

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 11, 2022. Minor depressions or undulations were noted on the disposal cell cover, particularly on the western edge of the cell. These features will be verified with the light detection and ranging (lidar) data from the baseline aerial survey. No other changes were observed on the disposal cell. No changes were observed in the associated drainage features. Inspectors identified one minor maintenance need but found no cause for a follow-up inspection.

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 11, 2022. The inspection was conducted by D. Miller, M. Franke, and E. Gaasche of the Legacy Management Support (LMS) contractor. M. Kautsky (LM), M. Cosby (Colorado Department of Public Health and Environment), and Linda Gersey (NRC) 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 whether maintenance or follow-up 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. Some 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 2022 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 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 feet (ft) south of the site and an inner metal gate at the stock fence (PL-1). The entrance sign, which is next to the inner gate, was faded and had minor cracks but remained legible. No maintenance needs were identified.

14.4.1.2 Stock Fence and Perimeter Signs

A four-strand barbed-wire stock fence at the southern 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 on the site vegetation. Inspectors noticed evidence of continued livestock grazing, discussed further in Section 14.4.2.3. 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 that are on the adjacent BLM allotment to pass through the fence. No maintenance needs were identified.

There are 27 perimeter signs positioned along the site 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. Perimeter signs P15 and P19 have bullet damage but remain legible. Perimeter signs P1, P3, P16, P18, P22, P24, and P26 have minor cracks and peeling but remain legible (PL-2). No maintenance needs were identified.

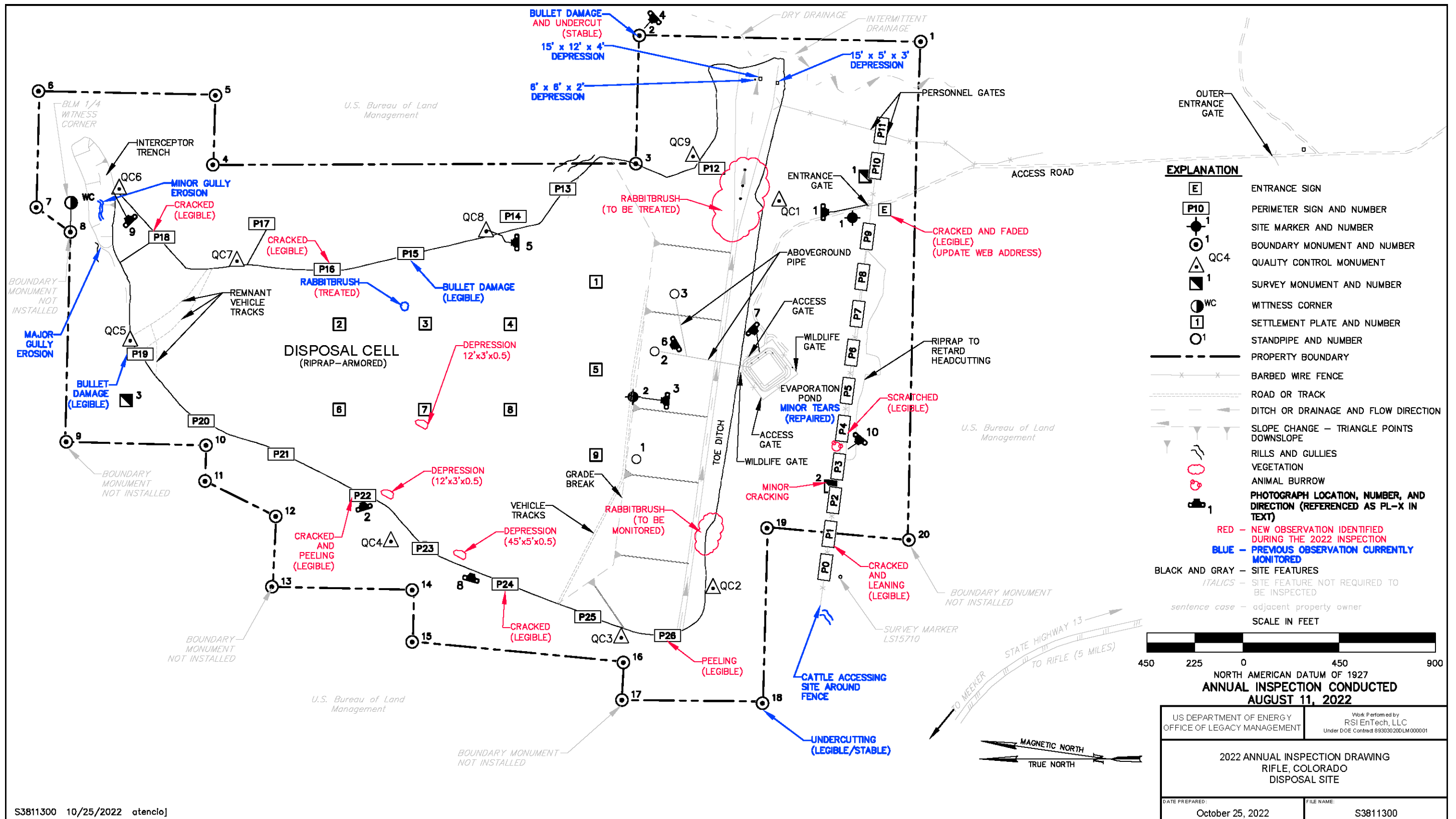


Figure 14-1. 2022 Annual Inspection Drawing for the Rifle, Colorado, Disposal Site

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 in hard-to-access areas. Boundary monument BM-2 has several bullet holes but remains intact. Boundary monuments BM-2 and BM-18 have undercutting at the ground surface but remain stable (PL-4). Survey monument SM-2 has slight cracking in the concrete, but the cracking does not affect the integrity of the survey monument. No maintenance needs were identified.

