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 17, 2022. 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 with results to report occurred in November 2019 with results reported in the 2019 annual inspection report. The 2022 groundwater sampling event was conducted in November 2022. Validated results from that sampling event were not available in time for inclusions into this report but will appear in next years' annual report.

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 0	--

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, 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 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, Z. Aldous, D. Atkinson, and J. Graham of the Legacy Management Support (LMS) contractor. B. Frazier (LM site manager), A. Rheubottom (NMED), and C. Wentz (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 follow-up 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. 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 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). 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 signs P12 (PL-3) and P41, but both perimeter signs are stable. Prairie dog colonies were identified near perimeter signs P17 and P18 during the 2021 inspection and observed again in 2022 (PL-4). The colony does not threaten the integrity of either of the perimeter signs, therefore, 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-5). No maintenance needs were identified.

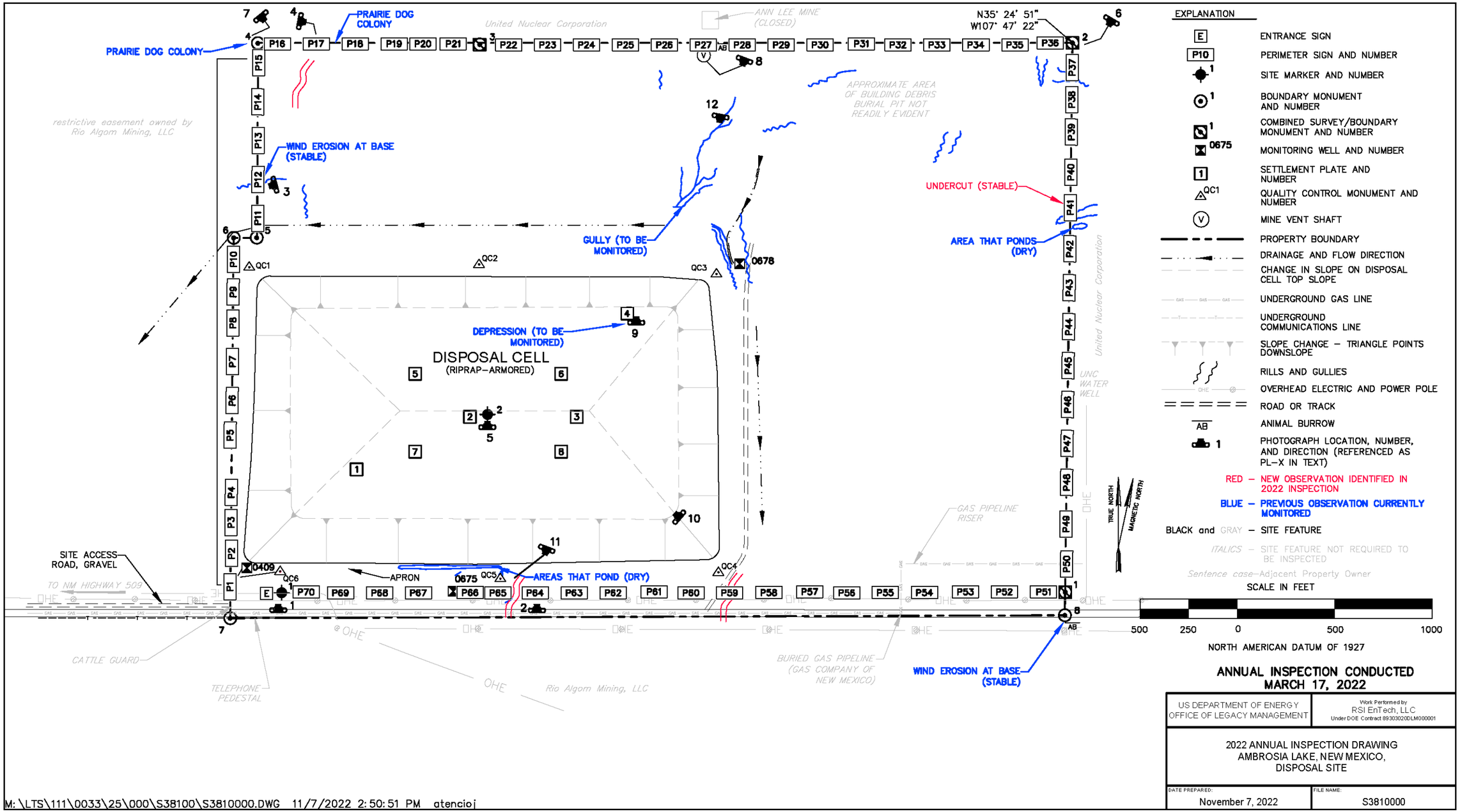

Figure 1-1. 2022 Annual Inspection Drawing for the Ambrosia Lake, New Mexico, Disposal Site

