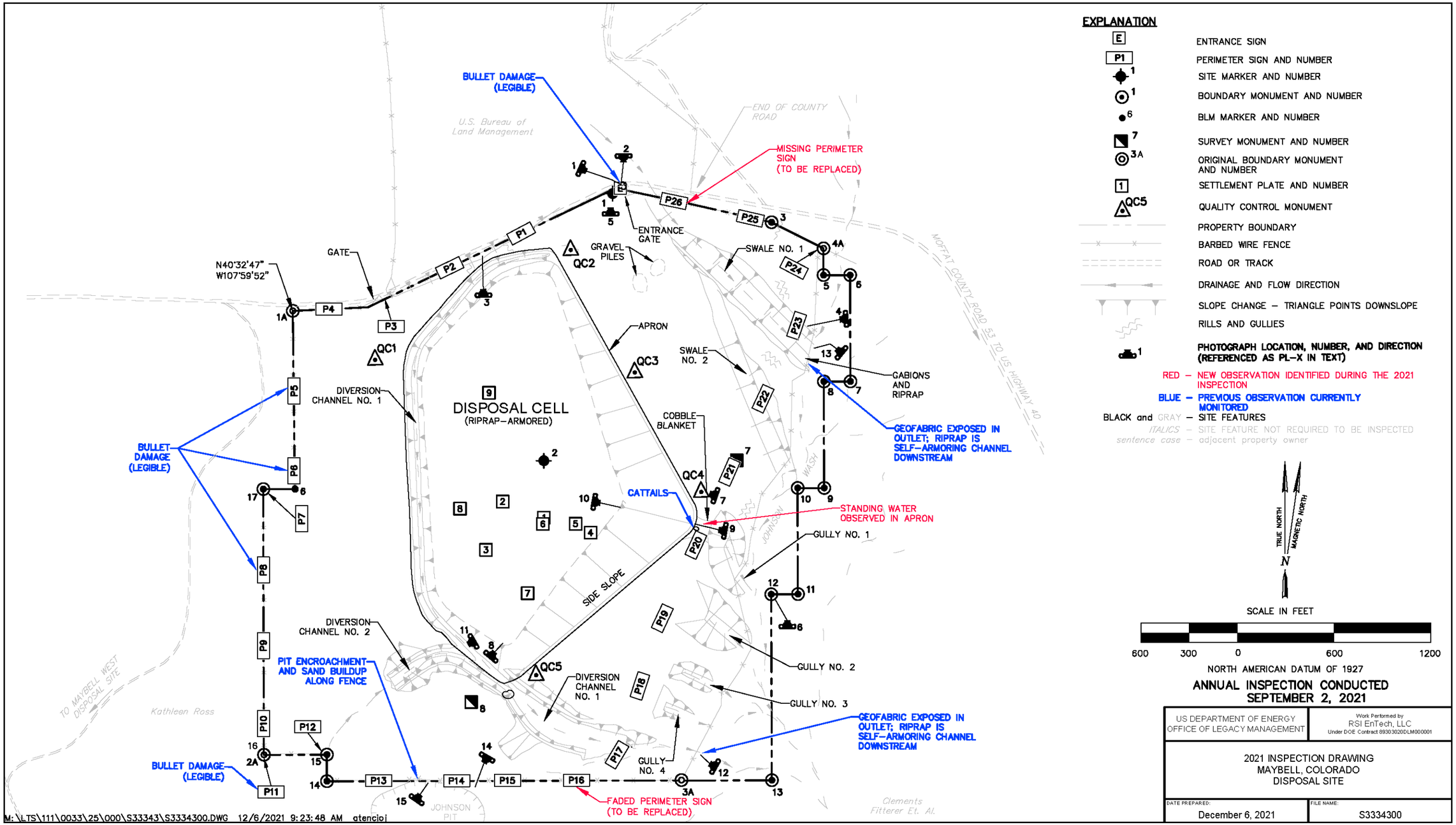


Figure 11-1. 2021 Annual Inspection Drawing for the Maybell, Colorado, Disposal Site

This page intentionally left blank

11.4.1.3 Site Markers

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

11.4.1.4 Survey and Boundary Monuments

The site has two survey monuments. Survey monument SM-7 is on the bench above Johnson Wash just north of perimeter sign P21, and survey monument SM-8 is south of the disposal cell on the bench above Diversion Channel No. 2. The two survey monuments are historical site features that are difficult to locate. They were not inspected during the 2021 inspection but were confirmed to be present and intact during a site visit in 2019. Seventeen boundary monuments delineate the property boundary (PL-6). No maintenance needs were identified.

11.4.1.5 Aerial Survey Quality Control Monuments

Five aerial survey quality control monuments were inspected during the 2021 inspection (PL-7). No maintenance needs were identified.

11.4.2 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 disposal cell, (2) other areas inside the site boundary, and (3) the outlying area. Inspectors examined the specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with LTSP requirements.

11.4.2.1 Disposal Cell

The disposal cell, completed in 1998, occupies 66 acres; it is armored with riprap to control erosion and deter animal and human intrusion (PL-8). There was no evidence of erosion, settling, slumping, rock degradation, or other modifying processes that might affect the integrity of the disposal cell. Scattered shallow-rooted plants continue to establish on the disposal cell top and side slopes; these plants do not affect the integrity of the cell. Deep-rooted plants and noxious weeds are controlled as required by the LTSP.

In accordance with the LTSP, inspectors looked for seeps on the east and southeast side slopes of the disposal cell, because slimes were encapsulated in this portion of the cell. No seeps were observed at the toe of the disposal cell in these areas. Stormwater runoff from the disposal cell discharges at this location, and standing water was observed in the easternmost portion of the disposal cell toe slope apron upgradient of the cobble blanket (PL-9 and PL-10). A storm was recorded in the area a few days before the annual inspection, and standing water has been observed at this location in the past. A 2003 laboratory analysis of evaporite minerals from this location confirmed that no constituents attributable to the disposal cell contents were present. No other maintenance needs were identified.

11.4.2.2 Other Areas Inside the Site Boundary

Surface conditions at the site are a combination of rock-armored drainage and diversion channels, along with contouring of soil surfaces to achieve the necessary surface water drainage control to protect the disposal cell from erosion. The rock-armored diversion channels (PL-11), swales, and gullies are performing as designed. Erosion directly downgradient of the outlets of Diversion Channel No. 1 (PL-12) and Swale No. 1 (PL-13) has exposed the underlying geofabric, but that exposure had not changed significantly since the 2020 inspection. Riprap placed in the outlets continues to protect against headcutting. Minor rills adjacent to Swale No. 1 and Gully No. 1 continue to stabilize as a result of natural armoring and increased vegetation growth. Minor erosion on the northern portion of the site directly downslope of the perimeter fence between perimeter signs P1 and P2 continues to stabilize. Minor erosion perpendicular to the perimeter fence near boundary monument BM-3 continues to be monitored, with no significant changes observed during the annual inspection. Documented erosion does not threaten the disposal cell, and there was no evidence of sediment moving offsite into Johnson Wash. No maintenance needs were identified.

11.4.2.3 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.

Directly south of the site is a former open-pit uranium mine known as the Johnson Pit (PL-14). Over time, slumping of the pit wall caused the pit to encroach several feet onto property now owned by DOE. This encroachment presents no threat to the integrity of the disposal cell and occurred before reclamation and transfer of the site to DOE for long-term surveillance and maintenance. This encroachment is visually monitored annually; it is periodically documented with photographs to assess whether the pit wall has slumped further and to verify the integrity and functionality of the perimeter fence. At the time of the inspection, there was no evidence of any additional encroachment of the pit onto the site. However, windblown sand continues to accumulate along the northern crest of the pit wall along the perimeter fence line (PL-15). The perimeter fence remains functional, but continued accumulation of sand will require vertically extending the fence or removing the sand. Inspectors will continue to monitor this area. No immediate maintenance needs were identified.

11.5 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.

11.6 Maintenance

Vegetation treatment of noxious weeds and deep-rooted plants on the disposal cell was performed before the 2021 inspection. Perimeter signs P16 and P26 will be replaced during the next routine maintenance event. No other maintenance needs were identified.

11.7 Emergency Measures

In compliance with the LTSP, 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. No need for emergency measures was identified.

11.8 Environmental Monitoring

11.8.1 Groundwater Monitoring

In accordance with the LTSP, groundwater monitoring is not required. Supplemental standards have been applied to site groundwater because it is designated as limited use—a designation given to groundwater that is not a current or potential source of drinking water. Groundwater in the uppermost aquifer is designated as limited use because it contains widespread ambient contamination that cannot be cleaned up by treatment methods employed in public water systems (40 CFR 192.11[e]). There are no current or future uses of the uppermost aquifer in the area. Water level monitoring, conducted from 1995 through 2004, did not detect disposal-cell-related impacts to the groundwater system, such as transient drainage downgradient of the cell, and NRC concurred that stipulated groundwater level monitoring requirements had been satisfied (Janosko 2005). Therefore, no further groundwater monitoring was required.

11.8.2 Vegetation Monitoring

In accordance with the LTSP, visual inspections are conducted annually to verify the continued health of onsite vegetation and to ensure that undesirable plant species (e.g., deep-rooted plants on the disposal cell cover and noxious weeds) do not proliferate onsite. No noxious weeds or deep-rooted plants were noted on the disposal cell during the inspection. Noxious weed treatment was performed on July 27, 2021, and will continue annually, as needed. Following reclamation, the disturbed soil surfaces on the site were revegetated with a mix of native and adaptive grasses to provide soil stability. These revegetated areas appeared to be healthy, with similar diversity and density as the surrounding nondisturbed areas.

11.9 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), 2008. *Long-Term Surveillance Plan for the Maybell, Colorado (UMTRCA Title I) Disposal Site, Moffat County, Colorado*, DOE-LM/1605-2008, Revision 4, April.

Janosko, G.S., 2005. Gary S. Janosko, chief of Fuel Cycle Facilities Branch, U.S. Nuclear Regulatory Commission, letter (about decommissioning of monitor wells at the Maybell, Colorado, Uranium Mill Tailings Radiation Control Act [UMTRCA] Title I Disposal Site) to Michael Tucker, site manager, U.S. Department of Energy, January 5.

11.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	115	Entrance Gate
PL-2	180	Entrance Sign
PL-3	0	Perimeter Fence Line
PL-4	265	Perimeter Sign P23
PL-5	—	Granite Site Marker SMK-1
PL-6	—	Boundary Monument BM-12
PL-7	290	Quality Control Monument QC-4
PL-8	40	Disposal Cell Top Slope and Southeastern Side Slope Interface
PL-9	280	Standing Water in Side Slope Apron
PL-10	100	Disposal Cell Eastern Side Slope and Cobble Blanket
PL-11	240	View Southwest of Diversion Channel No. 2
PL-12	300	Exposed Geofabric in Diversion Channel No. 1 Outlet
PL-13	310	Exposed Geofabric in Swale No. 1 Outlet
PL-14	210	Southwest View of Johnson Pit
PL-15	35	Sand Accumulation Along Southern Fence Line Near Johnson Pit

Note:
— = Photograph taken vertically from above.

PL-1. Entrance Gate

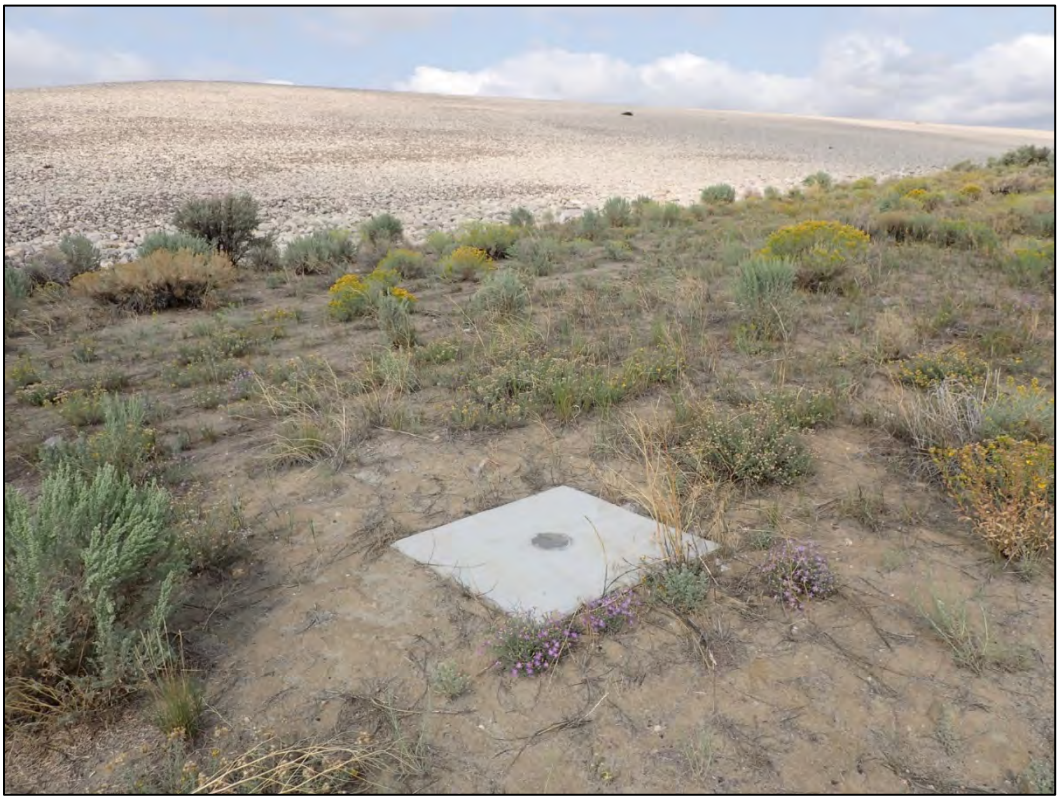
PL-2. Entrance Sign

PL-3. Perimeter Fence Line

PL-4. Perimeter Sign P23

PL-5. Granite Site Marker SMK-1

PL-6. Boundary Monument BM-12



PL-7. Quality Control Monument QC-4

PL-8. Disposal Cell Top Slope and Southeastern Side Slope Interface

PL-9. Standing Water in Side Slope Apron

PL-10. Disposal Cell Eastern Side Slope and Cobble Blanket

PL-11. View Southwest of Diversion Channel No. 2

PL-12. Exposed Geofabric in Diversion Channel No. 1 Outlet

PL-13. Exposed Geofabric in Swale No. 1 Outlet

PL-14. Southwest View of Johnson Pit

PL-15. Sand Accumulation Along Southern Fence Line Near Johnson Pit

12.0 Mexican Hat, Utah, Disposal Site

12.1 Compliance Summary

The Mexican Hat, Utah, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected August 25, 2021.

In response to the depressions identified in 2016, the U.S. Department of Energy (DOE) Office of Legacy Management (LM) continued investigations and performed geotechnical sampling and materials testing (GSMT) on the disposal cell side slope cover components in April 2019 (DOE 2019a). Data obtained through the GSMT were used to identify causes for cover degradation features observed at the site, and these causes are highlighted in the *Erosional Piping Characterization and Data Report, Mexican Hat, Utah, Disposal Cell* (DOE 2020).

The interim cover protection (ICP) project was conducted in 2019 as a temporary measure to replace and restore the cover to the original design specifications until a long-term solution can be assessed. The ICP project focused on the degradation associated with the lower portions of the northeast side slope.

No evidence of a breach through the radon barrier has been identified, and the site remains protective of human health and the environment. Collaborative efforts are in progress to evaluate other potential contributing causes of erosion.

During the annual inspection, LM also conducted annual observational seep monitoring. Observational documentation consists of photographing seeps (PL-1 through PL-7) and providing descriptions of the conditions observed at the seven designated seeps. Seep 0248 (PL-1) was dry, with no observed dripping. Upgradient (background) seep 0261 (PL-5) was dripping, and the remaining seeps were dry. Ephemeral drainages along the perimeter of the site were dry. Groundwater monitoring is not required.

12.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 2007) (LTSP) in accordance with procedures established to comply with the requirements of Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 12-1 lists these requirements.

Table 12-1. License Requirements for the Mexican Hat, Utah, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Sections 3.3 and 3.4	Section 12.4	(b)(3)
Follow-Up Inspections	Section 3.5	Section 12.5	(b)(4)
Maintenance	Section 3.6	Section 12.6	(b)(5)
Emergency Measures	Section 3.6	Section 12.7	(b)(5)
Environmental Monitoring	Section 3.7	Section 12.8	(b)(2)

12.3 Institutional Controls

The 119-acre disposal site, identified by the property boundary shown in Figure 12-1, is held in trust by the U.S. Bureau of Indian Affairs. The Navajo Nation retains title to the land. UMTRCA authorized DOE to enter into a Cooperative Agreement (DE-FC04-85AL26731) with the Navajo Nation to perform remedial actions at former uranium processing sites. DOE and the Navajo Nation executed a Custodial Access Agreement that provides perpetual access to DOE for custody and long-term care at the site.

The site was accepted under the U.S. Nuclear Regulatory Commission general license in 1997. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, LM is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal custody of the disposal cell and its engineered features, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gate and sign, fence, perimeter signs, site markers, and survey and boundary monuments.

12.4 Inspection Results

The site, 1.5 miles south of the town of Mexican Hat, Utah, and 0.5-mile northeast of the Navajo community of Halchita, was inspected on August 25, 2021. The inspection was conducted by K. Lott and J. Manée of the Legacy Management Support (LMS) contractor. J. Tallbull and G. Dayzie of the Navajo Nation Abandoned Mine Lands Reclamation/Uranium Mill Tailings Remedial Action department 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 whether maintenance or additional inspection and monitoring are needed.

12.4.1 Site Surveillance Features

Figure 12-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. 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 2021 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 12-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 12.10.

12.4.1.1 Site Access, Entrance Gate, and Entrance Sign

Access to the site is from a short, unmarked dirt road off U.S. Highway 163 that ends at a graded parking area. Minor erosion continues along the dirt access road, but the site remains accessible. The steel entrance gate at the northwest corner of the site was locked and functional. The entrance sign is affixed to a steel post immediately behind the entrance gate (PL-8). No maintenance needs were identified.

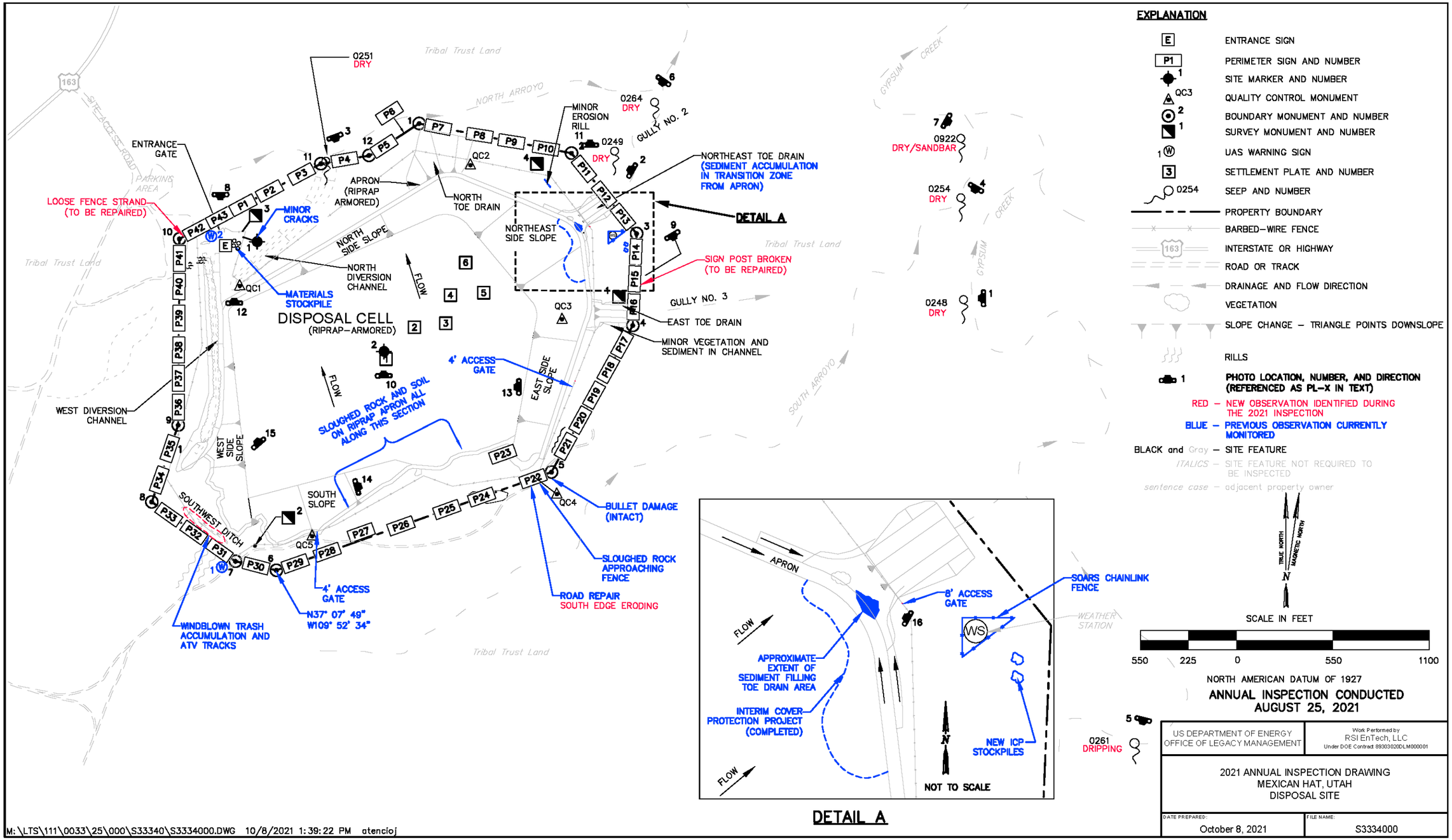


Figure 12-1. 2021 Annual Inspection Drawing for the Mexican Hat, Utah, Disposal Site

This page intentionally left blank

12.4.1.2 Fence and Perimeter Signs

A barbed-wire fence encloses the disposal cell. Damage to the fence by livestock, erosion, or vandalism requires occasional repair. One loose fence strand was identified on the northwest corner of the site near perimeter sign P42. Two 4-foot access gates and one 8-foot access gate were permanently installed in 2018 in the perimeter barbed-wire fence to support past disposal cell cover evaluations and maintenance activities.