14.4.1.5 Aerial Survey Quality Control Monuments

Nine aerial survey quality control monuments were inspected during the 2022 annual inspection. Inspectors noted minor sediment accumulation on quality control monuments QC-5 and QC-8 (PL-5). An aerial survey collected lidar data in July 2022. 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-6). 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. No other 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 (PL-7). 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 in May 2021. Evaluation of the liner by a testing laboratory indicated that 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. Inspectors will continue to monitor this before the planned liner preplacement.

The security fence around the pond was repaired, including replacing a bent gate, to prevent cattle entry in 2020. At the time of the 2022 inspection, the security fence around the pond was intact and effectively preventing livestock from entering the area. The vehicular access gates on the northern and western 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. Three possible depressions or undulations were noted, primarily on the west edge of the disposal cell. The largest of these features was approximately 45 feet long × 5 feet wide × 6 inches deep (PL-8). The aerial survey lidar data collected in July 2022 will be used to verify these observed features. There was no evidence of erosion, settling, slumping, or other modifying processes that might affect the integrity of the disposal cell. 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 northern portion of the disposal cell. Additional vehicle tracks continue to be visible in the southern portion of the disposal cell, which are attributable to the installation of solar panels and pumps at standpipes SP-02 and SP-03.

Two to three deep-rooted, woody rabbitbrush plants were observed on the southeastern slope of the disposal cell and in the toe ditch during the inspection. Rabbitbrush and common mullein were observed on the southwestern edge of the cell but were not impeding onto the top slope of the cell at the time of the 2022 inspection. The rabbitbrush on the southeastern slope of the disposal cell near the toe ditch will be treated before the 2023 inspection. Small, isolated patches of other grasses also were present on the disposal cell cover and side slope, but they do not present a concern and do not require treatment.

A vegetated interceptor trench was constructed at the top of the disposal cell to protect the disposal cell from stormwater and snowmelt runoff (PL-9). 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; 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. The gully did not appear to be increasing in depth or width during the 2022 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 (southern) 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. LM is evaluating additional fencing installation options on the southwest side of the site to prevent cattle access. Animals are burrowing under the fence between perimeter signs P3 and P4 (PL-10). Inspectors will continue to monitor this area and conduct repairs when necessary.

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 biking 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

Treatment of rabbitbrush growing on the top of the disposal cell was completed before the 2022 inspection. Inspectors identified the following maintenance items that will be completed before the next inspection:

- Update the website address on the entrance sign
- Treat the rabbitbrush growing on the southeastern slope of the disposal cell and toe drain area

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). The pore-water levels were monitored during monthly pump shutdown periods, which allowed the water level to equilibrate. This monitoring is conducted in conjunction with extraction to maintain water levels below the high-density polyethylene (HDPE) liner that was installed in the toe of the disposal cell at an elevation of 6022.50 ft during original construction. In 2022, monthly recovery tests have been paused for maintenance efforts and will resume in 2023. The bottom of standpipe SP-01 is at an elevation of 6023.95 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. Circumstances other than pore-water accumulation that triggers the dewatering pump 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 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 included as an attachment 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 and the solar-powered dewatering pump is initiated at a water level elevation of 6018.55 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; instead, they have continued to increase to the recent maximum level of 6022.42 ft. While the 6018.55 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 or lower.

Table 14-2 lists total dewatering volumes based on the flow meter at the evaporation pond.

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	144,796	720.38	144,796
2009	407,455	1144.54	552,251
2010	217,775	672.15	770,026
2011	60,555	186.32	830,581
2012	153,941	428.80	984,522
2013	106,262	292.74	1,090,784
2014	135,123	374.30	1,225,907
2015	154,625	423.63	1,380,532
2016	167,466	458.81	1,547,998
2017	86,075	237.12	1,634,073
2018	121,523	438.88	1,755,596
2019	244,529	681.34	2,000,125
2020	194,751	533.66	2,194,876
2021	296,908	814.20	2,491,784
2022*	167,265*	702.79*	2,659,049*

Notes:

* 2022 dewatering data through August 26, 2022.