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-6). 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. Prairie dog colonies were observed near boundary monuments BM-4 in 2021 (PL-7) and near BM-8 during the 2022 inspection. No maintenance needs were identified.

1.4.1.5 Aerial Survey Quality Control Monuments

Six aerial survey quality control monuments were inspected during the 2022 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. 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-8). Inspectors monitor the condition of the vent to ensure that the closure remains secure. 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. 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. Continual visual observations since the 2017 annual inspection indicate that minor additional settlement has occurred since the depression was repaired. During the 2022 annual inspection, the settlement was shallow enough that it was determined not to have changed significantly (PL-9). Inspectors will continue to monitor this

area during each annual inspection and document surface topography and note any developing erosional features.

Scattered annual weeds and perennial grasses are growing on the top of the disposal cell top (PL-10). 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. This location is the topographic low spot along the base of the disposal cell, and stormwater runoff collects in this area. Some rilling and erosion was observed near the base of the south side slope (PL-11) near aerial survey quality control monument QC-5. 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. Because the site is not fenced, grazing animals occasionally enter it. Inspectors did not observe cattle near the disposal cell, but there was evidence of recent grazing on other areas of the site. Occasional grazing will not affect the disposal cell protectiveness or long-term performance, however, grazing animals typically 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, and existing features have continued to develop, particularly to the northeast of the disposal cell. 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 in 2021. While no immediate maintenance needs were identified, an evaluation of the need for erosion control structures around the large gully northeast of the disposal cell will be conducted. Newly forming small rills were observed around the site during the 2022 annual inspection, near perimeter signs P17, P59, and P65.

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 that 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 immediate maintenance needs were identified during the 2022 inspection. Site engineers will evaluate the need for erosion control measures at the gully feature northeast of the cell.

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, or once every 3 years, schedule. The most recent sampling event occurred in November 2022. Validated results from that sampling event were not available for inclusion into this report but will be reported in next year's annual report.

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 the Tres Hermanos Unit C member of the Mancos Shale Formation. Well 0409 is dry, which suggests that alluvial groundwater is not leaving the southwest portion of the site.