A perimeter chainlink fence was installed in 2019 around the existing System Operation and Analysis at Remote Sites (SOARS) weather monitoring station. Approximately 260 linear feet of 6-foot-tall chainlink fence and a lockable double swing gate were installed on existing dirt and rock surfaces around the SOARS station.

There are 43 pairs of perimeter signs, designated P1 through P43 (each pair consisting of an upper sign indicating property ownership and barring trespassing and a lower sign identifying the site as a radioactive materials disposal site), positioned along the property boundary. Each paired perimeter sign is attached to a single steel post set in concrete. Perimeter signs are typically outside the fence that encloses the disposal cell, but some are affixed directly to the fence or immediately inside the fence. The signpost at perimeter sign P15 (PL-9) was broken and lying on the ground. This will be replaced before the next inspection. All remaining perimeter signs are in good condition. The corners of the lower southeastern perimeter signs (perimeter signs P16 through P21) show signs of animal contact.

Two signs prohibiting unauthorized unmanned aircraft system flights on the site were installed during the 2020 inspection and are in good condition. One sign was installed by the entrance gate at the northwest corner of the site, and one sign was installed on the southwest corner between perimeter sign P31 and boundary monument BM-5.

No other maintenance needs were identified.

12.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside the fence near the entrance gate; the concrete base has several minor cracks, which have been noted during previous inspections. This does not compromise the integrity of the base, and repairs are unnecessary at this time. Site marker SMK-2 is on the top slope of the disposal cell (PL-10) and is in good condition. No other maintenance needs were identified.

12.4.1.4 Survey and Boundary Monuments

During construction of the disposal cell, four survey monuments were installed. Twelve boundary monuments delineate the property boundary (PL-11). As noted previously, vandalism has resulted in bullet damage to boundary monument BM-5. However repairs are unnecessary at this time, as the boundary monument remains legible and intact. No immediate maintenance needs were identified.

12.4.1.5 Aerial Survey Quality Control Monuments

Five aerial survey quality control monuments, installed in 2018, were inspected during the 2021 annual inspection (PL-12). No maintenance needs were identified.

12.4.2 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 toe drains and diversion channels, (3) the balance of the site and the site perimeter, and (4) 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.

12.4.2.1 Disposal Cell

The disposal cell, completed in 1994, occupies 68 acres and is armored with riprap to control erosion. No erosion, settling, slumping, rock degradation, or other modifying processes that might affect the integrity of the disposal cell were evident on the top slope of the disposal cell (PL-13).

Depressions in the riprap cover along the toe and lower portions of the northeast side slope of the disposal cell were identified during the 2016 annual inspection and a follow-up inspection on April 8, 2016 (DOE 2017). Additional site visits to further characterize the depression features have been completed every year since 2016 and are detailed in the *Mexican Hat UMTRCA Disposal Cell Side Slope Cover Depressions Evaluation Report, Mexican Hat, Utah* (DOE 2019b). The ICP project was conducted in 2019 as a temporary measure to replace and restore the cover to the original design specifications until a long-term solution can be assessed. The ICP project focused on the degradation associated with the lower portions of the northeast side slope.

There was no noticeable increase of sloughed rock or soil along the south apron of the disposal cell (PL-14). Because the apron is adjacent to the base of a steep exposure of Halgaito Shale, it is expected that occasional sloughing of rock and soil associated with this exposure will continue. The accumulated material is not affecting the function of the apron, and this area will continue to be monitored. No maintenance needs were identified.

12.4.2.2 Toe Drains and Diversion Channels

Erosion continues in upgradient offsite areas resulting in sediment being transported onto the site and into the west diversion channel. Sediment accumulation has promoted the growth of vegetation in the past; however, the 2021 inspection identified less vegetation growth in the west diversion channel (PL-15).

Sediment accumulation has also been observed along the transition zone from the apron to the northeast toe drain. The origin of this material is being evaluated as part of the ongoing cover degradation assessment. Possible sources of this material include a windblown material that originates offsite and radon barrier material associated with the depression features on the northeast side slope of the disposal cell. Visual observations during the inspection did not identify any apparent increases in the sediment accumulation in this area compared to previous visual observations; however, increased vegetation growth was apparent in this drainage apron at the toe of the northeast side slope (PL-16). No immediate maintenance needs were identified.

12.4.2.3 Balance of the Site and Site Perimeter

Minor erosion continues in upgradient areas along the southwest portions of the site. This is an expected natural process, as the exposed geology at the site is composed of interbedded silty sandstone, siltstone, and shale with varying degrees of cementation and susceptibility to erosion. Inspectors will continue to monitor erosion in these areas.

Sloughed rock from an overhanging exposure of Halgaito Shale continues to be observed along the southern perimeter of the site. Although no visual changes were evident and this material appears to be stable, the sloughed rock is approaching the barbed-wire fence between perimeter signs P22 and P23 and will likely need to be removed or secured in the future to protect the fence from damage or a potential breach.

Scattered trash (broken glass, bottles, cans, cardboard, and paper containers) continues to accumulate in areas of the site that are accessible to vehicles (e.g., outside the perimeter of the barbed-wire fence). The most noticeable accumulation of trash is in the southwest ditch, inside the barbed-wire fence; however, this trash is likely transported onto the site by wind. Inside the site boundary (outside the fence) evidence of vehicle and all-terrain vehicle tracks were observed in the same areas where trash accumulation is present.

As part of the 2019 ICP project, road repairs were performed along the dirt access road to provide site access to haul trucks, delivery trucks and other vehicles. Road repairs included grading the entire access road. Two incised areas were stabilized by installing Geocell with standard U.S. Department of Transportation-specific rock types that also allow proper drainage. The repaired areas were examined during the inspection and appeared to be performing as designed, with the exception of minor erosion on the downslope side. Inspectors will continue to monitor the area.

The revegetated material and equipment storage areas used during the ICP project were inspected in 2021. Minimal vegetation growth has occurred. The straw wattles installed to provide stormwater run-on and runoff protection were intact and performing as designed.

Old bedding material removed during the ICP project and excess new bedding material were stockpiled near the SOARS perimeter chainlink fence. Straw wattles were installed around this material for stormwater runoff protection. This area was evaluated during the inspection and is performing as designed. No maintenance needs were identified.

12.4.2.4 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.

12.5 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 follow-up inspections, evaluations, or work is needed based on the inspection results.

12.6 Maintenance

No immediate maintenance needs were identified during the 2021 annual site inspection. The following maintenance items will be addressed before the next inspection:

- Repair loose fence strand near perimeter sign P42
- Replacement of sign post for perimeter sign P15

12.7 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 10 CFR 40 Appendix A Criterion 12. The depression features identified in 2016 along the disposal cell's northeast side slope do not meet the criteria for implementing an emergency action; therefore, no need for emergency measures was identified.

12.8 Environmental Monitoring

12.8.1 Groundwater Monitoring

In accordance with the 2007 LTSP, groundwater monitoring is not required because the uppermost aquifer is hydrogeologically isolated from contamination in the overlying formation.

12.8.2 Seep Monitoring

In accordance with Section 3.7.2 of the LTSP, LM conducts observational monitoring of seven designated seeps during annual inspections as specified in an approved monitoring plan (DOE 2019c). Observational monitoring consists of visual observations and photographic documentation of the seven seep locations specified in the LTSP. The observed seep locations, shown in Figure 12-2, are primarily the result of the infiltration of precipitation into the surrounding formation or perched water that leaked from the former processing site tailings pond. Most seeps have exhibited dry conditions during the previous years of observational monitoring.

The LTSP requires annual visual monitoring of the seven designated seeps through 2016, at which time an evaluation was to be conducted and a decision made about whether to continue or discontinue visual seep monitoring. This report has been finalized, and visual monitoring continues to be performed during the annual site inspections as described in the *Seep Monitoring Evaluation Report, Mexican Hat, Utah, UMTRCA Title I Disposal Site* (DOE 2019c).

Since 2010, groundwater discharge from seeps had been observed at cross-gradient seep 0248, which typically exhibits dripping conditions; however, during the 2021 inspection seep 0248 was dry. Upgradient (background) seep 0261 (PL-5) was observed to be dripping during the inspection; it is approximately 0.5 mile upstream of seep 0248 in Gypsum Creek.

Figure 12-2. Seep Monitoring Locations at the Mexican Hat, Utah, Disposal Site

The remaining seeps identified in the annual monitoring plan exhibited dry conditions during the inspection. Table 12-2 documents the conditions of each monitored seep observed during the inspection with the respective drainage in which each seep occurs and a reference to photographic documentation.

Table 12-2. Observations of Seeps near the Mexican Hat, Utah, Disposal Site

Seep Location Number	Drainage	Location Relative to Disposal Cell	Photograph Location Number	Observed Seep Conditions
0248	Gypsum Creek	Cross gradient	PL-1	Dry conditions (no flow rate measured).
0249	Gully No. 2	Downgradient	PL-2	Dry conditions (no evaporites present); seep area is covered with gray limestone that presumably is extra riprap apron material from disposal cell construction. Warning sign not posted at this location since this seep has never been documented to be discharging water.
0251	North Arroyo	Downgradient	PL-3	Dry conditions (no evaporites present).
0254	South Arroyo	Downgradient	PL-4	Dry conditions (no evaporites present). Warning sign not posted at this location due to seasonal flash flood conditions in the ephemeral drainage.
0261	Gypsum Creek	Upgradient (background)	PL-5	Seep was dripping. This seep discharges directly into Gypsum Creek, which was dry outside of the immediate seep discharge area. Warning sign not posted since this seep is a background location.
0264	North Arroyo	Downgradient	PL-6	Dry conditions (no evaporites present in immediate area). Ephemeral wash near seep location was dry, with no evidence of evaporites in the areas observed during the inspection.
0922	Gypsum Creek	Downgradient	PL-7	Dry conditions (no evaporites present in immediate area). Seep is along the south side of Gypsum Creek, and the seep location is covered entirely by a sandbar that has formed along this section of Gypsum Creek.

12.8.3 Vegetation Monitoring

In accordance with the LTSP, vegetation conditions are observed during annual inspections to ensure that undesirable plant species, including deep-rooted plants on the disposal cell cover and noxious weeds, do not proliferate at the site. Except for deep-rooted vegetation, natural plant community succession is expected and will not adversely impact the performance of the disposal cell. Vegetation growth in the west diversion channel will continue to be monitored during annual inspections to ensure that it does not negatively affect the performance of this surface water diversion structure (PL-16). No maintenance needs were identified.

12.9 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), 2007. *Long-Term Surveillance Plan for the Mexican Hat, Utah (UMTRCA Title I), Disposal Site, San Juan County, Utah,* DOE-LM/1530-2007, Rev. 3, October.

DOE (U.S. Department of Energy), 2017. *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.

DOE (U.S. Department of Energy), 2019a. *Geotechnical Sampling and Materials Testing Work Plan for the Mexican Hat, Utah, UMTRCA Title I Disposal Site*, LMS/HAT/S20483, Rev. 1, Office of Legacy Management, January.

DOE (U.S. Department of Energy), 2019b. *Mexican Hat UMTRCA Disposal Cell Side Slope Cover Depressions Evaluation Report, Mexican Hat, Utah*, LMS/HAT/S14765, Office of Legacy Management, January.

DOE (U.S. Department of Energy), 2019c. *Seep Monitoring Evaluation Report, Mexican Hat, Utah, UMTRCA Title I Disposal Site*, LMS/HAT/S15190, Office of Legacy Management, December.

DOE (U.S. Department of Energy), 2020. *Erosional Piping Characterization and Data Report, Mexican Hat, Utah, Disposal Cell*, LMS/HAT/S29391, Office of Legacy Management, December.

12.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	270	Seep 0248
PL-2	300	Seep 0249
PL-3	160	Seep 0251
PL-4	210	Seep 0254
PL-5	175	Seep 0261 (Background Seep)
PL-6	215	Seep 0264
PL-7	120	Seep 0922
PL-8	180	Entrance Gate
PL-9	150	Perimeter Sign P15
PL-10	—	Site Marker SMK-2
PL-11	—	Boundary Monument BM-2
PL-12	—	Quality Control Monument QC-1
PL-13	270	Disposal Cell
PL-14	75	Sloughed Rock
PL-15	320	West Diversion Channel
PL-16	300	Northeast Toe Drain

Note:
— = Photograph taken vertically from above.

PL-1. Seep 0248

PL-2. Seep 0249

PL-3. Seep 0251

PL-4. Seep 0254

PL-5. Seep 0261 (Background Seep)

PL-6. Seep 0264

PL-7. Seep 0922

PL-8. Entrance Gate

PL-9. Perimeter Sign P15

PL-10. Site Marker SMK-2

PL-11. Boundary Monument BM-2

PL-12. Quality Control Monument QC-1

PL-13. Disposal Cell

PL-14. Sloughed Rock

PL-15. West Diversion Channel

PL-16. Northeast Toe Drain

13.0 Naturita, Colorado, Disposal Site

13.1 Compliance Summary

The Naturita, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on June 8, 2021. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified several minor maintenance needs but found no cause for a follow-up inspection.

Groundwater monitoring is not required and was discontinued in 2014. The site-specific U.S. Department of Energy (DOE) Long-Term Surveillance Plan (DOE 2019) (LTSP) was revised in 2019 to exclude the groundwater monitoring requirement.

13.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the LTSP 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 13-1 lists these requirements.

Table 13-1. License Requirements for the Naturita, Colorado, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Sections 3.2, 3.3	Section 13.4	(b)(3)
Follow-Up Inspections	Section 3.4	Section 13.5	(b)(4)
Site Maintenance	Section 3.5.1	Section 13.6	(b)(5)
Environmental Monitoring	Section 3.6	Section 13.7	(b)(2)
Emergency Measures	Section 3.5.2	Section 13.8	—

13.3 Institutional Controls

The 26.65-acre site, identified by the property boundary shown in Figure 13-1, is owned by the United States and was accepted under the NRC general license in 1999. 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.

13.4 Inspection Results

The site, 13 miles northwest of Naturita, Colorado, was inspected on June 8, 2021. The inspection was conducted by K. Meadows and C. Wentz of the Legacy Management Support (LMS) contractor. A. Denny, the Office of Legacy Management (LM) site manager; M. Cosby from the Colorado Department of Public Health and Environment; and C. Oliver and M. Williams, representing the LMS contractor, also 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 maintenance or additional inspection and monitoring.

13.4.1 Site Surveillance Features

Figure 13-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. 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 2021 annual inspection are shown in red font. 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 13-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 13.10.

13.4.1.1 Site Access, Entrance Gate, and Entrance Sign

Access to the site is from Colorado Highway 141 to Montrose County Road EE22, which borders the northeast side of the site. Entrance to the site is through a locked steel gate directly off County Road EE22. The entrance sign is next to the entrance gate (PL-1). No maintenance needs were identified.

13.4.1.2 Perimeter Fence and Signs

A barbed-wire perimeter fence encloses the site. There are 25 perimeter signs positioned along the perimeter fence attached to steel posts set in concrete and set back 5 feet from the property line. Inspectors noticed a detached fence bracket and vegetation growing in the fence line near perimeter sign P6. Both require maintenance. Erosion around the concrete base of perimeter sign P22 will continue to be monitored. No other maintenance needs were identified.

13.4.1.3 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-2) is on the top slope of the disposal cell. No maintenance needs were identified.

13.4.1.4 Survey and Boundary Monuments

Three survey monuments and 14 boundary monuments delineate the property boundary. Boundary monuments BM-1 through BM-17 mark the property corners. Survey monuments SM-3, SM-4, and SM-11 represent boundary monuments BM-3, BM-4, and BM-11, respectively (PL-3). No maintenance needs were identified.

13.4.1.5 Aerial Survey Quality Control Monuments

Four aerial survey quality control monuments were installed before the 2021 inspection (PL-4). No maintenance needs were identified.

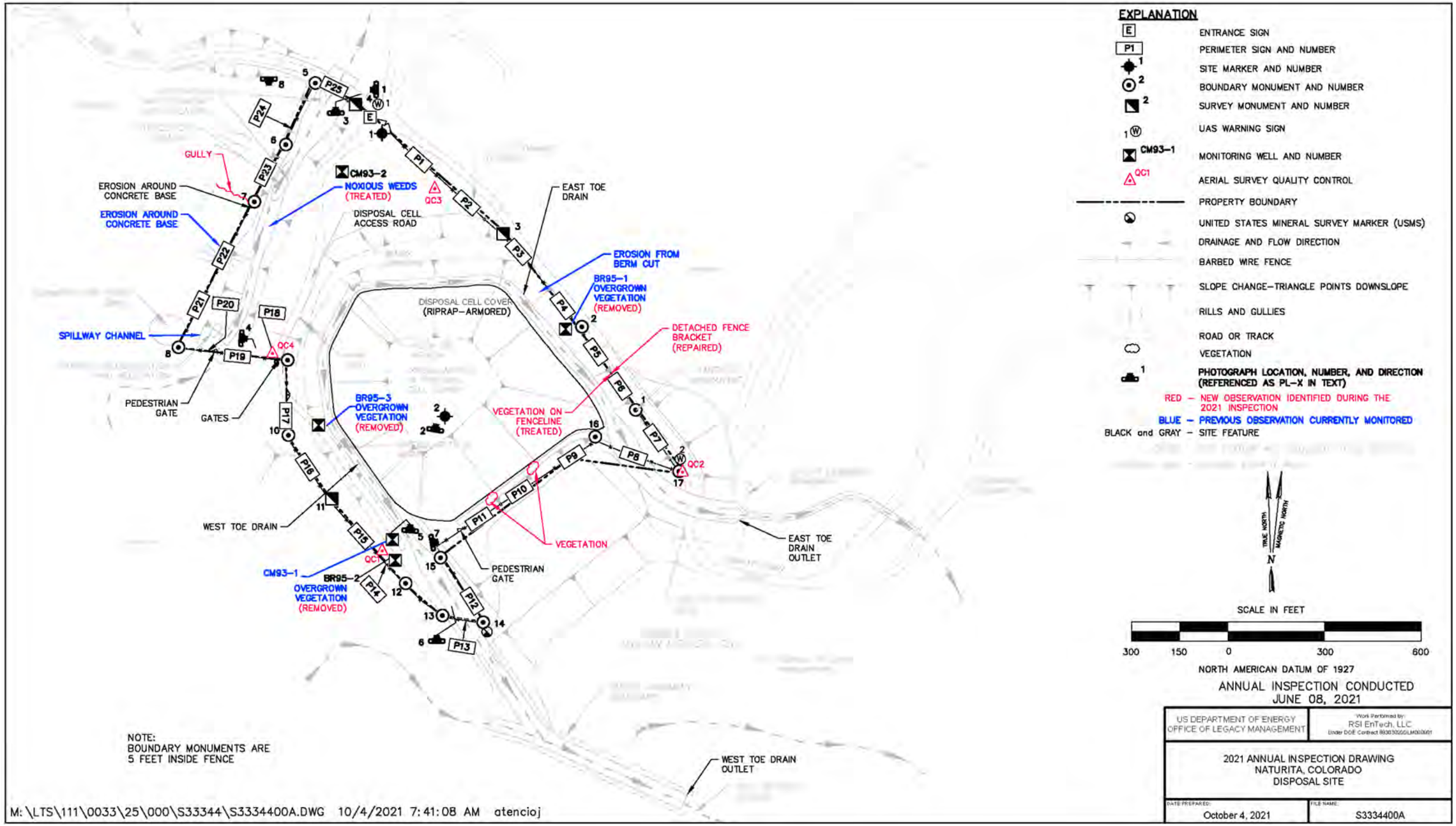


Figure 13-1. 2021 Annual Inspection Drawing for the Naturita, Colorado, Disposal Site

This page intentionally left blank

13.4.1.6 Monitoring Wells

The site has five groundwater monitoring wells. The wellhead protectors were intact and locked (PL-5). Overgrown vegetation identified in the 2020 inspection around wells BR95-1, BR95-3, and CM93-1 was removed in preparation for well abandonment. No immediate maintenance needs were identified.

13.4.2 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, (2) the remainder of the site, 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.

13.4.2.1 Disposal Cell

The disposal cell, completed in 1998, occupies 10 acres (PL-6). The disposal cell is armored with riprap to control erosion. The riprap is rounded, with larger diameter rock on the side slopes versus on the top slope. There was no evidence of settling, slumping, erosion, rock degradation, or other modifying processes that might affect the integrity of the disposal cell.

Irregularities in the riprap on the top slope of the disposal cell continue to be observed. The irregularities consist of slightly darker rock that are not lower than surrounding areas and have not changed over time. Another irregularity in the apron area on the west side of the disposal cell appears to be old vehicle tracks. The irregularity does not present a threat to the disposal cell or surrounding area. Inspectors will continue to monitor these areas for potential impacts. No maintenance needs were identified.

13.4.2.2 Remainder of the Site

Woody vegetation is growing on the south side of the disposal cell between the apron and the site boundary fence line (PL-7). This vegetation is not impacting the disposal cell, but inspectors will continue to monitor this area.

Two riprap-armored toe drains (the west and east toe drains) collect water from the disposal cell side slopes and divert it to the southeast. The west toe drain outlet is south of the site in an easement. Soft bedrock is being eroded near the west toe drain outlet, but that erosion does not threaten the performance of the toe drain, and repairs are not necessary. The east toe drain outlet is southeast of the site in an easement. Water is conveyed to the east toe drain outlet through the east toe drain and five culverts under County Road EE22. Vegetation continues to grow in the accumulating sediment just outside the culverts, potentially blocking stormwater flow. Erosion has exposed resistant bedrock near the east toe drain outlet but does not threaten the performance of the toe drain, and repairs are not necessary. Some sediment has accumulated in the upper end of the east and west toe drains, allowing scattered vegetation to grow, but this has not adversely affected the performance of the toe drains.

A riprap-armored interceptor channel, upgradient and northwest of the disposal cell, diverts stormwater and snowmelt runoff to the northeast under County Road EE22. Some sediment has eroded from the offsite area upslope from the channel and is being deposited in the channel. Sediment accumulation and associated vegetation have not adversely affected the performance of the interceptor channel (PL-8). Herbicide treatment of rabbitbrush plants is ongoing.

During the 2019 inspection, headcutting erosion was identified within the spillway channel below the sedimentation pond on the outlying area northwest of the site. Inspectors noted minor increases in erosion in this area during the 2021 inspection and will continue to monitor this area.