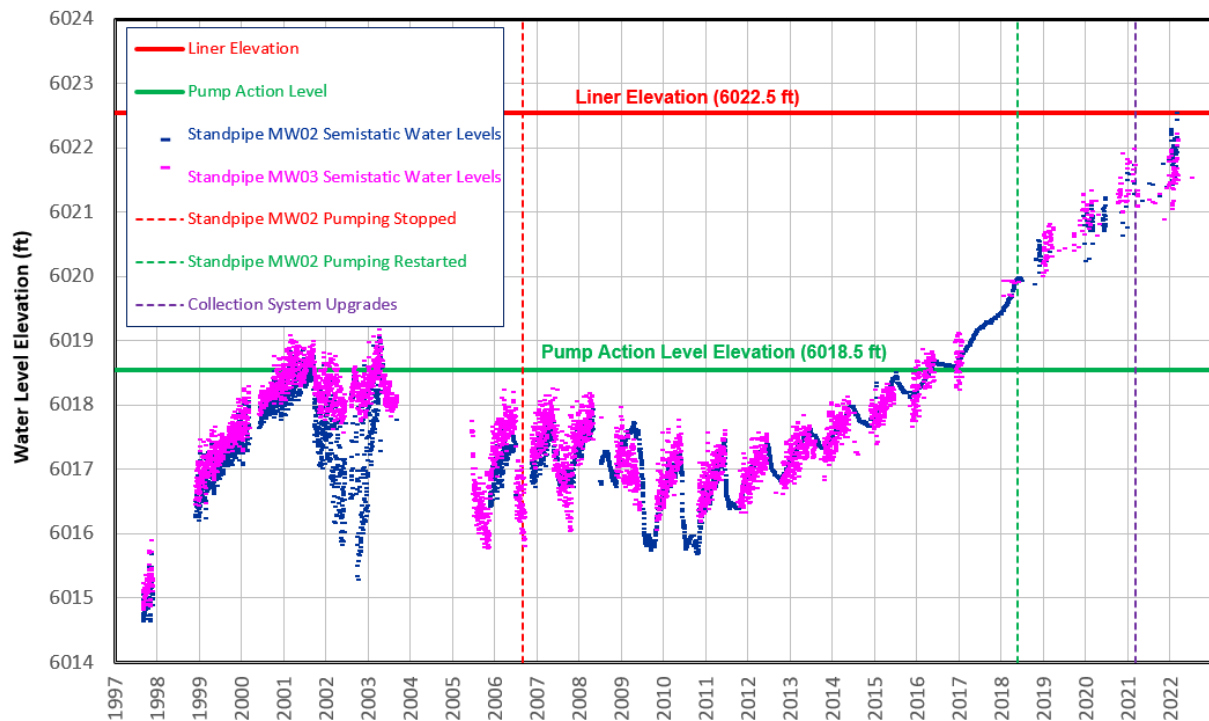
** Previously, Table 14-2 presented dewatering volumes based on the combined flow meter readings at standpipes SP-02 and SP-03. However, the flow meters at the standpipes are less accurate than the volumes reported by the pond flow meter. In general, the volumes reported by the pond flow meter are similar with the volumes reported by the flow meters at standpipes SP-02 and SP-03, except for the volumes reported in 2015, 2018, and 2021. One of the flow meters at standpipes SP-02 and SP-03 may have turned off and not accurately recorded the volumes pumped from one of the wells for a period of time during these years.

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 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 2022 are the result of partial overnight recharge due to well inefficiencies. The nonstatic levels have been removed 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 last completed in December 2020. Testing results indicated 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.



Semistatic maximum water levels shown following brief pump off periods and partial to full recovery (commonly during overnight shutdowns) to reduce graph fluctuations of dynamic water levels; only monthly fully recovered water levels are shown after system upgrades. The upper surface of all data points is the closest representation of static pore-water level conditions away from the standpipes.

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 has yielded an increase in annual dewatering volume but does not appear to have decreased the pore-water level.

In July 2022, the leachate discharge pipes were replaced with 2-inch diameter pipes and insulated where the pipe crosses the toe ditch to protect against freezing and pipe bursting in the winter. These improvements should allow the pumping system to function at colder temperatures in the winter, increasing the annual dewatering volume.

LM completed a collaborative initiative with the National Laboratory Network (NLN) in March 2022 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. The recommendations are being compiled into a Recommendations Report and a Pore-Water Accumulation Work Plan.

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	180	Entrance Gate
PL-2	73	Perimeter Sign P22
PL-3	5	Site Marker SMK-2
PL-4	318	Boundary Monument BM-2
PL-5	—	Aerial Survey Quality Control Monument QC-8
PL-6	330	Standpipe SP-02 and Instrumentation
PL-7	224	Evaporation Pond
PL-8	106	Potential Depression on Edge of Disposal Cell
PL-9	47	Interceptor Trench
PL-10	310	Signs of Animal Burrowing Under Fence

Note:

— = Photograph taken vertically from above.



PL-1. Entrance Gate



PL-2. Perimeter Sign P22



PL-3. Site Marker SMK-2



PL-4. Boundary Monument BM-2



PL-5. Aerial Survey Quality Control Monument QC-8



PL-6. Standpipe SP-02 and Instrumentation



PL-7. Evaporation Pond



PL-8. Potential Depression on Edge of Disposal Cell



PL-9. Interceptor Trench



PL-10. Signs of Animal Burrowing Under Fence