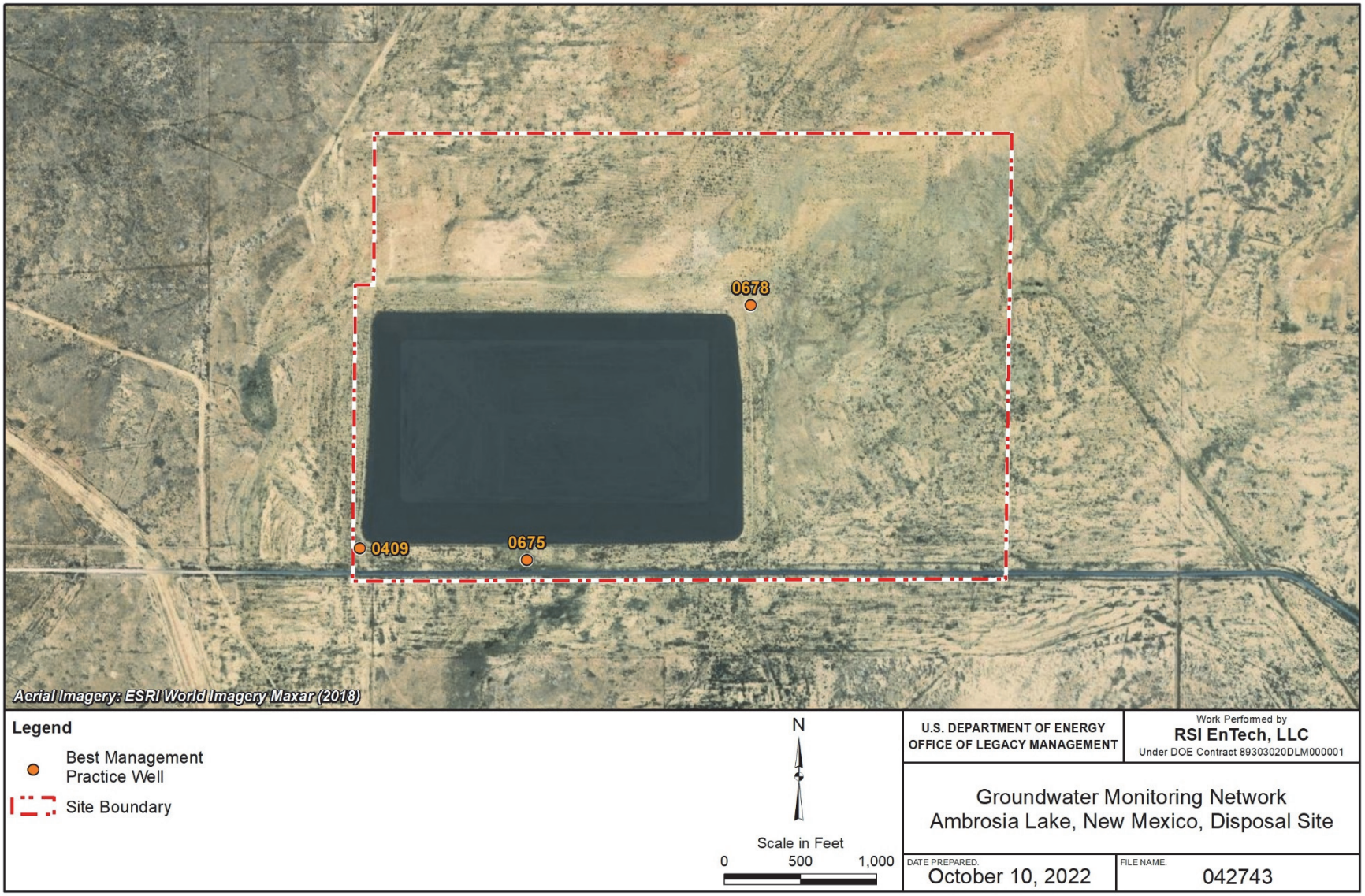

Figure 1-2. Ambrosia Lake, New Mexico, Groundwater Best Practice Monitoring Locations

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 most recent sampling event occurred in November 2022.

1.8 Corrective Action

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

1.9 References

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

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

DOE (U.S. Department of Energy), 1996. *Long-Term Surveillance Plan for the Ambrosia Lake, New Mexico, Disposal Site*, DOE/AL/62350-211, Rev. 1, Office of Legacy Management, 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, Office of Legacy Management, 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	Photograph Description
PL-1	0	Entrance Sign and Granite Site Marker SMK-1
PL-2	0	Perimeter Sign P64
PL-3	250	Wind Erosion at Base of Perimeter Sign P12
PL-4	100	Prairie Dog Colony near Perimeter Sign P17
PL-5	—	Site Marker SMK-2
PL-6	210	Combined Survey and Boundary Monument BM-2
PL-7	140	Prairie Dog Colony near Boundary Monument BM-4 and Perimeter Sign P15
PL-8	200	Mine Vent Shaft
PL-9	0	Settlement Plate 4
PL-10	320	Disposal Cell Top Slope
PL-11	200	Rills near Aerial Survey Quality Control Monument QC-5
PL-12	190	Main Channel of Deep Gully

Note:
— = Photograph taken vertically from above.

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

PL-2. Perimeter Sign P64

PL-3. Wind Erosion at Base of Perimeter Sign P12

PL-4. Prairie Dog Colony near Perimeter Sign P17

PL-5. Site Marker SMK-2

PL-6. Combined Survey and Boundary Monument BM-2

PL-7. Prairie Dog Colony near Boundary Monument BM-4 and Perimeter Sign P15

PL-8. Mine Vent Shaft

PL-9. Settlement Plate 4

PL-10. Disposal Cell Top Slope

PL-11. Rills near Aerial Survey Quality Control Monument QC-5

PL-12. Main Channel of Deep Gully