The disposal cell access road along the northwest side of the site descends through shale and sandstone units of the Salt Wash Member of the Morrison Formation. The road provides access to the disposal cell and monitoring wells on the west side of the site.

Erosion in the steep cliff below the previous berm cut alongside County Road EE22 does not threaten the integrity of the disposal cell or site features. The berm cut was repaired in 2020. Inspectors will continue to monitor this area. No maintenance needs were identified.

13.4.2.3 Outlying Area

The surrounding 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. The area has been highly disturbed by mining, quarrying, reclamation, and road building.

Inspectors noticed a gully forming on the outlying area along the northern site boundary near perimeter signs P-22 and P-23. The gully originates on the hillside beyond the northern perimeter fence and is slowly growing toward the fence line. Inspectors will continue to monitor this area for ongoing erosion and resulting impacts. No maintenance needs were identified.

13.5 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.

13.6 Maintenance and Repair

Before the 2021 inspection, four aerial survey quality control monuments were installed, and the vegetation overgrowing wells BR95-1, BR95-3, and CM93-1 was removed.

Inspectors documented minor maintenance during the 2021 inspection that was completed following the inspection:

- Treated vegetation growing in the fence line near perimeter sign P6
- Repaired detached fence bracket near perimeter sign P6

13.7 Environmental Monitoring

In accordance with the LTSP, LM ensures that a plant specialist or other qualified person conducts vegetation monitoring (DOE 2019).

If volunteer plant growth or sedimentation becomes extreme enough to potentially degrade the function of engineered structures, LM will evaluate the potential impact and select appropriate responses. The vegetation growing in the southern fence area does not require maintenance, but the vegetation growing in the fence line near P6 required treatment. No other maintenance needs were identified.

13.8 Emergency Measures

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

13.9 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*.

DOE (U.S. Department of Energy), 2019. *Long-Term Surveillance Plan for the Naturita, Colorado, Disposal Site*, LMS/NAD/S13227, December.

13.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	270	Entrance Sign with Unmanned Aircraft System Sign
PL-2	10	Site Marker on Disposal Cell Top
PL-3	—	Survey Monument SM-4
PL-4	95	Aerial Survey Quality Control Monument QC-4
PL-5	5	Monitoring Well CM93-1
PL-6	0	Disposal Cell
PL-7	180	Vegetation Growing near Southern Fence Line
PL-8	80	Vegetation Growing in Interceptor Channel

Note:
— = Photograph taken vertically from above.

PL-1. Entrance Sign with Unmanned Aircraft System Sign

PL-2. Site Marker on Disposal Cell Top

PL-3. Survey Monument SM-4

PL-4. Aerial Survey Quality Control Monument QC-4

PL-5. Monitoring Well CM93-1

PL-6. Disposal Cell

PL-7. Vegetation Growing near Southern Fence Line

PL-8. Vegetation Growing in Interceptor Channel

This page intentionally left blank

14.0 Rifle, Colorado, Disposal Site

14.1 Compliance Summary

The Rifle, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on August 31, 2021. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified one minor maintenance need but found no cause for a follow-up inspection.

In April 2021, the site's vertical datum from National Geodetic Vertical Datum of 1929 was transformed to North American Vertical Datum of 1988. The transformation resulted in an increase of 2.55 feet (ft) in elevation measurements across the site. Both the original 1929 vertical datum elevations and the new 1988 vertical datum elevations are presented in this report side by side with the new datum shown followed by the older datum in parentheses (e.g., 6022.55 ft [6020 ft]).

14.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 1997) (LTSP) 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 14-1 lists these requirements.

Table 14-1. License Requirements for the Rifle, Colorado, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 3.0	Section 14.4	(b)(3)
Follow-Up Inspections	Section 3.4	Section 14.5	(b)(4)
Maintenance and Repairs	Section 4.0	Section 14.6	(b)(5)
Groundwater Monitoring	Section 2.6	Section 14.7	(b)(2)
Disposal Cell Pore-Water Level Monitoring	Appendix	Section 14.8	—
Corrective Action	Section 5.0	Section 14.9	—

14.3 Institutional Controls

The 205-acre site, identified by the property boundary shown in Figure 14-1, is owned by the United States and was accepted under the NRC general license in 1998. The U.S. Department of Energy (DOE) is the licensee and, in accordance with the requirements for UMTRCA Title I sites, the Office of Legacy Management (LM) 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, stock fence, perimeter signs, site markers, survey and boundary monuments, standpipes, and evaporation pond.

14.4 Inspection Results

The site, 6 miles north of Rifle, Colorado, was inspected on August 31, 2021. The inspection was conducted by B. Mays and D. Holbrook of the Legacy Management Support (LMS) contractor. N. Keller, LM site manager, and M. Cosby, of 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 whether maintenance or additional inspection and monitoring are needed.

14.4.1 Site Surveillance Features

Figure 14-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. 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 2021 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are identified in the following subsections. Photographs to support specific observations are identified in the text and in Figure 14-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 14.11.

14.4.1.1 Access Road, Entrance Gates, and Entrance Sign

Access to the site is from an improved gravel road northeast of Colorado Highway 13. A perpetual right-of-way across U.S. Bureau of Land Management (BLM) property provides access to the site. Entrance to the site is through two locked gates on the access road: an outer reinforced metal gate about 1700 ft south of the site (PL-1) and an inner metal gate at the stock fence. The entrance sign, which is next to the inner gate, had minor cracks but remained legible. No other maintenance needs were identified.

14.4.1.2 Stock Fence and Perimeter Signs

A four-strand barbed-wire stock fence at the south end of the site extends to the edge of steep-sided arroyos that bound the site on the east and west. In previous years, livestock associated with an adjacent BLM grazing allotment would go around the fence to graze onsite vegetation. Results from the 2021 inspection showed evidence of continued livestock grazing, discussed further in Section 14.4.2.3. Strands of the barbed-wire fence were repaired in June 2021, and no additional maintenance needs were identified during the inspection. Two barbed-wire personnel gates are at the southeast corner of the site. The northern gate, which provides access to DOE property, was locked with a chain and padlock. The southern gate is left open to allow livestock on the adjacent BLM allotment to pass through the fence.

There are 27 perimeter signs positioned along the perimeter. Perimeter signs P0 through P11 are attached to the stock fence, and signs P12 through P26 are attached to steel posts set in concrete and set back 5 ft from the boundary (PL-2). Perimeter signs P15 and P19 have bullet damage, but remain legible and do not need to be replaced at this time. Perimeter sign P18 has shown minor cracks and peeling but remains legible. No other maintenance needs were identified.

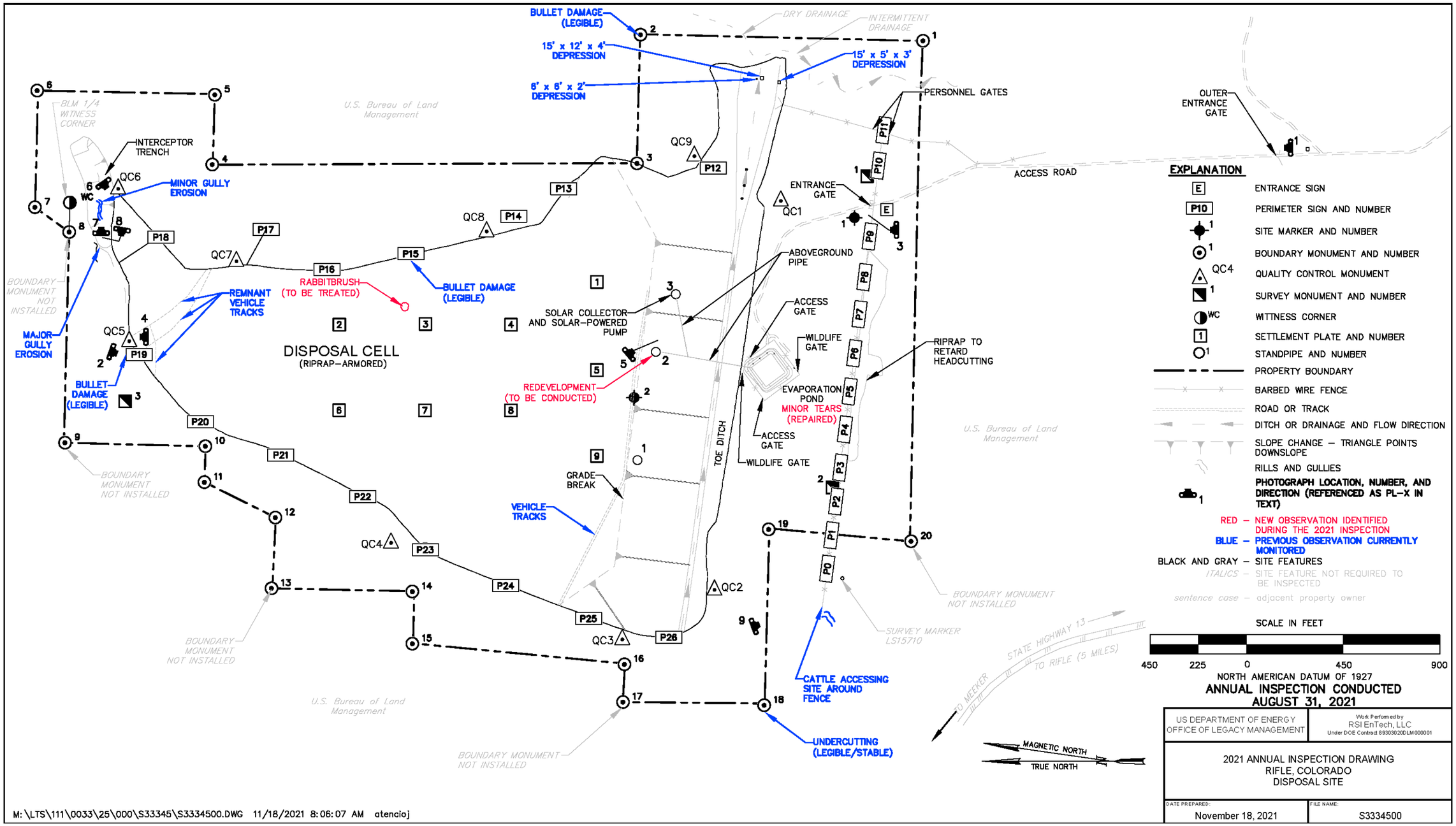


Figure 14-1. 2021 Annual Inspection Drawing for the Rifle, Colorado, Disposal Site

This page intentionally left blank

14.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside the inner entrance gate, and site marker SMK-2 is on the top slope of the disposal cell (PL-3). No maintenance needs were identified.

14.4.1.4 Survey and Boundary Monuments

Three survey monuments and 15 boundary monuments delineate the property boundary. The boundary monuments are set at the corners of the irregular site boundary. Although the site boundary has 20 corners, only 15 are marked by boundary monuments because 5 of the corners are on extremely steep terrain that is not safely accessible. Consequently, boundary monuments BM-8, BM-9, BM-13, BM-17, and BM-20 were never installed. GPS is used to identify and inspect existing boundary monuments that are installed in steep, hard-to-access areas. Boundary monument BM-2 has several bullet holes but remains intact. Boundary monument BM-18 has undercutting at the ground surface but remains legible and stable. No maintenance needs were identified.

14.4.1.5 Aerial Survey Quality Control Monuments

Nine aerial survey quality control monuments were inspected during the 2021 annual inspection. Inspectors noted minor sediment accumulation on quality control monuments QC-5 and QC-8 (PL-4). No maintenance needs were identified.

14.4.1.6 Standpipes

Three standpipes (SP-01, SP-02, and SP-03) on the south side slope of the disposal cell are used to monitor pore-water levels in the disposal cell (PL-5). At the time of the inspection, disposal cell pore water was being pumped from standpipes SP-02 and SP-03 (also known as monitoring wells 02 and 03, respectively) into the evaporation pond. Redevelopment of standpipe SP-02, consisting of mechanical and chemical cleaning to treat biofouling and debris removal, will be completed before the next inspection. No maintenance needs were identified.

14.4.1.7 Evaporation Pond

A lined evaporation pond was constructed adjacent to the disposal cell in 2001 to receive water pumped from standpipes SP-02 and SP-03. The pond contained water at the time of the inspection. Evaluation of the pond liner's integrity was completed in fall 2020 by a professional geosynthetic liner installation and inspection company. Two minor holes, approximately 2 inches in diameter, were identified at the top slope of the liner and repaired after the inspection. Evaluation of the liner by a testing laboratory indicated the liner is in good condition for its age. LM plans to replace the pond liner in fiscal year 2024 barring further damage that would necessitate earlier replacement. The security fence around the pond was intact and effectively preventing livestock from entering the area. The vehicular access gates on the north and west corners of the fence were closed and locked at the time of the inspection. A meteorological station alongside the pond was functioning normally. No other maintenance needs were identified.

14.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into four areas to ensure a thorough and efficient inspection. The inspection areas are (1) the disposal cell and interceptor trench, (2) the toe ditch and toe ditch outlet, (3) onsite reclaimed areas, and (4) 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.

14.4.2.1 Disposal Cell and Interceptor Trench

The disposal cell, completed in 1996, occupies 71 acres and is armored with riprap consisting of river cobbles and boulders to control erosion and deter animal and human intrusion. There was no evidence of erosion, settling, slumping, or other modifying processes that might affect the integrity of the disposal cell (PL-6). As in the past several inspections, inspectors noticed minor rock degradation on the disposal cell top slope, primarily in the form of cracking and spalling. Rock degradation does not present a concern at this time.

Remnant vehicle tracks, which formed on the cover during well decommissioning activities in 2002, remain evident in the north portion of the disposal cell. Additional vehicle tracks continue to be visible in the south portion of the disposal cell; these were made during installation of solar panels and pumps at standpipes SP-02 and SP-03.

In the early 2000s, inspectors became concerned that the steep slopes of the disposal cell cover, particularly in the north portion, could lead to slope instability. In response, LM conducted annual three-dimensional surveys of the rock cover between 2006 and 2011. The surveys confirmed that the rock cover was stable.

One deep-rooted rabbitbrush plant was observed on the cell cover during the inspection. The plant will be treated before the 2022 inspection. Small, isolated patches of other grasses and annual weeds also were present on the disposal cell cover and side slope, but they do not present a concern at this time.

A vegetated interceptor trench was constructed at the top of the disposal cell to protect the disposal cell from stormwater and snowmelt runoff. The trench appeared to be functioning as designed, although minor gully erosion has been occurring in the lower portion of the trench. The gully did not appear to be increasing in depth or width (PL-7); the deepest downcut was approximately 18 inches deep and 24 inches wide. In the outfall area below the trench (down the steep-sided natural slope), stormwater runoff has formed a major gully to the north of the armoring riprap placed in this area in the early 2000s. The gully did not appear to be increasing in depth or width (PL-8) during the 2021 inspection. The outfall area will continue to be monitored to assess if additional riprap is needed on the slope to prevent upstream gully migration. No maintenance needs were identified.

14.4.2.2 Toe Ditch and Toe Ditch Outlet

A toe ditch runs along the downslope (south) edge of the disposal cell and is armored with the same rock that protects the disposal cell. The toe ditch diverts stormwater runoff from the disposal cell offsite to the east. The ditch was stable and functioning as designed.

Minor erosion, anticipated in the design, remains evident in the channel at the toe ditch outlet. Rock previously placed in the outlet to stabilize the erosion has dropped into and armored the eroded areas. Inspectors found two depressions in the rock during the 2017 annual inspection (one about 15 × 12 ft in area and 4 ft deep and one about 6 × 6 ft in area and 2 ft deep) and another depression during the 2018 annual inspection (about 15 × 5 ft in area and 3 ft deep). These depressions were formed after the underlying soil eroded away. They are not a concern at this time but will continue to be monitored. No maintenance needs were identified.

14.4.2.3 Onsite Reclaimed Areas

Disturbed areas around the edges and south of the disposal cell were reseeded in 1996 and, overall, have been successfully reclaimed. Before 2012, there was little evidence of grazing within the site boundaries. Since 2012, however, grazing by cattle has been regularly observed, and cattle trails have been identified meandering up the steep arroyos on the unfenced, southwest side of the site (PL-9). LM is evaluating additional fencing installation options on the southwest side of the site to prevent cattle access.

Three arroyos are present in the reclaimed area south of the disposal cell and outside the stock fence. A rock apron was placed between the stock fence and the headcuts in these arroyos to prevent headward migration toward the disposal cell. As erosion has migrated into the rock apron, the rock has naturally armored the arroyos and effectively stabilized them from further erosion. Inspectors will continue to monitor this area. No maintenance needs were identified.

14.4.2.4 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. The primary land uses in the area are grazing, hunting, recreation, and wildlife habitat. The Rifle Arch Trailhead is approximately 0.25 mile southwest of the site along Highway 13. The city of Rifle constructed two additional mountain bike trails in spring 2021 that follow the Rifle Arch Trail. Historically, trash has been dumped along the access road between Highway 13 and the outer entrance gate, and BLM has periodically removed it. No other changes to the outlying area were observed.

14.5 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.

14.6 Maintenance and Repairs

Two minor tears in the evaporation pond were repaired after the 2021 inspection. Inspectors documented the following maintenance items to be completed before the 2022 annual inspection:

- Redevelopment of standpipe SP-02
- Treatment of the rabbitbrush on top of the disposal cell

14.7 Groundwater Monitoring

Groundwater quality monitoring is not required by the LTSP (DOE 1997). Transient drainage from the disposal cell enters the Wasatch Formation, a 3800-foot-thick sequence of shales, siltstones, and fine-grained sandstones (DOE 1997). The Wasatch Formation separates the disposal cell from the uppermost useable aquifer (the Mesaverde Group). Groundwater in the Wasatch Formation is classified as limited use due to naturally occurring concentrations of total dissolved solids that exceed 10,000 milligrams per liter (DOE 1997). Additionally, this unit produces very little water and is not considered to be an aquifer. Ambient levels of barium, cadmium, chromium, lead, molybdenum, selenium, and combined radium-226 and radium-228 exceed maximum concentration limits. The Wasatch Formation does not represent a useable source of water, and no exposure pathways to site-related groundwater exist at the site. Further groundwater monitoring is not required (DOE 1997). All monitoring wells at the site were decommissioned by 2002.

14.8 Disposal Cell Pore-Water Level Monitoring

In accordance with the LTSP, LM monitors pore-water levels in the disposal cell at standpipes SP-02 and SP-03, which are installed at the downgradient end of the disposal cell on the south side slope (Figure 14-1). This monitoring is performed to ensure that pore water in the disposal cell does not rise above a high-density polyethylene (HDPE) liner that was installed in the toe of the disposal cell at an elevation of 6022.50 ft (6020 ft) during original construction. The bottom of standpipe SP-01 is at an elevation of 6023.95 ft (6021.4 ft); as such, it continues to be dry and does not require continuous monitoring.

The disposal cell dewatering system (pump) is activated when the interior pore-water elevation reaches 6018.55 ft (6016 ft). Circumstances other than pore water accumulation that triggers water accumulation includes (1) periods when solar-powered pumps are nonoperational (for recovery tests or maintenance) or (2) when temperatures are below freezing, preventing the pump from operating. Pore-water levels in standpipes SP-02 and SP-03 have remained below the geotextile liner at 6020 ft (6022.55 ft), preventing water from overtopping the disposal cell liner.

A contingency plan for control of pore-water levels at the toe of the disposal cell was appended to the LTSP. The plan included the installation of a dewatering system and a retention pond to use when water levels reach an elevation of 6016.55 ft (6014 ft) and the solar-powered dewatering pump is initiated at a water level elevation of 6018.55 ft (6016 ft). Both the dewatering system and the evaporation pond were constructed in 2001. Water pumped from the standpipes is discharged through an aboveground polyethylene pipe to the evaporation pond.

Despite the pumping efforts to dewater the cell since 2001, pore-water levels in the cell have not decreased as expected; instead, they have continued to increase to the recent maximum level of 6022.45 ft (6019.5 ft). While the 6018.55 ft (6016 ft) pump action level has been exceeded, pore-water levels in both standpipes SP-02 and SP-03 have been maintained below the top of the HDPE liner elevation. In compliance with requirements of the LTSP, pumping will continue until water levels in the standpipes stabilize at an elevation of 6016.55 ft (6014 ft) or lower. Studies are ongoing to determine (1) potential sources of pore water in the disposal cell other than tailings leachate and (2) potential pumping system upgrades to increase dewatering volumes. Table 14-2 lists total dewatering volumes.

Table 14-2. Total Dewatering Volumes at the Rifle, Colorado, Disposal Site

Reporting Years	Annual Dewatering Volumes (gal)	Annual Dewatering (gal per day)	Cumulative Dewatering Volumes (gal)
2008	143,110	392.08	143,110
2009	389,618	1067.45	532,728
2010	215,569	590.60	748,297
2011	61,434	168.31	809,731
2012	155,189	425.18	964,920
2013	106,267	291.14	1,071,187
2014	138,574	379.65	1,209,761
2015	30,948	84.79	1,240,709
2016	168,555	461.79	1,409,263
2017	87,741	240.39	1,497,005
2018	160,191	438.88	1,657,196
2019	247,537	678.18	1,904,733
2020	194,788	533.66	2,099,521
2021*	266,065*	861.05*	2,365,586

Note:
* 2021 dewatering data through November 5, 2021.

Abbreviation:
gal = gallons

Real-time disposal cell water elevations collected in 2018 (using pressure transducers and dataloggers) continued to indicate that daily maximum or semistatic pore-water levels in standpipes SP-02 and SP-03 exceed the 6018.55 ft (6016 ft) pump action level (see Figure 14-2). In 2019, LM modified the seasonal pumping regimen for year-round pumping while a long-term solution is evaluated and implemented.

Data fluctuations for both standpipes observed from 2018 to 2021 are the result of partial overnight recharge due to well inefficiencies, and nonstatic levels have been filtered from the dataset shown in Figure 14-2. Downhole video taken in 2020 for both standpipes revealed fouling in the perforated interval. Redevelopment of standpipe SP-02 to remove mineral scale and biofouling was completed in December 2020. Initial testing results indicate an increase in production volume from standpipe SP-02 of approximately 22%. Downhole video in standpipe SP-03 also identified approximately 7.6 ft of 6- to 10-inch diameter rock riprap at the bottom of the standpipe. Potential methods to remove the rock and redevelop the standpipe are being considered to increase production.

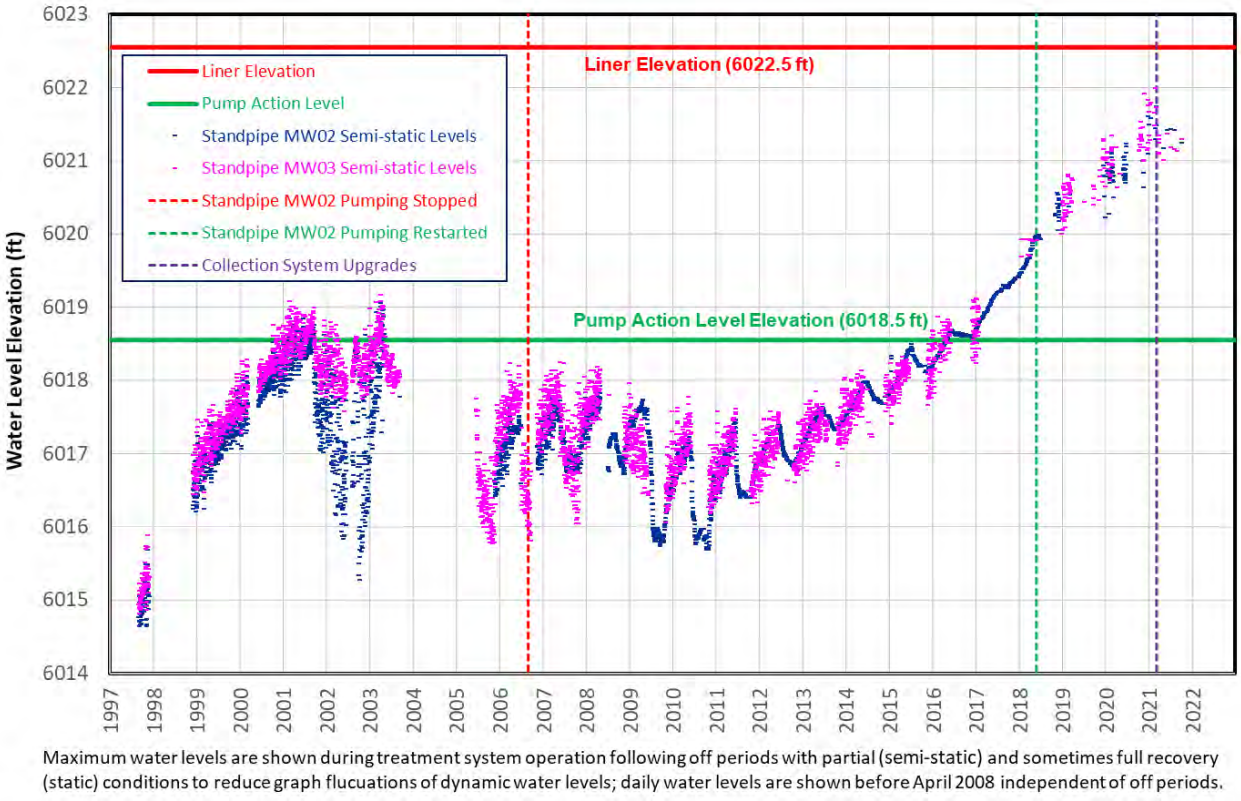


Figure 14-2. Disposal Cell Pore-Water Levels in Standpipes SP-02 and SP-03 at the Rifle, Colorado, Disposal Site

In March 2021, the solar-powered pumping system was upgraded to provide additional operation of the pumps by increasing electrical storage ability. By adding batteries to store solar-generated electricity, the pumps are able to operate throughout the night and on overcast days. This should yield a more consistent and lower pore-water elevation and increase annual dewatering volume. The pumping system will continue to have limited availability in winter because aboveground effluent lines are susceptible to freezing.

LM is organizing an ongoing collaborative initiative with the National Laboratory Network (NLN) to identify innovative approaches to perform pore-water source investigation and accumulation mitigation strategies for the site. LM included NRC in the LM and NLN collaborative process that began in fall 2021.

14.9 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.

14.10 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), 1997. *Long-Term Surveillance Plan for the Estes Gulch Disposal Site near Rifle, Colorado*, DOE/AL/62350-235 Rev. 1, November.

14.11 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	0	Outer Entrance Gate
PL-2	200	Perimeter Sign P19
PL-3	0	Site Marker SMK-1
PL-4	0	Quality Control Monument QC-5
PL-5	140	Standpipe SP-02 and Instrumentation
PL-6	235	Disposal Cell Cover
PL-7	90	(a) Gully Erosion in Interceptor Trench Outfall in 2021 (b) Gully Erosion in Interceptor Trench Outfall in 2016—Photo for Comparison
PL-8	280	(a) Gully Erosion in Interceptor Trench Outfall in 2021 (b) Gully Erosion in Interceptor Trench Outfall in 2016—Photo for Comparison
PL-9	160	Cattle Trail on Southwest Side of Site

PL-1. Outer Entrance Gate

PL-2. Perimeter Sign P19

PL-3. Site Marker SMK-1

PL-4. Quality Control Monument QC-5

PL-5. Standpipe SP-02 and Instrumentation

PL-6. Disposal Cell Cover

PL-7a. Gully Erosion in Interceptor Trench Outfall in 2021

PL-7b. Gully Erosion in Interceptor Trench Outfall in 2016—Photo for Comparison

PL-8a. Gully Erosion in Interceptor Trench Outfall in 2021

PL-8b. Gully Erosion in Interceptor Trench Outfall in 2016—Photo for Comparison

PL-9. Cattle Trail on Southwest Side of Site

This page intentionally left blank

15.0 Salt Lake City, Utah, Disposal Site

15.1 Compliance Summary

The Salt Lake City, Utah, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on April 20, 2021. No changes were observed on the disposal cell or in associated drainage features. Observations of rock-quality monitoring plots indicated no significant change from the previous year. Inspectors identified one routine maintenance need but found no cause for a follow-up inspection. Maintenance needs that could be addressed during the inspection were completed by inspectors. Groundwater monitoring is not required.

15.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 1997) (LTSP) 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 15-1 lists these requirements.

Table 15-1. License Requirements for the Salt Lake City, Utah, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 3.0	Section 15.4	(b)(3)
Follow-Up Inspections	Section 3.4	Section 15.5	(b)(4)
Maintenance and Repairs	Section 5.0	Section 15.6	(b)(5)
Groundwater Monitoring	Section 4.0	Section 15.7	(b)(2)
Corrective Action	Section 6.0	Section 15.8	--

15.3 Institutional Controls

The 100-acre site, identified by the property boundary shown in Figure 15-1, is owned by the United States and was accepted under the NRC general license in 1997. The U.S. Department of Energy 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 and sign, fences, perimeter (warning) signs, site markers, and boundary monuments.

15.4 Inspection Results

The site, 81 miles west of Salt Lake City, Utah, was inspected on April 20, 2021. The inspection was conducted by J. Lobato and D. Atkinson of the Legacy Management Support (LMS) contractor. H. Mickelson, C. Bishop, L. Kellum, and J. Olson (Utah Department of Environmental Quality) attended the inspection. S. Gurr, of EnergySolutions (private operator of the surrounding radioactive waste disposal facility), escorted the inspection group, and S. Stanley (EnergySolutions) provided support as a radiation control technician. 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 whether maintenance or additional inspection and monitoring are needed.

15.4.1 Site Surveillance Features

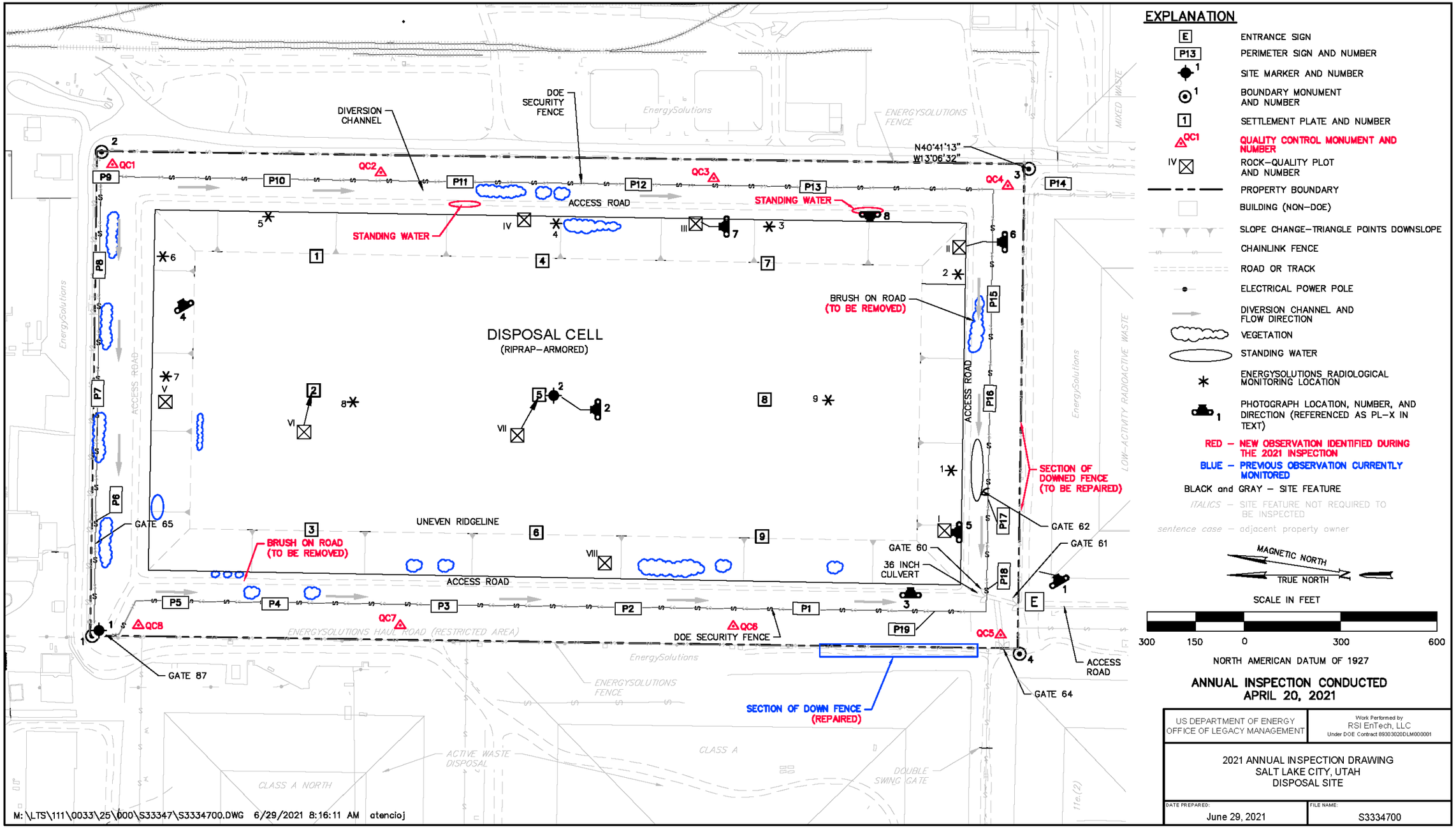
Figure 15-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue text, and new observations identified during the 2021 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 15-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 15.10.

15.4.1.1 Site Access, Entrance Gates, and Entrance Sign

The site is completely surrounded by the EnergySolutions radioactive waste facility. A perpetual right-of-way easement ensures that the Office of Legacy Management (LM) and its representatives have continued access across the EnergySolutions property to the site. LM also provides EnergySolutions access to the site to perform periodic maintenance activities, as needed, through a signed access agreement. In accordance with the agreement, EnergySolutions is required to provide a minimum 48-hour notice to LM before accessing or conducting maintenance activities at the site.

All personnel entering the EnergySolutions facility must sign in at the security building. Because of the surrounding radioactive waste disposal facility, posted radiological control areas must be crossed to access the site. Therefore, EnergySolutions requires that inspectors and other site visitors receive a radiological hazard awareness briefing, sign the EnergySolutions Radiological Work Permit, wear a dosimeter, and be escorted to and from the site. Hard hats, safety glasses, high-visibility vests, and steel-toed boots are also required on the EnergySolutions property. Following the inspection and before exiting the radiological control area, personnel and equipment are scanned for radiological contamination using a personal contamination monitor.

A route across the EnergySolutions property provides access to the southwest corner of the site. Six locked gates around the site limit access to the site and disposal cell. Two gates (Gates 61 and 64) are in the southwest corner of the property, and one gate (Gate 87) is in the northwest corner of the property; these property boundary gates are maintained by EnergySolutions. The remaining three gates (Gate 65 in the northwest corner and Gates 60 and 62 in the southwest corner) are along the interior chainlink security fence that surrounds the disposal cell; these interior gates are maintained by LM. Gates 60, 61, and 64 are considered site entrance gates. Gates were locked and functional. The entrance sign is on Gate 61. No maintenance needs were identified.



EXPLANATION

- E — ENTRANCE SIGN
- P13 — PERIMETER SIGN AND NUMBER
- 1 — SITE MARKER AND NUMBER
- 1 — BOUNDARY MONUMENT AND NUMBER
- 1 — SETTLEMENT PLATE AND NUMBER
- QC1 — QUALITY CONTROL MONUMENT AND NUMBER
- IV — ROCK–QUALITY PLOT AND NUMBER
- PROPERTY BOUNDARY
- BUILDING (NON–DOE)
- SLOPE CHANGE–TRIANGLE POINTS DOWNSLOPE
- CHAINLINK FENCE
- ROAD OR TRACK
- ELECTRICAL POWER POLE
- DIVERSION CHANNEL AND FLOW DIRECTION
- VEGETATION
- STANDING WATER
- ENERGYSOLUTIONS RADIOLOGICAL MONITORING LOCATION
- 1 — PHOTOGRAPH LOCATION, NUMBER, AND DIRECTION (REFERENCED AS PL–X IN TEXT)

RED – NEW OBSERVATION IDENTIFIED DURING THE 2021 INSPECTION

BLUE – PREVIOUS OBSERVATION CURRENTLY MONITORED

BLACK and GRAY – SITE FEATURE

ITALICS – SITE FEATURE NOT REQUIRED TO BE INSPECTED

sentence case – adjacent property owner

MAGNETIC NORTH

TRUE NORTH

SCALE IN FEET

300 150 0 300 600

NORTH AMERICAN DATUM OF 1927

ANNUAL INSPECTION CONDUCTED APRIL 20, 2021

US DEPARTMENT OF ENERGY OFFICE OF LEGACY MANAGEMENT	Work Performed by RSI EnTech, LLC Under DOE Contract 89303020DLM000001

2021 ANNUAL INSPECTION DRAWING
SALT LAKE CITY, UTAH
DISPOSAL SITE

DATE PREPARED:	FILE NAME:
June 29, 2021	S3334700

Figure 15-1. 2021 Annual Inspection Drawing for the Salt Lake City, Utah, Disposal Site

This page intentionally left blank

15.4.1.2 Fences and Perimeter Signs

The site has two chainlink fences: the exterior EnergySolutions perimeter fence along the property boundary and the interior LM security fence that encloses the disposal cell and surface water diversion channels. There are 19 perimeter signs attached to the LM security fence. Inspectors identified two new sections of the outer chainlink fence east of Gate 64 that had blown down (PL-1). Repairs to the fence will be completed before the next inspection.

15.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside Gate 87 in the northwest corner of the site. Site marker SMK-2 is on the top slope of the disposal cell (PL-2). No maintenance needs were identified.

15.4.1.4 Boundary Monuments

Four boundary monuments delineate the corners of the property boundary (boundary monuments BM-1 to BM-4). Protective casings that EnergySolutions installed over each boundary monument continue to protect the boundary monuments from damage by surrounding earthmoving activities. No maintenance needs were identified.

15.4.1.5 Aerial Survey Quality Control Monuments

Eight aerial survey quality control monuments were installed before the 2021 inspection (PL-3). No maintenance needs were identified.

15.4.2 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, (2) the area between the disposal cell 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.

15.4.2.1 Disposal Cell

The disposal cell, completed in 1988, occupies 54 acres. The disposal cell is armored with riprap to control erosion (PL-4). There were noticeable vehicle tracks on the east side slope of the disposal cell, but there was no evidence of erosion, settling, slumping, or other modifying processes that might affect the integrity of the disposal cell. No maintenance needs were identified.

One of several types of rock used for the disposal cell erosion-protection riprap layer has exhibited minor degradation since the disposal cell was constructed. As a result, eight rock-quality monitoring plots, each measuring 1 square meter (indicated by Roman numerals I–VIII in Figure 15-1), were established in 2010 to monitor for continued rock degradation.

The rock type exhibiting degradation constitutes approximately 1%–10% of the riprap material; degradation of this less competent rock is thought to result from freeze-thaw weathering. Rock-quality monitoring plots are visually monitored and documented annually with photographs. Approximately 1%–10% of the rock in the plots exhibited signs of weathering during the 2021 annual inspection (PL-5 through PL-7), with no significant changes from the 2020 annual inspection. Comparisons to the initial 2010 rock-quality plot photographs indicate very little (if any) additional rock degradation since monitoring began. The minimal rock degradation observed to date has not reduced the effectiveness of the riprap cover. Rock-quality monitoring plots will continue to be visually monitored and documented annually with photographs to ensure that the riprap continues to protect the integrity of the disposal cell.

Nine settlement plates are on the top slope of the disposal cell; several outer casings associated with the settlement plates were visually inspected. Surveying of the settlement plates is not required unless settlement appears to be occurring. Every year, EnergySolutions performs light detection and ranging (lidar) surveys of the area which includes the disposal cell. The lidar survey results are available on request.

Although areas of the disposal cell have continued to have minor perennial grass growth, no deep-rooted plants were present on the disposal cell. Standing water from stormwater runoff was observed in the apron at the base of the east side slope of the disposal cell toe drainage (PL-8); no adverse impacts to the disposal cell were noted or expected as a result of this standing water. No other maintenance needs were identified.

15.4.2.2 Area Between Disposal Cell and Site Perimeter

Inspectors examined the area between the toe of the disposal cell and the EnergySolutions security fence on the property boundary. No evidence of erosion was observed. Vegetation continues to encroach along the access road, but the road remains functional, EnergySolutions will remove vegetation along the road before the next annual inspection.

The surface water diversion channels were functioning as designed. Although minor areas of ponded water were observed, vegetation growth in these diversion channels is not impeding stormwater runoff.

Radiological surveys are performed every 2 years on the site by EnergySolutions personnel to confirm the absence of spillover or windblown radioactive contamination from surrounding radioactive waste disposal operations. The previous sampling occurred in 2019. The radiological measurements were not conducted in 2021 but will resume in 2022.

Results from radiological surveys conducted at the site have been below applicable exposure limits established in LM's *Radiological Control Manual* (LMS/POL/S04322). Therefore, both spillover and windblown radiological contamination from the surrounding radioactive waste disposal operation are not evident. All results from the 2019 wipe samples collected by EnergySolutions were below the minimum detectable activities (i.e., nondetect) for removable alpha and beta radiation contamination. The next radiological survey will occur during the 2022 annual site inspection.

EnergySolutions conducts periodic walkthroughs of the site to remove any windblown debris. The company reported no debris on the site in 2021. No maintenance needs were identified.

15.4.2.3 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.

A variety of features and ongoing waste disposal activities that are managed by EnergySolutions surround the site. The most obvious waste disposal activities are occurring directly west of the site where a Class A (i.e., low-level radioactive waste) disposal cell is being capped. On the northeast and east sides of the site, incoming wastes are unloaded from railcars and transferred to haul trucks; decontamination facilities are also present. Directly to the south is a completed low-level radioactive waste disposal cell, to the southwest is a waste disposal cell containing Atomic Energy Act Section 11e.(2) byproduct material, and to the southeast is an operating mixed-waste treatment and disposal facility. Administration, security, and maintenance buildings lie directly north-northwest of the site. A shredding facility, rotary dump, and railroad spur delivery loop are northwest of the site. These adjacent operations and facilities are not affecting the site.

15.5 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.

15.6 Maintenance and Repairs

Repairs to the chainlink fence north of Gate 64 were performed before the 2021 inspection. Aerial survey quality control monuments were installed before the inspection in 2021.

Inspectors documented minor maintenance to be addressed before the next inspection:

- Repair downed fence east of Gate 64
- Remove vegetation growing in the access road on the south and west side of the disposal cell.

No other maintenance needs were identified.

15.7 Groundwater Monitoring

In accordance with the LTSP, groundwater monitoring is not required. Supplemental standards have been applied as site standards because (1) the uppermost aquifer is classified as limited use due to naturally occurring concentrations of total dissolved solids that exceed 10,000 milligrams per liter, and (2) the site is not contributing to the contamination of any current or potentially useful aquifer. EnergySolutions owns and maintains several groundwater monitoring wells throughout its licensed radioactive waste facility.

15.8 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.

15.9 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), 1997. *Long-Term Surveillance Plan for the South Clive Disposal Site, Clive, Utah*, DOE/AL/62350-228, Rev. 2, September.

Radiological Control Manual, LMS/POL/S04322, continually updated, prepared by the LMS contractor for the U.S. Department of Energy Office of Legacy Management.

15.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	60	Down Fence Along South Side of Cell
PL-2	—	Site Marker SMK-2
PL-3	—	Baseline Aerial Survey Quality Control Monument
PL-4	60	North Side Cell Slope
PL-5	—	(a) Rock Quality Plot No. I—2021 (b) Rock Quality Plot No. I—2010 Photo for Comparison
PL-6	—	(a) Rock Quality Plot No. II—2021 (b) Rock Quality Plot No. II—2010 Photo for Comparison
PL-7	—	(a) Rock Quality Plot No. III—2021 (b) Rock Quality Plot No. III—2010 Photo for Comparison
PL-8	270	Standing Water in Southeast Cell Toe Drainage

Note:
— = Photograph taken vertically from above.

PL-1. Down Fence Along South Side of Cell

PL-2. Site Marker SMK-2

PL-3. Baseline Aerial Survey Quality Control Monument

PL-4. North Side Cell Slope

PL-5. (a) Rock Quality Plot No. I—2021

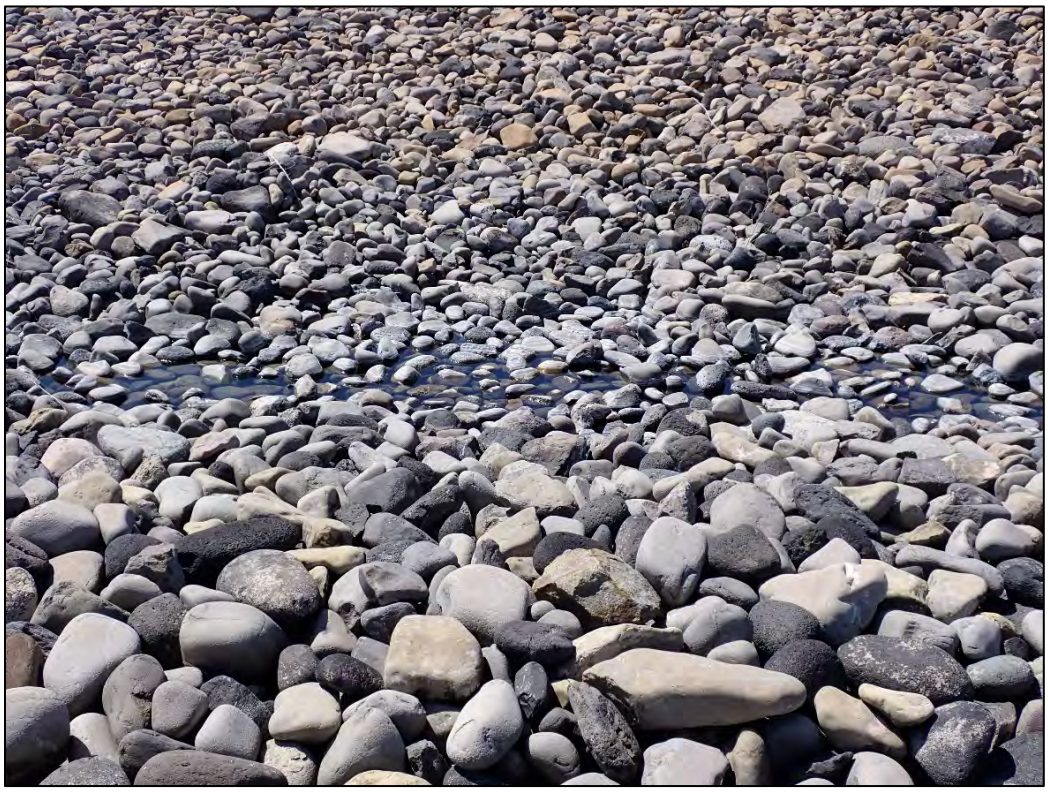
PL-5. (b) Rock Quality Plot No. I—2010 Photo for Comparison

PL-6. (a) Rock Quality Plot No. II—2021

PL-6. (b) Rock Quality Plot No. II—2010 Photo for Comparison

PL-7. (a) Rock Quality Plot No. III—2021

PL-7. (b) Rock Quality Plot No. III—2010 Photo for Comparison



PL-8. Standing Water in Southeast Cell Toe Drainage

16.0 Shiprock, New Mexico, Disposal Site

16.1 Compliance Summary

The Shiprock, New Mexico, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on June 8, 2021. No changes were observed on the disposal cell or in the associated diversion channels. Inspectors identified several minor maintenance needs but found no cause for a follow-up inspection. Groundwater monitoring to evaluate disposal cell performance is not required.

16.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 1994) (LTSP) 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 16-1 lists these requirements.

Table 16-1. License Requirements for the Shiprock, New Mexico, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 6.0	Section 16.4	(b)(3)
Follow-Up or Contingency Inspections	Section 7.0	Section 16.5	(b)(4)
Maintenance and Repairs	Section 8.0	Section 16.6	(b)(5)
Environmental Monitoring	Sections 5.0 and 6.4	Section 16.7	(b)(2)
Corrective Action	Section 9.0	Section 16.8	–

16.3 Institutional Controls

The 105-acre site, identified by the property boundary shown in Figure 16-1, is held in trust by the U.S. Bureau of Indian Affairs. The Navajo Nation retains title to the land. UMTRCA authorized the U.S. Department of Energy (DOE) to enter into a Cooperative Agreement (DE-FC04-85AL26731) with the Navajo Nation and required it to be in place before bringing the site under the NRC general license. DOE and the Navajo Nation executed a Custodial Access Agreement that conveys to the federal government title to the residual radioactive materials stabilized at the repository site and ensures that DOE has perpetual access to the site.

The site was accepted under the NRC general license in 1996. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, the Office of Legacy Management (LM) is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal custody of the disposal cell and its engineered features, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gates and signs, perimeter fence and signs, site markers, survey and boundary monuments, and erosion control markers.

16.4 Inspection Results

The site, 1 mile south of Shiprock, New Mexico, was inspected on June 8, 2021. The inspection was conducted by G. Jay and L. Scott of the Legacy Management Support (LMS) contractor and J. Tallbull of the (Navajo Nation Abandoned Mine Lands [AML] Program). S. Salt (Navajo Nation AML Program) and A. Chambers (LMS contractor) attended the inspection as well. The inspection was not led by the LTSP-required engineer or scientist because of pandemic-related restrictions on travel to the Navajo Nation. Instead, it was led and conducted by local LMS and AML personnel. Grand Junction-based LMS scientists provided the preinspection briefing and postinspection closeout meeting via teleconference with the onsite inspection team. The purposes of the inspection were to confirm the integrity of the visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate whether maintenance or additional inspection and monitoring are needed.

16.4.1 Site Surveillance Features

Figure 16-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. 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 2021 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 16-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 16.10.

16.4.1.1 Access Roads, Entrance Gates, and Entrance Signs

Access to the site is from a gravel road off U.S. Highway 491. Three gates allow access to the site through the perimeter fence: the east gate (the current main entrance gate near the terrace escarpment), the north gate (an auxiliary access gate), and the west gate (the former main entrance gate). Access to the main entrance gate is through a gravel pit. The three gates were locked and functional. Pairs of entrance signs—one pictorial and one textual—are present near each gate. One pair is present at the east and north gates, and two pairs are present at the west gate. No maintenance needs were identified.

16.4.1.2 Perimeter Fence and Signs

A chainlink perimeter fence encloses the disposal cell and drainage features. Regular maintenance to keep the perimeter fence free of trash, tumbleweeds, and other debris is ongoing. Seventeen pairs of perimeter signs, designated P1 through P17 (each pair consisting of one pictorial and one textual sign), are positioned along the perimeter fence.[1] Pictorial signs P1, P12, and P13 were faded and in need of replacement (PL-1), the radiation symbols on several signs were faded and the website information on perimeter sign P3 was faded. Faded signs and symbols will be replaced before the next inspection. No other maintenance needs were identified.

[1] Plate 1 of the LTSP shows six sets of perimeter signs on fence fabric along the terrace escarpment. These were not installed because a fence was never installed in this area. Because the escarpment prohibits access to the site, a fence was not needed.

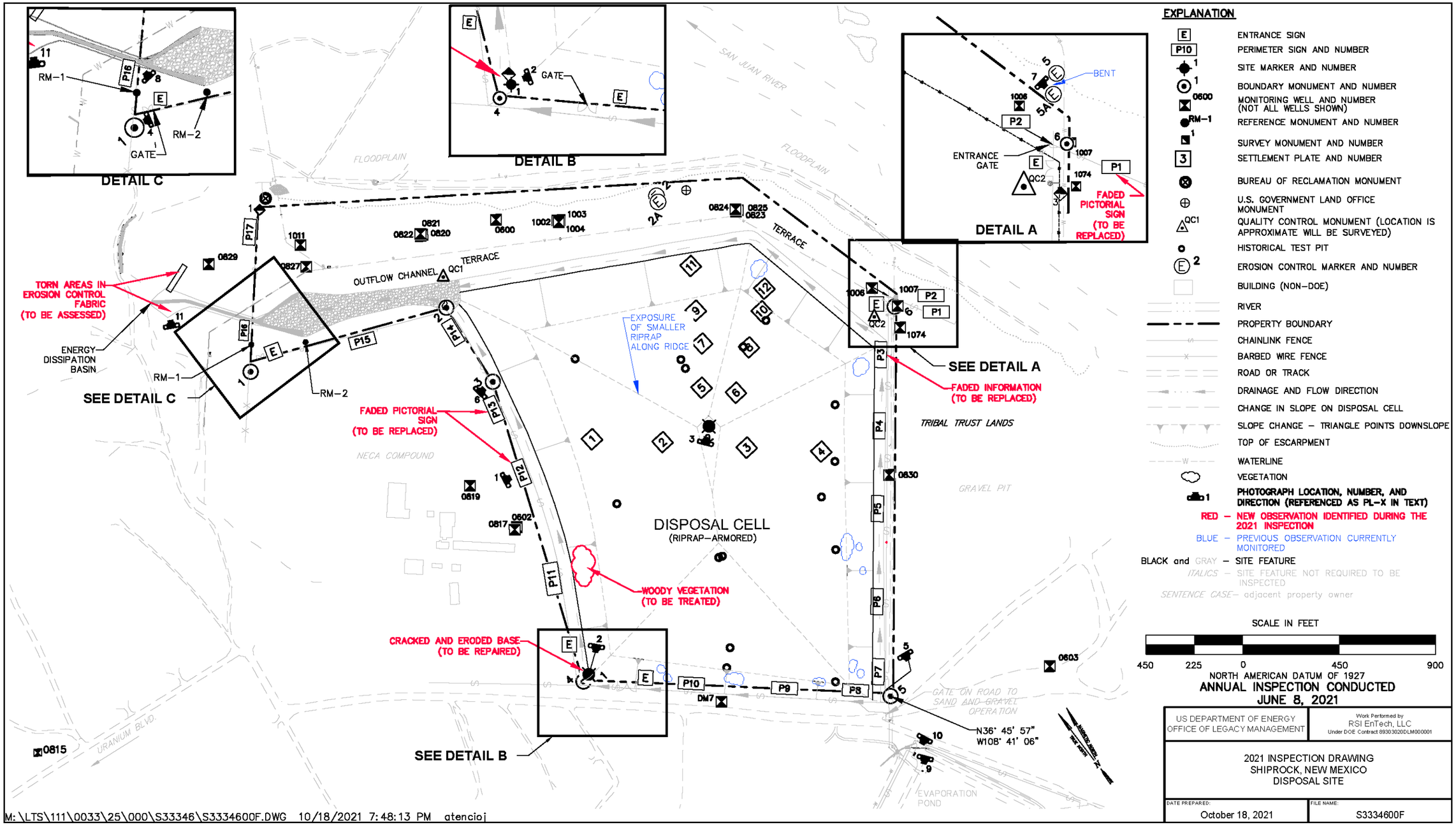


Figure 16-1. 2021 Annual Inspection Drawing for the Shiprock, New Mexico, Disposal Site

This page intentionally left blank

16.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside the west gate and contains minor cracks in its concrete base. Although the cracks were sealed in 2018, they are beginning to open and will start to deteriorate (PL-2). Inspectors also noted that a minor amount of soil had eroded from the north side of the concrete base. Both of these items will be repaired before the next inspection. Site marker SMK-2 is on the top slope of the disposal cell and is stable and legible (PL-3).

16.4.1.4 Survey and Boundary Monuments

Three survey monuments and six boundary monuments delineate the property boundary. Two additional boundary monuments are offsite; monitoring of these offsite monuments was discontinued in 2003. In 2002, boundary monument BM-1 was destroyed or removed by an adjacent landowner. It was replaced, and two reference monuments (RM-1 and RM-2) were installed next to it in 2003. Steel T-posts were installed next to all boundary monuments to make them more visible and help inspectors locate them. The concrete at survey monument SM-1 is cracked, but the crack does not threaten the integrity of the marker. All survey and boundary monuments were observed to be clear of vegetation and were either visible (PL-4) or uncovered with a shovel (PL-5 and PL-6) during the 2021 inspection. No maintenance needs were identified.

16.4.1.5 Aerial Survey Quality Control Monuments

Two aerial survey quality control monuments installed in early 2020 were inspected during the 2021 annual inspection. No maintenance needs were identified.

16.4.1.6 Erosion Control Markers

The site has four pairs of erosion control markers (1/1A, 2/2A, 3/3A, and 5/5A) (PL-4) along the edge of the terrace escarpment. Erosion control markers 4 and 4A are not inspected; they were installed on the terrace east of the site in the gravel pit. Erosion control marker 5A, near the east entrance gate, was previously bent by a vehicle (PL-7), but it is functional and does not require repair. No maintenance needs were identified.

16.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into three areas to ensure a thorough and efficient inspection. The inspection areas are (1) the disposal cell, diversion channels at the base of the disposal cell, and the outflow channel; (2) the terrace area north and northeast of the disposal cell; and (3) the outlying area, which includes the fenced evaporation pond south of the disposal cell and the gravel pit southeast of the disposal cell. 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.

16.4.2.1 Disposal Cell, Diversion Channels, and Outflow Channel

The disposal cell, completed in 1986, occupies 77 acres and is armored in riprap to control erosion and deter animal and human intrusion. There was no evidence of erosion, settling, slumping, rock degradation, or other modifying processes that might affect the integrity of the disposal cell. Piezocones associated with a research project that were installed on the disposal cell cover in the past are no longer in use. Some of the filled piezocone pits have subsided slightly or were never completely backfilled, which resulted in shallow conical depressions in the cover. As reported in previous site inspection reports, the surface of the disposal cell has numerous ruts associated with past vehicle traffic. An area where smaller riprap is exposed was identified along the northern ridge of the disposal cell in 2019. This area is monitored each year to detect possible changes that might indicate erosion or degradation of the cover. The inspectors observed no changes in this area in 2021. The condition of other depressions and vehicle ruts is monitored annually and has not changed significantly since the 2014 inspection.

Windblown sediment has accumulated in the rock cover in several places. In accordance with the LTSP, woody, deep-rooted shrubs are controlled. Several woody shrubs were found on the top and side slopes of the disposal cell and will be treated before the next inspection.

Diversion channels around the base of the disposal cell contained scattered vegetation, including several woody shrubs. The channel along the southwestern side of the disposal cell has accumulated sediment, and a significant amount of vegetation has grown. Inspectors noted that nonwoody plants were growing within the outflow channel, and woody vegetation was growing on the banks of the outflow channel (PL-8). Vegetation growth does not adversely affect the performance of any of these channels at this time and is not a concern; however, inspectors will continue to monitor this area. No other maintenance needs were identified.

16.4.2.2 Terrace Area

The terrace area is north and northeast of the disposal cell along the top of a steep escarpment. Other than annual weeds, little vegetation grows on the terrace. The edge of the escarpment varies between 175 and 345 feet from the base of the disposal cell and is prone to slumping. No new significant erosion was evident during the inspection in 2021. The LTSP states that the base of the terrace escarpment should be inspected for signs of seepage, and seeps were identified during early site inspections. However, this is no longer part of annual inspection procedures, as the seeps are now monitored as part of the groundwater compliance program for the site. No maintenance needs were identified.

16.4.2.3 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. A former gravel pit that is no longer actively extracting aggregate is immediately southeast of the disposal cell. Inspectors identified no significant changes in land use associated with the gravel pit or with other outlying areas near the disposal cell during the 2021 inspection.

In 2002, LM constructed an 11-acre lined evaporation pond near the disposal cell as part of the groundwater compliance strategy. The pond, surrounded by a chainlink security fence, is maintained under the groundwater compliance program. Both the security fence and pond were intact and functional at the time of the inspection (PL-9). The informational sign at the pond contained outdated information. Updates to the sign will be made before the next inspection.

Inspectors noted three new torn areas in the erosion control fabric on the banks of the lower outflow channel, one of which was considered significant (PL-10). The tears will be assessed in 2022 once travel restrictions are lifted.

Fences and warning signs posted in Bob Lee Wash are maintained under the groundwater compliance program and were not examined during the 2021 annual inspection.

16.5 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.

16.6 Maintenance and Repairs

The minor maintenance needs that have been identified will be completed when travel restrictions to the Navajo Nation are lifted, include:

- Replacing faded pictorial and information on perimeter signs
- Continuing to remove trash and debris (including tumbleweeds) along the perimeter fence
- Sealing the cracks and repairing erosion at the base of site marker SMK-1
- Treating deep-rooted woody shrubs on the top and side slopes of the disposal cell
- Assessing torn areas in erosion control fabric on the northwest end of the outflow channel

16.7 Environmental Monitoring

16.7.1 Groundwater Monitoring

In accordance with the LTSP, groundwater monitoring to evaluate disposal cell performance is not required. However, groundwater monitoring is conducted in accordance with a groundwater compliance strategy. The monitoring wells associated with the groundwater compliance strategy (i.e., along the terrace and at offsite locations) are not included in the annual inspection process. All wells observed during the inspection were locked, and no maintenance needs were identified.

16.7.2 Vegetation Monitoring

In a 1999 letter to the Navajo AML Reclamation/Uranium Mill Tailings Remedial Action Department (Bergman-Tabbert 1999), LM committed to spraying annual weeds on the disposal cell top slope. Annual weeds typically have grown on less than 1% of the top slope. After discussion among LM, Navajo AML, and LMS ecologists in 2019, LM recommended that it

cease treatment of nonnoxious weeds on the cell and allow natural plant succession to progress. In 2019, LM wrote to Navajo AML outlining its proposed vegetation management plan (Kautsky 2019). Under the plan, LM will continue to treat weeds listed as noxious by the State of New Mexico and Navajo Nation (primarily *Halogeton glomeratus*) in accordance with applicable laws and would treat deep-rooted woody species in accordance with the LTSP. Vegetation will continue to be monitored to inform future management decisions.

16.8 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.

16.9 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*.

Bergman-Tabbert, 1999. D. Bergman-Tabbert, site manager, U.S. Department of Energy Office of Legacy Management, letter (regarding the Shiprock Uranium Mill Tailings Remedial Action Site) to Madeline Roanhorse, director, Navajo Nation UMTRA Program Division of Natural Resources, May 13.

DOE (U.S. Department of Energy), 1994. *Long-Term Surveillance Plan for the Shiprock Disposal Site, Shiprock, New Mexico*, DOE/AL/62350-60F, Rev. 1, September.

Kautsky, M., 2019. Mark Kautsky, Title I manager, U.S. Department of Energy Office of Legacy Management, letter (Updated Agreement for Vegetation Control on the Shiprock Disposal Cell) to Madeline Roanhorse, director, Navajo Nation UMTRA Program Division of Natural Resources, October 10.

16.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	120	Faded Pictorial Sign and Radiation Symbol on Perimeter Sign P12
PL-2	250	Cracks and Erosion in Concrete Base of Site Marker SMK-1
PL-3	65	Site Marker SMK-2 on Cell Top
PL-4	265	Boundary Monument BM-1
PL-5	180	Boundary Monument BM-5
PL-6	0	Boundary Monument BM-3
PL-7	180	Erosion Control Marker 5A
PL-8	350	Outflow Channel at North Perimeter Fence
PL-9	245	Evaporation Pond
PL-10	40	Torn Areas in Erosion Control Fabric on Northwest End of Outflow Channel

PL-1. Faded Pictorial Sign and Radiation Symbol on Perimeter Sign P12

PL-2. Cracks and Erosion in Concrete Base of Site Marker SMK-1

PL-3. Site Marker SMK-2 on Cell Top

PL-4. Boundary Monument BM-1

PL-5. Boundary Monument BM-5

PL-6. Boundary Monument BM-3

PL-7. Erosion Control Marker 5A

PL-8. Outflow Channel at North Perimeter Fence

PL-9. Evaporation Pond

PL-10. Torn Areas in Erosion Control Fabric on Northwest End of Outflow Channel

This page intentionally left blank

17.0 Slick Rock, Colorado, Disposal Site

17.1 Compliance Summary

The Slick Rock, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on May 20, 2021. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified routine maintenance needs but found no cause for a follow-up or contingency inspection. Groundwater monitoring is not required.

17.2 Compliance Requirements

Requirements for long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 1998) (LTSP) 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 17-1 lists these requirements.

Table 17-1. License Requirements for the Slick Rock, Colorado, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Sections 3.0 and 6.2	Section 17.4	(b)(3)
Follow-Up Inspections	Section 3.4	Section 17.5	(b)(4)
Maintenance and Repairs	Section 4.0	Section 17.6	(b)(5)
Groundwater Monitoring	Section 2.5	Section 17.7	(b)(2)
Corrective Action	Section 5.0	Section 17.8	--

17.3 Institutional Controls

The 62-acre site, defined by the property boundary shown in Figure 17-1, is owned by the United States and was accepted under the NRC general license in 1998. The U.S. Department of Energy (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, perimeter fence and signs, site markers, and survey and boundary monuments.

17.4 Inspection Results

The site, 5 miles northeast of Slick Rock, Colorado, was inspected on May 20, 2021. The inspection was conducted by K. Meadows and L. Sheader of the Legacy Management Support (LMS) contractor. M. Cosby, from the Colorado Department of Public Health and Environment, and C. Oliver, from the LMS contractor, were also in attendance. 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 whether maintenance or additional inspection and monitoring are needed.

17.4.1 Site Surveillance Features

Figure 17-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. 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 2021 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 17-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 17.10.

17.4.1.1 Entrance Gate and Sign

Access to the site is from San Miguel County Road T11. Entrance to the site is through a chained and locked gate. The entrance gate was locked and is worn but remains functional. The entrance sign is next to the gate (PL-1). No maintenance needs were identified.

17.4.1.2 Perimeter Fence and Signs

A four-strand barbed-wire perimeter fence encloses the disposal cell, drainage structures, and much of the site. The top and bottom strands are smooth wire to allow wildlife to pass over and under, and the middle two strands are barbed wire.

There are 32 perimeter signs, attached to steel posts set in concrete, positioned along the property boundary; they are set back 5 feet (ft) from the boundary and cut in at the southwest corner. The printed overlay is cracked on several signs (PL-2), and several signs still display bullet damage, but all remain legible. The concrete bases on perimeter signs P14 and P15 are slightly undercut by erosion but remain stable. No maintenance needs were identified.

17.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside the entrance gate (PL-3), and site marker SMK-2 is on top of the disposal cell. No maintenance needs were identified.

17.4.1.4 Survey and Boundary Monuments

The site has three survey monuments. Survey monument SM-2 was set in a low area and is frequently covered by several inches of soil. A T-post and rocks have been placed next to the monument to assist in locating this feature. Six boundary monuments delineate the corners of the site boundary (PL-4). No maintenance needs were identified.

17.4.1.5 Aerial Survey Quality Control Monuments

Five aerial survey quality control monuments were installed before the 2021 inspection. No maintenance needs were identified during the inspection (PL-5).

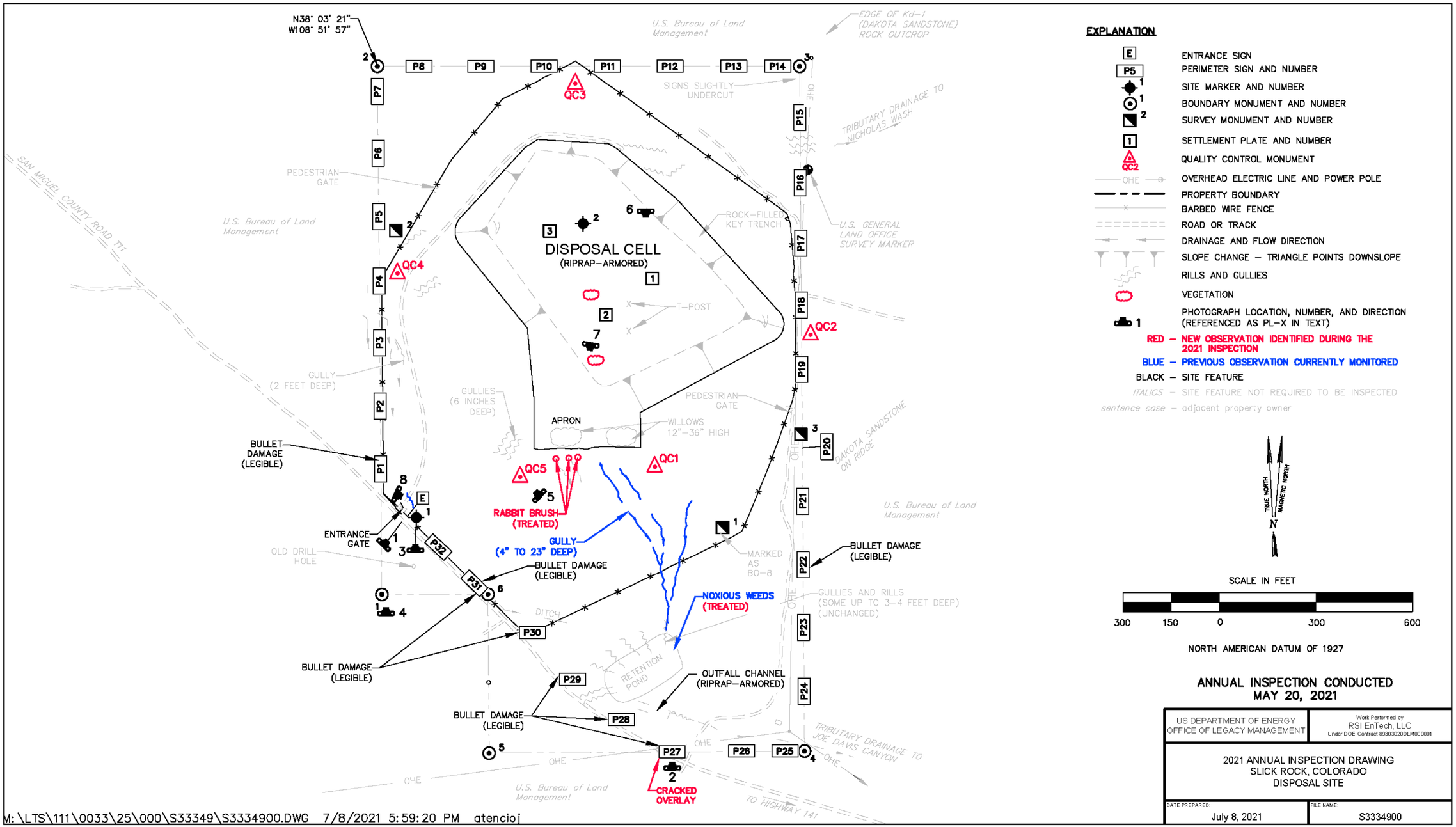


Figure 17-1. 2021 Annual Inspection Drawing for the Slick Rock, Colorado, Disposal Site

This page intentionally left blank

17.4.2 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, including side slopes, key trench, and apron; (2) the area between the disposal cell and the site boundary; 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.

17.4.2.1 Disposal Cell, Key Trench, and Apron

The disposal cell, completed in 1996, occupies 12.9 acres and is armored with riprap, consisting of rounded, cobble-sized river rock, to control erosion and deter animal and human intrusion (PL-6). The inspection found no evidence of erosion, settling, slumping, rock degradation, or other modifying processes that might affect the integrity of the disposal cell. Several bunches of grass are growing on the top of the disposal cell but do not require treatment at this time (PL-7). No other maintenance needs were identified.

At the toe of the disposal cell side slopes is a key trench that encloses the disposal cell. The key trench, designed to convey stormwater runoff away from the disposal cell, is as much as 5 ft deep and 20 ft wide and filled with rock. Stormwater runoff from the key trench discharges to an apron at the south (downslope) corner of the disposal cell. The apron extends 50 to 200 ft beyond the key trench. The key trench and apron are covered with rounded cobble- and pebble-sized river rock. Willows (a deep-rooted species) are growing on a portion of the apron but are not considered detrimental to the integrity of the disposal cell. No maintenance needs were identified.

17.4.2.2 Area Between the Disposal Cell and the Site Boundary

The area around the disposal cell includes a stormwater retention pond. Surface drainage from the disposal cell flows south from the apron into the retention pond, which is constructed in a channel tributary to Joe Davis Canyon. An outflow channel below the pond is lined with rounded riprap for a short distance. The pond was dry at the time of inspection.

The site was originally graded for sheet flow from the apron to the retention pond. Rills have been developing since 1998 on the northwest side of the retention pond and now are 3 ft deep or deeper adjacent to the pond and shallower farther upslope. Most of the rills have stabilized or are stabilizing. The deeper gully identified in the 2020 inspection has not grown significantly since the previous inspection and does not threaten the integrity of the disposal cell. Inspectors will continue to monitor this area.

Vegetation in the reclaimed areas was healthy. Noxious weeds are controlled regularly to comply with state and county requirements. A patch of Russian knapweed, a noxious weed, was identified below the apron area and will be treated following the site inspection.

Erosion rills and gullies are present in several other areas of the site but do not affect the disposal cell or any site features.

The two occluded culverts identified in the 2019 inspection, and subsequently cleaned out, have stabilized (PL-8). No other maintenance needs were identified.

17.4.2.3 Outlying Area

The area beyond the site boundary for 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 natural, undisturbed areas outside the site support grass and scattered pinyon and juniper trees. Steep hillsides north and northeast of the site slope eastward into Nicholas Wash. The primary land use is grazing. The areas north and northeast of the site also are routinely used for firewood cutting and recreation, such as hunting and off-road use by all-terrain vehicles.

17.5 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) a citizen or outside agency notifies LM that conditions at the site are substantially changed. No need for a follow-up inspection was identified.

17.6 Maintenance and Repairs

The patch of noxious weeds identified in the previous inspection were treated before the 2021 inspection. Five aerial survey quality control monuments were installed before the 2021 inspection. Rabbitbrush detected during the 2021 inspection south of the apron was treated after the inspection.

17.7 Groundwater Monitoring

In accordance with the LTSP, groundwater monitoring at this site is not required. Groundwater at the site qualifies for supplemental standards because it is designated as limited use, a designation given to groundwater that is not a current or potential source of drinking water. Groundwater in the uppermost aquifer is designated as limited use because of low yield. The aquifer does not yield enough water to be used for beneficial purposes; with no complete exposure pathways at the site, monitoring is not required. All monitoring wells were abandoned in 2001, and the standpipes in the disposal cell were abandoned in 2002.

17.8 Corrective Action

In accordance with the LTSP, corrective action is taken to correct conditions that threaten the integrity of the disposal cell or compliance with 40 CFR 192. No need for corrective action was identified.

17.9 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), 1998. *Long-Term Surveillance Plan for the Burro Canyon Disposal Cell, Slick Rock, Colorado*, DOE/AL/62350-236, Rev. 0, Ver. 4, May.

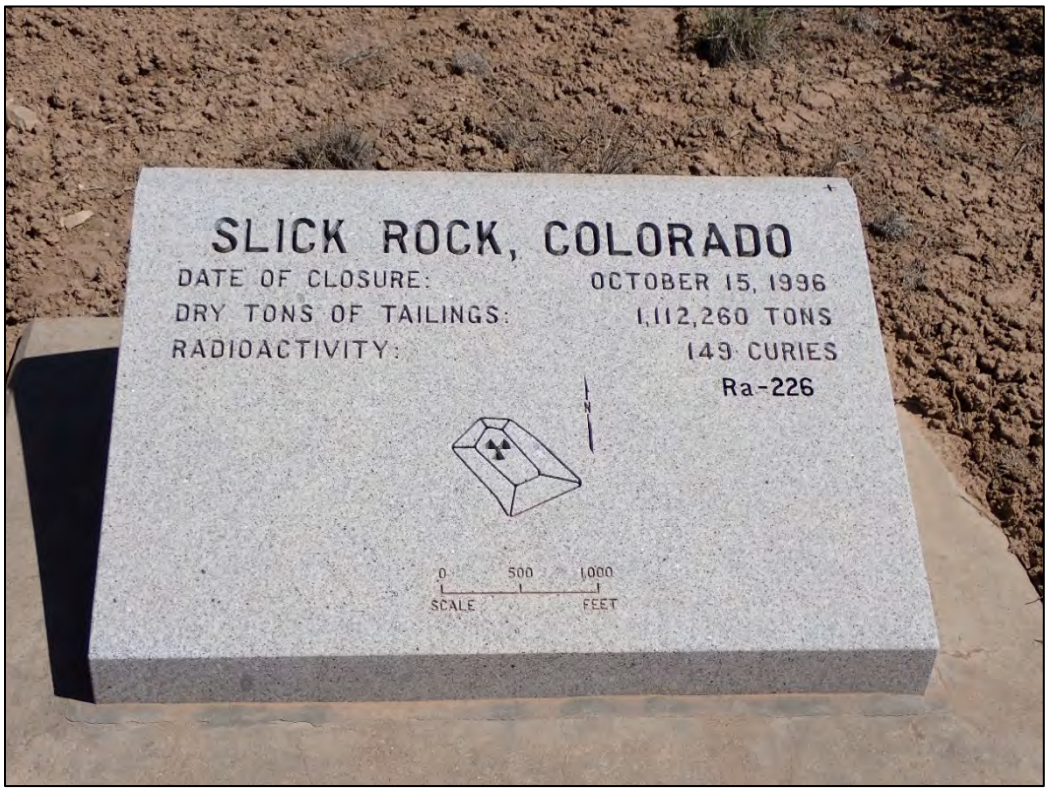
17.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	45	Entrance Sign
PL-2	0	Cracked Overlay on Perimeter Sign P27
PL-3	0	Site Marker SMK-1
PL-4	—	Boundary Monument BM-1
PL-5	315	Quality Control Monument QC-5
PL-6	180	Disposal Cell Cover
PL-7	190	Vegetation Growing on Disposal Cell Cover
PL-8	115	North Side of Culvert Under Access Road Inside Gate

Note:
— = Photograph taken vertically from above.

PL-1. Entrance Sign

PL-2. Cracked Overlay on Perimeter Sign P27



PL-3. Site Marker SMK-1

PL-4. Boundary Monument BM-1

PL-5. Quality Control Monument QC-5

PL-6. Disposal Cell Cover

PL-7. Vegetation Growing on Disposal Cell Cover

PL-8. North Side of Culvert Under Access Road Inside Gate

This page intentionally left blank

18.0 Spook, Wyoming, Disposal Site

18.1 Compliance Summary

The Spook, Wyoming, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on July 14, 2021. No changes were observed on the land surface of the disposal cell. Perimeter sign P5 was observed to be delaminating and will be replaced, but inspectors found no cause for a follow-up or contingency inspection. Groundwater monitoring is not required.

18.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 1993) (LTSP) 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 18-1 lists these requirements.

Table 18-1. License Requirements for the Spook, Wyoming, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 6.0	Section 18.4	(b)(3)
Follow-Up or Contingency Inspections	Section 7.0	Section 18.5	(b)(4)
Maintenance	Section 8.0	Section 18.6	(b)(5)
Groundwater Monitoring	Section 5.0	Section 18.7	(b)(2)
Corrective Action	Section 9.0	Section 18.8	--

18.3 Institutional Controls

The 14-acre site, identified by the property boundary shown in Figure 18-1, is owned by the United States and was accepted under the NRC general license in 1993. The U.S. Department of Energy (DOE) is the licensee and, in accordance with the requirements for UMTRCA Title I sites, the Office of Legacy Management (LM) 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, entrance sign, perimeter signs, site markers, and survey and boundary monuments.

18.4 Inspection Results

The site, 48 miles northeast of Casper, Wyoming, was inspected on July 14, 2021. The inspection was conducted by D. Traub and J. Cario of the Legacy Management Support contractor. C. Boger, 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 whether maintenance or additional inspection and monitoring are needed.

18.4.1 Site Surveillance Features

Figure 18-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. 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 font. New observations are shown in red font. 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 18-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 18.10.

18.4.1.1 Access Road and Entrance Sign

Access to the site is from Wyoming Highway 95 from Glenrock or Wyoming Highway 93 from Douglas to Converse County Road 31 and onto Hornbuckle Ranch Road. Site access is maintained through perpetual easements across the Hornbuckle ranch. The graded, hardpack road to the site is maintained by the ranch. The entrance sign is mounted on a steel post set in concrete (PL-1). No maintenance needs were identified.

18.4.1.2 Perimeter Signs

There are 10 perimeter signs (PL-2), attached to steel posts set in concrete, positioned around the site outside the unfenced property boundary. Perimeter sign P5 shows signs of weathering and is delaminating. The sign will be replaced during the next annual inspection. No other maintenance needs were identified.

18.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is at the south side of the disposal cell (PL-3). Its concrete base is damaged due to spalling but is stable; there were no apparent changes from the previous year. Site marker SMK-2 is at the north side of the disposal cell. No maintenance needs were identified.

18.4.1.4 Survey and Boundary Monuments

The site has three survey monuments and eight boundary monuments. Boundary monument BM-6 is bent but stable (PL-4). The boundary monuments and a survey monument, as well as the perimeter signs, are outside the property boundary. The owner of the surrounding property (Hornbuckle ranch) is aware that the monuments are on his property, but he is not concerned. Therefore, the survey and boundary monuments and perimeter signs will remain at their current locations.

18.4.1.5 Aerial Survey Quality Control Monuments

Four aerial survey quality control monuments were installed in 2019 following the site inspection (PL-5). The quality control monument locations are shown in Figure 18-1. No maintenance needs were identified.

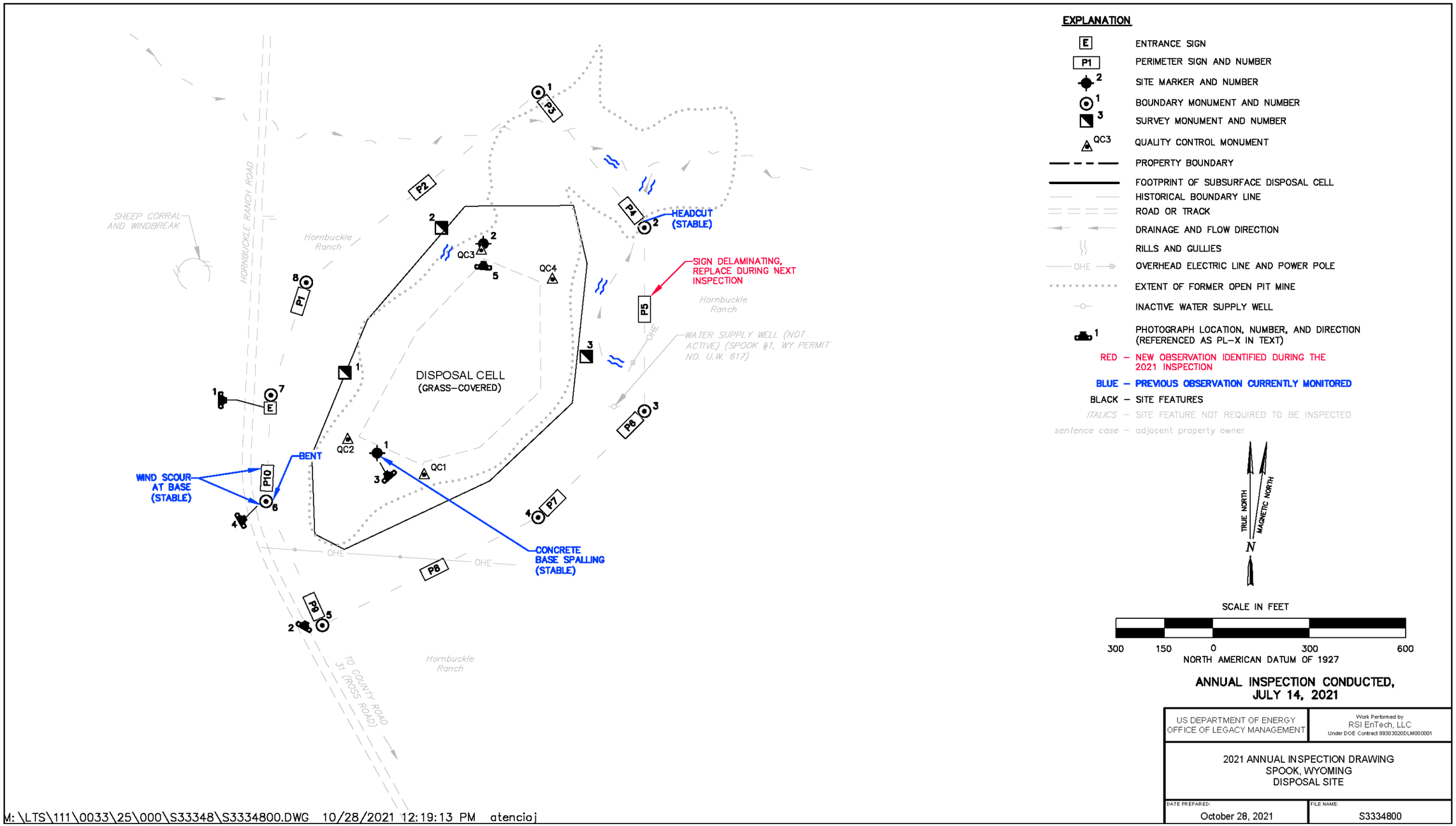


Figure 18-1. 2021 Annual Inspection Drawing for the Spook, Wyoming, Disposal Site

This page intentionally left blank

18.4.2 Inspection Areas

The site is divided into three inspection areas to ensure a thorough and efficient inspection. The inspection areas are (1) the disposal cell, (2) the site perimeter, and (3) the outlying area. Inspectors examined specific site surveillance features within each area, observed the condition of site vegetation, and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with the LTSP requirements.

18.4.2.1 Disposal Cell

The site is unique among Title I sites in that tailings were placed in the bottom of an open pit mine and covered with 40–60 feet of clean fill and topsoil. Therefore, many of the observations and concerns routinely associated with above-grade disposal cells—such as the quality of the riprap and the stability of side slopes—do not apply to this site. The ground surface over the 5-acre disposal cell, completed in 1989, showed no evidence of settling. Vegetation on the ground surface, consisting of grasses and forbs, was healthy and indistinguishable from that growing on the remainder of the site and on the surrounding ranch land. No maintenance needs were identified.

18.4.2.2 Site Perimeter

There is no perimeter fence at the site. The area between the disposal cell and the site perimeter showed no evidence of settling or active erosion. No maintenance needs were identified.

18.4.2.3 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. Several minor rills and gullies are near the site and appeared to be stable. The erosion is not harming the function of the disposal cell cover or other site features, and it is not a concern at this time. Inspectors will continue to monitor this area.

The access road has frequent truck traffic to service and maintain oil wells in the area. Although oil field activity has greatly increased near the site, inspectors found no evidence of trespassing or vandalism onsite.

18.5 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.

18.6 Maintenance

Perimeter sign P5 was observed to be delaminating and will be replaced. Small quantities of trash were observed at the site and will be collected during the next routine maintenance event. No other maintenance needs were identified.

18.7 Groundwater Monitoring

In accordance with the LTSP, groundwater monitoring is not required due to the application of supplemental standards. Groundwater at the site qualifies for supplemental standards because it is designated as limited use; this designation is given to groundwater that is not a current or potential source of drinking water. Groundwater in the uppermost aquifer is designated as limited use because it contains contamination from widespread, naturally occurring uranium mineralization and is of limited yield. Therefore, groundwater monitoring is not required.

18.8 Corrective Action

In accordance with the LTSP, corrective action is taken to correct conditions that threaten the integrity of the disposal cell or compliance with 40 CFR 192. No need for corrective action was identified.

18.9 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), 1993. *Final Long-Term Surveillance Plan for the Spook, Wyoming, Disposal Site*, UMTRA-DOE/AL-350215.0000, January.

18.10 Photographs

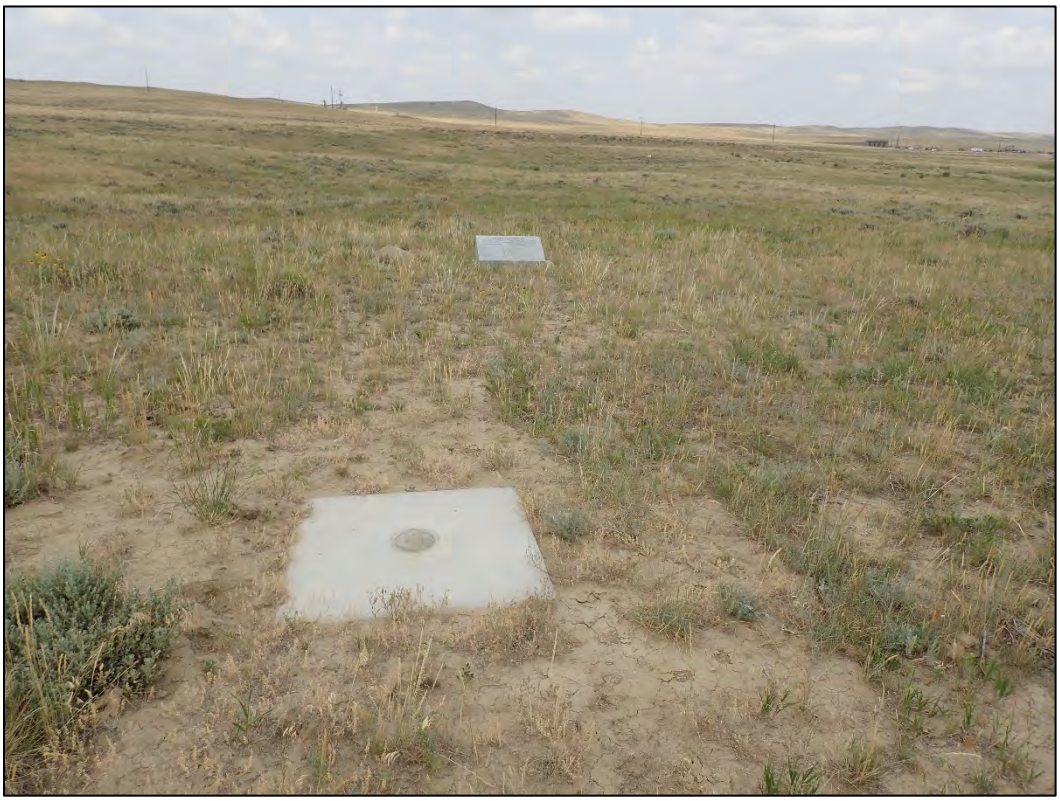
Photograph Location Number	Azimuth	Photograph Description
PL-1	90	Entrance Sign
PL-2	30	Perimeter Sign P9
PL-3	320	Site Marker SMK-1
PL-4	60	Boundary Monument BM-6
PL-5	5	Quality Control Monument QC-3 and Site Marker SMK-2

PL-1. Entrance Sign

PL-2. Perimeter Sign P9

PL-3. Site Marker SMK-1

PL-4. Boundary Monument BM-6



PL-5. Quality Control Monument QC-3 and Site Marker SMK-2

This page intentionally left blank

19.0 Tuba City, Arizona, Disposal Site

19.1 Compliance Summary

The Tuba City, Arizona, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on June 9, 2021. No significant changes were observed on the disposal cell or in the associated drainage features. Inspectors identified maintenance needs but found no cause for a follow-up inspection.

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducts semiannual groundwater monitoring at the site to compare current conditions to baseline postconstruction groundwater quality. Evaluative groundwater monitoring is performed in lieu of normal point-of-compliance (POC) monitoring, as preexisting milling-related groundwater contamination may mask contamination leaching from the disposal cell. Analytical results from the February 2020 evaluative monitoring event indicate that groundwater quality downgradient from the former mill site is still degraded. Concentrations of regulated contaminants (i.e., molybdenum, nitrate, selenium, and uranium) in the downgradient plume are elevated in comparison with unimpacted (upgradient) groundwater quality. The August 2020 and February 2021 semiannual sampling events were cancelled due to travel restrictions imposed in response to the coronavirus pandemic.

Active groundwater remediation is ongoing. Remediation includes operation of extraction wells and conveyance of the extracted (contaminated) groundwater to the onsite evaporation pond. Extraction wells in areas and depths of greatest contamination are operated to maximize source mass removal. However, annual extraction volume is constrained to 5 million gallons due to evaporation pond capacity. Since 2018, the remediation system has operated in 4-month-long high-intensity, short-duration campaigns that begin in July and end in October. The progress of groundwater remediation is evaluated and reported annually, separately from this compliance evaluation.

19.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 1996) (LTSP) 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 19-1 lists these requirements.

Table 19-1. License Requirements for the Tuba City, Arizona, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 6.0	Section 19.4	(b)(3)
Follow-Up Inspections	Section 7.0	Section 19.5	(b)(4)
Maintenance and Repairs	Section 8.0	Section 19.6	(b)(5)
Environmental Monitoring	Section 5.2	Section 19.7	(b)(2)
Corrective Action	Section 9.0	Section 19.8	—

19.3 Institutional Controls

The 145-acre disposal site, identified by the property boundary shown in Figure 19-1, is held in trust by the U.S. Bureau of Indian Affairs. The Navajo Nation retains title to the land. UMTRCA authorized DOE to enter into a Cooperative Agreement (DE-FC04-85AL26731) (DOE 1984) with the Navajo Nation to perform remedial actions at the former uranium processing sites. DOE and the Navajo Nation executed a Custodial Access Agreement that conveys to the federal government title to the residual radioactive materials stabilized at the disposal site and ensures that DOE has perpetual access to the site.

The site was accepted under the NRC general license in 1996. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, LM is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal custody of the disposal cell and its engineered features, 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.

19.4 Inspection Results

The site, 5 miles northeast of Tuba City, Arizona, was inspected on June 9, 2021. Due to the coronavirus pandemic and associated travel restrictions, Legacy Management Support (LMS) and LM staff living outside the Navajo Nation did not travel to the site to perform the annual inspection. Instead, LMS staff enlisted the assistance of individuals from tribal organizations familiar with the Tuba City disposal site. LMS personnel provided online training on the inspection process in advance to the assisting parties. The inspection was conducted by L. Scott, an LMS Tuba City disposal site operations staff member who lives in the Navajo Nation. Tribal individuals who assisted with the inspection were S. Salt (Navajo Abandoned Mine Lands/Uranium Mill Tailings Remedial Action [Navajo AML/UMTRA]), J. Tallbull (Navajo AML/UMTRA), and L. Leslie and N. Honie (both of the Hopi Tribe's Office of Mining and Mineral Resources). 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 whether maintenance or additional inspection and monitoring are needed.

19.4.1 Site Surveillance Features

Figure 19-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. 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 2021 annual inspection are shown in red font. 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 19-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 19.10.

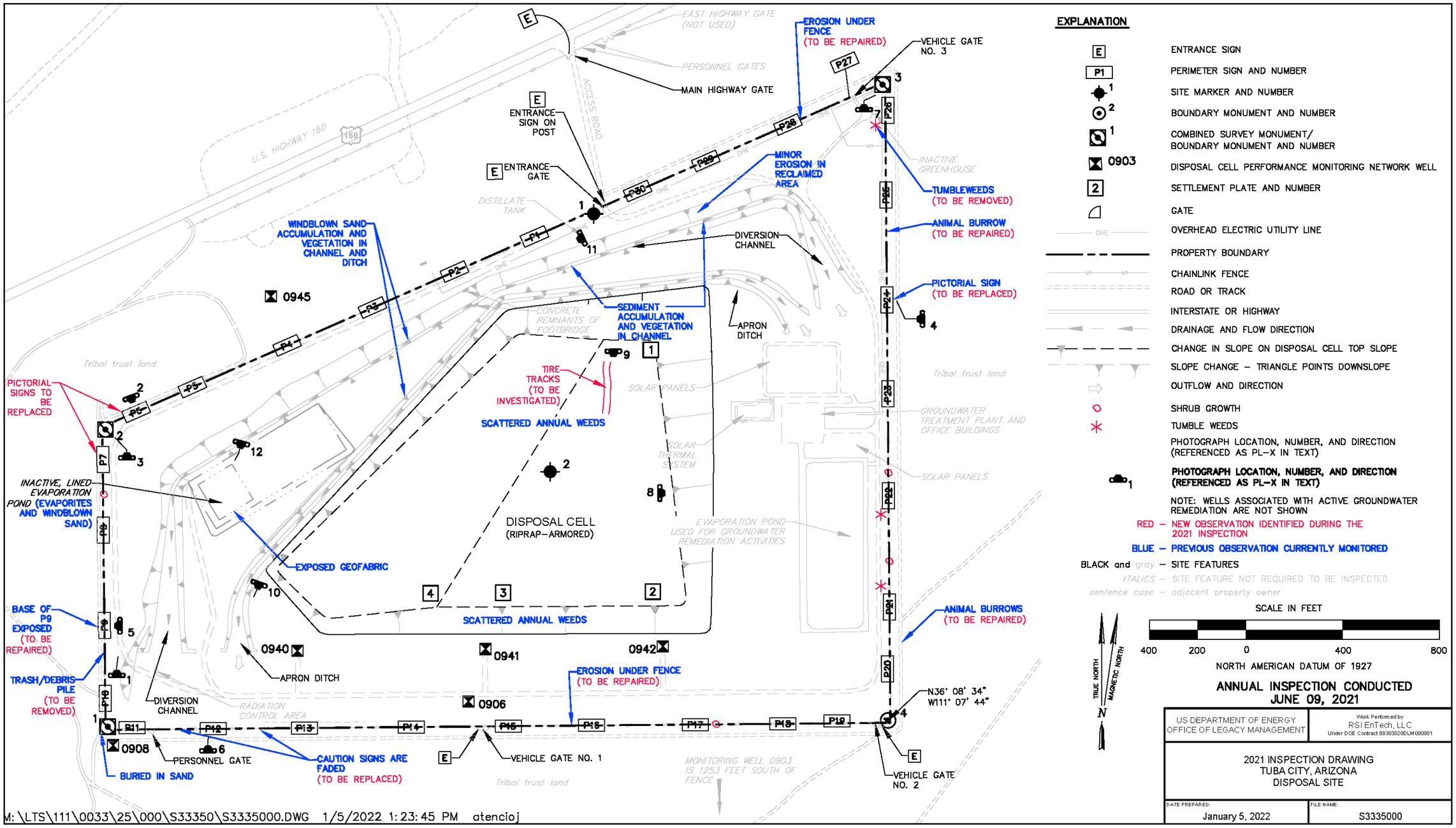


Figure 19-1. 2021 Annual Inspection Drawing for the Tuba City, Arizona, Disposal Site

This page intentionally left blank

Many structures and features at the site are associated with the former groundwater treatment system. Beginning in 2002, contaminated groundwater was extracted and treated through ion exchange and distillation processes, then returned to the aquifer through an infiltration trench upgradient of the disposal cell. Operation of the groundwater treatment plant (GWTP) was suspended in September 2014 due to hydrologic constraints on extraction and GWTP maintenance challenges. The structures associated with the GWTP remain onsite and include a control building; a shop and laboratory building; an ion exchange building, external tanks, and distillation skid; a solar water-heating system; two photovoltaic panel arrays for utility power generation; evaporation ponds; a network of extraction, injection, and monitoring wells; and a treated water infiltration trench.

An Interim Treatment Plan (DOE 2015) was prepared in 2015 after the GWTP operation was suspended. Active remediation continued in the form of extraction and conveyance of contaminated groundwater to the onsite evaporation pond. Under interim treatment, extraction of contaminant mass is optimized through operation of the extraction wells that are in the areas of highest contaminant concentrations. The contaminant plume is to be monitored, and additional mitigative actions are to be defined and implemented if monitoring reveals unacceptable migration of the plume.

From 2015 through 2017, the extract-and-evaporate system operated year-round, with the flow rate adjusted to maintain a constant water level in the pond (i.e., higher extraction flow rate in hot, windy, dry weather conditions and lower flow rate in cold, calm, humid conditions). The average annualized evaporation rate ranged from 7 to 10 gallons per minute (gpm), constraining annual groundwater extraction volume in a range of 3.7 million to 5.3 million gallons. Pumping tests were performed in 2017 to determine groundwater drawdown and recovery rates and to characterize variations in hydraulic conductivity. Results were reported in the *Interim Treatment System Evaluation Report, Tuba City, Arizona, Disposal Site* (DOE 2018).

In 2018, 2019, and 2020, short-duration, high-intensity extraction campaigns were planned and executed. The operational objectives were to extract a volume of contaminated groundwater equivalent to the pond's annual evaporative capacity and to maintain the maximum source mass removal under the constraint of interim operation. As many as 11 extraction wells were operated at a cumulative flow rate of 40 to 50 gpm from July through October. In addition to meeting the operational objectives, groundwater drawdown and recovery data were collected during and after the extraction campaign to refine the hydrologic site characterization and to define the effective capture zone of the most productive extraction wells.

The purpose of groundwater treatment is to remove contamination that resulted from past uranium-ore processing at the site. Groundwater remediation activities are not addressed in the LTSP because they are not related to the long-term disposal and stabilization of contaminated materials under the cell cover. Therefore, the features associated with groundwater treatment are not included in the annual inspection and are only addressed in this report as they relate to site integrity or safety concerns.

19.4.1.1 Access Road, Entrance Gates, and Entrance Signs

Access to the site is from U.S. Highway 160. Perpetual access to the site is granted by the Custodial Access Agreement. A gate in a chainlink fence on the highway right-of-way (described as the main highway gate in Figure 19-1) allows access to the site via a gravel road. The entrance

gate is in the inner chainlink perimeter fence between perimeter signs P1 and P30. Both gates were operational at the time of the inspection. Vehicle gates are also present in the northeast corner of the site to allow access to Diné College's greenhouse (now inactive) and along the southern fence line to facilitate access for offsite activities. All gates were secured and functional.

Entrance signs are posted on the main highway gate, on a post near the entrance gate (in the inner chainlink perimeter fence), and on two vehicle gates (No. 1 and No. 2). Vehicle Gate No. 3, in the northeast corner of the site, purposefully does not have a sign. No maintenance needs were identified.

19.4.1.2 Perimeter Fence and Signs

A chainlink perimeter fence encloses the site. Windblown sand continues to accumulate along the western perimeter fence and road (PL-1). The sand accumulation is not of concern at this time. Inspectors found several areas of accumulated tumbleweeds along the eastern fence line that will be cleared to reduce a potential fire hazard once Navajo Nation travel restrictions are lifted.

Thirty pairs of perimeter signs, designated P1 through P30, are attached to steel posts set in concrete directly inside and along the perimeter fence. One of the sign pairs is textual, and the other is pictorial. All were legible and stable, with the exception of pictorial signs P6, P7, and P24, which are faded and cracked (PL-2, PL-3, and PL-4); these observations were reported in 2020, but the signs cannot be replaced until travel to the Navajo Nation is approved.

The erosion reported in 2020 under the fence near perimeter sign P16 has developed into a significant gap under the fence; a similar gap was also observed near perimeter sign P28. Animal burrows under the fence line near perimeter signs P20 and P25 identified in the 2020 inspection are still in need of repair. Perimeter sign P9 is being undercut by wind erosion (PL-5). Two faded signs warning of high voltage near perimeter sign P-12 were identified in the 2020 inspection. These maintenance tasks will be conducted once travel restrictions to the Navajo Nation are lifted (PL-6).

19.4.1.3 Site Markers

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

19.4.1.4 Survey and Boundary Monuments

One boundary monument and three combined survey and boundary monuments delineate the corners of the site. Combined survey and boundary monuments SM/BM-1 and SM/BM-3 tend to get covered with windblown sand and are marked with steel T-posts. Boundary monument SM/BM-3 was found in this condition during the inspection and was cleared and exposed for visual detection during the inspection (PL-7). All other survey and boundary monuments were located and in good condition. No other maintenance needs were identified.

19.4.1.5 Monitoring Wells

Seven monitoring wells (0903, 0906, 0908, 0940, 0941, 0942, and 0945) constitute the disposal cell performance monitoring network. Monitoring wells 0906, 0908, 0940, 0941, and 0942 are inside or immediately outside the perimeter fence. Inspectors checked the wellhead protectors (with the exception of distal downgradient well 0903, which is offsite), and all were found to be undamaged and locked. Monitoring wells are also inspected during semiannual groundwater sampling events; their condition and maintenance needs are reported after those events as well.

19.4.2 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 disposal cell, (2) the area between the disposal cell and the site boundary, 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.

19.4.2.1 Disposal Cell

The disposal cell, completed in 1989, occupies 50 acres. The disposal cell is armored with riprap to control erosion and deter animal and human intrusion (PL-8). Inspectors detected parallel depressions from possible tire tracks on the cell top (PL-9). These will be investigated and mapped once travel restrictions are lifted. There was no evidence of erosion, settling, slumping, or other modifying process on the disposal cell.

In accordance with the LTSP, deep-rooted vegetation is controlled to prevent potential penetration of the radon barrier. Periodic spot-application of herbicide has been effective in controlling deep-rooted vegetation growth on the disposal cell cover. No deep-rooted shrubs were observed on the cell top or side slopes during the inspection. Scattered patches of annual weeds grow on the disposal cell top and side slopes, but these shallow-rooted plants are not a concern. Windblown sand and dirt continue to accumulate on the rock-covered surfaces, providing a favorable environment for plant growth. No maintenance needs were identified.

19.4.2.2 Area Between the Disposal Cell and the Site Boundary

The disposal cell is protected from stormwater runoff by a disposal cell apron ditch and a diversion channel, both of which are armored with riprap and located along the north and northwest sides of the disposal cell. Windblown sand and vegetation accumulate in the apron ditch and the diversion channel (PL-10) along the north and northwest sides of the disposal cell. This sand deposition and associated vegetation establishment have not adversely affected the performance of these structures. No evidence of recent or past water flows was observed in the apron ditch or the diversion channel.

The north slope above the diversion channel consists of noncohesive sandy soil and is subject to erosion from stormwater runoff. Erosion repair conducted in this area in 2013 reduced the rate of erosion and subsequent soil deposition in the channel. Some erosion and deposition continue, however, and erosion control repairs are performed as needed. No repairs are necessary at this time.

Inspectors noticed that much of the vegetation in reclaimed areas around the disposal cell appeared to be dormant or dead. This is likely the result of a prolonged drought in the region (https://www.epa.gov/climate-indicators/southwest). No action is necessary at this time.

Two of the three evaporation ponds near the northwest side of the disposal cell were removed in 2007. The area was reclaimed and seeded with a native seed mix in 2007 and again in 2013. Because the area is often scoured by wind, perennial vegetation is establishing extremely slowly; most of the plants are early successional annual species.

The remaining evaporation pond, filled minimally with windblown sand and evaporites, is retained as a backup for the main evaporation pond on the east side of the site (PL-12). The steel cable and caution signs surrounding the pond were in good condition. The high-density polyethylene liner was in good condition. The plastic geofabric that stabilizes the south-facing slope of the pond remains exposed. No repairs of the geofabric are needed at this time, as it remains mostly buried and continues to stabilize the slope. Inspectors will continue to monitor this area. No maintenance needs were identified.

19.4.2.3 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. A small pile of trash and debris was observed offsite on the west side near perimeter sign P9 in 2020, and will be removed when access to the site is allowed. No other maintenance needs were identified.

19.5 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.

19.6 Maintenance and Repairs

Several maintenance items identified in the 2020 inspection were not addressed due to the Navajo Nation's coronavirus travel ban. The items to be completed once travel restrictions are lifted include:

- Removal of tumbleweeds along the fence near perimeter sign P26.
- Repair of the gap beneath the fence near perimeter signs P16 and P28.
- Repair of the eroding base on perimeter sign P9.
- Replacement of two caution signs near perimeter sign P12.
- Repair of animal burrows under the fence line near perimeter signs P20 and P25.
- Removal of trash and debris by perimeter sign P9.

Maintenance needs identified during the 2021 inspection also will be completed after the coronavirus travel ban is lifted—before the next inspection, if possible. That maintenance will include:

- Replacement of the P6, P7, and P24 pictorial perimeter signs.
- Investigation of tire tracks on the disposal cell top.

No other maintenance needs were identified.

19.7 Environmental Monitoring

In accordance with the LTSP, semiannual groundwater monitoring is conducted to compare current conditions at the site to baseline postconstruction groundwater quality. Groundwater quality beneath and downgradient of the disposal cell has been degraded by contamination from former uranium-processing activities. This preexisting milling-related contamination might mask contamination leaching from the disposal cell, which limits the effectiveness of normal POC groundwater monitoring as a reliable indicator of disposal cell performance (40 CFR 192 Subpart A). In lieu of POC monitoring, groundwater monitoring is performed in accordance with Section 5.2.2 of the LTSP and is defined as evaluative monitoring. Evaluative monitoring is performed to "(1) evaluate trends in ground water quality, (2) monitor the downgradient extent of contamination in ground water, (3) analyze the impacts of transient drainage and surface runoff, and (4) assess the effects of ground water restoration measures associated with containing the contamination related to uranium processing activities" (DOE 1996). Evaluative groundwater monitoring was conducted once in August 2021. The progress of groundwater remediation is evaluated and reported annually, separate from this compliance evaluation.

Seven wells (Figure 19-2 and Table 19-2) identified in the LTSP are monitored for four hazardous constituents: molybdenum, nitrate, selenium, and uranium (DOE 1996). As a baseline for cell performance evaluation, provisional upper baseline limits (UBLs) for the four hazardous constituents were calculated in accordance with the U.S. Environmental Protection Agency's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities–Interim Final Guidance* (EPA 1989) and documented in the LTSP (Table 19-3). UBLs were described in the LTSP as provisional because "baseline conditions were established for locations other than the disposal cell monitor wells." Establishing baseline conditions at wells 906 and 908 intended to determine "transient excursions from baseline conditions, potential chemical gradients between baseline and disposal cell locations, and stabilization of postclosure disposal cell hydrology" (DOE 1996). UBLs are concentrations that, with 95% confidence, would be exceeded less than 5% of the time during long-term monitoring if groundwater conditions near the monitoring well did not change. Because the four hazardous constituents are present in tailings material, are relatively mobile in groundwater, and are found in low concentrations in background groundwater quality, exceedance of UBLs in more than 5% of sampling events over the long term could indicate that the disposal cell is not performing to design standards. However, the LTSP also notes that elevated concentrations could result from transient drainage of tailings fluid into the subsurface (directly beneath the cell) or from rainfall infiltrating through contamination in the unsaturated zone in the mill ponds area not covered by the disposal cell. Elevated concentrations attributed to transient drainage or infiltration would not be indicative of substandard performance for the cell.

Figure 19-2. Groundwater Monitoring Network at the Tuba City, Arizona, Disposal Site

Table 19-2. LTSP Groundwater Monitoring Network at the Tuba City, Arizona, Disposal Site

Monitoring Well	Hydrologic Relationship	Monitoring Frequency
0903	Downgradient (offsite)	Annually
0906	Downgradient	Semiannually
0908	Downgradient	Semiannually
0940[a]	Downgradient	Semiannually
0941	Downgradient	Semiannually
0942[b]	Downgradient	Semiannually
0945	Upgradient (background)	Annually

Notes:
[a] Between August 2004 and February 2010, samples from well 0940 could not be obtained because of an insufficient volume of water. This explains the data gaps in Figure 19-3 and Figure 19-6.
[b] Well 0942 was converted from a monitoring well to an extraction well in 2015.

Table 19-3. Provisional Upper Baseline Limits for Groundwater at the Tuba City, Arizona, Disposal Site

Constituent	Provisional UBL (mg/L)[a]	MCL (mg/L)[b]
Molybdenum	0.14	0.10
Nitrate (as nitrogen)	311	10
Selenium	0.05	0.01
Uranium	1.17	0.044

Notes:
[a] As documented in the LTSP (DOE 1996).
[b] MCLs as listed in 40 CFR 192 Subpart A.

Abbreviations:
MCL = maximum concentration limit
mg/L = milligrams per liter

Active groundwater remediation was anticipated when the LTSP was prepared in 1996, and it was expected that deviations from anticipated disposal cell performance could be detected even with ongoing groundwater remediation. However, the LTSP also noted that (1) POC sampling and analysis protocol to monitor cell performance could not be established until groundwater restoration was complete and (2) the LTSP would be revised at that time.

As noted in the definition of UBLs, the UBL value should not be exceeded more than 5% of the time as long as conditions near the monitoring well do not change. Due to implementation of active remediation (2000–2014) and interim treatment (2015 to present), the conditions near the LTSP cell performance wells have constantly been affected, and exceedance of UBLs cannot be attributed to disposal cell performance. Recent operation of the interim treatment system, which potentially affects concentrations of target analytes in the LTSP-specified evaluative monitoring wells, is described in the following paragraphs.

Throughout the period of interim treatment (2015 to present) active remediation has been performed by pumping contaminated groundwater directly to the onsite evaporation pond (DOE 2015). The volume of contaminated groundwater that can be extracted is limited to the

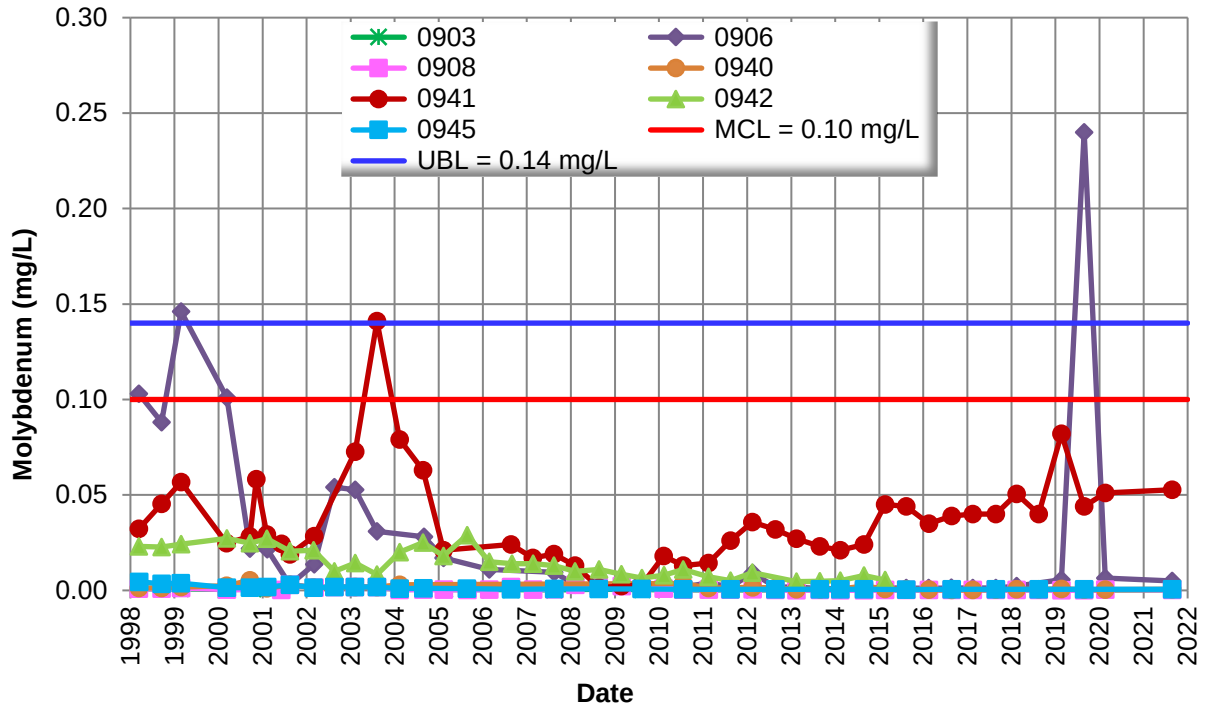
pond's evaporation rate of approximately 5 million gallons annually. From 2015 through 2017, groundwater extraction was operated year-round, and the extraction flow rate was adjusted seasonally; it operated at a relatively high rate in warm weather and at a lower rate in cold weather. In these years, three extraction wells were typically operated at flow rates ranging from 5 to 30 gpm, depending on seasonal changes in evaporation. The wells were used because of their consistent productivity and for maximum contaminant mass removal.

Since 2018, extraction pumping has been conducted in high-intensity/short-duration campaigns to evaluate the effects on plume capture and maximum groundwater drawdown achievable under the interim treatment regime. In 2018, the high-intensity/short-duration pumping campaign used 11 extraction wells operating at a cumulative flow rate of 44 gpm for 76 days. In 2019, the pumping campaign used nine extraction wells at a cumulative pumping rate of 33 gpm for 99 days. The 2020 and 2021 pumping campaigns were similar to 2018 in the number of wells operated, cumulative flow rate, and duration. Groundwater levels were constantly measured in a surrounding network of monitoring wells. Results and evaluation of the recent pumping campaigns will be reported in a groundwater performance report.

Figure 19-3 through Figure 19-6 show time-concentration plots for the four target analytes, along with corresponding UBLs and MCLs. The August 2020 and February 2021 sampling events were canceled, so there were no data for these periods. All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System (GEMS) website (https://gems.lm.doe.gov/#site=TUB). MCLs are presented only for informational purposes. The LTSP requirement related to disposal cell performance is for evaluative monitoring over time, in comparison with UBLs.

Since 2004, molybdenum concentrations have been below both the 0.10 milligram per liter (mg/L) MCL and the 0.14 mg/L UBL in all LTSP evaluative wells except well 0906 in August 2019 (Figure 19-3). Molybdenum concentrations in the westernmost downgradient well 0908 and in distal downgradient well 0903 (approximately 1250 feet south of the site perimeter) continue to be comparable to concentrations in background well 0945. Well 0906 exceeded the UBL for molybdenum in August 2019 for the first time since 1999. The UBL exceedance in well 0906 was measured during the 2019 pumping campaign. Molybdenum in well 0906 decreased below the MCL in February 2020 and remained below the MCL in August 2021.

Nitrate concentrations have historically exceeded the 10 mg/L MCL in all LTSP evaluative wells except background well 0945 (Figure 19-4). Exceedances of the 311 mg/L UBL were observed at compliance wells 0906 (338 mg/L), 0908 (434 mg/L), 0940 (550 mg/L), and 0941 (318 mg/L) in August 2021. Nitrate concentrations in distal downgradient well 0903 have regularly exceeded the MCL since 2004 but remained below the UBL in 2020.



Note: Results include validated data only; results below the detection limit are presented at the laboratory reported value.

Figure 19-3. Molybdenum in Groundwater at the Tuba City, Arizona, Disposal Site

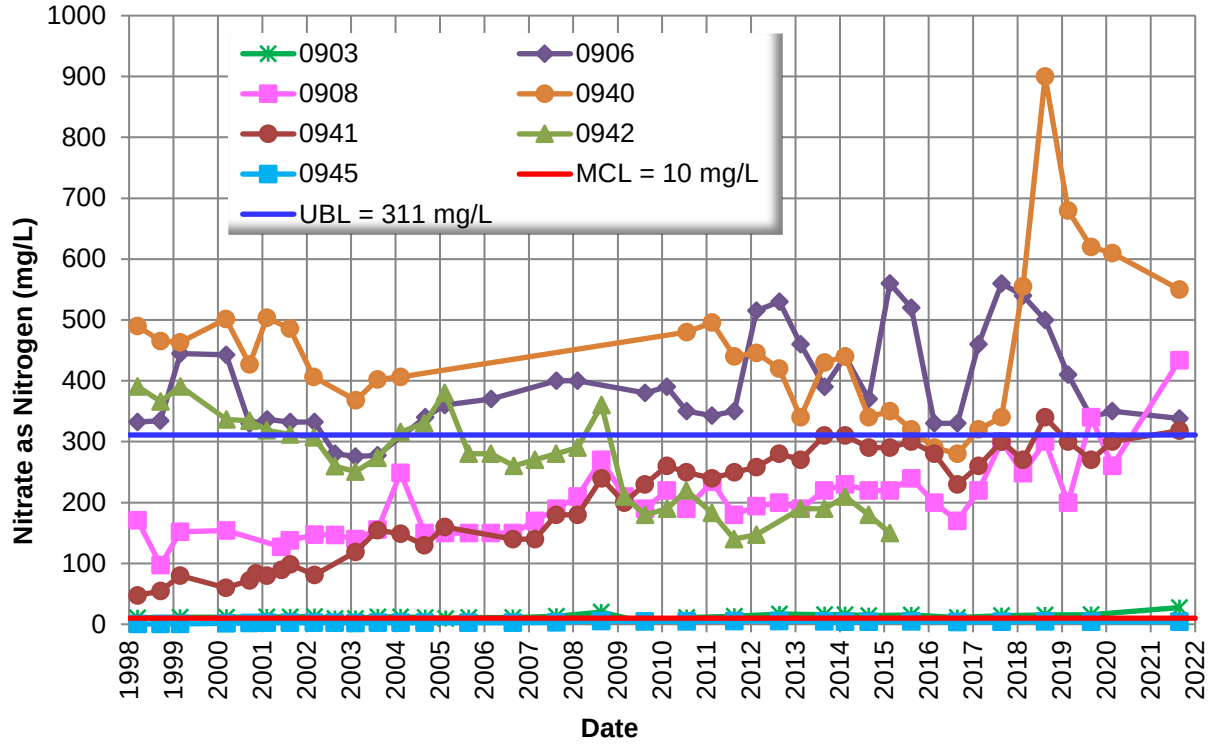
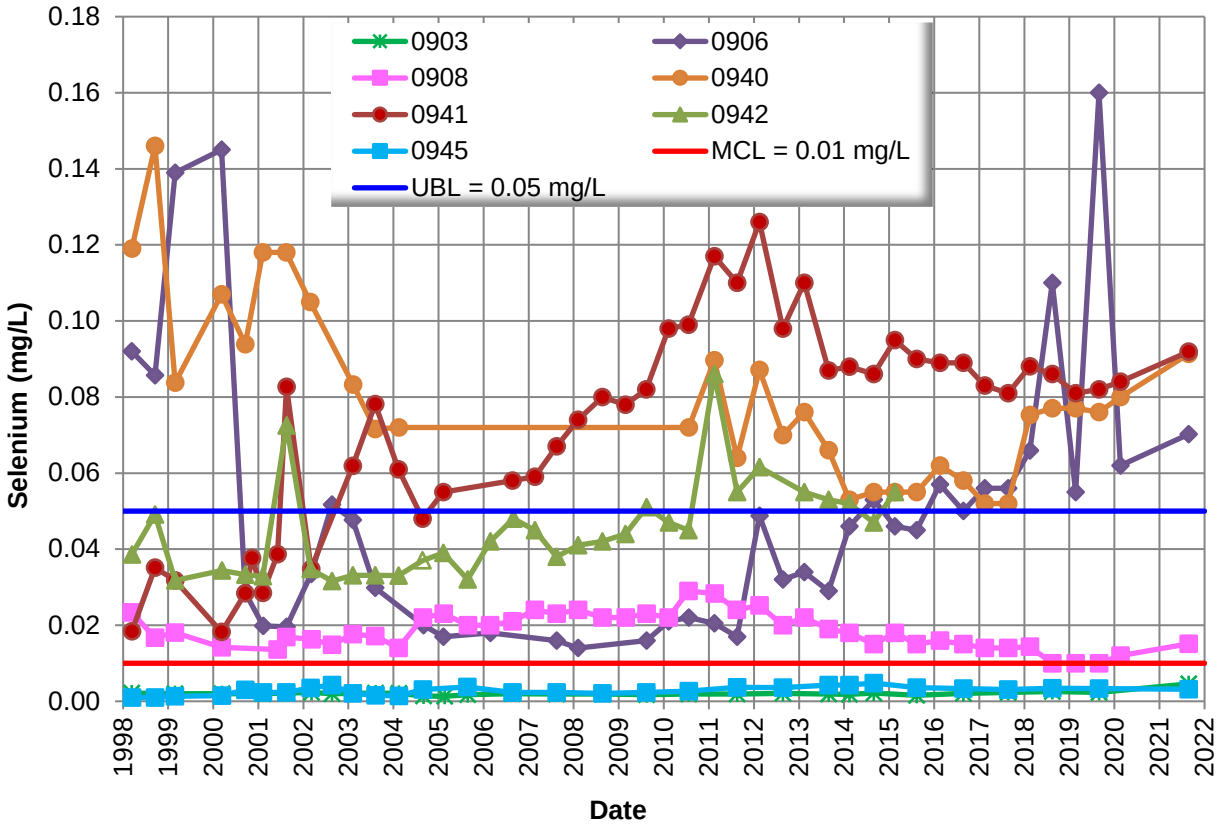


Figure 19-4. Nitrate in Groundwater at the Tuba City, Arizona, Disposal Site

Selenium concentrations have historically exceeded the 0.01 mg/L MCL in all LTSP evaluative wells except background well 0945 and distal well 0903 (Figure 19-5). Concentrations in well 0908 exceeded the UBL for selenium in 1997 and have since remained at or slightly above the 0.01 mg/L MCL since August 2018. Selenium concentrations in well 0942 exceeded the UBL in February 2015, and that well has not been sampled since. Concentrations continued to exceed the 0.05 mg/L UBL in wells 0906, 0940, and 0941, all of which are immediately downgradient of the disposal cell. Selenium concentrations increased in well 0941 from 0.018 mg/L in 1998 to 0.09 mg/L in 2021. Selenium concentrations in distal downgradient well 0903 have consistently been below both the UBL and the MCL and, since late 2004, below levels measured in background well 0945.

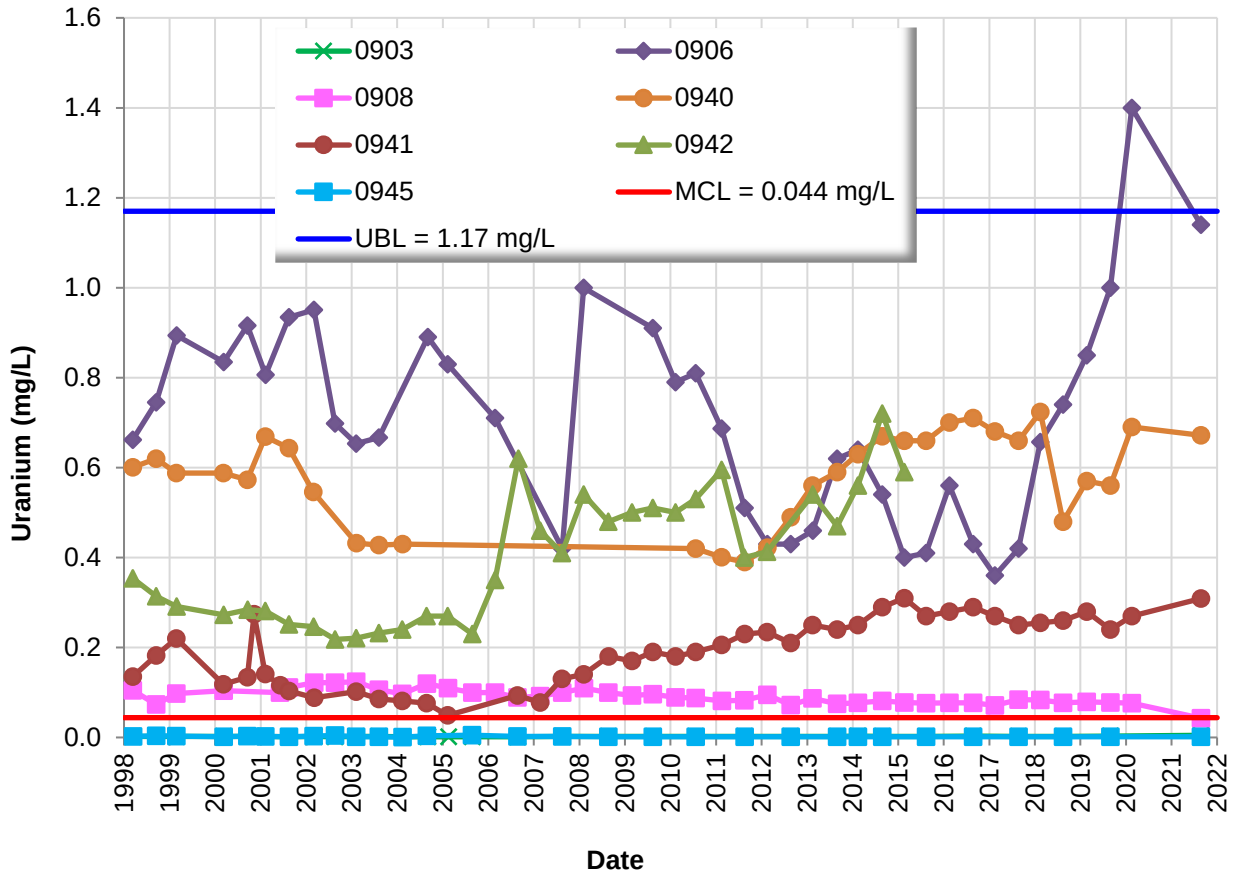


Note: Results include validated data only; results below the detection limit are presented at the laboratory reported value.

Figure 19-5. Selenium in Groundwater at the Tuba City, Arizona, Disposal Site

Uranium concentrations have historically exceeded the 0.044 mg/L MCL in all compliance wells except for distal downgradient well 0903 and background well 0945, both of which have always been below the MCL (Figure 19-6).

Uranium concentrations in central downgradient well 0941 have gradually increased since 2005 from 0.05 mg/L to 0.31 mg/L. Concentrations in well 0906 have more recently increased from 0.36 mg/L in February 2017 to 1.4 mg/L in February 2020, above the 1.17 mg/L UBL, then to 1.14 mg/L in August 2021, just below the UBL. Uranium concentration in well 0908 decreased to 0.043 mg/L, just below the MCL, in August 2021; this was the first time uranium concentrations were below the MCL in this well since evaluative monitoring began.



Note: Results include validated data only; results below the detection limit are presented at the laboratory reported value.

Figure 19-6. Uranium in Groundwater at the Tuba City, Arizona, Disposal Site

Sample results from the 2021 evaluative monitoring indicate that groundwater quality immediately downgradient of the former mill site (in wells 0906, 0908, 0940, 0941, and 0942) is still degraded relative to concentrations of molybdenum, nitrate, selenium, and uranium in background well 0945. Concentrations of all four analytes in distal downgradient well 0903 are comparable with those measured in background well 0945 and below corresponding UBLs, although nitrate concentrations continue to be slightly above the MCL. Analysis of water quality trending and progress of the groundwater remedy are reported in the site-specific annual groundwater report for the Tuba City site. No concerns about disposal cell performance are identified in the evaluative monitoring results.

19.8 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.

19.9 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 Subpart A. U.S. Environmental Protection Agency, "Standards for the Control of Residual Radioactive Materials from Inactive Uranium Processing Sites," *Code of Federal Regulations.*

DOE (U.S. Department of Energy), 1984. *Cooperative Agreement Between the United States Department of Energy, the Navajo Tribe of Indians, and the Hopi Tribe of Indians*, DE-FC04-85AL26731, December.

DOE (U.S. Department of Energy), 1996. *Long-Term Surveillance Plan for the Tuba City, Arizona, Disposal Site,* DOE/AL/62350-182, Rev. 0, October.

DOE (U.S. Department of Energy), 2015. *Plan for Interim Treatment During Distillation Shutdown for the Tuba City, Arizona, Disposal Site*, LMS/TUB/S12431, Office of Legacy Management, April.

DOE (U.S. Department of Energy), 2018. *Interim Treatment System Evaluation Report, Tuba City, Arizona, Disposal Site*, LMS/TUB/S18785, Office of Legacy Management, March.

EPA (U.S. Environmental Protection Agency), 1989. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities-Interim Final Guidance*, EPA/530-SW-89-026, Office of Solid Waste, Waste Management Division, Washington, D.C., February.

19.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	0	Windblown Sand Accumulation Along Western Perimeter Fence
PL-2	160	Faded and Cracked Pictorial Perimeter Sign P6
PL-3	—	Combined Survey Monument/Boundary Monument SM/BM-2
PL-4	270	Faded and Cracked Pictorial Perimeter Sign P24
PL-5	270	Exposed Concrete Base of Perimeter Sign P9
PL-6	0	Faded Caution Sign for Buried High Voltage Line
PL-7	—	Combined Survey Monument/Boundary Monument SM/BM-3
PL-8	90	Disposal Cell Top Slope
PL-9	180	Tire Tracks on Disposal Cell Top
PL-10	200	Minor Sedimentation and Plant Growth in Mouth of South Apron Ditch
PL-11	245	Drought-Stricken Vegetation in Reclaimed Area
PL-12	195	Evaporites and Windblown Sand in Inactive Evaporation Pond

Note:
— = Photograph taken vertically from above.

PL-1. Windblown Sand Accumulation Along Western Perimeter Fence

PL-2. Faded and Cracked Pictorial Perimeter Sign P6

PL-3. Combined Survey Monument/Boundary Monument SM/BM-2

PL-4. Faded and Cracked Pictorial Perimeter Sign P24

PL-5. Exposed Concrete Base of Perimeter Sign P9

PL-6. Faded Caution Sign for Buried High Voltage Line

PL-7. Combined Survey Monument/Boundary Monument SM/BM-3

PL-8. Disposal Cell Top Slope

PL-9. Tire Tracks on Disposal Cell Top

PL-10. Minor Sedimentation and Plant Growth in Mouth of South Apron Ditch

PL-11. Drought-Stricken Vegetation in Reclaimed Area

PL-12. Evaporites and Windblown Sand in Inactive Evaporation Pond